The Selection of the "Survival of the Fittest"

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> If such [favourable variations] do occur, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection.[1]

Darwin thus summarized his theory in the first edition of the *Origin of Species*. It was only with publication of the fifth edition, in 1869, that the phrase "survival of the fittest" appeared[2] — a shift presaged a year earlier in *The Variation of Animals and Plants under Domestication*, where Darwin noted that "Mr. Herbert Spencer has well expressed the same idea [natural selection] by the Survival of the Fittest."[3] To "Natural Selection," the original title of chapter 4 of the *Origin*, has been added "or the Survival of the Fittest," and the definition has been correspondingly altered: "This preservation of favourable individual differences and variations, and the destruction of those which are injurious, I have called Natural Selection, or the Survival of the Fittest."[4] Elsewhere in the *Origin*, Darwin even asserted that Spencer's expression was the "more accurate."[5]

Why did Darwin equate selection with the survival of the fittest, when to do so deemphasized the analogy with artificial selection while apparently associating Darwin — who shrank from controversy and disliked Spencer — with the latter's disputed social

1. Charles Darwin, *On the Origin of Species*, facsimile of first edition (Cambridge, Mass.: Harvard University Press, 1964), pp. 80—81.

2. Morse Peckham, ed., *The Origin of Species, by Charles Darwin: A Variorum Text* (Philadelphia: University of Pennsylvania Press, 1959), p. 22.

3. Charles Darwin, *The Variation of Animals and Plants under Domestication* (London: Murray, 1868), p. 17.

4. Peckham, *Origin*, p. 164.

5. Ibid., p. 145.

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theory? And why did he wait until 1868 if, as is often asserted, the expression originated in 1852, seven years prior to first publication of the *Origin*?

The latter question, at least, is easy to answer. Darwin first heard the expression in 1866, two years after it was coined by Spencer. Richard Hofstadter is the apparent root source of the widespread assumption that the phrase originated in the early 1850s. In his influential *Social Darwinism in American Thought*, Hofstadter wrote:

> Spencer's theory of social selection . . . arose out of his concern with population problems. In two famous articles that appeared in 1852, six years before Darwin and Wallace jointly published sketches of their theory, Spencer had set forth the view that the pressure of subsistence upon population must have a beneficent effect upon the human race. This pressure had been the immediate cause of progress from the earliest human times. By placing a premium upon skill, intelligence, self-control, and the power to adapt through technological innovation, it had stimulated human advancement and selected the best of each generation for survival. Because he did not extend his generalization to the whole animal world, as Darwin did, Spencer failed to reap the whole harvest of his insight, although he coined the expression "survival of the fittest."[6]

The implication that the expression dates from 1852 is reinforced by the footnote following "survival of the fittest," which cites the two articles noted above — only one of which, "A Theory of Population, Deduced from the General Law of Animal Fertility," actually concerns the effects of population pressure.[7] Gertrude

6. Richard Hofstadter, *Social Darwinism in American Thought* (Boston: Beacon Press, 1955; orig. ed. 1944), p. 39. The book's impact on subsequent accounts of Social Darwinism is discussed by Donald C. Bellomy in "'Social Darwinism' Revisited," *Perspect. Amer. Hist.*, new ser., *1* (1984), 1—129, esp. pp. 6—10.

7. Herbert Spencer, "The Development Hypothesis" (*Leader*, March 20, 1852; repr. in *Essays*, I [New York: Appleton, 1907], 1—7), is simply a defense of evolutionism against the criticisms of special creationists. The essay on population pressure ("A Theory of Population") appeared in *Westminster Rev.*, *57* (1852), 468—501. Spencer sadly reflects on his failure to extend his analysis of the effects of population pressure to all animals — thus inventing Darwinism before Darwin — in *An Autobiography*, I (New York: Williams and Norgate 1904), 448—452. He had earlier assessed its value rather modestly, commenting in the first edition of the *Principles of Biology* that it "contains merely a passing recognition of the selective process and indicates no suspicion of the enormous range of its effects, or of the conditions under which a large part of its effects are produced" (II [London: Williams and Norgate, 1867], 501).

Himmelfarb, discussing this essay, asserts even more directly that "the phrase, 'survival of the fittest' was used here for the first time."[8] James Rogers, citing "A Theory of Population," affirms that "Herbert Spencer used the phrase 'survival of the fittest' as early as 1852 . . ."[9] Spencer's biographer, J. D. Y. Peel, writes that the essay is "famous because in it Spencer coined the phrase 'survival of the fittest,' and because he seems to have come within a stone's throw in anticipating Darwin and Wallace . . ."[10] David Oldroyd notes of the same essay that "in 1852 . . . Spencer coined the famous phrase 'Survival of the Fittest.'"[11] And Alexander Alland, Jr., asserts in a recent book that "the 'survival of the fittest,' a slogan coined by Spencer ten years before the publication of *The Origin*, became the political rallying point for right-wing, expansionist politics in Victorian England."[12] Versions of the story have also found their way into textbooks, as in the following account:

> Cultural historians have long recognized that ideas of economic competition were pervasive throughout the nineteenth century. In the early 1850s, according to historian Richard Hofstadter, Herbert Spencer . . . coined the phrase "survival of the fittest." Spencer's phrase referred to competition both in human economics and in animal life. The notion that economic and social progress were the result of struggle and competition — with some individuals winning and others losing — was a generally accepted idea among educated middle- and upper-middle-class English Society.[13]

Alas, Spencer not only invented "survival of the fittest" five years after the publication of the *Origin*, but introduced it in a context devoid of association with competition in human economics. The phrase first appears in the *Principles of Biology* — simply as a synonym for natural selection: "This survival of the

8. Gertrude Himmelfarb, *Darwin and the Darwinian Revolution* (New York: W. W. Norton, 1962), pp. 224–225.

9. James A. Rogers, "Darwinism and Social Darwinism," *J. Hist. Ideas, 10* (1972), 269.

10. J. D. Y. Peel, *Herbert Spencer: The Evolution of a Sociologist* (New York: Basic Books, 1971), pp. 137–138.

11. D. R. Oldroyd, *Darwinian Impacts: An Introduction to the Darwinian Revolution* (Milton Keynes: The Open University Press, 1980), p. 207.

12. Alexander Alland, Jr., *Human Nature: Darwin's View* (New York: Columbia University Press, 1985), p. 19.

13. Jeffrey J. W. Baker and Garland E. Allen, *A Study of Biology*, 4th ed. (Reading, Mass.: Addison-Wesley, 1982), p. 681.

fittest, which I have here sought to express in mechanical terms, is that which Mr. Darwin has called 'natural selection, or the preservation of favoured races in the struggle for life.'"[14] Hence Darwin's equation of "survival of the fittest" with "natural selection" did not represent, as is often asserted, an explicit merger of economic and biological thought. Indeed, Darwin actually dismissed Spencer's 1852 essay, writing to Charles Lyell: "I have just read his essay on population, in which he discusses life and publishes such dreadful hypothetical rubbish on the nature of reproduction."[15] Perhaps the mythic quality of the Darwin-Spencer story is attributable to its consistency with widely shared assumptions about Darwin's debt to political economy. In any event, the argument that Darwinism reflected the world-view of the English bourgeoisie (which I myself have made and still believe) must rest on other, less direct, kinds of evidence.[16]

But an accurate version of the story does not, in itself, explain Darwin's willingness to equate Spencer's expression with his own. Personal, social, and scientific considerations make his decision puzzling, even in the absence of an *explicit* association in 1866 of the "survival of the fittest" with a policy of unrestrained capitalism. His use of Spencer's phrase associated Darwin with an individual whose talents he (sometimes) admired but whose social views were controversial and whose intellectual style and personality he thoroughly disliked.[17] Moreover, Darwin's original phrase

14. Herbert Spencer, *Principles of Biology*, I (New York: Appleton, 1898; orig. ed. 1864), 530–531.

15. Darwin to Charles Lyell, February 25, 1860, Darwin papers, American Philosophical Society, Philadelphia (I am grateful to the Syndics of the Cambridge University Library for permission to quote from this letter and other letters cited in n. 17 below). Wallace, on the other hand, was greatly impressed by the essay, which he used to defend the possibility of evolution in a socialist, egalitarian society; see his essay "Human Selection," originally published in *Fortn. Rev.*, September 1890, and reprinted in *Studies Scientific and Social* (London: Macmillan, 1980), I, 509–526, esp. pp. 521–523.

16. Diane B. Paul, "Marxism, Darwinism, and the Theory of Two Sciences," *Marx. Perspect.*, *3* (1979), 116–143. The literature on Darwin and political economy is vast. Ernst Mayr has summarized the leading arguments in *The Growth of Biological Thought* (Cambridge, Mass.: Harvard University Press, 1982), pp. 477–479, 484–487, 491–493.

17. Darwin's complex and shifting attitudes toward Spencer are reflected in his letters. Some examples: to Hooker, June 23, 1863: "You ask what I think of Herbert Spencer's great book: I never attempted to read any except last part; and that *greatly* disappointed me — all words and generalities . . . and I could grasp nothing clearly. But I suppose this is all my stupidity; as so many think so highly of this work"; Emma Darwin to Hooker, January 16 and 19, 1864: "Charles would like very much to know what you think of Herbert Spencer as he cannot

emphasized the analogy with artificial selection. As Michael Ruse has argued, analogous cause reasoning, as exemplified in the work of Lyell and expounded by John Herschel, was then considered an exceptionally persuasive form of scientific reasoning — and Darwin was very much concerned with canons of good scientific method.[18] How, then, do we explain his willingness to adopt Spencer's expression?

The answer probably lies in Darwin's frustration with misunderstandings attributable to the connotations of "selection." As early as 1860 he wrote to Lyell: "Talking of 'natural selection'; if I had to commence *de novo*, I would have used 'natural preservation.' For I find men like Harvey of Dublin cannot understand me, though he has read the book twice. Dr Gray of the British Museum remarked to me that, '*selection*' was obviously impossible with plants!"[19]

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appreciate him. He has heard from Mr. Wallace with the highest praise of him especially the Social Statics"; Charles Darwin to Hooker, November 3, 1864: "I am quite delighted with what you say about H. Spencer's book: when I finish each number I say to myself what an awfully clever fellow he is, but when I ask myself what I have learnt, it is just nothing"; to Lyell, March 25, 1865: "I have read most of H. Spencer's Biology & agree with you. Some of his remarks are very clever and suggestive, but somehow I seldom feel any wiser after reading him, but often feel mistified. His style is detestable in my opinion . . . "; to Hooker, December 10, 1866: "I feel rather mean when I read him; I could bear and rather enjoy feeling that he was twice as ingenious & clever as myself, but when I feel that he is about a dozen times my superior, even in the master art of wriggling, I feel aggrieved. If he had trained himself to observe more, even if at the expense, by the law of balancement, of some less of thinking power, he would have been a wonderful man"; to Wallace, October 12 and 13, 1867 (on hearing that he had named his first child after Spencer): "I heartily congratulate you on the birth of 'Herbert Spencer,' and may he deserve his name, but I hope he will copy his father's style and not his namesake's"; to E. Ray Lankester, March 15, 1870: "I suspect that hereafter he will be looked at as by far the greatest living philosopher in England; perhaps equal to any that have lived"; and to Spencer, June 10, 1872 (regarding an article that appeared in the *Contemporary Review*): "Every one with eyes to see and ears to hear (the number, I fear, are not many) ought to bow their knee to you, & I for one do."

18. Ruse argues that Darwin aimed to show that natural selection was a *vera causa*. According to Herschel, whom Darwin greatly admired, the best evidence that something is a *vera causa* is that we can argue by analogy from a force already known to be one. See Michael Ruse, "Darwin's Debt to Philosophy: An Examination of the Influence of the Philosophical Ideas of John F. W. Herschel and William Whewell on the Development of Charles Darwin's Theory of Evolution," *Stud. Hist. Phil. Sci.*, 6 (1975), 159—181. The argument is summarized in idem, *The Darwinian Revolution: Science Red in Tooth and Claw* (Chicago: The University of Chicago Press, 1979), pp. 126—180.

19. Darwin to Lyell, September 28, 1860, in *The Life and Letters of Charles Darwin*, ed. F. Darwin (New York: Appleton, 1887), II, 138—139. Darwin

Alfred Russel Wallace was even more troubled by difficulties arising from the term. Indeed, in his personal copy of the first edition of the *Origin*, Wallace frequently crossed out "natural selection" and substituted Spencer's phrase.[20] On July 2, 1866, he wrote Darwin concerning the "utter inability of numbers of intelligent persons" to see that selection could operate without conscious thought or direction. Even many naturalists assumed that selection required "an intelligent 'chooser.'"[21] Wallace argued that this misunderstanding

> arises almost entirely from your choice of the term Natural Selection, and so constantly comparing it in effects to man's selection, and also your frequently personifying nature as "selecting," "preferring," as "seeking only the good of the species," etc., etc. . . . I wish, therefore, to suggest to you the possibility of entirely avoiding this source of misconception . . . by adopting Spencer's term (which he generally uses in preference to Natural Selection), viz. "Survival of the Fittest." This term is the plain expression of a *fact*: "Natural Selection" is a metaphorical expression of it, and to a *certain* degree *indirect* and *incorrect*, since, even personifying Nature, she does not so much select special variations as exterminate the most unfavourable ones.[22]

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replied publicly to Gray in later editions of the *Origin*: "[Critics] have objected that the term selection implies conscious choice in the animals which become modified; and it had even been urged that, as plants have no volition, natural selection is not applicable to them! In the literal sense of the word, no doubt, natural selection is a false term; 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 in preference combines . . . . Everyone knows what is meant and is implied by such metaphorical expressions; and they are almost necessary for brevity" (Peckham, *Origin*, p. 165). (It was to avoid this problem that the French translated "natural selection" as the equivalent of "natural election," thus creating a wholly different set of problems. See Joy D. Harvey, "Races Specified, Evolution Transformed," Ph.D. diss., Harvard University, 1983.)

20. Wallace gave his presentation copy of the *Origin* to Ricardo Spruce. In 1958, it came into the possession of Sir Geoffrey Keynes and thence to the Cambridge University Library. Keynes was the first to notice the alteration. I am indebted to Peter J. Gautrey of the Cambridge University Library for this information.

21. Wallace to Darwin, July 2, 1866, in *Alfred Russel Wallace: Letters and Reminiscences*, ed. J. Marchant, I (New York: Harper, 1916), 170. Robert Young discusses some consequences of Darwin's anthropomorphic language in "Darwin's Metaphor: Does Nature Select?" *Monist*, 55 (1971), 442–503.

22. Wallace to Darwin, *Letters and Reminiscences*, pp. 170–171.

Darwin replied three days later. He agreed that Spencer's phrase was in some respects superior, but he argued that his own also possessed certain advantages, not least of which was familiarity after seven years of use. Darwin could not be convinced to abandon "natural selection" altogether, but he did agree to "work in" Spencer's phrase in the soon-to-be-published *Variation* and in future editions of the *Origin*. He wrote:

> I fully agree with all that you say on the advantages of H. Spencer's excellent expression of "the survival of the fittest." This, however, had not occurred to me till reading your letter. It is, however, a great objection to this term that it cannot be used as a substantive governing a verb; and that this is a real objection I infer from H. Spencer continually using the words, natural selection. I formerly thought, probably in an exaggerated degree, that it was a great advantage to bring into connection natural and artificial selection; this indeed led me to use a term in common, and I still think it some advantage. I wish I had received your letter two months ago, for I would have worked in "the survival, &c.," often in the new edition of the "Origin . . . " I will use the term in my next book on Domestic Animals, &c. . . . The term Natural Selection has now been so largely used abroad and at home, that I doubt whether it could be given up, and with all its faults I should be sorry to see the attempt made. Whether it will be rejected must now depend "on the survival of the fittest."[23]

Darwin's response is, on the face of it, rather puzzling. Why did he not protest Wallace's assertion that selection works principally through the elimination of unfavorable variants? Historians generally agree that the acknowledgment of selection as a negative force

23. Darwin to Wallace, July 5, 1866, in F. Darwin, *Life and Letters*, II, 229–230. In a footnote to the 1898 edition of his *Principles of Biology*, Spencer writes: "It will be seen that the argument naturally leads up to this expression — Survival of the Fittest — which was here used for the first time. Two years later (July 1866) Mr. A. R. Wallace wrote to Mr. Darwin contending that it should be substituted for the expression 'Natural Selection.' Mr. Darwin demurred to this proposal. Among reasons for retaining his own expression he said that I had myself, in many cases, preferred it . . . Mr. Darwin was quite right in his statement, but not right in the motive he ascribed to me. My reason . . . was that disuse of Mr. Darwin's phrase would have seemed like an endeavour to keep out of sight my own indebtedness to him, and the indebtedness of the world at large. The implied feeling has led me ever since to use the expressions Natural Selection and Survival of the Fittest with something like equal frequency" (I, 530).

— removing inferior variants and thus maintaining the "type" — long predated Darwin. In this perspective, Darwin's achievement lay in his recognition that selection was "a creative process and not merely a sieve."[24] But there is no evidence that he dissents from Wallace's essentially negative view.

Perhaps historians' radical distinction between natural selection as a creative force and as executioner of the unfit — that is, as "nature's broom" — was not recognized by Darwin. (The sharpness of the conventional distinction may reflect historians' desire to emphasize Darwin's uniqueness more than Darwin's own views.)[25] If the standard view is wrong — a topic whose serious exploration would extend far beyond the scope of this paper — Darwin's use of "survival of the fittest" is easily explained: any reservations arising from its association with Spencer and from the loss of the analogy with artificial selection were presumably overridden by a desire to avoid the misleading connotations of his own expression and to oblige Wallace, whom Darwin greatly liked and admired.

But even under the conventional interpretation, his response to Wallace's suggestion makes sense viewed in the context of Darwin's many strenuous attempts to accommodate his supporters and neutralize his critics. By 1866, when he adopted Spencer's phrase, Darwin's thesis was under severe, indeed potentially fatal, attack. In his attempt to build an evolutionary consensus, he had continually given ground; in successive editions of the *Origin*, and in other works such as *Variation*, the role accorded to selection (however defined) was progressively reduced. Darwin may well have seen any compromise involved in identifying selection with the "survival of the fittest" as minor, relative to the need — and to compromises already made regarding the efficacy and importance of selection.

It is in any case clear, both from their correspondence and from Darwin's autobiography (where he writes that he is "not conscious of having profited in my own work by Spencer's writing"), that neither Darwin nor Wallace believed himself to be taking a step of great significance in adopting "survival of the fittest" as a synonym for "natural selection."[26] They certainly did not intend, or anticip-

24. The expression is A. J. Nicholson's: "The Role of Population Dynamics in Natural Selection," in *Evolution after Darwin*, ed. Sol Tax, I (Chicago: University of Chicago Press, 1960), 515. For an example of this perspective see also Mayr, *Growth of Biological Thought*, pp. 488—490.

25. This possibility was suggested by David Kohn.

26. Nora Barlow, ed., *The Autobiography of Charles Darwin* (New York: W. W. Norton, 1958), p. 109.

ate, the social loading that the phrase almost immediately acquired. But given the assumption that evolution was progressive, conjoined with the association in ordinary language — and absorbed by nineteenth-century biology — of the "fit" with the socially successful, Spencer's expression inevitably conveyed a social message. "The strong and the weak are terms which admit of no definition unless they are made equivalent to the industrious and the idle, the frugal and the extravagant," asserted William Graham Sumner. "If we do not like the survival of the fittest, we have only one possible alternative, and that is the survival of the unfittest."[27] This chain of reasoning prompted T. H. Huxley to complain to one correspondent of "the unlucky substitution of the 'survival of the fittest' for 'natural selection' [which] has done much harm in consequence of the ambiguity of 'fittest,'"[28] In his essay "Apologetic Irenicon," Huxley wrote:

> The notion that the doctrine of evolution can furnish a foundation for morals seems to me to be an illusion which has arisen from the unfortunate ambiguity of the term "fittest" in the formula, "survival of the fittest." We commonly use "fittest" in a good sense, with the understood connotation of "best"; and "best" we are apt to take in its ethical sense. But the "fittest" which survives in the struggle of existence may be, and often is, the ethically worst.[29]

Hence evolution through the "survival of the fittest" came readily to imply the dependence of progress on laissez-faire economics. It came also to imply the need for social policies aimed at increasing the birth rate of the more prosperous classes. A policy of nonintervention might ensure the success of the worthiest enterprises, but it would spell disaster in respect to the future of the biological "stock" — for it was evident to virtually all nineteenth- and early twentieth-century evolutionists (Darwin included) that social success did not correlate with reproductive success.[30] According to Wallace, a veritable flood of articles in the

27. A. G. Keller and M. R. Davie, *Essays of William Graham Sumner*, II (New Haven: Yale University Press, 1934), 56.

28. Huxley to W. Platt Bald, October 27, 1890, in *Life and Letters of Thomas Huxley*, ed. Leonard Huxley, II (New York: Appleton and Company, 1901), 284.

29. Thomas Huxley, "Apologetic Irenicon," quoted in L. Huxley, *Life and Letters*, II, 322. See also "Evolution and Ethics" in T. H. Huxley, *Collected Essays*, IX (New York: Greenwood Press, 1968; orig. pub. 1902), 80–81.

30. Wallace reported: "In one of my latest conversations with Darwin he

leading periodicals decried the low reproductive rates of the ostensibly more fit (defined variously as the more intelligent, talented, or prosperous), and promoted social policies designed to reverse the process of biological degradation.[31] "The knowledge of the science of Eugenics will sooner or later develop the art," wrote David Starr Jordan. "At present, through the agencies of charities which perpetuate the weak, or war which eliminates the strong, and of an education which makes celibacy a condition of success, we are in a degree reversing the processes of natural selection. If the fittest do not serve as parents, the next generation will not inherit fitness."[32] Hence the apparently paradoxical implications of the nineteenth- and early twentieth-century concept of fitness, which helped rationalize both social Darwinism — with its commitment to radical individualism — and eugenics — with its commitment to social control.

The development of population genetics in the 1920s and 1930s ultimately eroded the colloquial view of fitness. The mathematization of genetics by J. B. S. Haldane, R. A. Fisher, and Sewall Wright involved identification of the gene as the target of selection and a consequent redefinition of selection as a change in gene frequencies. Success in leaving offspring — whatever its causes — became the measure of fitness, and eventually defined its essence. But "Darwinian fitness," as it came to be called in the early 1930s, did not immediately replace fitness in its vernacular sense; during the thirties and forties these meanings coexisted, even in works of the same individuals.[33] Thus J. B. S. Haldane, writing in 1937, could maintain that "eugenic organizations rarely include a demand for peace in their programmes, in spite of the fact that modern war leads to the destruction of the fittest

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expressed himself very gloomily on the future of humanity, on the ground that in our modern civilization natural selection had no play, and the fittest did not survive. Those who succeed in the race for wealth are by no means the best or the most intelligent, and it is notorious that population is more largely renewed in each generation from the lower than from the middle and upper classes" ("Human Selection," p. 509). See also the section, "Natural Selection as affecting Civilised Nations," in A. R. Wallace, *The Descent of Man* (Princeton: Princeton University Press, 1981; orig. ed. 1871), pp. 167–180. John C. Greene discusses Darwin's social views in "Darwin as a Social Evolutionist," *J. Hist. Ideas, 10* (1977), 1–27.

31. Wallace, "Human Selection," p. 509.

32. David Starr Jordan, *The Heredity of Richard Rowe* (Boston: American Universalist Association, 1911), "Prefatory Note."

33. The first use of the phrase that I know of was by J. B. S. Haldane in *The Causes of Evolution* (London: Longmans, Green and Co., 1932), p. 131.

members of both sides engaged in it,"[34] while his conservative colleague, R. A. Fisher, asserted:

> We must face the paradox that the biologically successful members of our society are to be found principally among its social failures, and equally that classes of persons who are prosperous and socially successful are, on the whole, the biological failures, the unfit of the struggle for existence.[35]

In the 1930s, Haldane and Fisher could trade on colloquial meanings of fitness to advance (very different) socio-political ends. At the same time, this mode of argument was undermined by their own technical work, which equated fitness with reproductive success.

By the 1950s, fitness was generally understood, at least by biologists, as fitness "in the Darwinian sense." The old Social Darwinist slogans were thus fatally weakened, shown to depend on a conflation of biological and cultural meanings. In effect, Huxley's point was made more precise and more effective. Fitness as reproductive success was now sharply contrasted with fitness conventionally understood. "It is indispensable to distinguish clearly Darwinian fitness from 'fitness' as excellence in human evaluation," insisted Theodosius Dobzhansky. "The two not only are not identical but are sometimes in opposition."[36]

The determined efforts of geneticists in the 1950s and 1960s to dissociate Darwinism from class and racial prejudice reinforced this development. The need to purge evolutionary theory of reactionary social implications became particularly acute with the rise of Nazism. Geneticists such as Dobzhansky, C. H. Waddington, and I. M. Lerner aimed to undermine biological defenses of racialism; following the Second World War, they wished also to defend their science to a public appalled by revelations of Nazi eugenic policies. One response was a search for words with a less compromised history than fitness. Thus in the early fifties, Dobzhansky tried (with little success) to replace "fitness" with "adaptive value."[37] At the same time, he and others

34. J. B. S. Haldane, "Human Biology and Politics," in *Adventures of a Biologist* (New York: Harper and Brothers, 1937), p. 151.

35. R. A. Fisher, *The Genetical Theory of Natural Selection* (New York: Dover, 1959; orig. pub. 1930), p. 240.

36. Theodosius Dobzhansky, *Mankind Evolving* (New Haven: Yale University Press, 1962), p. 129.

37. For example, see T. Dobzhansky, *Genetics and the Origin of Species*, 3rd ed. (New York: Columbia University Press, 1951), pp. 77—79.

stressed the value-neutrality of fitness, correctly understood. Waddington, for example, asserted that "the meaning of natural selection can be epigrammatically summarized as 'the survival of the fittest.' . . . to speak of an animal as 'fittest' does not imply that it is strongest or most healthy, or would win a beauty contest. Essentially it denotes nothing more than leaving more offspring."[38]

The discussion in the 1958 edition of the Sinnott, Dunn, and Dobzhansky genetics text provides a particularly clear illustration of the relationship between biologists' social concerns and their insistence that fitness *is* reproductive success:

> To most of the nineteenth-century evolutionists, natural selection meant the "survival of the fittest" in the "struggle for existence." These emotionally loaded phrases have been often misused for political propaganda purposes. A less spectacular but more accurate statement is that carriers of different genotypes transmit their genes to the succeeding generations at different rates . . . . The "fittest" is nothing more remarkable than the producer of the greatest number of children and grandchildren.[39]

Of course, the proposition that the fittest survive is necessarily true if fitness is defined as success in surviving and reproducing. Geneticists had extricated themselves from one horn of a dilemma apparently to impale themselves on another; they had unwittingly, and from the best of motives, replaced a socially loaded proposition with one that was logically empty.[40]

38. C. H. Waddington, *The Strategy of the Genes* (London: Allen and Unwin, 1957), pp. 64–65; quoted in Michael Bradie and Mark Gromko, "The Status of the Principle of Natural Selection," *Nat. Syst., 3* (1981), 5.

39. Edmund Sinnott, L. C. Dunn, and T. Dobzhansky, *Principles of Genetics*, 5th ed. (New York: McGraw-Hill, 1958), pp. 100–101.

40. Efforts to solve (or dissolve) the tautology problem have intensified over the last decade, perhaps in response to creationists' claims that Darwinism is empirically untestable, and hence unscientific. Some important examples are: Susan Mills and John Beatty, "The Propensity Interpretation of Fitness," *Phil. Sci., 46* (1979), 263–288; Stephen Jay Gould, "Darwin's Untimely Burial," in *Ever Since Darwin* (New York: W. W. Norton, 1977), pp. 39–48; Robert Brandon, "Adaptation and Evolutionary Theory," *Stud. Hist. Phil. Sci., 9* (1978), 181–206; Mary Williams, "The Logical Status of Natural Selection and Other Evolutionary Controversies," in M. Bunge, *The Methodological Unity of Science* (Dordrecht: Reidel, 1973), pp. 84–102 (all reprinted in Elliott Sober, *Conceptual Issues in Evolutionary Biology: An Anthology* (Cambridge, Mass.: MIT Press, 1984); also Costas B. Krimbas, "On Adaptation, Neo-Darwinian Tautology, and Population Fitness," in *Evolutionary Biology*, ed. M. Hecht, B.

We can thus trace a path from Darwin's adoption of Spencer's expression to what, in the early 1960s, came to be called the "tautology problem."[41] Is an unfortunate choice of words therefore to blame for twenty years' controversy over the logical status of the theory of natural selection? Such a conclusion implies that the tautology problem is attributable simply to language. But it is easy to imagine routes by which "fitness," under other rubrics, could be emptied of content. This paper has sketched the *actual* path by which a key concept of evolutionary theory became theory-laden, with the consequence that certain propositions were reduced to tautologies. There are, however, plausible alternate routes that lead to essentially the same place. For example:

What if Darwin had rejected Wallace's advice? We would perhaps, following his own usage, generally employ "adapted" and "adaptiveness" in place of "fit" and "fitness."[42] What would then change? The claim that "the best-adapted survive" is no more meaningful than the claim that "the fittest survive" — if adaptiveness is *defined* as success in surviving. As Elliott Sober has noted, the tautology problem ultimately derives from the fact that the force of natural selection is (or, more accurately, came to be) described in terms of its effects.[43] It does not depend on the words used to characterize either.

Since William Whewell, philosophers have argued that scientific terms eventually take on meanings that reflect the truth of the theories in which they are embedded.[44] It is easy, however, to forget that this is a historical process. Terms do not become theory-laden simply as a function of their place in sentences, but

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Wallace, and G. Prance, XVII (New York: Plenum, 1984), 1—57; Elliott Sober, *The Nature of Selection: Evolutionary Theory in Philosophical Focus* (Cambridge, Mass.: MIT Press, 1984), pp. 38—85; and M. J. S. Hodge, "Natural Selection as a Causal, Empirical, and Probabilistic Theory" (unpublished MS).

41. It was largely defined as an issue by Karl Popper; for a summary of his views, see Michael Ruse, "Karl Popper's Philosophy of Biology," *Phil. Sci.*, 44 (1977), 638—661. Popper has often been criticized for his naiveté about evolutionary theory, but, as Ruse notes and this paper confirms, he had distinguished company.

42. Darwin used "fit" and "fitted" interchangeably with "adapted" and "adaptive," but more frequently employed the latter; see Paul H. Barrett, Donald J. Weinshank, and Timothy T. Gottleber, eds., *A Concordance to Darwin's Origin of Species, First Edition* (Ithaca: Cornell University Press, 1981). "Fitness" appears once in the *Origin*: "Nor ought we marvel if all the contrivances in nature be not, as far as we can judge, absolutely perfect; and if some of them be abhorrent to our idea of fitness" (Darwin, *Origin*, p. 472).

43. Sober, *Nature of Selection*, p. 71.

44. I am grateful to John Beatty for suggesting this point.

over time, as a result of specific — and historically contingent — circumstances. This much is obvious from the history we have sketched. Social Darwinists and eugenicists certainly employed a nonvacuous concept of fitness, and whatever else might be said of their claims, they were not tautological. "Fitness" was not initially theory-laden, nor was the proposition that "the fittest survive" empirically empty; they became so as unintended consequences of a series of scientific and social developments. The fate of "fitness" thus reminds us that the process by which terms become theory-laden, and claims tautological, is always a matter of history, not the logic of words in sentences.