Applied Behavior Analysis: Foundations and Applications

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Abstract

Applied behavior analysis (ABA) is a science that involves applying interventions based on the principles of behavior analysis to change socially significant behavior. ABA is often erroneously viewed as an intervention, as opposed to a science. In this chapter, we discuss the science of ABA using the framework of the seven defining characteristics of the science, as described by Baer, Wolf, and Risley. We also provide a historical account of the science, focusing on its foundation in experimental analysis of behavior. As we discuss the defining features of ABA, we also identify some of the common misconceptions about ABA and attempt to clarify so as to dispel these misconceptions. Finally, given that therapies based on the principles of behavior analysis are the crux of evidence-based treatment for autism, we discuss the role of practicing behavior analysts in the treatment team. Because behavior analysis is a relatively young field, and there has recently been very large growth in the number of behavior analytic practitioners, known as Board Certified Behavior Analysts (BCBAs). We provide information on what a BCBA is, what their training consists of, and what skills they bring to the treatment team. It is our hope that this will assist the practitioner of parent–child interaction therapy (PCIT) in determining how behavior analysts can collaborate with them in the treatment process.

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Applied behavior analysis (ABA) emerged as a distinct discipline in 1968, with the formation of the discipline's flagship journal, the *Journal of Applied Behavior Analysis*. ABA is a science that involves applying interventions based on the basic principles of behavior analysis to change socially significant **behavior**. This field is based on foundational research referred to as "basic research" (i.e., with nonhuman animals) from which the principles of behavior analysis were derived. In the area of autism treatment, interventions based on the principles of behavior analysis are considered evidence-based treatment (National Autism Center, 2015). Thus, a field of practice known as "ABA" has also arisen. It is not uncommon for this form of treatment to be referred to as "ABA treatment" or "ABA therapy." However, it is important to understand that

ABA is not a "treatment" or a "therapy." Rather, ABA is a science and a discipline. ABA is connected to the science of behavior the same way the practice of medicine is connected to research in chemistry and biology. The purpose of this chapter is to provide a primer on the science of ABA. To that end, we begin with a review of the basic science that laid the foundation for the origins of ABA. In this section, we distinguish more clearly the science and practice of ABA.

In addition to the misunderstanding that ABA is a treatment as opposed to a science, there are several other myths about ABA that exist. These myths often arise from a misunderstanding of what ABA is and what it is not. Baer, Wolf, and Risley (1968) identified the hallmark features of ABA in the inaugural issue of the *Journal of Applied Behavior Analysis*. We review those features and discuss them in the context of common myths about ABA. Embedded in this discussion are examples of the key terms and principles of behavior analysis. Definitions of these key terms and principles can be found in Table 2.1. (The first time one of these key principles or terms is used in the chapter, it is printed in boldface type to indicate that the definition can be found in the table.)

Finally, because this book is practice oriented, we discuss clinical practice based on the principles of ABA. Behavior analysis is a broad field. After all, many problems people experience are behavioral in nature. For example, the problem of obesity is often due to individuals consuming too many calories and/or leading a sedentary lifestyle. Consuming food and exercising are behaviors in which people engage and, therefore, are controlled by the basic principles of behavior. Likewise, recycling and living a "green lifestyle" consist of behaviors controlled by basic principles of behavior, as do parenting skills and child-appropriate and -inappropriate behaviors.

Individuals who study the science of behavior analysis are called behavior analysts. As stated earlier, some behavior analysts focus their work on basic science. Others work in the applied arena. Broadly speaking, applied behavior analysts are interested in understanding how a person's environment affects their behavior

Table 2.1 Selected behavior analytic key terms and definitions

Term	Definition
Behavior	Movement of some part of an organism that changes some aspect of the environment (Johnston & Pennypacker, 1993). An observable act of an individual (Alberto & Troutman, 1990). A **response** is a single instance of behavior.
Stimulus	Energy change that affects an organism through its receptor cells (Michael, 2004).
Antecedent	A stimulus change existing or occurring prior to a behavior (Cooper, Heron, & Heward, 2007).
Consequence	A stimulus change that follows a behavior (Cooper et al., 2007).
Respondent behavior	Behavior that is elicited by antecedent stimuli (Cooper et al., 2007); these behaviors are typically reflexes.
Operant behavior	Behavior that is selected, maintained, or brought under stimulus control as a function of its consequences (Cooper et al., 2007); these behaviors are typically voluntary.
Reinforcer	A consequence stimulus that increases or maintains the future rate and/or probability of occurrence of a behavior (Alberto & Troutman, 1990).
Punisher	A consequence stimulus that decreases the future rate and/or probability of a behavior of the occurrence of a behavior (Alberto & Troutman, 1990).
Functional relation	Causal relation between a dependent and independent variable(s). This relation is said to exist if the dependent systematically changes as a result of the manipulation of the independent variable (Alberto & Troutman, 1990).
Contingency	A dependent and temporal relation between operant behavior and its controlling variables (Cooper et al., 2007).
Negative reinforcement	The contingent removal of an aversive stimulus immediately following a response that increases the future rate and/or probability of the response (Alberto & Troutman, 1990).
Positive reinforcement	The contingent presentation of a stimulus immediately following a response which increases the future rate and/or probability of the response (Alberto & Troutman, 1990).
Extinction	The discontinuation of reinforcement for a previously reinforced behavior. The primary effect is a decrease in the future probability of the behavior (Cooper et al., 2007).

and designing behavior-change interventions based on this understanding. Many treatment technologies based on principles of behavior analysis have emerged, and these technologies continue to evolve and improve as lessons from the laboratory are translated to practice (Mace, 1994; Mace & Critchfield, 2010; Neef & Peterson, 2005). Applied behavior analysts take these technologies into natural settings and work with a wide variety of populations on intervention goals, including teaching new skills (e.g., language development), increasing adaptive and healthy behavior (e.g., physical activity), and treating challenging behavior (e.g., aggression). A subset of those behavior analysts become certified to provide clinical services to individuals seeking treatment for problems such as those described above. These individuals are known as Board Certified Behavior Analysts (BCBAs). BCBAs are certified by the Behavior Analyst Certification Board (BACB) after they complete specific education requirements, specific field experiences, and take a qualifying exam. The BACB is a relatively young organization, established in 1998 (see https://www. bacb.com/about/), and BCBA certification is relatively new. Thus, many people outside the field of behavior analysis are unaware of what a BCBA is and what their practice involves. We conclude this chapter with a discussion of BCBAs and what their role might be as a member of a team working with parents and children diagnosed with ASD who are experiencing behavioral challenges.

2.1 The Origins of Applied Behavior Analysis

Behavior analysis as a clinical practice emerged in the 1960s, but its roots can be traced back to the early 1900s. The philosophy of behavioral science is called behaviorism, which was first introduced in its early form by John B. Watson. Watson laid the groundwork for classical behaviorism in his article, "Psychology as the Behaviorist Views It." He was skeptical of

psychology's reliance on introspection as a means of research, and he believed that the field should follow the lead of other natural sciences (Moore, 2008). In pursuit of this goal, Watson implored psychologists to use rigorous research methodology and abandon introspection in favor of collecting objective data for events that are both observable and measurable.

Watson's brand of behavioral science is known as **stimulus-response** (S-R) psychology. This approach focused on **antecedent** stimulus-eliciting—that is, triggering—behavior. Watson and other early behaviorists asserted that all behavior, even complex human behavior, is caused by preceding events, a conclusion that would later be rejected by B. F. Skinner and other modern behaviorists (Skinner, 1974). S-R psychologists studied only publicly observable events and behavior, and they notably rejected internal events such as thinking and feeling (Moore, 2008). By the 1930s, some psychologists were becoming skeptical of classical S-R behaviorism as a sufficient framework for analyzing and explaining all behavior. Two of the main criticisms of Watson's behaviorism were related to insufficiency for predicting and controlling "voluntary" behavior and lack of concern for mental events (Moore, 2008).

B.F. Skinner, who is credited with developing contemporary behaviorism and the modern field of behavior analysis, was an influential critic of classical behaviorism. Skinner was influenced by Watson and Pavlov early in his career, but the course of his research took a significant turn when he discovered that behavior can be modified by the events that follow it (i.e., **consequences**; Dixon, Vogel, & Tarbox, 2012; Skinner, 1938). This finding contrasted the S-R model that behavior is modified by antecedent events only (respondent behavior), and Skinner criticized classical behaviorists for overstating the significance of S-R conditioning (Skinner, 1974). Consequence-based learning became known as operant conditioning, and operant research has shown the importance of both the antecedent (events preceding) and consequence of (events following) behavior.

In 1938, Skinner published *The Behavior of Organisms*, in which he outlined his early work in behavior analysis and distinguished between **respondent** and **operant behavior** (Cooper et al., 2007).

Skinner coined his philosophy of behavior as radical behaviorism. He chose the word *radical* to highlight its distinction from classical behaviorism and to indicate a "thoroughgoing" of the behavioral philosophy (Moore, 2008). Besides its focus on operant behavior, one of the most notable differences between classical and radical behaviorism is that radical behaviorism considers mental events within bounds of a scientific analysis of behavior. Private events, such as thinking and feeling, are usually not considered causes of overt behavior, but forms of behavior themselves (Skinner, 1953). Skinner's new brand of behaviorism and his research on operant conditioning launched the field of behavior analysis and popularized the study of behavioral principles.

Researchers took strides toward a clinical practice of behavior analysis in the 1940s and 1950s when they began to replicate principles of operant learning in human subjects (Azrin & Lindsley, 1956; Bijou, 1958; Ferster & DeMyer, 1962; Long, Hammack, May, & Campbell, 1958; Michael, 2004). A few years later, Ayllon and Michael (1959) published one of the first studies using a clinical application of behavior analysis. They showed that nurses in a psychiatric hospital could use a behavioral approach to decrease psychotic talk for some patients, and increase self-feeding in other patients. Other early research on therapeutic applications included the use of behavioral principles to increase social behavior (e.g., Allen, Hart, Buell, Harris, & Wolf, 1964), decrease challenging behavior in individuals with intellectual and developmental disabilities (e.g., Wolf, Risley, & Mees, 1963), and design behavioral approaches to education (e.g., Keller, 1968). In the 1960s, Ivar Lovaas pioneered behavioral interventions for children diagnosed with autism. He developed behavioral treatments to decrease problem behavior and teach language and social skills (Smith & Eikeseth, 2011). Lovaas' work on early intervention at the University of California Los Angeles (UCLA)

was pivotal for shifting the treatment model for children with autism from institutionalization toward skill building at home and in clinic settings.

The field of applied behavior analysis has continued to evolve since the early years of clinical applications. Interventions have been applied to a wide range of new settings, target behaviors, and populations. Although the basic principles behind intervention technologies have largely remained the same, the methods employed by practitioners continue to become more sophisticated. For example, before there was the technology to identify the variables contributing to a given behavior, practitioners often attempted to change behavior by superimposing large consequences (**reinforcers** and **punishers**) without adjusting other aspects of the natural environment (Mace, 1994). Some of the methods used in behavior analysis in its early years were blunt tools for changing behavior known as "behavior modification." Behavior modification is a term used for changing behavior without an understanding of the behavior-environment interactions. Behavioral treatments have evolved significantly as researchers have developed and refined new approaches. Contemporary behavior analysis attempts to understand **functional relations** between the environment and behavior before developing a treatment for that particular behavior (Mace, 1994). For example, there was a shift in methods for decreasing challenging behavior in the 1980s and 1990s with the development of functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994/1982; Neef & Peterson, 2007, Chap. 10 of this text). With this new technology, practitioners were able to assess the precise variables affecting behavior and use this information to plan individualized treatments that affect behavior with greater precision. This is seen by many as the turning point away from the practice of behavior modification to a contemporary practice of applied behavior analysis (Mace, 1994). This contemporary view focuses more on behavior *analysis* as opposed to behavior *modification* in that environmental variables affecting behavior are carefully analyzed prior to treatment development. Thus, the recommended treatment

or therapy is more precisely matched to the reason problem behavior is occurring or the reason desired behavior is not. However, not everyone outside of behavior analysis recognizes this shift in applied practice, resulting in the persistence of myths and misunderstandings about behavior analytic practice. A review of the defining characteristics of ABA, from both a historical and contemporary perspective, may be helpful in understanding this contemporary view of behavior analysis and dispel the lingering myths about the science and practice of behavior analysis.

2.2   Defining Characteristics of ABA: Myths and Realities

Baer et al. (1968) offered seven defining characteristics of applied behavior analysis, which still define the field to this day. Any behavior analyst worth his or her salt clearly understands these defining characteristics; however, few outside the field of behavior analysis are familiar with them. Behavior analysis, like many fields (e.g., medicine), has its own vernacular. Some of the words behavior analysts use in a very technical manner (i.e., to refer to very specific procedures or effects on behavior) are also commonly used by the lay person to mean something different. Perhaps due to the relative youth of the field or as a result of poor communication between behavior analysts, other professional disciplines, and the broader community, several myths about behavior analysis have arisen and continue to persist to this day. In this section, we review the defining features of behavior analysis and attempt to put some of this vernacular into context in an attempt to bring about a better understanding of behavior analysis and avoid perpetuating myths.

2.2.1   Behavioral

Applied behavior analysis is pragmatic and centers around the study *of* behavior, rather than *about* behavior (Cooper et al., 2007). In other words, behavior analysts select measurable behaviors to target (i.e., goals to increase or decrease), and they take direct data on these behaviors before, during, and after treatment to directly assess change. For example, when working with a child who engages in physical aggression toward a caregiver, a behavior analyst specifically focuses on the physical aggression, current environmental **contingencies** that influence that behavior, and strategies to prevent or reduce the future frequency of that response. Behavior analysts do not focus on measuring speculative explanations for the behavior such as the child's level of anxiety, impulsivity, or emotion regulation. The rationale for this distinction is explained in three points outlined in the seminal article by Baer et al. (1968).

First, the behavior that is measured and studied must be the behavior that needs improvement. Behaviors that are similar or serve as proxies to the behavior of interest do not demonstrate the same applied value of actually changing the behavior. For instance, measuring a reduction of anxiety reported by the aggressive child is an example of a proxy, but changes in anxiety do not necessarily mean that he/she will engage in less dangerous behavior. Therefore, unless anxiety is the main target behavior, the behavior analyst does not prioritize this measurement and instead focuses on directly tracking instances of aggression. However, this is not to say that verbal reports or verbal responses are not of interest to behavior analysts. In fact, this is a persistent myth about behavior analysis. On the contrary, many behavior analysts focus a great deal on verbal responding; for example, behavior analysts often work with clients who have difficulties with communication, so targeting verbal responses specifically is a requisite. It is also worth noting that while behavior analysts avoid measuring proxy behaviors to judge the effects of intervention, they are sometimes measured for other reasons. For instance, behavior analysts value the satisfaction of stakeholders and recruit feedback regularly during treatment (social validity measures; Wolf, 1978; BACB, 2014). For example, even when a practitioner has data showing that the intervention has reduced aggression, they will assess whether the child's caregivers are satisfied with the treatment techniques being used and with the changes in behavior.

Second, due to behavior analysts' foundational belief that scientific study requires precise measurement, Baer et al. (1968) asserted that the behavior of interest must be observable and measurable. For instance, the previous example described a child who aggressed toward his/her caregiver. Some may attribute the aggression to constructs that are not observable, such as problems with emotion regulation. Emotion regulation can be difficult to measure, and thus proxies for emotion regulation (e.g., deep breathing, appropriately removing themselves from a situation, change in heart rate) are measured instead. Improvement in these proxy behaviors is then presumed to show improvements in emotion regulation. Measuring only such proxies for emotion regulation without also taking direct data on aggression would be problematic. Although strategies like deep breathing and appropriately removing oneself from a problematic situation may be of interest to behavior analysts as potential interventions, these strategies do not guarantee that aggression will decrease. Thus, it is essential that the target behavior—aggression—is directly measured because it is the primary behavior of concern. A behavior analyst may measure other behaviors as "replacement behaviors" for aggression as part of treatment. For example, intervention components could include teaching deep breathing and removing oneself from a difficult situation, and these coping skills are observable and measurable. But, even if improvements in these coping skills are observed, the behavior analyst would be cautious to assume that the client has improved his/her "emotion regulation." Emotion regulation is not observable and therefore requires assumptions on the part of the observer—something behavior analysts avoid. Baer, Wolf, and Risley (1987) stated that direct observation of the behavior is the standard measurement method for applied behavior analysts. This is not to say that behavior analysts ignore private or internal events (i.e., emotions, thoughts, feelings), but instead view those events similarly to public events and treat them accordingly (Baer et al., 1968; Skinner, 1957). In other words, private events (i.e., "thoughts") are treated as behaviors that are unobservable by those other than the client himself/herself.

Finally, it is important to ensure that any measured changes in behavior are actually changes in the behavior of the client and not an accidental measurement artifact. Small changes in the behavior of individuals involved in treatment or the data collection system itself can produce artificial changes in measurement of the behavior. In keeping with our previous example, the caregiver at whom aggression is directed may unwittingly begin to avoid being in close physical proximity to the child. As a result, the child may not have as many opportunities to engage in aggression. This reduces the overall amount of behaviors recorded, but not necessarily because the behavior is less likely in circumstances similar to earlier conditions (i.e., frequent close proximity to an adult). Additionally, the method of collecting data can produce invalid results. For example, trained observers may experience observer drift, where they unintentionally deviate from the original definition of the behavior of interest, producing inaccurate data (Kazdin, 1977). Therefore, explicit and precise measurement of an appropriate behavior in an appropriate context, along with checks to ensure that data are collected in a consistent manner, is essential to the behavioral approach. These checks are called "interobserver agreement checks," and are an important part of the behavior analytic approach (see Vollmer, Sloman, & St. Peter Pipkin, 2008).

2.2.2 Applied

As indicated in the title, *applied* behavior analysis is a discipline that prioritizes socially significant behaviors. With a commitment to improve the lives of the individuals receiving services, pioneers of applied behavior analysis translated the basic principles studied in behavioral laboratories to interventions for socially important behavior in the real world. Even today, basic researchers study behavior in well-controlled laboratory settings while their work continues to

inform the practices of applied researchers and practitioners (see Neef & Peterson, 2005 for a complete description of how basic research, applied research, technology, and applied practice inform each other). ABA is the part of behavioral science oriented toward helping society and solving immediate problems. In contrast to myths that behavior analysts control behavior for the sake of controlling behavior or select arbitrary behaviors to improve, applied behavior analysts are obligated to select behaviors for study/intervention that have direct relevance to improving the daily life experiences of those involved in treatment. This is accomplished by talking with care providers prior to intervention to determine behaviors they view as important to change, being culturally sensitive, and selecting target behaviors that will unlock more resources for clients. For example, one practical problem for many parents is potty-training their child. This can be difficult with a nondisabled child, but it can be even more challenging when the child has a disability. In some communities, if a child is not potty-trained by a certain age, the child cannot attend daycare or even a general education classroom. Thus, lacking the skill of appropriate toileting can severely limit one's access to community and educational settings. Thus, teaching appropriate bathroom behaviors not only helps the immediate concern of eliminating problems associated with individuals urinating and defecating on themselves, but it also allows the child access to natural environments and opportunities to learn and receive positive reinforcers. As a result, behavior analysts consider this a socially significant behavior to target.

2.2.3 Effective

In conjunction with the focus on socially significant behaviors, behavior analysts also judge the success of their interventions based on the clinical significance of the change. Clinical significance, similar to social significance, is determined by assessing the social validity of the intervention. That is, in order to call an intervention effective, it must produce meaningful change in the life of the persons of interest. As a field, behavior analysis has developed many effective procedures and tactics for individuals across the life span with a variety of problem behaviors. However, behavior analysts do not assume that interventions for one client are effective for another client. Instead, behavior analysts determine the effectiveness of interventions individually using ongoing data collection and social validity measures from stakeholders. For instance, a family with a child who screams daily up to 3 or 4 h without interruption would likely perceive meaningful change to be reducing the duration of the screaming to less than 5 s and the frequency to once or twice a week. While the child still screams, the quality of life for the child and family has noticeably improved and, therefore, the intervention would be deemed effective. In contrast, if screaming is reduced to 2 h a day, but it still occurs daily, this would not be considered clinically significant, although a reduction in screaming was observed. Although screaming was reduced, the reduction was not to a level that produced meaningful change for the family. The intervention is only clinically significant (i.e., effective) to the extent that it decreases to a level that is socially important for that family. Behavior analysts determine these criteria for "success" individually for their clients.

There is a common misconception that the principles of behavior analysis are effective with only individuals with autism and developmental disabilities. In fact, within the 50-year history of ABA, autism has only recently become a major interest (Axelrod, McElrath, & Wine, 2012). Behavior analytic strategies and assessments have demonstrated effectiveness with many populations including typical children, specific issues related to mental illness, those addicted to drugs (e.g., cocaine), typical adults (e.g., how we drive our cars, whether we recycle), and more.

2.2.4 Analytic

Fundamentally, behavior analysts are scientists who must demonstrate a causal relation between interventions and changes in behavior; in other

words, there must be a functional relation between the behaviors of interest and environmental events (oftentimes an intervention) to determine effectiveness. In any science, controlled research designs and data analysis are important in demonstrating the effectiveness. In the practice of applied behavior analysis, close, continual contact with the data is important in achieving high-quality services and significant outcomes for clients. Applied behavior analysts collect repeated measures of behavior over time while carefully holding constant the environmental conditions or systematically manipulating environmental conditions to observe and measure the effect on behavior. By controlling the environment around the behavior (i.e., antecedents and consequences) and systematically measuring the behavior of interest on numerous occasions, the behavior analyst can determine reliable environmental influences on the behavior of interest. Once these relations are determined, the behavior analyst can help arrange the environment to support and teach adaptive behaviors while decelerating inappropriate behaviors. A common myth is that behavior analysts control behavior. Behavior analysts do not control behavior. Rather, they study how environmental variables impact the behavior of interest and arrange environments to reliably influence the behavior in socially valid ways—that is, to create contexts in which clients are likely to behave in the most adaptive ways so as to maximize reinforcement and independence.

2.2.5 Technological

Any successful science or practice has guidelines for appropriately sharing and replicating procedures of interest. The science develops a technology for implementation (see Neef & Peterson, 2005). "Technological," as described by Baer et al. (1968), means identifying and sufficiently describing techniques that make up a behavioral application. This does not necessarily mean "manualizing" applied behavior analytic procedures. Behavior analysts are often reluctant to "manualize" their treatments because doing so means treating each client with a standardized treatment. This flies in the face of studying the effects of specific variables on an individual's behavior and providing individualized treatment. Instead, technological descriptions of the intervention are provided for the purpose of identifying replicable behavioral tactics. In doing so, all of the "salient ingredients" of an application are described so that multiple care providers can implement the treatment consistently and so the relevant variables responsible for behavior change are clear. For example, stating social reinforcement was provided to a child for intervention is not sufficiently technological. It is not clear what social reinforcement consists of in this situation. A more appropriate description of "social reinforcement" as an intervention would be delivering a praise statement, such as enthusiastically stating "great job raising your hand," along with brief physical contact, such as tousling the child's hair. Being technological is important not only for sharing information with other practitioners, but also for sharing information with the caregivers we train. The best way to determine if procedures are adequately technological is to ask someone to implement a procedure based solely on the written description, observe them doing so, and measuring the individual's accuracy of implementation. These are referred to as "treatment fidelity checks" and are used to measure whether the treatment is being implemented as prescribed (see Vollmer et al., 2008). Implementing treatments with high fidelity both within and across care providers and environments is an important hallmark of behavior analytic practice.

2.2.6 Generality

A primary responsibility of a behavior analysts is to ensure that behavior change occurs across important care providers, environments, behaviors, and time. Behavior analysts are concerned that a generalization of effect occurs across care providers, environments, behaviors, and time. If behavior change only occurs in a controlled context, meaningful change has not occurred. Behavior change must generalize to

natural settings, with multiple people, and under multiple circumstances over time. For instance, if a behavior analyst teaches a child adaptive behaviors to replace physical aggression with deep breathing and removing himself/herself from the situation, these new behaviors must occur in non-treatment settings in the absence of the therapist (i.e., they must "generalize") to be considered important changes in behavior. Behavior analysts consider generalization strategies from the beginning stages of intervention so that generalization can be measured and, if it does not occur, systematically taught. It is not acceptable to simply teach a behavior and hope that behavior generalizes, across people, settings, and time. Rather, programming for generalization is intentional (see Stokes & Baer, 1977). It is also expected that behavior analysts arrange interventions and supports to fade systematically until natural contingencies support adaptive behavior appropriately.

2.2.7 Conceptually Systematic

A scientific discipline requires consistency in the conceptual approaches and explanations practiced. The field of ABA has observed this and been devoted to a conceptually systematic approach. In doing so, ABA has successfully maintained as a *discipline* over time, recently experiencing growth and rapid expansion. This means the field carefully maintains its roots in behavior principles and continues to train practitioners to base their interventions on behavioral analyses of behavior. Without conceptual systems, ABA would not be a science but would instead be a vaguely related collection of behavior modification tricks. For instance, a token economy is a common behavioral intervention. A token economy involves delivering a token of some sort (e.g., a poker chip, a point) as a reinforcer immediately following a behavior. After some period of time, these tokens are exchanged for a "backup reinforcer," such as tangible items (e.g., pencils, edible items). This common behavioral intervention can be construed as a "behavioral trick," because its implementation is often

inconsistent with behavioral principles. That is, it is applied without an understanding of the underlying behavior-environment interactions. The "trick" might be very effective, however, in that it may change behavior in the desired direction. On the other hand, if the underlying behavior-environment interactions are not understood, the trick may not be effective because the backup reinforcers for token exchanges may be irrelevant. This "trick" is only behavior analytic if it is implemented in a manner consistent with the principles of behavior and encompassing all seven dimensions of behavior analysis. The key to being conceptually systematic is maintaining relevance to principle in all respects.

2.3 Relevance of ABA in PCIT

At the core of ABA is a fundamental reliance on basic principles of behavior. Occasionally, approaches from other disciplines that are not presented as behavior analytic, per se, are remarkably consistent with ABA. Behavior analysts recognize and appreciate these points of convergence across disciplines. For example, behavior analysts embrace important aspects of Patterson's (1982) coercive family process model, in which Patterson describes caregivers inadvertently reinforcing progressively more aggressive behaviors in their children by terminating events that evoke problem behavior. Because the child removes an aversive stimulus (i.e., problem behavior) when the caregiver removes the aversive stimulus (e.g., a demand), the caregiver's behavior is also negatively reinforced. Thus, an unhealthy cycle of inappropriate behaviors that produce **negative reinforcement** for both parties commences. Some behavior analysts use different terminology to describe this model. For example, Malott and Shane (2015) describe this as the "sick social cycle." Although Patterson's model is not fully behavior analytic, behavior analysts are likely to embrace it because of its clear foundation based on negative reinforcement.

Similarly, much of PCIT is consistent with behavior analytic concepts. A PCIT therapist

providing services to a child and caregiver with a coercive relationship will begin with teaching child-directed interaction (CDI) skills. Doing so may interrupt the coercive relationship previously established by making the parent interaction/attention less aversive and potentially even **positively reinforcing**. Establishing reinforcers for appropriate behavior is certainly consistent with the behavioral approach. Likewise, the use of time-out in PCIT can also be consistent with the behavioral approach *assuming that "time-in" is reinforcing*. Similar to the token economy example provided earlier, time-out is an intervention that is often used as a "trick" and is not always conceptually systematic in its implementation. Time-out is a procedure that involves removing a child from the current context for a brief period of time. Often, it is implemented with the intention of decreasing the problem behavior that occurred immediately before the time-out commenced (i.e., as a punishment procedure). What we know from behavioral principles is that such a procedure is only effective to the extent that the initial context (i.e., "time-in") is desirable, thus making removal from that context undesirable. However, time-out poses a threat of negatively reinforcing problem behavior if the "time-in" consists of an aversive stimulus (i.e., it consists of demands and is unpleasant). For example, consider a situation in which a parent is instructing a child to complete his/her homework (a situation the child might find aversive). Let's assume the child responds to this instruction with a tantrum, and the parent subsequently places the child in time-out. Even though the parent was attempting to decrease tantrums, it is possible the parent may accidentally reinforce the problem behavior. By allowing the child to escape a situation or demand, even for a brief time, time-out could function as a negative reinforcer rather than a punisher.

If specific aspects of an intervention such as PCIT are implemented as "tricks" outside the parameters of the behavior analytic conceptual system, the therapist runs the risk of implementing counter-therapeutic interventions. Because behavior analysts adhere to a conceptual system,

they are very cautious about implementing time-out (or any other intervention) in the absence of an understanding of the behavior-environment interactions. Consequently, they will typically only implement time-out after first assessing the function of the problem behavior. If a context exists where the child is being asked to engage in a demanding task or nonpreferred situation, the child may be motivated to escape. In this case, time-out is contraindicated as a treatment component. In some cases, however, parent attention can successfully be conditioned as a positive reinforcer. In this case, the positive reinforcement available from parent attention may decrease the child's motivation to escape, despite the continued demands. In this context there exists a competition between two reinforcers (i.e., positive and negative), which creates a choice context for the child. Behavioral researchers (e.g., Lalli et al., 1999; Peck et al., 1996) have shown that positive reinforcers can be arranged to "beat out" the negative reinforcers in such a choice context. Teaching CDI skills may be a way to condition parent attention as a reinforcer and may help change the coercive interaction cycle such that complying with parent requests is more reinforcing than escaping task demands. However, PCIT therapists may wish to evaluate whether the time-out component of the intervention should be implemented (at least initially) for any given child if there is a risk that it will reinforce problem behavior. This is an area where a behavior analyst may play an important role in assisting with PCIT.

2.4 Role of a Behavior Analyst on Treatment Teams

Behavior analysis is a growing field, and as a result the Board Certified Behavior Analyst (BCBA) credential is being encountered more frequently by other professionals (Stratton & Gadke, 2016). A BCBA is a professional who utilizes the principles of behavior analysis, as described within this chapter, to improve the human condition. Behavior analysts are

credentialed to practice independently at the masters or doctoral level. The general requirements of the BCBA credential are a graduate degree in behavior analysis, psychology, or education with explicit training in behavior analytic principles; supervised professional experience; and passing a knowledge-based exam (see www. bacb.com for further information).

The BCBA credential arose from a series of events, which included alleged abuses of individuals with disabilities by professionals claiming application of behavior analytic principles (Johnston & Shook, 1987). As a result of those events over 30 years ago, behavior analysts created a certification process to help insure a standard of practice to protect consumers. Advocates then pushed the BCBA credential from a state-sponsored credential to an internationally recognized credential with over 20,000 certificants. Although the overall number of BCBAs is small compared to other professionals (Carr & Nosik, 2017), the number of behavior analysts is increasing rapidly (Deochand & Fuqua, 2016).

BCBAs work across a variety of fields/settings including schools, autism and developmental disability treatment, residential treatment, and parent training. Thus, it is not uncommon for individuals working with individuals or families with behavioral needs to encounter a BCBA on a treatment team. One of the benefits of working with BCBAs in any setting is the BCBA's skill set in performing functional behavior assessments (FBAs). An FBA is a method for obtaining information about the environment and the behavior to determine the purpose a behavior serves for an individual (Neef & Peterson, 2007). In other words, it is an assessment method for determining functional relations between behavior and environmental variables. Thorough FBAs can help treatment teams select effective interventions and rule out potentially counter-therapeutic interventions. For example, a PCIT practitioner might work with a BCBA to assess a child's problem behavior at the start of PCIT. Information gathered in the FBA by the BCBA could then be used by the PCIT practitioner to determine the appropriateness of time-out and other consequences planned as part of the treatment protocol.

In addition to evaluating problem behavior, a BCBA can also help to identify skill deficits and create plans for skill acquisition. For example, if a PCIT therapist is attempting to implement CDI with a parent, the therapist may notice that the child does not have a well-developed play repertoire. The behavior analyst could help pinpoint play skills that need to be developed, explicitly identify those targets for the parent, and make suggestions for how to prompt (VanDerHeyden, Snyder, DiCarlo, Stricklin, & Vagianos, 2002) and reinforce displays of those play behaviors (Stahmer, Ingersoll, & Carter, 2003). Similarly, if the child is lacking the skills to engage in appropriate social interaction with the parent, the behavior analyst could help identify targeted social skills or verbal interactions and teach them using direct instruction (Englemann, 1968) or scripts (Krantz & McClannahan, 1993).

Behavior analysts also bring to the table skills in coaching parents to implement treatments for problem behavior and skill acquisition in naturalistic settings such as homes. With respect to treatments for problem behavior, there exist several studies that describe procedures for coaching parents to implement interventions based on ABA in their own homes, even when the behavior analysts are not present and are providing coaching via telemedicine technologies (e.g., Lindgren et al., 2016; Suess et al., 2014). Behavior analysts are often knowledgeable about technologies for training parents, child care workers, and other care providers to teach desired skills as well. For example, there is evidence that pyramidal training can be effectively used to teach others to implement effective practices (see Andzik & Cannella-Malone, 2017 for a review).

A BCBA can play an important role on the intervention team, from helping to assess and pinpoint skills for improvement, designing effective intervention strategies for developing those skills, and training parents to implement intervention strategies. Given their expertise in operationalizing target behaviors, behavior analysts can also be instrumental in working with the

team to identify and define the socially meaning-ful outcomes desired as a result of PCIT. This can allow the team to obtain direct measures of the desired outcomes produced through PCIT.

2.5   Summary

ABA is often misunderstood as a "therapy," when in fact it is a science and a philosophy. The pur-pose of this chapter is to help readers understand the roots and underpinnings of applied behavior analysis, as well as the field's hallmark features and key terms. It is our hope that providing an overview of the field will be beneficial to practi-tioners of PCIT in at least a couple of ways. First, understanding key terms of the field may help establish shared vernacular. Second, understand-ing the defining features of the science may help dispel some of the common misconceptions and myths about the science.

When solving problems, behavior analysts typically rely on the foundational and core prin-ciples of the science—reinforcement, punish-ment, and **extinction**—as well as specific environmental contingencies. Some might view this approach as rigid. However, what may appear to others as rigidness may simply be the behavior analyst attempting to remain conceptu-ally systematic, which is consistent with the behavior analyst's training and the ethics codes to which the behavior analyst is bound. Having said that, it is important to understand that prac-titioners from different disciplines often have much in common. We have provided a couple of examples above (e.g., Patterson's coercive fam-ily process, PCIT). We encourage members of all professions to look for points of convergence in their disciplines and work from there, rather than look for points of divergence. Working from points of convergence focuses on the com-monalities across professions and may provide a better basis for collaboration.

Behavior analysts can play an important role in the treatment team for a child who is experiencing problem behaviors and may be a candidate for PCIT. Perhaps because the field of behavior analytic practice is relatively new, behavior ana-lysts and what role they may play in a treatment team are often not well understood. We have attempted to describe what we see as the role of a behavior analyst in the treatment team. We pro-vide this in hopes that professionals implement-ing PCIT can find points of convergence with behavior analysts and that this will encourage productive work together that ultimately benefits the children and families engaged in PCIT.

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