

# John Dewey and American Psychology

---

PETER T. MANICAS

## INTRODUCTION

John Dewey is always included as critical player in the development of psychology in America. But his relationship to this development is complicated and, for this reason—and others, too—nearly always misunderstood. Moreover, there is a double irony in this.

First, it is often assumed that he played a significant role in the development of behaviorist psychology, which came to dominate American psychology. In part, this depends upon the view that, as Boring put it, American psychology “got its mind from Darwin” and dealt with “a mind in use,” and, as “an experimental science,” was to be pursued in terms already well established in the biological sciences (Boring, 1950, p. 506). It was Dewey’s “faith in use-value” that “made him able to give definition in psychology to the American temper” (1950, p. 553). It also depends on the related assumption that Dewey gave Progressivism its voice and that “as the twentieth century went on, psychologists would fulfill Dewey’s hopes. Psychologists would increasingly move out into society, remaking its misfits, its children, its schools, its government, its businesses, its very psyche” (Leahy, 1992, p. 277). Finally, the misunderstanding depends upon a distinctly positivist reading of pragmatism, the genuinely distinctive American family of philosophies. Thus Hilgard writes of a “conception of scientific method that was continuous with the pragmatism of James and the instrumentalism of Dewey” that “continued to influence the nature of psychological investigations in America even after Watson had dropped consciousness in favor of behavioral measurement” (Hilgard, 1987, p. 778). Dewey, the functionalists, *and* the behaviorists resisted mind/body dualism and focused on “adaptive behavior.” This allowed an easy collapse of the “functionalism” of James, and then of Dewey, into later versions of functionalism, the “characteristic American psychology,” and from there to the later “operationist” versions of behaviorism.

Indeed, Dewey was powerfully influenced by Darwin and was a strong advocate of “experiment,” and he often spoke not only of “the mind in use” but also of “control” (Hickman, 1992). But while Dewey was a leading voice in Progressive thought, it is easy to demonstrate that he was a strenuous critic of the sort of scientism so well expressed in the text cited from Leahy (Manicas, 1988; Westbrook, 1991). And, it was easy, but wrong, to think that the differences between positivism and variant forms of pragmatism were of little importance to the idea of a “scientific psychology” (Manicas, 1998). Finally, Dewey was committed to an empirical approach to mind and did reject dualist psychology, but his “instrumentalism” was no positivism. Indeed, it is not difficult to show that he played nearly no role in the development of mainstream American psychology. Part I of this essay addresses these confusions. It requires providing a reconstruction of the development of American psychology, if only in sketchy fashion, assaying what Dewey actually did and said, and clarifying some key concepts.

What, then, of the second irony? Although as I shall argue, Dewey had great hopes for “the new psychology,” and, early on in his career, identified himself as a psychologist, he abandoned psychology and came to believe that it ill served what became his primary intellectual goal, that philosophy must address not the problems of philosophy, but the problems of humankind. While he continued to argue that “the nature of all objects of philosophical inquiry is to be fixed by finding out what experience has to say about them,” instead of getting answers from “scientific psychology,” the problems he was interested in addressing would respond to a new conception of inquiry, work which culminated in his 1938 *Logic: The Theory of Inquiry*. This profound shift is missed primarily because Dewey’s theory of inquiry is so fundamentally in opposition to the dominating logical empiricist theory of science, which had by then captured psychology, that it was misunderstood and then ignored. The second irony then is this: Having abandoned even the more refined forms of behaviorism, the cutting edge of current work in psychology is so-called “cognitive psychology.” But, remarkably, not only does Dewey’s *Logic* give us prophetic insights into the most fruitful of these approaches, an ecologically oriented, biologically grounded cognitive science, but shows us decisively why “symbolic” AI models must fail. One wonders whether Dewey will be ill served once again. Part II addresses these complicated issues.

## PART I: DEWEY AND THE ORIGINS OF AMERICAN PSYCHOLOGY

### The “New Psychology”

One of Dewey’s earliest essays was an examination of “The New Psychology” (1884). Historians agree that “the new psychology” derived from Wilhelm Wundt who founded the first psychological laboratory in 1879 and whose *Gründzüge der physiologische Psychologie* (1<sup>st</sup> Edition, 1873) was an enormous success. But Wundt’s

psychology was complicated and offered many not always clearly consistent strands. Drawing on all the recent advances in physiology, neurology and psychophysics, Wundt seems to have put it all together: brain localization, sensory psychology, will, memory and cognition. Moreover, in contrast to the reigning British tradition, mind was conceived as both active and unitive. Thus “apperception,” a central idea, was a psychic mechanism that gave us the power of “selective attention” and “discriminative judgment.” “Introspection,” which for Wundt was the “foundation of psychology,” licensed this view. Third, for Wundt, mind also was social, an idea thoroughly developed in his massive *Völkerpsychologie* (1900–1920). Finally, psychology earned its credential as a science (and not a branch of philosophy) because it was “experimental” and because it disclaimed irrelevant metaphysical issues, e.g., the relation of mind and body. To be sure, this made problematic the question of the relation of physiology to psychology, a question that still haunts inquiry.<sup>1</sup>

The entirely new American universities provided ample opportunity to institutionalize the “new,” scientific psychology (Manicas, 1987). In short order, American psychology would pre-empt all others. By 1900, some 42 psychology laboratories were established in American colleges and universities; by 1926, there were 117. Of the first of these, thirteen of the founders had taken degrees with Wundt.

We get a clear picture of Dewey’s assessment of the high importance of the “new psychology,” by looking at his essay, so entitled. Dewey first notes that the new psychology is part of the new *Zeitgeist* of the new sciences, including the advances in physiology, but Dewey sees a confusion. The common view is that “some or all the events of our mental life are physically conditioned upon certain nerve structures, and thereby *explains* these events.” But, he insists, “nothing could be further from the truth” (EW: 1, p. 52). According to Dewey, “all the leading investigators clearly realize that explanations of psychical events, in order to *explain*, must be psychical and not physiological” (*ibid.*). Professor George Ladd was an exception. In Dewey’s review of Ladd’s *Elements of Physiological Psychology* (1887), Ladd is charged with holding to both “the older opinion” that physiological psychology is the science of the relations of mind and body; of the correlations of the physical and the psychical” (EW: 1, p. 200) and to the new view, promoted by Wundt, of “physiological psychology as a method, whose end is not the parallelisms between the brain and consciousness, but the investigation of *consciousness* itself by physical methods” (*ibid.*). This very well characterizes nearly all the Wundtian inspired work then going on in America, e.g., as represented by the influential work of Dewey’s teacher at Johns Hopkins, G. Stanley Hall, and of E.B. Titchener, fresh from his PhD under Wundt. It was “experimental” but it relied heavily on introspection and its primary goal was investigation of “consciousness.”

But, according to Dewey, advances in the biological sciences have had another direct effect on the new psychology: “To biology is due the conception

of organism . . . In psychology this conception has led to the recognition of mental life as an organic unitary process developing according to the laws of all life, and not a theater for the exhibition of independent autonomous faculties, or a rendezvous in which isolated, atomic sensations and ideas may gather, hold external converse and then forever part" (EW: 1, p. 56).

This, of course, is directed at British-style associationist psychology, but as part of this, Dewey, still the Hegelian, endorses an ecological conception and the Wundtian premise that mind is social. Thus, "the idea of environment is a necessity to the idea of organism, and with the conception of environment comes the impossibility of considering psychical life as an individual, isolated thing, developing in vacuum" (*ibid.*)

But there is more. As a "movement" the new psychology has certain general features: "The chief characteristic distinguishing it from the old psychology is undoubtedly the rejection of a formal logic as a method and test. The old psychologists almost without exception held to a nominalist logic" (p. 58), a pronounced tendency, especially among those "who proclaimed that 'experience' was the sole source of all knowledge" (p. 59). Hume destroyed all relations except as "accidents" and "denied all universality." But he did this on the basis of "purely logical models," "abstract principles of difference and identity . . . put in the guise of psychological expression." The reaction to this, as in Kant, was to "fall back on certain ultimate, indecomposable, necessary first truths immediately known through some mysterious faculty of mind . . . Such intuitions are not psychological; they are conceptions bodily imported from the logical sphere" (*ibid.*). These criticisms of the prevailing alternatives are, of course, familiar Deweyan themes, to be re-articulated and developed in the remainder of his long life—even if, as we shall see, he will be badly disappointed as regards his hopes for "the new psychology."

Dewey's hopes for "the new psychology" were not restricted to psychology only; he believed that it held enormous promise for philosophy itself. In three essays published in 1884 and 1886, he offered a redefinition of philosophy and a new role for psychology: "in the ordinary way of putting it, the nature of all objects of philosophical inquiry is to be fixed by finding out what experience has to say about them. And Psychology is the scientific and systematic account of this experience" ("The Psychological Standpoint," EW: 1, p. 123). To be sure, not any psychology will do. Dewey's first effort was his 1886 *Psychology*, published four years before James's *Principles of Psychology*.

Dewey intended the book to be an introductory text in psychology, but wanted also that it be an introduction to philosophy. In his preface, he remarked: "How shall we make our psychology scientific and up to the times, free from metaphysics—which, however good in its place, is out of place in a psychology—and at the same time make it an introduction to philosophy in general?" (EW, 2, p. 4). In good Wundtian fashion, the book covers all the characteristic topics, but despite

the disclaimer of the preface, the argument is couched thoroughly within a Hegelian frame.

The ground for this was set in the three programmatic essays just mentioned. In “Kant and Philosophic Method” (1884), Dewey challenged the “method of ‘intellectualism’ begun by Descartes” (EW: 1, p. 34) and he argued, as before, that Humeans, avowedly empirical, distorted experience. Kant’s attempted repair had failed: “Though the categories make experience, they make it out of foreign material . . . They constitute objects, but these objects are not such in universal reference, but only to beings of like capacities of receptivity as ourselves. They respect not existence in itself, but ourselves as *affected* by that existence” (p. 39). Again, “the only conception adequate to experience as a whole is organism,” a conception which Dewey found in Hegel’s *Logic* (pp. 42, 43).

The rationale for Absolute Idealism emerges more clearly in “The Psychological Standpoint” of 1886. “The fact that sensations exist before knowledge and that knowledge comes about by their organic registration and integration is undisputed” (EW: 1, p. 127). If one accounts for this by something not in consciousness, then it is not known and we have abandoned “the psychological standpoint” for “an ontological standpoint” (pp. 128f.) But “either this matter is unknown, is a thing-in-itself . . . or is known, and then becomes one set of the relations which in their completeness constitute mind,—when to account for mind from it is to assume as ultimate reality that which has existence only as substantiated by mind” (p. 129).

The argument is straightforward: “From the psychological standpoint the relation of subject and object is one which exists within consciousness” (p. 131). Hence, materialism and all forms of dualism, as e.g., the “Transfigured Realism” of Spencer, all fail. But so too does Subjective Idealism.

The essence of Subjective Idealism is that the subject consciousness or mind, which remains after the ‘object world has been subtracted,’ is that for which after all this object world exists. Were this not so—were it admitted that this subject, mind, and the object, matter, are both but *elements within*, and both exist *for*, consciousness—we would be in the sphere of an eternal absolute consciousness, whose partial realization both the individual ‘subject’ and the ‘external world’ are (p. 135).

Similarly, in “Psychology as Philosophic Method,” Dewey wrote: “The relation of Psychology to Philosophy now stands, I suppose, something like this: There is an absolute self-consciousness. The science of this is philosophy. This absolute self-consciousness manifests itself in the knowing and acting of individual men. The science of this manifestation, a phenomenology, is psychology” (EW: 1, p. 136).

Before the century ended, Dewey did become uncomfortable with his Hegelianism, abandoning it for the variety of naturalism that now so strongly identifies him, but *it is essential to see that while he abandoned Hegel and psychology, he never did abandon the seminal psychological insights that his Hegelianism afforded.*<sup>2</sup>

## William James and The Problem of a Scientific Psychology

But before we pursue the divergence between Dewey and the development of academic American psychology, we need here to bring in the work of William James. Along with Wundt, James is often credited as being one of the founders. As with Wundt, James's psychology was complex, freely drawing from a wide variety sources and orientations. And like Wundtian psychology, it was also to be rejected.<sup>3</sup>

James himself played a role in this. Despite his extremely rich and provocative beginning, there were some genuine tensions in his magnificent *Principles of Psychology*, tensions that led him ultimately to despair of the very idea of a scientific psychology. The center of this was precisely the problem that had so perplexed Wundt and Dewey, in James' terms (in criticism of Spencer), if there was no "correspondence" between "inner" and "outer" relations, then the problem of knowledge was insoluble!<sup>4</sup>

In his 1894 Presidential Address to the American Psychological Association, "The Knowing of Things Together," James returned to the problem of "the nature of synthetic unity of consciousness" and concluded that none of the available theories could be accepted. What of his own account in the *Principles*? There he had proposed, "to simply eliminate from psychology 'considered as a natural science' the whole business of ascertaining how we come to know things together or to know them at all" (James, 1978, p. 87). As Dewey had earlier also noted, "That we do know things, sometimes singly and sometimes together, is a fact. That states of consciousness are the vehicle of knowledge, and depend on brain states, are two other facts." At the time of the writing of the *Principles*, James believed that "a natural science of psychology might legitimately confine itself to tracing the *functional variations* of these three sorts of fact." But he now believed that this was a dead-end. Remarkably, after struggling for some twelve years to write his great book, James concluded that it was "a loathsome, distended, tumified, bloated dropsical mass, testifying to nothing but two facts: 1<sup>st</sup>, that there is no such thing as a *science* of psychology, and 2<sup>nd</sup>, that W.J. is an incapable."<sup>5</sup>

One must dismiss James's self-deprecation. But could he be right: There is no such thing as a science of psychology? Well, at least not quite in the way that James conceived it. But if not, what would count for psychology to be a science?

Two things may immediately be said: Psychology had to be experimental and, as positivists had been arguing, it had to be free of metaphysics. But what were to be data of experiment? Indeed, this could not be answered without first deciding what was to be included as not metaphysical. Some experimental psychologists were interested in establishing "functional relations" between physiological events and mental events. As noted, this was essentially the position of Ladd and James, but also of the earlier psycho-physicists, e.g., Fechner, and of some of the "old psychologists," e.g., Helmholtz and Spencer. Moreover, there

was currently available a powerful argument that such inquiry was not metaphysical. Ernst Mach, the eminent philosopher/physicist whose enormously influential *Analysis of Sensations* (1883) provided a clear and forceful statement of a “positivist” theory of science which had no place for “the metaphysical.” He held that “sensations” are the data of *all* science. Versus the “metaphysicians,” including here Kant and realist versions of Kant, Mach asserted:

For us, the world does not consist of mysterious entities that by their interaction with another, equally mysterious entity the ego, produce sensations, which alone are accessible. For us, colors, sounds, spaces, times, . . . are provisionally the ultimate elements, whose connexion (sp) it is our business to investigate” (Mach, 1959, pp. 29f).

Since following Hume, on this view of science, “causes” are not “productive powers,” scientific laws are merely “connexions.” As Comte (who both introduced the term positivism and ably defined it) had argued, they are merely “invariant associations,” taking the form, “if this, then that.” This idea was powerfully propelled by Mach and his followers, including Karl Pearson and, at just about the same time, by Francis Galton, “the pioneer of a ‘new’ psychology in Great Britain” (Boring, 1950, p. 482). Galton accepted the idea that quantitative measurement is the mark of a science and following Adolph Quetelet, applied the “law of error” to biological and psychological data, including, of course, “mental inheritance” (Boring, 1950, p. 476). At this point, “experimental psychology,” which was moving quickly in the direction of behaviorism, and “the psychology of individual differences,” which employed the new statistical methods, were developing independently of each other. In the following decades, fully legitimated by positivist theory of science, these research programs would converge.<sup>6</sup>

Or one could deny the *explanatory* relevance of physiology, as Dewey had suggested, and argue, with Titchener, for an experimental science of consciousness which included data gained by “trained” introspective experimenters. Titchener also was deeply influenced by Mach. Indeed, as Hilgard says, “because sensation was the unit out of which mental processes were built, Titchener’s position was called *structuralism*, with its emphasis on the *what* of consciousness with somewhat less concern for the *how* or *why* (Hilgard, 1987, pp. 73–74). Attention to “function” would be the response to Titchener’s “structuralism.”

### Pragmatism and Functionalism

In all the standard histories, “functionalism,” the distinctive American psychology, figures heavily in subsequent development. Moreover, the “pragmatists” figure heavily in the development of “functionalism,” from its beginnings in Chicago to its variant forms elsewhere (Boring, 1950, Chapter 22; Hilgard, 1966, Chapter 10; Hilgard, 1987, pp. 73–103; Leahy, 1992, pp. 285–290; Benjamin, 1988;

Murray, 1988; Schultz, 1969).<sup>7</sup> The so-called “functionalist” school included James Mark Baldwin, James McKeen Cattell, both trained by Wundt, and James Rowland Angell, who did an MA under Dewey and took on James as his mentor at Harvard. While Hilgard regards James as the guiding spirit, Boring remarks that if James, Hall, Ladd, Scripture, Baldwin and Cattell were the “pioneers” of American psychology, it was John Dewey who was “the organizing principle behind the Chicago school of functional psychology . . .” (Boring, 1950, p. 539). Leahy holds that Dewey’s “important but tediously written” mid-1890s papers “furnished the central conceptions of America’s native psychology, functionalism” (Leahy, 1992, p. 281).

In these histories, the path from “functionalism” to “behaviorism” is less clear, even if Dewey, as the mentor to Angell, Watson’s dissertation supervisor and the premier functionalist, remains in the fuzzy background. Returning in 1950 to his remarkable 1929 *History*, Boring could note that “Watson was a functionalist (with a small f) but he could not tolerate for long the requirement of the Chicago school that even the animal psychologist must take time to translate (sic) positively observed behavior into the vague terms of an inferred consciousness” (1950, p. 641). Indeed, with this not so subtle erasure of differences between pragmatism and positivism, Boring could conclude that “[operationism] was there all along,” recognized well before Percy Bridgman and Vienna positivism as an “advance” by American psychologists (1950, p. 656). Similarly, Willard Day, Jr, notes in his otherwise very helpful account (1980) of the antecedents of behaviorism that “James was . . . concretely influential in the thinking of certain individuals who are important in the history of behaviorism” and goes on to name John Dewey and William McDougall. But he makes no argument as to how these two figure in this history. Hilgard offers that “it would be a mistake . . . to think of Dewey’s influence upon the psychology of learning as limited to the work of those who developed functional psychology within the laboratories” (1966, p. 299). He sees three additional lines: learning as the “product of schoolroom practices,” “sociological social psychology” “by way of Mead,” and Dewey’s influence as a philosopher, “carrying on the pragmatic tradition” (p. 300).<sup>8</sup> In his later history, he notes that Dewey-inspired Chicago functionalism became, with E.L. Thorndike’s “connectionism,” a “stimulus-response psychology.” Thorndike, whose later work in educational psychology would cross paths with Dewey, had begun his animal studies in William James’s Cambridge basement and, contestably, was already a behaviorist. His influential “law of effect” is also termed “functionalist.” Indeed, as Hilgard sees matters, although functionalism “declined as a recognizable school,” it was “destroyed by its success, and in part, by the success of its intellectual progeny,—behaviorism” (Hilgard, 1987, p. 87f.). Leahy sees “functionalist” controversy, especially as regards the “motor theory of consciousness,” as playing a key role. He offers that Thaddeus Bolton (1902) “integrated theoretical developments since James, including the motor theory of consciousness and Dewey’s account of the reflex arc, into a theory of perception



embodying the coming behaviorist psychology" (1992, p. 286). For Leahy, Angell's APA Presidential address (1906) was "a milestone on the road to behavioralism" (p. 288). As Angell later (1911) concluded:

There is unquestionably a movement on foot in which interest is centered in the *results* of conscious process, rather than the *processes* themselves. This is particularly true in animal psychology; it is only less true in human psychology. In these cases interests is in what may for lack of a better term be called "behavior"; and the analysis of consciousness is primarily justified by the light it throws on behavior, rather than vice-versa (cited by Leahy, 1992, p. 305).

Boring was probably correct: "Watson touched a match to this mixture, there was an explosion, and behaviorism was left" (Boring, 1950, p. 506). "Watson founded behaviorism because everything was ready for the founding. Otherwise he could not have done it" (*ibid.*). With Watson's behaviorism, scientific psychology had not only expunged all talk of "consciousness," but indeed had become a technocratic science of prediction and control.

Considering the stereotypes of American pragmatism, its talk of the "cash value" of ideas, and Dewey's association with Progressive political and social theory, it is easy to understand his taken-for-granted role in this development, especially when his 1896 essay, "The Reflex Arc Concept in Psychology" is taken, remarkably, to be "one of the most important arguments for the functional attitude toward the interactions (sic) between stimulus and response" (Hilgard, 1987, p. 81) and, even more remarkably, when we recall that in 1943, this paper "was chosen as one of the most important articles ever published in *Psychological Review*" (Leahy, 1992, p. 282).

The confusions will take some unpacking. First, it is hardly clear what "functionalism" meant for those writers who got the label pinned on them. The distinction and labels evidently came from Titchener who got the idea from James (Boring, 1929, p. 542). Dewey's orientation surely was "functionalist," but that term carries a host of meanings. For Dewey (as for James), "functionalism" in psychology implied that there was an essential relation between cognition and purpose. *Indeed, this idea may be taken to be a defining idea of pragmatism.* But there is more than this: For both James and Dewey, it meant, as with Wundt, that intentionality was the critical feature of minded behavior. Finally, functionalism entailed that mechanism in biology will not suffice.<sup>9</sup> These come together, to be sure, in the remarkable essay on the reflex arc, to be considered shortly.

But other senses were very much in the air. In addition to the mathematical sense of "function," Boring offers that Angell's 1906 paper to the APA is useful in this regard. Angell distinguished three conceptions of functional psychology. First, it may be regarded as "a psychology of mental operations in contrast to the psychology of mental elements" (Boring, 1950, p. 557, quoting Angell). Second, it may be thought of as the "psychology of the fundamental utilities of consciousness," in which mind is 'primarily engaged in mediating between the environment

and the needs of the organism” (*ibid.*). Finally, “there is a broader view of functional psychology as psychophysics, that is to say, the psychology of the total mind-body organism” (p. 557). All three conceptions are open to diverging interpretations, from a mentalism to a dualism to a radical behaviorism. All, I think, would have made Dewey uncomfortable, even if the second, at least, gives attention both to the purposiveness of “mind” and of the relation of the “needs” of the organism in relation to its environment.<sup>10</sup>

### Dewey’s 1896 Essay on the Reflex Arc

But the critical point is the failure to recognize the philosophical background and fundamental point of Dewey’s famous essay on the reflex arc. It is true and important to recognize that between perhaps 1891 and 1903, with the *Studies in Logical Theory*, Dewey had made a conversion to his distinctive version of naturalism. But it is equally true and important that this was a naturalism that carried a huge Hegelian residue. Flower and Murphey say it well:

It is almost as if Dewey held off from naturalism until he should be able to integrate with it those aspects of idealism which he regarded as philosophically important: the view of knowledge as organic and relational, the social character of both self and knowledge, the unifying and purposive character of judgment. Dewey could not bring together those features with naturalism as long as the dominant model of the latter was atomistic . . . (Flower and Murphey, 1977, p. 820).<sup>11</sup>

This was precisely the burden of the reflex arc essay. Dewey acknowledged that “the idea of a reflex arc has upon the whole come nearer to meeting the demand for a general working hypothesis than any other concept (EW: 5, p. 96) and his essay is not intended “to make a plea for what it replaced.” But the new account, best intentions notwithstanding, suffered from all the features of the older account. “The dualism between sensation and idea is repeated in the current dualism of peripheral and central structures and functions; the older dualism of body and soul finds a distinct echo in the current dualism of stimulus and response” (*ibid.*). Thus, “the sensory stimulus is one thing, the central activity, standing for the idea, is another thing, and the motor discharge, standing for the act proper, is a third.” But if so, it is impossible to see how action can be thought-guided or how we can learn? Experience shows not only that we do, but also what is amiss: the reflex arc is not “a patchwork of disjointed parts, a mechanical conjunction of unallied processes.” It was not to be understood “mechanically” but “functionally.” Rather, it is “a comprehensive or organic unity” (p. 97). Dewey could now reject mechanism and atomism from a fully naturalistic point of view.

Consider James’ familiar child-candle example. First, contrary to the prevailing view, it does not begin with a “stimulus.” The real beginning is an act of seeing. This act stimulates another act, the reaching, but both are bound together,

subordinate elements of a larger coordination so that the seeing controls the reaching and the reaching, in turn, stimulates and controls the seeing. It is now the heavily intentional "seeing-for-reaching purposes." At the next stage, there is another sensori-motor coordination: Indeed, "only because the heat-pain quale enters into the same circuit of experience with the optical-ocular and muscular quales, does the child learn from the experience and get the ability to avoid the experience in the future." The act has become not merely seeing, but "seeing-of-a-light-that-means-pain-when-contact-occurs" (p. 98).

Dewey has given a *description*, a point of departure for a psychology. But he has not given us a psychology. While for Dewey, intentionality is a fundamental feature of all learning, he surely has not given us any account that provides the mechanisms for this.<sup>12</sup> It will surely be a messy psychology including as it does a revisioning of the role and relationships of all the critical elements. But it is a program which can be naturalistically implemented. That is not, however, the point here. The point rather is that while subsequent S-R psychology adopted the language of "function," it failed utterly to take seriously Dewey's 1896 criticisms, and continued, happily, with the development of an atomistic, mechanical and, ultimately, mindless psychology.

It is striking that Boring's account of Dewey's 1896 paper is both sympathetic and generally accurate, but that he fails to note the consequences of Dewey's criticism for all later functionalist and behaviorist thinking. Instead, he remarks that "Dewey was anticipating the position of Gestalt psychology" and "occupying a position in the history of dynamic psychology" (Boring, 1950, p. 554). Of pertinence here is Boring's view that American psychology protested Wundt, first with functionalism and then with behaviorism, while German psychology protested and got Gestalten. Boring concludes, "given everything else in America as it was in 1910, the year of James' death, you could not have had a protest against Wundt developing as Gestalt psychology—not there and not then" (1950, p. 643). Nor indeed, as part of the present argument, does it seem that Dewey's far more radical alternative protest could have been grasped and taken seriously!<sup>13</sup>

Others are even less clear as regards the radical character of Dewey's position. Hilgard, in assessing the very much later loss of hegemony of S-R psychology, writes that "some dissatisfaction with the stimulus-response concept had been expressed as early as Dewey's (1896) criticism of the reflex arc concept" and that Thorstone had reiterated some of Dewey's points in 1923 against behaviorism (Hilgard, 1987, p. 224), but Hilgard does not reconsider the opinion that he had earlier expressed, that Dewey's paper "gave one of the important arguments for the functional attitude toward the interactions between stimulus and response" (p. 81). Given the flabbiness of the category, "functionalist" psychology, one might be tempted to hold, with Leahy, that the ideas of the reflex-arc paper were "the commonplaces of functionalism." But the temptation should probably be resisted, especially since, more important, Leahy goes on to conclude that

"Dewey's formulation was centrally important for later American psychology" (1992, p. 282). His grounds for this claim are of interest. Dewey showed, he wrote, that psychology could dispense with "an inaccessible ego" and instead "account for [the control of perception and decision] in terms of coordinated, ever-changing, adaptive behaviors" (1992, p. 282). There is a sense in which Dewey did show this, but unfortunately, nobody followed him! Indeed, in the effort to sustain a genuinely "scientific" psychology, anything that hinted that "mind" was doing the "coordinating" would either be eliminated, or as Boring had noted, made safe by appropriate "translation."<sup>14</sup>

### "Scientism" and "Scientific Psychology"

J.B. Watson's "Psychology as the Behaviorist Views It" (1913) is generally taken to be the founding document.<sup>15</sup> Watson had little patience for philosophy and was a diligent experimenter. For him, the "new psychology" had produced no systematic body of knowledge (Boring, 1950, p. 642), and introspection was incapable of producing consensus on anything. It was, writes Boring, "more interesting to study behavior for its own sake, describing it and noting its functional use to the behaving organism" (1950, p. 641). One could observe "discriminatory behavior" in both animals and humans. All reference not merely to "will" or "attention" could be dispensed with, but so too "sensation" and "perception." All could be re-stated in terms of the "discriminatory response." Imagery and feeling were another matter. Watson denied both.

In the ensuing years, "stimulus" will be employed to suit nearly any purpose, from a physical input or physiological event to, incoherently, "a situation or an involved object with meaning encrusted on it" (Boring, 1929, p. 586). All of this, to be sure, was "scientific" defined exactly in positivist terms. By the 1930s, Percy Bridgman's notion of an "operational definition" was absorbed by the reigning logical positivism. Thus, propelled and legitimated by the wedding of traditional Humean empiricism and the extensionalist logic of *Principia Mathematica*, logical positivism could vindicate the so-called "Age of Theory." With "intervening variables" and "hypothetical constructs", S-R psychology could even offer gestures in the way of central processes. Indeed, it was during the heyday of the Age of Theory that the *Psychological Review* applauded Dewey's reflex-arc essay, exactly because it seemed at least to allow for both central processes, as per Hull-Spence, and teleology, as per Tolman, of course, all properly operationalized.<sup>16</sup> If it seems unlikely that the judges in this instance could have misunderstood Dewey's paper, we can note also that Watson fully admitted being perplexed by Dewey. Although he had been drawn to Chicago to study with Dewey, in his autobiography Watson wrote: "I never knew what he was talking about then, and unfortunately for me, I still don't know" (cited by Fancher, 1979, p. 316; see also Robinson, 1981).

Philosophically grounded in “nominalist” logic and Humean empiricism, psychology had become “objective” and “instrumental” with a vengeance. But this was not all. In that same 1913 programmatic statement, having redefined “experimental psychology” in his strictly behaviorist terms, Watson could also see the future of American psychology:

Those branches of psychology which have already partially withdrawn from the parent, experimental psychology, and which are consequently less dependent upon introspection are today in the most flourishing condition. Experimental pedagogy, the psychology of drugs, the psychology of advertising, legal psychology, the psychology of tests, and psychopathology are all vigorous growths (Watson, 1963: 158).

It should be emphasized that it mattered less that introspection had been expunged, but that “atomism” had prevailed, and that the “theoretical” (sic) goal of scientific psychology had been transformed from an effort to understand “the mind in use” to “the prediction and control of behavior” (Samelson, 1979; Manicas, 1987; Danziger, 1990). We can see this most clearly in the case of “experimental pedagogy” and “the psychology of tests.”

Although the tools were created in Europe, Boring is correct to argue that “the psychology of tests is essentially American.” And, as Lewis Terman insisted, it “brought psychology down from the clouds and made it useful to men” (quoted by Samelson, 1979, p. 106). Poor Dewey would be again credited, if not directly, at least by innuendo.<sup>17</sup> In 1929 Boring was clear that it was the functional psychology of G. Stanley Hall and Cattell which prepared “the psychological soil” for tests and measurements, but as with educational psychology, it was James and Dewey who gave it “its philosophical sanction” (1950, p. 570). Indeed, in his 1929 account, Boring presumed to show “how this spirit of America was crystallized by Dewey and Angell at Chicago” (Boring, 1929, pp. 545–546)!

The problem here is a remarkable flabbiness as regards “pragmatism,” especially in relation to “positivism” and “scientism.” Boring is good on the early relation of psychology with Machist positivism, and as already noted, he offers that logical empiricist philosophy of science vindicated behaviorism by making “the question of the existence or non-existence of consciousness a pseudo-problem” (1950, p. 658). But he makes no mention, in either edition of his influential book, of Dewey’s “instrumentalism.” More generally, he has no interest in discriminating between pragmatism and positivism.

Hilgard discusses positivism and pragmatism, but is not at all clear, sometimes offering both that “there are distinctions to be made among the various forms of positivism and pragmatism” (p. 777) and that the “conception of scientific method” of later behaviorisms was “continuous with the pragmatism of James and the instrumentalism of Dewey” (p. 778).<sup>18</sup> Leahy links James to Mach and thence to the logical positivists who influenced behaviorism (p. 148), but omits reference here to Dewey. Despite his welcome concern with philosophy of science, Leahy pays no attention to Dewey’s theory of inquiry nor to his views of science. More

generally, for him, the dominant influence of pragmatism was its role in promoting a scientific *Zeitgeist* for America: "American psychologists . . . offered a science with pragmatic 'cash value.' Pragmatism demanded that ideas become true by making a difference in human conduct." This entailed that psychology be applied: adjustment, testing, control (1992, p. 342).<sup>19</sup>

Similar confusions attend Dewey's work in educational psychology, especially as that is often confounded with the work of his colleague at Columbia, E.L. Thorndike. Unfortunately, space forbids an extended discussion of Dewey's contributions—and the misunderstandings of them. Briefly, everyone recognizes that Dewey emphasized "intelligent problem solving, in which each child solves the problems that are confronted by selecting appropriate materials and methods and by learning to adapt these materials and methods to his or her needs" (Hilgard, 1987, p. 674). This emphasis derived directly from insights already set out in his early psychological writings, and, of course, they were developed extensively in the work in experimental logic. It is also recognized, remarkably perhaps, that the "intellectual heritage" of Dewey's views on education was a critical appropriation from European thinkers, including Rousseau, Pestalozzi, Froebel and Herbart, "particularly the doctrine of interest, which he apparently permitted to cover also the Herbartian concept of apperception" (Hilgard, 1987, p. 674). Indeed, as Hilgard appreciates, although both Thorndike and Dewey preached "scientific method," Thorndike, in marked contrast to Dewey, was conservative, aiming not at innovation in the schools, but at "quality control," a consequence of the fact that "Thorndike was first of all an experimenter and measurer who valued data above all else" (Hilgard, 1987, p. 671). This was a result, of course, of his version of "functionalism,"—S-R "connectionism," and made him an ally of the more general movement in testing. As Hilgard remarks: "Largely as a consequence of Thorndike's insistence on measurement of all aspects of education, supported by the prominence that intelligence and achievement testing had received just before and after World War I, the decade of the 1920s was one in which educational psychology flourished" (Hilgard, 1987, p. 682). But to repeat: this was emphatically not an educational psychology that was in any sense Deweyan. Adding to confusion, Dewey's efforts at reform went in parallel to this development—even if in fundamental ways, they were at odds.

### Dewey and Psychology Part Ways

After the mid 1890s, Dewey wrote nearly nothing which could be said to find a place in the mainstream academic American psychology.<sup>20</sup> Several reviews give us some additional insight into why this was so. His 1898 review of Baldwin's *Social and Ethical Interpretations of Mental Development* offers a critical distinction: between examining the individual from the standpoint of psychical process and determining what of this is social, and examining not the process but the content

of the individual's experience to discover what this has in common with others (EW: 5, pp. 385–386). For Dewey, the first belongs to psychology, the second to sociology. Baldwin confuses these questions because he falls into a trap: Both “the individual” and “the society” are taken as given. Accordingly, “when we want to know about the individual we are referred to society; when we want to know about society we are referred to the individual” (388).

This theme is elaborated in the often misunderstood address, “The Need for Social Psychology,” given in celebration of the 25<sup>th</sup> anniversary of the APA in 1916. Ludy Benjamin well captures the misunderstanding. He notes that this address, given shortly after Watson's manifesto, “linked behaviorism with the development of a social psychology in the service of social control” (Benjamin, 1988, p. 419).<sup>21</sup> But this not only capitulates to myth, but utterly misses Dewey's central point. Arguing that “anything which may properly be called mind or intelligence is not an original possession but is a consequence of the manifestation of instincts under the conditions supplied by associated life” (MW: 10, p. 59), Dewey endorses Tarde's view that “all psychological phenomena can be divided into the physiological and the social, and that when we have relegated elementary sensation and appetite to the former head, all that is left of our mental life is our beliefs, ideas and desires, falls within the scope of social psychology” (p. 54).

Although both “the application of statistical methods” and “the behavioristic movement” were just getting started, Dewey believed, optimistically, that both would contribute to what, he believed, was needed. Thus: “Social phenomena are of a kind which demand statistical mathematics” and the behavioristic movement “transfers attention from vague generalities regarding social consciousness and social mind to the specific processes of interaction which take place among human beings” (p. 57). Indeed, Dewey, forever the optimist, foresaw “a great reflex wave from social psychology back into general psychology” (p. 58). “The net outcome of the newer type of psychological method” will then be “an unexpected confirmation of the insight of Tarde that what we call ‘mind’ means essentially the working of certain beliefs and desires, and that these in the concrete—in the only sense in which mind may be said to exist—are functions of associated behavior . . .” (p. 59). We need to be clear that his suggestion that “from the point of view of the psychology of behavior all psychology is either biological or social psychology” (p. 63), was both radical and unheeded—excepting, of course, for the work of George Herbert Mead whose “social behaviorism,” also frequently misunderstood, both influenced and was influenced by Dewey.

Dewey's optimism regarding the future of psychology should have been tempered. Indeed, just three years earlier, in 1913 in a paper read at a joint session of the American Philosophical and American Psychological Associations on “Psychological Doctrine and Philosophical Teaching,” he expressed fears about the direction of “the behavioristic movement.” It was quite one thing to throw out “consciousness” as private and open only to introspection. It was quite

another thing to throw out “mind” in the sense just noted. “To conceive behavior exclusively in terms of the changes ongoing on within an organism physically separate in space from other organisms is to continue that conception of mind which Professor Perry has well termed, ‘subcutaneous’” (MW: 7, p. 54). His criticisms paralleled those made against S-R psychology: “In so far as behaviorists tend to ignore the social qualities of behavior, they are perpetuating exactly the tradition against which they are nominally protesting” (*ibid*).

So far as I can tell, Dewey explicitly discussed ongoing work in psychology only twice more.<sup>22</sup> In 1927, in his essay, “Body and Mind” (LW: p. 3), he argued that in consequence of neglecting the development and historical career of an individual, “an account of the mechanism of a particular movement of behavior is converted into an account of behavior itself and of behavior in its entirety” (LW: 3, p. 33). “The criticism may be broadened to take in the whole reduction of mental phenomena to the stimulus-response type as that reduction obtains in current *psychological theory*, even among those who do not call themselves behaviorists” (pp. 33–34, emphasis added).

By this time, indeed, it was clear that there was very little about American psychology that Dewey could endorse, despite the already taken-for-granted belief that somehow it was “pragmatic” in inspiration. But already by 1903, Dewey saw that what he wanted to say did not *need* psychology—at least as it was then conceived, that “logic” articulated within a thoroughgoing naturalism was the way to go. But, of course, “logic” for Dewey did not mean what it meant for most. It was, as I shall insist, a strong form of an ecological psychology.

We need not review the development of Dewey’s views on logic, which includes not only the *Studies in Logical Theory* (1903) and *How We think* (1911), but *Human Nature and Conduct* (1922) and *Experience and Nature* (1926), along with a host of pertinent essays. Instead, we can directly consider the bearing of his 1938 *Logic*, the text which is the culmination of this development, on the problem of a scientific psychology.<sup>23</sup>

## PART II “LOGIC” AND THE NEW “COGNITIVE PSYCHOLOGY”

### *Principia* Logic and Empiricist Epistemology

“Logic” for Dewey regarded the theory of inquiry, and inquiry, for him, was a problem-solving activity. In 1958, Allen Newell, Clifford Shaw and Herbert A. Simon published “The General Problem-Solver,” a computer “simulation” of human problem-solving. This provoked an entirely new direction for scientific psychology. Behaviorism in the form that Skinner had taken it had utterly discounted “central processes.” “Age of Theory” S-R psychology, from Hull-Spence to Tolman to Estes, had made gestures in the direction of these, but with the new technologies, an entirely different approach was possible: “an information-



processing paradigm that has generality across artificial and natural problems-solving systems" (Wagman, 1998, p. 11).

Remarkably, Dewey's remarks in 1884 regarding his hopes for "the new psychology" expressed a prophetic caution applicable to the new cognitive psychology: Would it make "mental life" "a theater for the exhibition of independent autonomous faculties, or a rendezvous in which isolated, atomic sensations and ideas may gather, hold external converse and then forever part"? (EW: I, p. 56). Indeed, would it, like "the old psychology" hold to "a nominalist logic" and re-institute "formal logic as a method and test" (I: 58). As with Hume, would it proceed "on the basis of "purely logical models," "abstract principles of difference and identity . . . put in the guise of psychological expression"?

*Amazing as it might seem, this is exactly what it did.* And the reason for this turns precisely on the question of whether we should or should not accept the still dominant empiricist epistemology, of which the logic of Russell and Whitehead is an essential element. For Dewey "logic" is the theory of inquiry, naturalistically envisaged. It is sufficiently general "to explain the behaviors of simple biological systems but also those of, say, a human scientific community" (Burke, 1994, p. 23). It was intended to replace "epistemology" as that had been conceived. "Logic" or "inquiry into inquiry" was for him "autonomous" in that it was "a circular process" which did not need "foundations," either in epistemology, metaphysics or psychology. Indeed, it was the supposition that it did that had forestalled an adequate understanding of knowing. In a wonderful understatement, he notes that "a sound psychology" may be a great advantage and that "unsound psychology has done great damage" (Dewey, LW: 12, p. 29).

For the standard view, logic is basically a formal theory of linguistic syntax and insofar as "true belief" is a function of both the "knowledge base" and the "inference mechanisms," it plays an essential role in epistemology.<sup>24</sup> In sum, first, it is the aim of traditional epistemology to establish the grounds for discriminating beliefs as either true or false. Thus, the primary vehicle is the sentence. Second, the problem of the "knowledge-base" takes the form of identifying "the proposition or meaning of a sentence with the information conveyed." Quine notes that "some epistemologists would catalog [the] alternatives by introspection of sense data. Others, more naturalistically inclined, would look to neural stimulation" (Quine, 1970). Third, an extensionalist logic is assumed. That is, "if logic is to be centrally concerned with tracing truth conditions through the grammatical constructions, an artificial grammar designed by logicians is bound to assign the truth functions a fundamental place among its constructions . . . The simple sentences are got by predication, and all further sentences are generated from these by negation, conjunction, and existential quantification" (Quine, 1970, pp. 35–36). A consequence of this is the notorious incapacity to deal with intentionality or to provide a convincing analysis of causality and of lawfulness.<sup>25</sup> Finally, empiricist epistemology is epistemologically individualist in holding that there are beliefs for which social causes are wholly irrelevant. As Quine puts the

matter: “[The] human subject is accorded a certain experimentally controlled input—certain patterns of irradiation in assorted frequencies, for instance—and in the fullness of time the subject delivers as output a description of the three-dimensional external world and its history” (Quine, 1969, p. 77). That our subject could give a description of the world and its history without having any human interaction would be a truly stunning achievement.<sup>26</sup>

I specifically select Quine here to represent current empiricist epistemology since the assumptions summarized obtain whether the epistemologist is positivist, logical empiricist (neo-positivist) or post-positivist à la Quine, that is, whether or not one holds to a firm analytic/synthetic distinction, to a non-holist verification theory of meaning or indeed, to one of the more recent varieties of “reliabilism,” “internalism or “externalism” (Haack, 1995).

### Empiricist Epistemology and AI

It can hardly be doubted that the blossoming of “artificial intelligence” (AI) was profoundly constrained by assumptions taken uncritically from standard empiricist epistemology. Here is an early formulation:

The human brain is an information-processing system whose memories hold interrelated symbol structures and whose sensory and motor connections received encoded symbols from the outside via sensory organs and send encoded symbols to motor organs. It accomplishes its thinking by copying and reorganizing symbols in memory, receiving and outputting symbols, and comparing symbol structures for identity and difference (Wagman, 1998, p. 11).<sup>27</sup>

And this claim depends upon logic. As Zenon Pylyshyn argues, “there is good reason why computers can be described as processing knowledge.” The good reason, which owes, he says, to Hilbert, Gödel, Russell and Whitehead, Turing and Church, was this:

Reasoning about meaningful things—about things in the world or in the imagination could be carried out by a process that itself knew nothing of the world or of meanings, did not know what ‘thoughts’ were about . . .

The idea that logical inference can be carried out by a process of examining meaningless symbols leads directly to the foundational assumption of cognitive science, which is that thought is species of computing . . . The bridge from formal symbol manipulation to computing was completed in 1936 by the mathematician Kurt Gödel who showed that anything that could be described in terms of manipulations of symbols could be carried out by a simple machine (later called a Turing machine), which became the defining property of reasoning and later of intelligent action” (Lepore and Pylyshyn, 1999, pp. 6–7).

For AI theory, “the intelligent organism is a sentential automaton, whose behavior is the outcome of a sequence of mental states (beliefs that *p*, desires that *p*, etc.) and the processing will be described in terms of the *semantic* and *syntactic* relations

among the content-specifying sentences" (Churchland, 1980, p. 188; Wagman, 1998, p. 25). Accordingly, AI inquiry can proceed, not only independently of organism/environment relations, but independently of neurophysiology as well.

This paradigm has not, to be sure, proceeded without criticism.<sup>28</sup> An important challenge comes from the so-called "connectionist" or neural network paradigm. This approach assumes that sensory, motor and, ultimately, cognitive processes are explained in terms of inhibitory or excitatory connections between "nodes" that differ in strength. A brain model of mind replaces the computer model of mind. Cognition is viewed as "the emergence of global states in a network of simpler components. Instead of symbols, meaning resides in these emergent global states. Instead of processing "information" made to mind by the senses, minds create information for their own uses. (Varela, Thompson and Rosch, 1991).<sup>29</sup>

#### AN ECOLOGICAL PSYCHOLOGY?

It is clear that while "the symbolic" AI approach is wholly inconsistent with a Deweyan approach, the connectionist approach is not. I will round out this discussion with some brief remarks on this. First, and critically, in connectionist theory, "there will be nothing that corresponds to the classical symbolic data-structures. Instead, context-sensitive shifting coalitions of units will correspond to single classical representations . . . Since there are thus no neat analogues to the classical symbolic structures, the system *cannot* (not even tacitly) embody knowledge of transition rules defined over *those very structures*" (Clark, 1990, p. 297). That is, problem-solving does not require either "symbols" or "rules." Put bluntly, the constraints on an intelligent problem-solving device are "no labels in the world, no external semantics, and no internal, unexplained homunculus in the loop to provide meaning" (Franklin, 1995, p. 301, explicating the work of Edelman, 1992). *These constraints were all fully articulated and defended by Dewey.* Second, and in a positive vein, as Dennett has argued, there is nothing in connectionist theory, nor in Dewey, which forbids that human symbolic capacities are "a recent add-on," an evolutionary "enhancement" of "mammalian cognitive architecture" (Dennett, 1991, p. 28). Finally, there is the question of whether attention to neural networks will be sufficient to glean an understanding of problem-solving intelligence.

The early chapters of his *Logic* set out the naturalistic basis for "logic" in his sense, beginning with the obvious fact that when people inquire, they "employ their eyes and ears, their hand and their brains" and that "these organs, sensory, motor or central are biological" (LW: 12: p. 30). *That is, minds are embodied—another of the crucial constraints on theory.* Huge chunks of this read as if they had come directly from his reflex arc essay. For example, in decided contrast to the then current S-R theory, he writes:

When the stimulus is recognized to be the tension in the total organic activity (ultimately reducible to that between contact activities and those occasioned through distance receptors), it is seen that the stimulus in its *relationship* to special activities persists throughout the entire pursuit, although it changes its actual content at each stage of the chase. As the animal runs, specific sensory excitations . . . alter every change of position . . . (LW: 12, p. 37).

*That is, there is no way to disconnect sensing and acting nor to disconnect these from the situation which is changing as the consequence of acting.*

Other passages sound like arguments in *Human Nature and Conduct*.

Habits are the basis of organic learning. According to the theory of independent successive units of excitation-reaction, [both then current S-R and later learning theory] habit formation can mean only the increasing fixation of certain ways of behavior through repetition . . .

Developmental behavior shows, on the other hand, that in the higher organisms excitations are diffusely linked with reactions that the sequel is affected by the state of the organism in relation to environment. In habit and learning the linkage is tightened up not by sheer repetition but by the institution of effective integration of organic-envirning energies—the consummatory close of activities of exploration and search (LW: 12, p. 38).

And:

Even the neuro-muscular structures of individuals are modified through the influence of the cultural environment upon the activities performed . . .

This modification of organic behavior in and by the cultural environment accounts for, or rather is, the transformation of properties with which the present discussion is concerned . . . Any theory that rests upon a naturalistic postulate must face the extraordinary differences that mark off the activities and achievements of human beings from those of other biological forms (LW: 12, p. 49).

As Dewey well recognized, while lower organisms are proficient problem solvers, there was no problem acknowledging that much human problem-solving does require “symbolic” (and linguistic) capacities. But as he insisted, it was an “intellectualist” fallacy to impose on all experience, “specifically sentient experience, a structure which is present only in sophisticated (cognitive) developments of experience” (Tiles, 1988, p. 55). Moreover, as part of his powerful account of language, Dewey insisted that the plateau of coordinated animal response is not irrelevant to communication at the linguistic plateau even if it is not reducible to it. Finally, for Dewey (as for Mead), versus both nominalism and realism, meaning cannot be explained in terms of “intentions” (psychic or otherwise) or platonic universals, but requires attention to the pre-existing regularities in social interaction (LW: 12, pp. 51–65). In the absence of acknowledging these, meaning cannot be made intelligible.

As these texts imply, Dewey’s approach is not “psychologistic” if that means (as it usually does) that “mental life” is “a theater for the exhibition of independent autonomous faculties, or a rendezvous in which isolated, atomic sensations and ideas may gather, hold external converse and the forever part” (EW: I,

p. 56). It is, if anything, an “ecological psychology.” It is just here where Dewey’s approach raises pertinent questions about the direction of future neural network research, whether indeed, modeling a brain is all there is to modeling a mind (Dreyfus and Dreyfus, 1990).

As Burke rightly notes, Dewey’s views compare to J.J. Gibson’s theory of perception, which stands in marked contrast to standard “psychologistic” theories. “Ecological psychologists and Dewey share the view that perception is not mediated by internal representational processes, which is not to hold that it is not mediated by *something*. Perception is mediated, rather, by established attunements to lawlike relations among ways of acting in the world, that is by habits . . .” (Burke, 1994, p. 93); and more generally: “Perception and cognition in general do not happen somewhere up in the head, but rather they involve an interactive information-processing mesh that cuts across a simplistic organism/environment distinction” (Burke, 1994, p. 95). As cognitive scientist Stan Franklin notes (following Skarda and Freeman, 1987, Edelman, 1992, and Varela et al, 1996), “information is created not from sensory *input*, but from structural coupling,” the dynamical relation between the organism and what is “out there” (Franklin, 1997, p. 382). Moreover, as Brooks has argued, the pertinent architecture is what he calls “subsumption architecture,” accomplished by “competences,” “a series of incremental layers, each layer connecting perception to action” (Brooks, 1989).

As the foregoing suggests, not all current connectionist inquiry would seem able to deal with the problem initially posed by Dewey’s reflex arc essay. As Hanson notes: “Connectionist models have been fundamentally about system-level brain accounts.” And, indeed,

Without appreciating that commitment, it is hard to understand how a simplified neuron model and synaptic connectivity could be informative for actual brain function . . . It is a common experience in the neurosciences to discover cells that behave in some orderly way without at the same time understanding what their larger purpose might be in terms of system-level function, which in turn requires a deep understanding of the way cells interact and what emergent properties might arise when millions of cells that code for spatial, temporal or structural properties of the world begin to compute something (Hanson, 1999, 425).

Hanson is surely correct that this problem does not go away by measuring more cells, measuring them more precisely or measuring the molecular properties of cells. But he is overly optimistic in supposing that the problem is sufficiently addressed by a systems-level theory “that takes into account some simplified assumptions about systems of cells and simplified self-organizing principles such as learning.” That is, if Dewey is correct, we need to be talking about an intact organism with a brain, including, ultimately, an organism with a mind in Dewey’s sense, acting in an environment. This cannot be a simulated by a computer. But it might be simulated by a robot that could “explore, work in, and communicate results of its ongoing activities in distant planetary environments” (Burke, 262).

Burke offers that Dewey's logical theory cannot tell us how to build such a machine, "but it does offer a number of design principles which would, in his view, have to be treated as fundamental, not as goals to be achieved later, once other preliminaries are taken care of" (263). Indeed, as we have already suggested, Dewey defended constraints which are already prominent in the literature, including, the embodied character of mind, the fact that there are no labels in the world, and hence the implausibility of an external semantics, the dispensability of an internal, unexplained homunculus in the loop to provide meaning, the inseparability of cognition, perception, action and situation, a natural world which is both stable and precarious, and the idea that minds create information for their own use. Indeed, as Burke notes, such an approach to AI and robotics "is actually not so foreign to work lately found in the cognitive science literature."<sup>30</sup> Finally, one might want to claim that

Whether or not Dewey's theory of knowledge is acceptable in every detail, his type of theory, namely, a naturalistic operation-based theory geared to explaining problem solving in concrete contexts, is the only one which holds any promise for handling issues in the cognitive sciences which hinge on our knowing what knowledge is (Burke, 1994, p. 265).

More generally, Dewey's type of theory is the only one which holds any promise for understanding the remarkable capacities of sentient beings—including *homo sapiens sapiens*.

Peter T. Manicas

*Liberal Studies*

*University of Hawaii at Manoa*

2444 Dole St

Honolulu

HI 96822

USA

## NOTES

<sup>1</sup> That Wundt ultimately divorced psychology from physiology is now generally agreed. See Manicas, 1987, pp. 182f. and Manicas, 1986, which both follow Diamond, 1980. In the last edition of the *Gründzüge*, Wundt wrote:

Of the two tasks that are . . . implied by the name of physiological psychology—one methodological, relating to the use of experiment, the other amplificatory, relating to the corporeal basis of mental life—it is the former that is more essential to psychology itself, while the later has value chiefly with respect to the philosophic question about the unity of life processes" (quoted by Diamond, 1980: 169).

<sup>2</sup> Flower and Murphey (1977) see rightly that his essay, "The New Psychology," "reads like a preliminary comment for *Experience and Nature* and that "armed with post game wisdom," all the "idealist" works have the promise of "the thoroughly naturalistic direction of his pragmatism" (p. 820).

<sup>3</sup> Hilgard refers to a Berlin newspaper account of the 1896 Third International Congress of Psychology in Munich which described Wundt as "the psychological Pope of the Old World" and James as the "the psychological Pope of the New World" (Hilgard, 1987, p. 37). He offers a useful comparison of the two and rightly concludes that "neither the psychology of Wundt nor the psychology of James persisted in America in anything like their original forms" (1987, p. 65).

<sup>4</sup> Spencer's "Transfigured Realism" (developed in his *Principles of Psychology*, first edition, 1855, and many thereafter) also had no influence in the development of a scientific psychology for reasons similar to those which explain the rejection of Wundt and James. Briefly, Spencer distinguished sharply between physiology, an "objective science" and psychology whose data were "subjective." But contrary to the mentalism of associationist (and Wundtian) psychology, and to materialism, inquiry could not be restricted to the laws of successive states of the mind. One needed also to know how these were connected with changes in the central nervous system ("inner relations") and then to the external environment ("outer relations"). He called this "aestho-physiology." Similar moves were made by Gustav Fechner's *Psychophysics* (1860). The idea is fatally criticized by James. For discussion, see Manicas, 1990.

<sup>5</sup> Letter to Henry Holt, his publisher, May 1890, quoted from R.B. Perry, 1935. Hilgard, 1987, usefully discusses Gordon Allport's 1943 article, "The Productive Paradoxes of William James." He sees six: the relation of mind and body, positivism and phenomenology, the self, freedom and determinism, association and individuality. James, suggested Allport, "did not make them productive by synthesizing his contradictory views, at least not in the *Principles*, but left them as unsolved paradoxes" (Hilgard, 1987, p. 59). I have argued (Manicas, 1988) that "radical empiricism" was, ultimately, James' preferred solution, a solution similar to the one offered by Mach. See below. But this "solution" similarly had no effect on the development of American psychology.

<sup>6</sup> The history of the use of "variable" in psychological discourse was critical here. See Kurt Danziger, 1997, pp. 163–179. Causal relations (and hence, lawfulness) could now be construed extensionally, in positivist fashion, as "relations of variables," or "functions" in the mathematical sense. For an excellent review of the importance of positivist philosophy of science on modern psychology, see K. Danziger, 1979.

<sup>7</sup> There is now available a three-volume collection, *The Chicago School of Functionalism*, edited by John R. Shook, 2001 which contains an array of relevant papers, some otherwise hard to find, by all the relevant parties.

<sup>8</sup> It is of interest to note that in 1966, Hilgard offered that "a case could be made for bringing these diverging trends into a new synthesis that would have significance for the psychology of learning" and that "in ill-defined ways something of the sort may already be happening." He refers here to the interpretation of perception "as a *transaction* between the organism and the environment" (p. 300) and cites the work of E.C. Kelley (1947).

<sup>9</sup> "Functionalism/mechanism" is still an unsettled bundle of issues. See the essays by Stephen Jay Gould, Christopher Bourse and William Wimsatt, in Sober (ed.), 1984. The term "mechanism" is especially troublesome. Dewey used it often enough, but he seems consistently to mean a complex causal process which most certainly involved bounded transactions, anything but the mechanism of (say) a clock. Dewey persisted in rejecting an opposition between "life and mechanism," an attitude which reduced the latter to an unintelligent automatism and the former to an aimless splurge."

<sup>10</sup> Dewey must take some responsibility for confusion as regards his views of the emerging behaviorism. In his 1922/25 "Development of American Pragmatism" (LW, 2), he did associate pragmatism with behaviorism, but as the context makes clear, it was the idea that the brain was "an organ for the co-ordination of sense stimuli" which led him to make the association.

<sup>11</sup> For Flower and Murphey, the "drift" he reported in his autobiographical essay was "an eminently reasonable one in terms of the very 'new question' of the relation of psychological methods to philosophy" (p. 819). In addition to the psychological articles, including several not discussed here, e.g., "The Theory of Emotion" (1884, 1885), "The Psychology of Infant Language" (1894) and "Interpretation of the Savage Mind" (1902), Flower and Murphey trace the "drift" also in the revised *Study of Ethics: A Syllabus* (1894), propelled by James's *Principles*. The revision, remarked Dewey, was "in no sense a second edition . . . On the contrary, [the new studies] undertake a thorough examination of the process of active experience, and a derivation from this analysis of the chief ethical types and crises—a task, so far as I know, not previously attempted" (EW, 4, p. 221).

<sup>12</sup> G.H. Mead, Dewey's close friend from their years at the University of Michigan and then at Chicago, was fully in agreement on the central issue. In his explicit effort to distance himself from both Wundt's parallelism and Watson's behaviorism, Mead insisted that although "it is impossible to reduce mind or consciousness to purely behavioristic terms . . . yet it is not impossible to *explain* it in these terms," (*Mind, Self and Society*, p. 10). But to do this "we have to be much more thoroughgoing in our statement of the act than Watson was" (p. 11). In a text which fully captures Dewey's point, he continued: "We have to take into account not merely the complete social act, but what goes on in the central nervous system as the beginning of the individual's act and the organization of the act . . . Present results, however, suggest the organization of the act in terms of attitudes. There is an organization of the various parts of the central nervous system that are going to be responsible for acts, an organization which represents not only what is immediately taking place, but also the later stages that are to take place. If one approaches a distant object he approaches it with reference to what he is going to do when he arrives there . . . The act as whole can be there determining the process" (p. 11). Later, he writes: "What the central nervous system presents is not simply a set of automatisms, that is, certain inevitable reactions to certain specific stimuli. . . . The nervous system provides not only the mechanism for that sort of conduct but also for recognizing an object to which we are going to respond" (p. 83). If we want to drive a nail, but find the hammer gone, then we reach for anything that we can use.

<sup>13</sup> Similar considerations apply to the work of Mead who had negligible influence in academic psychology. In arguing against both Wundt and Watson, his problem was precisely to explain "mind" and meaning in terms consistent with Darwin. In sum, "self" presupposed "communication" which presupposed "meaning" which presupposed "significant symbols" which presupposed "vocal gestures" which presupposed the "conversation of gestures" already available to lower animals. "Acts" were "social" in exactly the sense that "the human animal has the ability over and above the adjustment which belongs to the lower animal to pick out and isolate the stimulus . . . Mentality consists in indicating those values to others and to one's self so that one can control one's response" (p. 132).

<sup>14</sup> That is, if "behavior" is not merely "movement," then it involves intentional description: reference to the object, goal or meaning that it has for the agent (Taylor, 1964; Margolis, 1985). As we now appreciate, efforts to eliminate this reference (as in Watson), or to "operationalize" it (as in Tolman), not only failed, but had to fail.

Hilgard suggests that "there is a family resemblance between Dewey's position and Skinner's operant behavior, in which responses are coordinated with the stimuli to which



they lead" (Hilgard, 1966, p. 298 note). But of course, Skinner's "reinforcers" are vacuous. As Taylor (1964) writes: "But although the property of having been reinforced is certainly a property of the object itself separate from other properties of size, shape, etc., it cannot as a stimulus property be so separated. For in order for it to hold as a stimulus property the animal has to recognize the object as that object which was in fact reinforced on the last trial. And in order to recognize something as an object which was reinforced, one has to know some other description true of it besides simply that of 'having been reinforced'" (p. 133).

<sup>15</sup> It is true that the mainstream was not attracted to the more extreme physicalism of Watson. They would be content to be "experimentalists" who, employing the standard S-R jargon, were interested in "behavior," ambiguously understood. See Kurt Danziger, 1997, chapter 9. For a perceptive history of behaviorism, see especially "Willard F. Day, Jr., 1998.

<sup>16</sup> See Estes et al, 1954 and, for critique, Koch, S., 1964, "Psychology and Emerging Conceptions of Knowledge as Unity."

<sup>17</sup> To my knowledge, Dewey never offered his views on the psychology of mental tests. There is an 1889 review of "Natural Inheritance, Galton's Statistical Methods," in which Dewey both encourages the use of the new techniques and notes its limitations.

<sup>18</sup> He holds also that the logical positivism of the 1930s and after was itself not particularly important in the development of American psychology (pp. 778–780), and this development owed more to concerns internal to psychology. Indeed, as the foregoing has suggested, the fundamental ideas regarding the constitution of a scientific psychology predated the enormous technical developments accorded by Vienna positivism. These included not only the treatment of "mind," but as well, as Dewey saw in the 1890s, the philosophical grounding of psychology in nominalist logic and Humean empiricism.

<sup>19</sup> See also Dorothy Ross, 1991, who characteristically chastises Dewey for his "scientism." I have considered aspects of this pervasive confusion in Manicas, 1988, 1992, 1998.

<sup>20</sup> One might want to include Dewey's *Human Nature and Conduct* (1922) which did attract some critical attention from mainstream psychologists. But the combination of Allport's individualist social psychology (1924), laboratory experimentation (e.g., Thurston, 1928) and Freud were sufficient to marginalize Dewey's book among psychologists.

<sup>21</sup> See also Leahy's comments on this paper: "[Dewey] offered his pragmatic conception of mind as a social creation as the proper foundation for an experimental psychology. Since, in Dewey's view mind was created by society, it could be deliberately molded by society, and psychology, the science of the mind, could take as its goal, the scientific management of society" (1992, p. 342).

<sup>22</sup> Dewey was interested in some of the developments in the field of developmental psychology. For example, in a very recently published essay by Dalton and Bergenn, he collaborated with Myrtle McGraw in the 1930s. But as these writers note, this work found its place in Dewey's *Logic*. Similarly, there are arguments in *Experience and Nature* and in the *Logic* which draw on his earlier criticisms of the prevailing theories. But, as I argue, Dewey calls his alternative logic—not psychology.

<sup>23</sup> Tom Burke's 1994 is the groundbreaking work.

<sup>24</sup> See Manicas, "W.V. Quine," forthcoming.

<sup>25</sup> A realist theory of science is essential in this regard. See M.T. Turvey, R.E. Shaw, E.S. Reed and W.M. Mace, 1981; Manicas and Secord, 1984.

<sup>26</sup> For examples of the pervasiveness of this view, see Kornblith, 1994. For mainstream epistemology, social factors enter *only* as potential distortions of truth. But versus these views, as for Dewey, cognition is social all the way down.

<sup>27</sup> Dewey wisely remarked: "Those who are concerned with 'symbolic logic' do not always recognize the need for giving an account of the reference and function of

symbols . . . Any theory of logic has to take some stand on the question of whether symbols are ready-made clothing for meanings that subsist independently, or whether they are necessary conditions for the existence of meanings . . ." (LW, 1938: 27). The former view neatly characterizes "symbolic AI theory," the latter idea is developed both in Dewey and Mead.

<sup>28</sup> This is hardly the place to review this. An excellent review is Stan Franklin, 1995.

<sup>29</sup> This approach has a much longer lineage going back to late nineteenth century neurophysiological speculations underpinning "associationist" psychology. Hebb's account (1949) is "purely associationist and, in the form of simple vector dot potentials, takes on the presumption of neuronal activations and synaptic potentials" (S.J. Hanson, 1999). McCulloch and Pitts (1943) offered a model of the brain as a specialized computing device and Rosenblatt in 1962 developed the Perceptron, a perception learning machine. AI inquiry (in contrast to "natural intelligence") in the 1970s and 80s overwhelmed these beginnings, which lately have been rediscovered and have resulted in a variety of new efforts, including so-called "hybrid symbolic, connectionist" models. See Franklin, 1997.

<sup>30</sup> See the review by Judith Effken and Robert E. Shaw, 1992, pp. 247–270. See also Rodney A. Brooks, 1989; 1990; Franklin, 1995 and Wagman, 1998, pp. 83–95.

## REFERENCES

- ALLPORT, G.W. (1924). *Social Psychology*. Boston: Houghton Mifflin.
- BENJAMIN, L.T. JR. (1988). *A History of Psychology*. New York: McGraw-Hill.
- BORING, E.G. (1929/1950). *A History of Experimental Psychology*. New York: Century.
- BROOKS, R.A. (1989). A robot that walks: emergent behaviors from a carefully evolved network. *Neural Computation*, **1**, 253–62.
- (1990). A robust layered control system for a mobile robot. In P.H. Winston (ed.), *Artificial Intelligence at MIT*, Vol. 2. Cambridge, Ma.: MIT Press.
- BURKE, T. (1994). *Dewey's New Logic: A Reply to Russell*. Chicago: University of Chicago Press.
- CHISHOLM, R. (1977). The contrary-to-fact conditional. *Mind*, **LV**, 220.
- CHURCHLAND, P.S. (1980). A perspective on mind-body research, *The Journal of Philosophy*, **57**.
- CLARK, A. (1990). Connectionism, competence, and explanation. In M. Boden (ed.) *The Philosophy of Artificial Intelligence*. New York: Oxford University Press.
- DALTON, T.C. and BERGEN, V.W. (1996). John Dewey, Myrtle McGraw and *Logic*, Reconstructing an unusual collaboration in the 1930s. *Studies in History and Philosophy of Science*, **17**, 69–107.
- DANZIGER, K. (1979). The social origins of modern psychology: positivist sociology and positivist sociology of knowledge. In A.R. Buss (ed.) *The Social Context of Psychological Theory*. New York: Irvington, 27–45.
- (1990). *Constructing the Subject: Historical Origins of Psychological Research*. Cambridge: Cambridge University Press.
- (1997). *Naming the Mind: How Psychology Found its Language*. London: Sage.
- DAY, W.F. JR. (1998). Historical antecedents of contemporary behaviorism. In R.W. Rieber and K. Salzinger (eds.) *Psychology: Theoretical-Historical Perspectives*. Washington, D.C.: American Psychological Association.
- DERNETT, D. (1991). Mother nature versus the walking encyclopedia: a western drama. In W. Ramsey, S.P. Stich, and D.E. Rumelhart. *Philosophy and Connectionist Theory*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

- DEWEY, J. (1969–1972). *The Early Works*, 5 Volumes. Carbondale: Southern Illinois Press.  
(Cited as EW, with volume and page).
- (1976–1983). *The Middle Works*, 15 Volumes. Carbondale: Southern Illinois Press.  
(Cited as MW, with volume and page).
- (1981–1990). *The Later Works*, 17 Volumes. Carbondale: Southern Illinois Press.  
(Cited as LW, with volume and page).
- DIAMOND, S. (1980). Wundt before Leipzig, in R.E. Reiber (ed.) *Wilhelm Wundt and the Making of a Scientific Psychology*. New York: Plenum.
- (1990). *Constructing the Subject: Historical Origins of Psychological Research*. Cambridge: Cambridge University Press.
- DREYFUS, H.L. and DREYFUS, S.E. (1990). Making a mind versus modelling the brain: artificial intelligence as a branch-point. In M. Boden (ed.) *The Philosophy of Artificial Intelligence*. New York: Oxford University Press.
- EDELMAN, G.M. (1992). *Bright Air, Brilliant Fire: On the Matter of Mind*. New York: Basic Books.
- EFFKEN, J. and SHAW, R.E. (1992). Ecological perspectives on the new artificial intelligence. *Ecological Psychology*, **4**, 247–270.
- ESTES, W.K. et al. (1954). *Modern Learning Theory: A Critical Analysis of Five Examples*. New York: Appleton-Century-Crofts.
- FANCHER, RAYMOND, E. (1979). *Pioneers of Psychology*. New York: W.W. Norton.
- FLANAGAN, O. JR. (1984). *The Science of the Mind*. Cambridge: MIT Press.
- FRANKLIN, S. (1997). *Artificial Minds*. Cambridge: MIT Press.
- FLOWER, E. and MURPHEY, M. (1977). *A History of Philosophy in America*. Two Volumes. New York: G.P. Putnam's Sons.
- HAACK, S. (1995). *Evidence and Inquiry*. Oxford: Basil Blackwell.
- HANSON, S.J. (1999). Connectionist neuroscience: representational and learning issues in neuroscience. In E. Lepore and Z. Pylyshyn (eds.) *What is Cognitive Science?* Oxford: Basil Blackwell.
- HICKMAN, L. (1992). *John Dewey's Pragmatic Technology*. Bloomington: Indiana University Press.
- HILGARD, E.R. and BOWER, G.H. (1966). *Theories of Learning*. New York: Appleton-Century-Crofts.
- (1987). *Psychology in America: A Historical Survey*. San Diego: Harcourt Brace Jovanovich.
- JAMES, W. (1978). The knowing of things together (1894), in *Essays in Philosophy, Works*. Cambridge: Harvard University Press.
- KELLEY, E.C. (1947). *Education for What is Real*. New York: Harper and Row.
- KOCH, S. (1964). Psychology and emerging conceptions of knowledge as unity. In W.T. Wann (ed.) *Behaviorism and Phenomenology*. Chicago: University of Chicago Press.
- KORNBLITH, H. (1994). A conservative approach to social epistemology. In F.F. Schmitt (ed.) *Socializing Epistemology: The Social Dimensions of Knowledge*. Lanham, Maryland: Rowman and Littlefield.
- LEAHY, T.H. (1992). *A History of Psychology* (3<sup>rd</sup> Edition). Englewood Cliffs, N.J.: Prentice-Hall.
- LEPORE, E. and PYLYSHYN, Z. (eds) (1999). *What is Cognitive Science*. Oxford: Basil Blackwell.
- MACH, E. (1959). *Analysis of Sensations* (1883). New York: Dover.
- MANICAS, P.T. and SECORD, P. (1984). Implications of the new philosophy of science: a topology for psychology. *American Psychologist*, Vol. **38**, (4), 399–413.
- MANICAS, P.T. (1986). Whither psychology? In J. Margolis et al. *Psychology: Designing the Discipline*. Oxford: Basil Blackwell.
- (1987). *A History and Philosophy of the Social Sciences*. Oxford: Basil Blackwell.
- (1988). Pragmatic philosophy of science and the charge of scientism. *Transactions of the Charles S. Peirce Society*, XXIV, **4**.

- (1998). Dewey and American social science. In L. Hickman (ed.) *Reading Dewey*. Bloomington: Indiana University Press.
- (1990). Modest realism, experience and evolution. In R. Bhaskar (ed.) *Harré and His Critics*. Oxford: Blackwell.
- (1992). Naturalizing epistemology: recent developments in psychology and the sociology of knowledge. In J.J. Stuhr (ed.) *Philosophy and the Reconstruction of Culture: Pragmatic Essays After John Dewey*. Albany: SUNY Press.
- (forthcoming). W.V. Quine. In A. Marssoobian and J.W. Ryder. In *American Philosophy*. Oxford: Basil Blackwell.
- MEAD, G.H. (1967). *Mind, Self and Society*. Chicago: University of Chicago Press.
- OWENS, D.A. and WAGNER M. (eds.) (1992). *Progress in American Psychology*. Westport: Praeger.
- PERRY, R.B. (1935). *The Thought and Character of William James*. Two Vols. Boston: Little, Brown.
- QUINE, W.V. (1969). Epistemological naturalized. In H. Kornblith (ed.) (1985). *Naturalizing Epistemology*. Oxford: Basil Blackwell.
- (1970). *Philosophy of Logic*. Englewood Cliffs: Prentice-Hall.
- REIBER, R.W. and SALZINGER, K. (eds.) (1998). *Psychology: Theoretical and Historical Perspectives*. Washington, D.C.: American Psychological Association.
- ROBINSON, DANIEL, K. (1981). *An Intellectual History of Psychology*. New York: Macmillan.
- ROSS, D. (1991). *The Origins of American Social Science*. Cambridge: Cambridge University Press.
- SAMELSON, F. (1979). Putting psychology on the map: ideology and intelligence testing. In A.R. Buss (ed.) *Psychology in a Social Context*. New York: Irvington.
- SHOOK, J.R. (ed.) (2001). *The Chicago School of Functionalism*. Three Volumes. Bristol: Thoemmes Press.
- SKARDA, C. and FREEMAN, W.J. (1987). How brains make chaos in order to make sense of the world. *Behavioral and Brain Science*, **10**, (2), 161–195.
- SOBER, E. (ed.) (1984). *Conceptual Issues in Evolutionary Biology*. Cambridge, MA.: MIT Press.
- TAYLOR, C. (1964). *The Explanation of Behavior*. London: Routledge and Kegan Paul.
- THURSTON, L.L. (1928). Attitudes can be measured. *American Journal of Sociology*, **33**, 529–54.
- TILES, J.E. (1988). *Dewey*. London: Routledge.
- TURVEY, M.T., SHAW, R.E., REED, E.S. and MACE, W.M. (1981). Ecological laws of perceiving and acting: In reply to Fodor and Pylyshn (1981). *Cognition*, **9**, 237–304.
- VARELA, F.J., THOMPSON, E. and ROSCH, E. (1996). *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge, Ma.: MIT Press.
- WAGMAN, M. (1998). *Cognitive Science and the Mind–Body Problem*. Westport: Praeger.
- WATSON, J.B. (1963). Psychology as the behaviorist sees it. In W. Dennis (ed.) *Readings in the History of Psychology*. New York: Appleton-Century-Crofts.
- WESTBROOK, R.B. (1991). *John Dewey and American Democracy*. Ithaca: Cornell University Press.