6 SCIENTIFIC RHETORIC IN THE NINETEENTH AND EARLY TWENTIETH CENTURIES

HERBERT SPENCER, THOMAS H. HUXLEY, AND JOHN DEWEY

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The study of rhetoric and communication since ancient Greece and Rome has been concerned with the relationship of rhetoric to modes of inquiry and to the social community, with the relationship of language to thought and action. Aristotle explored the relationship of rhetoric to logic and to politics, for example, and Cicero viewed oratory as the union of wisdom and eloquence in service of the state. This concern reappears in discussions of scientific rhetoric in the nineteenth and early twentieth centuries, which explore the relationship of language to science and to civilization. Some studies of British and American rhetoric in the nineteenth century note the decline of classical rhetoric and the currency of belletristic, elocutionary, practical, and psychological-epistemological rhetoric during this period (Berlin, 13–41, 58–76; Connors, Ede, and Lunsford, 2–5; Ehninger, xxiii–xxx; Halloran; Howell, 695–717; Ried; Stewart, 136–52). Other studies note the persistence of classical rhetoric despite, and sometimes in conscious reaction against, the then more widely current rhetorics (Crowley, "Evolution of Invention"; Crowley, "Invention"; Johnson; Rosner). Most of these studies, including those that note the persistence of classical rhetoric, also note its eventual

demise and its replacement by the so-called practical rhetorics. Several of these studies attribute these changes in part to the rise of experimental science and the specialization of the curriculum in general in British and American colleges and universities in the latter part of the nineteenth century (Berlin, 62–64; Connors, Ede, and Lunsford, 3–4; Halloran, 260–62; Ried, 232–33; Rosner, 164–66). Discussions of scientific rhetoric in the nineteenth and early twentieth centuries suggest, however, that neither of these forces in itself necessarily led to the development of practical rhetorics – and, with it, the separation of rhetoric from science and other specialized subjects and from societal concerns. Rather, these discussions suggest that science and scientific rhetoric in the service of organized, professionalized communities may have encouraged the development of practical rhetorics but that science and scientific rhetoric also served broader social communities and that, in this context, scientific rhetoric remained inseparable from its modes of inquiry and from the social communities it sought to serve, and language remained inseparable from science and civilization.

In this chapter, I explain how rhetoric is related to modes of inquiry and to the social community in classical rhetoric and in scientific rhetoric in the nineteenth and early twentieth centuries. I begin with a brief summary. Next, I show how Aristotle's rhetoric is related to logic and to politics and ethics and how late-eighteenth- and early-nineteenth-century versions of it sever this relationship. Finally, I show how several scientific rhetorics from the nineteenth and early twentieth centuries, despite their considerable differences, nonetheless reaffirm the relationship of rhetoric to inquiry and to the social community, to science and civilization.

Summary

Classical rhetorics such as Aristotle's had noted the relationship of rhetoric to logic or dialectic and to politics and ethics, which were identified with the good of the social community (George A. Kennedy, 65–67; Randall, 280–81). Nineteenth-century rhetorics, with some exceptions, did not share these concerns, and even a self-avowed Aristotelian rhetoric such as that of Richard Whately distinguished and separated the role of logic from that of rhetoric and ignored politics almost entirely (Berlin, 28–30; Ehninger, ix–xv, xxvii–xxx; Einhorn, "Consistency," 93–96; Einhorn, "Public Persuasion," 49–51; Howell, 698–703, 707–12; Stewart, 139–40). The scientific rhetorics of Herbert Spencer, Thomas H. Huxley, and John Dewey seldom used the term *rhetoric*, except pejoratively. Nonetheless, these rhetorics reaffirmed the relationship of what they called composition, language, or communication to science, usually

some form of Baconian science, and to civilization. In this respect, they were *rhetorical* in the classical sense of the term.[1]

These nineteenth- and early-twentieth-century scientific rhetorics were not, however, all of a kind. They differed, in large measure, because they were based upon different views of science and civilization and of their relationship to both. Spencer's science, which he claimed was inductive but which in practice was largely deductive, provided the basis for both his theory of English composition and his sociology, which held that the development of civilization was an entirely natural evolutionary process (James G. Kennedy, 87–118; Peel, 131–65). His theory of composition was functional in the context of his views of science and civilization, but it did not recognize science as a mode of inquiry or civilization as a process of building a social community. Rather, it engaged the method of science to establish its one and only principle of economy, and it served a narrow reportorial role in the natural evolution of civilization (James G. Kennedy, 101–2).

Both Huxley's view of language and Dewey's theory of communication, in contrast, were inseparable from science, construed as a mode of inquiry, and from civilization, construed as a process of building a social community. Huxley's science was based upon facts rather than deductions (Paradis, 73–113, 165–73). His view of language was a logical corollary to a science based upon facts, and it provided the basis of all language education. His view of civilization was synonymous with politics construed in the classical sense, and as such it was at odds with the natural process of evolution (Paradis, 115–63). However, his view of language and language education was directed toward improvement of the human condition, and it served a broad and constructive role in the development of civilization.

Finally, Dewey's science, his theory of communication, and his view of civilization were all part of a broad philosophical and educational program intended to collapse the dualism between man and nature, theory and practice, the individual and society, and so on (for example, Dykhuizen, 178–79; Frankel, 29–38). Like Huxley's view of language, Dewey's theory of communication was inseparable from science construed as a mode of inquiry and from civilization construed as a process of building a social community. His method of science was identical with his method of communication, and both sought to promote the public good and so to foster the development of civilization. However, by the early twentieth century, science was no longer what it was in the latter half of the nineteenth century, a science based upon facts. It was, increasingly, science organized into professional, academic, and industrial communities (Bernal, 134–78; Mason, 352–63). As a result, Dewey's method of science and communication, which was based upon the model of organ-

ized physical science, was less concerned with enabling public discussion about the public good than with promoting organized inquiry and disseminating the results of that inquiry. This method was suited to organizational, especially professional, rather than social communities; indeed, it collapsed the dualism of science and civilization (inquiry and community, thought and action) by identifying the social community with organized science. Dewey's method of science and communication was widely influential in several fields of communication, including scientific and technical communication.

The Relationship of Rhetoric to Logic and to Politics and Ethics: Aristotle

Aristotle's system of sciences places rhetoric in relation to logic or dialectic and to politics and ethics, but not to science. As set forth in the *Prior Analytics* and *Posterior Analytics*, science achieves true knowledge through syllogistic demonstration and observation of facts, deduction and induction (Hill, 24, 28–29; George A. Kennedy, 61–63; Randall, 32–51). Logic or dialectic, in contrast, as set forth in the *Topica*, achieves only probable knowledge since it is based upon generally accepted opinion, not facts (Hill, 24; George A. Kennedy, 64–65; Randall, 37–39). Therefore, as Aristotle explains in *The "Art" of Rhetoric*, a rhetoric that seeks to achieve true or scientific knowledge is no longer rhetoric, but science (1.4.1359b4–7). Because it is concerned with probable knowledge only, Aristotle's rhetoric is related to logic and also to politics and ethics, but not to science.

Through its relationship with logic and with politics and ethics, Aristotle's rhetoric provides a vehicle for doing public business in the legislative assemblies, the lawcourts, and on formal occasions (Hill; George A. Kennedy, 63–76; Randall, 279–87). As Aristotle explains in the *Rhetoric*, rhetoric is the counterpart of dialectic, and it is also an offshoot of politics and ethics (1.1.1354a1–2; 1.2.1356a7). Like dialectic, rhetoric rests its "proofs and arguments" upon "generally accepted principles," probabilities rather than truths. (1.1.1355a11–b13). Rhetoric is synonymous with invention (though it also includes style and arrangement and perhaps delivery); it is "the faculty of discovering the possible means of persuasion" (1.2.1355b1). It derives these means of persuasion from three sources: the character and virtues of the speaker, the emotions of the hearer, and the speech itself, insofar as it proves or seems to prove (1.2.1355b3–56a6). Because it depends upon these sources, rhetoric is related to logic and to politics and ethics, the proofs from the speech presumably being related

to logic, those from character and the emotions to politics and ethics (1.2.1356a7). It uses proofs derived from these sources to do public business in three kinds of speeches: deliberative, forensic, and epideictic, the rhetoric of the legislative assemblies, of the lawcourts, and of formal occasions (1.3.1358a1–59a6). Of the three kinds of speeches, rhetoric gives more attention to deliberative and forensic than epideictic, and it privileges deliberative, which deals with questions of policy in the legislative assemblies, as "nobler and more worthy of a statesman" than forensic (1.1.1354b10–55a10).

Through its relationship with politics and ethics, Aristotle's rhetoric serves the public good, the good of the social community, the *polis* or state. As Aristotle explains in the *Politics*, political science is the science concerned with man's political association, with the laws, customs, and institutions of the community, the *polis* (1.1.1252a1–3; Rackham, Introduction, *Politics*, xvi–xvii). Within his system of sciences, which he describes in the *Nicomachean Ethics*, political science is the master science that directs all the others. Political science has as its end happiness, the good of man, not the good of the individual but the good of the state, of the two the greater and more perfect good (1.1–2). For this reason, political science directs the other sciences and faculties, including rhetoric: "for it is this that ordains which of the sciences are to exist in states, and what branches of knowledge the different classes of the citizens are to learn, and up to what point; and we observe that even the most highly esteemed of the faculties, such as strategy, domestic economy, oratory, are subordinate to the political science" (1.2.1094a4–b8). Within the context of Aristotle's system, rhetoric serves the end of political science, the good of the social community.

These statements on the relationship of rhetoric to logic and to politics and ethics are elitist to the extent that they reflect aristocratic ideals based upon gender, class, and wealth and power (Berlin, 18; Rackham, Introduction, *Nicomachean Ethics*, xxvii–xxviii). Nevertheless, they articulate issues of recurring interest in the history of rhetoric and of particular interest in the nineteenth and early twentieth centuries when, the traditional relationship between rhetoric and other sciences having been severed, the scientific rhetorics sought to restore it.

The Separation of Rhetoric from Logic and Politics: Richard Whately

By the early nineteenth century, the new science had discredited the old logic of probabilities, and two logics – one deductive and

syllogistic, the other inductive and scientific – vied for credibility (Howell, 698–706; McKerrow). The most widely current rhetorics were those now usually designated belletristic, elocutionary, practical, and psychological-epistemological (Berlin, 19–34; Ehninger, xxiii–xxx; Howell, 707–14; Stewart, 136–52). These rhetorics, having severed their traditional relationship with logic, were left with, at most, a modified and restricted form of invention to go with style, arrangement, and delivery (memory, the traditional fifth part of rhetoric, was usually ignored). The belletristic and elocutionary rhetorics were concerned with style and delivery, respectively, and the practical rhetorics were concerned largely with arrangement, especially paragraph arrangement, and with style. The psychological-epistemological rhetorics – including George Campbell's *Philosophy of Rhetoric* (1776), Joseph Priestley's *Lectures on Oratory and Criticism* (1777), and, in the nineteenth century, Whately's *Elements of Rhetoric* (1828) – were concerned in part with invention, but invention of a sort that was left to rhetoric after logic, whether deductive or inductive, had assumed responsibility for the discovery of proofs.[2] As a self-avowed Aristotelian rhetoric, Whately's *Rhetoric* provides a particularly apt illustration of the change that the psychological-epistemological rhetorics brought to the classical tradition in rhetoric in general and to Aristotle's rhetoric in particular.

Whately's *Rhetoric* distinguishes and separates the role of logic from that of rhetoric and all but ignores politics. In its new role, rhetoric becomes, so Spencer and Huxley observe, virtually synonymous with rule teaching. A churchman, eventually Archbishop of Dublin, Whately wrote both the *Elements of Logic* (1826) and the *Rhetoric* for Oxford divinity students to help them to develop their argumentative powers for use in their defense of the true faith (Ehninger, ix–xii, xv–xvi; McKerrow, 177–78). In the *Logic*, Whately presents both the technical rules (as in Aristotle) and a defense of the utility of syllogistic reasoning (McKerrow, 178–84). In the *Rhetoric*, he separates logic from rhetoric, the discovery of proofs from the presentation of proofs to an audience, on both Aristotle's and Francis Bacon's authority (Ehninger, xii–xv; Einhorn, "Consistency," 93–96; Einhorn, "Public Persuasion," 49–51; Howell, 698–703, 707–12). He proposes "to treat of 'Argumentative Composition,' *generally*, and *exclusively*; considering Rhetoric (in conformity with the very just and philosophical view of Aristotle) as an off-shoot from Logic" (4). However, unlike Aristotle, he does not include the discovery of proofs within the domain of rhetoric. Rather, he distinguishes inquiry from proof, the discovery of proofs from their presentation to an audience. To logic he assigns inquiry, "the *ascertainment* of the truth by investigation"; to rhetoric, proof, "the *establishment* of it to the satisfaction of *another*" (5–6, 35). He justifies this distinction on grounds that Bacon has already established

the rules of inquiry and even suggests that Bacon would approve his own emphasis on "*Dialectics*" rather than the "accumulation of facts," deductive rather than inductive logic, as more appropriate to the needs of his time (5–6, 15).

Having assigned the discovery of proofs to logic, Whately leaves to rhetoric only their presentation to the satisfaction of an audience. His *Rhetoric* belongs to the tradition of psychological-epistemological rhetorics, so-called because they were concerned with the adaptation, selection, and expression rather than the discovery of proofs, a "managerial" or supervisory role (Berlin, 28–30; Ehninger, xxviii–xxix; Einhorn, "Consistency," 96; Einhorn, "Public Persuasion," 50–51; Stewart, 139–40). Psychological-epistemological rhetorics such as Campbell's and Priestley's had concerned themselves with the managerial rather than the investigative role of rhetoric, but they had not formulated the principles and methods for such a rhetoric. Whately's *Rhetoric* does so by providing a system for the classification of proofs: a division of the forms of arguments and rules for their use for the purpose of conviction (35–168) and a division of the "Active Principles" of human nature – including both the passions (emotions) of the hearer and the character of the speaker – and rules for their use for the purpose of persuasion (175–230).

Whately passes over almost in silence the separation of rhetoric from politics. Although he provides a role for the emotions of the hearer and the character of the speaker, he notes with approval Aristotle's complaint that previous writers on rhetoric had subsumed "the Science of Legislation and of Politics" as part of their own art (3–4, 10–11). His own rhetoric, in contrast, is ecclesiastical, not political, and it "remains strangely aloof from the world of men and affairs" (Ehninger, xii).

The Science of English Composition and Sociology: Herbert Spencer

Although rhetoric in the late eighteenth and early nineteenth centuries thus severed its relationship with invention, construed in the classical sense, and hence with logic and politics as well, the scientific rhetorics of Spencer, Huxley, and Dewey reaffirmed the relationship of composition or language or communication to modes of inquiry and to social communities, to science and civilization. These scientific rhetorics were based upon Baconian science, in one form or another the prevailing standard in science in the middle and late nineteenth century. Baconian science in the middle of the century was largely the legacy of Scottish Realism, which was itself a reaction against skeptical tendencies

in British philosophy that culminated in the writings of David Hume (Bozeman, 3–21; Campbell, 352–58). In its most reductive sense, it was simply the "accumulation of facts" that Whately rejected in favor of deductive logic. It was justified almost wholly on grounds of its industrial applications, but it was only later in the century, for this reason, associated with Bacon.

Spencer's theory of composition is functional in the context of his views of science and civilization, but it does not recognize science as a mode of inquiry or civilization as a process of building a social community. Rather, it engages the method of science to establish its principle of economy and serves a narrow reportorial role in the natural evolution of civilization (James G. Kennedy, 87–118; Peel, 131–65). Once a railway engineer and an occasional participant in radical politics, Spencer became a prolific writer and contributed to such fields as sociology (especially in its relationship to biology), education, and many others (James G. Kennedy; Peel). He is best remembered for his contributions to sociology, including *Social Statics* (1850), *The Study of Sociology* (1873), and *The Principles of Sociology* (1876–1897), which set forth his view of social evolution as a natural process analogous to biological evolution and earned him the title "the arch-Social Darwinist" (James G. Kennedy, 7). He is also remembered for *Education: Intellectual, Moral, and Physical* (1861), which earned him a reputation as the most uncompromising proponent of scientific education in England in the middle of the nineteenth century (Barnard, 136–42; Evans, 215–16; Saffin, 198–200). He has only recently been remembered for his essay "Philosophy of Style" (1852), which influenced E. D. Hirsch's philosophy of composition in the twentieth century (Hirsch, 76–82; Secor, 82–84; Stewart, 142).

Spencer's science provides the basis for both his theory of composition and his sociology. Spencer claims to base his science upon Baconian induction, but in practice he appears to operate upon deduction, to use principles to explain facts rather than to derive principles from facts (Peel, 158–65). In *Education*, he claims to base his science upon the observation of facts and upon experimentation and the derivation of principles from facts, and he justifies his science on grounds of its industrial applications. On Bacon's authority, he claims to begin with the observation of facts, with "an accurate acquaintance with the visible and tangible properties of things" (106–7). And he claims to proceed from rudimentary facts through the experimental discovery of the relationship of facts to the organization of knowledge, which is simply the "union of facts into generalizations," or principles (104–7). He justifies his science on grounds of its industrial applications: for virtually all men are employed in industry, and efficiency in "the production, preparation, and distribution of com-

modities . . . depends on Science" (44–45). In practice, however, Spencer appears to operate by deduction, to use principles to explain facts. In *The Study of Sociology*, he claims, as a basic principle of his sociology, that the nature of the unit determines the nature of the aggregate, and he explains that by nature he means "essential" rather than "incidental" traits (43–45). He thus permits himself to dismiss as "incidental" any facts that appear to provide evidence counter to his own generalizations or principles about society (Peel, 160–65). For this reason, Huxley was moved to observe that "Spencer's idea of a tragedy is a deduction killed by a fact" (Irvine, 24; Paradis, 4–5).

Spencer's theory of English composition engages his science to establish its principle of economy (Hirsch, 76–82; Secor, 82–84; Stewart, 142). His theory, set forth in "Philosophy of Style," addresses literary texts, for the most part, and in this sense it is belletristic (Stewart, 142). Yet it is also scientific—not in the sense that it embraces science as a mode of inquiry, but in the sense that it engages science to establish its principle of economy (Secor, 82–83). Spencer's theory is apparently functional in the context of his claim to an inductive science. However, Spencer does not explain how the principle of economy might serve inductive science but instead engages his science to establish the principle. In *Education*, he rejects the rote learning and rule teaching that he claims is characteristic of classical education in the middle of the nineteenth century (22–23, 109–10). At the beginning of "Philosophy of Style," he directs these criticisms at the rules of logic, grammar, and rhetoric in general and of the rhetoricians (including Whately) in particular, despite the fact that he borrows extensively from them (9–10; Denton). In place of rules, he offers a principle of composition based upon a "scientific ordination," which he calls the principle of economy or efficiency and by which he means "the least possible mental effort" on the part of the reader (10–11).

Spencer uses this principle to explain facts about both the style and arrangement of an effective composition and in so doing illustrates his deductive approach to science. He applies the principle to style in his comparison of the English and French languages. For example, he refers to the phrase *un cheval noir*, or *a black horse*, which, he asserts, is more economical in English than in French because the picture of black conveys only an abstract quality and so is readily formed by the addition of horse (in English) whereas the picture of horse conveys images of color, kind, and the like and so must be reformed by the addition of black (in French) (16–18). Spencer applies the principle of economy to the overall arrangement of an effective composition as well. He asserts that this principle explains, for example, the need to "progress from the less interesting to the more interesting," to avoid "long continuity of the same kind of

thought, or repeated production of like effects," and so on (44–45). He apparently believes that economy of effect exists first of all in the reader, quite apart from concerns with the writer or with the formal properties of a text (Secor, 84).

Spencer's sociology also engages his science to establish his view that the development of civilization is an entirely natural evolutionary process (James G. Kennedy, 87–118; Peel, 131–65). Like his theory of composition, Spencer's sociology illustrates his deductive approach to science. His theory of composition is functional in the context of his view of civilization, which assigns to language a narrow reportorial role (James G. Kennedy, 101–2), rather than an active role in building a social community. In *Social Statics*, Spencer expresses his belief in the natural evolution of the human race toward perfection: "Progress, therefore, is not an accident, but a necessity. Instead of civilization being artificial it is a part of nature; all of a piece with the development of an embryo or the unfolding of a flower" (32). On the principle that the nature of the unit (in this instance, the individual) determines the nature of the aggregate (the society), he affirms the natural rights of the individual and advocates a laissez-faire approach to government, hence his general proposition "that every man may claim the fullest liberty to exercise his faculties compatible with the possession of like liberty by every other man" (36–45, 109–36).

In *The Principles of Sociology*, Spencer includes among his most important principles the two processes of change that bring about the natural evolution of civilization: a tendency toward differentiation and growing complexity and a trend from militancy to industrialism (1:491–587; Peel, 166–223). He explains the process of differentiation in a series of analogies between organisms and societies, both of which, he claims, differentiate or increase in structure as they increase in mass, as cells combine to form complex organisms, for example, and tribes combine to form nations (1:491–548). He explains the trend from militancy to industrialism as a transition from a society characterized by compulsory cooperation to a society characterized by voluntary cooperation, both necessary stages in the natural evolution of civilization (1:549–87). However, he cannot satisfactorily account for either primitive societies that exhibit an industrial character or modern societies that exhibit a militant character (Peel, 198–214). At this point, his sociology illustrates the limitations of his deductive science. His theory of composition is nonetheless functional in the context of his view of the natural evolution of civilization, for such a view does not take into account the use of language to transmit a social way of life, to build a social community, but rather assigns to language a narrow reportorial, or *"inter-nuncial,"* role analogous to, but beyond the scope of, physical stimuli (1:459–60; James G. Kennedy, 101–2).

Science, Language, and Civilization: Thomas H. Huxley

Huxley's theory of language, in contrast to Spencer's theory of composition, is inseparable from science construed as a mode of inquiry and from civilization construed as a process of building a social community. His view of language is a logical corollary to his science, and it provides the basis of all language education and serves a broad and constructive role in the development of civilization. Huxley was an accomplished scientist who before the age of thirty had been elected to the Royal Society and had won the Society's Gold Medal. He became known popularly for his defense of Charles Darwin's theory of evolution, for his support of scientific education, and for his defense of science and its role in civilization (Ashforth; Irvine; Paradis). Huxley defended Darwin's theory at scientific and public meetings and so earned a reputation as "Darwin's Bulldog," and he extended the theory to include man in his most important essay, "Man's Place in Nature" (1863) (Ashforth, 23). On a famous occasion, he revealed the low esteem accorded to rhetoric when, in reply to Bishop Wilberforce, he remarked that he would rather have an ape for a grandfather than a man who obscured the truth by "aimless rhetoric" and "eloquent digressions" (Ashforth, 36; Irvine, 4–6). Huxley supported scientific education in "Science and Culture" (1880), "On Science and Art in Relation to Education" (1882), and other essays, but, unlike Spencer, he held a balanced view of the role of science in education (Barnard, 142–43; Evans, 215–16; Saffin, 198, 257–60). Finally, he defended science itself and its role in civilization in "The Progress of Science 1837–1887" (1887), "Evolution and Ethics" (1893) and its "Prolegomena" (1894), and other essays.

Huxley's science is based upon facts rather than deductions and so is Baconian in the sense in which Bacon was understood in the middle of the nineteenth century (Paradis, 73–113, 165–73). Huxley claims to admit hypotheses in science, and he eschews applications. But he most often refers to facts to justify his conclusions, and he often justifies science on grounds of its industrial applications. In "The Progress of Science," Huxley argues that Bacon's science was "hopelessly impracticable" because it rejected hypotheses and misguided because it sought "practical advantages" (1:46–56). He claims that, in fact, "the invention of hypotheses based on incomplete inductions . . . has proved itself to be a most efficient, indeed an indispensable, instrument of scientific progress" and that "the joy of the discovery" rather than "practical utility" accounts for the growth of science in the late eighteenth and early nineteenth centuries (1:46–47, 51–54).

Yet Huxley often has recourse to facts. In "The Progress of Science," he alludes to the recent growth of science and proclaims "this new Nature begotten by science upon fact" (1:51–52). In "Man's Place in Nature," he introduces his discussion on the origin of man with reference to "the chief facts upon which all conclusions respecting the nature and the extent of the bonds which connect man with the brute world must be based" and other references to the factual basis of his discussion (7:81). Moreover, Huxley, like Spencer, emphasizes the industrial applications of science. In "The Progress of Science," he argues that science and industry are identical, "that science cannot make a step forward without . . . opening up new channels for industry; and . . . that every advance of industry facilitates those experimental investigations, upon which the growth of science depends" (1:54–56).

Huxley's view of language as proper signification is a logical corollary to a science based upon facts, and it provides the basis of all language education. In "On Science and Art," Huxley complains about the classical education he experienced in his youth and cites the same emphasis on rule teaching that Spencer complains about in *Education* (3:180–81). But he most frequently decries the kind of teaching that misuses words: "The difference between good and bad teaching mainly consists in this, whether the words used are really clothed with a meaning or not" (3:168–70). To ensure the correct use of words, proper signification, he relies upon facts. In "On Science and Art," he turns to the seventeenth century and cites Harvey, Bacon, and Locke to confirm his insistence upon the correspondence between words and things, or facts (3:168–70, 173–74, 186–88). He is particularly fond of Bacon's remark that truth comes more readily from error than from confusion because error can more readily be corrected by "knocking your head against a fact" (3:173–74).

This view of language as proper signification provides the basis of all language education, directed either toward personal pleasure or toward social and practical pursuits. In "Science and Culture," Huxley argues that the industrial applications of science are a necessary but not a sufficient condition for industrial prosperity because industry is a means, not an end, the end being human wants, the wants being determined by innate and acquired desires (3:156). He claims that language education provides a means of directing the acquired desires away from base wants toward "pleasures, which are neither withered by age, nor staled by custom, nor embittered in the recollection by the pangs of self-reproach" (3:156–57). He also engages language education to address social and practical pursuits. In "Science and Culture," he argues that language education in English, French, and German can provide access to the "three greatest literatures of the modern world" and to "full knowledge in any depart-

ment of science" (3:154). In "On Science and Art," he maintains that English provides models for imitation and practice in composition, which is generally neglected by Englishmen, and that it provides an essential part of the preparation for an Englishman "to go anywhere, to occupy the highest positions, to fill the highest offices of the State, and to become distinguished in practical pursuits, in science, or in art" (3:184–86).

Huxley's view of civilization is synonymous with politics construed in its classical sense, and as such it is at odds with the natural process of evolution (Paradis, 115–63). However, his view of language and language education is directed toward improvement of the human condition, and it serves a broad and constructive role in the development of civilization. In later works, Huxley explains what he has come to believe is a conflict between civilization and evolution, art and nature, good and evil. In "Evolution and Ethics," he explains that civilization is synonymous with politics, that the "civilized state, or polity," is "political" in the sense in which the Greek Stoics used the term, to denote "the sacrifice of self to the common good," a meaning so remote as to "now sound almost grotesque" (9:74–75). In the "Prolegomena," he claims that this view of civilization is at odds with evolution, and he explains the conflict in a lengthy analogy between a garden and a human society (9:1–17). He argues that the analogy breaks down because, on the one hand, an administrator in a human society neither would nor could adopt horticultural principles, neither would nor could, for example, discriminate between the fit and the unfit and select for survival only the most fit (9:17–23). Nor, on the other hand, would even the most basic rules of conduct acceptable in human society, for example, the "golden rule," be useful to the horticulturist: "What would become of the garden if the gardener treated all the weeds and slugs and birds and trespassers as he would like to be treated, if he were in their place?" (9:31–33).

Despite his pessimistic view of natural evolution, Huxley believes that improvement of the human condition is possible through the exercise of human purpose. At the end of the "Prolegomena," he argues that "man, as a 'political animal,' is susceptible of a vast amount of improvement, by education, by instruction, and by the application of his intelligence to the adaptation of the conditions of life to his higher needs" (9:44). Huxley had not forgotten that between "Man's Place in Nature" and "Evolution and Ethics" he wrote "Science and Culture" and other essays in support of education, in both science and language. His view of language and language education contributes to the human effort to develop a "worthy civilization" (9:44–45), for it helps to ensure the correct use of words, to turn human wants toward worthy pleasures, and to provide preparation for social and practical pursuits.

Scientific Facts and Organized Science: Karl Pearson, Arthur James Balfour, and Henry Adams

Science had changed in at least two important respects by the late nineteenth and early twentieth centuries, and both proponents and critics of science observed these changes. First, science no longer seemed to be firmly based upon facts. As late as the third edition of *The Grammar of Science* (1911), Karl Pearson still cites Charles Darwin's account of his painstaking collection of facts as a model of Baconian science (32–33). But other observers of science such as Arthur James Balfour and Henry Adams assert that this model is fundamentally wrong. In "Reflections Suggested by the New Theory of Matter" (1904), Balfour notes that the discovery of the atom calls into question "those 'plain matters of fact' among which common-sense daily moves with its most confident step and most self-satisfied smile" and asserts that the human race, before this discovery, had "lived and died in a world of illusions" (207–8). In *The Education of Henry Adams* (1918), Adams alludes to the "metaphysical bomb" called radium and accuses Pearson of shutting out of science "everything which the nineteenth century had brought into it" (450–52).

Second, science had reaped the rewards of its industrial applications and had, in the process, taken on increasingly intricate forms of organization – professional, academic, and industrial (Bernal, 134–78; Mason, 352–63). As a result, it was still Baconian science, but Baconian science in an entirely different sense, for both proponents and critics of science acknowledged Bacon as the visionary who foresaw the possible applications of pure science. In his essay "Bacon" (1912), Balfour calls Bacon a seer because he foresaw the need for pure science as a basis for "industrial invention" (35–36). In *Education*, Adams supposes that witnesses to the Great Exposition of 1900 knew nothing of science that Bacon did not know three hundred years earlier (379). Dewey recognizes both of these changes in Baconian science and brings them to bear upon his views of science, communication, and civilization.

Scientific Method, Communication, and Professional Communities: John Dewey

Dewey's science, his theory of communication, and his view of civilization are all part of a broad philosophical and educational program intended to collapse various dualisms (for example, Dykhuizen, 178–79; Frankel, 29–38). Like Huxley's view of language, Dewey's theory

of communication is inseparable from science construed as a mode of inquiry and from civilization construed as a process of building a social community. Dewey's method of science and communication, however, is based upon the model of organized physical science, in particular as applied to professional communities of social scientists, and so is suited to organizational, especially professional, rather than social communities. His method collapses the dualism of science and civilization by identifying the social community with organized science. Probably America's most influential philosopher and educator, Dewey made significant contributions to philosophy, social science, education, and numerous other fields (Boydston; Dykhuizen; Frankel). To philosophy, in works such as *Experience and Nature* (1925), *The Quest for Certainty* (1929), and *Logic: The Theory of Inquiry* (1938), Dewey brought "antifoundationalism," the belief that philosophy ought to abandon its quest for certainty, a belief that has influenced contemporary philosophy, though in several directions, principally through the work of Richard Rorty (Sleeper, 1–9).[3] Through his social science, set forth in *The Public and Its Problems* (1927), *Liberalism and Social Action* (1935), and other works, Dewey and his students influenced not only the universities but the practice of law, economics, social psychology, and political science (Frankel, 3–4). Finally, by his approach to education, described in *How We Think* (1910 and 1933), *Democracy and Education* (1916), and other works, Dewey established the foundation of the "experimentalist-oriented progressive school," widely popularized by William Heard Kilpatrick (Gutek, 191–201; Peters, 106–9).

Dewey's science is Baconian in the sense in which Bacon was understood in the late nineteenth and early twentieth centuries. That is, it looks for its method not in the accumulation of facts but in organized physical science. It is based upon facts, but it does not regard those facts as intuitively obvious. At the beginning of *The Public and Its Problems*, Dewey disputes the contention that facts have meaning in and of themselves: "Many persons seem to suppose that facts carry their meaning along with themselves on their face. Accumulate enough of them, and their interpretation stares out at you" (*LW* 2:238). He explains that the meaning of facts derives not from the facts themselves but from the method of the physical sciences: "Take away from physical science its laboratory apparatus and its mathematical technique, and the human imagination might run wild in its theories of interpretation even if we suppose the brute facts to remain the same" (*LW* 2:238). As a model for this method, Dewey's science looks to organized physical science and to Bacon, the visionary. In *Liberalism and Social Action*, Dewey applauds the achievements of physical science and credits Bacon with the vision to foresee that those achievements were possible: "The prophetic vision of Francis Bacon of subjugation of the energies of nature through change in methods of inquiry

has well-nigh been realized" (*LW* 11:51–52). He argues, however, that these achievements were made possible only by organized science, "organized intelligence," the "combined effect of science and technology," and that they were purchased at great cost, as "industrial entrepreneurs have reaped out of all proportion to what they sowed" (*LW* 11:51–54). For this reason, Dewey believes that Bacon's vision was only partially realized, for "the conquest of natural energies has not accrued to the betterment of the common human estate in anything like the degree he anticipated" (*LW* 11:53). Nonetheless, Dewey admires the power and achievement of the physical sciences, and he looks to organized physical science as the model for his method of science and communication.

Dewey's method of communication, set forth in his analysis of reflective thinking, is identical with his method of science. Dewey developed this method as a part of his educational practice for the purpose of involving students in cooperative problem-solving experiences as opposed to inert subject matter, and the method became the foundation of the progressive movement in education (Gutek, 193–94; Peters, 107–8). This method, as set forth in *Democracy and Education* and *How We Think*, is a generalization of the method of the physical sciences. It includes five steps, as a response to a confused situation: examining suggestions, or possible solutions; locating and defining the problem; using the suggestions to develop a hypothesis; reasoning, or elaboration of the hypothesis; and testing the hypothesis (*MW* 9:159–70; *LW* 8:199–209). This method is a method of both science and communication. As such, it is concerned with the relationship of words to facts and of the process of reflective thinking to its product. In *How We Think*, Dewey, like Huxley, turns to the seventeenth century, to Bacon and Locke, for cautions about the relationship of words to things, or facts (*LW* 8:131–34). He provides advice on how to organize words into meaningful sentences and units of consecutive discourse (*LW* 8:301–14). He distinguishes the process from the product of reflective thinking, logical method from logical form, actual thinking from the setting forth of the results of thinking (*LW* 8:171–76). But he also insists upon the necessary connection between the two, "the internal and necessary connection between the actual process of thinking and its intellectual product," and he observes that for a mature learner the psychological process of reflective thinking terminates in the logical product of "scientifically organized material" (*LW* 8:176–82). As the logical form of the psychological process, Dewey's method of communication is identical with his method of science.

Dewey's view of civilization, like Huxley's, is synonymous with politics in the classical sense. His method of science and communication, however, is based upon the model of organized physical science and so is suited to organizational and especially to professional rather than social com-

munities. In his essay "Philosophy and Civilization," Dewey revives the classical Greek view that regards all philosophy as a civic enterprise (Frankel, 5–6). He insists upon the intrinsic connection between philosophy and civilization, by which he means "that complex of institutions which forms culture," politics in the classical sense (*LW* 3:3–4). Elsewhere, he identifies politics with pursuit of the public good, and he proposes to use his method of science and communication, based upon the model of organized physical science, to identify and achieve that good. In *Liberalism and Social Action*, Dewey identifies the public good as the greatest good of the greatest number but rejects public discussion in favor of organized science as a means of achieving that good. He claims that public discussion, as "a kind of political watered-down version of the Hegelian dialectic, . . . has nothing in common with the procedure of organized cooperative inquiry which has won the triumphs of science in the field of physical nature" (*LW* 11:50–51, 54).

Inspired by the success of organized physical science, Dewey proposes to use its method to enhance inquiry in the social sciences. In *The Public and Its Problems*, he defines the problem of modern political life as the "eclipse" of the public due to the survival of archaic political and legal forms and arrangements in a machine age (*LW* 2:313–15). He seeks to make "the interest of the public" the guide and criterion of governmental activity, and to that end he proposes to search for means "by which a scattered, mobile and manifold public may so recognize itself as to define and express its interests" (*LW* 2:327). However, he does not seek to enhance the methods of public discussion about the public interest. Rather, he proposes to use the method of organized physical science to enhance inquiry in the social sciences and the dissemination of the results of that inquiry for the purpose of public discussion and the formation of public opinion (*LW* 2:339). Again, he proposes to address "the improvement of the methods and conditions of debate, discussion and persuasion," but he seeks to do so by perfecting the processes of inquiry and the dissemination of conclusions (*LW* 2:365). He does not propose to involve the public in the process of inquiry, which in his analysis of reflective thinking might include defining a problem, developing a hypothesis, and suggesting and testing solutions. He tacitly presumes that the organizational (professional) communities responsible for inquiry can represent the public interest and the public good on these issues.

Dewey's attempt to bring the method of science and communication to bear upon civilization has been criticized on grounds that it presupposes the existence of a community but does not identify the source of the community's shared ideas, views, and values (Bitzer, 77–81). It has also been criticized because it seeks to identify a "shared substantive interest" rather than to develop competent participants in public discussion

(Hauser and Blair, 161–63). Nonetheless, his method was widely influential in textbooks in speech communication, where it was designated "the motivated sequence" (Ehninger, Monroe, and Gronbeck, 143–61; Simons, 165), and in organizational communication, where it was "for many years the only organizational pattern taught in group discussion classes" (Bradley and Baird, 235). It provides theoretical support for the traditional identification of scientific and technical communication with organizational communities (for example, Bazerman; Farrell and Goodnight, 292–300; Miller and Selzer; Paradis, Dobrin, and Miller). And it reflects widespread practice in the methods of inquiry and organization of scientific articles, test reports, and design and feasibility reports; in these forms, it appears in virtually every textbook on research report writing and scientific and technical communication.

Dewey's method of science and communication collapsed the dualism of science and civilization. Insofar as this method was successful, it restored the traditional relationship of rhetoric to inquiry and to community. It brought together the method of science and the method of communication in the interest of building a social community. However, in so doing, it identified the social community with organized science. The utility of this method is that it enlists the power of the method of science as a method of communication in the service of a particular organizational community, its limitation that (if only implicitly) it forecloses participation in that community by those outside it.

The scientific rhetorics of Spencer, Huxley, and Dewey are not all of the same kind. Insofar as they are similar, these rhetorics reaffirm the relationship of rhetoric to inquiry and to the social community and so provide some (perhaps indirect) support for the supposition that the ideals (at least) of classical rhetoric persisted well into the nineteenth century (Crowley, "Evolution of Invention"; Crowley, "Invention"; Johnson; Rosner).[4] Insofar as they differ, these rhetorics suggest a range of possible relationships of rhetoric to inquiry and to the social community. Spencer's rhetoric, however narrow and reductive, is functional in the context of his claim to an inductive science and his belief in the natural evolution of civilization. Huxley's rhetoric, at its worst similarly reductive, nonetheless shows how rhetoric might aid scientific inquiry by ensuring the proper use of words and might help to improve the human condition and promote the development of civilization by serving personal, social, and practical goals. Dewey's rhetoric is more problematic. On the one hand, this rhetoric identifies social with organizational, especially professional, communities and aids science in the service of those communities. In this respect, it illustrates how science and scientific rhetoric in the service of organized, professionalized communities, rather than science or the specialization of the curriculum in itself, may have encour-

aged the development of practical rhetorics and the separation of rhetoric from science and from societal concerns. In just this way, it has been the most influential of these rhetorics in several fields of communication, including scientific and technical communication. On the other hand, Dewey's rhetoric enlists the method of organized physical science as a method of communication to promote the public good and so to foster the development of civilization. In this respect, it too reaffirms its relationship to inquiry and to the social community, to science and civilization.

NOTES

I am indebted to S. Michael Halloran and Merrill D. Whitburn for their comments on various drafts of this paper.

1. The terminology is not yet settled. Spencer uses the term *composition* fairly consistently. Huxley uses the terms *language* and *literary education* almost interchangeably. Dewey uses the term *communication* to subsume several other meanings, including *discussion*, *dissemination*, and *persuasion*.

2. Titles and dates for Campbell, Priestley, and Whately are from Ehninger; for Spencer, from Peel; for Huxley, from Paradis and *Huxley's Works*; and for Dewey, from Dykhuizen.

3. Rorty argues that philosophy ought to abandon its quest for the foundations of knowledge and ought rather to promote "conversation" between and among disciplines (313–94). Although he acknowledges that science is Dewey's favorite mode of communication, Sleeper nonetheless emphasizes the broader social purposes of Dewey's theory of communication, especially as set forth in *Experience and Nature*, and so provides a counterbalance to Rorty's (and my own) reading of Dewey (116–23).

4. John Stuart Mill's use of Plato in *A System of Logic Ratiocinative and Inductive* (1843) and *On Liberty* (1859) provides more direct evidence of the persistence of classical rhetoric in the scientific rhetorics of this period. Turner includes a brief introduction to Mill's use of Plato in *On Liberty* (386–87, 401–3).

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