

Applied behavior analysis

9.1 Applied behavior analysis (ABA), previously known as behavior modification, is the application of operant and classical conditioning to modify human behaviors as part of a learning or treatment process. Behavior analysts focus on the observable relationship of behavior to the environment, including antecedents and consequences, without resort to "hypothetical constructs". By functionally assessing the relationship between a targeted behavior and the environment, the methods of ABA can be used to change that behavior.

Methods in applied behavior analysis range from validated intensive behavioral interventions—most notably utilized for children with an autism spectrum disorder (ASD)—to basic research which investigates the rules by which humans adapt and maintain behavior. However, applied behavior analysis contributes to a full range of areas including: AIDS prevention, business management, conservation of natural resources, education, gerontology, health and exercise, industrial safety, language acquisition, littering, medical procedures, parenting, psychotherapy, seatbelt use, severe mental disorders, sports, substance abuse, and zoo management and care of animals.

Definition

ABA is defined as the science in which the analysis of behavior are applied systematically to improve socially significant behavior, and in which experimentation is used to identify the variables responsible for change in behavior. It is one of the three fields of behavior analysis. The other two are radical behaviorism, or the philosophy of the science; and experimental analysis of behavior, or basic experimental research.

History

B.F. Skinner further revised the traditional theory of Behaviorism in the 1930s, and developed the modern form of it known as Behavior Analysis.

Although deriving from a similar philosophy, behavior modification was one form of behaviorism that modified behavior without addressing what was causing it. ABA uses environmental events. In other words, it *analyzes* what is prompting that behavior (the antecedent) and then develops consequential strategies. The

antecedent also allows the practitioner to teach replacement behaviors for the individual.

ABA is a science used in a wide range of fields to reinforce behavior with various subtypes such as Organizational behavior management (OBM), Positive behavior support, (such as School-wide Positive Behavioral Interventions and Supports (SWPBIS)), and Clinical behavior analysis (CBA, such as Contingency Management). Most of the time people use the subtype term Early intensive behavioral intervention (EIBI, including the Lovaas model and Pivotal response treatment (PRT)) interchangeably with ABA. However, the latter is a distinct psychological science of reinforcing behavior.

Ole Ivar Lovaas is considered a grandfather of Applied Behavior Analysis and developed standardized teaching interventions based on behavioral principals. Lovaas was cited in his early career to use low dosages of electroshock therapy to children with extreme self injurious behavior.

In 1973, Lovaas published a long-term follow-up for the behavior modification intervention and was dismayed to find that most of the subjects had reverted to their pre-intervention behaviors. After these findings, Lovaas and his colleagues proposed several ways to improve outcomes such as starting intervention during the children's preschool years instead of later in childhood or adolescence, involving parents in the intervention, and implementing the intervention in the family's home rather than an institutional setting. Subsequent articles like the 1987 "Behavioral Treatment and Normal Educational and Intellectual Functioning in Young Autistic Children" reinforce this proposal of early and intensive intervention—without the use of aversives (such as electric shocks)—paired with continual therapy yields the most effective results for children with autism.^[24] Lovaas highly believed that the support and involvement in parents applying therapy at home contributed to a higher success rate. Lovaas dedicated his life to the study of autism and was a strong advocate for people with autism even co-founding what is today the Autism Society of America.

Applied

ABA focuses on areas that are of social significance. In doing this, behavior scientists must take into consideration more than just the short-term behavior change, but also look at how behavior changes can affect the consumer, those who are close to the consumer, and how any change will affect the interactions between the two.

Behavioral

ABA must be behavioral, i.e.: behavior itself must change, not just what the consumer *says* about the behavior. It is not the goal of the behavior scientists to get their consumers to stop complaining about behavior problems, but rather to change the problem behavior itself. In addition, behavior must be objectively measured. A behavior scientist cannot resort to the measurement of non-behavioral substitutes. (Obviously multidisciplinary work within behavior and psychology may include, for example, analysis of cognition or demographics and exploration of the individual as well, where experimental standards are maintained.)

Analytic

ABA must be analytic, which means that the behavior analyst can control the behavior that is being changed by changing the control behavior. In the lab, this has been easy as the researcher can start and stop the behavior at will. However, in the applied situation, this is not always as easy, nor ethical, to do. According to Baer, Wolf, and Risley, this difficulty should not stop a science from upholding the strength of its principles. As such, they referred to two designs that are best used in applied settings to demonstrate control and maintain ethical standards. These are the reversal and multiple baseline designs. The reversal design is one in which the behavior of choice is measured prior to any intervention. Once the pattern appears stable, an intervention is introduced, and behavior is measured. If there is a change in behavior, measurement continues until the new pattern of behavior appears stable. Then, the intervention is removed, or reduced, and the behavior is measured to see if it changes again. If the behavior scientist truly has demonstrated control of the behavior with the intervention, the behavior of interest should change with intervention changes. Here control may be better called "effect" or "influence", of behavior.

Technological

This means that if any other researcher were to read a description of the study, that researcher would be able to "replicate the application with the same results."^[25]

This means that the description must be very detailed and clear. Ambiguous descriptions do not qualify. Cooper *et al.* describe a good check for the technological characteristic: "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." This is where the experiment is repeatable.

Conceptually Systematic

A defining characteristic is in regard to the interventions used; and thus research must be conceptually systematic by only using procedures and interpreting results of these procedures in terms of the principles from which they were derived.^[27]

Effective

ABA must be effective, which means that the application of these techniques changes the behavior it seeks to change. Specifically, it is not a theoretical importance of the variable, but rather the practical importance (social importance) that is essential. If the application of behavioral techniques does not produce a large enough effects for practical value, then the application has failed.

Generality[edit]

ABA must be general, which means that it persists over time, in different environments, and spreads to other behaviors not directly treated by the intervention. In addition, continued change in specified behavior after intervention for that behavior has been withdrawn is also an example of generality. It is a goal to identify behavior stimuli with long-lasting and general effect.

Proposed additional characteristics[edit]

In 2005, Heward, *et al.* added their belief that the following five characteristics should be added:

- **Accountable:** Direct and frequent measurement enables analysts to detect their success and failures to make changes in an effort to increase successes while decreasing failures. ABA is a scientific approach in which analysts may guess but then critically test ideas, rather than "guess and guess again." This constant revision of techniques, commitment to effectiveness and analysis of results leads to an accountable science.
- **Public:** Applied behavior analysis is completely visible and public. This means that there are no explanations that cannot be observed, but of course these are each imposed. There are no mystical, metaphysical explanations, hidden treatment, or magic. Thus, ABA produces results whose explanations are available to all of the public.

- **Doable:** ABA has a pragmatic element in that implementors of interventions can consist of a variety of individuals, from teachers to the participants themselves. This does not mean that ABA requires one simply to learn a few procedures, but with the proper planning, it can effectively be implemented by almost everyone willing to invest the effort.
- **Empowering:** ABA provides tools to practitioners that allow them to effectively change behavior. By constantly providing visual feedback to the practitioner on the results of the intervention, this feature of ABA allows clinicians to assess their skill level and builds confidence in their technology.
- **Optimistic:** According to several leading authors, practitioners skilled in behavior analysis have genuine cause to be optimistic for the following reasons:
 - Individual behavior is largely determined by learning and cumulative effects of the environment, which itself is manipulable
 - Direct and continuous measurements enable practitioners to detect small improvements in performance that might have otherwise been missed
 - As a practitioner uses behavioral techniques with positive outcomes, the more they will become optimistic about future success prospects
 - The literature provides many examples of success teaching individuals considered previously unteachable.

Concepts

Behavior is the activity of living organisms. Human behavior is the entire gamut of what people do including thinking and feeling. Behavior can be determined by applying the Dead Man's test:

If a dead man can do it, it isn't behavior. And if a dead man can't do it, then it is behavior.

This is obviously only a simple rubric.

Behavior is that portion of an organism's interaction with its environment that is characterized by detectable displacement in space through time of some part of the organism and that results in a measurable change in at least one aspect of the environment. Often, the term behavior is used to reference a larger class of responses that share physical dimensions or function. In this instance, the term *response* indicates a single instance of that behavior. If a group of responses have

the same function, this group can be classified as a response class. Finally, when discussing a person's collection of behavior, repertoire is used. It can either pertain specifically to a set of response classes that are relevant to a particular situation, or it can refer to every behavior that a person can do.

Environment

The environment is the entire constellation of stimuli in which an organism exists. This includes events both inside and outside of an organism, but only real physical events are included. The environment consists of stimuli. A stimulus is an "energy change that affects an organism through its receptor cells."

A stimulus can be described:

- **Topographically** by its physical features.
- **Temporally** by when they occur in respect to the behavior.
- **Functionally** by their effect on behavior.

Reinforcement

Reinforcement is the most important principle of behavior and a key element of most behavior change programs. It is the process by which behavior is strengthened, if a behavior is followed closely in time by a stimulus and this results in an increase in the future frequency of that behavior. The addition of a stimulus following an event that serves as a reinforcer is termed positive reinforcement. If the removal of an event serves as a reinforcer, this is termed negative reinforcement. There are multiple schedules of reinforcement that affect the future probability of behavior.

Punishment

Punishment is a process by which a consequence immediately follows a behavior which decreases the future frequency of that behavior. As with reinforcement, a stimulus can be added (positive punishment) or removed (negative punishment). Broadly, there are three types of punishment: presentation of aversive stimuli (e.g., pain), response cost (removal of desirable stimuli as in monetary fines), and restriction of freedom (as in a 'time out'). Punishment in practice can often result in unwanted side effects. Some other potential unwanted effects include resentment over being punished, attempts to escape the punishment, expression of pain and negative emotions associated with it, and recognition by the punished individual between the punishment and the person delivering it.

9.2 History of Functional Analysis

Prior to the seminal article on functional analytic methodology for aberrant behaviors, behavior analysts used the behavioral technology available to them at the time. Instead of treating the function of the disruptive behavior, behavior analysts would instead use potent consequences to manage disruptive behaviors. For example, in the past to decrease self-injurious behavior in an individual, behavior analysts may have delivered an aversive stimulus contingent on the response (Iwata, 1988). This type of intervention was successful to the individual, but it was not uncommon to see other variations of aberrant behavior begin to appear. Applied behavior analysis as a field favors reinforcement based interventions over punishment based intervention, but at the time the behavioral technology was not advanced enough and the individuals needing intervention had a right to an effective treatment (Van Houten et al., 1988). In 1977, Edward Carr published a paper on potential hypotheses for the occurrence and maintenance of self-injurious behaviors.

This paper laid out the initial groundwork for a functional analysis of aberrant behaviors. In the paper, Carr described five potential causes for self-injurious behaviors that included (1) positive social reinforcement contingent on the response, (2) negative reinforcement in the form of removal of an aversive stimulus contingent on the response, (3) the response produced stimuli possessed reinforcing qualities (automatic reinforcement), (4) the behavior was a byproduct of an underlying psychological condition, and (5) psychodynamic hypothesis in which the behavior was an attempt to reduce guilt. Throughout the paper, Carr cited recent research to support the first three hypotheses, and disprove the latter two hypotheses, but no formal experiment was conducted to determine the controlling variables of the problem behavior.

In 1982, Iwata and colleagues conducted the first experimental analysis of the maintaining variables for self-injurious behavior. In the paper, the researchers alternated between specific conditions to examine whether or not the behavior occurred under specific environmental conditions. Through direct manipulation of the environment, the researchers could accurately identify the controlling variables of the aberrant behavior, and provide interventions that targeted the functional relationship between the behavior and the environment. Since this seminal article was published, a wide range of research has been published in the area of functional analyses of aberrant behaviors. The methodology has since become the gold standard in assessment and treatment of aberrant behaviors.

9.3 Method of Identifying Functions of Behavior

FBA methods can be classified into three types: • Indirect assessment • Descriptive assessment • Functional (experimental) analysis

Indirect FBA

This method utilizes structured interviews, checklists, rating scales, or questionnaires to obtain information from persons who are familiar with the person exhibiting the behavior to identify possible conditions or events in the natural environment that correlate with the problem behavior. They are referred to as "indirect" because they do not involve direct observation of the behavior, but rather they solicit information based on others' recollections of the behavior. This form of assessment typically yields the least reliable information about the function of behavior, but can provide insight as to possible functions of the behavior to be tested in the future, the form of the behaviors (e.g. screaming, hitting, etc.), and environments in which the behavior typically occurs (e.g. school, home, etc.). This type of assessment should be performed as the initial step of any Functional Behavior Assessment to gather relevant information to complete more direct assessments.

Descriptive FBA

Unlike the indirect methods of FBAs, descriptive functional behavior assessment utilizes direct observation of behavior. These observations occur in the environment in which the behavior naturally occurs (e.g. school, home, etc.) therefore there is no direct manipulation of the environment. The most common form of descriptive assessment involves recording the antecedents and consequences that naturally occur when the individual emits the behavior. This is referred to as ABC data collection, in which (A) represents the common antecedent, (B) represents the behavior of interest, and (C) represents the immediate consequences that occurs following the behavior. ABC data collection is used to identify the naturally occurring consequences delivered in the environment in which the behavior occurs. ABC data collection can be conducted by a wide array of individuals who have received appropriate training on how to record the data. Another form of descriptive FBA is called a scatter plot. In this assessment, staff record the time and setting in which the behavior of interest occurs over a series of days. The data are plotted on a visual scale to indicate whether there are any patterns in the behavior. For example, does the behavior occur more frequently during math instruction than it does during lunchtime?

Although this assessment does not expose the staff member to the consequences of the behavior, it can be used to identify some of the antecedent conditions that typically surround the behavior of interest.

Functional (Experimental) Analysis

A functional analysis is the most direct form of Functional Behavior Assessments in which specific antecedents and consequences are systematically manipulated to test their separate effects on the behavior of interest. Each manipulation of the antecedent and consequence in a particular situation is referred to a condition. In a functional analysis, conditions are typically alternated between quite rapidly independent of responding to test the different functions of behavior. When data paths are elevated above the control condition (described below) it can be said that there is a functional relation between that condition and the behavior of interest. Below, common examples of experimental conditions are described. A standard functional analysis normally has four conditions (three test conditions and one control):

Conducting a Functional Behavior Assessment

Functional Behavior Assessments are rarely limited to only one of the methodologies described above. The most common, and most preferred, method of identifying the function of behavior can be seen as a four part processes. 1) The gathering of information via indirect and descriptive assessment. 2) Interpretation of information from indirect and descriptive assessment and formulation of a hypothesis about the purpose of problem behavior. 3) Testing of a hypothesis using a functional analysis. 4) Developing intervention options based on the function of problem behavior.

Efficacy in autism

ABA-based techniques are often used to treat autism, so much so that ABA itself is often mistakenly considered to be synonymous with therapy for autism. ABA for autism may be limited by diagnostic severity and IQ. The most influential and widely cited review of the literature regarding efficacy of treatments for Autism is the National Research Council's book *Educating Children with Autism* (2001) which concluded that ABA was the best research supported and most effective treatment for the main characteristics of Autism. Some critics claimed that the NRC's report was an inside job by behavior analysts but there were no board certified behavior analysts on the panel (which did include physicians, speech pathologists, educators, psychologists, and others).