

Behavior analysis has already contributed substantially to the treatment of children with autism, and further gains can result from more use of Skinner's analysis of language in *Verbal Behavior* (1957) and in the resulting conceptual and experimental work. The approach emphasizes a unit of analysis consisting of the relations between behavior, motivative and discriminative variables, and consequences. Skinner identifies seven types of verbal operants—echoic, mand, tact, intraverbal, textual, transcriptive, and copying a text—which function as components of more advanced forms of language. This approach focuses on the development of each verbal operant (rather than on words and their meanings) and on the independent training of speaker and listener repertoires. Five more specific contributions are described that relate to the importance of (a) an effective language assessment, (b) mand training in early intervention, (c) establishing operations, (d) an intraverbal repertoire, and (e) automatic reinforcement.

The Benefits of Skinner's Analysis of Verbal Behavior for Children With Autism

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There have been several major advances in the behavioral treatment of children with autism since the publication of the initial study by Wolf, Risley, and Mees (1964). The majority of these advances are attributable to the development and maturing of the field of applied behavior analysis and to the extensive work of Ivar Lovaas and his students (e.g., Koegel, Russo, & Rincover, 1977; Leaf & McEachin, 1998; Lovaas, 1977, 1981; Lovaas, Koegel, & Schreibman, 1979; Lovaas & Smith, 1989; Schreibman & Carr, 1978). Much has been learned about the disorder from behavior analysis and this exceptional line of research. For example, early and intensive intervention is essential, behavioral techniques can be quite effective, and the pri-

mary focus of the treatment plan needs to be on the development of language skills.

APPLIED BEHAVIOR ANALYSIS

The basic intervention program, now quite common in the behavioral treatment of autism (e.g., Maurice, Green, & Luce, 1996), consists largely in identifying goals in terms of specific behaviors to be altered in frequency; recording target behaviors; identifying effective forms of reinforcement; the use of extinction, shaping, and intermittent reinforcement; the development of operant stimulus control, stimulus prompting, and the fading of prompts; and the development of chaining, generalization, rules, imitation, modeling, and other now well-known behavioral procedures. With respect to research, there is an emphasis on within-subject (also called single-subject) experimental comparisons, direct observation (as opposed to the use of mental tests and self-report), ensuring the reliability of observations, and other methodological refinements. Any one of several current texts will suffice as a source of the scientific background, technical concepts, procedures, and methodology of applied behavior analysis (e.g., Cooper, Heron, & Heward, 1987; Kazdin, 2001; Martin & Pear, 1999; Miltenberger, 2001; Sulzer-Azaroff & Mayer, 1991).

LANGUAGE TRAINING

Because language underlies most learning in the typical child and is so conspicuously defective in children with autism, developing language skills is seen as a major goal of any training program. In most such programs, the training consists of the application of the behavioral technology described above to what is usually called communicative behavior. With deliberate use of reinforcement, the children are taught to look at an instructor, react appropriately to verbal stimuli by following simple instructions (“Stand up”), and identify stimuli by pointing or touching (“Touch nose”). They are taught to imitate the movements of the instructor (“Do this”), obtain one of several possible reinforcers by pointing at it (“What do you want?”), imitate the instructor’s vocal responses (“Say *cat*”), name objects and pictures of

objects (“What is this?”), name actions performed by the instructor (“What am I doing?”), and so on, with the tasks becoming increasingly complex as the child learns to perform the simpler ones. The training eventually requires correct pronunciation, correct grammar, appropriate tone of voice, appropriate use of *please*, and so on, with the goal that the child’s language should ultimately be like that of typically developing peers. There are several versions of this general approach to language training (e.g., Guess, Sailor, & Baer, 1976; Kent, 1974; Lovaas, 1977; Maurice, 1993; Taylor & McDonough, 1996); however, they share most of the basic behavioral features identified above.

The behavioral approach in general has been much more effective than those based on psychoanalysis, holding therapy, auditory training, sensory integration, swimming with dolphins, weighted jackets, facilitated communication, vitamin therapy, and others (Green, 1996; T. Smith, 1996). Some children, after early and intensive intervention, have entered regular education classes at their appropriate age level (e.g., Fenske, Zalenski, Krantz, & McClannahan, 1985; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993), and most children at least acquire more effective social and language repertoires. However, even intensive intervention may be considerably less successful with some children than might be hoped (e.g., Lovaas, 1987, 1993; Maurice, 1996), perhaps due in part to the wide variability seen in children diagnosed with autism, the age at intervention, and the nature of the intervention program received.

In most of the current programs, the technical vocabulary of the instructor with respect to language is essentially that found in general language instruction as it occurs in elementary education, special education, speech and language instruction, and, to some extent, linguistics. Language is seen as receptive (understanding the language of others) and expressive (using language to interact with others), with the two referred to as communicative behavior. The descriptive terms for different kinds of language behavior are those of ordinary language such as *labels, requests, nouns, verbs, prepositions*, responding to and using “Wh” questions, responding to yes-no questions, and so on. This general approach seems quite reasonable, but the failure to make much use of the technical concepts and principles that appear in B. F.

Skinner's (1957) *Verbal Behavior* seems inconsistent with the stated behavioral focus of many intervention programs.

In 1984, the *Journal of the Experimental Analysis of Behavior* devoted an entire issue to "present trends and directions for the future." Jack Michael (1984), one of the authors of the current article, contributed an article titled "Verbal Behavior," and among the current trends he covered was behavioral theory and research on "learning to be an effective speaker and listener" (pp. 367-369). After describing the theoretical and practical importance of the existing behavioral work on teaching language, Michael commented as follows:

Interestingly, this extensive body of research makes almost no use of the concepts, terms, and analyses that appear in Skinner's (1957) *Verbal Behavior*. Although the term verbal behavior had become widespread, the recent trend is toward increased use of the traditional term, language, in spite of its implication of a common process underlying kinds of behavior that differ considerably from one another, such as speaking and listening. The terms for elementary verbal relations—mand, tact, echoic, etc.—are used occasionally, but not to any important purpose; the research could easily have been conceived without the benefit of the distinctions Skinner makes. (pp. 368-369)

This comment still seems accurate today with respect to the relevance of *Verbal Behavior* to current work with children with autism. In the present article, we will consider some possible benefits of a closer look at Skinner's behavioral interpretation of language and suggest some applications based on that approach.

SKINNER'S GENERAL APPROACH TO VERBAL BEHAVIOR

THE UNIT OF ANALYSIS

First, Skinner (1957) defined verbal behavior as behavior that is reinforced through the mediation of another person's behavior (whereas nonverbal behavior is reinforced directly through contact with the physical environment) (pp. 1-2). He was concerned with the verbal behavior of the individual speaker rather than with the verbal

practices of a verbal community (e.g., as they are represented in a dictionary or a grammar text). The unit of analysis is the functional relation between a type of responding and the same independent variables that control nonverbal behavior, namely, motivative variables, discriminative stimuli, and the consequences that have followed that type of responding. Skinner referred to this unit as a verbal operant, with *operant* implying a type or class of behavior as distinct from a particular response instance; he referred to a set of such units in a particular individual as a verbal repertoire (pp. 19-22).

THE ELEMENTARY VERBAL RELATIONS

In chapters 3 through 7 of *Verbal Behavior*, Skinner (1957) distinguished between several different types of verbal operants (see Table 1). In addition to the audience relation, the following elementary verbal relations are described: mand, tact, echoic (and imitation), intraverbal, textual, transcriptive, and copying a text. The mand is a type of verbal behavior where the response form is controlled by a motivative variable (deprivation, satiation, or aversive stimulation, currently termed *establishing operation*, or EO); the echoic, intraverbal, textual, copying a text, and transcriptive relations are types of verbal behavior whose response forms are controlled by verbal stimuli; and the tact is a type of verbal behavior whose response form is controlled by a nonverbal stimulus. These are the elements of which all more complex forms of verbal behavior are composed; all consist of relations between motivative variables, discriminative stimuli, and response forms; and all are developed through the occurrence of response-contingent consequences.

THE VERBAL OPERANT VERSUS WORDS AND THEIR MEANINGS

At the beginning of chapter 8 of *Verbal Behavior*, "The Verbal Operant as the Unit of Analysis," Skinner (1957) elaborated on the difference between a traditional or commonsense understanding of language and his behavioral analysis. The first subsection heading is "The Same Form of Response in Different Types of Operants" (pp. 187-188), and its main point is that it may be the same word, but it

TABLE 1
Technical Definitions of Skinner's (1957)
Elementary Verbal Operants

<i>Controlling Variable</i>	<i>Response</i>	<i>Consequence</i>
Verbal stimulus with point-to-point correspondence and formal similarity	Echoic Imitation Copying a text	Nonspecific reinforcement
Establishing operations	Mand	Specific reinforcement
Nonverbal stimulus	Tact	Nonspecific reinforcement
Verbal stimulus without point-to-point correspondence or formal similarity	Intraverbal	Nonspecific reinforcement
Verbal stimulus with point-to-point correspondence but without formal similarity	Textual Transcriptive	Nonspecific reinforcement
Verbal stimulus	Nonverbal behavior (receptive language)	Nonspecific reinforcement

is not the same functional unit for the individual verbal behavior. Or, said differently, the word is not a functional unit of the verbal behavior of the individual speaker or listener, even though it may be a unit of traditional grammar.

In the terminology of meaning, we say that the word *doll* is used at one time "to ask for a doll" and at another "to describe or refer to a doll." When the response *Doll!* has been acquired as a mand, however, we do not expect that the child then spontaneously possesses a corresponding tact of similar form. If we find both types of operants in the repertoire of the child, we must account for them separately. This appears to make the task of explaining verbal behavior more difficult, but the advantage which appears to be gained by the traditional concept of the "word *doll*" is offset by the problem which remains of explaining how a child may learn to use a word both to "express a desire" and also to "describe an object." The total formulation has not been simplified; part of the task has merely been postponed. If we are to accept the full responsibility of giving an account of verbal behavior, we must face the fact that the mand *doll* and the tact *doll* involve separate functional relations which can be explained only by discovering all relevant variables. (pp. 187-188)

Skinner similarly criticized the notion that it is the same word whether written or spoken, the same word spoken or heard, or that we can “say the same thing” in different languages (e.g., in French or English, in technical and nontechnical jargons, etc.). Evidence is presented to the effect that because it is in some sense the same word, this does not in any way imply that it is the same behavioral functional relation. Various reasons why we might think so are considered, and in each case it is concluded that we are dealing with different verbal operants with independent functional control. Respect for this independent functional control is especially important for language training with children who have very little language. Skinner, of course, recognized that a sophisticated speaker can acquire a functional relation of one form, for example, as a tact, and then have it available without further training as a mand, but this seemingly spontaneous transfer from one verbal operant to another also needs analysis in terms of basic behavioral concepts and principles and in some cases turns out to be quite complex. This section of *Verbal Behavior* is only 12 pages long (pp. 187-198) but is filled with points that seem very relevant to much of the current efforts to develop verbal behavior in children with autism.

A major manifestation of the theme of the verbal operant as a unit is Skinner’s clear distinction between the behavior of speaker and listener. In contrast with most traditional approaches, Skinner was primarily concerned with the behavior of the speaker. He avoided use of the terms *expressive language* and *receptive language* because of the implication that these are merely different manifestations of the same underlying processes. It is important to teach a child to react appropriately to the verbal stimuli provided by speakers, as well as to behave verbally as a speaker, but these are separate and different functional relations. In some cases, learning one type of behavior facilitates learning another, but this must also be understood in behavioral terms (in terms of motivative variables, stimuli, responses, and consequences) rather than in terms of learning the meanings of words as a listener and then using the words in various ways as a speaker.

This emphasis on a behavioral functional unit for the individual speaker and listener is especially important for training children with

autism who may not have had the massive exposure to verbal stimuli and related environmental events in the same manner as a typical child. Thinking in terms of the traditional linguistic unit consisting of words and meanings, it is easy to underestimate the complexity of some particular verbal relation and attribute a failure to the child's autism rather than to an incomplete behavioral analysis of the task. Skinner's verbal operants are fairly simple and readily understood in terms of basic behavioral principles—reinforcement, motivative variables, discriminative stimuli, and response forms—but some programs attempt to develop behavior that involves multiple and interacting repertoires before the relevant components are even in early stages of effectiveness. Skinner's general approach can help prevent these mistakes and avoid some of the discouragement on the part of trainers working at a very difficult task.

TEACHING CHILDREN WITH AUTISM

An important contribution of this approach is a training focus on the elementary verbal operants as separate functional units. These units are then seen as the bases for building more advanced language behavior. The emphasis on speaker and listener behaviors as independent repertoires is a closely related and equally important general contribution. In addition to these general themes, five more specific contributions will be described in some detail: the nature of an effective language assessment, the importance of mand training in early intervention, the relevance of EOs in language training, the importance of teaching an intraverbal repertoire, and the role of automatic reinforcement in language acquisition.

LANGUAGE ASSESSMENT

Viewing language as an interaction between speakers and listeners with the verbal operants as the basic units implies the relevance of these units for an assessment of defective or delayed language. For example, if a child with autism is referred for a language assessment, rather than administer a standardized test or search for an age-

equivalent score, one might examine the current effectiveness of each verbal operant. The behavior analyst would start by obtaining information about the child's mand repertoire. When known EOs are at strength, what behavior does the child engage in to obtain relevant reinforcement? When the reinforcement is provided, does the behavior cease? What is the frequency of the various mand units? Information regarding the quality and strength of the echoic repertoire can reveal potential problems in producing response topographies that are essential for other verbal interactions. If the child cannot echo specific sounds, then the probability of those responses occurring in other functional units of verbal behavior is quite low. A thorough examination of the tact repertoire will show the nature and extent of nonverbal stimulus control over verbal responses, and a systematic examination of the receptive and intraverbal repertoires will show the control by verbal stimuli. Finally, although not relevant for many early learners, the tendency for textual stimuli to evoke verbal behavior should be examined (although a surprising number of children with autism are hyperlexic). Each of these functional units can be examined briefly (M. L. Sundberg & Partington, 1998) or in extensive detail (Partington & Sundberg, 1998).

THE IMPORTANCE OF THE MAND IN INITIAL LANGUAGE TRAINING

The mand (Skinner, 1957, pp. 35-51) is a type of language in which the form of the child's verbal response (what the child says) is controlled by what the child wants (by what is currently effective as an EO—see below). Mands receive reinforcement specific to the particular mand—the mand *milk* is reinforced by receiving milk, *out* is reinforced by an adult's opening a door, *up* is reinforced by being picked up, and so on. The other verbal operants (echoic, tact, intraverbal) typically receive nonspecific reinforcement—some form of generalized conditioned reinforcement such as social attention, approval, or termination of a demand of some sort. Said another way, mands directly benefit the speaker by producing access to desired (often unconditioned) reinforcers. The other verbal operants, while certainly important, do not have this type of immediate benefit. They produce social

approval, possibly immediately after the response, but the reinforcing effectiveness of social approval may itself be dependent on more remote events. It is not surprising, then, that mands are typically the first type of verbal behavior that humans acquire (Bijou & Baer, 1965; Skinner, 1957). Much of a typical infant's early language consists in mands for unconditioned reinforcers or for strong conditioned reinforcers.

From the perspective of Skinner's analysis, it would be quite reasonable for mand training to be the major focus of early language training. The other types of verbal behavior should not be neglected, but it is the mand that gives the child some control over the social and, indirectly, the nonsocial environment. This control should increase the value (to the child) of language training in general, which in turn should make the task of the language trainer an easier one. Until recently, however, the mand has been somewhat neglected in training programs for children with autism in favor of receptive language training and training in the tact relation. This neglect is quite reasonable if one believes that the acquisition of language consists largely in learning the meanings of words that can then be used in various ways with no further training. From this traditional language perspective, receptive language training is clearly one of the easiest ways to teach such meanings, and tact training is probably next. Based on experience with typical children and adults, once a person has learned what an object is called (by learning to point to it when given its name or to say the name when the object is shown), it is reasonable to assume that when the object becomes important, the learner will be able to ask for it without further training. However, it is clear that this does not happen with children who have very little language, many of whom have had a good deal of receptive language and tact training but are said to lack a functional language repertoire, which is then explained in terms of their intellectual deficit. Such children can often point to several kinds of objects when the name is spoken, and they can sometimes even say the name when the object is shown, but they have no tendency to request the object when it is clear from other evidence that it would be an effective form of reinforcement for them. Or, in more general terms, they have no tendency to use language to control their environment for their own benefit.

Another reason for the neglect of mand training, even by those who might well appreciate its significance, is that the trainer must contrive appropriate motivative variables (EOs) or take advantage of those that develop naturally. Contriving a variety of effective EOs for the learner seems at first glance much more difficult than providing a variety of objects (usually pictures of objects) to be named or pointed at. And relying on naturally occurring EOs in a language-training setting will not usually result in sufficient variety, although the variety can be increased by providing language training under other circumstances not instituted for that purpose. The procedure called incidental teaching (Hart & Risley, 1975) makes some use of this latter approach in that verbal prompts for mands are provided whenever the learner needs help in obtaining some kind of reinforcement during ordinary training or care-giving activities.

Mands are very important to early language learners. Not only do they allow a child to control the delivery of conditioned and unconditioned reinforcers, but they begin to establish the speaker and listener roles that are essential to further verbal development. Mands are also the most likely type of verbal behavior to be emitted spontaneously, and generalization may occur quickly because of the unique effects of the EO (see below). The data are quite clear that manding does not emerge from tact and receptive training for severely language-delayed children (for a review, see Shafer, 1994). Controlling and manipulating EOs is slightly more complex than presenting discriminative stimuli, but if one is familiar with learned EO (Michael, 1993) methods of contriving and capturing, EOs are relatively straightforward (e.g., Shafer, 1994; M. L. Sundberg & Partington, 1998). Finally, it is frequently reported by parents and trainers that mand training is more enjoyable for both parties, that inappropriate behavior occurs less, and that children are more willing to participate in language-training activities.

THE ESTABLISHING OPERATION AS AN INDEPENDENT VARIABLE IN LANGUAGE TRAINING

In chapter 3 of *Verbal Behavior*, Skinner (1957) described several different types of mands and discussed in detail how deprivation, sati-

ation, and aversive stimulation control these mands as well as other types of behavior. In short, Skinner carried on a theme introduced in *Behavior of Organisms* (1938) and elaborated on in *Science and Human Behavior* (1953) that deprivation, satiation, and aversive stimulation are basic independent variables in the analysis of behavior. *Establishing operation* (Keller & Schoenfeld, 1950; Michael, 1982, 1988, 1993) is a general term for any environmental change that functions like deprivation, satiation, and aversive stimulation in momentarily altering the reinforcing effectiveness of other events and in altering the frequency of occurrence of the type of behavior that is a consequence of those other events. For example, food deprivation increases the momentary effectiveness of food as a reinforcer (when or if the organism encounters food) and increases the frequency of any behavior that has been followed by food. For a child, food deprivation will make any kind of food effective as reinforcement and evoke going to the place where food has been found or possibly evoke the mand, saying "eat" or "food," if this behavior has been followed by the receipt of food in the past.

Michael (1993) distinguished between two main types of EOs: (a) unconditioned establishing operations (UEOs) related to unlearned forms of motivation and (b) conditioned establishing operations (CEOs) related to learned forms of motivation. Examples of UEOs are food deprivation, water deprivation, sleep deprivation, painful stimulation, and being uncomfortably cold. He identified several kinds of CEOs, two of which (transitive and reflexive) are quite relevant to training children with autism, but a description of their function would take us somewhat beyond the purpose of this article (see McGill, 1999; Michael, 1993, in press; M. L. Sundberg, 1993a).

Eos play a significant role in the development of mands during early training, as suggested previously, but they are also relevant to a wide variety of more complex mands in later training, and they also share control with verbal and nonverbal discriminative stimuli in other verbal operants. However, the controlling variable for the mand, the EO, is not as conspicuous as a discriminative stimulus and may be overlooked as an essential part of the verbal functional relation. Several versions of this kind of problem are given below.

An EO for a mand cannot be assumed from discriminative stimulus control. As discussed in the section "The Verbal Operant Versus Words and Their Meanings," providing a tact when shown an object (naming the object) or identifying that object among several when a verbal stimulus is provided (receptive language) does not constitute evidence that the same response form will function as a mand when the object is wanted (i.e., would be effective as reinforcement if obtained). In the early stages of training a child to say "cup" as a mand, an EO that makes the receipt of a cup effective as reinforcement should be in effect, and the cup (not social approval) should then be provided contingent on the child's saying "cup." The manipulation of an EO followed by specific reinforcement relevant to that EO is essential for the development of effective mands, yet this procedure seems not to be a prominent part of many of the current training programs. This issue is closely related to the next problem.

Mands for missing items. The ultimate value of the mand to the speaker is to obtain objects or to bring about conditions that are not present. This means that to be optimally useful a mand should occur in the absence of the object or condition that is the reinforcement for the mand; it should occur primarily under the control of the EO. A common problem faced by many children with autism is that they are unable to mand for items that are not physically present. For example, a child may be able to ask for a specific toy when that toy is present and being offered to the child, but if the toy is missing, the child may be unable to tell anyone what is desired and just engages in generalized mand behavior such as pulling at the adult, crying, and so on. Thus, many parents find themselves playing a guessing game by presenting several toys or objects or actions.

Mand training, to the extent that it is given at all, may consist largely in presenting an object that is assumed to be effective as a reinforcer and asking, "What do you want?" The "correct" answer to the question is then the same response form that has been appropriate as a tact, and the social reinforcement for making the response as a tact may be as important to the child as receiving the object. This procedure results in a functional relation that is part tact and part mand, and the mand relation may be the smaller part, with the result that there

will be no strong tendency to make the same response in the absence of the object (when the tact stimulus is not present) even when it would be effective as a form of reinforcement. The target repertoire for mand training is a pure mand, that is, a response that is free from nonverbal stimulus control and under the exclusive control of an EO. Specific training on these verbal skills is typically necessary and must occur when the EO is strong by either capturing an existing EO or contriving a new EO (Hall & Sundberg, 1987; M. L. Sundberg, 1993a; M. L. Sundberg & Partington, 1998).

Mands for information. Questions are mands that are reinforced by verbal behavior on the part of the listener, who typically supplies what can be considered information about the environment. Questions are thus under the control of EOs that make such information valuable to the asker. Questions are important for verbal development because they allow a speaker to react more precisely to the environment and to acquire additional verbal behavior. Training a child with autism to ask questions, however, is difficult in part because there must be an EO for information at strength during the training, and many children with autism are not strongly reinforced by such verbal information. Training may fail because the role of the relevant EO as the primary source of control for asking questions is not appreciated. Teaching a child to say "Where is the cup?" as an echoic response and then providing the information ("On the table") along with social reinforcement for the echoic response will not generate a functional verbal relation unless there is a current EO at strength responsible for the value of the information. The relevant EO must either be captured or contrived to conduct the necessary training. Other mands for information, such as those involving the response forms "who," "what," "when," "which," "how," and "why," also involve specific EOs that must be present during training.

Mands to remove aversive stimuli. There are several different mands that can be evoked by learned aversive stimuli (a type of learned EO or CEO), and children with autism need to be specifically taught each of them (e.g., "go away," "don't," "stop," "give that back," "leave me alone"). It is important that these responses be under EO

control rather than control by a discriminative stimulus, which means that the aversive stimulus must be present during training, and terminating the aversive stimulus must be the main form of reinforcement for the correct response, otherwise the mand will not occur in the natural environment under appropriate conditions.

The use of the EO to teach other verbal behaviors. It also appears that mand training, and the specific use of the EO as an independent variable, can facilitate the later development of echoic, tact, and intraverbal training in at least two ways. First, a successful mand training program with a previously nonverbal child often changes the child's willingness to participate in training sessions. The child is now successful where only failure had occurred in the past, and trainers are paired with this kind of reinforcement rather than with punishment consisting of demanding further efforts and possibly other social behaviors that function negatively. Second, the EO can be used as an additional independent variable in teaching echoics, tacts, and intraverbals (multiple control). Once a specific response form is acquired as a mand, then procedures to break free from EO control and bring the response solely under discriminative stimulus control can be implemented (Carroll & Hesse, 1987; Drash, High, & Tutor, 1999; Skinner, 1957; M. L. Sundberg & Partington, 1998).

THE INTRAVERBAL REPERTOIRE

Skinner (1957, pp. 71-78) identified the intraverbal relation as a type of verbal behavior where a verbal response is controlled by an antecedent verbal stimulus that lacks point-to-point correspondence between the stimulus and the response. That is, the verbal stimulus and the verbal response are not composed of the same verbal units (letters, sounds, etc.). A tendency to say "dog" as a result of hearing someone else say "animal" or seeing the word *animal* on a chalkboard is an example of an intraverbal relation. By contrast, a tendency to say "dog" as a result of hearing someone else say "dog" is echoic behavior, a tendency to say "dog" as a result of seeing the word *dog* on a chalkboard is textual behavior, and a tendency to say "dog" as a result of seeing an actual dog or a picture of a dog is a tact. The first three

examples illustrate control by a verbal stimulus and the fourth by a nonverbal stimulus. In the educational context, the reinforcement for all four of these relations usually involves some form of social conditioned reinforcement (see Table 1) such as “good job” or “right.”

An intraverbal repertoire facilitates other verbal and nonverbal behavior. It prepares a speaker to behave rapidly and accurately with respect to further stimulation and, at a more advanced level, plays an important role in continuing a conversation. For example, a child hears an adult speaker say “animal” in some context. If this stimulus functions to evoke several relevant intraverbal responses, such as “elephant,” “lion,” “camel,” “bear,” and so on, the child is then better able to react to other parts of the adult’s verbal stimulus that may be related to a recent trip to a zoo. One might say that the child is now thinking about animals and now has relevant verbal responses at strength for further responses to the adult’s verbal behavior. An intraverbal stimulus probes the listener’s repertoire and gets it ready for further stimulation.

Intraverbal chains are important components of many normal intellectual repertoires, such as a tendency to say “three” as a result of hearing “one, two . . .”; a tendency to say “blue” as a result of hearing “red, white, and . . .”; reciting the alphabet; providing addresses and phone numbers; and so on. Typical adult speakers have hundreds of thousands of such relations as a part of their intraverbal repertoires. In terms of conversation, a tact repertoire permits verbal behavior about an object or event that is actually present, whereas an intraverbal repertoire allows a speaker to talk about (and to think about) objects and events that are not physically present.

Many children with autism have delayed, defective, or nonexistent intraverbal repertoires, even though they can emit hundreds of words for objects and actions (tacts) and can point to those objects under the control of appropriate verbal stimuli (receptive language). For example, a child may be able to identify a picture of a bed when hearing “bed” spoken by another person, tact a bed, and even mand for bed, but may not have any tendency to say “bed” when hearing someone say “sleep” or, more formally, when hearing “You sleep in a . . .” In traditional terms, this type of language disorder may be described as a child’s failure to auditorily process the verbal stimulus or in terms of

other hypothesized internal processes. Conceptualizing the deficit this way can easily hinder acquiring intraverbal behavior because it distracts us from an analysis of the appropriate environmental controlling variables. Rarely is the problem identified as a failure to teach intraverbal behavior along with the other types of verbal behavior, a characterization that more clearly implies the necessary remedial training.

Typical children acquire much of their intraverbal repertoire as a result of massive exposure to a complex and valuable verbal environment. For example, they can be heard reciting television commercials with no special instruction or encouragement—even in spite of some discouragement. However, with a beginning learner who is not strongly reinforced by stimuli that make up the typical social environment, it may be necessary to directly teach some intraverbal behavior that the more typically developing child acquires indirectly. Due to the independence of the various functional verbal units in the early stages of language training, one cannot assume the development of an intraverbal repertoire from the availability of an extensive echoic, tact, and mand repertoire. Empirical research has shown that some children with mands and tacts may not be able to emit those same response forms under intraverbal control (e.g., Braam & Poling, 1983; Luciano, 1986; Partington & Bailey, 1993; Watkins, Pack-Texteria, & Howard, 1989).

AUTOMATIC REINFORCEMENT

Skinner used the term *automatic reinforcement* in a number of his writings simply to indicate that the reinforcement occurred without someone providing it (Vaughan & Michael, 1982). In other words, the reinforcement was the automatic result of the response. For example,

the young child alone in the nursery may automatically reinforce his own exploratory vocal behavior when he produces sounds which he has heard in the speech of others. . . . The adult acquires intonational patterns which are automatically reinforcing because they are characteristic of, say, a person of prestige. (Skinner, 1957, p. 58)

Others have made use of a similar analysis or have elaborated on Skinner's (e.g., Bijou & Baer, 1965; Braine, 1963; Mowrer, 1950; Osgood,

1953; Spradlin, 1966). A two-stage conditioning history is involved in this process. In Stage 1, a neutral stimulus (e.g., a mother's voice) is paired with an existing form of conditioned or unconditioned reinforcement (food, warmth, removal of aversive stimuli). As a result, the previously neutral stimulus becomes a form of conditioned reinforcement (hearing mother's voice or any similar stimulus will now strengthen whatever behavior precedes that stimulation). In Stage 2, a vocal response by the child (either as random muscle movement of the vocal cords or as reflexive behavior) produces an auditory stimulus that sounds somewhat like the mother's voice (words, intonation, pitch), which then functions as reinforcement in automatically increasing the frequency of that type of vocal behavior. The concept of automatic reinforcement may help to explain why a typical infant engages in such extensive babbling without the apparent delivery of reinforcement. In their analysis of child language development, Bijou and Baer (1965) also concluded that automatic reinforcement, along with direct reinforcement, is a major independent variable responsible for an infant's tendency to babble.

A problem faced by many language-delayed children is that their vocalization rate is too low to acquire the muscle control necessary for the later training of echoic responses. There is some evidence that the application of an automatic reinforcement procedure (pairing sounds made by a trainer with various reinforcers) can increase vocal behavior, which should facilitate the development of echoic and mand behaviors (R. Smith, Michael, & Sundberg, 1996; M. L. Sundberg, Michael, Partington, & Sundberg, 1996; Yoon, 1998; Yoon & Bennett, 2000). A significant aspect of these studies is that the procedure not only results in an increase in the rate of babbling the sounds that were paired with reinforcement but that new vocal responses have sometimes been acquired without the use of direct reinforcement or prompts to respond. Thus, the procedure can provide parents and clinicians with a new way to increase a child's vocal repertoire, and it is an especially easy procedure to carry out (just make simple sounds like those the child can or could also make and provide reinforcement of any kind at the same time).

It seems quite likely that automatic reinforcement continues to play an important role in the development of the more complex aspects of

verbal behavior, such as the acquisition of grammatical conventions. Donahoe and Palmer (1994, pp. 317-319) and Palmer (1996, pp. 289-290; 1998, p. 14) have suggested that much grammar is acquired as children hear their own vocal behavior and are automatically reinforced when it sounds like that of other people in their environment and automatically punished when it sounds odd or unusual. Palmer (1996) referred to this as the child's "achieving parity." If this interpretation is correct, we should expect that the use of explicit reinforcement to teach many subtle grammatical conventions (e.g., those relating to the use of "the" and "a") without the support of massive automatic reinforcement and punishment may be relatively unsuccessful. One implication is that the focus on developing verbal behavior in children with autism should be on communicative effectiveness and not impaired by a focus on grammatical correctness that can be expected to develop without instruction as the child's functional verbal repertoire increases. Another implication is that language training should be fun for the child and paired with reinforcement as much as possible rather than with the aversive stimuli often associated with demands.

IMPLICATIONS FOR MORE COMPLEX VERBAL BEHAVIOR

In many cases, the task of the program designer is to directly teach most of the elements of a language repertoire to an individual child. This task may be quite straightforward at the early steps of nonverbal imitation, echoic, tact, mand, and intraverbal training because the components of the basic operants are quite clear (i.e., EOs, discriminative stimuli, consequences, etc.) and it is known what to expect from the child who starts with nothing. However, more advanced targeted repertoires may depend on verbal relations that are considerably more complex than is realized. This is especially likely if the training tasks and goals are taken from a commonsense understanding of the verbal behavior a typical child engages in, rather than starting with the elementary verbal operants and building from those elements.

Many more advanced verbal relations involve multiple sources of control and interacting repertoires that cannot be developed before the

relevant components are firmly established. Verbal behavior involving possession (“Point to Mary’s book”), yes-no questions (“Is this a cup?”), emotional states (“How do you feel?”), subject-verb-object combinations (“Boy touching dog”), and so on may be one kind of behavior when exhibited by a typical child who already has a large repertoire of mands, tacts, and intraverbals but a very different kind of behavior for the child with autism. Even what is ordinarily viewed as relatively simple behavior may be more complicated than it seems. For example, some beginning receptive language involves joint control (see below) and conditional discriminations. When asked to point to an object when there are several objects present, the child must have a reasonable scanning repertoire—looking at the first object, then looking at the next object, and so on, without skipping any objects—and the pointing response must then be controlled by both the verbal stimulus (the instruction) and nonverbal stimulus (the object), clearly a type of multiple control or conditional discrimination. The typically developing child may make echoic responses to the verbal instruction and then further self-echoic responses as the objects are being scanned. When it is possible to tact an object with the same response form as the echoic or self-echoic response, that object is then selected. This is the joint control discussed at length and specifically trained in a number of experiments by Lowenkron (e.g., 1984, 1991) in connection with generalized matching to sample. Pointing at the correct object would involve a different kind of verbal control for a child with no systematic scanning repertoire and no relevant echoic and tact responses, if it were possible at all for such a child.

It is also common in some training programs to attempt early to bring verbal behavior under the control of private stimuli, such as those involved in emotional states (sad, happy, afraid), pains, itches, a full bladder, hunger pangs, nausea, and so on. Such verbal behavior is an important part of any person’s repertoire, but because the controlling variables that are affecting the learner cannot be directly contacted by the teacher or parent, accurate tact relations are difficult to develop. An instructor cannot present the relevant private stimulus that is inside a person’s body and therefore cannot differentially reinforce correct tact responses in the same way that correct tacts to objects and actions can be reinforced. Teaching a child to correctly say

“itch” with respect to a stimulus coming from a portion of the child’s arm is trained indirectly as the teacher reacts to common public accompaniments of such stimuli (observing a skin rash) and collateral responses by the learner (observing the child’s scratching), but this method is fraught with difficulties (the rash may not itch, the scratching may be imitated), and such repertoires even in typical adults are often quite imprecise. Verbal behavior under the control of private stimuli is an issue that has been at the core of much of the theoretical and philosophical analyses of behavior ever since Skinner (1945) first described his radical behaviorism and contrasted it with methodological behaviorism. It goes considerably beyond the scope of this article to deal with this issue, but its understanding is critical for teaching this most subtle and personal type of language. (For more on this topic, see chap. 17 of Skinner’s *Science and Human Behavior* [1953] and pp. 130-146 of *Verbal Behavior* [1957].)

There are a number of complex types of verbal behavior that raise special problems when language is being deliberately generated in those who have very little language. Some examples are verbal behavior under the control of relative concepts, such as large and small (a large dog is much smaller than even a tiny mountain), under, over, to the right of, and so on, and teaching children to talk about the past (“What did you see at the zoo yesterday?”). Such verbal relations are difficult to train from any theoretical or conceptual approach, but Skinner’s detailed analysis, as in *Verbal Behavior* (1957), may offer some additional techniques and concepts in our effort to develop this type of language in children with autism.

MORE GENERAL ISSUES

Skinner’s analysis of verbal behavior may also help parents and professionals make decisions regarding general instructional approaches for a child. Three such issues will be considered: augmentative communication, discrete-trial training (DTT) versus natural environment training (NET), and inclusion. Selecting a form of augmentative communication often involves a decision between a selection-based form of verbal behavior (e.g., the picture exchange communication system) (Frost & Bondy, 1994) and a topography-

based form of verbal behavior (e.g., sign language). Conceptual analyses and research based on Skinner's *Verbal Behavior* suggest that selection-based systems involve multiple response forms (e.g., scanning, selecting, handing over) and conditional discriminations that are more complex than they first appear (e.g., Lowenkron, 1991; Michael, 1985; Potter & Brown, 1997; Potter, Huber, & Michael, 1997; Shafer, 1993; C. T. Sundberg & Sundberg, 1990; M. L. Sundberg, 1993b; Wraikat, Sundberg, & Michael, 1991), yet selection-based systems remain the most popular choice by augmentative communication specialists but not necessarily because of more effective short- and long-range performance by the learner (Shafer, 1993).

DTT is often contrasted with NET in the behavioral literature, with studies attempting to show that one approach is more beneficial than the other (e.g., Elliott, Hall, & Soper, 1991; Koegel, Koegel, & Surratt, 1992). However, a verbal behavior analysis suggests that the two focus on different verbal operants. Both teach receptive and expressive language, but NET is primarily based on mand training by using the child's current EOs and delivering specific reinforcement, whereas DTT is primarily based on tact and receptive training with nonverbal and verbal stimuli and delivering nonspecific reinforcement. From a verbal behavior perspective, a more complete language repertoire would be acquired from a combination of DTT and NET procedures (M. L. Sundberg & Partington, 1999).

Inclusion is also an issue that is frequently discussed by parents and professionals. Probably a major advantage of including a child with autism in a regular education classroom is the presence of verbal peers who can model typical verbal interactions, present a wide variety of verbal stimuli, and produce consequence verbal behavior through social interaction and specific reinforcement. However, the decision to place a child with autism in a regular education class should be based, in part, on whether the child has the basic verbal repertoires necessary to acquire new behaviors in that learning environment. The child needs functional mand, tact, and intraverbal repertoires, as well as effective listener skills, in order to acquire new verbal behaviors from peers. If the child does not have a strong intraverbal repertoire, for example, the verbal stimuli presented by peers will not evoke appropriate verbal responses and may produce a form of punishment

rather than reinforcement. If the child does have the prerequisite verbal skills, then an inclusion environment is essential for further verbal development (M. L. Sundberg & Partington, 1998). Skinner's analysis of verbal behavior as a conceptual basis for examining these issues could result in a more effective individualized intervention program.

CONCLUSION

Children with autism have benefited greatly from the procedures and techniques of applied behavior analysis. It is suggested in this article that it may be possible to make further gains by using some aspects of Skinner's analysis of verbal behavior as a basis for assessment and intervention programs with these children. The emphasis on the verbal operant as an appropriate unit of analysis has implications for several elements of an intervention program: a focus on the separate training of each verbal operant and with greater emphasis on mand and intraverbal relations than is currently practiced; consideration of speaker and listener repertoires as requiring separate and independent training; and consideration of EOs and automatic reinforcement as important factors in the analysis and training of verbal skills. Another implication is that with the more traditional emphasis on words and meanings it may be easy to underestimate the complexity of some verbal relations and attribute failure to the child's autism rather than to an incomplete behavioral analysis of the language task. Skinner's approach may help prevent some errors of this type and hasten the acquisition of language by children with autism.

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