Behaviorism

Early forms of psychology assumed that mental life was the appropriate subject matter for psychology, and introspection was an appropriate method to engage that subject matter. In 1913, John B. Watson proposed an alternative: classical S–R behaviorism. According to Watson, behavior was a subject matter in its own right, to be studied by the observational methods common to all sciences. Unfortunately, by around 1930, Watson's behaviorism had proved inadequate. Many researchers and theorists then adopted a view in which various organismic entities were inferred to mediate the relation between S and R: meditational S–O–R neobehaviorism. This general view has remained influential, although the details of the various versions have differed over the years. The behavior analysis of B. F. Skinner took an entirely different approach. Particularly important was the study of verbal behavior. Although behaviorism is often conventionally defined as an approach that seeks to explain behavior without directly appealing to mental or cognitive processes, this definition needs considerable clarification, especially as it pertains to Skinner's behavior analysis and his view of behaviorism as a philosophy of science.

According to standard histories, psychology emerged as an independent discipline in 1879, when Wilhelm Wundt (1832–1920) founded a psychology laboratory at the University of Leipzig, Germany. In his work, Wundt assumed that the study of conscious or subjective mental life was the appropriate subject matter for psychology. As part of his study of mental life, Wundt conducted experiments in an area close to what we would now call sensation and perception. Wundt believed that by understanding mental life, we could come to understand the full range of the human condition, including human culture. Prior to that time, people may well have studied sensory physiology and reflexes, engaged in discussions about moral philosophy and conduct, engaged in philosophical discussions about the nature and limits of knowledge, or even carried out demonstrations similar to Wundt's. However, Wundt is generally credited with launching psychology as a distinct branch of experimentally based, scientific study, idiosyncratic though it was.

Many individuals went to Leipzig to study the "new psychology" with Wundt and then went on to start programs at other universities. Among those who studied at Leipzig was the Englishman E. B. Titchener (1867–1927), who emigrated to the United States and started his own psychologyprogram at Cornell University in Ithaca, New York, in 1892. Titchener called his approach "structuralism." Following Wundt, Titchener assumed that the appropriate subject matter for psychology was conscious, subjective mental life. For Titchener, the elements of mental life were our sensations, images, and feelings. These elements were to be studied by carefully drawing inferences from participants' introspective reports and reaction times. Participants needed to be adults—children were not suitable. Participants also needed to be "properly trained"—they needed at least 10,000 closely supervised training trials. Given appropriate training, for example, participants could then be expected to introspectively discern as many as 42,415 different sensations, and Titchener could infer which of those sensations were higher or lower in the structure of consciousness. Throughout, however, participants needed to be careful to report the stimulus as a primitive, fundamental phenomenon, and not commit the "stimulus error" by interpreting the stimulus.

Even though structuralism did become reasonably influential in the United States, many questioned whether it had practical implications, such as for educating children, training the workforce, or managing behavior in any general sense. Accordingly, an alternative to structuralism emerged in the late 1800s and early 1900s in the United States called "functionalism." Functionalists employed some of the same research methods as had structuralists but emphasized the function of conscious mental phenomena, such as how they aided adaptation. For example, functionalists might use reaction times to study how children's conscious mental phenomena developed over time, so that educational practices could be properly tailored to their development.

Two difficulties that arose in connection with both structuralism and functionalism were the lack of reliability and the lack of agreement. Introspection as a method was particularly problematic. For instance, concerning the lack of

reliability, research findings with the introspective method were not often replicated with other participants or in other laboratories, despite the emphasis on properly trained participants. Similarly, concerning the lack of agreement, it was not abundantly clear what psychologists were actually talking about when they debated whether there was a difference between introspective reports about the "texture" of an image and a sensation. As a result, psychology lurched back and forth between many esoteric discussions that failed to convince the general public of its practical value.

Beginning in the second decade of the 20th century, John B. Watson (1878–1958) argued ferociously against both structuralism and functionalism. In a now classic article, Watson (1913) asserted that neither was effective as a science and that the time had come for psychology to take its place as a legitimate natural science. It could do so by discarding its long-standing concern with conscious mental functioning as a subject matter and introspection as a method. In Watson's view, mental life as traditionally conceived simply did not exist. Rather, psychology should embrace behavior as its subject matter and rely on experimental observation of that subject matter as its method. He called his viewpoint behaviorism. It was objective as opposed to subjective; it borrowed measurement and analytical techniques from "animal psychology" and reflexology and then applied them to adaptive forms of behavior. It insisted on analyzing behavior at a detailed and, if necessary, sequential level—what we would now call a molecular level—instead of accepting it at a large-scale and integrated level—what we would now call a molar level. By emphasizing observability, it avoided problems inherent in introspective reports, namely, the lack of reliability and the lack of agreement. The principal unit of analysis for Watson was the "habit," defined as the coordinated and consistent act that develops in a given situation through repetition, rather than some supposed phenomenon from mental life. He applied his analysis to everything from human emotional responses to language. Today we call Watson's viewpoint classical S–R behaviorism. Classical behaviorism may be said to represent the first phase of the "behavioral revolution."

Despite the importance of Watson's contributions, two problems remained. One was the apparent spontaneity of behavior: Some responses seemed to develop without a characteristic stimulus evoking them. A second problem was the variability of behavior. Even when a characteristic stimulus preceded responses, the topography and frequency of the responses often differed significantly. As a result of such problems, by 1930 many researchers and theorists began to seek ways to modify classical S–R behaviorism.

At issue was how to do so. One approach that proved popular was to insert intervening, "organismic" variables between stimulus and response. The function of these variables was to mediate the relation between stimulus and response, thereby accommodating the previously mentioned concerns about spontaneity and variability. In this mediational approach, external stimuli (S) are held to activate some intervening, internal process or entity (O) that is causally connected in a complex but systematic way to an eventual response (R), and the mediating process or entity (the aforementioned O variable) is taken as the proper focus of psychological science, rather than the response itself. In other words, the response is functionally related to the mediator, rather than the environment, because the organism is in direct contact with only the mediator, rather than the environment. Early examples of these mediating organismic variables were response tendencies, motives, and purposes. Later examples were attitudes, moods, perceptions, interpretations, and the like. These variables were thought to be inside the organism in some sense, in a dimensional system that was nonbehavioral. A nonbehavioral dimension means that the factors are not described in the same terms and are not confirmed with the same methods of analysis as the behavioral facts they are said to address (e.g., Catania & Harnad, 1988). This approach was sufficiently novel to warrant being called a new form of behaviorism—a neobehaviorism. Hence, we may meaningfully refer to this position as mediational S–O–R neobehaviorism. Mediational S–O–R neobehaviorism may be said to represent the second phase of the behavioral revolution. The issue then became how to be scientifically respectable while postulating these organismic variables. The solution, borrowed to some degree from the philosophy of science that was developing under the auspices of logical positivism at about the same time, was to interpret them as "theoretical terms" or "theoretical concepts." Theoretical terms were contrasted with observational terms. Observational terms referred to phenomena that could

be directly measured using instruments, such as dials, counters, pointers, and meters. Theoretical terms referred to constructs that were, by definition, unobservable and inferred.

Even so, how could researchers be sure that the inferred theoretical terms were not just made up? Especially, how could researchers agree on the meaning of the terms? After all, structuralism and functionalism were plagued by the inability to agree on the meaning of their concepts, and mediational S–O–R neobehaviorism did not want to repeat the well-known errors of its intellectual ancestors. The solution was to require that the terms or concepts be "operationally defined." The concept of operational definitions was developed in the natural sciences by the theoretical physicist

P. W. Bridgman (1882–1961). An operational definition was achieved by relating the term or concept to something publicly observable, namely, the experimental operation that served as the measure of the term. For example, the term "length" was operationally defined by pointing to the actual observable operation of measuring something—say, by a ruler. In psychology, the operational definition of a "sensation" was a verbal report about the magnitude of a stimulus, perhaps designated on some numerical scale, or some other differential reaction on a sensory discrimination task.

The embrace of operationism occurred at approximately the same time that two related developments were occurring in the philosophy of science. One of these developments concerns the details of how strictly theoretical terms or concepts were to be defined by referring to observables, in light of the principle of operationism. The second concerns the formalization of the hypothetico-deductive methodology. These developments influenced all forms of psychology during the 1930s and beyond. They especially influenced the behavioral learning theories of Edward C. Tolman (1886–1959), Clark L. Hull (1884–1952), and Kenneth W. Spence (1907–1967). We may now look more closely at these two developments.

As mentioned above, an important concern for theorists in both philosophy and the sciences was how strictly theoretical terms or concepts were to be defined. More specifically, were the concepts to be exhaustively or partially defined by relating them to observables? An exhaustive definition meant that the concepts were defined without remainder by referring to observables. The implication was that exhaustively defined concepts could be applied in only one situation. In contrast, a partial definition meant that the concepts did have additional meaning beyond the current situation and could be applied elsewhere. To illustrate the distinction between exhaustive and partial definitions, consider two terms in psychology. The first is habit strength, from the learning theory of C. L Hull , referring to the observed number of reinforcements that had taken place in the presence of the stimulus of interest. It was wholly defined by the observable terms in an equation. Hence, habit strength was exhaustively defined. In contrast, consider the term super-ego, from psychoanalytic theory. It was not the result of computations in the same way that habit strength was. Rather, it pertained to something that "existed" in some sense, and it functioned by expressing cultural rules across a wide range of situations, from sexually tinged childhood episodes to later forms of adult moral conduct. It was only partially defined by any particular "observation." Early on, both logical positivism and operationism had exhaustively defined their terms. Perhaps this strategy was useful at the time because it guarded against unwarranted speculation or extension of analytical concepts when rigor and clarity of thought were at a premium. However, in logical positivism Carnap (1936, 1937) eventually came to de-emphasize exhaustive definitions in favor of partial definitions. Worth noting is that he did so on the basis of technical considerations in formal logic, analyses of which are beyond the scope of the present sketch, rather than practical concerns about the actual derivation and application of the terms. Important to note at this point is that operationism prompted similar discussions in psychology. However, these discussions did involve practical concerns, rather than technical considerations involving formal logic:

Theorists objected that with exhaustive definitions, no general systems could be built that applied concepts across different situations. One example was mentioned above: super-ego. As another example, consider something called a "negative attitude." Theorists reasoned that a negative attitude might influence several forms of behavior, not just

one. The construct of a negative attitude therefore needed to have a broad range of application, across many different situations. Hence, many researchers and theorists came to emphasize partial definitions because they believed exhaustive definitions were far too restrictive in the actual conduct of science.

The psychologists MacCorquodale and Meehl (1948) sought to calm the epistemologically troubled waters by formally proposing a distinction between two interpretations of theoretical terms. They called one interpretation the intervening variable interpretation. According to this interpretation, terms were exhaustively defined, without remainder, by their relation to observable measures. As mentioned above, this interpretation was consistent with the original definition of terms under logical positivism and operationism.

MacCorquodale and Meehl called the other interpretation the hypothetical construct interpretation. According to this interpretation, terms were only partially defined by their relation to observable measures. In their words, hypothetical constructs admitted "surplus meaning." This interpretation was consistent with the liberalized definition in logical positivism mentioned above (e.g., Carnap, 1936, 1937). Either usage was acceptable; it was just a matter of clarifying and being consistent in that usage. The variables and inferred constructs in the learning theories of C. L. Hull and K. W. Spence were then analyzed extensively, and numerous articles debated whether the terms were defined exhaustively or partially, and were in fact being used consistently. In light of the distinction, Tolman (1949), who was one of the first researchers or theorists to introduce the notion of theoretical terms to psychology, quite explicitly abandoned his original intervening variable interpretation in favor of the hypothetical construct interpretation:

I am now convinced that "intervening variables" to which we attempt to give merely operational meaning by tying them through empirically grounded functions either to stimulus variables, on the one hand, or to response variables, on the other, really can give us no help unless we can also embed them in a model from whose attributed properties we can deduce new relationships to look for. That is, to use Meehl and MacCorquodale's [sic] distinction, I would abandon what they call pure "intervening variables" for what they call "hypothetical constructs," and insist that hypothetical constructs be parts of a more general hypothesized model or substrate. In fact, most researchers and theorists followed Tolman and tacitly embraced the hypothetical construct interpretation, which allowed an explanatory concept to be applied in more than one situation. As we shall see later in this sketch, the distinction was critical for the following reason. If a term was held to be only partially defined by observations or calculations, then the way was open for a broader interpretation of theoretical concepts in psychology. A hypothetical construct interpretation clearly afforded greater latitude and generality in theory construction. More general systems could be developed, with broader ranges of application. The concept could "mean" anything, including something mental if not dualistic. The observational basis provided by the operational definition provided only the evidence to justify the use of the concept, rather than its nature. The upshot was that partial definitions admitted and actually legitimized mental if not dualistic concepts. Most researchers and theorists saw nothing wrong with this outcome, as they held to essentially mental if not outright dualistic beliefs anyway. They simply saw operationism as a way to generate the necessary agreement about concepts, so that they could believe they were being scientific in their endeavors. Consider the following passage from Kimble (1985):

Even in Watson's day there were those, most notably Tolman, who attempted to bring mentalistic-sounding concepts back into psychology by means of what amounted to operational definitions. In a general way, the operational point of view did nothing more than insist that terms designating unobservables be defined in ways that relate them to observables. From there it proceeded to a further insistence that concepts defined in this way must have a relationship to behavior. In this way these concepts became intervening variables, ones that stand between observable antecedent conditions on the one hand and behavior on the other. The diagram below serves to summarize this point:

Antecedent Conditions — Mentalistic Concepts — Behavior

Independent Variables — Intervening Variables — Dependent Variables

Obviously, there is nothing in this formula to exclude mentalistic concepts. In fact, the whole point of it is to admit unobservables. Comments by the eminent Harvard psychologist E. G. Boring (1950), one of the principals in the debates, are similarly illustrative: All the mentalistic entities come in as reduced to the operations by which they are observed.... Quite contrary to expectation, it turns out that the behaviorist can eat the cake of consciousness and have it too. He may not always know it, but he can. The Hypothetico-Deductive Method

The second development concerned the formalization of the hypothetico- deductive method (Hempel & Oppenheim, 1948). According to this method, which can be traced through Newton and Galileo back as far as Aristotle, the appropriate method for science was to test a hypothesis by deducing an implication from a more general law or theory. This approach is sometimes also known as the "covering law" approach. When the deduction or implication was framed in the past tense, it was regarded as an explanation. When it was framed in the future tense, it was regarded as a prediction. If experimentation or observation yielded publicly observable data that were consistent with the deduction or implication, the theory was regarded as supported, and the event was regarded as subsumed under the law and therefore explained. According to this view, the appropriate goal for science was to develop theories that generated predictions that could be tested against the facts of experience. Under the influence of logical positivism, this methodology became the standard in most disciplines, psychology included. Indeed, it was particularly important in psychology because it represented a further safeguard against returning to the uncertainties of introspection. Here was a concrete "empirical" method according to which theories could be tested against the facts of experience. Researchers had "objective criteria" for deciding whether a theory was supported or not. They had finally overcome the criticisms based on introspective concerns with unobservable mental life. Nearly all areas of psychology embraced the method, but it was particularly significant in behavioral learning theory. For example, C. L. Hull and K. W. Spence enthusiastically embraced the method, although E. C. Tolman, who was decidedly less formal and systematic in his theorizing, relied less upon it.

Nevertheless, closer analysis suggests that the supposed advantages of the method actually fell well short of what was claimed. As researchers and theorists adopted an approach that involved partial definition of concepts according to a hypothetical construct interpretation, those concepts might actually be dualistic in nature, as discussed earlier. The hypothetico-deductive method served to insulate those concepts from scrutiny. Recall that a partial definition would legitimately admit some dualistic concept, because the evidence for the concept differed from the nature of the concept.

Thus, all sorts of measures were hailed as proxies or surrogates for what was actually some underlying dualistic concept, simply because the measures were publicly observable and could generate agreement. Boring's (1950) quote, cited earlier, was symptomatic. A conspicuous example was the reliance on some physiological measure, which was taken as evidencethat legitimized talk about some underlying dualistic concept. According to common reasoning, brain recordings were taken to indicate some localization of function. That localization of function was, in turn, taken to indicate that some inner controlling entity or agent, perhaps in the form of a theoretical homunculus, resided in that location. This whole approach simply represented the return to a long-standing dualistic concern with an all-controlling mind or soul, and it was of concern to many (e.g., Kantor, 1938; Skinner, 1945). In addition, it implied that the construction and testing of hypotheses involved mysterious mental activities on the part of scientists, not understandable in naturalistic terms. In short, the hypothetico-deductive method represents a form of "epistemological dualism" as it concerns the processes by which scientists are presumed to acquire knowledge.

The Radical Behaviorism of B. F. Skinner

B. F. Skinner (1904–1990) was a graduate student, postdoctoral fellow, and faculty member during the discussions outlined above. However, he never embraced the S–O–R model of mediational neobehaviorism in his explanations of behavior. As a result, he did not have the same concerns as his neobehaviorist contemporaries about definitions of

unobservable mediating terms, inferred constructs, validation, theory testing, and so on. Skinner's approach to a science of behavior is now known as behavior analysis. The philosophy of science underlying behavior analysis is called radical behaviorism.

How Skinner came to develop his ideas is a complex story, described in his several autobiographical works, and is not repeated here. Especially important from the outset were his interests in verbal behavior and epistemology. The term radical implies a thoroughgoing and comprehensive behaviorism, rather than an extreme position that is fanatically restricted to only publicly observable behavior. Skinner (1989) explicitly linked his ideas to the philosophy of science when he defined radical behaviorism in the following way:

I don't believe I coined the term radical behaviorism, but when asked what I mean by it, I have always said, "the philosophy of a science of behavior treated as a subject matter in its own right apart from internal explanations, mental or physiological." (p. 122) Although both Skinner and Watson hold that behavior is a subject matter in its own right, Skinner differs from Watson in certain other respects, chief among which are the implications of the conception of operant behavior. We can now review the basic principles of Skinner's radical behaviorism (Moore, 1999, 2008).

Some Basic Principles of B. F. Skinner's "Radical Behaviorism"

1. Behavior: A subject matter in its own right. Behavior is the name for that part of the functioning of an organism that consists of its interacting or having commerce with its surrounding environmental circumstances. An instance of behavior is an event. The formulation of a behavioral event includes not only (a) how the organism is acting but also (b) the features of the surrounding environmental circumstances with respect to which it is acting. This subject matter is formulated as a functional relation between the behavior in question and environmental variables. The environmental variables are those that have become significant during the lifetime of the species, or have been experienced during the lifetime of the organism, including its social-cultural environment. Part of the environment is enclosed within the skin. We determine functional relations by varying environmental conditions and seeing if behavior varies accordingly, through the experimental method. In special situations it is appropriate to consider "doing nothing" or "standing still" as instances of behavior. Thus, not all instances of movement are behavior, and not all instances of behavior entail movement.

Some instances of behavior occur because an eliciting stimulus has been presented to the organism, either unconditioned or conditioned. Other instances occur because in the past, the behavior has produced a particular consequence in the presence of a particular set of antecedent circumstances, and those antecedent circumstances are again present. This latter case is described as a three-term contingency of reinforcement: In the presence of

(a) a discriminative stimulus, (b) a response characteristically produces (c) a reinforcing consequence. To be sure, a theoretically oriented behavioral neuroscience is clearly a legitimate discipline. There is a sense in which a behavioral account of an event has two gaps. One gap is within the event, from the time an organism encounters some environmental circumstance to the time it responds. A second gap is between events, from the time the subject has a given experience to the time the effects of that experience are reflected in its behavior. There are physiological phenomena associated with these gaps that neuroscience can know about and that will increase our ability to predict and control behavior, for example, if information about an organism's behavioral history is lacking. In any case, behavior is not studied because it provides evidence that validates theoretical or explanatory inferences about causes of behavior (e.g., acts, states, mechanisms, processes, entities) from another dimension (e.g., neural, mental, cognitive, psychic, conceptual). The bulk of traditional psychology embraces the second perspective, however implicitly.

2. Analytic concepts: Functional, relational, and generic. Definitions of concepts are functional and relational. For example, a reinforcer is defined in terms of its function. It is a consequence of a response that increases the

probability of the response. Furthermore, it is defined by its relation to the response in question. Readers may note that something with sugar in it may well function as a reinforcer when it is presented as a consequence of a response. However, we define it as a reinforcer because of its effect on behavior, not by how much sugar it has in it. Finally, stimuli and responses are generic concepts—they belong to classes, and the functional relations (such as reinforcement) obtain between classes. Class boundaries are sometimes determined by experience, and sometimes they are innate.

3. Behavior: Public and private. Although many behavioral events are publicly observable, not all are. Some behavioral events are "private," in the sense that they are accessible to only the person who is behaving. Private behavioral events are determined by the tools or characteristics of an observer, rather than by anything pertaining to the nature of the event itself (Donahoe & Palmer, 1994). Typically, these private behavioral events gain their functional significance through public relations. Consequently, there is no appeal to autonomous private entities from another dimensional system as causes of behavior. Behavioral principles are developed through the analysis of public behavior and then used in interpretations of private forms.

Private behavior is therefore the recipient of analyses of public behavior, notthe autonomous and initiating donor to them. As used here, this sense of privacy implies that in the future, perhaps with technological advances, private behavioral events may be more readily accessible to others, but even if they are not, they remain natural behavioral events. In sum, private behavioral events (a) are not in another dimension; (b) are not a necessary antecedent or mediator for a publicly observable behavioral event; (c) are neither initiating nor originating causes of behavior, although they can potentially contribute to discriminative control over subsequent behavior; (d) are themselves caused by, and may enter into the behavioral stream as a result of, events that transpire during the lifetime of the organism; and (e) should be analyzed in the same way as publicly observable behavior, rather than according to a different mode of inquiry. The "radical" in radical behaviorism means "an approach that is thoroughly and comprehensively behavioral and that thereby can include behavioral events which are not publicly observable." It does not mean "an extreme approach that is fanatically restricted to only the publicly observable in order to meet certain conceptions of what science must be, and requires therefore that everything that is not publicly observable be either (a) ignored by behavioral science or (b) treated as a theoretical construct, which is then operationally defined in terms of publicly observable variables." The bulk of traditional psychology embraces this second meaning, however implicitly.

4. Opposition to mentalism. Mentalism is the appeal to causes of behavior (e.g., acts, states, mechanisms, processes, entities, faculties, structures) from other dimensions (e.g., neural, mental, cognitive, psychic, conceptual, mystical, transcendental) in an explanation of behavior. However, there is no literal mental dimension that differs from a behavioral dimension. Consequently, "mental talk" in traditional psychology does not occur because of the actual influence of phenomena from the mental dimension. Rather, mental talk occurs because of a wide variety of other extraneous influences. To be sure, in certain cases mental talk may appear to be valid, but any apparent validity is because the talk somehow takes into account actual neurophysiological variables, contingent relations between behavior and environment, patterns of ongoing behavior, or private behavioral events, rather than so-called mental factors that are regarded as different from behavioral factors and belonging to a dimensional system that differs from the behavioral dimension. For example, talk of internal "states" may neglect to trace the origin of the states, if any internal state is even relevant, back to contact with the environment, such that the states are not independent, autonomous contributions of the organism from another dimensional system. Closer analysis indicates that most of the time, mental talk entails fanciful explanatory fictions that are cherished for extraneous and irrelevant reasons, such as by being part of the general view of human nature that is tacitly assumed to be true and is deeply ingrained in our Western culture.

In sum, these fictions are taken (a) to be in another dimensional system; (b) to afford "competence," to be a mediator, or to be a necessary initiating or originating cause for a publicly observable behavioral event; (c) to be part of the intrinsic psychological makeup that defines human nature; and (d) to require a different mode of inquiry than

does publicly observable behavior. Radical behaviorists argue that the mental talk is to be rejected because it is manifestly counterproductive: It diverts attention away from, and therefore interferes with, the analysis of functional relations between behavior and environmental variables. In particular, failure to conceive of private phenomena as behavioral rather than mental opens the door to traditional dualistic conceptions of the causes of behavior and ultimately a "nothing can be done about it" attitude concerning behavior. Indeed, an entire orientation to research has become orthodox in contemporary psychology that supports mentalistic analyses of behavior. This orientation uses publicly observable variables as proxies, or surrogates, for the mental causes in order to meet the presumed requirements of science, and is called "methodological behaviorism."

5. Selection by consequences. Selection by environmental consequences is the significant causal mode, at three levels: (a) phylogeny—the level of the species, dealt with by a behavior-analytically informed behavioral genetics; (b) ontogeny—the level of the individual organism during its lifetime, dealt with by behavior analysis; and (c) cultural—the level of the culture, dealt with by a behavior-analytically informed cultural or social anthropology.

6. Verbal behavior as operant behavior. Verbal behavior is a result of operant behavioral processes, rather than representational or logical processes that are explicitly held to be nonbehavioral. Knowledge claims such as scientific theories and explanations are verbal phenomena and may be analyzed as such, rather than as constructions having a representational or logical status that is explicitly nonbehavioral. Indeed, to view them as nonbehavioral constructions is to accept mentalistic assumptions about the nature of the processes according to which humans are said to become knowledgeable.

Theories and explanations identify causal relations in behavior, and then formulate them in abstract, economical terms. The importance of research and the scientific method is that they sharpen the discriminative control of natural variables over the scientific verbal behavior that constitutes knowledge claims, for example, by removing metaphors or other forms of mischievous verbal distortions or extensions. A particularly important contribution of research and the scientific method in behavioral science is to remove the mentalistic influence from knowledge claims. This mentalistic influence may be readily seen in theories and explanations that appeal to events taking place somewhere else, at some other level of observation, described in different terms, and measured, if at all, in different dimensional systems, instead of theories that are formal and economical representations of data, reduced to a minimal number of terms. Appropriately formulated scientific statements allow individuals to behave effectively without direct or prolonged personal contact with the codified situations.

7. Pragmatism. Given the preceding principles, the importance of knowledge claims is judged in terms of their pragmatic contribution to practical, effective action (e.g., prediction and control). For example, two important goals of science are (a) to analyze the contingencies of reinforcement found in nature and (b) to formulate rules or laws that make it unnecessary to be directly exposed to the contingencies to secure desired outcomes. These goals could be said to lead in turn to increased "understanding" of natural events. Truth may therefore be regarded as a matter of increasing our understanding of what promotes effective action with respect to nature.

8. Social activism. Our culture should actively promote practices that increase the quality of life for its citizens. One of these is the rejection of mentalism in human affairs. In the long run, mentalism decreases quality of life because it misidentifies causes of behavior and thereby inhibits the growth of scientific knowledge. Another practice is the application of behavioral principles to remedy problems with socially significant behavior, for example, by strengthening repertoires of adaptive behavior. Our culture will presumably benefit if persons are better readers, or more careful stewards of environmental resources. A culture thrives when it teaches its members to be concerned about the welfare and ultimate survival of the culture, rather than just their own immediate well-being. Unfortunately, the radical behaviorist goals run counter to well-established mentalistic practices in the culture at large, and are often met with great misunderstanding and resistance.

9. Summary. A comprehensive science of behavior is concerned with accounting for, predicting, controlling, influencing, explaining, and in a very broad sense understanding behavior. What is relevant for researchers and theorists to take into account as they address these concerns? First, they can usefully take into account the underlying physiology of the organism with which they are dealing. This is the province of neuroscience. By understanding how the organism's body works, or how it has been equipped through evolution to deal with the environment, or how it already has been changed by experiences during its lifetime, they can better predict and control behavior. Second, researchers and theorists can usefully take into account the underlying genetic structure of the organism. This is the province of behavior-analytically informed behavioral genetics. Evolution has selected particular genetic endowments that provide certain responses to environmental stimulation, as well as nervous systems that can be modified during the lifetime of the organism to acquire new forms of response to the environment. Third, researchers and theorists can usefully take into account events during the lifetime of the organism. This is the province of behavior analysis. The organism typically experiences both eliciting events and consequences of its responses during its lifetime, and these experiences change the organism so that it behaves in different ways in the future. Fourth, researchers and theorists can usefully take into account the broad cultural context in which the organism lives. This is the province of a behavior-analytically informed cultural anthropology. The living organism is influenced by practices and circumstances that have their origins in the behavior of other organisms, and the influence of these interlocking arrangements is significant.

For behavior analysts, behaviorism is the philosophy of science underlying the science of behavior. It takes behavior as a subject matter in its own right, and applies the principles and methods of other natural sciences to develop theories and explanations. A common statement about behaviorism is that because it deals with behavior rather than the mind, it holds that behavior should be explained without directly referring to mental events or processes. At first glance, this statement seems reasonably straightforward. However, closer inspection indicates it is actually somewhat ambiguous. What needs to be clarified is why it holds that behavior should be explained without directly referring to mental processes.

For example, a common position in Western culture is that a mental dimension exists that differs qualitatively from a behavioral dimension and that phenomena in this mental dimension cause behavior. However, this position goes, explanations cannot appeal directly to the causal mental phenomena because they are not publicly observable. As a result, another mode of inquiry, different from one based on direct observation, is necessary to engage the mental phenomena. The other mode of inquiry may involve something like rational philosophical analysis, or it may involve engaging the mental indirectly, by using publicly observable phenomena like behavior or physiological recordings as theoretical proxies for the mental phenomena. The operative term here is indirectly. According to this position, behaviorism may indeed be defined as a science of a publicly observable subject matter like behavior, but the study of behavior is useful only because it provides evidence for conclusions about the unobservable mental phenomena that really cause behavior, which are then rendered as "theoretical" and "operationally defined" in terms of observables to meet epistemological assumptions about science. So interpreted, this position is consistent with the statements that behaviorism deals with behavior rather than the mind, and that behavior should be explained without directly referring to mental events or processes.

However common this position is, behavior analysis rejects it. To repeat, behavior analysis holds that behavior is a subject matter in its own right. The study of behavior is not a proxy for concerns with inferred causal factors in another dimension. Behavior is functionally related to environmental variables at the level of phylogeny, ontogeny, or culture. Both behavior and environment reflect factors inside or outside of the skin. A mental dimension that differs from a behavioral dimension has never existed for anybody. Persons talk about the mental because of spurious social influences, not because mental phenomena literally exist in another dimension and cause people to talk about them.

The implications are as follows. Suppose we spend our time searching for causal acts, states, mechanisms, processes, structures, or entities that we assume are in another dimension. If neither those phenomena nor the other

dimension exist, then we will miss the relevant phenomena in the one dimension that do cause behavior. For example, suppose some traditional form of psychology attributes an instance of behavior to the presence or absence of an inferred, inner causal entity called "self-esteem." This causal entity is further assumed to be part of another dimension, which may be variously characterized as hypothetical, conceptual, or theoretical. Certainly self-esteem is not itself an entity that is directly observable. Traditional forms of psychology may then fail to note whether responses have had characteristic consequences in the lives of persons said to possess or lack self-esteem.

Presumably, it is desirable to provide consequences that will result in persons' (a) being described as having greater self-esteem and (b) engaging in more productive, adaptive behavior. We can debate how well it is defined, whether it is an intervening variable or hypothetical construct, and so on. But all these debates are simply irrelevant at best. At worst, they damage the potential of a science of behavior. The important consideration is that when we appeal to causal phenomena like self-esteem from another dimension, we do not pay attention to the person's interaction with the environment in the relevant behavioral dimension, and whether responses in the person's life have had the necessary characteristic consequences. We therefore miss possibilities for direct, practical, effective action when it comes to promoting the behavior of interest. We will further miss possibilities to enhance the quality of human life, if not to increase the probability of our very survival as a species. By understanding when we are appealing to phenomena from another dimension, and by focusing our scientific energies instead on causal phenomena in the one dimension, we can go a long way toward replacing our mentalistic and dualistic tendencies and improving our chances of success. Therein lies the promise of a genuine behaviorism.