Chapter 5
The Value of a Behavioral Analysis of Language for Autism Treatment

Mark L. Sundberg

Thank you Ron Leaf, Sally Rogers, and Bill Ahearn for your excellent presentations. I've enjoyed listening to you today and learning more about your programs. In general, the message you have all presented so far has been that behaviorally based interventions for children with autism are powerful, and their roots are well-established in the scientific literature. You gave us three examples of what behavior analysis has to offer autism treatment, and I will present a fourth, the applied behavior analysis/verbal behavior (ABA/VB) approach. But first, I would like to acknowledge that what we are collectively presenting here today is just a sample of the many behaviorally based models of autism treatment that are available in the literature. For example, incidental teaching (Hart & Risley, 1975), pivotal response training (Koegel, O'Dell, & Koegel, 1987), and CABAS (Greer & Ross, 2007) all provide solid behavioral intervention programs. These behavioral models, as well as others, all share a common basic foundation in behavior analysis, the branch of psychology initially set forth by B. F. Skinner. The application of behavior analysis to autism treatment has a long and successful history, and because that is the focus of our talks today, I would like to briefly review that history.

History of the Intervention Approach

B. F. Skinner's book *Science and Human Behavior* (1953) is considered to be the conceptual beginning of the field of Applied Behavior Analysis (ABA) (Morris, Smith, & Altus, 2005). The first systematic application of Skinner's analysis of

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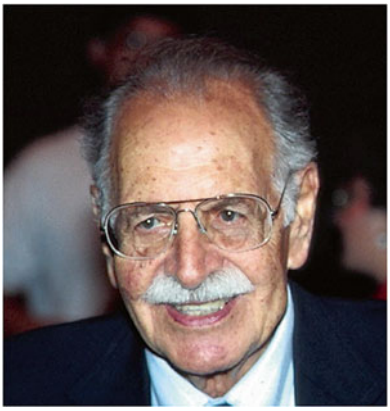
behavior to human problems was Ayllon and Michael's (1959) research at Saskatoon State Hospital in Saskatoon, Saskatchewan (Cooper, Heron, & Heward, 2007), where they worked with persons with schizophrenia and/or mental deficiencies. The title of their seminal research paper was "The psychiatric nurse as a behavioral engineer" and was Ayllon's doctoral dissertation at The University of Houston (U of H), with Jack Michael as his advisor. Their research demonstrated the immediate clinical success of several procedures based on operant principles (e.g., reinforcement, extinction, satiation) across a variety of human behaviors (e.g., psychotic talk, excessive entering of the nurses' office, self-feeding, magazine hording). Ferster (1961) provided the first behavioral analysis of the problems faced by children with autism, along with a line of related experimental research (e.g., Ferster & DeMyer, 1962). During that same time period, Sidney Bijou, who was a departmental colleague of Skinner's in the 1940s at Indiana University, was developing applications of Skinner's work at the Institute of Child Development in Seattle, WA. Bijou was a professor at the University of Washington (U-of-W) and the director of the Institute.

Jack Michael and B. F. Skinner, circa 1979

Jack Michael and Ted Ayllon, circa 2008

Charles B. Ferster, circa, 1972

Sidney Bijou, circa, 1990



By the late 1950s, Bijou had assembled an impressive team of students and professors at U-of W to work at the Institute. They established the first university-based clinical program that systematically applied behavioral principles and procedures to children with autism or other types of disabilities. Among Bijou's team was a fellow faculty member at U-of-W, Donald Baer. Bijou recruited several others to join them, including one of Jack Michael's Ph.D. students from Arizona State University (ASU), Montrose Wolf. Todd Risley was an undergraduate student at U-of-W at the time and also joined the team. Many of our field's early contributors participated in Bijou's program over the years including Jay Birnbrauer, Barbara Etzel, R. Vance Hall, Betty Hart, Rob Hawkins, Bill Hopkins, Ivar Lovaas, Jim Sherman, and Howard Sloane to name a few. In his memoriam to Bijou, Ghezzi (2010) wrote that this list of participants in Bijou's lab "reads like a who's who of pioneers in behavior analysis" (pp. 176–177). Ghezzi also noted that, "If applied behavior analysis has a birthplace it would be in Seattle at the University of Washington's Institute of Child Development with Sid at the helm" (p. 177). In fact, the first published application of behavioral principles to autism treatment was a study conducted at Bijou's Institute (Wolf, Risley, & Mees, 1964). That study presented many firsts in our field, including the first to use a reversal design, time out, reports of social validity, and the first to describe their intervention strategy as "discrete trial" instruction. Thus, it is quite clear that current models of ABA intervention for children with autism have their roots in this groundbreaking line of work, guided by Sid Bijou.

Jack Michael and Montrose Wolf, circa, 1975

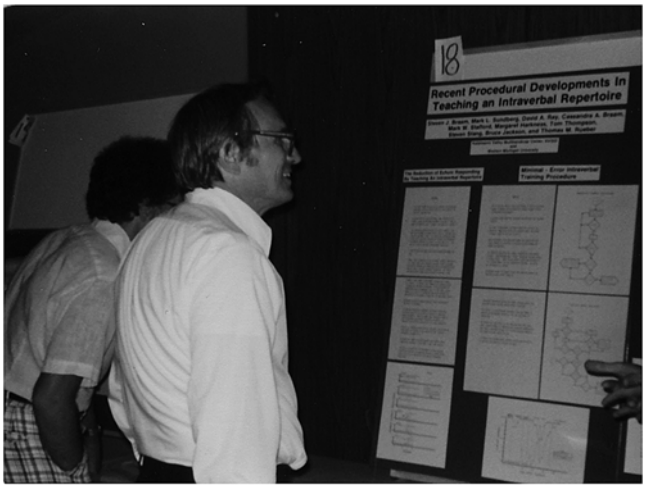
Donald Baer, Montrose Wolf, and Todd Risley, circa, 1999

The particular approach to autism treatment that I am going to present, "applied behavior analysis/verbal behavior" (ABA/VB) (also termed the "verbal behavior approach"), has its roots in the same history described above, as well as a history of its own, but involving some of the same pioneers identified above. Skinner published another book in the 1950s titled *Verbal Behavior* (1957). That book elaborated on several issues raised and discussed in *Science and Human Behavior* (1953), but primarily those that involved language. Skinner described a complete behavioral analysis of language that differed so significantly from all other treatments of language at the time that verbal protests erupted (e.g., Chomsky, 1959). Skinner's book was based on the basic principles of behavior and data published from the various animal and human operant research labs operating at the time. Skinner analyzed language as learned behavior under the control of the same environmental contingencies that control nonverbal behavior (i.e., stimulus control, motivation, reinforcement, extinction) and argued against the cognitive theories of language popular at the time. Skinner (1957) termed his approach to language as "A functional analysis of verbal behavior" (p. 1).

Jack Michael is widely recognized for his long-standing contributions to refining, teaching, and disseminating Skinner's analysis of verbal behavior (e.g., Michael, 1982, 1984, 1988, 2004). He began teaching verbal behavior in 1955 using a draft of Skinner's book, and along with his U-of-H and ASU colleague Lee Meyerson, began to undertake applied challenges such as deafness and intellectual disabilities (e.g., Meyerson & Michael, 1964). During that same time period, Joe Spradlin, at the University of Kansas and Parsons State Hospital, developed the first application of Skinner's analysis of verbal behavior to language assessment for low-verbal institutionalized persons (Spradlin, 1963). Spradlin was also instrumental in the early applications of Skinner's work on language to the development of intervention programs for persons with intellectual disabilities (e.g., Spradlin, 1966).

Lee Meyerson, circa, 1974

Joseph Spradlin, circa, 1979



Michael moved to Western Michigan University (WMU) in 1967 where he continued to teach a course on Skinner's analysis of verbal behavior every academic year and eventually added a "verbal behavior applications" course to his list of offerings (Sundberg, Michael, & Peterson, 1977). In addition, Michael was the research advisor for the Kalamazoo Valley Multihandicap Center (KVMC), a school district program directed by Jerry Shook (who later co-founded the Behavior Analyst Certification Board). KVMC provided services for approximately 70 multiply impaired children and young adults and was primarily staffed by WMU psychology department students. I was one of Michael's M.A. and Ph.D. students and the director of research at KVMC. Over a 6-year period during the 1970s, our group conducted approximately 50 research projects on verbal behavior and teaching language to children with disabilities. Many of these projects were theses or dissertations for Michael's students. Most of this research was presented at the early

Midwestern Association for Behavior Analysis and the Association for Behavior Analysis conferences. Several of these studies and projects were eventually published in various behavioral journals and books (e.g., Braam & Poling, 1983; Hall & Sundberg, 1987; Stafford, Sundberg, & Braam, 1988; Sundberg, 1983; Sundberg, Michael, Partington, & Sundberg, 1996; Touchette & Howard, 1984).

Jack Michael, Ivar Lovaas, and Mark Sundberg, circa, 1979

Spradlin's work on a behavioral approach to language assessment provided the foundation for later work on assessment (McGreevy, Fry, & Cornwall, 2012; Partington & Sundberg, 1998; Sundberg, 1983, 2007, 2008, 2014; Sundberg & Partington, 1998), as did his work on language intervention (Sundberg, 1980, 2007; Sundberg & Partington, 1998). As a result of the encouragement of Catania, Day, Glenn, Michael, Skinner, Spradlin, E. Vargas, Wood, and others at an ABA Special Interest Group meeting (Wood & Michael, 1977), I started a verbal behavior newsletter (VB NEWS) that later became the journal *The Analysis of Verbal Behavior* (TAVB). I was the Editor of that journal for the first 14 volumes. Currently, it is published by the Association for Behavior Analysis: International and is in its 32nd volume. Much of the conceptual and empirical basis for the ABA/VB approach can be found among the 352 papers published in TAVB, along with many additional verbal behavior papers published in variety of other journals, books, and online outlets.

Foundational Aspects of the ABA/VB Approach

The ABA/VB approach originated from the work of those cited above, especially B. F. Skinner, Jack Michael, and Joe Spradlin. I am going to suggest four basic components of this approach, all of which are derived from behavior analysis (Table 5.1).

Table 5.1 Four foundational aspects of the ABA/VB approach

1.	The teaching procedures are based on the basic concepts and principles of behavior analysis (e.g., Michael, 2004; Skinner, 1953)
2.	The language assessment and intervention programs are based on Skinner's (1957) analysis of verbal behavior
3.	The target skills and curriculum sequence are based on a behavioral analysis of human development and related research (e.g., Bijou & Baer, 1961, 1965, 1967; Novak & Pelaez, 2004; Schlinger, 1995)
4.	A behavioral analysis of language, learning, and social barriers that can impede progress is ongoing (Sundberg, 2014)

The Concepts and Principles of Behavior Analysis

The first component of the ABA/VB approach is that the specific teaching procedures that make up the daily intervention program are based on the concepts and principles of behavior analysis (e.g., Cooper et al., 2007; Michael, 2004; Skinner, 1953; Sundberg & Michael, 2001). These basic procedures are common to all intervention methods that are identified as constituting a behavioral approach (e.g., DTT, ABA, EIBI, PRT, ABA/VB). For example, teaching trials involve the commonly termed "three-term contingency" consisting of antecedents, behavior, and consequences. In a structured teaching arrangement, if the target is to teach a child to tact a specific item (e.g., a cup), the instructor would present the item while prompting the child to respond with a general verbal prompt (e.g., "What is it?") and possibly with a direct echoic prompt (e.g., "Say cup") and differentially reinforce successive approximations to the target behavior. The instructor would gradually fade out the prompts over a number of teaching trials in order to establish the nonverbal stimulus as a discriminative stimulus (S^D) that evokes the targeted tact response. This is the basic discrete trial teaching (DTT) format that was first introduced by Wolf et al. (1964), elaborated on extensively by Lovaas (1977), and now common in the behavioral treatment of autism (e.g., Maurice, Green, & Luce, 1996).

In a natural environment teaching arrangement (e.g., Hart & Risley, 1975; Koegel et al., 1987), the same three-term-contingency framework also guides the intervention, but this arrangement makes use of a child's motivating operations (MOs), as well as naturally occurring stimuli, routines, and activities in the child's daily environment. For example, if a child initiates an interaction to play with a train set (MO is strong), attempts to establish various forms of stimulus control are implemented. If a particular imitative behavior is desired (e.g., pushing the train), that behavior would be modeled by an adult, who would then prompt the child to imitate her, and if at least an approximation to the target behavior occurs, praise and perhaps other reinforcers are delivered. The ABA/VB approach makes use of both discrete trial teaching and natural environment teaching methods. (For more detail on the distinction between these teaching strategies, related research, and the suggested need for both methodologies, see Sundberg & Partington, 1999.)

Table 5.2 A sample of 25 behavioral principles and concepts

Motivating operations	Stimulus control
Prompting	Fading
Shaping	Chaining
Reinforcement	Extinction
Differential reinforcement procedures (e.g., DRO, DRI)	Pairing
Intermittent reinforcement procedures (e.g., VR, FI, VI)	Modeling
Structured and natural environment teaching methods	Generalization
Transfer of stimulus control techniques	Errorless learning
Behavioral momentum techniques	Fluency procedures
Conditional discrimination training	Task analysis
Contingency contracting	Token economies
Multiple exemplar training	Interspersal methods
Functional and descriptive analyses	

There are hundreds of different teaching procedures that make up an ABA style program. These procedures are based on the concepts and principles of behavior analysis and have many variations (e.g., Cooper et al., 2007; Michael, 2004). A sample of 25 of the basic behavioral principles and concepts is presented in Table 5.2. In the behavioral literature, each of these topics often has its own chapter, or even an entire book devoted to it (e.g., *The Token Economy*, by Ayllon & Azrin, 1968). A primary task for those who design and implement ABA programs is to teach staff and parents how to implement behavioral procedures, as well as how to determine when a procedure is appropriate for a given problem or child. More details on the scientific background, technical concepts, procedures, and methodology of applied behavior analysis can be found in any one of a number of textbooks currently available (e.g., Cooper et al., 2007; Malott & Shane, 2013; Martin & Pear, 2015; Miltenberger, 2015; Sulzer-Azaroff, Mayer, & Wallace, 2013).

Skinner's (1957) Analysis of Verbal Behavior

The second component of ABA/VB, the application of Skinner's (1957) analysis of verbal behavior, is the most distinguishing aspect of the ABA/VB approach. Given that "social communication" deficits constitute the primary diagnostic criteria for autism according to the DSM-5, any approach for teaching children with autism should contain an intensive language intervention component. The question is what theory of language should be used to frame the assessment and intervention process? There are many choices with the majority of views stemming from biological or cognitive theories of language (e.g., Brown, 1973; Bruner, 1983; Chomsky, 1957; McNeill, 1970; Piaget, 1952; Pinker, 1994; Slobin, 1973). Noam Chomsky stands out as one of the most famous psycholinguists, perhaps best known for his strong criticism of Skinner's analysis of verbal behavior (Chomsky, 1959). But, despite the

commonly held (and erroneous) view that Chomsky proved Skinner and his views of language wrong, behavioral psychology, including Skinner's analysis of verbal behavior, provides the core of modern day "effective-treatments" for children with autism (National Standards Project, 2014). On the other hand, there is to date no known application of Chomsky's theory to autism treatment offered by those who maintain Chomsky's position on language acquisition.

However, cognitive psychology still provides the foundation for most language assessment and intervention programs used for children with autism (Esch, LaLonde, & Esch, 2010). In this traditional conceptual framework of language, it is characteristic to divide language into expressive and receptive components (e.g., Brown, 1973). Skinner (1957) argued against this dichotomy and conceptual foundation of language for a number of reasons. Perhaps most relevant to our goals of teaching children with autism to communicate is that "expressive language" is actually comprised of several different language functions. That is, the same word can have different functions (or "meanings"), and a child with autism may demonstrate one function of a word, but not another. For example, a child could say "spoon" because he sees a spoon (called a "tact" by Skinner), or he could say "spoon," because he needs a spoon and none are present ("mand"), or he could say "spoon" when none are visible, but he hears "knife, fork, and…" (intraverbal). From Skinner's point of view, despite that the same word is emitted in each example, that word is evoked by different antecedents, and thus have different functions. It is not uncommon to identify children with autism who can emit one function (often tacting) but not the others. Thus, when one term "expressive language" is applied to all three of these different functions, important distinctions and possible language deficits can be missed in the assessment and intervention process.

I would like to offer a quote from Skinner (1957), early in his book *Verbal Behavior*: "What happens when a [person] speaks or responds to speech is clearly a question about human behavior and hence a question to be answered with the concepts and techniques of psychology as an experimental science of behavior." (p. 5). So, early on in the book, Skinner makes his position clear: language is behavior. Thus, behavior analysis should participate in the analysis and understanding of this type of behavior. He also states, "we don't find this field unoccupied" (p. 3). We are not the first ones to offer an analysis of language, but Skinner's basic and unique premise is that speaking and listening constitute behavior. So if they are behaviors, they are a function of antecedents and consequences, and a specific learning history, just like nonverbal behavior. Thus, from Skinner's point of view, the same basic principles of behavior that apply to nonverbal behavior (e.g., stimulus control, MOs, reinforcement, extinction) also apply to verbal behavior. There are no new principles of behavior required to explain language. The only difference between the two is in the way they are reinforced. Nonverbal behavior obtains its reinforcement directly from the environment, whereas verbal behavior obtains its reinforcement through the behavior of another person, that is, it is a socially mediated type of reinforcement, and a complete verbal episode involves both a speaker and a listener (for more detail on the definition of verbal behavior see Normand, 2009).

Earlier, Bill Ahearn talked about the difference between functional and structural approaches to understanding human behavior. For the most part, autism treatment is dominated by structural approaches to language. Bill pointed out some of the problems of structural approaches to working with behavior problems and the clear advantages, clinically, for using a functional approach. For example, if one is asked to work with a child who pulls others' hair, the structural quantification of hair pulling alone will not identify the cause of the behavior, which is what the clinician needs to know in order to change the behavior. The behavior analyst would look at a negative behavior like hair pulling and ask, "What's the function?" "What's the source of control for this behavior?" "What are the antecedents that evoke the behavior?" "What are the consequences?" "What is the history of this behavior?" "Is the behavior related to motivating operations or verbal behavior?" Knowing the function of a behavior tells us what to do. The same problems that Bill identified for structural approaches to behavior problems exist for structural approaches to language. What is most important is not the specific words that are emitted, but the sources of control that evoke these words, that is, the relevant antecedents, consequences, and learning history. A functional analysis is the basis of behavior analysis, including Skinner's analysis of language.

The field of speech and language pathology and applied behavior analysis share much in common when it comes to the treatment of children with autism. I've worked in many different public schools, private schools, and homes over the years, and speech and language pathologists (SLPs) are often on the same page as behavior analysts. We may have different terms and talk differently about language, but our goals are often the same. We have to teach the child to communicate. We have to teach him to request (or mand for) the things he wants using words, signs, or icon exchange. We have to teach him to name objects and actions in his environment, understand what those words mean, imitate our actions and words, and so on. SLPs have long used the basic principles and concepts of behavior analysis, that is, they use prompting, fading, shaping, differential reinforcement, etc., as key elements of their intervention procedures. Over the past few decades, however, the field of speech pathology is moving closer and closer to a functional analysis of language, and I think work in the area of autism is facilitating that union.

Support for this transition to a functional analysis of language comes from within the field of speech pathology. Hedge (2010), an author of several speech pathology textbooks notes, "SLPs have successfully used the behavioral intervention procedures….If the SLPs also adopt a functional (cause-effect) analysis of verbal behaviors, they would then be internally more consistent with their concepts and treatment methods. Treatment research in child language disorders has generally supported Skinner's view that verbal behavior is not organized structurally, but functionally" (p. 110). However, structural approaches to language still dominate language assessment and intervention programs for children with autism. While Skinner's analysis of verbal behavior was published 60 years ago, the basic principles of behavior have not changed and his analysis is still quite relevant to the current efforts to teach language to persons in whom it is absent or impaired.

Skinner (1957) preferred the terms "speaker" and "listener" over the terms "expressive language" and "receptive language" for a number of reasons. Perhaps most bothersome to Skinner was that in traditional cognitive theories of language "Common processes are suggested when language is said to arouse in the mind of the listener 'ideas present in the mind of the speaker,' or when communication is regarded as successful only if an expression has 'the same meaning for both speaker and listener.' Theories of meaning are usually applied to both speaker and listener as if the meaning process were the same for both" (pp. 34–35).

Skinner's Analysis of Speaker Behavior

The basic premise of Skinner's analysis of verbal behavior is that language constitutes learned behavior under the functional control of environmental contingencies. An important aspect of this analysis is that the same behavior (e.g., saying "spoon" or pulling hair) can have different functions, thus constitute different operant behaviors. In addition, Skinner points out that the speaker and listener have different roles in verbal discourse and must be analyzed separately. Although some important aspects of listening are actually covert speaking (e.g., "thinking") and constitute verbal behavior, that should be analyzed as such (Schlinger, 2008). At the core of Skinner's functional analysis of speaker behavior is the distinction between the mand, tact, and intraverbal (listener behavior is also important and I'll discuss that in more detail shortly). As mentioned previously, these three types of verbal behavior are traditionally all classified in one category, expressive language. Skinner suggests that the expressive classification system lumps together important distinctions between functionally independent types of language. In addition to these three core verbal operants, Skinner (1957) also presents the echoic (including motor imitation as it relates to sign language), textual, transcriptive, and copying-a-text relations. These "elementary verbal operants" are viewed as separate functional units that serve as the basis for building more advanced verbal skills (Michael, Palmer, & Sundberg, 2011). Let us now look more closely at the mand, tact, and intraverbal, and the different sources of control that define these types of verbal behavior.

Mand. The mand is a type of verbal behavior where words (or signs, icon exchanges, etc.) are under the functional control of MOs affecting a speaker. That is, a speaker emits words to ask for things or actions that he wants or does not want. For example, a child may ask for milk that is missing when he needs milk for his cereal. The MO related to eating the cereal and the missing milk primarily controls the mand "milk." The reinforcement for the mand is what Skinner calls "specific reinforcement," in that the response identifies the motivator and the consequence is specific to that motivator and satisfies it (the child gets the milk). The same child may also ask for "up" when he is finished eating and wants to get out of a high chair (a mand regarding removing an aversive). Skinner (1957) coined the term mand because it is conveniently brief and is similar to the common English words "com**mand**," "de**mand**," "repri**mand**," and "**mand**atory."

Mands are very important for the early development of language and for the day-to-day verbal interactions with others. Mands are usually the first type of communication acquired by an infant (Bijou & Baer, 1965; Novak & Pelaez, 2004; Schlinger, 1995; Skinner, 1957). These early mands occur in the form of differential crying or eye contact when an infant is hungry, tired, in pain, cold, afraid, or wants social attention. As the infant grows, crying and eye contact can also occur as a mand for toys, help, movement of objects and people, or for the removal of aversive stimuli. Typically, developing children learn to replace crying with words or other standard forms of communication. Manding lets children interact with others in their world and begins to establish the speaker and listener roles that are essential for further verbal development.

Skinner (1957) points out that the mand is the only type of verbal behavior that "directly benefits the speaker" (p. 36), meaning the mand (often) gets the speaker what he wants such as edibles, toys, activities, attention, or the removal of aversive stimuli. As a result, mands can become strong forms of verbal behavior because they satisfy the needs experienced by the child. Young children often engage in a high rate of manding because of these special effects. Eventually, a child learns to mand for many different reinforcers, including mands for verbal information with words like "what," "who," and "where," and the child's acquisition of new verbal behavior accelerates rapidly (Brown, Cazden, & Bellugi, 1969). Ultimately, mands become quite complex and play a critical role in social interaction, conversations, academic behavior, employment, and virtually every aspect of human behavior. Perhaps one of the most valuable pieces of information about a child with autism is the nature of his existing mand repertoire. Given the role of the mand in typical language development, and its frequent relation to problem behavior (e.g., crying, tantrums, refusal) when a child cannot communicate his needs and wants, many clinical issues can be revealed by an analysis of a child's current ability to mand.

Tact. The tact is a type of language where a speaker verbally identifies items, actions, attributes, locations, relationships, etc. in the immediate physical environment. The speaker has direct contact with these "nonverbal" stimuli through any of his sense modes. For example, if a child says "Dog" because he sees a dog, this type of verbal behavior would be classified as a tact. Skinner (1957) selected the term tact because it suggests that a speaker is making direct contact with the physical environment. Technically, the tact is a verbal operant under the functional control of a nonverbal S^D and it is followed by generalized conditioned reinforcement. The tact relation is closely synonymous with what is commonly identified as "expressive labeling" in many language training programs for children with language delays (e.g., Lovaas, 2003).

There are many nonverbal stimuli in a child's world that he eventually must learn to tact. Some of the first tacts that children may acquire include family member's names, toys, common household objects, clothing, pets, etc. (e.g., mama, ball, kitty, car, cup, book). Nonverbal stimuli come in many forms. They can be, for example, static (nouns), transitory (verbs), relations between objects (prepositions), properties of objects (adjectives), possession of objects or actions (pronouns), properties of actions (adverbs), and so on. Nonverbal stimuli can be simple

like a shoe or complex like a shopping mall. A stimulus configuration can also have multiple nonverbal properties (e.g., color, size, location), and a response may be under the control of those multiple properties, as in the tact, "The black dog jumped up on the table and ate my sandwich." Nonverbal stimuli may be observable (e.g., a car) or unobservable (e.g., pain), subtle (e.g., a wink) or salient (e.g., flashing neon lights), or involve properties common to many different nonverbal stimuli (e.g., size, color). Given the variation and ubiquity of nonverbal stimuli in the physical world, it is no surprise that the tact is a primary topic in the study of language (Skinner, 1957; Sundberg, 2015).

Intraverbal. The intraverbal is a type of language where a speaker verbally responds (including sign language) to the words of others. He also can intraverbally respond to his own words as a type of self-listening (e.g., problem solving). In general, intraverbal behavior involves "talking about" things and activities that are not present. For example, saying "farm" as a result of hearing someone say "Old McDonald had a…" is intraverbal behavior. Answering questions like, "What did you do last night?" or "What's your favorite sport?" is also intraverbal behavior. Intraverbal behavior can involve talking about things and activities when they are present, but this would constitute multiple control and should be analyzed as such (Skinner, 1957). Typically developing children emit a high frequency of intraverbal responses in the form of singing songs, telling stories, describing activities, explaining problems, and so on. Intraverbal responses are also important components of many intellectual behaviors (e.g., when asked, "What does a plant need to grow?" saying "water, soil, and sunshine," or, saying "ten" as a result of hearing "five plus five equals…"). An intraverbal repertoire can become quite massive and complex. Typical adolescents and adults have hundreds of thousands of intraverbal connections in their language repertoires, and they may emit thousands of them every day.

In technical terms, an intraverbal occurs when a verbal S^D evokes a verbal response that does not have point-to-point correspondence with the verbal stimulus (Skinner, 1957). No point-to-point correspondence means the verbal stimulus and the verbal response do not match each other, as they do in the echoic and textual relations. Like all verbal operants (except the mand), the intraverbal produces generalized conditioned reinforcement. For example, in an educational context, the reinforcement for correct answers usually involves some form of generalized conditioned reinforcement such as hearing "right" from a teacher, receiving good grades, or the opportunity to move to the next problem or level.

Many children with autism fail to acquire a functioning intraverbal repertoire. While there are various causes of this, one preventable cause is that the intraverbal relation is not assessed as a separate verbal skill and taught accordingly. It is often assumed that intraverbal skills, like manding, will simply develop from training on tact and listener skills. Often, by the time a child's conversational, social, and verbal skills are identified as weak or impaired, they have developed "barriers" such as prompt dependency, rote responding, or negative behavior. An individual's failure to verbally respond to verbal stimuli may make it hard to develop a functional intraverbal repertoire. Children begin to acquire simple intraverbal behavior

following the acquisition of a beginning mand, tact, and listener repertoires. It's important to note that "conversations" are comprised of a combination of the different verbal and listening skills, but none are more critical than the intraverbal. For many children, the emergence of intraverbal behavior can be observed at around the age of two. Many of these early intraverbal relations are quite simple, such as songs, animal sounds, and one- and two-word intraverbal associations and relations (e.g., "Mommy and…"). More complex intraverbal responses, such as answering multiple component questions (e.g., "Why do you wear shoes on your feet?"), may not occur with typically developing children until around 3 or 4 years old (Sundberg & Sundberg, 2011).

Distinctions between the mand, tact, and intraverbal. There are many clinical benefits for making the distinction between the mand, tact, and intraverbal for children with autism. An assessment that respects the distinction between the verbal operants may reveal that one operant is strong, (e.g., tact), while others are weak (e.g., mand, intraverbal). That is, even though a child may be able to tact a spoon when he sees a spoon, that the same child may not be able to mand for the spoon when he needs one, or intraverbally answer the question, "What do you eat cereal with?" when a spoon is not visually present. While the response "spoon" is topographically the same in all three examples, the three repertoires are functionally separate behavioral relations (Skinner, 1957). As previously mentioned, it is quite common and accepted to blend these repertoires together as expressive language and not identify the functional differences. Yet, we often see children, for example, who demonstrate strong tact repertoires, but have weak or absent mand and intraverbal skills regarding the same words. One child I worked with could tact over a dozen different types of dinosaurs, but when his dinosaurs were missing he could not mand "dinosaur." Nor could he say "dinosaur" when asked the intraverbal fill-in, "A stegosaurus is a…", despite that he could easily tact "stegosaurus" when asked to do so.

This problem becomes more apparent when we look at common language assessments used for children with autism (Esch et al., 2010). For example, the expressive section of the *Peabody Picture Vocabulary Test* (Dunn & Dunn, 2007) primarily assesses the tact repertoire and then provides a norm-referenced age equivalent score. If you are told your child has a 2.1 expressive vocabulary, the implication is that his language level is approximately that of a typically developing 2-year-old. Yet, a typically developing 2-year-old is far beyond just being able to tact. A 2-year-old also has an extensive mand repertoire. A 2-year-old emits thousands of words a day, with a high rate of unprompted verbal behavior. A 2-year-old demonstrates observational learning, often learns new words in one or two trials, and generalizes and maintains these new words without formal training. Thus, basing an intervention program on the results of a tact assessment alone may not completely identify a child's linguistic needs. In addition, neglect of the other verbal operants may lead to a premature focus on more advanced tacting such as prepositions, adjectives, and adverbs when the child may not be developmentally ready, and potentially producing rote responding.

Skinner's Analysis of Listener Behavior

Skinner (1957) provides extensive detail regarding the behavior of the listener, including two full chapters mostly devoted to the topic (Chaps. 6 and 7). In addition to noting that much of what is termed "listening" is actually covert verbal behavior and should be analyzed as such (Schlinger, 2008), Skinner identifies four different roles of a listener that can be applied to children with autism.

Listener discriminations. The most familiar role of a listener in ABA programs is his ability to understand the words of a speaker, commonly referred to as "receptive language," or "receptive labeling." That is, when a speaker emits words, does the listener comprehend what is said in some measurable manner? At the simplest level, do verbal stimuli (e.g., "jump") evoke a corresponding nonverbal response (i.e., jumping) on the part of the listener? Does the listener discriminate between verbal stimuli (e.g., "jump" "arms up") as demonstrated by differential behaviors? At a more complex level, when verbal stimuli interact with nonverbal stimuli (e.g., "touch car") does the verbal stimulus alter the evocative effect of the nonverbal stimulus in the form of a conditional discrimination (Saunders & Spradlin, 1989)? Much of our treatment efforts with children who have language delays involve establishing these types of discriminations (i.e., receptive discriminations), but they represent only one type of listener skill, although certainly an important type.

Audience participation. A listener also serves as an audience for a speaker. Skinner devotes a whole chapter in the book *Verbal Behavior* (Chap. 7) to audience control. "An audience, then, is a discriminative stimulus in the presence of which verbal behavior is characteristically reinforced and in the presence of which, therefore, it is characteristically strong" (p. 172). Children with language delays also need to learn to serve this role as an audience for others (e.g., making eye contact, emitting facial expression indicating listening is occurring). Skinner identifies several types of audience control, one of which is that an audience sets the occasion for particular topics of discussion. He notes, "A third function of an audience is to select a subject matter. Listeners differ in the extent to which they reinforce different types of verbal operants and, particularly, various classes of intraverbal responses and tacts. Given a single speaker with a specific history and a specific current situation, the audience will determine not only whether verbal behavior occurs, or the subdivision of the language in which it occurs, but also what types of responses are made and 'what is talked about'" (p. 175). For example, if a child with autism is skilled in a certain video game (e.g., Minecraft), his presence among peers with similar interests can function as an S^D to evoke verbal behavior regarding that particular game. Learning to serve as an audience is an important and appreciated aspect of social behavior.

Mediator of reinforcement. A listener also acknowledges and reinforces a speaker in a number of important ways. He may emit behaviors that increase or maintain verbal interactions such as smiling, nodding, agreeing, and making eye contact when a person talks. In addition, the listener may act upon specific words spoken by another person, for example, opening a door upon hearing "Can you open the door for me?"

Learning to behave in this manner may require specific training for children with autism. This repertoire is not the same as listener discriminations skills. Many children with autism have extensive listener discrimination skills (e.g., they could identify a 1000 different pictures if asked), but they may have problems with looking at speakers, acknowledging and reinforcing speakers, or acting upon what they are saying. For these individuals, it is these various nonverbal behaviors that should become the target for intervention. It is important to note that these listener problems are identified in DSM-5 as nonverbal communication skills.

Emotional responses. Skinner also describes an emotional effect of language, that is, words alone can elicit respondent behaviors (e.g., emotions such as fear and joy). He writes "In the behavior of the listener (or reader)…verbal stimuli evoke responses appropriate to some of the variables which have affected the speaker. These may be conditioned reflexes of the Pavlovian variety or discriminated operants. The listener reacts to the verbal stimulus with conditioned reflexes, usually of an emotional sort" (p. 357). For example, when somebody tells you sad news, genuine respondent behaviors (e.g., tears) along with related operant behaviors that are usually described as empathy ("I'm sorry to hear that") may occur. Part of a listener repertoire involves being emotionally affected by verbal stimuli. Displaying empathy is often a problem for children with autism, and establishing this type of listener behavior may help to facilitate caring, compassion, and other empathetic behaviors.

Applications of Skinner's Analysis of Verbal Behavior

Early in *Verbal Behavior* Skinner makes the point that "The formulation is inherently practical and suggests immediate technological applications at almost every step" (p. 12). Many of the 50 research projects conducted in the 1970s that I mentioned previously were designed to address specific communication problems presented by children and young adults with language delays, and indeed there is an abundant supply of applications and research topics available from Skinner's book (e.g., Sundberg, 1991). Current applications of Skinner's analysis cover a wide variety of language issues and populations (for reviews see Oah & Dickinson, 1989; Sautter & LeBlanc, 2006). In an effort to increase awareness of the value of Skinner's contributions to language intervention, Jack Michael and I published a paper (Sundberg & Michael, 2001) suggesting that Skinner's analysis of language had several specific benefits for children with autism. In doing so, we made the point that Skinner's analysis of verbal behavior is "additive" to the existing ABA style of behavioral programs for autism treatment. I would like to describe some of those additional benefits, as well as a couple of others, and how they could add to a child's program.

Incorporate the mand relation into the program. Most ABA-based early intervention programs for children with autism formally target five core domains: matching-to-sample and sorting, motor imitation, vocal imitation, expressive labeling (tact),

and receptive labeling (listener discrimination). Teaching procedures for these core skills were first developed in Bijou's lab, and then elaborated on by Lovaas (1977). In our paper (Sundberg & Michael, 2001), we suggest adding the mand relation to those five core skills, and we identify several advantages for doing so. Those five core skills are still quite important, but it is imperative that a child be able to emit verbal behavior under motivational control, so language becomes useful and functional for the child.

An example of the additive nature of the mand involved a project we conducted at KVMC with deaf teenagers with autism who could tact several items using sign language and identify those same items as a listener, but could not mand for those items when they were needed, but missing (Hall & Sundberg, 1987). For example, one participant who enjoyed instant coffee could tact all the items necessary to make the coffee, identify those items as a listener (via sign language), and even independently make coffee. But when one of the necessary items was missing (e.g., hot water), despite that the participant could tact the item when it was present (S^D control), he could not mand for it when it was missing (MO control). An interrupted chain procedure was used to create an MO, and then a prompting and fading procedure was used to transfer antecedent control from an S^D to an MO (i.e., tact to mand transfer). The conclusion of this research was that the mand can be functionally independent from the tact in language acquisition and may need to be directly trained for some individuals. These data demonstrate the value of adding the mand domain to the group of 5 core skills for language intervention programs for children with autism.

Incorporate MOs into the intervention program. Skinner has always treated motivation as an antecedent variable that is separate from stimulus control (Michael, 1982; 2007; Skinner, 1953; Sundberg, 2013). The example I just presented with the coffee and manding exemplifies that distinction. If you are unfamiliar with MOs, I'd suggest reading Jack Michael's (2007) chapter in Cooper et al. (2007), titled "Motivating operations." Motivation is an important cause of human behavior and many aspects of this principle of behavior can be additive to an ABA program for children with autism. The role of the MO as the primary source of control for manding is now well-appreciated, but there are other applications of the MO principle. For example, the MO can be used as an additional antecedent variable to teach skills such as imitating, tacting, listener discriminations, reading, self-care, play, functional living skills, and social behavior. In fact, for some of these skills, the MO may be quite useful. Self-care offers such an example. If I were to ask you "Why do you bath, brush your teeth, and wear clothes that match?" My guess would be that it could be related to an MO to make a good impression on people, or it might make you automatically feel good, or it might allow you to avoid social punishment for not doing so, all of these involve different behavioral effects. Capturing or creating any of these MOs could play a role in teaching and maintaining self-care skills to individuals with disabilities. There are many potential applications of the MO concept to autism treatment (e.g., Carbone, 2013; Sundberg, 1993, 2013), and the ability to use MOs in intervention programs is a powerful set of clinical skills that can improve the results of a child's program.

Incorporate intraverbal training into the program. As previously mentioned, an intraverbal repertoire is not the same as a mand and tact repertoire, even though the same words might be involved. In addition, the presence of a tact repertoire does not guarantee the presence of an intraverbal repertoire, or vice versa. The example I gave previously regarding the spoon provided a demonstration of this. A child may be able to say "spoon" when he sees a spoon, but not be able to answer the question "What do you eat soup with?" In one of the early studies conducted at KVMC, Braam and Poling (1983) demonstrated this separation with teenagers with autism who could tact, for example, home things and school things, but could not answer questions regarding those items ("Can you name some school things?"), until specific intraverbal training was provided. Intraverbal development occurs with typical children well after early mands and tacts are firmly established, which is usually about 2 years of age (Sundberg & Sundberg, 2011). The intraverbal is perhaps the most difficult of the verbal operants to directly teach due to the complexity of stimuli and responses involved (Axe, 2008; Eikeseth & Smith, 2013). However, it is important to include intraverbal training in a child's program, when they are ready, because it is an essential part of our daily verbal interactions with others (e.g., education, safety, socializing with peers). The concept of the intraverbal, and its applications, demonstrates another additive feature of Skinner's analysis of verbal behavior for autism treatment.

Use the verbal operants as a framework for language assessment. I previously mentioned the work of Spradlin (1963) in developing the *Parsons Language Sample* as a tool for language assessment. Spradlin's assessment contained items for echoic, imitation, mand, tact, and intraverbal skills and sections for speech as well as signed responses. This assessment tool went far beyond other tools available at the time to identify language intervention needs. With Spradlin's permission, I modified this assessment tool (Sundberg, 1983) for use with younger children with language delays, and have since expanded on it in many ways (Partington & Sundberg, 1998; Sundberg, 2008, 2014; Sundberg & Partington, 1998). The *Verbal Behavior Milestones Assessment and Placement Program* (*VB-MAPP*) (Sundberg, 2014) is the most current version of an ABA/VB-based assessment tool. The VB-MAPP provides more information about an individual child than commonly used standardized language assessments (Esch et al., 2010). The VB-MAPP contains an assessment of 170 milestones across 16 language, play, and social domains that are developmentally matched to typical children. In addition, this tool contains an assessment of 24 language, learning, and social barriers that may impede progress and prevent a child from learning new skills. The VB-MAPP also contains a transition assessment to help determine what educational format might be of most value to a child (e.g., 1:1 instruction and/or group instruction, a center-based or inclusion program, DTT and/or NET) and help parents and educators make decisions. A list of supporting skills is also provided with an additional 700 skills that can be incorporated into an intervention program when appropriate. The final component of the VB-MAPP is a placement program that can be used to interpret the assessment results and guide an individualized educational program for a child.

Fig. 5.1 An example of a 3-year-old child's VB-MAPP profile

A sample of a VB-MAPP Milestones assessment scoring form is presented in Fig. 5.1. This is the scoring form for Jacob, a 3-year-old boy with autism who does not emit any functional speech. His overall score on the VB-MAPP Milestones Assessment is in the Level 1 range as indicated by a score of 31 out of a possible score of 170. This places his language abilities around the developmental age of approximately 12–16 months. His comparative scores across domains are out of balance, demonstrating that some skills are much stronger than others. His general strengths are in the areas of visual perceptual and matching-to-sample skills, motor imitation, echoic, and play skills, while his weaknesses are in the areas of mand, tact, listener skills, and social skills (which constitute the primary domains of early lan-

guage development and social behaviors). Jacob's VB-MAPP shows that a number of language and social skills are needed, and these should be the focus of his IEP and addressed in his daily intervention program. For example, his profile would suggest an intensive intervention program be implemented with the priorities being to establish a functional mand repertoire, free from echoic prompts, as well as targeting tacts, listener skills, social skills, and generalization of those skills. His strengths in the matching-to-sample, motor imitation, and echoic domains can be used to help teach mands, tacts, listener discriminations, and social skills (Sundberg, 2014).

Use the verbal operants as a framework for language intervention. A language intervention program for a child with autism should include training on all the verbal operants if needed, as well as on listener skills. Developmental norms should be considered and respected to help judge the appropriateness of the curriculum. The VB-MAPP can be used to guide that intervention program, insuring that each verbal operant is developed in a systematic manner. For example, if a child can emit listener discriminations, but not tacts, tact training should become an important part of his intervention program. Or, if he can tact, but not mand, then mand training should be included in the program. Ultimately, all of the verbal operants need to be developed and be reasonably balanced with each other. The VB-MAPP Barriers Assessment can help to identify specific problems a child may face, and lead to an individualized intervention program for those problems. For example, if a child is prompt-dependent, then specific procedures should be implemented to teach the child to self-initiate and be less dependent on prompts. But also, those implementing programming in the future should be careful to free responses from prompts during training. The book *Teaching language to children with autism or other developmental disabilities* (Sundberg & Partington, 1998) provides a verbal behavior-based intervention program that describes the basic training procedures for each of the verbal operants, as well as listener and matching skills.

Automatic reinforcement. Earlier, Bill Ahearn brought up the concept of automatic reinforcement in relation to problem behavior. This concept also plays a role in language acquisition. Skinner used the term automatic reinforcement in a number of his writings simply to indicate that reinforcement for a behavior can occur without someone directly providing it (Palmer, 1996; Vaughan & Michael, 1982). Automatic reinforcement, in lay terms, can occur because a behavior is fun to do (e.g., drawing, singing, self-stimulation) or has practical environment effects that are reinforcing (e.g., pushing on a door opens the door). There are many applications of this concept to skill acquisition for children with autism (Sundberg et al., 1996). For example, initially a child may need to be taught to imitate others, but eventually the child may imitate others because the behavior itself is fun and automatically reinforcing. This effect becomes obvious when the child independently emits adult behaviors (e.g., a funny walk, pretending to talk on a phone). It can be fun to act like mom or dad, sound like a movie or TV character, or follow peers who are running around. Again, the use of procedures to bring behavior under the control of automatic reinforcers is additive to existing ABA procedures (for a review of the research see Stock, Schulze, & Mirenda, 2008).

Multiple causation. One of the advantages of Skinner's functional analysis of language is that by clearly identifying the primary antecedent variable for each verbal operant, it is easy to identify situations where more than one variable is involved in evoking a specific response. Skinner calls this "multiple causation" (p. 227) and points out that most of our verbal behavior involves multiple antecedents and responses. Multiple causation pays an important role in our day-to-day behavior and constitutes a powerful analytical tool for understanding human behavior, especially verbal behavior (Michael et al., 2011). Incorporating this concept into assessment and intervention programs for children with language delays can have a significant impact on the correct development of some language skills. For example, if a child is asked "What color is that ball?" Saying "red" is multiply controlled by both the spoken word "color" and the actual color of the ball. If the question was "What shape is that ball?" A different word should be evoked, even though it is the same ball. The specific word emitted would depend on both the spoken word "shape" and the shape observed. This makes the response part tact and part intraverbal, and both sources of control are required to be correct. If a child emits a color word when asked a shape question, that would reveal that the relevant sources of multiple control were not affecting the child, thus suggesting the need for specific training.

Emerging (*untrained*) *relations*. An important aspect of language acquisition is often referred to as generative grammar, that is, new verbal responses occur without direct training (e.g., Alessi, 1987). For example, as a child learns to put verbs and nouns together (e.g., "push swing"), new combinations with different nouns and verbs usually occur without any formal instruction (e.g., "push wagon"). Thus, new verbal skills are said to emerge from existing skills and occur given novel combinations of variables in a child's daily environment. Skinner (1957) devoted several sections in *Verbal Behavior* to the analysis of emerging behavior (e.g., see Chap. 10), which has multiple applications to language intervention programs. An important contribution to the development of this area comes from the work of Sidman (1994) on equivalence relations, Horne and Lowe (1996) on naming, and Lowenkron (1998) on joint control. These three lines of research have produced extensive advancements in our understanding of emerging behavior and language acquisition (e.g., Causin, Albert, Carbone, & Sweeney-Kerwin, 2013; DeGraaf & Schlinger, 2012; Eikeseth & Smith, 1992; Horne, Lowe, & Randle, 2004; Kobari-Wright & Miguel, 2014; Lowenkron, 2006; Miguel, Petursdottir, Carr, & Michael, 2008; O'Donnell & Saunders, 2003; Perez-Gonzalez, Cereijo-Blanco, & Carnerero, 2014; Sidman & Tailby, 1982).

A Behavioral Analysis of Human Development

The third foundational aspect of the ABA/VB approach is a behavioral analysis of how a child learns and how human behavior becomes more complex. I refer here back to the work of Bijou and Baer. In the 1960s, they published a three-book *Child Development Series* (Bijou & Baer, 1961, 1965, 1967). These books contained the

foundational aspects of a behavioral analysis of how children learn and develop throughout their early childhood. Their work has lead to a robust line of research and applications, as well as a dedicated journal (*Behavioral Development Bulletin*) and numerous extensions (e.g., Greer & Koehane, 2005; Morris et al., 1982; Novak & Pelaez, 2004; Schlinger, 1995). The VB-MAPP makes use of this aspect of behavior analysis in a number of ways, such as the developmental nature of the sequence of skills assessed, and comparisons of the acquisition of those skills to typical development (e.g., Sundberg & Sundberg, 2011). In addition, an ABA/VB intervention program makes use of Bijou and Baer's analysis of child learning when developing individualized intervention programs for children with autism.

A Behavioral Analysis of Language, Learning, and Social Barriers

The fourth component of an ABA/VB approach is the analysis and amelioration of barriers that can impede a child's language, learning, and social development. Several of these barriers address the second aspect of the DSM-5 criteria for the autism diagnosis "restricted and repetitive patterns of behavior" such as stereotypic or repetitive motor movements, inflexible adherence to routines, restricted or fixated interests, and sensory issues. These barriers may be quite complex and their treatment can be an ongoing aspect of a child's intervention program (e.g., behavior problems). In the VB-MAPP, I identify 24 barriers across six general categories (Sundberg, 2014). First, many children with autism or other intellectual disabilities exhibit strong and persistent negative behaviors that impede the teaching and learning process and make social interactions difficult (e.g., tantrums, aggression, self-injurious behaviors). Second, any one or more of the verbal operants or related skills may be absent, weak, or in some way impaired (e.g., echolalia, rote intraverbals). Third, social behavior can also become impaired for a variety of reasons (e.g., limited motivation for social interaction, or impaired mands). Fourth, there are several fundamental barriers to learning that must be analyzed and ameliorated to achieve significant gains (e.g., the failure to generalize, weak motivators, or prompt dependency). Fifth, there are a variety of specific behaviors that can compete with learning and social behavior (e.g., self-stimulation, hyperactive behavior, or sensory defensiveness). And, finally, some problems may be related to physical or medical barriers that must be accommodated or accounted for (e.g., sleep disorders, seizures, illnesses, allergies, cerebral palsy, visual and/or hearing impairments).

An intervention program for a child with autism should include both skills that need to be increased (e.g., mands, tacts, play, social skills, academics) and address behaviors or barriers that need to be decreased (e.g., tantrums, rote responding, sensory defensiveness). Often, it is the case that the absence of skills and the presence of barriers are closely related, and a comparison of a child's scores on both the Milestones Assessment and the Barriers Assessment can provide direction for a more focused intervention program. For example, the VB-MAPP Milestones

Assessment may show that a child needs to learn to mand (see Fig. 5.1), and this skill should be targeted for intervention with a focus on increasing the number of different mands that the child emits. However, the barriers assessment might reveal that a child is prompt-bound and scrolls (i.e., guesses) through words. These two barriers would need to be removed in order for the mand repertoire to grow and become functional for the child. Thus, the intervention program should contain a careful focus on freeing the child's mands from prompts and eliminate scrolling when manding. New barriers or recurring barriers can emerge at any point and can only be ameliorated if and when detected.

Conceptual Basis for the ABA/VB Approach

The conceptual foundation of the ABA/VB approach is from the field of behavior analysis in general (Skinner, 1953) and the analysis of verbal behavior in particular (Skinner, 1957). As previously mentioned, the concepts and principles of behavior analysis provide the basic foundations for this approach and drive the intervention. I would like to provide an example of how the four foundational aspects of the ABA/VB approach can be used to better understand and treat the language training needs faced by children with autism.

ABA/VB Foundation 1: The concepts and principles of behavior analysis. Consider the problem of a child with autism's inability to ask questions. What principles of behavior are involved in asking questions? What is the relevant antecedent source of control for a child asking, for example, "When is mommy coming home?" Would it be an MO or an S^D? These are two separate sources of control. The answer is that questions should be under the functional control of MOs, specifically MOs for verbal information (Skinner, 1957). That is, when the value of information regarding when mother is coming home is strong, it should evoke a specific behavior (a verbal question). The reinforcement for this behavior is specific to the MO for information (providing the time of arrival). If a child is not able to ask questions, or his question-asking repertoire is impaired in some way, then intervention procedures such as modeling, prompting, fading, and differential reinforcement can be used to teach the skill. Data are collected and learning can be measured. If learning is not occurring, adjustments to the intervention program should be made.

ABA/VB Foundation 2: Skinner's (1957) analysis of verbal behavior. How does Skinner's analysis of language help us with the analysis of question asking? Asking questions would be classified as mands given the causal role of the MO and specific reinforcement. These mands for information are not the same as echoics, tacts, or intraverbals. This analysis would drive the intervention program with the goal of being assured that the target response is primarily controlled by an MO, not a verbal or nonverbal S^D. Thus, the intervention procedure would require that an MO for information be captured or created, followed by the implementation of ABA techniques (e.g., prompting, reinforcement) to bring the verbal response under the

control of the relevant MO (e.g., Lechago, Carr, Grow, Love, & Almason, 2010; Shillingsburg & Valentino, 2010; Sundberg, Loeb, Hale, & Eigenheer, 2002).

ABA/VB Foundation 3: *A behavioral analysis of human development*. What does an analysis of typical human development and language acquisition tell us? Mands for information are relatively late in language development. That is, functionally correct WH questions may not begin to appear in the verbal repertoire of typically developing children until around the age of two (Brown et al., 1969). But by 2 years of age, a typically developing child has anywhere from 100 to 200 mands and tacts, with noun–verb combinations, and a high rate of daily verbal output, and they are just beginning to ask functionally correct WH questions. If a child with autism does not demonstrate this level of prerequisite verbal behavior, an intervention program for asking questions may not be appropriate at this time.

ABA/VB Foundation 4: *A behavioral analysis of potential barriers*. It also may be possible that a focus on WH questions too soon could produce rote question asking that becomes difficult to ameliorate (e.g., an MO for information may not be the source of control for the question-asking behavior). A child might learn to ask questions that appear structurally correct, but are not functionally correct. For example, a child with autism might learn to walk up to somebody and say, "What's your name?," but walks away before the peer says his name. He may look to a staff member who may give him an edible or token for initiating the verbal interaction with the peer, but this behavior is not under the control of an MO for information, or the reinforcement relevant to that MO, rather it is controlled by S^Ds, tokens, and praise, and not a functionally correct question.

Primary Procedural Components

I will now provide a brief overview of the main components of the ABA/VB teaching methodology. The first element of an ABA/VB program is an assessment of a child's verbal and nonverbal skills, as well as his barriers to learning, with a tool such as the VB-MAPP. Once a profile is obtained, priorities can be determined, IEP goals set, and an intervention program designed. Like all ABA approaches, an intensive style of intervention constitutes the educational format offered to the child. By intensive, I mean several hours a day of direct teaching of the skills that a child may need, with a high rate of active responding on the part of the child. Instruction is conducted in multiple daily structured teaching sessions (DTT), as well as teaching in the child's natural environment (NET). The teaching procedures used are those derived from the field of applied behavior analysis (e.g., Cooper et al., 2007) and are common to most ABA style programs (prompting, fading, shaping, reinforcing). Data are collected daily with an emphasis on a "first trial correct" mastery criteria measurement system. For example, given a particular target, on the first trial of the day, (e.g., a tact for wheel), the first response emitted by the child must be correct for 3 days in a row. Once a word is acquired in this manner, it is then moved

to generalization, integration with the other domains, and expansion that involves various combinations with other parts of speech (e.g., noun–verb combinations).

As previously mentioned, the most unique aspect of the ABA/VB approach is the use of Skinner's analysis of verbal behavior as the foundation for the assessment and intervention program. With typical language development serving as a curriculum guide, the goal is to establish each verbal operant for a child, beginning with developmentally appropriate, fun, and engaging skills and systematically progressing to more complex skills. Every effort should be made to make teaching and learning reinforcing and functional for the child. The child's daily schedule and IEP goals are primarily focused on developing the verbal operants, social behavior, academic behavior, as well as other related skills. Given the role of the mand in language development, and its early appearance in the repertoires of most typically developing children, establishing a functional mand repertoire is an early and ongoing instructional target for many children with autism. Continuing efforts are made to integrate each verbal operant with the other verbal and listener domains (mands, tacts, intraverbals, listener discriminations), and with nonverbal behavior, social behavior, academic behavior, activities of daily living, and so on. In order to facilitate this, and novel responding, creativity, and generative linguistic behavior, a "mixed verbal behavior" teaching format with multiple exemplars is often (but not exclusively) used. With this format, multiple exemplars of the verbal operants are interspersed with each other, including examples and non-examples, in a given teaching session (e.g., a tact trial, then a listener trial, then a mand trial). This same teaching strategy is also used for instruction in the child's natural environment.

There is also an emphasis on a child's ongoing MOs and reinforcing and expanding child-initiated behaviors (e.g., Hart & Risley, 1975). Opportunities to mand are frequent and often used as a form of reinforcement for other correct verbal and nonverbal behaviors. Augmentative and Alternative communication (AAC) is used when necessary for individual children, but there is always a primary focus on speech if possible. Sign language is generally the preferred type of AAC for a variety of reasons (Sundberg, 1993; Sundberg & Sundberg, 1990), but icon selection or textual stimuli can be effective when appropriate. There is also a strong focus on teaching verbal and social interaction with peers and developing both social and independent play skills. More advanced language skills (e.g., intraverbals, adjectives, pronouns) are taught by building on known skills (e.g., tacts, nouns, verbs) and are systematically incorporated into all the verbal operants guided by developmental norms. There is a strong focus on parent training and their involvement in the intervention program.

How Goals Are Selected and Sequenced

The VB-MAPP (Sundberg, 2014) can be used to establish a child's baseline skills across 16 domains, 24 barriers, and 18 transition areas. As previously mentioned, the VB-MAPP contains a developmentally based sequence of language and social

skills that can be used to guide the content of the treatment program. The data from this assessment are used to identify priorities and establish IEP goals for a child. For example, the VB-MAPP profile I presented for Jacob previously indicates that he needs an intensive intervention program with the immediate priorities being to establish a mand repertoire, free from echoic prompts, as well as targeting tacts, listener skills, and social skills. A barriers assessment would also be used to identify any specific problems that might warrant IEP goals (e.g., non compliance, aggression). Others such as SLPs, occupational therapists, and parents might add additional targets. The placement section of the VB-MAPP provides direction in selecting specific goals for a child. Each domain contains a list of sample IEP goals, with over 200 goals provided in total. These suggested goals can be adjusted to meet the needs of an individual child. The VB-MAPP is developmentally sequenced in an effort to target skills that match those of typically developing children at the various performance levels. For example, if a child can tact at least 100 individual nouns and verbs, work should begin on developing noun–verb two word combinations both as a speaker and as a listener, which is a well-accepted 2-year linguistic milestone for typically developing children.

Staff Skills and Required Training

The problems faced by a child with autism are complex and widely varied and usually require a highly specialized intervention program to achieve meaningful gains. Behavioral approaches have been demonstrated to be the most effective (National Standards Project, 2014), but they require an extensive skill set on the part of those conducting the intervention. First, supervisors and hands-on staff must be proficient in a large number of different ABA procedures and data collection methods (e.g., Cooper et al., 2007), any of which could play a role in a given child's program (e.g., shaping, prompting, chaining, tokens, probe measures). A program for children with autism should include a structured staff training component that contains both the academic content of behavior analysis and hands-on supervision, training, and monitoring from those who are already proficient in behavioral concepts (e.g., a BCBA). This process can take several years, and can be on-going, but without it an intervention program is likely to be less successful.

The second significant skill set required to implement an ABA/VB program is a working knowledge of the basic concepts and the procedures derived from Skinner's analysis of verbal behavior (e.g., MO manipulation, mand training, intraverbal training). Given that social communication deficits constitute the major diagnostic criteria for autism, an intervention program without a focus on language cannot possibly address a child's needs. The question is what theory of language, of the many choices, will provide the best conceptual foundation necessary to guide a language intervention program? It is suggested here that Skinner's behavioral formulation provides the most value for children with autism. In addition to procedures relevant to ABA and Skinner's analysis verbal behavior, staff must also learn the basic

aspects of structural linguistics, and how to integrate these systems. For example, there are different procedures for teaching adjectives and prepositions as tacts versus teaching adjectives and prepositions as intraverbals.

There are a variety of additional skills that are necessary for working with children with autism. Supervisors should be in touch with the body of research on autism that is available in the literature. Knowledge in the area of child development is also quite important to understanding what typical children at various ages are capable of doing, along with the analysis of how they learn the skills they have. Such an analysis can provide both a curriculum guide as well as comparison data regarding a child's progress. In addition, specific experience with autism or other intellectual disabilities may be useful for staff to have. This experience could be acquired in formal college coursework, as well as hands-on supervised training. Given the wide range of issues children with autism often present, the more varied a person's contact is with this population, the more prepared he or she will be when facing new children and new challenges.

Finally, it is important that parents of children with autism receive as much of the same basic training as possible; realizing, of course, that may be difficult for some families and resources may be limited. However, parents who do acquire basic ABA/VB skills are in a much better position to work with their children and provide teaching moments throughout the child's day. Some possible ways to provide support for parents include: (1) provide a weekly or monthly parent training class, (2) provide weekly small group parent discussions moderated by the BCBA, SLP, or classroom teacher, (3) provide in-classroom demonstrations of the procedures for the parents to observe, (4) have the parents practice those procedures and provide them with feedback, (5) give the parents homework assignments, (6) teach parents how to read and collect data, (7) teach parents how to interpret and use the VB-MAPP, (8) provide the parents with user-friendly material on ABA and verbal behavior (e.g., Barbera & Rasmussen, 2007; Reynolds, 2013; Schramm, 2011; Sundberg & Partington, 1998; Weiss & Demiri, 2011), and (9) provide parents with links to internet information that will help them, rather than confuse them.

The Evidence Base

The foundation of ABA/VB comes directly from the well-established field of behavior analysis. It makes specific use of the scientific principles of human behavior (Skinner, 1953) to guide assessment and intervention procedures used for children with language delays. Its origins can be traced back to the founders of our field and the initial application of behavioral principles to autism treatment. The systematic inclusion of Skinner's analysis of verbal behavior is a novel contribution compared to other ABA approaches, but that too is based on a solid foundation of empirical behavioral data. There is now an extensive body of outcome studies showing the positive effects of ABA methodology (e.g., Eikeseth, Smith, Jahr, & Eldevik, 2002; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987). Some

ABA intervention outcome studies have included aspects of a verbal behavior program such as a mand training component (e.g., Sallows & Graupner, 2005), and there are many studies demonstrating the effectiveness of the individual components of an ABA/VB program (e.g., Sautter & LeBlanc, 2006).

Perhaps the most immediate contribution of Skinner's analysis of verbal behavior to ABA and work with children with autism may be that it provides an organized and thorough way to analyze language. With ASD being characterized by communication challenges and social interaction difficulties, a verbal behavior analysis can be used to identify and quantify language deficits and provide direction and guidance for language intervention programs. There are many thematic lines of empirical research emanating directly from Skinner's analysis of verbal behavior that have directly benefited children with autism. For example, research on the distinction between the verbal operants has demonstrated that mands may not emerge from tact training (e.g., Gamba, Goyos, & Petursdottir, 2015; Hall & Sundberg, 1987; Shafer, 1994; Twyman, 1996). Also, there are data to support that intraverbal behavior may not emerge from tact training (e.g., Braam & Poling, 1983; Goldsmith, LeBlanc, & Sautter, 2007; Ingvarsson & Duy, 2011; Luciano, 1986). On the other hand, there are circumstances where these operants are interdependent and transfer among them and listener discriminations occur with little or no formal training (Gamba et al., 2015; Horne & Lowe, 1996; Miguel et al., 2008; Wallace, Iwata, & Hanley, 2006). Collectively, this extensive line of research provides empirical support for the importance of distinguishing between the verbal operants for children with autism. At the least, an intervention program that respects these distinctions seems to be an improvement over those that neglect them.

There are a number of empirical studies on teaching language to children with autism that are based on Skinner's analysis of verbal behavior. For example, two different thematic lines of research on mand training provide support for Skinner's conceptual analysis of that verbal operant. First, the extensive work on functional communication training initiated by Carr and Durand (1985) demonstrates how an alternative and acceptable mand form can replace a mand form consisting of aggressive or self-injurious behavior. Second, the research mentioned previously on manding for information has provided immediate applications to autism treatment (e.g., Endicott & Higbee, 2007; Lechago et al., 2010; Shillingsburg & Valentino, 2010; Sundberg et al., 2002). Another body of research addresses Skinner's analysis of the distinction between the behavior of the speaker and behavior of the listener, and data show, like Skinner suggested, they are functionally independent repertoires (e.g., Lee, 1981). However, the speaker and listener repertoires can interact in a number of important ways as described by Skinner (1957), such as the "naming" repertoire identified by Horne and Lowe (1996). The naming literature is now quite extensive and has significant implications for the emergence of untrained types of verbal behavior from those that have been formally trained (e.g., Eikeseth & Smith, 1992; Horne, Hughes, & Lowe, 2006; Kobari-Wright & Miguel, 2014; Lowe, Horne, & Hughes, 2005; Miguel et al., 2008; Perez-Gonzalez et al., 2014; Randell & Remington, 1999). Lowenkron's (1984, 1988, 1989, 1998, 2006) work on joint control also addresses the issue of emergence of untrained behaviors with a strong

collection of data demonstrating the effects of combining the verbal operants (multiple control) in generating new behavioral relations (Michael et al., 2011). Valuable applications based on this line of research are also available in the literature (e.g., Causin, Albert, Carbone, & Sweeney-Kerwin, 2013).

Greer and colleagues (e.g., Greer & Ross, 2007) have published an extensive collection of verbal behavior research projects over the past 30 years that have produced a number of important findings, such as the value of multiple exemplar training in establishing the verbal operants (e.g., Greer, Yuan, & Gautreaux, 2005). A growing body of empirical research also exists on Skinner's analysis of automatic reinforcement and its relation to language acquisition, as well as autism treatment (Smith, Michael, & Sundberg, 1996; Stock et al., 2008; Sundberg et al., 1996; Yoon & Bennett, 2000). Michael's (1985) distinction between topography-based verbal behavior and selection-based verbal behavior has generated a number of research projects that have provided conceptual and empirical clarity to the issue of using sign language versus icon selection-based communication systems for children with autism (Lowenkron, 1991; Shafer, 1993; Sundberg & Sundberg, 1990; Wraikat, Sundberg, & Michael, 1991). Hundreds of additional studies on a wide range of verbal behavior topics can be found in various journals (e.g., TAVB, JABA, JEAB, JEIBI, ETC). In fact, it is now quite common to see empirical studies based on verbal behavior in most issues of JABA. Several reviews of various aspects of verbal behavior research and practices are also available in the literature (e.g., Carr & Petursdottir, 2011; Gamba et al., 2015; Oah & Dickinson, 1989; Sautter & LeBlanc, 2006; Shafer, 1994; Stock et al., 2008), as well as reviews of the publication trends in the journal, *The Analysis of Verbal Behavior* (Luke & Carr, 2015; Petursdottir, Peterson, & Peters, 2009). The data seem to indicate that there no longer appears to be a shortage of verbal behavior research (Carr & Firth, 2005; Sundberg, 1991).

Conclusion

The primary focus of an intervention program for a child with autism should be on the development of effective language and social skills, as well as the reduction of negative behaviors. Behavior analysis has much to offer this effort. ABA is a scientifically based analysis of human behavior (Skinner, 1953) that has generated a robust applied field that produces a steady stream of applications for ameliorating various human problems (e.g., Cooper et al., 2007) and has undoubtedly benefitted many children with ASD. Skinner's (1957) analysis of verbal behavior adds to existing ABA programs by providing a behavioral analysis of language that is also based on a foundation of empirical research. The benefits of Skinner's analysis of verbal behavior are substantial and provide for greater consistency between the conceptual and applied aspects of an intervention program (Hedge, 2010). A behavior analysis of child development can contribute further to an intervention program by providing a framework for sequencing language and other skills. Finally, the analysis and amelioration of language, learning, and social barriers experienced by a

child with autism is an essential component of an intervention program, but may require professionals with advanced skills in behavior analysis. Collectively, these foundational aspects of an ABA/VB program can provide specific evidenced-based guidance for the development of an intervention program for a child with autism.

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