JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 2006, **86,** 123–129 NUMBER 1 (JULY)

HERBERT SPENCER'S CONTRIBUTIONS TO BEHAVIOR ANALYSIS: A RETROSPECTIVE REVIEW OF PRINCIPLES OF PSYCHOLOGY

JULIAN C. LESLIE

UNIVERSITY OF ULSTER

Herbert Spencer's *Principles of Psychology* (1855, first edition) was regarded by his contemporaries, including William James and John Dewey, as a major contribution to what was then a very new discipline. In this book he first expounded his ideas about both evolution of species and how behavior of the individual organism adapts through interaction with the environment. His formulation of the principle that behavior changes in adaptation to the environment is closely related to the version of the law of effect propounded some years later by Thorndike. He can thus be seen as the first proponent of selectionism, a key tenet of behavior analysis. He also explicitly attacked the then prevailing view of free will as being incompatible with the biologically grounded view of psychological processes that he was advocating, and thus put forward ideas that were precursors of B. F. Skinner's in this important area of debate.

Key words: Spencer, selectionism, adaptation

The move towards scientific psychology has been associated with a number of conflicting paradigms. The scientific mentalism of the late 19th century was abandoned when behaviorism was enthusiastically endorsed in the early 20th century. After several decades of dominance, behaviorism was itself usurped by cognitivism. In each case, there is a set of informally stated (or unstated) assumptions about the nature of psychology associated with the paradigm, and these sets of assumptions differ quite radically. Consequently, there have been no ''critical experiments'' that disprove one approach or another. An upshot of this conceptual pluralism is that a different history of psychology can be constructed from a mentalist, behaviorist, or cognitivist perspective, with correspondingly different key figures and great events.

In this confusing context, perhaps one is not surprised at the difficulty of tracing current themes in psychological theory and research back to antecedents in 19th-century writers. Nonetheless, important surveys of the history of relevant areas of psychology (for example, Boakes, 1980; Boring, 1929, 1950; Flugel, 1933; Hearnshaw, 1972; Young, 1970) invariably point to the contribution of Herbert Spencer (1820–1904). Although Spencer's work in psychology is clearly a product of the scientific mentalism of its time, it can be seen as crucial for the development of behavior analysis.

The terms ''selectionism'' and ''selectionist'' are now well established in the vocabulary of behavior analysis: ''a selectionist account holds that behavior is selected by its consequences within the lifetime of the individual, much as organisms are selected over generations by evolutionary contingencies'' (Catania, 2005, p. 449; see also Leslie, 2000). In both behavior and evolutionary change, selection through interaction with the environment has the effect of altering probabilities. These are the probabilities of behaviors in the repertoires of individual organisms in the first case and of species characteristics in the second. Moxley (2001) identifies B.F. Skinner's 1945 paper, ''The operational analysis of psychological terms'', as the point from which Skinner clearly adopted a type of ''pragmatic selectionism'' (Moxley, 2001, p. 132), as opposed to the mechanistic determinism (which Moxley defines as each response being caused by a prior stimulus) espoused by writers from Descartes to Watson and Pavlov. From 1945 onwards, Skinner identifies selection as the cause of behavior change and also acknowledges the parallel with Darwinian natural selection (e.g., Skinner, 1966, 1981).

Moxley considers C.S. Peirce's work (e.g., Peirce, 1907/1998) to be the biggest influence on Skinner's selectionist framework, and

I am indebted to John Offer for his advice and comments on an earlier version of this paper.

Correspondence should be sent to J. C. Leslie, School of Psychology, University of Ulster Coleraine BT52 1SA, Northern Ireland, UK (e-mail: jc.leslie@ulster.ac.uk).

doi: 10.1901/jeab.2006.04-06

Staddon (2004) also acknowledges the contribution of Peirce to the development of radical behaviorism. A strong case can be made, however, that Spencer first developed the notion of selection in biology and psychology. Given that Spencer's work was very widely read in his day, this makes Spencer a significant precursor of behavior analysis.

The contemporary reader of Herbert Spencer's *Principles of Psychology* (first edition, 1855, second edition, 1870–1872, third edition, 1881, third edition, authorized edition, 1897) is immediately struck by two features: the enormous and enthusiastic length at which Spencer wrote on psychology (a discipline which scarcely existed prior to his writing about it), and his commitment to the interrelatedness of psychological issues with biology, on the one hand, and with the environment, on the other. Spencer perhaps wrote at great length in an attempt to convince the skeptical reader of these connections through many examples. The connections in turn were necessary because they formed part of Spencer's grand plan, which was one of a unified science:

> Biology is a specialized part of Geogeny [Geology], dealing with peculiar aggregates of peculiar chemical compounds formed of the Earth's superficial elements—aggregates which…also exert certain general actions and reactions on one another. And Psychology is a specialized part of Biology, limited in its application to the higher division of these peculiar aggregates, and occupying itself exclusively with those special actions and reactions which they display, from instant to instant, in their converse with the objects, animate and inanimate, amid which they move. (Spencer, 1881, Volume 1, p. 138)

In addition, Spencer was centrally associated with the development of evolutionary thought and theories in the middle of the 19th century, and made some assertions about the nature of behavioral processes that are still important and interesting today (along with a great number which are neither). Ideas about evolution have continued to be provocative since their emergence in the mid-19th century primarily because they represent a marked shift away from the ''essentialism'' that had characterized Western thought for many centuries—wherein the essential autonomy of human beings is a given—and towards alternative accounts of human existence.

Various historians and commentators (e.g., Flugel, 1933) credit Spencer with the first publication of the evolutionary principle in biology, and thus being the first to propose a systematic alternative to the prevailing dogma of creationism. Spencer wrote an article in 1852 in the *Leader* on ''The development hypothesis'' (reprinted in Spencer, 1901), and the same ideas were incorporated into the first edition of *Principles of Psychology* in 1855. Even though the second edition of this huge work (Volumes 1 and 2, 1870–1872) was more coherent and more widely read (Boring, 1950), his earlier publications clearly preceded that of Darwin's *On the Origin of Species by Means of Natural selection* in 1859. In the present context, we should note that these ideas first appeared in his work on psychology, rather than any of his many other works. Amongst other things, this signals Spencer's commitment to the strong links between psychology and biology. This was a radical suggestion in the 1850's, and even though it was heavily underscored by several of Darwin's works in the few following years (*The Descent of Man*, 1871; *The Expression of Emotion in Man and Animals*, 1872; as well as *Origin of Species*), it remains a complex and contentious matter.

Early commentators responded strongly to Spencer's account of psychology. MacPherson (1900) wrote:

> Mr Spencer revolutionized Psychology by abolishing the absolute distinction which metaphysicians had drawn between mind and the outer world, between subject and object… In the Spencerian philosophy Psychology stands in close and necessary relation to Biology. In both departments two all-mastering conceptions hold sway—the continuity of phenomena, and the intimate relations between the organism and its environment. Between the humblest expression of life in the animal world and the highest manifestations in the intellect of man, the difference is not one of kind but of degree. (pp. 105–106)

Here, MacPherson notes that Spencer makes a strong claim of continuity between the human species and other animals, which is of course familiar from Darwin and his interpreters writing on psychological matters, and that Spencer also emphasizes the interaction between organism and environment. Having

explained that Spencer sees consciousness as arising from nervous activity which in turn comes about through the need for more complex organisms to respond to complex aspects of their environments, MacPherson goes on:

> Psychology is that department of science which deals with the evolution of consciousness by means of which, and under the direction of which, the mind maintains its correspondence with an environment no longer purely material, but including history, society, and all the influences which flow from the atmosphere of conscious life and thought—in a word, civilization. (p. 107)

Thus far, in an elegant commentary—which is far more readable than Spencer's own work which is often of legendary impenetrability (Boakes, 1980; Boring 1950)—MacPherson (1900) presents Spencer's central ideas in a way that makes them seem interesting and important to a contemporary reader. The characterization of psychology as involving the interaction of the individual with a complex environment that includes social as well as physical aspects remains a very useful framework (and is also close to that of J. R. Kantor, 1888–1984, see for example Kantor, 1959). However, MacPherson's eulogy goes on to embrace an aspect of Spencer's evolutionary account of psychology which led it into disrepute. MacPherson alleges that Spencer had reconciled the different accounts of the mind given by Locke and Kant, and this would indeed have been an important event in the history of philosophy. In brief, MacPherson sees the reconciliation coming about through Spencer's belief that, as well as the ideas of the individual being acquired through experience in a manner consistent with the views of Locke and the other associationists, the individual will also have a tendency to acquire ideas held by earlier generations:

> The school of Leibnitz and Kant was wrong in assuming a kind of intuitional knowledge, not ultimately due to experience. For the ideas formerly called innate or intuitional are the results of nutritional tendencies in the cerebral tissue, which have been strengthened by the uniform experience of countless generations until they have become as resistless as the tendency of the dorsal line of the embryo to develop into a dorsal column. (MacPherson, 1900, p. 116)

That is, Spencer maintains that well-learned or practiced associations in the brain of one generation will be, to an extent, transmitted to subsequent generations. This is an endorsement of the theory of inheritance of acquired characteristics which is now known to be false.

Weissman (1904) was responsible for the central dogma of evolutionary genetics. This states that starting from the fertilized egg there are two independent processes of cell division, one leading to the body or ''soma'' and the other providing the germ line for the next generation. This is now expressed in molecular terms: information can pass from DNA to DNA and from DNA to protein, of which the body is largely comprised, but not from protein to DNA. As Maynard-Smith (1998) remarks, just why Weissman believed this is not clear given the scientific information that was available to him at that time, but he has been amply vindicated, particularly by modern molecular genetics. Lamarck (1744–1829) was primarily associated with the theory of inheritance of acquired characteristics, and while Darwin opposed Lamarck's general account of adaptation he did not rule out this form of inheritance (Maynard-Smith, 1998).

Given the era in which Spencer was writing, it is perhaps unfair for him to be pilloried for enthusiastically endorsing the inheritance of acquired characteristics. However, this criticism started very early and is presented by Elliot (1917). Ellis (1919) commends Elliot's views to us:

> He [Elliot] has passed more thoroughly than most of us through all the phases of feeling which Herbert Spencer evokes. He read the whole of Spencer's works when on active service in South Africa during the Boer War, often with little other baggage than a toothbrush and a volume of *Principles of Psychology*… He became a dogmatic Spencerian. But in the years that followed …he had to recognise that… Spencer's facts were often wrong and his theories unsound… During the Great War, however, and in the light of that war, he read Spencer again and evidently from a higher plane of vision, with new discrimination and a more penetrating insight. He is able to throw aside all that was temporary and unessential in Spencer's doctrines, the limitations of his own time and his own outlook. (pp. 105–106)

The redoubtable Elliot (1917) certainly expresses strong views about Spencer: ''...all the

best of him will be found in his philosophy. His personality, outside his works, was meagre and petty'' (p. 9). In his chapter on Spencer's psychology, Elliot reviews Spencer's associationist ideas and account of the nervous system as known in the mid to late 19th century (Spencer's ideas in these areas are typical of 19th-century mentalistic speculation), and goes on to examine the account of inheritance of ideas and instincts. Elliot accurately detects Spencer's commitment to the Lamarckian theory, and roundly criticizes him for it. Elliot returns to this theme in his conclusion:

> Surveying Spencer's Psychology as a whole, we cannot but be struck with the magnitude and brilliance of its conceptions. It is unquestionably what is called an epoch-making work. It introduced the idea of evolution into the science of psychology; and this fact is the more remarkable when we remember that ''The Principles of Psychology'' was first published four years before the appearance of ''The Origin of Species''. To this circumstance, however, is due the inherent weakness of the work. Spencer based evolution throughout on the inheritance of acquired characteristics: in the main doctrines there is no attempt to utilise natural selection. Hence, while he was usually right in his main evolutionary propositions, he was wrong in the details. If the book had been based upon natural selection, it would probably have been the most remarkable philosophic production of the last century. (pp. 290–291)

As well as providing an account of evolution, Spencer also proposes selection as a behavioral process. In *Principles of Psychology*, he writes, after already having covered some 500 pages of the two-volume version that totals around 1200 pages: ''It is not enough that…intelligence has been shown to have the same nature and the same law from the lowest reflex action up to the most transcendent triumph of reason… By what process is the organisation of experience achieved? …And how does the transformation which brings it about come within the formula of Evolution in general?'' (Spencer, 1870–1872, Volume 1, p. 507). In modern parlance, he asks, what is the basic principle of learning, or changes in behavior, being common to many species, and how is that related to evolution? A little further on he supplies an answer that is remarkable. It comes in the form of a hypothetical example of learning:

> Suppose, now, that in putting out its head to seize prey scarcely within reach, a creature has repeatedly failed. Suppose that along with the group of motor actions approximately adapted to seize prey at this distance, the diffused discharge is, on some occasion, so distributed throughout the muscular system as to cause a slight forward movement of the body. Success will occur instead of failure; and after success will immediately come certain pleasurable sensations with an accompanying large draught of nervous energy towards the organs employed in eating etc… On recurrence of the circumstances, these muscular movements that were followed by success are likely to be repeated: what was at first an accidental combination of motions will now be a combination having considerable probability… Every repetition of it will… increase the probability of subsequent repetitions; until at length the nervous connexions become organized. (Spencer, 1870–1872, Volume 1, pp. 544–545)

More than 20 years later, E. L. Thorndike (1874–1949) carried out his celebrated series of experiments in the U.S.A. on animal learning and describes the outcome in very similar terms (Thorndike, 1898). Among these studies were the ''puzzle box'' experiments with cats, in which a cat was placed inside a box which required one particular action to open it, releasing the cat and allowing it access to a small piece of food. Thorndike observes that, on successive attempts, a cat which at first made a varying series of motions which at length accidentally operated the latch leading to release from the box, gradually became quick and efficient in getting out. In a later publication, he describes it thus:

> Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connection with the situation weakened, so that when it recurs, they will be less likely to recur. The greater the satisfaction or discomfort, the greater the strengthening or weakening of the bond. (Thorndike, 1911, p. 244.)

There is a remarkable similarity between the hypothetical example provided by Spencer and the interpretation of actual experiments

by Thorndike. The principle enunciated by Thorndike is the ''law of effect'' (because it is behavior that has a certain type of effect which subsequently becomes more probable), but both Young (1970) and Boakes (1980) conclude that the idea did not originate with Spencer. In their view, Spencer included his principle resembling the law of effect in the second edition of *Principles of Psychology* only after reading a similar principle in the work of his contemporary, Alexander Bain (1818–1903) who published two important treatises on the developing field of psychology in the 1850's (Bain, 1855, 1859). This may well be the case, but Spencer was read by many in the late 19th century, including William James who in turn influenced many psychologists in the early twentieth century. Spencer himself was keen to establish his primacy over Darwin in publishing on evolution (see Smith, 1982), and wrote a letter in 1875 commending Bain's apparent move towards a greater enthusiasm for evolution (see Duncan, 1911, p. 181), but Spencer did not seem to regard his own version of the law of effect as particularly important. Collins's (1889) summary of the whole of the ''synthetic philosophy'' of Spencer includes a version of his statement of the problem—''Section 222. We have to identify the physical process by which an external relation that habitually affects an organism, produces in the organism an adjusted internal relation'' (p. 239)—but omits a coherent version of the solution.

Some writers of textbooks on psychology from the perspective of behavior analysis have attributed to Spencer the original formulation of the law of effect, a cornerstone for the development of Skinner's (and others') selectionist approach to behavior analysis and psychology. The most important of these books was Keller and Schoenfeld (1950) (also titled *Principles of Psychology*). Interestingly, Keller, in notes to that book written in 1958–1959 and published in a 1995 edition, clearly attributes the quotation given earlier in this paper (Spencer, 1870–1872, Volume 1, pp. 544–545) to the 1855 edition of Spencer's work, and states that Spencer published the idea before Alexander Bain, who included it in his 1859 book. However, inspection of the 1855 edition of Spencer shows that the chapter to which that quotation is attributed does not appear in that version. Later books in the same tradition (Leslie, 1996; Millenson, 1967; Millenson & Leslie, 1979) attribute the idea to an edition of Spencer's work that appeared in the U.S.A. in the 1870's.

Whether primacy for the idea of the law of effect should go to Bain or Spencer, the strong link to the general notion of evolution, and the popularizing of the idea that evolution can be seen in psychological processes as in many other spheres, is due to Spencer. Dennett (1995) attributes to Godfrey-Smith (1993) the term 'Spencerian' for the family of views that there is complexity in the organism by virtue of complexity in the environment, and goes on to conclude:

> Evolutionary thinking is just one chapter in the history of Spencerian-versus-anti-Spencerian thinking. Adaptationism is a Spencerian doctrine, and so is Skinner's behaviorism, and so, more generally, is any variety of empiricism. Empiricism is the view that we furnish our minds with details that all come from the outside environment, via experience. Adaptationism is the view that the selecting environment gradually shapes the genotypes of organisms…Behaviorism is the view that …the ''controlling environment'' is what ''shapes'' the behavior of all organisms. ' (p. 395)

Spencer's contribution to the development of selectionist approaches in psychology is thus clear. Brief mention will be made of two other aspects of Spencer's work, Social Darwinism and his account of free will. Spencer's Social Darwinism is social theory rather than psychology, but there are connections with the foregoing because Social Darwinism is also a species of selectionism. Not only that, but the basic error of Social Darwinism is one that pervades all of Spencer's writings and relates to many aspects of his account of psychology. Some contemporary commentators (for example, Badcock, 1991), trace Social Darwinism to the phrase ''survival of the fittest'', coined by Spencer but often attributed to Darwin. While contemporary evolutionary biologists use ''fitness'' as a technical term referring to the reproductive success of an organism in future generations, Social Darwinists thought they could readily identify characteristics that should be promoted as providing fitness in human society, and this led to chauvinistic and racist views. As Badcock (1991) points out, this approach was inspired by Spencer's view that evolution inevitably produced greater special-

ization, sophistication, more complex interaction with the environment, etc. Natural selection does not, however, necessarily produce anything of the kind. It does produce complex adaptations to complex ecological niches, but this tells us little about which human characteristics ''should'' be promoted.

The furor that followed Darwin's publication of a selectionist theory of evolution, and its implications for the special status of human beings in the scheme of things, is well known. What is less well known is that, prior to the publication of *Origin of Species*, Spencer (1855) launched a robust attack on the conventional notion of free will in the first edition of his *Principles of Psychology*. A denial of freedom of the will is common to all the editions of this work (Offer, 2003). For example, in the third edition, Spencer (1897, Volume 1) writes:

> ...readers must have perceived that the doctrines developed [here]… are at variance with the current tenets respecting the freedom of the Will… [T]hat every one is at liberty to desire or not to desire, which is the real proposition involved in the dogma of free will, is negatived [*sic*] by the analysis of consciousness… From the universal law that, other things being equal, the cohesion of psychic states is proportionate to the frequency with which they followed each other in experience, it is an inevitable corollary that all actions whatever must be determined by those psychical connexions which experience has generated…. Considered as an internal perception, the illusion results from supposing that at each moment the ego, present as such in consciousness… is something more than the aggregate of feelings and ideas which then exists. (pp. 500–501)

Spencer here states that experience, interaction with the environment, is responsible for all aspects of a person's current psychological (or neural) state, and that it is a mistake to invent an inner autonomous agent or homunculus. He goes on to suggest that self-awareness leads to the illusion (as he terms it) of free will, and generally adopts a type of psychophysical parallelism (Taylor, 1992). This aspect of his work attracted early criticism, with Cairnes (1875), for example, accusing him of treating the individual as a ''conscious automaton'', but in his later writings he never modified his position (Offer, 2003). Spencer's work is thus a significant precursor to behavior analysis in this area as in that of selection. Although it can be argued that a denial of personal autonomy (in the sense of the traditional notion of free will) is shared across various scientific approaches to psychology, Skinner's (1971) publication of *Beyond Freedom and Dignity* led to a storm of criticism around that issue more than one hundred years after the first publication of Spencer's *Principles of Psychology*.

Richards (1987) reports that during Spencer's lifetime, both Bain and Conwy Lloyd Morgan (a significant figure in the development of behaviorism, see Boakes, 1980) wrote to him acknowledging his impact on the development of their approach. Shortly after Spencer's death, many luminaries wrote of his bewilderingly huge contribution to 19th-century thought. Among these, Dewey (1904) reflected on the importance of the fact that Spencer and Darwin wrote at the same time:

> But it was a tremendous piece of luck for both the Darwinian and Spencerian theories that they happened so nearly to coincide in the time of their promulgation. Each got the benefit not merely of the disturbance and agitation aroused by the other, but of the psychological and logical reinforcement as each blended into and fused with the other in the minds of readers and students. (pp. 171–172)

James (1911, first published in 1904), like many others, was struck by the contradictions in Spencer's personality and ambivalent about his contributions in many areas. However, he wrote: ''My impression is that, of the systematic treatises, the ''Psychology'' will rank as the most original. Spencer broke new ground here in insisting that, since mind and its environment have evolved together, they must be studied together… to have brought in the environment as vital was a master stroke'' (pp. 139–140). Indeed, it can be argued that, prior to Spencer's contribution, 19th-century mentalism made little progress for lack of understanding the contribution of the environment to psychological processes. The succeeding early 20th-century behaviorism shifted the focus from mind to behavior, but was arguably also hampered by a failure to recognize the strong interrelatedness of behavior and the environment (cf. Kantor, 1959). Contemporary behavior analysis will continue to prosper so long as it endorses Spencer's ''master stroke'' and gives a central

role to the interaction between behavior and the environment.

REFERENCES

Badcock, C. (1991). *Evolution and individual behavior: An introduction to human sociobiology*. Oxford: Basil Blackwell.

Bain, A. (1855). *The senses and the intellect*. London: Parker.

Bain, A. (1859). *The emotions and the will*. London: Parker.

Boakes, R. A. (1980). *From Darwin to behaviorism*. Cambridge: Cambridge University Press.

Boring, E. G. (1929). *A history of experimental psychology*. New York: Century.

Boring, E. G. (1950). *A history of experimental psychology* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Cairnes, J. E. (1875). Mr Spencer on social evolution. *Fortnightly Review, 17*, 63–82.

Catania, A. C. (2005). Attention-deficit/hyperactivity disorder (ADHD): One process or many? *Behavioral and Brain Sciences, 28*, 446–450.

Collins, F. H. (1889). *An epitome of the synthetic philosophy*. London: Williams and Norgate.

Darwin, C. (1859). *On the origin of species by means of natural selection*. London: Murray.

Darwin, C. (1871). *The descent of man, and selection in relation to sex*. London: Murray.

Darwin, C. (1872). *The expression of emotions in man and animals*. London: Murray.

Dennett, D. C. (1995). *Darwin's dangerous idea: Evolution and the meanings of life*. New York: Simon and Schuster.

Dewey, J. (1904). The philosophical work of Herbert Spencer. *Philosophical Review, 13*, 159–175.

Duncan, D. (1911). *The life and letters of Herbert Spencer*. London: Williams and Norgate.

Elliot, H. (1917). *Herbert Spencer*. London: Constable.

Ellis, H. (1919). *The philosophy of conflict and other essays in war-time*. Boston, MA: Houghton Mifflin.

Flugel, J. C. (1933). *A hundred years of psychology*. London: Duckworth.

Godfrey-Smith, P. (1993, November). *Spencerian explanation and constructivism*. Paper presented at the MIT Philosophy Colloquium, Cambridge, MA.

Hearnshaw, L. S. (1972). Psychology. In C. B. Cox & A. E. Dyson (Eds.), *The twentieth century mind: History, ideas, and literature in Britain: Vol. I. 1900–1918* (pp. 225–247). London: Oxford University Press.

James, W. (1911). Herbert Spencer's autobiography. In *Memories and studies* (pp. 107–142). London: Longman, Green, and Co.

Kantor, J. J. (1959). *Interbehavioral psychology*. Granville, OH: Principia Press.

Keller, F. S., & Schoenfeld, W. N. (1950). *Principles of psychology*. New York: Appleton-Century-Crofts. (Republished in 1995 with supplementary notes by F. S. Keller, 1958–1959, by B. F. Skinner Foundation, Cambridge, MA.)

Leslie, J. C. (1996). *Principles of behavioral analysis* (3rd ed.). Amsterdam: Harwood Academic Publishers.

Leslie, J. C. (2000). Selectionism, relational learning and radical application. In J. C. Leslie & D. Blackman (Eds.), *Experimental and applied analysis of human behavior* (pp. 9–22). Reno, NV: Context Press.

MacPherson, H. (1900). *Herbert Spencer: The man and his work*. London: Chapman and Hall.

Maynard-Smith, J. (1998). *Evolutionary genetics* (2nd ed.). Oxford: Oxford University Press.

Millenson, J. R. (1967). *Principles of behavioral analysis*. New York: Macmillan.

Millenson, J. R., & Leslie, J. C. (1979). *Principles of behavioral analysis* (2nd ed.). New York: Macmillan.

Moxley, R. A. (2001). The modern/postmodern context of Skinner's selectionist turn in 1945. *Behavior and Philosophy, 29*, 121–153.

Offer, J. (2003). Free agent or 'conscious automaton'? Contrasting interpretations of the individual in Spencer's writing on social and moral life. *Sociological Review, 51*, 1–19.

Peirce, C. S. (1907/1998). Pragmatism. In N. Houser, J. R. Eller, A. C. Lewlis, A. D. Tienne, C. L. Clark & D. B. Davies (Eds.), *The essential Peirce: Selected philosophical writings: Vol. 2. 1893–1913* (pp. 398–433). Bloomington, IN: Indiana University Press.

Richards, R. J. (1987). *Darwin and the emergence of evolutionary theories of mind and behavior*. Chicago, IL: University of Chicago Press.

Skinner, B. F. (1945). The operational analysis of psychological terms. *Psychological Review, 42*, 270–277.

Skinner, B. F. (1966, September 9). The phylogeny and ontogeny of behavior. *Science, 153*, 1205–1213.

Skinner, B. F. (1971). *Beyond freedom and dignity*. New York: Knopf.

Skinner, B. F. (1981, July 31). Selection by consequences. *Science, 213*, 501–504.

Smith, C. U. M. (1982). Evolution and the problem of mind, Part 1 – Herbert Spencer. *Journal of the History of Biology, 15*, 55–88.

Spencer, H. (1855). *The principles of psychology*. London: Longman, Brown, Green, and Longmans.

Spencer, H. (1870–1872). *The principles of psychology* (2nd ed., Vols. 1–2). London: Williams and Norgate.

Spencer, H. (1881). *The principles of psychology* (3rd ed., Vols. 1–2). London: Williams and Norgate.

Spencer, H. (1897). *The principles of psychology*. (3rd ed., authorized ed., Vols. 1–2) New York: Appleton.

Spencer, H. (1901). *Essays, scientific, political, and speculative: Vol. 1* (pp. 1–7). London: Williams and Norgate.

Staddon, J. (2004). Scientific imperialism and behaviorist epistemology. *Behavior and Philosophy, 32*, 231–242.

Taylor, M. W. (1992). *Men versus the state*. Oxford: Clarendon Press.

Thorndike, E. L. (1898). Animal intelligence: An experimental study of the associative processes in animals. *Psychological Review Monograph Supplement, 2* (Whole No. 8).

Thorndike, E. L. (1911). *Animal intelligence: Experimental studies*. New York: Macmillan.

Weissman, A. (1904). *On evolution*. London: Edward Arnold.

Young, R. M. (1970). *Mind, brain and adaptation in the nineteenth century*. Oxford: Clarendon Press.