Behavior Analytic Pragmatism

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According to pragmatism, the meaning of a philosophical topic is found in its implications and consequences for human affairs. Absent is any assumption that the topic represents some aspect of a metaphysical reality inferred to be beyond human experience and behavior. The present review suggests that the views of metaphysics and scientific verbal behavior found in contemporary pragmatism, with Richard Rorty as the example, are compatible with those found in the behavior analysis of B.F. Skinner.

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Pragmatism is a decidedly American viewpoint in philosophy whose development in the late nineteenth century is often attributed to Charles Sanders Peirce, William James, and John Dewey (Menand, 2002), and whose influence in the late twentieth and early twenty-first centuries is often attributed to the late Richard Rorty. As is well known, James and Dewey contributed to psychology as well as to philosophy. Indeed, pragmatism was instrumental in the development of American functionalism at the close of the nineteenth century, and is often linked with the development of behaviorism during the twentieth century. In regard to behaviorism, Leigland (1999), Moxley (2001, 2001/2002, 2002), and more recently Schoneberger (2016) have reviewed the relation between pragmatism, for example, as represented by Peirce and Rorty, and the behaviorism of B. F. Skinner, known as behavior analysis. The present paper seeks to continue the discussion of the relation between pragmatism and behavior analysis, and for purposes of illustration to compare the pragmatic dimensions of behavior analysis with those of cognitive science.

Pragmatism as a Philosophical Orientation

Pragmatism has been described in many ways by many commentators, sometimes as much in terms of what it opposes as what it advocates. The following passage from Dewey (1926) is illustrative:

> [Philosophy's] primary concern is to clarify, liberate, and extend the goods which inhere in the naturally generated functions of experience. It has no call to generate a world of "reality" de novo, nor to delve into secrets of Being hidden from common sense and science. It has no stock of information or body of knowledge peculiarly its own; if it does not always become ridiculous when it sets up as a rival of science, it is only because a particular philosopher happens to be also, as a human being, a prophetic man of science. Its business is to accept and to utilize for a purpose the best available knowledge of its own time and place. And this purpose is criticism of beliefs, institutions, custom, policies with respect to their bearing on good. This does not mean bearing upon the good, as something itself formulated and attained within philosophy. For as philosophy has no private store of knowledge or of methods for attaining truth, so it has no private access to good. As it accepts knowledge of facts and principles from those competent in science and inquiry, it accepts the goods that are suffused in human experience. It has no Mosaic or Pauline authority of revelation entrusted to it. But it has the authority of intelligence, of criticism of these common and natural goods…. (pp. 407–408, italics in original)

Dewey here clearly continued in the tradition of Peirce and James by challenging the dominant philosophical thinking of his time and suggesting an alternative approach. Absent was an emphasis on a metaphysics that extended beyond the domain of human affairs. In its place was a firm commitment to analyses grounded in human experience and behavior.

A second and more modern illustration of pragmatism is the work of Richard Rorty. Much as Dewey had, Rorty (e.g., 1979, 1991) emphasized that pragmatism is therapeutic instead of constructive. It is therapeutic in the sense that it argues the job of philosophers is to clarify and refine an understanding of the processes according to which humans interact with the world, often in causal ways. For Rorty as for Dewey, the meaning and value of philosophical terms invoked in this endeavor follow from their implications and consequences with respect to human experience and behavior. Rorty rejected the idea that philosophers should be concerned with constructing a metaphysical story about how human minds create the world in which humans live, and then with justifying how this story reflects a reality that philosophers know in some privileged way. Rorty employed the umbrella term "antirepresentationalism" in conjunction with his pragmatic views. By this term he meant an account "which does not view knowledge as a matter of getting reality right, but rather as a matter of acquiring habits of action for coping with reality" (Rorty, 1991, p. 1).

Unpacking Rorty's words is useful here. Following Dewey (1926), Rorty (1991) challenged the traditional view of philosophers "who find it fruitful to think of mind or language as containing representations of reality" (p. 2). Thus, Rorty objected to assuming that philosophical language mirrors or represents an underlying reality in some Platonic, Cartesian, or Kantian sense, and that Truth was a matter of the fidelity of this representation, through the correspondence between words and the inferred, underlying reality. Rorty further objected to reducing philosophy to debates between such traditional dualisms as objective vs subjective, appearance vs reality, realism vs anti-realism, and so on. Indeed, Rorty argued that even entering into these debates implicitly accepts the legitimacy of such dualisms. The more useful position is to reject them as representationalist. Rorty took his antirepresentationalism from a wide variety of sources, some of which are listed here alphabetically: Darwin, Davidson, Dewey to be sure; Heidigger, Quine, Wilfrid Sellars, and even the later work of Wittgenstein. For example, in his early work such as the *Tractatus*, Wittgenstein (1922/1974) sought to develop a logically consistent "picture theory" of language. This work was central in the rise of logical positivism during the 1920s. In his later work, Wittgenstein (1953) virtually repudiated the earlier work, writing instead of language games, wherein language was a tool for speakers instead of a mirror. For the later Wittgenstein, speakers talk about the world and its constituents as part of getting along in life. Meaning consists in use, rather than in correspondence between a word and some entity from a domain beyond human affairs, where the entity was inferred to possess some essential quality according to some metaphysical doctrine. Whereas the early Wittgenstein was in the essentialist tradition, the later Wittgenstein was in the pragmatic tradition.

With respect to the human condition, in Rorty's hands pragmatism challenges a host of traditional philosophical assumptions regarding the relation between mind and body. As Rorty (1991) put it,

> [T]here is no harm in continuing to speak of a distinct entity called "the self" which consists of the mental states of the human being: her beliefs, desires, moods, etc. The important thing is to think of the collection of those things as *being* the self rather than as something which the self *has*. This latter notion is a leftover of the traditional Western temptation to model thinking on vision, and to postulate an "inner eye" which inspects inner states…. The important thing is to avoid taking common speech as committing one to the view that there is, after all, such a thing as the "True Self," the inner core of one's being which remains what it is independent of changes in one's beliefs and desires. There is no more a center to the self than there is to the brain. (p. 123, italics in original)

Here, Rorty argues against traditional assumptions that a human intention, belief, or desire is one thing but human beings are entirely different, such that they can be known only in some privileged way. Rorty sees these traditional assumptions

as deceptive and not particularly helpful ways of conceiving of how humans actually interact with the world or learn more about themselves.

At the heart of pragmatism is a rejection of the traditional view of verbal behavior, according to which words are conceived as symbols that gain their meaning by referring or corresponding to something else. The something else is generally some object that is spoken about. The object is defined in terms of some essential metaphysical quality it is inferred to possess, and this quality identifies the object as belonging to some particular metaphysical category. Note here the assumptions underlying the traditional view: reality consists of the collection of such objects; humans come to know these objects and their essential qualities through their mental processes; human language represents this reality; Truth is a matter of the correspondence between words and the objects in reality; epistemology is a matter of justifying a story about how the mental states and processes in question yield statements about reality that can be agreed upon and thereby validated as facts; and so on. Pragmatism takes such assumptions to be simply a legacy of longstanding social–cultural traditions that are of little or no value in providing answers to important questions about (a) how humans actually interact with and adapt to the world and (b) how philosophy can contribute to an understanding of those interactions.

The Relation Between Pragmatism and Early Schools of Psychology

As noted in the present introduction, pragmatism was especially influential in the development of American functionalism in the last quarter of the nineteenth century, where functionalism may be distinguished from structuralism. Structuralism was an "Ivory Tower" approach to psychology, concerned with the supposed contents of consciousness — sensations, images, and feelings. For example, structuralists thought that if participants had the correct amount of training — perhaps as many as 10,000 training trials were necessary, the participants would then be able to introspectively discern 42,415 different sensations. However, nonhumans were not eligible to serve as subjects because whether they even had conscious minds was not clear, let alone how they could introspectively comment on the contents of those minds. Similarly, children were not eligible to serve as participants because although they did have minds, whether their introspective comments could be trusted was not clear. Applications in the world outside the research laboratory were not of concern. Evolution was not directly relevant. A representative research question in structuralism was: What is the texture of an individual's sensation of green? Structuralists were not bothered in the least that the pragmatic dimensions of such questions were doubtful.

In contrast, functionalism was more directly concerned with the adaptation of behaving organisms, especially humans, to their social and material environments. In keeping with its concern with adaptation, functionalism was infused

with developmental, evolutionary thinking. Its analytic and explanatory concepts were dynamic and functional. Highlighting an area that might now be called service delivery or applied psychology, James (1892) emphasized that "All natural sciences aim at practical prediction and control and in none of them is this more the case than psychology to-day" (p. 148). He went on to argue that what "every educator, every asylum superintendent, asks of psychology is practical rules" that will help these professionals to improve the ideas, dispositions, and conduct of people in their charge (p. 148). Arguments about the philosophic grounds of mental phenomena are not especially useful to professionals in such endeavors.

A further example of early pragmatic, functionalist thinking is Dewey's (1896) well-known article on the concept of the reflex arc in psychology. As did other functionalists, Dewey suggested that the important goal in psychology was to explain adaptation. To explain adaptation, he argued psychologists needed a holistic account that integrated both physiological and mental processes on the part of the behaving organism. Such an account was obviously not restricted to the physiology of reflex processes. Moreover, the value of knowledge claims in psychology lay in their ability to engender prediction and control of behavioral events in the world of human affairs outside the laboratory, as James (1892) had earlier argued. All this is consistent with pragmatism as it may be broadly understood. Indeed, many functionalists were staunch pragmatists.

The Relation Between Pragmatism and Watson's Classical S–R Behaviorism

The beginning of behaviorism as an independent movement is sometimes traced to the work of John B. Watson (e.g., 1913, 1925). To be sure, Watson was reasonably familiar with the philosophy of his time, and Dewey was one of Watson's mentors during Watson's graduate school days at Chicago in the early 1900s. Watson also sought to reinterpret some traditional topics in psychology in terms of interactions with the environment, such as by rendering thinking as subvocal speech elicited by various internal and external stimuli (e.g., Watson, 1925, p. 215). On these grounds one might suspect Watson was at least somewhat familiar with a pragmatic orientation.

Important to emphasize, however, is that Watson was primarily interested in pursuing a natural science of behavior, not philosophy. For example, the two opening sentences of Watson's (1913) "behaviorist manifesto" are well known: "Psychology as the behaviorist views it is a purely objective branch of natural science. Its theoretical goal is the prediction and control of behavior" (p. 158). This sense of prediction and control lent itself to practical application not only as William James would have it, but also in the form of behavioral engineering to secure desired outcomes. The engineering goal of producing desired forms of behavior was directly in the spirit of Jacques Loeb, also one of Watson's mentors at Chicago. At the time

of his manifesto, Watson had not yet committed to a behavioral technology based on S–R relations. When he did commit to that technology a few years later, the path for social progress based on a science of behavior seemed clear to him, and dominated his work in his remaining years in academic psychology and through the 1920s, when he sought to popularize his behavioristic approach. Nonetheless, although Watson was almost certainly aware of pragmatism, it appears to have influenced him less systematically than it did James and Dewey.

The Relation Between Pragmatism and Neobehaviorism

Smith (1986) has provided a comprehensive analysis of E. C. Tolman's and C. L. Hull's forms of behaviorism during the era of "Grand Learning Theories" in the second quarter of the twentieth century. To be sure, their forms of behaviorism, usually known as mediational neobehaviorism, differ greatly from each other. Nevertheless, pragmatism is linked in subtle ways with the rise of neobehaviorism.

First, neobehaviorists accepted observable stimulus (S) and response (R) variables as the principal data in their systems, which is in keeping with a pragmatism. However, neobehaviorists then postulated unobservable organismic variables (O) to mediate the relation between stimulus and response according to an S–O–R framework. The concept of mediation means that observable external stimuli activate or trigger one or more unobservable intervening structures that are hypothesized to be causally connected in some complex but systematic way to an ensuing observable response. Note that Watson's classical S–R behaviorism had no such mediating organismic variables. Appeal to the mediating variables was thought to be necessary to overcome the limitations of Watson's strict S–R framework in explaining the flexibility of behavior as well as its sequential organization.

Neobehaviorists then cast the mediating variables as theoretical terms, based on developments in the philosophy of science at about the same time. However, those mediating variables needed to be operationally defined. Thus, operationism became a central concern during this era, as a technique to produce agreement about the mediating variables and avoid a return to the vague, ambiguous ways of introspective structuralism. Agreement was achieved through linking the unobservable mediating variable with some specified, observable stimulus or response measure. Here then was one link between pragmatism and neobehaviorism.

Second, neobehaviorists were also concerned during this era with developing a coherent approach to psychological research and theorizing. Laws and theories were primary considerations based on their contributions to the hypothetico–deductive model of explanation that was developing in the philosophy of science under the influence of logical positivism. Predictions deduced from the laws and theories about actual observable behavioral data were paramount. Here again is a link between pragmatism and neobehaviorism, insofar as pragmatism asked for observable implications and consequences of theoretical endeavors in science.

As an aside, despite the neobehaviorist emphasis on observation, the pragmatic dimensions of the proposed laws and theories were sometimes questionable, in light of the uncertain ontology of some of the mediating organismic variables: What variables would practitioners actually manipulate? Hull's "oscillation factor" and "afferent neural interaction" are generally cited as problematic in this regard. In addition, questions were raised about experimental control: What interventions would actually produce desired and predictable outcomes? To be sure, Hull's Institute for Behavioral Relations at Yale was concerned with the practical application of conditioning principles to psychopathology (Dollard and Miller, 1950), but again there was little formal identification with pragmatism as a philosophical movement. The principal concern was with theory development rather than application.

Third and finally, neobehaviorists subscribed to the thesis of instrumentalism. Instrumentalism holds that the function of theories and the terms they contain is to generate testable predictions about events. On this view, the nature of a specific term in the theory, such as a mediating O variable in the S–O–R framework, is less important than its role in generating a verifiable prediction, following from the hypothetico–deductive model of theorizing and explaining. Here, an emphasis on using some observable behavioral measure to assess the predictive success of the mediating variables and theories suggests a third link between pragmatism and neobehaviorism.

In sum, pragmatism probably influenced the methods of classical behaviorism and neobehaviorism more than their content, such as by emphasizing objective methods, observable data, and a decision process rather than introspection. As well, the neobehaviorist reliance on operationism seems consistent with pragmatism. However, the story is more complex than it first appears, and more now needs to be said about the relation between modern pragmatism and behaviorism, especially in regard to Skinner's behavior analysis.

The Relation Between Modern Pragmatism and Behavior Analysis

The relation between modern pragmatism, with Richard Rorty as the representative, and Skinner's behavior analysis is of particular interest in the present review. Rorty speaks critically of Skinner in several instances, for example, when he disparages Skinner's work as mere methodological behaviorism (Rorty, 1979, p. 213), pointless fantasy (Rorty, 1991, p. 33), and positivistic reductionism (Rorty, 1991, pp. 110, 135). Regrettably, Rorty's charges are well wide of the mark.

For instance, in an informative review of Rorty (1991), Leigland (1999) addressed some of Rorty's charges against Skinner. Leigland pointed out that Skinner has consistently embraced a pragmatic interpretation of truth. One example is when Skinner (1974) said that "Scientific knowledge is verbal behavior…. It is a corpus of rules for effective action…. [A] proposition is true to the extent that with its help the listener responds effectively to the situation it describes" (pp. 241–242).

This passage indicates that Skinner did not subscribe to the traditional conception of knowledge as some representation of reality, but rather to a pragmatic conception in terms of how humans interact effectively with the world. Scientists may well collect facts as they go about their business, but those facts are construed as aids to effective action, not unassailable representations of a reality that exists beyond human experience and behavior.

In addition, Rorty's charges that Skinner subscribed to Baconian or Machian positivism simply suggest Skinner's preference to view scientific knowledge as aiding in adaptation. To be sure, Skinner sympathized with Bacon's (1623/1937) wishes that involved "shaping nature as on an anvil" (p. 413) and achieving outcomes that benefit humans through direct, practical action. Mach (1886/1959) put it similarly: "The ways even of science still lead to the mouth" (p. 23). For Skinner (1969), "The point of science … is to analyze the contingencies of reinforcement found in nature and to formulate rules or laws which make it unnecessary to be exposed to them in order to behave appropriately" (p. 166). Skinner's statement here is surely in the pragmatic tradition.

The key to understanding behavior analytic pragmatism lies in a behavioral view of verbal behavior. For Skinner (e.g., 1957), verbal behavior is operant behavior that develops through its effects on other persons. Once a suitable verbal repertoire is acquired, speakers' verbal behavior can influence the speakers themselves, just as it influences other persons. Whether it actually does is an empirical question and a function of further relations during the lifetime of a speaker. Words are rather arbitrary patterns of "sounds and marks" (to use Rorty's felicitous phrase) that arise according to conventional practices of a social group. Words have meaning through their participation in contingencies pertaining to that group. However, meaning for the speaker may be usefully distinguished from meaning for the listener. Meaning for the speaker is a matter of the contingencies that govern the emission of the word. Meaning for the listener is a matter of the contingencies according to which the word functions as a source of discriminative stimulation for the listener, recognizing again that speakers can sometimes be their own listeners. On this view, dictionaries don't give meanings of words. Rather, they give other words that mean the same thing (e.g., Skinner, 1957, p. 9). Grammar and syntax are special, higher-order features of verbal behavior. One such feature is agreement in case, tense, and number between or among individual responses. Another feature is the structural arrangement or sequence of individual responses. The higher-order features develop when listeners encourage speakers to take into account various aspects of the situation about which they speak, such as which of several conceivable actors is or are engaging in the action in question or the source or strength of the speaker's response, because listeners find those aspects useful to know. These features contribute to the discriminative value of the verbal behavior.

Nowhere in this treatment is there an endorsement of a reference or representational theory of language. In fact, Skinner (1957, pp. 114–129) explicitly rejected

a reference theory. The term language simply identifies the set of conventional practices that prevail in a verbal community. To speak of linguistic rules is simply to speak of descriptions of those conventional practices. Nowhere is there an endorsement that words refer to or represent a reality of essential Platonic, Cartesian, or Kantian qualities in another dimensional system. Much of this is consistent with Rorty and the spirit of modern pragmatism.

When Dewey (1926) spoke of "the goods which inhere in the naturally generated functions of experience" (p. 407) and Rorty (1991) spoke of "acquiring habits of action for coping with reality" (p. 1), their words are consistent with Skinner's emphasizing that individuals interact with their world through their repertoire of operant behavior. The operant repertoire includes both nonverbal and verbal components. These components develop through the reinforcing outcomes of an individual's actions. Thus, for behavior analysts an understanding of how humans adapt to the world is a matter of understanding the function of their operant behavior. This concern is science not metaphysics, much as pragmatists from Dewey to Rorty argued. Again, behavior analysis may be seen as compatible with pragmatism.

Finally, both pragmatism and behavior analysis strive to avoid ontological commitments, albeit in their own ways. For example, Rorty repeatedly argues against the epistemic, quasi-instrumentalist claim that when a scientist's verbal behavior leads to prediction and control, the verbal behavior in question should be assumed to accurately represent some metaphysical reality. For Rorty, verbal behavior — whether that of scientist or poet — just isn't the type of phenomenon that represents anything, accurately or otherwise. Rather, verbal behavior is simply an instance of an organism's interacting with its world. The relation between the world and language is causal, not representational. As Rorty (1991) put it when advocating his antirepresentationalism,

> The anitrepresentationalist is quite willing to grant that our language, like our bodies, has been shaped by the environment we live in. Indeed, he or she insists on this point — the point that our minds or our language could not (as the representationalistic skeptic fears) be "out of touch with the reality" any more than our bodies could. What he or she denies is that it is explanatorily useful to pick and choose among the contents of our minds or our language and say that this or that item "corresponds to" or "represents" the environment in a way that some other item does not. (p. 5)

Skinner (1969) engaged questions of ontology in a similar fashion when he said that "The basic issue is not the nature of the stuff of which the world is made or whether it is made of one stuff or two but rather the dimensions of the things studied by psychology and the methods relevant to them…. The objection is not that these things are mental but that they offer no real explanation and stand in the way of a more effective analysis" (pp. 221–222). Suffice it to note that for both

pragmatism and behavior analysis, matters of ontology develop from uncritical assumptions about verbal behavior. These matters may be set aside in favor of analyzing the events, variables, and relations responsible for both (a) a given instance of behavior, and (b) the verbal behavior about that instance of behavior, so the relevant concerns in the domain of human affairs may be more effectively engaged.

Pragmatism, Behavior Analysis, and Cognitive Science

Behavior analysts argue that mentalism, for example as evidenced in cognitive science, is the dominant explanatory orientation in contemporary psychology. Further, behavior analysts are opposed to mentalism. Worth noting, of course, is that mentalists are just as opposed to behavior analysis, as virtually any text in cognitive psychology will reveal. Thus, a more direct comparison of how behavior analysis and mentalism stand with respect to pragmatism is useful at this point. To lay the groundwork for the comparison, some characteristics of the behavior analytic view of science are examined first, followed by characteristics of the mentalist view.

For behavior analysts, science is in large measure the operant behavior of scientists, along with (a) the artifacts associated with the origin and the execution of their behavior and (b) the artifacts produced by their behavior. The operant behavior of scientists can be nonverbal or verbal. Nonverbal scientific behavior involves interactions with nature that include such material artifacts as test tubes, scales, microscopes, spectrum analyzers, gas chromatography devices, and so on. In turn, this behavior may yield new and improved material artifacts as well as techniques for employing them. Verbal scientific behavior involves such verbal artifacts or products as theories and explanations. In some instances, these verbal artifacts are formulated prior to and guide the investigation of some subject matter. In other instances, new and improved verbal artifacts arise during or after such investigations.

The reinforcers for engaging in scientific behavior fall on a continuum. At one end is the prediction and control of natural events. At this end is a concern with outcomes that have relatively immediate, practical benefits for humans. As reviewed earlier, Bacon and Mach were concerned with such outcomes. At the other end is "the discovery of uniformities, the ordering of confusing data, the resolution of puzzlement" (Skinner, 1979, p. 282). At this end is a higher-order concern with the more abstract products of science, such as theories and explanations that transcend particular instances of prediction and control. Sometimes these products are identified as "knowledge for its own sake," where that phrase signifies verbal products that are derived from more particular endeavors and whose generality has increased as a science progresses.

Primitive science presumably began with relatively primitive technologies that targeted particular outcomes: making clay pots to store food, making garments to

keep warm, making houses to protect against the elements, making wheeled carts and wagons to transport people or goods, domesticating and selectively breeding animals to provide for the needs of the clan, selectively breeding plants to provide a predictable food supply, making hammers and knives to aid construction, making swords and spears and shields to defend against rivals or attack them. Cultures then developed rules for implementing these technologies. The rules became formalized as sources of discriminative control — typically verbal, which in turn allowed the knowledge of how to produce desired outcomes to be transmitted to future generations. As the rules became more abstract over time, the degrees of freedom for their application increased, and the rules then became useful across more and more situations.

The important point here is that theories and explanations may be understood as accounts built on a foundation of functional relations. However, the mere accumulation of results is no more valuable as a theory than a heap of stones is valuable as a house (e.g., Poincaré). Data become useful when organized and extended so as to suggest a coherent way to deal with a subject matter. To be sure, some degree of "speculation" may even be involved in the process, as Skinner (1974) suggested: "Speculation is necessary, in fact, to devise methods which will bring a subject matter under better control" (p. 17). The speculation, which is related to what Skinner called "interpretation," takes the form of applying (a) known principles derived from situations in which controlled experimentation was carried out to (b) further situations in which controlled experimentation is not feasible (Moore, 2008a, p. 306 ff.). Lyell's (1830–1833) uniformitarianism is an early example, and much modern work continues this tradition, for example, in (a) plate tectonics, where findings from research on the behavior of substances subjected to high pressures and temperatures are invoked to explain the movement of land masses on the surface of the earth and earthquakes; and (b) evolution, where findings from research on molecular processes in genetics are invoked to explain the origin of species.

As suggested above, behavior analysts call attention to the contingencies that control scientific behavior. Presumably, effective scientific behavior is controlled to a great extent by contingencies arising from operations and contacts with data, rather than from social and cultural contingencies that are more a matter of conforming to statements of revelation and authority. These social and cultural contingencies are linked to a supposed domain beyond the natural world and evidence minimal regard to the outcome of interactions with the natural world, which is a great problem. More is said later in this review about why this matter is critical.

In contrast, mentalism pertains to a particular way of pursuing the causal explanation of behavior. According to mentalism, an individual's intrinsic psychological make-up is taken for granted to include such nonbehavioral phenomena as mental acts, states, mechanisms, processes, entities, structures, faculties, and cognitions.

These states, processes, and structures belong to a domain that differs from the behavioral domain. The mental phenomena are unobservable and inferred to underlie observable behavior. They cannot be characterized in the same terms, and do not function according to the same principles as observable events, variables, and relations in the environment. Some representative terms for this nonbehavioral domain are mental, cognitive, and subjective — in short, the domain of "mind." Traditional mind–body psychophysical (i.e., substance) dualism is an example of mentalism, but not the only one.

These mental phenomena are not acquired or influenced by environmental events during an organism's lifetime (i.e., through experience) in any significant way. Rather, the phenomena are postulated to be evolutionary, innate, or maturational. Physiological measures are said to provide neural correlates and are evidence of the underlying mental phenomena, but do not define them. Rather, the phenomena are defined in terms of their functional characteristics, such as their capacities, contents, processing times, and so forth, rather than their physical realization or observable expression. Observable behavior is important for mentalism insofar as it provides objective evidence to support explanatory inferences about the causal properties of the phenomena, rather than because observable behavior is a subject matter in its own right, as in behaviorism. The phenomena afford competence, which makes the observed behavior possible in whatever situation the organism finds itself.

Importantly, according to the mentalism of cognitive science, researchers and theorists should explain behavior in terms of the functional properties and architecture of the underlying mental mechanisms, structures, states, and processes. Mentalists sometimes argue that their point of view follows from the history of science. According to mentalists, science progresses by inferring unobservable yet theoretically rich analytical and explanatory concepts, rather than by restricting analyses and explanations to observable events, variables, and relations. Frequently cited examples are atoms, electrons, cell theory, germ theory of disease, and receptor sites. None of these explanatory concepts were directly observed at the time they were first inferred. The mentalist argument is that they all illustrate why science should not be restricted to observable events, variables, and relations. The primary concern in science should be epistemological: to construct and justify a story of how the underlying structures yield competence. Prediction and, if necessary, control are held to be at best secondary, technological concerns about performance. Mentalists argue they are simply doing the same as all genuine sciences by inferring these underlying, unobservable phenomena. In turn, these inferences lead to the appropriate causal understanding at a theoretical level.

Mentalists typically contrast their position with any form of behaviorism, including behavior analysis. According to mentalists, behavioral statements simply describe observable environmental events, variables, and S–R relations in the manner of Watson (1925). Behavioral statements don't explain how behavior

can come about. In addition, behavior is more flexible than is expected on the basis of observable S–R relations, and its sequential organization differs from expectations based on observable S–R relations. Therefore, mentalists hold that purported explanations of behavior in terms of how that behavior is related to features of the environment are incomplete at best and defective at worst because they don't specify the underlying, unobservable causal structures responsible for the performance. Therefore, behaviorism can't possibly be regarded as generating genuinely theoretical, explanatory knowledge, and can't possibly be regarded as scientific in any meaningful sense of the word.

Finally, mental explanations may even gravitate toward the S–O–R neobehaviorist framework that is prominent in the history of behaviorism, where the O stands for organismic variables that are inferred to mediate the relation between stimulus (S) and response (R) and to provide the desired richness and flexibility. For example, Neisser (1967) argued that "Whatever we know of reality has been *mediated*, not only by the organs of sense but by complex systems which interpret and reinterpret sensory information" (p. 3, italics added). However, for mentalism these mediating O variables are explicitly conceived as nonbehavioral and unobservable. Accordingly, mentalism argues that its explanatory scope supersedes that of any form of behaviorism (Moore, 2013a, 2013b).

In reply to mentalist concerns, behavior analysts agree that trying to explain all behavior in terms of observable S–R relations is surely inadequate, just as mentalists charge. However, behavior analysts do not seek to explain all behavior in terms of observable S–R relations. Although some behavior is indeed attributable to observable S–R relations, by far the most important and relevant form of human behavior is operant behavior, and a contingency is responsible for operant behavior, not observable S–R relations. An important consideration is whether mentalist criticisms of behavior analysis recognize the difference. Many — possibly most — do not.

On a deeper level, behavior analysts argue that mentalism adheres to correspondence theories of truth by virtue of the epistemological concern with justifying the metaphysical story about the supposedly underlying mental states and processes that mediate psychological functioning. Of less concern is any pragmatic interest in the prediction and control of actual behavioral events. Accordingly, mentalism is inherently concerned with formulating an account in terms of the essential properties of those states and processes. Miller's (1956) "Magical number seven plus or minus two" is a case in point. This concern is antithetical to pragmatism. Again, a concern with structure per se is not what makes mentalism unpragmatic. Talk about these structures, their operating characteristics, and their capacities that informs effective action is surely pragmatic. What makes mentalism unpragmatic is its concerns with (a) justifying the metaphysical talk about those structures and their operating characteristics, such that the structures can be said to correspond with reality; and (b) dismissing as unscientific any interest in how the talk contributes to effective

action, such as through prediction and control. Justifying the concern in mentalism by saying it is conceptual or theoretical rather than technological is merely begging the metaphysical question.

To be sure, many psychological theories and explanations do contain terms and concepts that at first glance appear to be mental. Nonetheless, for behavior analysts, some of those terms and concepts are free from concern because they do not appeal to causal entities from a nonbehavioral domain. Rather, they take into account behavioral events, variables, and relations worthy of study in their own right. However, many other terms are unselfconsciously mental. Therein lie behavior analytic concerns. These judgments need to be made on a case-by-case basis. Behavior analysts refer to these judgments as involving the operational analysis of the verbal behavior in question (e.g., Skinner, 1945).

Thus, behavior analysts are concerned about mentalism on a pragmatic basis. More specifically, behavior analysts argue that the supposed properties to which mentalists appeal tend to obscure and indeed actively impede the search for the relevant relations between behavior and environment, allay curiosity by inducing the acceptance of fanciful "explanatory fictions" as causes, misrepresent the facts to be accounted for, and give false assurances about the state of our knowledge. Consequently, behavior analysts argue that mentalism tends to interfere with effective prediction, control, and explanation of behavior, despite mentalist claims to the contrary. Moreover, the mentalist conception of these unobservable phenomena implies that they and the behavior they cause arise and function independently of environmental circumstances, and nothing can be done to promote beneficial forms of behavior or to replace troublesome forms. Such a view is surely unpragmatic.

Pragmatism and Behavior Analytic Theories and Explanations

Worth emphasizing at this point is how strongly behavior analysts are committed to theories and explanations, rather than simply descriptions of observed events, as critics so often argue. For example, Skinner (1972) argued that "[T]he cataloguing of functional relationships is not enough…. Behavior can only be satisfactorily understood by going beyond the facts themselves. What is needed is a theory of behavior…. [E]xperimental psychology is properly and inevitably committed to the construction of a theory of behavior. A theory is essential to the scientific understanding of behavior as a subject matter" (pp. 301–302). The important issue for behavior analysts is the source of control in the contingencies governing the verbal behavior of theorizing and explaining. The source of control is important because it determines the discriminative contribution of the verbal behavior to effective action.

For Skinner, theories with extensive sources of control in neural, mental, and conceptual domains were pragmatically questionable. As Skinner (1950) put it in a well-known article, such theories offer "explanations which appeal to events

taking place somewhere else, at some other level of observation, described in different terms, and measured, if at all, in different dimensions" (p. 215). In their place, Skinner advocated theories having other forms: "Beyond the collection of uniform relationships lies the need for a formal representation [sic] of the data reduced to a minimal number of terms…. But such a construction will not refer to another dimensional system and will not, therefore, fall within our present definition" (p. 215). Such theories are based on organizations of facts. They have a broad generality that transcends particular facts and allows them to contribute to effective action, such as through prediction and control.

Skinner actually wrote a great deal about his recommendations for a pragmatically based scientific epistemology. In one instance, Skinner (1964) put it as follows: "When I said 'explanation' I simply meant the causal account" (p. 102). Thus, an explanation entails the specification of a functional relation between behavior and manipulable or controllable variables. In another instance, Skinner (1953) argued that "Science is not concerned with contemplation. When we have discovered the laws which govern a part of the world about us, we are then ready to deal effectively with that part of the world. By predicting the occurrence of an event we are able to prepare for it. By arranging conditions in ways specified by the laws of a system, we not only predict, we control: we 'cause' an event to occur or to assume certain characteristics" (pp. 13–14). Again, such statements indicate that for behavior analysts, the principal concern of scientific epistemology is the extent to which a scientific statement promotes practical, effective action. As before, an assertion that the function of a theory is to generate some theoretical understanding divorced from the possibility of practical action, as in traditional theories concerned with competence and expressed in neural, mental, or conceptual dimensions, is pragmatically questionable.

Pragmatism, Behavior Analysis, and the Sources of Control over Scientific Verbal Behavior

As argued in the present review, behavior analysts emphasize sources of control over scientific verbal behavior. One source of control over such verbal behavior is surely the operations that a scientist performs and the outcomes of those operations. In Skinner's (1957) terminology, this source of control involves tact relations and extensions of those relations.

However, some verbal behavior said to be scientific is linked at least partly to social–cultural sources that are cherished for extraneous and irrelevant reasons. One such social source of control lies in Western culture, which is largely mentalistic if not palpably dualistic. After all, scientists are typically socialized in a mentalistic society. They conform in certain respects to the prevailing social–cultural traditions and institutions, which are surely mentalistic. A popular name for this source is "folk psychology." For example, religious practices and institutions routinely

appeal to the Soul, commonly secularized as the Mind. The individual is seen as an originator of action or as an agent with "free will." These views are prevalent in books, articles, as well as statements by learned figures in the culture. Students get high grades in their schoolwork for reciting these views in their classwork. The social reinforcement associated with this source of control is enormous. Starting with Watson (1913), behaviorists have been concerned with it. For behavior analysts, the task is to set such mentalistic social influences aside in favor of effective action at the naturalistic level. To use the field of medicine as an example, surely therapeutic practices would have advanced more rapidly if physicians had critically examined the outcomes of treating illnesses with leeches, cuppings, and emetics instead of conforming to convention and remaining with these socially approved techniques.

A second source of social control lies in the mischievous linguistic practice of converting adjectives and adverbs to nouns, then assuming the noun stands for some entity in some other domain — neural, mental, conceptual — of which behavior is merely a symptom or an expression. Again, Skinner (1974) commented on this practice as follows: "When a person has been subjected to mildly punishing consequences in walking on a slippery surface, he may walk in a manner we describe as cautious. It is then easy to say that he walks with caution or that he shows caution. There is no harm in this until we begin to say that the walks carefully because of his caution" (p. 166). Here, caution is invoked as a mediating property in a mental domain, when it has simply been converted from an adjective into a noun, and then cited as a cause. Common terms for this process are reification and hypostatization.

A third source of social control is in the mischievous use of metaphors. Perhaps metaphors are useful in some sense. After all, some applications on computer networks are meaningfully said to function according to a client–host arrangement. Data are said to be stored on the "cloud." However, metaphors can also mislead. For example, memory is commonly accepted to be a process of storage and retrieval. However, if anything is stored, it is a changed organism, not a copy of an experience that is later retrieved. Part of the problem is the general acceptance in our culture of a reference (or as a pragmatist might put it, representational) theory of meaning in which various entities are invented to fill linguistic niches.

In Rorty's (1979, 1991) arguments in favor of construing verbal behavior in a particular way, he speaks approvingly of a number of authors in the post-modern tradition, including Nietzsche, Derrida, Foucault, and even Thomas Kuhn. When it comes to science, Rorty's writing often offers post-modern objections to the assumption that through a philosophically based scientific method, scientific verbal behavior may be taken as correctly identifying fundamental elements of reality, and that prediction and control justify the knowledge claims that arise from such endeavors. Rorty was especially concerned about scientism, which may be described as a "representationalist view of science as a privileged window

on Reality. According to this view, science employs a special Method that provides information on the true nature of things" (Leigland, 1999, p. 495). Rorty further argued that our culture does well not to embrace a post-Kantian epistemology "taken for granted by most Western philosophers during the last two centuries" (Rorty, 1991, p. 118), according to which the Self consists of various layers that mediate our perceptions of and statements about physical reality. Rorty favored instead the position of *nonreductive materialism*, according to which the fundamental distinction is between the individual and the rest of the universe, recognizing that various neural and physiological processes are carried out within the individual's body. Leigland further commented that "Such a straightforward view of biological–behavioral–environmental interaction is quite compatible with … behavior-analytic science" (p. 492). On a behavior analytic view, science is a form of human interaction with and adaptation to the world, rather than a picture of a reality that philosophy tries to justify as lying somewhere else, in some other domain than that of human affairs.

A related question at this point is whether pragmatism and by extension behavior analysis should be considered as equivalent to an instrumentalist view of the role of verbal behavior in science. The position taken here is that pragmatism, behavior analysis, and instrumentalism are not equivalent. To be sure, all three positions can be said to use observations to determine whether predictions are accurate and action is effective. Indeed, many contemporary forms of science do the same. At issue is the source of control over a scientific statement, such that predictions are accurate and action is effective. Behavior analytic pragmatism asks whether the source of control can be refined, for example, by minimizing or even eliminating any control related to mentalistic social influences, such that predictions can be even more accurate and actions even more effective. Instrumentalism stops short of asking such questions. As a result, the present argument is that behavior analytic pragmatism cannot be equated with instrumentalism.

This matter is relevant because of the common instrumentalist orientation of "as if" (e.g., Vaihinger, 1924), for example, in statements that humans act "as if" their minds were computers with such and such capacities, or humans act "as if" their behavior were a function of some personality factor with such and such properties. This orientation invites mental theories and explanations, owing to the social prevalence of mentalism, and the liabilities of mentalism have already been reviewed. Again, if some theory or explanation proves useful, the basis for its utility needs to be examined, and possibilities for enhancement need to be explored. Because previous behavioral rather than so-called mental theories and explanations have proved effective, every reason exists to believe the same situation prevails again, and the reasons for the effectiveness of any theory or explanation are behavioral rather than mental. If so, further examination will reveal what those behavioral reasons are. Moreover, the social reasons for appealing to mental factors will become apparent. As noted, those social reasons include conformity to mentalistic

social–cultural traditions, reification brought about by linguistic practices, and embrace of mischievous metaphors. The basis for effective action derives from understanding the variables and relations that participate in the event being described, rather than the aforementioned social influences. Moreover, the possibility exists that by refining the control from naturalistic factors, the action can be even more effective and ultimately of greater benefit in human affairs.

The position espoused above does not mean all verbal behavior that appears to be mentalistic should be automatically rejected. Indeed, Skinner (1964) commented quite the opposite when he said that "No entity or process which has any useful explanatory force is to be rejected on the ground that it is subjective or mental. The data which have made it important must, however, be studied and formulated in effective ways" (p. 96). The second sentence in Skinner's statement is central. Again, at issue is the source of control over the verbal behavior in question. All this is critical in behavior analysis, although not developed to the same degree in Rorty and pragmatism.

The important consideration is that verbal processes may be understood as behavioral rather than logical, referential processes, and as language games of speakers as they get along in their verbal and nonverbal worlds. To say that words have meanings and that some meanings contribute better to adaptation than do others is clearly reasonable. However, to say that some meanings are more legitimate than others because of that to which they refer concedes rather than rejects the premise of representation. In this regard, concepts are matters of discriminative control: generalization within the class of stimuli that sets the occasion for a term and discrimination between classes. Abstraction is similarly a matter of discriminative control, where the source of control lies in, say, one property rather than the totality of properties of the object, situation, or event with which the speaker is currently in contact. In all cases, an assumption that the concept corresponds to some unobservable, underlying category of reality determined by some metaphysical essence is unwarranted. Importantly, a behavioral understanding of verbal behavior puts everything in good order. Most especially, an operational analysis of the concept as an instance of verbal behavior reveals any extraneous sources of control. When revealed, these extraneous sources can be minimized, leaving refined and ultimately more effective verbal behavior to help individuals adapt to their world.

A final point concerns the source of control over terms commonly said to be mental. Five cases may be examined. In the first, terms said to be mental have a source of control that is actually in private behavioral events (e.g., Moore, 2008a, chapter 10). Private behavioral events are those events to which no one beyond the behaving individual has access, for example, because the events are within the behaving individual's skin. One subcategory of these terms pertains to the development and maintenance of verbal reports about internal sensations and feelings, as in statements about personal experiences involving pain, pleasure, or anxiety. Another subcategory pertains to the development and influence of

covert operants, as in thinking or problem solving. Skinner (1964) commented on the importance of private behavioral events in the following passage: "*An adequate science of behavior must consider events taking place within the skin of the organism, not as physiological mediators of behavior, but as part of behavior itself.* It can deal with these events without assuming that they have any special nature or must be known in any special way. The skin is not that important as a boundary. Private and public events have the same kinds of physical dimensions" (p. 84, italics added). For behavior analysts, private events are behavioral and owe their origin and influence to environmental circumstances that individuals experience during their lifetimes. Once again, the importance of remaining in the domain of human affairs when engaging certain psychological or philosophical topics, rather than appealing to a mental domain, is evident. More is said about private behavioral events in a following section of this review.

In the second case, terms said to be mental have a source of control that is actually in physiology. An organism's physiology necessarily participates in any behavioral event. At issue is how the contribution of its physiology is to be incorporated in an explanation of its behavior. For behavior analysts, these terms pertain to physiological processes in the two gaps in a purely behavioral account. One gap is within a behavioral event, such as the time from an organism's contact with a stimulus until its response. A representative term here is recruitment. A second gap is between behavioral events, such as between an organism's experiences on one occasion and the effects of those experience on a later occasion. A representative term here is consolidation. After all, an organism's body is surely composed of physiological structures, and these structures surely do have operating characteristics and capacities that can be studied and known about.

In the third case, terms said to be mental have a source of control that is actually in behavioral dispositions. These terms pertain to the probability of a particular form of behavior in particular circumstances. Dispositional interpretations are the prominent substitute for all mental terms in various forms of philosophical behaviorism, from Carnap's logical empiricism to Ryle's conceptual analysis. For behavior analysts, some but not all mental terms may indeed be understood as dispositional. Representative terms here are those of propositional attitudes and the intentional idiom, such as belief, desire, and intention.

In the fourth case, terms said to be mental have a source of control that is actually in stimulus control relations. These terms pertain to the influence of antecedent environmental circumstances on behavior. Representative terms here are from the vocabulary of stimulus control: attention, discrimination, generalization. For example, the term discrimination identifies the fact of differential responding as a function of differential antecedent stimuli, not a mediating mental process of discrimina*ting* that causes the differential responding.

The terms in the preceding four cases have sources of control in tact relations or extensions of those relations. In contrast to these terms are those with sources

of control that may be traced more to irrelevant and extraneous social factors, such as conforming to authority or uncritically accepting social conventions and cultural practices. These terms are evident in folk psychology, appeal to inappropriate metaphors, and follow from various linguistic practices, such as when adjectives and adverbs are converted into nouns and then the nouns are assumed to correspond to causal acts, states, etc., that exist in a mental domain. These terms are reified explanatory fictions said to belong to a domain that differs from the behavioral domain. Examples abound in the lexicon of traditional psychology. Memory is conceived as a mental storage and retrieval process, rather than as the reinstatement of a response as a function of the passage of time. Thinking is conceived as an autonomous mental process whose neural correlates are located in the prefrontal cortex, rather than as a behavioral process with either public or private dimensions that contributes to discriminative control. And so it goes. Rather than a function of the tact relation or its extensions, these terms are simply socially induced by language patterns according to what Skinner (1957) identified as intraverbal or echoic control. Terms with these sources of social control are troublesome because they ultimately lead to the counterproductive practices of mentalism and methodological behaviorism (Moore, 2011/2012, 2013a, 2013b).

Behavior Analysis and Private Behavioral Events

One of the topics that attracts a great deal of attention in traditional approaches to both philosophy and psychology is how to understand processes that go on inside individuals in some sense, such as when individuals talk about aches and pains or think. Whereas overt behavior may be easily seen and measured, processes inside the skin seem to require another mode of inquiry and analysis. As a result, the risk of metaphysical intrusion from extraneous sources looms large. In keeping with pragmatism, behavior analysts neither deny nor ignore events inside the skin, nor do behavior analysts remain strictly at the level of relations between observable stimuli and responses. In addition, behavior analysts do not accept traditional assumptions that unobserved processes must be mental. Rather, behavior analysts regard these processes as just as behavioral as observed processes. Thus, an important feature of behavior analysis involves private behavioral events.

As noted earlier, for behavior analysts, private behavioral events fall into two categories (Moore, 2008a, chapter 10). The first is when individuals talk about their sensations and feelings. The second is when individuals engage in covert behavior, such as thinking or solving a problem. Thus, private behavioral events may be undeniably relevant to an understanding of a given instance of behavior as an act in context, even though these events are inaccessible or unobservable from the vantage point of another. What behavior analysts argue is that such covert events may be explained using the same principles as overt behavior.

When it comes to talk about sensations and feelings, behavior analysts argue that listeners reinforce such talk on the basis of public features of the circumstances in which it occurs. Thus, speakers learn to say the pain they feel is a sharp pain when it is caused by a sharp object, a dull pain when it is caused by a dull object, a burning pain when it is caused by a hot object, and so on. There then can be generalization to other circumstances based on the similarity of the sensation. For example, speakers might learn to say they are experiencing butterflies in their stomachs when they experience a fluttering sensation resembling that of a butterfly on their arm.

When it comes to engaging in covert behavior like thinking, behavior analysts argue that behavior is acquired in overt form. Then, because of experiences in the environment, the behavior recedes to the covert form. It is executed by the same motor system, just reduced in magnitude. One common experience that leads behavior to become covert is punishment. After all, individuals learn to read aloud, but reading aloud is punished in the library. As a result, individuals learn to read covertly. Another factor is that engaging in covert behavior is often faster or more expedient. Skilled mathematicians can often solve a problem covertly — "in their heads" — faster and easier than laboriously writing out computations using paper and pencil. In such cases, the individuals are not doing anything essentially different from when they engage in overt forms of the behavior.

Importantly, the behavior analytic position on private behavioral events is neither mentalism nor methodological behaviorism. The position is not mentalism because (a) the events are in the behavioral domain, not a mental domain; (b) the responses are executed by the same response systems as overt responses, just reduced in magnitude; and (c) the origins and effects of private behavioral events on subsequent behavior are a function of environmental circumstances. Thus, for behavior analysts, private behavioral events are very different from the wide variety of causal mental or cognitive states and processes that traditional psychology posits as necessary for an explanation.

Similarly, the behavior analyst position on private behavioral events is not methodological behaviorism because behavior analysts speak directly about the functional relevance of covert behavior, even though the covert behavior is inaccessible to others. Behavior analysts do not try to gain agreement and make analytic or explanatory talk of phenomena from an unobservable mental domain scientifically respectable by appealing to observable data, as in a traditional operational definition. Thus, thinking is a form of behavior in and of itself. Thinking is not construed as traditional approaches have it as some underlying mental or cognitive process that is expressed in overt behavior and for which that overt behavior is an operational measure. To be sure, until technology improves and a second person can directly access the otherwise private events of a first, a second person infers the private events of the first, but for the first, the private events are no inference.

With respect to the first category of private behavioral event — verbal reports about sensations and feelings, what individuals feel are conditions of their bodies. The conditions felt are causal in the sense that they are discriminative stimuli for verbal reports about them. However, the conditions felt are not usefully regarded as causal for behavior. Rather, a more useful understanding is that environmental events, variables, and relations cause both (a) behavior and (b) the conditions felt. A causal analysis most usefully traces a verbal report about sensations and feelings back to the environmental circumstances to which the verbal report is related.

With respect to the second category of private behavioral event — covert behavior, such behavior is causal in the sense it can contribute to discriminative control over subsequent behavior, for example, through its participation as a link in a sequence of responses extended over time. However, covert behavior does not automatically and necessarily occur in every instance of behavior. When it does occur, it does not necessarily influence subsequent behavior. Rather, covert behavior may contribute to discriminative control through individuals' experiences during their lifetimes. The extent to which it actually does so depends on those experiences. These considerations distinguish the behavior analytic conception of covert behavior from the accounts of mediational S–O–R neobehaviorism.

The concept of private behavioral events offers a comprehensive and pragmatic scientific account of one form of human activity based on thoroughgoing behavioral principles, rather than an account based on the explanatory fictions of mediating mental states and processes. The fundamental issue is whether psychologists can explain in a naturalistic way how humans learn to talk about what they feel or how they learn to think. For example, suppose psychologists simply ignore such matters or deny they are relevant on the grounds they are not publicly observable. For behavior analysts, the problem is that psychologists who do so resort to a form of methodological behaviorism, which is hardly a solution.

Alternatively, suppose psychologists accept internal events as ontologically mental, endow the events with the desired causal status, and then render those events as operationally defined hypothetical constructs for the purposes of science. These moves are commonplace in psychology. However, behavior analysts argue that the moves create problems when it comes to explaining the behavior of (a) subjects in psychological research and (b) psychologists as they do science. First, with respect to explaining the behavior of research subjects, behavior analysts argue that the moves institutionalize causal mental phenomena from beyond the behavioral domain. Rendering the mental phenomena as operationally defined hypothetical constructs only makes the constructs proxies for explanatory fictions of dubious origin and ad hoc properties. In short, the moves fractionate rather than unify accounts of nature.

Second, with respect to explaining the behavior of psychologists as they do science, behavior analysts argue that the moves endorse an epistemological dualism. That is, the moves mean that psychologists take for granted that the explanation

they provide of their own scientific behavior should be in mental, nonbehavioral terms, as when psychologists take for granted that appealing to operationally defined hypothetical constructs provides them with the epistemological leverage necessary to explain certain processes in their subjects. The moves promote a demonstrably ineffective and unpragmatic means of seeking prediction and control, despite the mentalists' claims of scientific legitimacy (Moore, 2011/2012, 2013a, 2013b, 2013c).

Pragmatism and the Relation between Psychology and Physiology

The matters considered to this point are relevant to a pragmatic understanding of several further issues in a science of behavior. One is the relation between psychology and physiology. On a traditional view, physiology is held to be the epistemological foundation for theories and explanations of behavior, such that theories and explanations are incomplete unless some underlying physiological mechanism is elucidated. To be sure, knowledge of an organism's physiology can be relevant if prediction and control of the organism's behavior is sought. Also relevant is a physiological technology for intervening in the situation at hand. The technology would involve the knowledge of how to intervene as well as the means to do so.

On a pragmatic view, one issue is whether knowledge of an organism's physiology is necessary for prediction and control of its behavior. The answer here is no — behavior is easily altered without knowing how independent and dependent variables are connected physiologically.

A second issue is whether behavior can be more easily altered, or whether more resources are available for altering behavior, if knowledge of an organism's physiology is available. In principle the answer here is yes.

Consider a child who is being taught to read in a classroom. A child who has learned to read differs physiologically from one who has not yet learned. If those physiological differences are known, then in principle direct interventions and manipulations could produce them. However, a series of questions follows. How likely will the knowledge of the relevant physiology of a human even be known, regardless of the setting in which it is sought, such that prediction and control of reading is possible? Even if it is known, how likely is it that the appropriate apparatus will be connected to the child in the classroom, such that a teacher has access to the apparatus and to the relevant physiological state of the child? How likely is it that the teacher can actually intervene physiologically in the necessary ways?

Notwithstanding the earlier "in principle" answer, practical considerations suggest answers to the questions above skew in the direction of not very likely. An alternative approach is suggested by viewing explanation as well as prediction and control in pragmatic terms. For behavior analysts, an explanation of behavior entails a functional account that leads at least in principle to prediction and control. On this view, interventions based on either physiological or environmental variables can yield prediction and control. The choice of which

intervention to employ is pragmatic, based on the resources available at a particular time and place that will bring about the behavior of interest. So formulated, physiological interventions may be seen as complementary to environmental, rather than foundational: the more that is known from one domain to predict and control, the less is needed from the other. The decision of how to intervene and shape nature as on an anvil, as Bacon would have it, is pragmatic: Which type of intervention will work better, easier, faster, and so on, based on the current state of psychological knowledge and the technology that psychologists have available at the time and place they wish to influence behavior (Moore, 2002)? Physiological knowledge is not superior to or more fundamental than behavioral knowledge, nor does physiological knowledge provide the grounds for validating behavioral knowledge.

Thus, the physiology of the behaving organism is clearly a relevant topic in a science of behavior, but in a different way than much of traditional psychology argues. At issue for behavior analysts is the extent to which much of contemporary neuroscience with its unselfconscious cognitive orientation can contribute to predict and control, owing to its inherent mentalism. Skinner was doubtful:

> [C]ognitive constructs give physiologists a misleading account of what they will find inside. (Skinner, 1978, p. 111)

> Cognitive science is premature neurology. (Skinner, 1987, p. 111)

Additional understanding of the relation between psychology and physiology is gained by turning to Aristotle's classic treatment of causation. For behavior analysts the error in much of contemporary neuroscience and cognitive science generally is the conception of an organism's physiology as an efficient cause. More usefully, an organism's physiology may be understood as a material cause. The organism's neural, muscular, and hormonal systems mean that the organism is sensitive to the environmental circumstances that it experiences, such that environmental interventions will have their desired effect. Without that sensitivity, those interventions would be ineffective. Of course, direct physiological interventions may produce an equivalent effect, and if so, are as valuable as interventions based on environmental manipulations. This sense of causation differs from a sense in which those systems are endowed with endogenous power to produce the behavior in question, in a variation of efficient causation, and promotes a pragmatic view of the relation between psychology and physiology.

Pragmatism and Levels of Analysis in Psychology

The matters considered to this point are also relevant to a pragmatic understanding of another controversial issue, that of molar versus molecular levels of

analysis (e.g., Moore, 1983). Early in the nineteenth century, E. B. Holt (1915) rejected Watson's molecular thesis that temporally extended forms of behavior consisted of a series of concatenated reflexes, strung together like beads on a string. Holt's molar views were then elaborated by his student Tolman, who proposed mediating states and processes, as in mediational S–O–R neobehaviorism, to explain the organization of behavior. For Skinner (1969), Tolman's proposal was clearly not a solution:

> [Tolman] put the "third" variables inside the organism, where they "intervened" between stimulus and response. There was no reason to do this except to maintain something like the old reflex-arc pattern. His intervening variables quickly assumed the function of mental processes (as they were essentially designed to do), and it is not surprising that they have been warmly taken up by cognitive psychologists. (p. 28)

An alternative is to think of molar versus molecular levels of analysis in terms of the temporal context of independent and dependent variables, where molar implies long term temporal relations and molecular short term temporal relations (Moore, 2008a, 2008b). Thus, the pragmatic question would be: According to which time scale — short, intermediate, long, or even some combination — are prediction and control more usefully achieved? As stated, the pragmatic aspects of the question are clear, and the answers will follow from conducting research. The answers need not be identical for all behavioral processes, whether operant or respondent; for all subjects or participants, whether white rats, white Carneau pigeons, or humans; for all discriminative stimuli, whether lights or tones; for all consequences, whether food, water, and money as a positive reinforcer or shock avoidance as a negative reinforcer; or for all punishers, whether electric shock or loss of money. Attempts to formulate laws as metaphysical representations of reality and then to explain behavioral events by asserting that they are instances of those laws are simply legacies of essentialist thinking outlined earlier (Moore, 2008b). Accordingly, in many instances those attempts fall victim to unpragmatic thinking, with its attendant liabilities. If research does find uniformities across species, variables, and relations, so much the better, but the data are the arbiter.

Summary and Conclusions

In conclusion, pragmatism and behavior analysis have much in common. Of particular concern for both is an account of how verbal behavior contributes to adaptation. A problem arises with traditional assumptions when words are assumed to refer to items of reality, and truth is assumed to be a matter of how faithfully words correspond with reality. Rather, a more useful position is that the analysis of verbal behavior reveals its sources of control. Some valuable sources of control are derived from observations and extensions of those observations.

In contrast, other sources of questionable value are derived from social influences: social–cultural traditions, reification, and inappropriate metaphors. These social sources are cherished for extraneous and irrelevant reasons, and mislead inquiry. Overall, to engage in science is to engage in operant behavior. Such behavior is maintained by a range of outcomes, from (a) prediction and control of events in our lives to (b) making sense of those events by seeing order and identifying the factors that participate in them. Questions about the relation between neuroscience and psychology and levels of analysis for psychological data are inherently pragmatic questions about scientific effectiveness, based on such criteria as technological knowledge and resources available to the scientist, rather than on a metaphysically reductive epistemology. A healthy and informed interaction between pragmatism and behavior analysis benefits both parties.

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