Closure

Let us conclude. The myth of totally rigorous, totally formalized mathematics is indeed a myth. Mathematics in real life is a form of social interaction where "proof" is a complex of the formal and the informal, of calculations and casual comments, of convincing argument and appeals to the imagination and the intuition.

The competent professional knows what are the crucial points of his argument—the points where the audience should focus its skepticism. Those are the points where he will take care to supply sufficient detail. The rest of the proof will be abbreviated. This is not a matter of the author's laziness. On the contrary, to make a proof too detailed would be more damaging to its readability than to make it too brief. Complete mathematical proof does not mean reduction to a computer program. Complete proof simply means proof in sufficient detail to convince the intended audience—a group of professionals with training and mode of thought comparable to that of the author. Consequently, our confidence in the correctness of our results is not absolute, nor is it fundamentally different in kind from our confidence in our judgments of the realities of ordinary daily life.

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5 CHARLES DARWIN

RHETORICIAN OF SCIENCE

JOHN ANGUS CAMPBELL

To claim that Charles Darwin was a "rhetorician" may seem to confuse the provinces of rhetoric and science. Their juxtaposition, however, is not only warranted; it is also inescapable. Even scientific discourse must be persuasive to rescue insight from indifference, misunderstanding, contempt, or rejection. Aristarchus was not believed when he argued that the earth moved around the sun, and although Mendel discovered the laws of inheritance, he failed to convince his scientific peers.[1] To claim that Darwin was a rhetorician, therefore, is not to dismiss his science, but to draw attention to his accommodation of his message to the professional and lay audiences whose support was necessary for its acceptance. Commonly overlooked in studies of Darwin is that he persuaded his peers and the wider community by using plain English words and plain English thoughts.[2]

Prior to Darwin, no evolutionist, whether popularizer or professional scientist, enjoyed both a popular and a professional following.[3] (Some enjoyed neither.) To understand why Darwin was persuasive with the reading public as well as with a key minority of his professional peers requires an examination of Darwin as a rhetorician of science.

I

That *The Origin of Species* was a popular book should hardly be surprising. *The Origin* is rhetorical from the ground up. The brevity of Darwin's classic work—indeed, its appearance as an "abstract"—is evidence of its rhetorical character. That *The Origin* made its appearance as a single compact volume, accessible to a general au-

dience, was the result of a remarkable circumstance. In June 1858 Darwin was in the second year of writing *Natural Selection*, a book on transmutation which he had been planning since 1837. On the sixteenth of that month Darwin was startled to receive from the young naturalist Alfred Russel Wallace the sketch of a theory virtually identical to his own. In the wake of the Wallace letter, Darwin put aside his mammoth text, then two-thirds complete, and in nine months produced the work on which his fame rests.[4] Darwin received Wallace's letter on June eighteen, 1858.[5] He began *The Origin* on July 20, and by March 22 the book was written. *The Origin* went on sale on November 24, 1859.[6]

The ethos of its author is further proof that *The Origin* is rhetorical. Darwin directly appeals to the reader's sympathy: "my health is far from strong. . . . This Abstract . . . must necessarily be imperfect. I cannot here give references and authorities for my several statements; and I must trust to the reader reposing some confidence in my accuracy."[7] As Darwin's son Francis observed, "The reader feels like a friend who is being talked to by a courteous gentleman, not like a pupil being lectured by a professor. The tone of . . . *The Origin* is charming, and almost pathetic."[8]

The rhetorical character of *The Origin* is further established by its everyday language. Darwin's very title, *On the Origin of Species by Means of Natural Selection, or, The Preservation of Favoured Races in the Struggle for Life*, is colloquial. The themes of "origin," "selection," "preservation," "race," "struggle," and "life" underscore the intimacy, not the distance, between the author and the everyday world. Further, Darwin's exposition is as down to earth as his title. C. C. Gillispie's list of Darwin's commonplaces could be easily duplicated by any reader:

> So ordinary is the language that it almost seems as if we could be in the midst of reading a lay sermon on self-help in nature. All the proverbs on profit and loss are there, from pulpit and from counting house—On many a mickle making a muckle: 'Natural selection acts only by the preservation and accumulation of small inherited modifications, each profitable to the preserved being'; On the race being to the swift: 'The less fleet ones would be rigidly destroyed'; On progress through competition: 'Rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being'; . . . . On saving time: 'I could give many examples of how anxious bees are to save time'; . . . On the compensation that all is, nevertheless, for the best: 'When we reflect on this struggle, we may console ourselves with the full belief, that the war of nature is not incessant, that no fear is felt, the death is generally prompt, and that the healthy and the happy survive and multiply.'[9]

Further evidence that *The Origin* is rhetorical is seen in Darwin's deference to English natural theology. Everyone knows that theological objections were raised against *The Origin*. What might surprise the modern reader is the theological defense within it. In the first edition, Darwin's flyleaf contained two citations from works in the tradition of English natural theology, one from William Whewell's *Bridgewater Treatise* and one from Francis Bacon's *Advancement of Learning*. In the second edition the first two citations were reinforced by a third from Bishop Butler's *Analogy of Revealed Religion*. In the first edition, the famous final line, which begins, "There is grandeur in this view of life," continues, "with its several powers, having been originally breathed into a few forms or into one." Starting in the second edition, the line has been changed to read "breathed by the Creator into a few forms or into one." In the fourth edition of the work, the reader finds the following postscript at the end of the table of contents: "An admirable . . . Review of this work including an able discussion on the Theological bearing of the belief in the descent of species, has now been . . . published by Professor Asa Gray, M.D., Fisher Professor of Natural History in Harvard University."[10] The reader of *The Origin* would not know that Darwin himself was responsible for financing the publication of Gray's essays in pamphlet form (originally they appeared as unsigned essays in the *Atlantic Monthly*), and until 1867 he would have no way of knowing that Darwin did not believe in the argument they contained.[11] Although Darwin privately expressed his difference with Gray in a letter in the fall of 1860, it was not until 1867 that he publicly rejected Gray's argument in the conclusion to his two-volume *Variation in Plants and Animals Under Domestication*.[12] No mention of this refutation was ever made in the subsequent two editions of *The Origin* (1869, 1872). Indeed, throughout the body of his book, whether the reader examines Darwin's case for the common ancestry of the horse, hemionus, quagga, and zebra or his account of how natural selection could have formed the eye, Darwin urges his views as more in keeping with proper respect to the ways of Providence than the views of his opponents.[13]

The rhetorical character of *The Origin* is also seen in Darwin's appeal to common sense. In language reminiscent of Scottish Commonsense Philosophy, Darwin urged that we can trust a theory which explains so

many large classes of facts because this "is a method used in judging in the common events of life."[14]

II

In light of the manifest rhetorical features which would have recommended *The Origin* to a general audience, an obvious question suggests itself. Why did the clearly popular character of Darwin's writing not impede the reception of his ideas among his scientific peers? One reason Darwin's literary language did not pose the kind of obstacle to professional acceptance it would today is, as Susan Gliserman has noted, that all science was so plainly literary in Darwin's day: "I have considered the literary structure of the science writers as no difference from that of Tennyson's poems."[15] Yet, as Darwin's imagistic language was an issue, even by the standards of his own time, something more than Darwin's conformity with accepted literary conventions seems to have been involved in his generating both professional support and popular appeal.

A reputation for eloquence can be a dangerous thing. Although the art of rhetoric may make a speech or book striking, if its artistry is detected, that very fact may be advanced as reason for rejecting it. If it seems unlikely that anyone in real life could claim, "I am no orator as Brutus is," and then deliver an eloquent address without the audience's getting suspicious, it is well to recall the example of Thomas Henry Huxley. It was the no-nonsense Huxley who coined the term "agnosticism" and who characterized Comte's religion of humanity as "Catholicism *minus* Christianty."[16] Both Darwin and Huxley enjoyed solid reputations as scientists, both were unusually gifted writers, yet neither man's literary skills ever compromised his reputation for fact and dusty sobriety. Like Huxley, Darwin minimized his literary gifts. He also minimized his formidable theoretical power. Darwin's dismissal of his own colorful language and deemphasizing of the hard, sustained theoretical work behind his theory are connected.

Darwin introduced the major theoretical work of modern biology by minimizing the importance of his own speculative powers; he used provocative images throughout his exposition, yet he explained away his originality by insisting that his ideas were the result of "facts" and his metaphors mere expressions of convenience.

The thesis I am arguing is that Darwin was able to make his rhetoric seem unimportant or at best incidental to his scientific point and to persuade his professional peers because his narrative was governed by the

conventions of Baconian induction and quasi-positivist standards of proof. Examination of the discrepancies between Darwin's public and private attitudes toward his method, language, and achievement offers a rare glimpse of a process which, in successful science at least, is infrequently observed: the production of the Mark Anthony effect, in which rhetoric is freely employed and effectively masked.

One of the most striking discrepancies between Darwin's public and private attitudes toward the conventions of proper scientific theory is the contrast between his declared and his actual path to discovery. In the opening paragraph of *The Origin* we read the following account:

> When on board H.M.S. 'Beagle,' as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species—that mystery of mysteries as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years work I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions, which then seemed to be probable: from that period to the present day I have steadily pursued the same object. I hope that I may be excused for entering on these personal details, as I give them to show that I have not been hasty in coming to a decision.[17]

In his *Autobiography* Darwin similarly affirms: "I worked on true Baconian principles, and without any theory collected facts on a wholesale scale." Of his famous insight on reading Malthus, Darwin records: "Here, then, I had at last got a theory by which to work."[18]

What one finds when one examines Darwin's private notebooks, however, is irreconcilable with Darwin's public statements about his research method. One of the closest students of these notebooks, Howard Gruber, says of Darwin's public comments on method: "Insofar as he said anything publicly on the subject of method, Darwin presented himself in ways that are not supported by the evidence of the notebooks." In response to Darwin's granddaughter, Nora Barlow, who affirmed that in the earlier days there was a closer fit between her grandfather's theorizing and observations, Gruber observed that "it seems to me that even in these early notebooks, . . . he delighted in far-ranging speculations and saw himself as creating ideas of the same

grandeur and cosmic scale as the 'early astronomers' to whom he likened himself."[19] Of the specific citations we have noted from *The Origin* and the *Autobiography,* Gruber comments:

> Taken together, these statements give an extremely misleading picture. Darwin certainly began the notebooks with a definite theory, and when he gave it up it was for what he thought was a better theory. True, when he gave up his second theory he remained in a theoretical limbo for some months. But even then he was always trying to solve theoretical problems. . . . he almost *never* collected facts without some theoretical end in view. It was not simply from observations but from hard theoretical work that he was so well prepared to grasp the significance of Malthus' essay.[20]

Occasionally in his correspondence, Darwin would similarly present himself as a firm inductionist. In a letter to Herbert Spencer's American disciple John Fiske, Darwin diplomatically avoided discussing Fiske's books by affirming: "my mind is so fixed by the inductive method, that I cannot appreciate deductive reasoning. I must begin with a good body of facts and not from principle (in which I always suspect a fallacy), and then as much deduction as you please."[21] But in letters to his associates, Darwin expressed himself quite differently. In a letter written in June 1860 to his long-time friend Charles Lyell, Darwin bemoaned a paper by Hopkins, who would not accept the argument of *The Origin* on the ground that the mere explanatory value of a theory did not prove its correctness: "on his standard of proof, natural science would never progress, for without the making of theories, I am convinced there would be no observations."[22] In a letter written in 1861 to his colleague Henry Fawcett, Darwin criticized strict inductionists in these words: "About 30 years ago there was much talk that geologists ought only to observe and not theorise; and I well remember some one saying that at this rate a man might as well go into a gravel pit and count the pebbles and describe the colours. How odd it is that anyone should not see that all observation must be for or against some view if it is to be of any service!"[23]

Given that Darwin not only understood the importance of theory, but began his own research with a conclusion that transmutation had occurred, and held to that conclusion even when he could not factually support it, how are we to account for the discrepancy between Darwin's private and public statements on method? The discrepancy, I believe, is explained by the view that Darwin was using a methodological convention important to his colleagues, though irrelevant to his science, to give a traditional warrant to a controversial thesis and hence make it persuasive.

That Darwin's public account of his method was rhetorically motivated is supported by the esteem in which Baconian induction was held by all English philosophers of science in the mid-nineteenth century. John Herschel, William Whewell, and John Stuart Mill disagreed about many particulars, but on one thing they were resolved—true science was inductive. In analyzing the place of induction in mid-century philosophy or science, David Hull makes the wry observation: "It would be nice to be able to set out at this point the meaning which the disputants attached to this word, but I cannot. Everyone meant something different by it, and in the works of a single man, one is likely to find many different uses of the word."[24] In short, by Darwin's time "Baconian Induction" had become what Bacon would have called an "Idol of the Theatre."

As Charles Bazerman points out in his paper on the history of the American Psychological Association's stylesheet, professional conventions dictate the form of scientific discourse.[25] In Darwin's time, no less than in our own, data certified by the appropriate method are far more likely to be accepted than argument about fundamentals. Even M. T. Ghiselin, who along with Gavin DeBeer holds that Darwin was true to the canons of the hypothetical-deductive method, describes Darwin's introductory paragraph to *The Origin* as a "dialectical maneuver" and observes that "Darwin, like other scientists of his day, gave much lip service to 'induction,' and such hypocrisy has long obscured the real nature of scientific discovery." Ghiselin's way of avoiding misunderstanding Darwin is "to abandon the study of words and to derive our understanding from concepts." In Ghiselin's view, "The structure of Darwin's systems explains his success and failure alike. When the process through which his discovery was generated has been understood, there is no reason whatever to treat his perfectly ingenuous accounts of the discovery as mistaken, contradictory, or hypocritical."[26]

I concur with Ghiselin's assessment of the importance of understanding "Darwin's systems." I reluctantly differ with his judgment that once this is done Darwin's statements on method emerge as "perfectly ingenuous." The testimony of Darwin's notebooks argues strongly that Darwin thought long and hard, not only about nature, but about persuasion, and that he went to great lengths, including not developing his views on the evolution of man, to minimize the shock of novelty *The Origin* would occasion.[27] No one serious about making a revolution can lightly ignore accepted professional standards. How far

one goes in deferring to standards irrelevant or hostile to one's actual research procedures determines the personal dimension in science. Some writers, like René Descartes or Noam Chomsky, may storm the citadel of convention directly. The fact is, however, that frontal assault was not Darwin's style, and thus a certain disingenuousness was necessary for Darwin to be persuasive. Edward Manier puts the issue of Darwin's rhetorical strategy succinctly: "the early drafts of the theory do not conform to the 'hypothetico-deductive model' of scientific explanation, although they indicate Darwin's intent to represent his views as *if* they did conform to that model."[28]

To appreciate how much rhetorical ingenuity went into the composition of *The Origin*, one has only to contrast the reassuring inductivist style of *The Origin* with the rapid sequence of topics, inferences, and reflections on strategies of persuasion one finds in Darwin's notebooks. There is ample science in Darwin's notebooks and much of it is outstanding science. But the story-line is not the same as that in *The Origin*. In the notebooks, we see the young Darwin, even before he solved the technical problem of speciation, thinking of ways to solve the problem of persuasive exposition. In the "C" notebook Darwin reminds himself to point out to his audience the moral responsibility of the scientist as epochal truth-bearer:

> Mention persecution of early Astronomers,—then add chief good of individual scientific men is to push their science a few years in advance only of their age . . . . must remember that if they *believe* & not openly avow their belief they do as much to retard as those whose opinion they believe have endeavored to advance the cause of truth.[29]

The same notebook illustrates the intermingling of his scientific insight with his theological and strategic reflections:

> Study Bell on Expression & the Zoonomia, for if the former shows that a man grinning is to expose his canine teeth ((this may be made a capital argument. if man does move muscles for uncovering canines)) no doubt a habit gained by formerly being a baboon with great canine teeth.—((Blend this argument with his having canine teeth at all.—)) . . . Hensleigh says the love of the deity & thought of him / or eternity / only difference between mind of man & animals.—yet how faint in a Fuegian or Australian! Why not gradation.—no greater difficulty for Deity to choose. when perfect enough for Heaven or bad enough for Hell.—(Glimpses bursting on mind & giving rise to the wildest imagination & superstition.—York Minster story of storm of snow after his brother's murder.—good anecdote.[30]

In the "M" notebook Darwin's awareness of the rhetorical dimension of his task is registered in his reflection on how best to make his underlying philosophy: "To avoid stating how far I believe in materialism, say only that emotions, instincts, degrees of talent, which are hereditary are so because brain of child resembles parent stock."[31] The "M" notebook also makes clear that from the first Darwin speculated freely on both science and philosophy and did not begin by amassing facts and postponing thought: "Origin of Man now proved.—Metaphysics must flourish.—He who understands baboon would do more toward metaphysics than Locke."[32] When one contrasts the breadth and exuberance of Darwin's early reflections, which freely move backward and forward through philosophy, theology, rhetoric, psychology, and numerous branches of natural science, and encompass ethics and aesthetics, with the chastened tone and narrow range of topics addressed in *The Origin*, one is little short of awed by the massive restraint and carefully premeditated adaptation of his public argument.

Darwin's care to redescribe his path to discovery so that it appeared to conform with conventional standards of Baconian inductionism is not the only way in which he adapted his ideas to his scientific peers. Darwin was rhetorical both in his concern with persuasion and in the heavily metaphorical character of his thought. His images lent his ideas popular appeal, but since they drew attention to themselves as images, explaining them away posed a distinct rhetorical challenge. As of his method, so of his metaphors. Darwin argued that his language conformed to accepted professional standards.

The highly imagistic character of Darwin's language was a center of controversy from the very first. Ghiselin's recommendation that Darwin's language simply be set aside indicates that the problem of how to interpret it is still an open question. C. C. Gillispie has long held that Darwin expressed himself in a needlessly misleading manner, and even Howard Gruber, who does not appear to share Ghiselin's view of the cogency of Darwin's approach to method, cautions that making too much of the social roots of Darwin's language is "unDarwinian."[33] It is at least curious that so many distinguished interpreters of Darwin, who do not necessarily agree on other points, concur in deemphasizing the importance of his language for an understanding of his achievement. The thesis is worth considering that Darwin used metaphorical language to make his scientific point and that the very connotations we are warned not to take seriously were instrumental in his ability to per-

suade both his professional peers and the general public. To determine what importance to attach to Darwin's language, let us contrast his public statements concerning language with the testimony of his private papers.

Starting with the third edition of *The Origin*, Darwin responded to the criticism of his imagistic language by pointing out that certain of his metaphors were in fact metaphors:

> In the literal sense of the word, no doubt, natural selection is a misnomer; but who ever objected to chemists speaking of the elective affinities of the various elements?—and yet an acid cannot strictly be said to elect the base with which it will in preference combine.
>
> It has been said that I speak of natural selection as an active power or Deity; but who objects to an author speaking of the attraction of gravity as ruling the movements of the planets? Everyone knows what is meant and is implied by such metaphorical expressions; and they are almost necessary for brevity. So again it is difficult to avoid personifying the word Nature; but I mean by Nature, only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us. With a little familiarity such superficial objections will be forgotten.[34]

Darwin's public account of his metaphors creates the impression that his images could be replaced by literal statements if time were not a factor. But Darwin's philosophy of language, as well as his use of language generally, shows that rhetoric is essential, not incidental, to his case.

Darwin's minimizing of metaphor manifests his seeming deference to the linguistic standards of Comtean positivism. In August 1838 Darwin read David Brewster's review of the first two volumes of Comte's *Philosophie Positive*.[35] Brewster's review convinced Darwin of Comte's thesis that, like humankind in general, each science goes through the stages of myth and metaphysics before reaching a final positive stage. After reading Brewster's review, Darwin took as his own the mission of bringing biology out of the metaphysical stage.[36] A significant point of difference between Darwin and Comte, revealed by Darwin's notebooks and underscored by his published writing, however, concerns the language proper to science. Comte's philosophy of language was thoroughly nominalist. Both in his theory of language and in his use of language, Darwin was a realist. Comte, for example, would ban from chemistry such expressions as "elective affinities" and ban "attraction"

from the language of astronomy. In the above quotation from the *The Origin*, although he retains the offensive terms from astronomy and chemistry, Darwin's definition of "nature" and "natural law" are solidly in line with Comtean linguistic standards.[37]

Darwin's difference with Comte on the language proper to science in fact was radical. First, in keeping with the realism of Scottish Commonsense Philosophy, Darwin saw nature itself as expressive. Human language, in the Scottish Commonsense view, was a continuation of the natural expressiveness of all sentient life.[38] Having accepted this position, Darwin did not have the horror of anthropomorphism that was endemic to positivism, with its demand for a language appropriate to a Cartesian billiard-ball universe. Second, and as a corollary, Darwin saw the aim of scientific language as persuasive communication and not conceptual precision.[39]

Darwin's philosophy of language is as important to his *scientific* achievement as to his popular success because it, rather than the inductivist-positivist theory of language to which he publicly deferred, helps explain his success in estabishing a novel research paradigm. We can see the distance between Darwin's public quasi-positivist account of his metaphors and the actual use he made of figurative language by examining his key terms, "natural selection" and "struggle for existence." In a crucial section of his chapter on "Natural Selection," Darwin dramatically contrasts man's puny powers with the powers of nature: "Man can act only on external and visible characters: nature cares nothing for appearances. . . . She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life." In the next paragraph, Darwin says, "It may metaphorically be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers."[40]

There is a marked discrepancy in these passages between Darwin's claim that he is merely adopting a way of speaking and his inability to speak any other way. Since in Darwin's own terms nature's selection is invisible and insensible, his metaphor is a matter of necessity and not of convenience. In this passage Darwin uses rhetorical language simultaneously to propose a new paradigm for science and to create a new popular understanding of humanity's relation to nature. The key element is the tension between Darwin's image of the human selector (the breeder), whose operations are known to the audience, and the operations of nature, whose ways are unknown. The image of the selector is persuasive precisely because it brilliantly exploits a technological sym-

bol and thus competes with the idea of miracle in a concretely believable way. Miracles were more credible to Darwin's contemporaries than the obvious a fortiori argument, popularly advanced by Robert Chambers and Herbert Spencer, that since natural law governed every other department of science, it *must* govern biology as well. A common expression in the science of Darwin's time was "the laws of creation."[41] Darwin, we may surmise, was persuasive because he took the "confused notion" of "creation" by "law" and gave it a decisive naturalistic turn.[42] In comparison with Milton's "The grassie Clods now calv'd, now half appeer'd the Tawnie Lion, pawing to get free His hinder parts," Darwin's "natural selection" was equally concrete yet provided a more believable illusion because the reader knew how domestic varieties came into being.[43] The image of nature forming species, much as the cattle-breeder or the pigeon-fancier formed varieties, is a naturalistic image that for scientist and general reader is truer to experience than is miracle. For the scientist in particular, "natural selection" heuristically embodies a richer research program than the one embodied in the notion of "laws of creation." When we appreciate that Darwin had originally hoped to explain variation, and could not, we begin to understand why it is the rhetorical tradition of the Scottish Commonsense Philosophers, and not the positivist tradition of August Comte, that accounts for his language.

"Natural selection" does not explain how an imperceptible variation internal to the organism could be selected. Nor does it allow us to predict the kind of internal variations we would expect to find in organisms in a particular environment. What natural selection does is clear a semantic space that a natural law might fill. Indeed, Edward Manier describes the semantic-rhetorical function of natural selection precisely when he describes it as a "place-holding allusion."[44] Natural selection is not incompatible with any known law, and it is not supernaturalistic, because although Darwin magnifies nature's powers, his concept of "nature," like the breeder, acts only on variations when they happen to occur.

The nonpositivist character of Darwin's term is underscored when we consider its ancestry. In his sketch of 1842, and again in his draft of 1844, Darwin had asked the reader to imagine "a being more sagacious than man, (not an omniscient creator)."[45] Although "natural selection" is less anthropomorphic than the "being more sagacious than man," the function of the image remains identical. Rather than asking the reader to imagine "a being," Darwin simply has the reader project what is known of the operations of the domestic breeder onto nature. Although Darwin's image does not explain variation, or even how imperceptible unspecified internal variations could be of use to the organism, it does provide science with a heuristically rich "as if" to guide research.

What we have seen as true of "natural selection" holds equally for Darwin's other centrally important term, "struggle for existence." In both cases, the affective connotations of the terms seem to have been at least as important as their literal meanings. When we see the variety of terms Darwin considered, the self-consciously rhetorical character of Darwin's choice of "struggle for existence" becomes clear. In *Natural Selection*, the book Darwin abandoned when he received the Wallace letter, the section which corresponds to chapter 3 of *The Origin*, "The Struggle for Existence," had once been entitled "War of Nature." An early topic sentence had read, "The elder De Candolle in an eloquent passage has declared that all nature is at war."[46] Manier notes that Darwin at one time considered using Lyell's expression "equilibrium in the number of species." Indeed, Darwin affirmed that Lyell's expression was "more correct" than his own. Significantly, however, Darwin rejected Lyell's expression on the ground that it conveyed "far too much quiescence." By Darwin's own account, accuracy was not his criterion. He chose "struggle for existence" because it occupied a desirable semantic space mid-way between "war" and "equilibrium."[47] In *The Origin*, Darwin distinguished three uses of the term "struggle." He indicated that we could speak of organisms as "truly" engaged in struggle where two animals were in competition with one another for the same scarce resource and if one obtained more of the resource, that animal would increase its life expectancy or prospects of leaving progeny, while its adversary would not. Second, the "less proper" meaning of struggle would describe a situation in which an organism confronted a limited environment, as in the case of a plant in time of drought. Darwin recognized that it would be "more proper" in such an instance to say that the plant was "dependent" upon moisture than to say that it was struggling to survive. Finally, Darwin used "far fetched" to characterize a struggle in which a parasite so increased in power that it threatened its host's existence and, ultimately, its own. Darwin noted that the three meanings "pass" or "graduate" into each other.[48] As Manier observes of these three meanings:

> it is necessary to consider the possibility that each meaning influenced his understanding of the other two. The domain of events referred to by the terms 'war' or 'conflict,' for example, may be significantly redescribed if the same term ('struggle') is used to designate it and two other domains (those more

commonly designated by 'dependence' and 'chance') as well. The result is not the expression 'too much quiescence' but rather an elaborate qualification of the 'strict meaning' of 'struggle' within the context of Darwin's theory. Darwin's use of this metaphor may have been poetic as well as scientific. He was willing to risk the ambiguity resulting from the inter-connection of a variety of related but distinct meanings in a single, compressed metaphoric representation.[49]

Darwin's invocation of quasi-positivistic disclaimers for his use of metaphoric terms can be reconciled neither with his adherence to Scottish Commonsense linguistic philosophy nor with the functions of his key terms "natural selection" and "struggle for existence" in *The Origin*. His public insistence that his images were for convenience was an apparent attempt to defer to scientific conventions too professionally entrenched to challenge. Darwin's distinct genius for giving old terms new meanings in order to present persuasively a novel vision of nature was central to his scientific and popular success, even though the linguistic-rhetorical theory which informed his choice of language could not have been made explicit without damage to his credibility.

A final aspect of Darwin's adaptation to his professional audience concerns his endeavor to convince his peers that in natural selection he had identified the specific mechanism by which evolution occurs. Clearly, since Erasmus Darwin, Jean Baptiste Lamarck, Etienne Geoffroy Saint-Hilaire, Robert Chambers, and Herbert Spencer all had argued the general case for evolution, Darwin's unique scientific contribution was his theory of natural selection. In presenting his theory, he was careful to use language that would communicate to his peers the unique explanatory power he believed natural selection possessed. Following the theoretical language popularized by John Herschel, Darwin spoke of natural selection as the *vera causa* of organic change.[50]

As has been often remarked, the irony of Darwin's achievement is that he succeeded in popularizing all forms of evolutionism but his own.[51] Even Huxley, wholehearted as he was in advancing science through championship of Darwin, did not believe natural selection to be the sole cause of evolution. Whereas Darwin insisted that "natura non facit saltum," Huxley was willing to allow an occasional leap, particularly when Lord Kelvin insisted that data from physics denied that the earth was as old as Darwin needed it to be. Although personally, as Michael Ruse puts it, Darwin "miserably dug in his heels and refused to defer to the physicists," he concluded in private and in a letter to the

Athenaeum that the specific theory one adopted was less important than the choice between evolution of whatever kind and special creation.[52]

From a rhetorical standpoint, the irony of Darwin's achievement is only partial. However scientifically important natural selection is for contemporary science, in historical and rhetorical perspective, Darwin's discovery was only an incident in the development of a general argument he already believed in on other grounds. In the spring of 1838, before he had read Malthus, Darwin observed in his notebook that there was scarcely any novelty in his theory of transmutation and that the whole object of his prospective book was proof. Dov Ospovat concluded his examination of the pre- and post-Malthus Darwin by underscoring the early emphasis on the general argument: "Darwin was fond of the theory of natural selection, but his greatest concern was to establish the doctrine of descent."[53] Darwin's use of the theoretically fashionable expression *vera causa* was not entirely lost on his professional peers and no doubt made his ideas seem all the more impressive to the general reader. His brilliant evolutionary reinterpretation of the known facts and theories of mid-century science persuaded a significant number of his peers and no doubt many of his lay contemporaries that some naturalistic *vera causa* could account for organic change.[54] We err when we think that Darwin's underlying intent was to offer an original scientific theory. Darwin's initial intent was to make evolutionism persuasive.

III

Charles Darwin was a brilliant scientist, but neither an iconoclast nor a martyr. Shortly after his return to England, probably as a result of reviewing the data on geographical distribution from the *Beagle* voyage, Darwin became a convinced transmutationist. As his was a bold and original mind, Darwin at once proceeded to draw out the various implications of his discovery. As Darwin's notebooks demonstrate, theological, aesthetic, and moral theorizing, as well as sustained reflection on how best to persuade, were integral to his thought from the first. After formulating and abandoning two theories of transmutation, Darwin at last recognized in Malthus the principle long implicit in his own thought. His personal identification with the professional scientific community of his time made him anxious that advocacy of evolutionism not damage his scientific reputation. Darwin found in the language of Baconian inductivism and positivism the pro-

tective coloration he needed for his unorthodox conclusions. Indeed, Darwin was so persuasive in redescribing his path to discovery and his philosophy of language that he even convinced himself. Various letters and the statement in his *Autobiography* that only with Malthus did he at last have a theory all indicate that as he grew older Darwin began to remember his path to discovery not as it had been, but as Baconian and positivist method held that it should have been.[55]

Darwin's disavowal of his own rhetoric was not without cost. Consequent to his denial of his philosophy of language, Darwin lost his ability to delight in what he beheld. In later life he complained, "My mind seems to have become a kind of machine for grinding general laws out of large collections of facts, but why this should have caused the atrophy of that part of the brain alone, on which the higher tastes depend, I cannot conceive."[56]

At the beginning of this essay I affirmed the propriety of juxtaposing rhetoric and science. For Darwin, the consequence of denying his own rhetoric was poignant. For us, affirming Darwin as a rhetorician of science underscores rhetoric as the bridge uniting science with culture and, far from denying the integrity of Darwin's vision, restores the motive which gave it life.

NOTES

1. Giorgio de Santillana, *The Origins of Scientific Thought* (New York: Mentor Books, 1961), pp. 248–50; Loren Eiseley, *Darwin's Century* (New York: Anchor Books, 1961), pp. 205–7.

2. Paul N. Campbell, "Poetic-Rhetorical, Philosophic, and Scientific Discourse," *Philosophy and Rhetoric* 6 (1973): 1–3. Dov Ospovat observes in *The Development of Darwin's Theory* (Cambridge: Cambridge University Press, 1981), p. 229, "that the formation and transformation of Darwin's theory represent not so much the results of an interaction between the creative scientist and nature as between the scientist and socially constructed conceptions of nature."

3. Michael Ruse, *The Darwinian Revolution* (Chicago: University of Chicago Press, 1979), pp. 94–131.

4. R. C. Stauffer, ed., *Charles Darwin's Natural Selection* (Cambridge: Cambridge University Press, 1975), pp. 8–10.

5. For a critical discussion of the date on which Darwin received the Wallace letter, see John Landon Brooks, *Just Before the Origin* (New York: Columbia University Press, 1984), pp. 229–57.

6. November 24 is the traditional date. For discussion of November 26 as the true date see Morse Peckham, *The Origin of Species by Charles Darwin: A Variorum Text* (Philadelphia: University of Pennsylvania Press, 1959), p. 18.

7. Charles Darwin, *On the Origin of Species: A Facsimile of the First Edition with an Introduction by Ernst Mayr* (New York: Atheneum, 1967), pp. 1–2.

8. Francis Darwin, ed., *Charles Darwin's Autobiography*, with introductory essay by Gaylord Simpson (New York: Collier Books, 1950), p. 115.

9. Charles Coulston Gillispie, *The Edge of Objectivity* (Princeton: Princeton University Press, 1960), pp. 303–4.

10. Peckham, *Origin of Species*, pp. [ii], 759, 57.

11. A. Hunter DuPree, *Asa Gray 1810–1888* (Cambridge: Harvard University Press, 1959), pp. 298–301.

12. Sir Francis Darwin, ed., *More Letters of Charles Darwin* vol. 1 (London: John Murray, 1903), p. 146; see also pp. 190–94; Charles Darwin, *Variation in Plants and Animals Under Domestication*, vol. 2 (New York: D. Appleton & Co., 1896), pp. 248–49.

13. Darwin, *The Origin*, 1st ed., pp. 167, 188–89. For other examples of the same kind, see, for instance, pp. 243–44, 484, and Peckham, *Origin of Species*, pp. 748, 753.

14. Peckham, *Origin of Species*, p. 748, 6th ed.

15. Susan Gliserman, "Early Victorian Science Writers and Tennyson's 'In Memoriam': A Study in Cultural Exchange," Pt. 2, *Victorian Studies* 18 (1975): 456.

16. Cited in William Irvine, *Apes, Angels and Victorians* (New York: Meridian Books, 1964), pp. 249–50.

17. Darwin, *The Origin*, 1st ed., p. 1.

18. Nora Barlow, ed., *The Autobiography of Charles Darwin: 1809–1882* (London: Collins, St. James Place, 1958), p. 120.

19. Howard Gruber, *Darwin on Man: A Psychological Study of Scientific Creativity: Together with Darwin's Early and Unpublished Notebooks*, transcribed and annotated by Paul Barrett, foreword by Jean Piaget (New York: E. P. Dutton), p. 123.

20. Ibid., p. 173.

21. Francis Darwin, ed., *Life and Letters of Charles Darwin*, vol. 2 (New York: D. Appleton, 1896), p. 371.

22. Francis Darwin, ed., *More Letters of Charles Darwin*, vol. 1 (New York: D. Appleton, 1903), p. 195.

23. Ibid.

24. David Hull, *Darwin and His Critics* (Cambridge: Harvard University Press, 1973), p. 4.

25. Charles Bazerman, "Codifying the Social Scientific Style: The APA *Publication Manual* as a Behaviorist Rhetoric," in this volume.

26. Michael T. Ghiselin, *The Triumph of the Darwinian Method* (Berkeley and Los Angeles: University of California Press, 1969), pp. 35, 75.

27. Gruber, *Darwin on Man*, pp. 23–24.

28. Edward Manier, *The Young Darwin and His Cultural Circle* (Boston: D. Reidel, 1978), p. 195.
29. Gruber, *Darwin on Man*, p. 450 (C123).
30. Ibid., p. 454 (C243).
31. Ibid., p. 276 (M57).
32. Ibid., p. 281 (M84).
33. Gillispie as cited in Manier, *The Young Darwin*, p. 19; Gruber, *Darwin on Man*, p. 12.
34. Peckham, *Origin of Species*, p. 165, 3d ed.
35. Manier, *The Young Darwin*, p. 40.
36. Gruber, *Darwin on Man*, p. 278 (M69-M73).
37. Manier, *The Young Darwin*, pp. 39-40.
38. Ibid., p. 199.
39. Ibid., pp. 61–64, 149, 150, 154–56, 158, 161.
40. Peckham, *Origin of Species*, pp. 168–69, 2d ed.
41. Ruse, *Darwinian Revolution*, pp. 152–57, 99, 100; Charles Coulston Gillispie, *Genesis and Geology* (New York: Harper & Row, 1951), pp. 146–50.
42. Chaim Perelman, and Lucie Olbrechts-Tyteca, *The New Rhetoric: A Treatise on Argumentation* (Notre Dame, Ind.: University of Notre Dame Press, 1969), pp. 79, 132–35, 450.
43. John Milton, *The Complete Poetry and Selected Prose*, vol. 7: *Paradise Lost*, introduction by Cleanth Brooks (New York: Modern Library, 1950), p. 260.
44. Manier, *The Young Darwin*, p. 174.
45. Ibid., 174–75; Charles Darwin and Alfred Russel Wallace, *Evolution by Natural Selection*, with a foreword by Sir Gavin DeBeer (Cambridge: Cambridge University Press, 1958), pp. 45, 114, 115.
46. Stauffer, *Darwin's Natural Selection*, pp. 175, 569. Darwin attributes the phrase "All nature . . . is at war" to the elder De Candolle rather than to Hobbes as Manier affirms. See Manier, *The Young Darwin*, p. 181.
47. Manier, *The Young Darwin*, p. 181.
48. *The Origin*, pp. 62–63, 1st ed.
49. Manier, *The Young Darwin*, p. 13.
50. Darwin, *The Origin*, e.g., pp. 159, 482, 1st ed. For the role of *vera causa* in the dispute, see Hull, *Darwin and His Critics*, pp. 27, 45, 109, 115, 163, 180, 355.
51. Ruse, *Darwinian Revolution*, pp. 205–6.
52. Ibid., pp. 222–25; Ospovat, *Development of Darwin's Theory*, p. 89.
53. Ospovat, *Development of Darwin's Theory*, pp. 87, 88.
54. Ibid., pp. 210–35.
55. See nn. 18, 21, 22.
56. *Autobiography*, p. 139.

6 WHERE OBJECTIVITY LIES

THE RHETORIC OF ANTHROPOLOGY

RENATO ROSALDO

One foggy night a number of years ago, I found myself driving with a physicist along the mountainous stretch of Route 17 between Santa Cruz and San Jose. Being a little anxious about the weather and having nothing better to do, we tried to talk about our respective fields. He began by asking me, as only a physicist could, what anthropologists had discovered.

"Discovered?" I asked, pretending not to know what he meant and hoping something would come to me.

"Yes," he said, "like the properties or laws of other cultures."

"Oh," I mumbled, my heart sinking, "you mean something like $E = mc^2$."

"Yes," he said.

"There's one thing," I suddenly heard myself saying, "that we know for sure. We all know a good description when we see one. We haven't discovered any laws of culture, but we do think there are classic ethnographies, really telling descriptions of other cultures, like the Trobriand Islanders, the Tikopia, and the Nuer."

What a relief! Probably I burbled on about Tom Kuhn's notion of exemplars: classic experiments that physicists learn in the process of mastering their trade.[1] Though such experiments cannot be reduced to rules or recipes, they are vehicles through which young physicists learn to recognize and produce a good piece of work. Similarly, perusal of classic ethnographies rather than a set of methodological procedures teaches young anthropologists what a good description of other lifeways looks like.

Considering the discipline's folk belief in an ethnographic canon, it is peculiar that apprentice anthropologists, as a matter of course, do not