CHAPTER 1

Definition and Characteristics of Applied Behavior Analysis

LEARNING OBJECTIVES

- Describe the basic characteristics and goals of science.
- Explain behavior in accordance with the philosophical assumptions of behavior analysis.
- Explain determinism as it relates to behavior analysis.
- State distinguishing features of mentalistic and environmental explanations of behavior.
- Describe and explain behavior in behavior analytic terms.
- State and describe each of the dimensions of applied behavior analysis.

> *[S]ince I was a child I always found my biggest reinforcer was something called understanding. I liked to know how things worked. And of all of the things in the world there are to understand, it became clear to me that the most fascinating was what people do. I started with the usual physical science stuff, and it was intriguing to me to understand how radios work, and how electricity works, and how clocks work, etcetera. But when it became clear to me that we could also learn how people work—not just biologically, but behaviorally—I thought that's the best of all. Surely, everyone must agree that that's the most fascinating subject matter. That there could be a science of behavior, of what we do, of who we are? How could you resist that?*
>
> —Donald M. Baer in Heward & Wood, (2003, p. 302)

Applied behavior analysis is a science devoted to understanding and improving human behavior. Other disciplines have similar intents. What sets applied behavior analysis apart? The answer lies in its focus, goals, and methods. Applied behavior analysts focus on behaviors of social importance, they intervene with research-based strategies and tactics to improve the targeted behaviors, and they use scientific methods—objective description, measurement, and experimentation—to demonstrate reliable relations between their interventions and the behavioral improvements. In short, applied behavior analysis, or ABA, is a scientific approach for discovering environmental variables that reliably influence socially significant behavior and for developing a technology of behavior change that takes practical advantage of those discoveries.

This chapter briefly outlines the history and development of behavior analysis, discusses the philosophy that underlies the science, and identifies defining dimensions and characteristics of applied behavior analysis. Because applied behavior analysis is first and foremost a science, we begin with an overview of precepts shared by scientists in all disciplines.

SCIENCE: BASIC CHARACTERISTICS AND A DEFINITION

Science is a systematic approach for seeking and organizing knowledge about the natural world. Before offering a definition of science, we discuss the purpose of science and the basic assumptions and attitudes that guide the work of all scientists, irrespective of their fields of study.

Purpose of Science

The overall goal of science is to achieve a thorough understanding of the phenomena under study—socially important behavior change, in the case of applied behavior analysis. Science differs from other sources of knowledge or ways we obtain knowledge about the world around us (e.g., contemplation, common sense, logic, authority figures, religious or spiritual beliefs, political campaigns, advertisements, testimonials). Science seeks to discover nature's truths: facts and universal laws that exist and operate independent of the opinions and beliefs of any person or group, including the scientist. Therefore, scientific knowledge must be separated from any personal, political, economic, or other reasons for which it was sought. Although it is frequently misused, science is not a tool for validating the cherished or preferred versions of "the truth" held by any group, corporation, government, or institution.

Different types of scientific investigations yield knowledge enabling one or more of three levels of understanding: description, prediction, and control. Each level of understanding contributes to the scientific knowledge base of a given field of inquiry.

Description

Systematic observation enhances the understanding of a given phenomenon by enabling scientists to describe it accurately. Descriptive knowledge consists of a collection of facts about the observed events that can be quantified, classified, and examined for possible relations with other known facts—a necessary and important activity for any scientific discipline. The knowledge obtained from descriptive studies often suggests possible hypotheses or questions for additional research.

The work of John James Audubon, a naturalist and painter in the early 19th century, provides a classic example of descriptive science. While observing birds in their natural habitat, Audubon documented their habits with extensive field notes and made detailed drawings. He identified 25 new species of birds. His major work, *The Birds of America* (Audubon, 1827–1838), contains 435 hand-colored life-sized prints of birds in their natural habitat and is considered one of the finest ornithological works ever completed.

White's (1975) study of classroom teachers' "natural rates" of approval (verbal praise or encouragement) and disapproval (criticisms, reproach) is an example of descriptive research in applied behavior analysis. Observations of 104 classroom teachers in grades 1 to 12 yielded two major findings: (a) Rates of teacher praise dropped with each grade level, and (b) in every grade after second, teachers delivered statements of disapproval to students at rates exceeding their rates of praise. The results of this descriptive study led to dozens of subsequent studies aimed at discovering factors responsible for the disappointing findings, analyzing the effects of disproportionate rates of disapproval and praise on student behavior, and increasing teachers' effective use of praise (e.g., Alber, Heward, & Hippler, 1999; Duchaine, Jolivette, & Fredrick, 2011; Fullerton, Conroy, & Correa, 2009; Mrachko, Kostewicz, & Martin, 2017; Niwayama & Tanaka-Matsumi, 2016; Sutherland, Wehby, & Yoder, 2002).

Prediction

A second level of scientific understanding occurs when repeated observations reveal that two events consistently covary with each other. That is, in the presence of one event (e.g., approaching winter) another event occurs (or fails to occur) with some specified probability (e.g., certain birds fly south). When systematic covariation between two events is found, this relationship—termed a *correlation*—can be used to predict the relative probability that one event will occur, based on the presence of the other event. "We obviously cannot intervene or manipulate the movement of the stars or planets, but by studying their movements we can gauge the seasons and when we can plant crops to produce a bountiful harvest" (Moore, 2010, p. 48).

Because no variables are manipulated or controlled by the researcher, a correlational study cannot demonstrate whether one of the observed variables is responsible for the changes in the other variable, and no such relations should be inferred. A strong correlation exists between hot weather and an increased incidence of drowning deaths, but we should not assume that a hot and humid day causes anyone to drown. Hot weather also correlates with other factors, such as an increased number of people (both swimmers and nonswimmers) seeking relief in the water, and many instances of drowning have been found to be a function of factors such as the use of alcohol or drugs, the relative swimming skills of the victims, strong riptides, and the absence of supervision by lifeguards.[1]

In addition to their usefulness in aiding prediction, the findings of correlational studies can suggest the possibility of causal relations, which can then be explored with experimental studies. The most common type of correlational study reported in the applied behavior analysis literature compares the relative rates or conditional probabilities of two or more observed (but not manipulated) variables (e.g., Atwater & Morris, 1988; Symons, Hoch, Dahl, & McComas, 2003; Thompson & Iwata, 2001). For example, McKerchar and Thompson (2004) found correlations between problem behavior exhibited by 14 preschool children and the following consequent events: teacher attention (100% of the children), presentation of some material or item to the child (79% of the children), and escape from instructional tasks (33% of the children). The results of this study not only provide empirical validation for the social consequences typically used in clinical settings to analyze the variables maintaining children's problem behavior, but also increase confidence in the prediction that interventions based on the findings from such assessments will be relevant to the conditions that occur naturally in preschool classrooms (see Chapter 27). In addition, by revealing the high probabilities with which teachers responded to problem behavior in ways that are likely to maintain and strengthen it, McKerchar and Thompson's findings also point to the need to train teachers in more effective ways to respond to problem behavior.

Control

The ability to predict with a certain degree of confidence is a valuable and useful result of science; prediction enables preparation. However, the greatest potential benefits from science are derived from the third, and highest, level of scientific understanding—control. Evidence of the kinds of control that can be derived from scientific findings in the physical and biological sciences surrounds us in the everyday technologies we take for granted: pasteurized milk and the refrigerators we store it in; flu shots and the automobiles we drive to go get them; pain relievers and the televisions that bombard us with advertisements and news stories about the drugs.

> The scientific "system," like the law, is designed to enable us to handle a subject matter more efficiently . . . 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. (Skinner, 1953, pp. 13–14)

Functional relations, the primary products of basic and applied research in behavior analysis, provide the kind of scientific understanding that is most valuable and useful to the development of a technology for changing behavior. A **functional relation** exists when a well-controlled experiment demonstrates that a specific change in one event (the *dependent variable*) is reliably produced by specific manipulations of another event (the *independent variable*), and that the change in the dependent variable was unlikely to be the result of other extraneous factors (*confounding variables*).

Johnston and Pennypacker (1980) described functional relations as "the ultimate product of a natural scientific investigation of the relation between behavior and its determining variables" (p. 16).

> Such a "co-relation" is expressed as $y = f(x)$, where x is the independent variable or argument of the function, and y is the dependent variable. In order to determine if an observed relation is truly functional, it is necessary to demonstrate the operation of the values of x in isolation and show that they are sufficient for the production of y. . . . [H]owever, a more powerful relation exists if necessity can be shown (that y occurs *only if* x occurs). The most complete and elegant form of empirical inquiry involves applying the experimental method to identifying functional relations. (Johnston & Pennypacker, 1993a, p. 239)

The understanding gained by the scientific discovery of functional relations is the basis of applied technologies in all fields.

Assumptions and Attitudes of Science

> *Science is first of all a set of attitudes.*
>
> —B. F. Skinner, (1953, p. 12)

The definition of science lies not in test tubes, spectrometers, or electron accelerators, but in the behavior of scientists. To begin to understand any science, we need to look past the apparatus and instrumentation that are most readily apparent and examine what scientists do.[2] The pursuit of knowledge is properly called *science* when it is carried out according to general methodological precepts and expectations that define science. All scientists share a fundamental assumption about the nature of events that are amenable to investigation by science, general notions about basic strategy, and perspectives on how to view their findings. These attitudes of science—determinism, empiricism, experimentation, replication, parsimony, and philosophic doubt—constitute a set of overriding assumptions and values that guide the work of all scientists (Whaley & Surratt, 1968).

Determinism

Science is predicated on the assumption of **determinism**. All scientists presume that the universe is a lawful and orderly place in which all phenomena occur as the result of other events. In other words, events do not just happen willy-nilly; they are related in systematic ways to other factors, which are themselves physical phenomena amenable to scientific investigation.

If the universe were governed by *accidentalism,* a philosophical position antithetical to determinism that holds that events occur by accident or without cause, or by *fatalism,* the belief that events are predetermined, the scientific discovery of functional relations and use of those discoveries to improve things would be impossible.

> If we are to use the methods of science in the field of human affairs, we must assume behavior is lawful and determined. We must expect to discover what a man does is the result of specifiable conditions and that once these conditions have been discovered, we can anticipate and to some extent determine his actions. (Skinner, 1953, p. 6)

Determinism plays a pivotal dual role in the conduct of scientific practice: It is at once a philosophical stance that does not lend itself to proof and the confirmation that is sought by each experiment. In other words, the scientist first assumes lawfulness and then proceeds to look for lawful relations (Delprato & Midgley, 1992).

Empiricism

> *When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind*
>
> — Lord Kelvin, (1824–1907)

Scientific knowledge is built on, above all, **empiricism**—the practice of objective observation and measurement of the phenomena of interest. Objectivity in this sense means "independent of the individual prejudices, tastes, and private opinions of the scientist. Results of empirical methods are objective in that they are open to anyone's observation and do not depend on the subjective belief of the individual scientist" (Zuriff, 1985, p. 9).

In the prescientific era (and in nonscientific and pseudoscientific activities today) (Nichols, 2017), knowledge was (and is) the product of contemplation, speculation, personal opinion, authority, and the "obvious" logic of common sense. The scientist's empirical attitude, however, demands objective observation based on thorough description, systematic and repeated measurement, and precise quantification of the phenomena of interest.

As it is in every scientific field, empiricism is the foremost rule in behavior analysis. Every effort to understand, predict, and improve behavior hinges on the behavior analyst's ability to completely define, systematically observe, and accurately and reliably measure occurrences and nonoccurrences of the behavior of interest.

Experimentation

Experimentation is the basic strategy of most sciences. Whaley and Surratt (1968) used the following anecdote to introduce the need for experimentation.

> A man who lived in a suburban dwelling area was surprised one evening to see his neighbor bow to the four winds, chant a strange melody, and dance around his front lawn beating a small drum. After witnessing the same ritual for over a month, the man became overwhelmed with curiosity and decided to look into the matter.

> "Why do you go through this same ritual each evening?" the man asked his neighbor.
>
> "It keeps my house safe from tigers," the neighbor replied.
>
> "Good grief!" the man said. "Don't you know there isn't a tiger within a thousand miles of here?"
>
> "Yeah," the neighbor smiled. "Sure works, doesn't it!" (pp. 23–2 to 23–3)

When events are observed to covary or occur in close temporal sequence, a functional relation may exist, but other factors may be responsible for the observed values of the dependent variable. To investigate the possible existence of a functional relation, an experiment (or better, a series of experiments) must be performed in which the factor(s) suspected of having causal status are systematically controlled and manipulated while the effects on the event under study are carefully observed.

Reliably predicting and controlling any phenomena, including the presence of tigers in one's backyard, requires identifying and manipulating the factors that influence those phenomena. One way that the individual described previously could use the experimental method to evaluate the effectiveness of his ritual would be to first move to a neighborhood in which tigers are regularly observed and then systematically manipulate the use of his anti-tiger ritual (e.g., 1 week off, 1 week on, 1 week off, 1 week on) while observing and recording the presence of tigers under the no-ritual and ritual conditions.

> The experimental method is a method for isolating the relevant variables within a pattern of events. . . . [W]hen the experimental method is employed, it is possible to change one factor at a time (independent variable) while leaving all other aspects of the situation the same, and then to observe what effect this change has on the target behavior (dependent variable). Ideally, a functional relation may be obtained. Formal techniques of experimental control are designed to make sure that the conditions being compared are otherwise the same. Use of the experimental method serves as a necessary condition (sine qua non) to distinguish the experimental analysis of behavior from other methods of investigation. (Dinsmoor, 2003, p. 152)

Thus, an **experiment** is a controlled comparison of some measure of the phenomenon of interest (the dependent variable) under two or more different conditions in which only one factor at a time (the independent variable) differs from one condition to another. Strategies and tactics for conducting experiments in applied behavior analysis are described in Chapters 7 through 10.

Most of the studies cited in this text are experiments that have demonstrated or discovered a functional relation between a target behavior and one or more environmental variables. Such studies are said to have achieved a functional analysis. The term **functional analysis** has two meanings in contemporary behavior analysis literature. In its original and most fundamental usage, *functional analysis* denotes demonstrations of functional relations between environmental variables and behavior. Schlinger and Normand (2013) reported that Skinner used the term 36 times in *Science and Human Behavior* and cited this example:

> The external variables of which behavior is a function provide for what may be called a causal or *functional analysis*. We undertake to predict and control the behavior of the individual organism. This is our "dependent variable"—the effect for which we are to find the cause. Our "independent variables"—the causes of behavior—are the external conditions of which behavior is a function. Relations between the two—the "cause-and-effect relationships" in behavior—are the laws of a science. (Skinner, 1953, p. 35, italics added)

Iwata, Dorsey, Slifer, Bauman, and Richman (1982) introduced the second and today most widely recognized usage of *functional analysis* in their groundbreaking article describing an experimental methodology for determining environmental variables and contingencies maintaining problem behavior (see Chapter 27). In its original meaning, functional analysis provides the very foundation for an experimental science of behavior; as a method for assessing the controlling variables for problem behavior, functional analysis informs the design of effective treatments.

Replication

The results of a single experiment—no matter how well it was designed and conducted, no matter how clear and impressive the findings—are never sufficient to earn an accepted place among the scientific knowledge base of any field. Although the data from a single experiment have value in their own right and cannot be discounted, only after an experiment has been replicated a number of times with the same basic pattern of results are scientists convinced of the findings.

Replication—repeating of experiments (as well as repeating independent variable conditions within experiments)—"pervades every nook and cranny of the experimental method" (Johnston & Pennypacker, 1993a, p. 244). Replication is the primary method with which scientists determine the reliability and usefulness of their findings and discover their mistakes (Johnston & Pennypacker, 1980; 1993a; Sidman, 1960). Replication—not the infallibility or inherent honesty of scientists—is the primary reason science is a self-correcting enterprise that ultimately gets it right (Skinner, 1953).

How many times must an experiment be repeated with the same results before the scientific community accepts the findings? There is no required number of replications, but the greater the importance of the findings to theory or practice, the greater the number of replications to be conducted. Chapters 7 through 10 explain the role of replication in behavioral research and describe replication strategies used by applied behavior analysts.

Parsimony

One dictionary definition of *parsimony* is great frugality, and in a special way this connotation accurately describes the behavior of scientists. As an attitude of science, **parsimony** requires that all simple, logical explanations for the phenomenon under investigation be ruled out, experimentally or conceptually, before more complex or abstract explanations are considered. Parsimonious interpretations help scientists assess and fit new findings within the field's existing knowledge base. A fully parsimonious interpretation consists only of those elements that are necessary and sufficient to explain the phenomenon at hand. The attitude of parsimony is so critical to scientific explanations that it is sometimes referred to as the Law of Parsimony (Whaley & Surratt, 1968), a "law" derived from *Occam's Razor,* credited to William of Occam (c. 1285–1349), who stated: "One should not increase, beyond what is necessary, the number of entities required to explain anything." In other words, given a choice between two competing and compelling explanations for the same phenomenon, one should shave off extraneous variables and choose the simplest explanation, the one that requires the fewest assumptions.

Philosophic Doubt

The attitude of **philosophic doubt** requires the scientist to continually question the truthfulness of what is regarded as fact. Scientific knowledge must always be viewed as tentative. Scientists must be willing to set aside their most cherished beliefs and findings and replace them with the knowledge derived from new discoveries.

Good scientists maintain a healthy level of skepticism. Although being skeptical of others' research may be easy, a more difficult but critical characteristic of scientists is that they remain open to the possibility—as well as look for evidence—that their own findings or interpretations are wrong. "Science is a willingness to accept facts even when they are opposed to wishes" (Skinner, 1953, p. 12). As Oliver Cromwell (1650) stated in another context: "I beseech you . . . think it possible you may be mistaken." For the true scientist, "new findings are not problems; they are opportunities for further investigation and expanded understanding" (Todd & Morris, 1993, p. 1159).

Practitioners should be as skeptical as researchers. The skeptical practitioner not only requires scientific evidence before implementing a new practice, but also evaluates continually its effectiveness once the practice has been implemented. Practitioners must be particularly skeptical of extraordinary claims made for the effectiveness of new theories, therapies, or treatments (Foxx & Mulick, 2016; Maurice, 2017).

> Claims that sound too good to be true usually are. Extraordinary claims require extraordinary evidence (Sagan, 1996; Shermer, 2002). What constitutes extraordinary evidence? In the strictest sense, and the sense that should be employed when evaluating claims of educational effectiveness, evidence is the outcome of the application of the scientific method to test the effectiveness of a claim, a theory, or a practice. The more rigorously the test is conducted, the more often the test is replicated, the more extensively the test is corroborated, the more extraordinary the evidence. Evidence becomes extraordinary when it is extraordinarily well tested. (Silvestri & Heward, 2016, p. 149)

We end our discussion of philosophic doubt with two pieces of advice, one from Carl Sagan and one from B. F. Skinner: "The question is not whether we *like* the conclusion that emerges out of a train of reasoning, but whether the conclusion *follows* from the premise or starting point and whether that premise is true" (Sagan, 1996, p. 210). "Regard no practice as immutable. Change and be ready to change again. Accept no eternal verity. Experiment" (Skinner, 1979, p. 346).

Other Important Attitudes and Values

The six attitudes of science that we have examined are necessary features of science and provide an important context for understanding applied behavior analysis.

However, the behavior of most productive and successful scientists is also characterized by qualities such as thoroughness, curiosity, perseverance, diligence, ethics, and honesty. Scientists acquire these traits because behaving in such ways has proven beneficial to the progress of science.

A Definition of Science

Science has no universally accepted, standard definition. We offer the following definition as one that encompasses the previously discussed purposes and attitudes of science, irrespective of the subject matter. **Science** is a systematic approach to understanding natural phenomena—as evidenced by description, prediction, and control—that relies on determinism as its fundamental assumption, empiricism as its prime directive, experimentation as its basic strategy, replication as its necessary requirement for believability, parsimony as its conservative value, and philosophic doubt as its guiding conscience.

A BRIEF HISTORY OF BEHAVIOR ANALYSIS

The science of behavior analysis entails three interrelated domains: philosophy, basic research, and applied research. **Behaviorism** is the philosophy of the science of behavior, basic research is the province of the experimental analysis of behavior (EAB), and developing a technology for improving behavior is the concern of applied behavior analysis (ABA). To be fully understood, applied behavior analysis must be considered in the context of the philosophy and basic research traditions and findings from which it evolved and remains connected today. This section provides an elementary description of the basic tenets of behaviorism and outlines some of the major events that have marked the development of behavior analysis.[3] Table 1.1 lists major books, journals, and professional organizations that have contributed to the advancement of behavior analysis since the 1930s.

Watson's Stimulus–Response Behaviorism

Psychology in the early 1900s was dominated by the study of states of consciousness, images, and other mental processes. Introspection, the act of carefully observing one's own conscious thoughts and feelings, was a primary method of investigation.

TABLE 1.1 Books, Journals, and Organizations That Have Played a Major Role in the Development and Dissemination of Behavior Analysis

Decade	Books	Journals	Organizations
1930s	*The Behavior of Organisms*—Skinner (1938)	*The Psychological Record* (1937)	
1940s	*Walden Two*—Skinner (1948)		
1950s	*Principles of Psychology*—Keller and Schoenfeld (1950)	*Journal of the Experimental Analysis of Behavior* (1958)	Society for the Experimental Analysis of Behavior (SEAB) (1957)
	Science and Human Behavior—Skinner (1953)		
	Schedules of Reinforcement—Ferster and Skinner (1957)		
	Verbal Behavior—Skinner (1957)		
1960s	*Tactics of Scientific Research*—Sidman (1960)	*Journal of Applied Behavior Analysis (1968)*	American Psychological Association's Division 25 Experimental Analysis of Behavior (1964)
	Child Development, Vols. I & II—Bijou and Baer (1961, 1965)		Experimental Analysis of Behaviour Group (UK) (1965)
	The Analysis of Behavior—Holland and Skinner (1961)		
	Research in Behavior Modification—Krasner and Ullmann (1965)		
	Operant Behavior: Areas of Research and Application—Honig (1966)		
	The Analysis of Human Operant Behavior—Reese (1966)		
	Principles of Behavioral Analysis—Millenson (1967)		
	Behavior Principles—Ferster and Perrott (1968)		
	Contingencies of Reinforcement: A Theoretical Analysis—Skinner (1969)		
1970s	*Beyond Freedom and Dignity*—Skinner (1971)	*Behaviorism* (1972) (became *Behavior and Philosophy* in 1990)	Norwegian Association for Behavior Analysis (1973)
	Elementary Principles of Behavior—Whaley and Malott (1971)	*Revista Mexicana de Analisis de la Conducta* (1975)	Midwestern Association for Behavior Analysis (MABA) (1974)
	About Behaviorism—Skinner (1974)	*Behavioural Processes* (1976)	Mexican Society of Behavior Analysis (1975)
	Single Case Experimental Designs—Hersen and Barlow (1976)	*Behavior Modification* (1977)	Association for Behavior Analysis (formerly, MABA) (1978)
	Applying Behavior-Analysis Procedures with Children and Youth—Sulzer-Azaroff and Mayer (1977)	*Journal of Organizational Behavior Management* (1977)	
	Learning—Catania (1979)	*Education & Treatment of Children* (1977)	
		The Behavior Analyst (1978)	
1980s	*Strategies and Tactics of Human Behavioral Research*—Johnston and Pennypacker (1980)	*Journal of Precision Teaching and Celeration* (formerly, *Journal of Precision Teaching*) (1980)	Society for the Advancement of Behavior Analysis (1980)
	Behaviorism: A Conceptual Reconstruction—Zuriff (1985)	*Analysis of Verbal Behavior* (1982)	
	Recent Issues in the Analysis of Behavior—Skinner (1989)	*Behavioral Interventions* (1986)	Cambridge Center for Behavioral Studies (1981)

(*continued*)

TABLE 1.1 (continued)

Decade	Books	Journals	Organizations
		Japanese Journal of Behavior Analysis (1986)	Japanese Association for Behavior Analysis (1983)
		Behavior Analysis Digest (1989)	
		Behavioural Pharmacology (1989)	
1990s	*Concepts and Principles of Behavior Analysis*—Michael (1993)	*Behavior and Social Issues* (1991)	Accreditation of Training Programs in Behavior Analysis (Association for Behavior Analysis) (1993)
	Understanding Behaviorism: Science, Behavior, and Culture—Baum (1994)	*Journal of Behavioral Education* (1991)	Behavior Analyst Certification Board (BACB) (1998)
	Radical Behaviorism: The Philosophy and the Science—Chiesa (1994)	*Journal of Positive Behavior Interventions* (1999)	Council of Directors of Graduate Programs in Behavior Analysis (Association for Behavior Analysis) (1999)
	Equivalence Relations and Behavior—Sidman (1994)	*The Behavior Analyst Today* (1999)	First Board Certified Behavior Analysts (BCBA) credentialed by the BACB (1999)
	Behavior Analysis and Learning—Pierce and Epling (1995)		
	Functional Analysis of Problem Behavior—Repp and Horner (1999)		
2000s	*Relational Frame Theory: A Post-Skinnerian Account of Human Language and Cognition*—Hayes, Barnes-Holmes, and Roche (2001)	*European Journal of Behavior Analysis* (2000)	
	Conceptual Foundations of Radical Behaviorism—Moore (2008)	*Behavioral Development Bulletin* (2002)	
		Journal of Early and Intensive Behavior Intervention (2004)	European Association for Behaviour Analysis (2002)
		Brazilian Journal of Behavior Analysis (2005)	Association for Professional Behavior Analysts (APBA) (2007)
		International Journal of Behavioral Consultation and Therapy (2005)	Association for Behavior Analysis International (ABAI) (formerly, ABA) (2008)
2010s	*Handbook of Applied Behavior Analysis*—Fisher, Piazza, and Roane (2011)	*Behavior Analysis in Practice* (2011)	First Registered Behavior Technician (RBT) credentialed by the BACB (2014)
	The Science of Consequences—Schneider (2012)	*Journal of Contextual Behavioral Science* (2012)	BACB credentials the 30,000th behavior analyst (2018)
	APA Handbook of Behavior Analysis—Madden (2013)	*Operants* (2014)	Membership in ABAI and affiliate chapters surpasses 26,000 in 63 countries (2018)
	Radical Behaviorism for ABA Practitioners—Johnston (2013)	*Behavior Analysis: Research and Practice* (formerly, *The Behavior Analyst Today* (2015)	
	The Wiley-Blackwell Handbook of Operant and Classical Conditioning—McSweeney and Murphy (2014)	*Perspectives on Behavior Science* (formerly, *The Behavior Analyst*) (2018)	
	The Nurture Effect: How the Science of Human Behavior Can Improve Our Lives & Our World—Biglan (2015)		

Note: Books are listed by initial year of publication. Some titles are available in more recent editions.


B. F. Skinner *(left)* in his Indiana University lab circa 1945 and *(right)* circa 1967.

Although the authors of several texts in the first decade of the 20th century defined psychology as the science of behavior (see Kazdin, 1978), John B. Watson is widely recognized as the spokesman for a new direction in the field of psychology. In his influential article "Psychology as the Behaviorist Views It," Watson (1913) wrote:

> Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods, nor is the scientific value of its data dependent upon the readiness with which they lend themselves to interpretation in terms of consciousness. (p. 158)

Watson argued that the proper subject matter for psychology was not states of mind or mental processes but observable behavior. Further, the objective study of behavior as a natural science should consist of direct observation of the relationships between environmental stimuli (S) and the responses (R) they evoke. Watsonian behaviorism became known as stimulus–response (S–R) psychology. Although scientific evidence was insufficient to support S–R psychology as a workable explanation for most behavior, Watson was confident that his new behaviorism would lead to the prediction and control of human behavior and that it would allow practitioners to improve performance in areas such as education, business, and law. Watson (1924) made bold claims concerning human behavior, as illustrated in this famous quotation:

> Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years. (p. 104)

It is unfortunate that such extraordinary claims were made, exaggerating the ability to predict and control human behavior beyond the scientific knowledge available. The quotation just cited has been used to discredit Watson and continues to be used to discredit behaviorism in general, even though the behaviorism that underlies contemporary behavior analysis is fundamentally different from the S–R paradigm. Nevertheless, Watson's contributions were of great significance: He made a strong case for the study of behavior as a natural science on a par with the physical and biological sciences.[4]

Experimental Analysis of Behavior

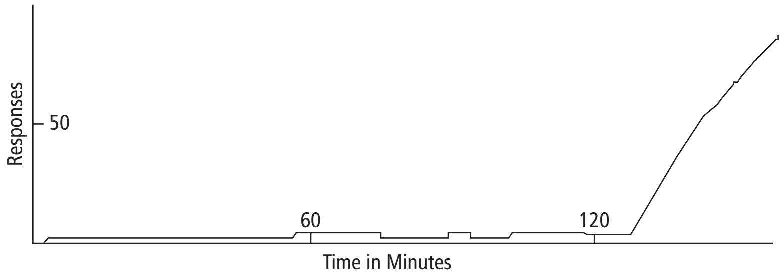
> *[Science] is a search for order. It begins, as we all begin, by observing single episodes, but it quickly passes on to the general rule, to scientific law.*
>
> —B. F. Skinner, (1953, pp. 13–14)

> *I had the clue from Pavlov: Control your conditions and you will see order.*
>
> —B. F. Skinner, (1956, p. 223)

The experimental branch of behavior analysis formally began with the publication of B. F. Skinner's *the Behavior of Organisms* (1938). The book summarized Skinner's laboratory research conducted from 1930 to 1937 and brought into perspective two kinds of behavior: respondent and operant.

Respondent behavior is reflexive behavior as in the tradition of Ivan Pavlov (1927). Respondents are elicited, or "brought out," by stimuli that immediately precede them. The antecedent stimulus (e.g., bright light) and the response it elicits (e.g., pupil constriction) form a functional unit called a *reflex.* Respondent behaviors are essentially involuntary and occur whenever the eliciting stimulus is presented.

Skinner was "interested in giving a scientific account of all behavior, including that which Descartes had set aside as 'willed' and outside the reach of science" (Glenn, Ellis, & Greenspoon, 1992, p. 1330). But, like other psychologists of the time, Skinner found that the S–R paradigm could not explain a great deal of behavior, particularly behaviors that had no



Original Conditioning
All responses to the lever were reinforced. The first three reinforcements were apparently ineffective. The fourth is followed by a rapid increase in rate.

Figure 1.1 The first data set in B. F. Skinner's *The Behavior of Organisms: An Experimental Analysis* (1938).

Based on *the Behavior of Organisms: An Experimental Analysis* by B. F. Skinner, p. 67. Original copyright 1938 by Appleton-Century. Copyright 1991 by B. F. Skinner Foundation, Cambridge, MA. Used by permission.

apparent antecedent causes in the environment. Compared to reflexive behavior with its clear eliciting events, much of the behavior of organisms appeared spontaneous or "voluntary." In an attempt to explain the mechanisms responsible for "voluntary" behavior, other psychologists postulated mediating variables inside the organism in the form of hypothetical constructs such as cognitive processes, drives, and free will. Skinner took a different tack. Instead of creating **hypothetical constructs**, presumed but unobserved entities that could not be manipulated in an experiment, Skinner continued to look in the environment for the determinants of behavior that did not have apparent antecedent causes.

> He did not deny that physiological variables played a role in determining behavior. He merely felt that this was the domain of other disciplines, and for his part, remained committed to assessing the causal role of the environment. This decision meant looking elsewhere in time. Through painstaking research, Skinner accumulated significant, if counterintuitive, evidence that behavior is changed less by the stimuli that precede it (though context is important) and more by the consequences that immediately follow it (i.e., consequences that are contingent upon it). The essential formulation for this notion is S–R–S, otherwise known as the three–term contingency. It did not replace the S–R model—we still salivate, for instance, if we smell food cooking when we are hungry. It did, however, account for how the environment "selects" the great part of learned behavior.
>
> With the three-term contingency Skinner gave us a new paradigm. He achieved something no less profound for the study of behavior and learning than Bohr's model of the atom or Mendel's model of the gene. (Kimball, 2002, p. 71)

Skinner called the second type of behavior *operant behavior*.[5] Operant behaviors are not elicited by preceding stimuli but instead are influenced by stimulus changes that have followed the behavior in the past. Skinner's most powerful and fundamental contribution to our understanding of behavior was his discovery and experimental analyses of the effects of consequences on behavior. The operant three-term contingency as the primary unit of analysis was a revolutionary conceptual breakthrough.

Skinner (1938) argued that the analysis of operant behavior "with its unique relation to the environment presents a separate important field of investigation" (p. 438). He named this new science the **experimental analysis of behavior** and outlined the methodology for its practice. Simply put, Skinner recorded the rate at which a single subject (he initially used rats and later, pigeons) emitted a given behavior in a controlled and standardized experimental chamber.

The first set of data Skinner presented in *The Behavior of Organisms* was a graph that "gives a record of the resulting change in behavior" (p. 67) when a food pellet was delivered immediately after a rat pressed a lever (see Figure 1.1). Skinner noted that the first three times that food followed a response "had no observable effect" but that "the fourth response was followed by an appreciable increase in rate showing a swift acceleration to a maximum" (pp. 67–68).

Skinner's investigative procedures evolved into an elegant experimental approach that enabled clear and powerful demonstrations of orderly and reliable functional relations between behavior and various types of environmental events.[6] By systematically manipulating the arrangement and scheduling of stimuli that preceded and followed behavior in literally thousands of laboratory experiments from the 1930s through the 1950s, Skinner and his colleagues and students discovered and verified the basic principles of operant behavior that continue to provide the empirical foundation for behavior analysis today. Description of these principles of behavior—general statements of functional relations between behavior and environmental events—and tactics for changing behavior derived from those principles constitute a major portion of this text.

Skinner's Radical Behaviorism

> *Behavior analysts dispense with the myth of the inner person as creator of behavior. Both philosophically and empirically to the behavior analyst, we are what we do, and when and where we do it.*
>
> —Murray Sidman, (2013, p. xvi)

In addition to being the founder of the experimental analysis of behavior, B. F. Skinner wrote extensively on the philosophy of that science. Without question, Skinner's writings have been the most influential both in guiding the practice of the science of behavior and in proposing the application of the principles of behavior to new areas.[7] In 1948 Skinner published *Walden Two,* a fictional account of how the philosophy and principles of behavior might be used in a utopian community (see Altus & Morris, 2009). This was followed by his classic text, *Science and Human Behavior* (1953), in which he speculated on how the principles of behavior might be applied to complex human behavior in areas such as education, religion, government, law, and psychotherapy.

Much of Skinner's writing was devoted to the development and explanation of his philosophy of behaviorism. Skinner began his book *About Behaviorism* (1974) with these words:

> Behaviorism is not the science of human behavior; it is the philosophy of that science. Some of the questions it asks are these: Is such a science really possible? Can it account for every aspect of human behavior? What methods can it use? Are its laws as valid as those of physics and biology? Will it lead to a technology, and if so, what role will it play in human affairs? (p. 1)

The behaviorism Skinner pioneered differed significantly (indeed, radically) from other psychological theories, including other forms of behaviorism. Although there were, and remain today, many psychological models and approaches to the study of behavior, **mentalism** is the common denominator among most.

> In general terms, *mentalism* may be defined as an approach to the study of behavior which assumes that a mental or "inner" dimension exists that differs from a behavioral dimension. This dimension is ordinarily referred to in terms of its neural, psychic, spiritual, subjective, conceptual, or hypothetical properties. Mentalism further assumes that phenomena in this dimension either directly cause or at least mediate some forms of behavior, if not all. These phenomena are typically designated as some sort of act, state, mechanism, process, or entity that is causal in the sense of initiating or originating. Mentalism regards concerns about the origin of these phenomena as incidental at best. Finally, mentalism holds that an adequate causal explanation of behavior must appeal directly to the efficacy of these mental phenomena. (Moore, 2003, pp. 181–182)

Hypothetical constructs and explanatory fictions are the stock and trade of mentalism, which has dominated Western intellectual thought and most psychological theories (Descartes, Freud, Piaget), and it continues to do so into the 21st century. Freud, for example, created a complex mental world of hypothetical constructs—the id, ego, and superego—that he contended were key to understanding a person's actions.

Hypothetical constructs—"theoretical terms that refer to a possibly existing, but at the moment unobserved process or entity" (Moore, 1995, p. 36)—can be neither observed nor experimentally manipulated (MacCorquodale & Meehl, 1948; Zuriff, 1985). Free will, readiness, innate releasers, language acquisition devices, storage and retrieval mechanisms for memory, and information processing are all examples of hypothetical constructs that are inferred from behavior. Although Skinner (1953, 1974) clearly indicated that it is a mistake to rule out events that influence our behavior because they are not accessible to others, he believed that using presumed but unobserved mentalistic fictions (i.e., hypothetical constructs) to explain the causes of behavior contributed nothing to a functional account.

Consider a typical laboratory situation. A food-deprived rat pushes a lever each time a light comes on and receives food, but the rat seldom pushes the lever when the light is off (and if it does, no food is delivered). When asked to explain why the rat pushes the lever only when the light is on, most will say that the rat has "made the association" between the light being on and food being delivered when the lever is pressed. As a result of making that association, the animal now "knows" to press the lever only when the light is on. Attributing the rat's behavior to a hypothetical cognitive process such as associating or to something called "knowledge" adds nothing to a functional account of the situation. First, the environment (in this case, the experimenter) paired the light and food availability for lever presses, not the rat. Second, the knowledge or other cognitive process that is said to explain the observed behavior is itself unexplained, which begs for still more conjecture.

The "knowledge" that is said to account for the rat's performance is an example of an **explanatory fiction**, a fictitious variable that often is simply another name for the observed behavior that contributes nothing to an understanding of the variables responsible for developing or maintaining the behavior. Explanatory fictions are the key ingredient in "a circular way of viewing the cause and effect of a situation" (Heron, Tincani, Peterson, & Miller, 2005, p. 274) that lead to a false sense of understanding.

> Turning from observed behavior to a fanciful inner world continues unabated. Sometimes it is little more than a linguistic practice. We tend to make nouns of adjectives and verbs and must then find a place for the things the nouns are said to represent. We say that a rope is strong and before long we are speaking of its strength. We call a particular kind of strength tensile, and then explain that the rope is strong *because* it possesses tensile strength. The mistake is less obvious but more troublesome when matters are more complex.
>
> Consider now a behavioral parallel. When a person has been subject 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 he walks carefully *because* of his caution. (Skinner, 1974, pp. 165–166, emphasis added)

It is widely believed that Skinner rejected all events that could not be independently verified by agreement among observers. However, Skinner was explicit early on that he valued effective action over agreement among observers.

> The ultimate criterion for the goodness of a concept is not whether two people are brought into agreement but whether the scientist who uses the concept can operate successfully upon his material—all by himself if need be. What matters to Robinson Crusoe is not whether he is agreeing with himself but whether he is getting anywhere with his control over nature. (Skinner, 1945, p. 293).

Pragmatism, the philosophical position that "the truth value of a statement is a function of how well the statement promotes effective action" (Moore, 2008, p. 400), continues to be a primary criterion by which behavior analysts judge the value of their findings (Leigland, 2010; Moxley, 2004).[8]

In reality, there are many kinds of behaviorism—structuralism, methodological behaviorism, and forms of behaviorism that use cognitions as causal factors (e.g., cognitive behavior modification and social learning theory)—in addition to the radical behaviorism of Skinner. Structuralism and methodological behaviorism do reject all events that are not operationally defined by objective assessment. Structuralists avoid mentalism by restricting their activities to descriptions of behavior. They make no scientific manipulations; accordingly, they do not address questions of causal factors. Methodological behaviorists differ from the structuralists by using scientific manipulations to search for functional relations between events. Uncomfortable with basing their science on unobservable phenomena, some early behaviorists either denied the existence of "inner variables" or considered them outside the realm of a scientific account. Such an orientation is often referred to as **methodological behaviorism**.

Methodological behaviorists acknowledge the existence of mental events but do not consider them in the analysis of behavior (Skinner, 1974). Methodological behaviorists' reliance on public events, excluding private events, restricts the knowledge base of human behavior and discourages innovation in the science of behavior. Methodological behaviorism is restrictive because it ignores areas of major importance for an understanding of behavior.

Contrary to another common misconception, Skinner did not object to cognitive psychology's concern with private events (i.e., events taking place "inside the skin") (Moore, 2000). Skinner was the first behaviorist to view thoughts and feelings (he called them "private events") as behavior to be analyzed with the same conceptual and experimental tools used to analyze publicly observable behavior, not as phenomena or variables that exist within and operate according to principles of a separate mental world. "I contend that my toothache is just as physical as my typewriter" (Skinner, 1945, p. 294).

Essentially, Skinner's behaviorism makes three major assumptions regarding the nature of private events: (a) Private events such as thoughts and feelings are behavior; (b) behavior that takes place within the skin is distinguished from other ("public") behavior only by its inaccessibility; and (c) private behavior is influenced by (i.e., is a function of) the same kinds of variables as publicly accessible behavior.

> We need not suppose that events which take place within an organism's skin have special properties for that reason. A private event may be distinguished by its limited accessibility but not, so far as we know, by any special structure of nature. (Skinner, 1953, p. 257)

By incorporating private events into an overall conceptual system of behavior, Skinner created a **radical behaviorism** that includes and seeks to understand all human behavior. "What is inside the skin, and how do we know about it? The answer is, I believe, the heart of radical behaviorism" (Skinner, 1974, p. 218). The proper connotations of the word *radical* in radical behaviorism are *far-reaching* and *thoroughgoing,* connoting the philosophy's inclusion of all behavior, public and private. *Radical* is also an appropriate modifier for Skinner's form of behaviorism because it represents a dramatic departure from other conceptual systems in calling for

> probably the most drastic change ever proposed in our way of thinking about man. It is almost literally a matter of turning the explanation of behavior inside out. (Skinner, 1974, p. 256)

Skinner and the philosophy of radical behaviorism acknowledge the events on which fictions such as cognitive processes are based. Radical behaviorism does not restrict the science of behavior to phenomena that can be detected by more than one person. In the context of radical behaviorism, the term *observe* implies "coming into contact with" (Moore, 1984). Radical behaviorists consider private events such as thinking or sensing the stimuli produced by a damaged tooth to be no different from public events such as oral reading or sensing the sounds produced by a musical instrument. According to Skinner (1974), "What is felt or introspectively observed is not some nonphysical world of consciousness, mind, or mental life but the observer's own body" (pp. 18–19).

The analysis of private events is a major aspect of radical behaviorism and indispensable for a comprehensive science of behavior (Palmer, 2011). Moore (1980, 2015) stated it concisely:

> For radical behaviorism, private events are those events wherein individuals respond with respect to certain stimuli accessible to themselves alone. . . . The responses that are made to those stimuli may themselves be public, i.e., observable by others, or they may be private, i.e., accessible only to the individual involved. Nonetheless, to paraphrase Skinner (1953), it need not be supposed that events taking place within the skin have any special properties for that reason alone. . . . For radical behaviorism, then, one's responses with respect to private stimuli are equally lawful and alike in kind to one's responses with respect to public stimuli. (1980, p. 460)

> [T]hese events are critical to understanding behavior in all its complexity. Just as importantly, they need not be formulated in different terms and with different concepts that are publicly observable behavior events. (2015, p. 18)

Scientists and practitioners are affected by their own social context, and institutions and schools are dominated by mentalism (Heward & Cooper, 1992; Kimball, 2002). A firm grasp of the philosophy of radical behaviorism, in addition to knowledge of principles of behavior, can help the scientist and practitioner resist the mentalistic approach of dropping the search for controlling variables in the environment and drifting toward explanatory fictions in the effort to understand behavior. The principles of behavior and the procedures presented in this text apply equally to public and private events. Radical behaviorism is the philosophical position underlying the content presented in this text.

As Friman (2017) noted, Skinner's behaviorism viewed behavior as a natural science.

> By taking this stand, he was promoting a larger idea, specifically that behavior was solely a physical phenomenon brought about, maintained, strengthened, or weakened solely by physical (environmental) events. In other words, he was promoting the idea that behavior is a function of environmental circumstances and their context. This is the most powerful idea ever invented by mankind for understanding, knowing, and approaching human behavior especially when it is a problem. (p. 176)

A thorough discussion of radical behaviorism is far beyond the scope of this text. The serious student of applied behavior analysis will devote considerable study to Skinner's original writings and to other authors who have critiqued, analyzed, and extended the philosophical foundations of the science of behavior.[9] (See Box 1.1 for Don Baer's perspectives on the meaning and importance of radical behaviorism.)

Applied Behavior Analysis

The first study to report the human application of principles of operant behavior was conducted by Fuller (1949). The subject was an 18-year-old boy with profound developmental disabilities who was described in the language of the time as a "vegetative idiot." He lay on his back, unable to roll over. Fuller filled a syringe with a warm sugar-milk solution and injected a small amount of the fluid into the young man's mouth every time he moved his right arm (that arm was chosen because he moved it infrequently). Within four sessions the boy was moving his arm to a vertical position at a rate of three times per minute.[10]

> The attending physicians . . . thought it was impossible for him to learn anything—according to them, he had not learned anything in the 18 years of his life—yet in four experimental sessions, by using the operant conditioning technique, an addition was made to his behavior which, at this level, could be termed appreciable. Those who participated in or observed the experiment are of the opinion that if time permitted, other responses could be conditioned and discriminations learned. (Fuller, 1949, p. 590)

During the 1950s and into the early 1960s researchers used the methods of the experimental analysis of behavior to determine whether the principles of behavior demonstrated in the laboratory with nonhuman subjects could be replicated with humans. According to Thompson and Hackenberg (2009), "the field of applied analysis emerged from the experimental analysis of behavior, like Adam's rib" (p. 271).

Much of the early research with human subjects was conducted in clinic or laboratory settings. Although the participants typically benefited from these studies by learning new behaviors, the researchers' major purpose was to determine whether the basic principles of behavior discovered in the laboratory operated with humans. For example, Sidney Bijou (1955, 1957, 1958)[11] researched several principles of behavior with typically developing subjects and people with intellectual disabilities; Don Baer (1960, 1961, 1962) examined the effects of punishment, escape, and avoidance contingencies on preschool children; and Ogden Lindsley (1956; Lindsley & Skinner, 1954) assessed the effects of operant conditioning on the behavior of adults with schizophrenia. These early researchers clearly established that the principles of behavior are applicable to human behavior, and they set the stage for the later development of applied behavior analysis.

The branch of behavior analysis that would later be called applied behavior analysis (ABA) can be traced to the 1959 publication of Ayllon and Michael's paper titled "The Psychiatric Nurse as a Behavioral Engineer." The authors described how direct care personnel in a state hospital used a variety of techniques based on the principles of behavior to improve the functioning of residents with psychotic disorders or intellectual disabilities. During the 1960s many researchers began to apply principles of behavior in an effort to improve socially important behavior, but these early pioneers faced many problems. Laboratory techniques for measuring behavior and for controlling and manipulating variables were sometimes unavailable, or their use was inappropriate in applied settings. As a result, the early practitioners of applied behavior analysis had to develop new experimental procedures as they went along. There was little funding for the new discipline, and researchers had no ready outlet for publishing their studies, making it difficult to communicate among themselves about their findings and solutions to methodological problems. Most journal editors were reluctant to publish studies using an experimental method unfamiliar to mainstream social science, which relied on large numbers of subjects and tests of statistical inference.

Despite these problems it was an exciting time, and major new discoveries were being made regularly. For example, many pioneering applications of behavior principles to education occurred during this period (see, e.g., O'Leary & O'Leary, 1972; Ulrich, Stachnik, & Mabry 1974), from which were derived teaching procedures such as contingent teacher praise and attention (Hall, Lund, & Jackson, 1968), token reinforcement systems (Birnbrauer, Wolf, Kidder, & Tague, 1965), curriculum design (Becker, Engelmann, & Thomas, 1975), and programmed instruction (Bijou, Birnbrauer, Kidder, & Tague, 1966; Markle, 1962). The basic methods for reliably improving student performance developed by those early applied behavior analysts provided the foundation for behavioral approaches to curriculum design, instructional methods, classroom management, and the generalization and maintenance of learning that continue to be used decades later (cf., Twyman, 2013).

University programs in behavior analysis were begun in the 1960s and 1970s at Arizona State University, Florida State University, the State University of New York at Stony Brook,

BOX 1.1

What Is Behaviorism?

Don Baer loved the science of behavior. He loved to write about it, and he loved to talk about it. Don was famous for his unparalleled ability to speak extemporaneously about complex philosophical, experimental, and professional issues in a way that always made thorough conceptual, practical, and human sense. He did so with the vocabulary and syntax of a great author and the accomplished delivery of a master storyteller. The only thing Don knew better than his audience was his science.

On three occasions, in three different decades, graduate students and faculty in the special education program at The Ohio State University were fortunate to have Professor Baer serve as Distinguished Guest Faculty for a doctoral seminar, Contemporary Issues in Special Education and Applied Behavior Analysis. The questions and responses that follow were selected from transcripts of two of Professor Baer's three OSU teleconference seminars.

If a person on the street approached you and asked, "What's behaviorism?" how would you reply?

The key point of behaviorism is that what people do can be understood. Traditionally, both the layperson and the psychologist have tried to understand behavior by seeing it as the outcome of what we think, what we feel, what we want, what we calculate, and etcetera. But we don't have to think about behavior that way. We could look upon it as a process that occurs in its own right and has its own causes. And those causes are, very often, found in the external environment.

Behavior analysis is a science of studying how we can arrange our environments so they make very likely the behaviors we want to be probable enough, and they make unlikely the behaviors we want to be improbable. Behaviorism is understanding how the environment works so that we can make ourselves smarter, more organized, more responsible; so we can encounter fewer punishments and fewer disappointments. A central point of behaviorism is this: We can remake our environment to accomplish some of that much more easily than we can remake our inner selves.

An interviewer once asked Edward Teller, the physicist who helped develop the first atomic bomb, "Can you explain to a nonscientist what you find so fascinating about science, particularly physics?" Teller replied, "No." I sense that Teller was suggesting that a nonscientist would not be able to comprehend, understand, or appreciate physics and his fascination with it. If a nonscientist asked you, "What do you find so fascinating about science, particularly the science of human behavior?" what would you say?

Ed Morris organized a symposium on just this topic a couple of years ago at the Association for Behavior Analysis annual convention, and in that symposium, Jack Michael commented on the fact that although one of our discipline's big problems and challenges is communicating with our society about who we are, what we do, and what we can do, he didn't find it reasonable to try to summarize what behavior analysis is to an ordinary person in just a few words. He gave us this example: Imagine a quantum physicist is approached at a cocktail party by someone who asks, "What is quantum physics?" Jack said that the physicist might very well answer, and probably should answer, "I can't tell you in a few words. You should register for my course."

I'm very sympathetic with Jack's argument. But I also know, as someone who's confronted with the politics of relating our discipline to society, that although it may be a true answer, it's not a good answer. It's not an answer that people will hear with any pleasure, or indeed, even accept. . . . Therefore, I think we have to engage in a bit of honest show business. So, if I had to somehow state some connotations of what holds me in the field, I guess I would say that since I was a child I always found my biggest reinforcer was something called understanding. I liked to know how things worked. And of all of the things in the world there are to understand, it became clear to me that the most fascinating was what people do. I started with the usual physical science stuff, and it was intriguing to me to understand how radios work, and how electricity works, and how clocks work, etcetera. But when it became clear to me that we could also learn how people work—not just biologically, but behaviorally—I thought that's the best of all. Surely, everyone must agree that that's the most fascinating subject matter. That there could be a science of behavior, of what we do, of who we are? How could you resist that?

Adapted from "Thursday Afternoons with Don: Selections from Three Teleconference Seminars on Applied Behavior Analysis" by W. L. Heward & C. L. Wood (2003). In K. S. Budd & T. Stokes (Eds.), *A Small Matter of Proof: The Legacy of Donald M. Baer* (pp. 293–310). Reno, NV: Context Press. Used by permission.

the University of Illinois, Indiana University, the University of Kansas, The Ohio State University, the University of Oregon, the University of Southern Illinois, the University of Washington, West Virginia University, and Western Michigan University, among others. Through their teaching and research, faculty at each of these programs made major contributions to the rapid growth of the field.[12]

Two significant events in 1968 mark that year as the formal beginning of contemporary applied behavior analysis. First, the *Journal of Applied Behavior Analysis (JABA)* began publication. *JABA* was the first journal in the United States to deal with applied problems that gave researchers using methodology from the experimental analysis of behavior an outlet for publishing their findings. *JABA* was and continues to be the flagship journal of applied behavior analysis. Many of the early articles in *JABA* became model demonstrations of how to conduct and interpret applied behavior analysis, which in turn led to improved applications and experimental methodology.

The second major event of 1968 was the publication of the paper "Some Current Dimensions of Applied Behavior Analysis" by Donald M. Baer, Montrose M. Wolf, and Todd R. Risley. These authors, the founding fathers of the new discipline, recommended criteria for judging the adequacy of research and practice in applied behavior analysis and outlined the scope of work they envisioned for those engaged in the science. Their iconic paper is the most widely cited publication in applied behavior analysis and generally regarded as the standard description of the discipline.

CHARACTERISTICS OF APPLIED BEHAVIOR ANALYSIS

Baer, Wolf, and Risley (1968) recommended that applied behavior analysis be *applied, behavioral, analytic, technological, conceptually systematic, effective,* and capable of appropriately *generalized outcomes.* In 1987 Baer and colleagues reported that the "seven self-conscious guides to behavior analytic conduct" (p. 319) they had offered 20 years earlier "remain functional; they still connote the current dimensions of the work usually called applied behavior analysis" (p. 314). The seven dimensions they posed continue to serve as useful and relevant signposts for identifying research in applied behavior analysis.

Applied

The *applied* in applied behavior analysis signals ABA's commitment to effecting improvements in behaviors that enhance and improve people's lives. To meet this criterion, the researcher or practitioner must select behaviors to change that are socially significant for participants: social, language, academic, daily living, self-care, vocational, and/or recreation and leisure behaviors that improve the day-to-day life experience of the participants and/or affect their significant others (parents, teachers, peers, employers) in such a way that they behave more positively with and toward the participant.

Behavioral

At first it may seem superfluous to include such an obvious criterion—of course applied *behavior* analysis must be *behavioral.* However, Baer and colleagues (1968) made three important points relative to the behavioral criterion. First, not just any behavior will do; the behavior chosen for study must be *the* behavior in need of improvement, not a similar behavior that serves as a proxy for the behavior of interest or the subject's verbal description of the behavior. Behavior analysts conduct studies *of* behavior, not studies *about* behavior. For example, in a study evaluating the effects of a program to teach school children to get along with one another, an applied behavior analyst would directly observe and measure clearly defined classes of interactions between and among the children instead of using indirect measures such as the children's answers on a sociogram or responses to a questionnaire about how they believe they get along with one another.

Second, the behavior must be measurable; the precise and reliable measurement of behavior is just as critical in applied research as it is in basic research. Applied researchers must meet the challenge of measuring socially significant behaviors in their natural settings, and they must do so without resorting to the measurement of nonbehavioral substitutes.

Third, when changes in behavior are observed during an investigation, it is necessary to ask whose behavior has changed. Perhaps only the behavior of the observers has changed. "Explicit measurement of the reliability of human observers thus becomes not merely good technique, but a prime criterion of whether the study was appropriately behavioral" (Baer et al., 1968, p. 93). Or perhaps the experimenter's behavior has changed in an unplanned way, making it inappropriate to attribute any observed change in the subject's behavior to the independent variables that were manipulated. The applied behavior analyst should attempt to monitor the behavior of all persons involved in a study.

Analytic

A study in applied behavior analysis is *analytic* when the experimenter has demonstrated a functional relation between the manipulated events and a reliable change in some measurable dimension of the targeted behavior. In other words, the experimenter must be able to control the occurrence and nonoccurrence of the behavior. Sometimes, however, society does not allow the repeated manipulation of important behaviors to satisfy the requirements of experimental method. Therefore, applied behavior analysts must demonstrate control to the greatest extent possible, given the restraints of the setting and behavior; and then they must present the results for judgment by the consumers of the research. The ultimate issue is believability: Has the researcher achieved experimental control to demonstrate a reliable functional relation?

The analytic dimension enables ABA not only to demonstrate effectiveness but also to provide the "acid test proof" of functional and replicable relations between the interventions it recommends and socially significant outcomes.

> Because we are a data- and design-based discipline, we are in the remarkable position of being able to prove that behavior can work in the way that our technology prescribes. We are not theorizing about how behavior *can* work; we are describing systematically how it *has* worked many times in real-world applications, in designs too competent and with measurement systems too reliable and valid to doubt. Our ability to prove that behavior can work that way does not, of course, establish that behavior *cannot* work any other way: we are not in a discipline that can deny any other approaches, only in one that can affirm itself as knowing many of its *sufficient* conditions at the level of experimental proof . . . our subject matter is behavior change, and we can specify some *actionable* sufficient conditions for it. (D. M. Baer, personal communication, October 21, 1982, emphasis in original)

Technological

A study in applied behavior analysis is *technological* when all of its operative procedures are identified and described with sufficient detail and clarity "such that a reader has a fair chance of replicating the application with the same results" (Baer, Blount, Detrich, & Stokes, 1987, p. 320).

> It is not enough to say what is to be done when the subject makes response R_1; it is essential also whenever possible to say what is to be done if the subject makes the alternative responses, R_2, R_3, etc. For example, one may read that temper tantrums in children are often extinguished by closing the child in his room for the duration of the tantrums plus ten minutes. Unless that procedure description also states what should be done if the child tries to leave the room early, or kicks out the window, or smears feces on the walls, or begins to make strangling sounds, etc., it is not precise technological description. (Baer et al., 1968, pp. 95–96)

No matter how powerful its effects in any given study, a behavior change method will be of little value if practitioners are unable to replicate it. The development of a replicable technology of behavior change has been a defining characteristic and continuing goal of ABA from its inception. Behavioral tactics are replicable and teachable to others. Interventions that cannot be replicated with sufficient fidelity to achieve comparable outcomes are not considered part of the technology.

A good check of the technological adequacy of a procedural description is to have a person trained in applied behavior analysis carefully read the description and then act out the procedure in detail. If the person makes any mistakes, adds any operations, omits any steps, or has to ask any questions to clarify the written description, then the description is not sufficiently technological and requires improvement.

Conceptually Systematic

Although Baer and colleagues (1968) did not state so explicitly, a defining characteristic of applied behavior analysis concerns the types of interventions used to improve behavior. Although an infinite number of tactics and specific procedures can be used to alter behavior, almost all are derivatives and/or combinations of a relatively few basic principles of behavior. Thus, Baer and colleagues recommended that research reports of applied behavior analysis be *conceptually systematic,* meaning that the procedures for changing behavior and any interpretations of how or why those procedures were effective should be described in terms of the relevant principle(s) from which they were derived.

Baer and colleagues (1968) provided a strong rationale for the use of conceptual systems in applied behavior analysis. First, relating specific procedures to basic principles might enable the research consumer to derive other similar procedures from the same principle(s). Second, conceptual systems are needed if a technology is to become an integrated discipline instead of a "collection of tricks." Loosely related collections of tricks do not lend themselves to systematic expansion, and they are difficult to learn and to teach.

Effective

An effective application of behavioral techniques must improve the behavior under investigation to a practical degree. "In application, the theoretical importance of a variable is usually not at issue. Its practical importance, specifically its power in altering behavior enough to be socially important, is the essential criterion" (Baer et al., 1968, p. 96). Whereas some investigations produce results of theoretical importance or statistical significance, to be judged *effective* an applied behavior analysis study must produce behavior changes that reach clinical or social significance.

How much a given behavior of a given subject needs to change for the improvement to be considered socially important is a practical question. Baer and colleagues stated that the answer is most likely to come from the people who must deal with the behavior; they should be asked how much the behavior needs to change. The necessity of producing behavioral changes that are meaningful to the participant and/or those in the participant's environment has pushed behavior analysts to search for "robust" variables, interventions that produce large and consistent effects on behavior (Baer, 1977a).

When they revisited the dimension of effectiveness 20 years later, Baer and colleagues (1987) recommended that the effectiveness of ABA also be judged by a second kind of outcome: the extent to which changes in the target behaviors result in noticeable changes in the reasons those behaviors were selected for change originally. If such changes in the subjects' lives do not occur, ABA may achieve one level of effectiveness yet fail to achieve a critical form of social validity (Wolf, 1978).

> We may have taught many social skills without examining whether they actually furthered the subject's social life; many courtesy skills without examining whether anyone actually noticed or cared; many safety skills without examining whether the subject was actually safer thereafter; many language skills without measuring whether the subject actually used them to interact differently than before; many on-task skills without measuring the actual value of those tasks; and, in general, many survival skills without examining the subject's actual subsequent survival. (Baer et al., 1987, p. 322)

Generality

A behavior change has *generality* if it lasts over time, appears in environments other than the one in which the intervention that initially produced it was implemented, and/or spreads to other behaviors not directly treated by the intervention. A behavior change that continues after the original treatment procedures are withdrawn has generality. And generality is