Numerous behavior analytic methods developed since the early 1960s have proved effective for developing a wide range of skills in learners with autism. Recent advances in stimulus control technology, in particular, offer effective methods for teaching many important skills and for promoting independent, generalized performances. This article reviews selected stimulus control techniques, including new methods for teaching conditional discrimination (matching) skills, stimulus equivalence procedures, prompt and prompt-fading techniques, and incidental teaching procedures.

In 1948 an event occurred that was to have far-reaching effects: Sidney Bijou became director of the Institute of Child Development at the University of Washington. Bijou was a Columbia University-trained psychologist with a strong interest in child development, learning theory, and the relatively new radical behaviorism of B. F. Skinner, with whom he had worked for 2 years at Indiana University. Shortly after Bijou went to the University of Washington, a research program was established within the Institute of Child Development to study normal and abnormal behavior in young children in a laboratory and in an experimental school. There Bijou and his colleagues and students blended Skinner’s natural science approach to behavior—including methods of functionally analyzing individual behavior—with research on child development. Over the next two decades they conducted landmark studies of operant behavior in young children and pioneered numerous methods for managing problem behavior, teaching academic skills to students with mental retardation, training parents to work as therapists with their own children, and conducting research in natural settings. In 1961 Bijou and Donald M. Baer published their classic text, *Child Development: A Systematic and Empirical Theory*, in which they examined development from a behavioral perspective (Bijou, 1996).

How is this history relevant to the topic at hand? Some researchers might be surprised to learn that much of the seminal research on behavior analytic methods for teaching children with autism was conducted at the University of Washington Institute for Child Development under Bijou’s direction. In the early 1960s a local physician asked Bijou if the staff at the institute might be able to teach a visually impaired boy with autism to wear glasses. Dicky, then 3½ years old, exhibited severe tantrums, self-injurious behavior, problems with sleeping and eating, and very limited communication, social, and self-care skills. Bijou had seen Charles Ferster and Marion DeMyer use Skinnerian methods to build the repertoire of children with autism at Indiana University Hospital (Ferster & DeMyer, 1961), so he asked his colleague, behavioral psychologist Montrose Wolf, a graduate student, Todd Risley, and clinical psychologist, Hayden Mees to take on Dicky’s case. Fortunately, they did. After 7 months of intensive behavioral treatment, Dicky was wearing his glasses most of the time, and his problem behaviors had diminished enough that he could be returned to his home (Wolf, Risley, & Mees, 1964). At the age of 5, Dicky was enrolled in the Institute’s nursery school. He still had few skills; some of the old problem behavior had recurred, and aggressive behavior had developed. Wolf and Risley trained the nursery school staff to implement behavioral teaching procedures with Dicky. The goal was to develop sufficient language and other skills that Dicky could enroll in public school. By the beginning of the next school year that goal had been achieved (Wolf, Risley, Johnston, Harris, & Allen, 1967). Dicky ultimately graduated from high school. He had been deemed “untestable” as a youngster; at age 26 he achieved a score of 98 on an IQ test. When he was in his 30s, Dicky was living and working independently and had relatively good reading, writing, and social skills (Bijou, 1996; Wolf, 1999).

Wolf went on to start the *Journal of Applied Behavior Analysis* and, with Baer and Risley, set out the very first definition of applied behavior analysis, or ABA (Baer, Wolf, & Risley, 1968). They and others who worked or studied with Bijou at the University of Washington (including Jay Birnbrauer, Betty Hart, Ivar Lovaas, Howard Sloane, and Robert Wahler, among others) made invaluable contributions in many areas, particularly applications of Skinner’s science of behavior to human development, language, education, mental retardation, autism, and behavior disorders. Their work estab-
lished the foundation for much of the field of applied behavior analysis, and for the hundreds of studies of behavior analytic interventions for autism that have been published since the 1960s (see Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996). That research, in turn, has made it possible for people with autism to achieve unprecedented outcomes today.

The interventions designed by Bijou, Wolf, Risley, and colleagues in the 1960s had several key features: (a) integration of developmental and behavioral approaches; (b) an emphasis on positive reinforcement procedures to build useful repertoires; (c) functional analysis of individual behavior (i.e., experimental demonstrations of functional relations between environmental events and behavior); (d) use of scientific methods to evaluate the effects of interventions; (e) individualization of goals and instructional procedures; (f) gradual, systematic progression from simple to more complex skills; (g) training of parents and others to implement interventions in multiple environments; and (h) transfer of intervention from structured to natural settings. Contrary to assertions that these features characterize only certain “contemporary” versions of ABA (e.g., Prizant & Rubin, 1999; Prizant & Wetherby, 1998; Wetherby, Schuler, & Prizant, 1997), the facts are that they have characterized genuine, comprehensive ABA programming for learners with autism since the 1960s, and the work of Bijou and his colleagues has long been included in many graduate training curricula in behavior analysis.

Of course, many additional techniques have been developed and integrated into ABA programming for learners with autism since those early days. Indeed, a very large array of behavior analytic procedures have been proved effective for developing a wide range of skills in individuals with autism of all ages. This article does not provide an exhaustive or detailed review of all of them; that would take many pages, and, besides, some good comprehensive reviews of the relevant research have been published recently (e.g., Hall, 1997; Matson et al., 1996). Instead, because all instructional methods involve manipulations of antecedent stimuli, the focus here is on selected recent advances in using stimulus control principles and procedures to build skills in learners with autism and related disorders. Space limitations prohibit exhaustive coverage of all stimulus control procedures. Excluded, for example, are instructional techniques that make use of establishing operations, which are manipulations of antecedent stimuli that influence the momentary effectiveness of reinforcers. (For discussions of establishing operations in teaching language to learners with autism, see Sundberg & Partington, 1998, 1999.) Because the topic is skill development, antecedent manipulations designed primarily to manage or reduce problem behavior are also excluded.

ABA for Autism: An Overview

To provide context for readers, the behavior analytic framework and basic ABA methods are first reviewed briefly in this section. They have been detailed in numerous books, chapters, and articles, including the principal sources used here (Anderson & Romanycz, 1999; Anderson, Taras, & Cannon, 1996; Green, 1996; Hall, 1997; Keenan, Kerr, & Dillenburger, 2000; Koegel & Koegel, 1995; Lovaas et al., 1981; Matson et al., 1996; Romanycz, 1996; Sundberg & Partington, 1998).

In the behavior analytic view, autism is a syndrome of behavioral deficits and excesses that have a biological basis but are nonetheless amenable to change through carefully orchestrated, constructive interactions with the physical and social environment. Behavior analytic intervention seeks to redress those deficits and excesses by providing multiple planned opportunities for the learner to develop and practice skills that are useful in a variety of situations, and are effective alternatives to less socially acceptable behaviors, such as tantrums, stereotypy, and destructive behaviors (Green, 1996; Koegel & Koegel, 1995; Lovaas & Smith, 1989; Schreibman, 1988).

Behavior analytic instruction begins with a comprehensive assessment of each learner’s current skills and needs, accomplished by observing the learner directly in a variety of situations and recording what she or he does and does not do. Every skill that is selected for instruction (often called a “target”) is defined in clear, observable terms and broken down into its components. Each component response is taught by presenting or arranging one or more specific antecedent stimuli, such as cues or instructions from another person, and/or items of interest to the learner. Often, the kinds of cues that are effective with typically developing children (such as spoken instructions) are not effective when a skill is first introduced to a learner with autism; that is, those cues are not reliably followed by (discriminative for) the desired response. In such cases, another antecedent, called a prompt, is often added to get the response going. Effective prompts are stimuli that are reliably followed by the desired responses. For example, given the language deficits that are often observed in children with autism, spoken instructions like “Come here” or “Touch your nose” may not be followed by the actions they specify initially—that is, they are not discriminative stimuli for those responses. But gentle physical guidance is effective for getting many children to carry out actions, so it might be added to the spoken instructions as a prompt during initial teaching, and gradually reduced (faded) over successive learning opportunities.

When target responses occur, they are followed immediately by consequences that have been found to function as reinforcers; that is, repeated observations have verified that when those consequences consistently followed a particular response, the response occurred again and again. Incorrect or interfering responses are explicitly not reinforced. Each antecedent–response–consequence cycle constitutes a learning opportunity, or trial. There are many behavior analytic procedures for arranging learning opportunities, some adult-initiated, some learner-initiated, some embedded in typically occurring activities or sequences of re-
sponses, and some that are hybrids or permutations of these. Each type of procedure has its uses and advantages. Genuine ABA programming uses any and all procedures required to accomplish the job of skill development and skill generalization with each individual learner; it is by no means just “discrete trial training” (e.g., see Anderson & Romanzcyk, 1999; Sundberg & Partington, 1999). Learning opportunities are typically repeated many times until the learner performs the target response readily and fluently, without prompts from adults. Again, there are many ways to arrange multiple, repeated learning opportunities; they need not (and should not) be limited to blocks of massed trials presented as drills. The learner’s responses are recorded frequently according to specific, objective criteria. Those data are summarized and graphed to provide pictures of the learner’s progress and to enable frequent adjustments in instructional procedures when the data show that the learner is not making the desired gains.

The timing and pacing of teaching sessions, practice opportunities, and consequence delivery are determined precisely for each learner and each skill. To maximize the learner’s success, skills are practiced and reinforced in many settings. The long-range goal is to build simple responses systematically into complex and fluid combinations of age-appropriate responses. In quality ABA programming, the overarching goal is to teach learners with autism how to learn from typical environments, and how to act in ways that will consistently produce positive outcomes for the learner and those around him or her.

**Teaching Discriminations and Stimulus Equivalence Classes**

From the first incarnations in the 1960s to the present versions, many behavior analytic curricula have included techniques for teaching learners with autism to discriminate among various types of stimuli, and to match certain stimuli to one another. Discrimination and matching skills are components of many (arguably, all) cognitive, communication, social, academic, work, and self-care skills, so this emphasis is understandable and appropriate. Lovaas, Schreibman, and their colleagues conducted some seminal research on teaching discrimination and matching skills to learners with autism in the 1970s. Procedures developed in those early studies seem to have been adopted by many practitioners, perhaps because they have been widely disseminated in such media as The ME Book (Lovaas et al., 1981). Meanwhile, during the ensuing three decades, a great deal of stimulus control research has been conducted by behavior analysts in laboratories and classrooms affiliated with the Eunice Kennedy Shriver Center, the University of Kansas, and the New England Center for Children, to name a few. Much of that research has focused on analyzing various types of discriminations and developing effective and efficient techniques for establishing discriminations and stimulus classes (sets of mutually substitutable stimuli) in learners with developmental disabilities, including autism. To date, however, those techniques have not enjoyed widespread adoption, even among applied behavior analysts, perhaps because they have not yet been “packaged” in comprehensive, user-friendly programs that are readily available to practitioners (although some steps in that direction have been taken, e.g., Johnson, White, Green, Langer, & MacDonald, 2000; Serna, Dube, & McIlvane, 1997). A complete presentation of the aforementioned stimulus control research is beyond the scope of this article, so what follows is a summary of principles and methods drawn from some of that literature.

### Types of Discriminations

As noted earlier, virtually all skills involve discriminating among, or responding differentially to, environmental events—sounds, colors, shapes, letters, numbers, words, foods, clothing items, people, responses, locations, and the like. At the same time, many functional skills require learners to treat some environmental events as if they are the same, including some that bear little or no physical resemblance to one another (such as spoken words and various types of visual stimuli). As it turns out, these latter types of performances also require complex discriminations among stimuli—discriminations that are made up of other, simpler discriminations and that have particular and unique characteristics. In short, discriminations vary in their complexity and in the types of environmental events they comprise. Therefore, a useful strategy for analyzing and teaching discrimination skills is to break each discrimination into its components (R. Saunders & Green, 1999; Sidman, 1986).

Many important skills require **simple discriminations**. A simple discrimination contingency has three elements: the antecedent stimulus (S), the response (R), and the consequence (C). That is, simple discriminations are established by rein-
forcing particular responses in the presence of particular antecedents, and not in the presence of other antecedents. When the defined responses occur reliably in the presence of the defined stimuli and not in the presence of other stimuli, the stimuli are said to be discriminative for reinforcement. Some examples relevant to teaching learners with autism include:

- **Oral naming:** For example, in the presence of a spoon (S1), the vocal response “spoon” (R1) is reinforced and “fork” (R2) is not; in the presence of a fork (S2), the response “fork” (R2) is reinforced and “spoon” (R1) is not.
- **Instruction following:** For example, in the presence of the spoken instruction “Stand up” (S1), standing up (R1) is reinforced and sitting down (R2) is not; in the presence of the spoken instruction “Sit down” (S2), sitting (R2) is reinforced and standing up (R1) is not.

Many other very important skills require learners to match stimuli to one another, that is, to treat them as if they are the same, in some sense. For instance, language comprehension entails matching spoken words with corresponding objects, symbols (such as pictures and printed words), actions, people, and so forth; basic math skills involve matching corresponding printed numerals, quantities, and spoken number names; and so on. True matching requires conditional discriminations. Conditional discriminations are established by reinforcing responses to particular antecedent stimuli if and only if they are preceded or accompanied by particular additional stimuli. In contrast with simple discriminations, here each antecedent stimulus is discriminative for reinforcement or not, depending on (conditional on) the presence of another particular antecedent (Sidman, 1986; Sidman et al., 1982; Sidman & Tailby, 1982). Conditional discrimination contingencies, thus, involve four (rather than three) elements: conditional stimuli, antecedent stimuli, responses, and consequences. Some common categories and illustrations of conditional discriminations are:

- **Conditional identity matching:** For example, in the presence of a red patch (S3), pointing to an identical red patch (S1) is reinforced, whereas pointing to a blue patch (S2) is not, AND, in the presence of a blue patch (S4), pointing to an identical blue patch (S2) is reinforced, whereas pointing to a red patch (S1) is not.
- **Object–picture correspondence:** For example, in the presence of a ball (S3), pointing to a picture of a ball (S1) is reinforced, whereas pointing to a picture of a toy car (S2) is not, AND, in the presence of a toy car (S4), pointing to a picture of a car (S2) is reinforced, whereas pointing to a picture of a ball (S1) is not.
- **Receptive vocabulary, or “receptive identification.”** For example, after one hears “nose” (S3) spoken by an adult, touching one’s own nose (S1) is reinforced, whereas touching one’s mouth (S2) is not, AND, after hearing “mouth” (S4) spoken by the adult, touching one’s mouth (S2) is reinforced, whereas touching one’s nose (S1) is not.
- **Picture-based communication:** For example, when cookies (S3) are available, bringing Mom a picture of a cookie (S1) is reinforced, whereas bringing Mom a picture of juice (S2) is not reinforced, AND, when juice (S4) is available, bringing Mom a picture of juice (S2) is reinforced, whereas bringing Mom a picture of a cookie (S1) is not.

**Conditional Discrimination Teaching Methods.** A handy and reliable set of procedures for potentially teaching conditional discriminations is match-to-sample (MTS). Typically, each of a series of MTS trials begins with the presentation of a designated sample (or conditional) stimulus to the learner, who is required to respond to it (e.g., by touching it if it is visual, or touching a blank card or a key on a computer screen if the sample is auditory). An array of two or more other stimuli is then presented, called the comparison, or choice, stimuli. The learner is required to respond to one comparison, usually by touching or pointing to it. One comparison is designated correct (discriminative for reinforcement; S+) with each sample; that is, responses to it are followed by reinforcer delivery, whereas responses to the other comparisons in the presence of that sample are not reinforced (S−). After a brief intertrial interval, the next trial is presented in similar fashion. The sample stimulus typically varies unsystematically from trial to trial, as does the position of the S+ comparison stimulus on each trial.

Match-to-sample procedures are commonly used to teach learners with autism to match identical visual stimuli (e.g., objects, colors, shapes, letters, numerals) and nonidentical visual stimuli (e.g., pictures to objects, pictures to printed words). It is important to note, however, that virtually any kind of stimuli that can be seen, heard, touched, tasted, or smelled can be used in MTS procedures (with a few commonsense qualifications; e.g., it is not practical to present two or more auditory stimuli simultaneously as comparisons). More importantly, as the foregoing examples illustrate, many functional skills call for learners to make conditional discriminations, whether or not explicit MTS procedures are involved. Skills that are often termed “receptive vocabulary,” “receptive identification,” or “language comprehension,” for instance, require learners to respond to each of a number of visual stimuli (e.g., body parts, objects, pictures, printed words) if and only if that stimulus was preceded by a particular spoken word. The spoken words can be thought of as samples, the visual stimuli as comparisons. When samples and their corresponding correct comparisons are not physically identical to one another, the procedure is often referred to as arbitrary matching.

Analyzing the components of conditional discriminations reveals precisely what makes them more complex than simple discriminations. To fulfill conditional discrimination reinforcement contingencies
consistently (i.e., to respond correctly on most opportunities), the learner must (a) discriminate each sample from every other sample presented across a series of trials (these are successive simple discriminations), (b) discriminate each comparison from all other comparisons presented within each trial (simultaneous simple discriminations), and (c) relate (match) each comparison stimulus with one and only one sample stimulus. Put another way, in conditional discriminations the sample stimuli exert stimulus control over the functions served by the comparison stimuli (as S+ or S-) from trial to trial. This kind of stimulus control develops only when contingencies consistently require the learner to observe the sample stimulus on each trial, discriminate it from the other samples and from the comparisons, and discriminate each comparison from every other comparison and from the samples (K. Saunders & Spradlin, 1989, 1993; R. Saunders & Green, 1999; Sidman, 1986, 1994). Teaching procedures that arrange other kinds of contingencies, explicitly or inadvertently, are likely to establish something other than the desired stimulus control.

During the past 20 years or so, many researchers have investigated conditional discrimination learning in developmentally young learners and those with developmental disabilities. Some analyzed the kinds of faulty stimulus control that can easily arise from certain arrangements of trials and trial sequences (e.g., Harrison & Green, 1990; Johnson & Sidman, 1993; McIlvane & Stoddard, 1985; Stromer & Osborne, 1982). Others tested procedures for minimizing errors and for establishing conditional discriminations with learners who did not readily acquire them via standard training procedures (e.g., Dube & Serna, 1998; McIlvane & Stoddard, 1981; K. Saunders & Spradlin, 1989, 1993; Zygmont, Lazar, Dube, & McIlvane, 1992). The following recommended general procedures for teaching conditional discrimination skills have been extracted from that research (cf. Green & Saunders, 1998). They are discussed in MTS terms, but it is important to reiterate that the same basic guidelines can and should be followed whenever the objective is to establish conditional discriminations, whether or not the teaching procedures are explicitly MTS (e.g., for receptive vocabulary instruction, picture-based communication training, etc.).

1. Within a session or block of MTS trials, a different sample should be presented on each trial, but the same comparisons should appear on every trial. Each comparison should be the S+ with one and only one sample, and should be S- equally often with each of the other samples.

2. For most purposes, it is preferable to have at least three comparisons on every trial. Because each comparison is designated correct with one sample, the number of different sample stimuli presented in a session or block of trials should equal the number of comparison stimuli presented on each trial.

3. Each sample should be presented equally often within a session or block of trials, in unsystematic order. A good rule of thumb is that the same sample should not be presented on more than two consecutive trials.

4. The position of the S+ comparison should vary unsystematically from trial to trial. A good rule of thumb is that the S+ should never appear in the same position in the comparison array for more than two trials consecutively.

Some examples of MTS trials that fulfill these parameters are illustrated in Table 1. Each trial has three comparisons presented in horizontal arrays with positions designated from the learner’s (rather than the instructor’s) perspective. Of course, multiple trials (in multiples of three, in this case) should be presented in each teaching session or block of trials, arranged in accordance with the procedures described above.

Any deviation from the arrangements of balanced trial types and teaching sequences just described creates the potential for one or more types of extraneous stimulus control to interfere with development of the desired control by sample stimuli over the selection of comparison stimuli. For example, if the S+ appears more often in one position in the comparison array than in the others across trials, the learner’s comparison selections may come to be controlled by position rather than by sample stimuli. Another type of extraneous stimulus control can arise from the common practice of presenting novel incorrect comparisons (often referred to as “distractors”) periodically.
cally, sometimes on every trial. The risk with such a procedure is that learners will respond either to the novel stimuli or away from them simply because they are novel to the context. In either case, learners may not observe the sample stimuli and therefore may not learn the intended conditional discriminations. If the incorrect (S–) comparisons presented with any given sample change from trial to trial while the S+ remains constant, learners may simply learn to respond away from the comparisons that are new from trial to trial. If so, performance will seem to be highly accurate—the learner will touch the S+ consistently—but, again, she or he need not observe or discriminate the sample stimuli in order to satisfy the reinforcement contingencies (Harrison & Green, 1990; Johnson & Sidman, 1993).

Another common practice that may create unwanted stimulus control is repeated presentation of each sample with its designated correct comparison and no other comparisons, often referred to as teaching “in isolation” (cf. Lovaa et al., 1981). For example, in an attempt to teach picture-object matching, the instructor may start by presenting a picture of a spoon (the nominal sample) and an actual spoon (the nominal comparison) for many repeated trials, reinforcing touches to the spoon. Trials to teach “fork” are presented in similar fashion, then “knife.” In this procedure, the reinforcement contingencies do not require the learner to discriminate among different sample stimuli, or among different comparison stimuli, because all he or she has to do is touch the one comparison that is available on each trial to earn reinforcers consistently—a simple, not a conditional, discrimination. After two or three samples and their corresponding correct comparisons are each presented in isolation for a number of trials, the stimuli are typically mixed so that all comparisons (the spoon, fork, and knife) appear on every trial but the sample (picture of spoon, fork, or knife) differs from trial to trial, as in the MTS trials described earlier. Many learners with autism perform at chance levels when mixed trials are introduced following isolation training, and their performance often does not improve even with repeated presentations. That is probably because the contingencies on the mixed trials require conditional discriminations rather than simple ones, but the immediate history of reinforcement for simple discriminations may predispose learners to simply track the comparison stimuli to which responses were reinforced most recently or most often in the training that just preceded.

Training in isolation may even inadvertently teach learners not to attend to sample stimuli at all, because attending to the sample is not required on those trials; it is most efficient for the learner to simply touch the one available comparison stimulus quickly in order to maximize reinforcement. This same type of faulty stimulus control may develop when children with autism are taught to use pictures presented repeatedly in isolation to request preferred items, as in the initial phases of Picture Exchange Communication System training (Frost & Bondy, 1994). These are simple discrimination contingencies that do not require the learner to observe the item that corresponds to each picture, or even to observe the features of each of the pictures, in order to obtain reinforcers consistently and quickly. All he or she has to do is pick up the only picture that is available and hand it to an adult, to immediately receive a preferred item. Following such training, it would not be surprising to see many learners perform at chance levels when two or more pictures (comparison stimuli) are presented simultaneously, only one of which matches the item available on any given requesting opportunity.

5. Learners should be required to make an “observing response” to the sample stimulus on each trial (e.g., by pointing to the stimulus or to a blank card or key when the actual sample cannot be touched, such as a spoken word). Of course, requiring learners to touch sample stimuli does not guarantee that they are actually looking at or listening to the samples, but it does make those responses more likely than simply presenting samples without requiring an observing response.

6. When the sample stimuli are auditory (e.g., spoken words, as in receptive language tasks), the sample should be presented clearly to start the trial, then repeated when the comparison stimuli are presented, and again every 2 seconds or so until the learner responds to a comparison or to some maximum number of repetitions. The rationale is as follows: If an auditory sample is presented only once to start a trial, learners have just that one fleeting opportunity to “observe” it. There is considerable risk that (a) they will not hear it, (b) they will hear it but not discriminate it from samples presented on other trials, or (c) they will hear it but not remember it throughout the interval that elapses while they examine the comparison array and respond to one comparison. Repeating auditory samples reduces those risks.

Another desirable practice is to limit the auditory stimulus presented to start each trial to the word to which one of the comparisons is to be matched (e.g., “spoon,” “fork,” or “knife”), rather than starting each trial with a nominal instruction like “Touch ________,” or “Point to ________.” If every sample consists of a series of sounds, the first of which are exactly the same from trial to trial while only the last differs, it is likely to be very difficult for many learners to discriminate among those sounds and respond to the critical one on each trial. Instead of using spoken instructions like “touch” or “point to,” it is preferable to teach learners to point to comparisons through nonverbal methods, such as physical guidance or modeling, and to help them discriminate among auditory samples by presenting each one distinctly and repeatedly, unaccompanied by redundant and extraneous words.

7. Instead of rearranging the comparison stimuli in front of the learner between trials, prepare the comparison array for each trial on a mat or board out of the learner’s sight (e.g., behind a screen, on a chair next to you) during the intertrial interval. Then present the whole comparison array after the sample has been presented and responded to. This helps reduce the likelihood that the learner will respond to extraneous cues,
such as the comparison stimulus the instructor touched first or last when she or he rearranged the comparisons.

8. Teach learners how to perform MTS tasks before trying to teach them new conditional discrimination using those procedures. Several skills are required to perform these tasks: sitting quietly between trials, orienting to the stimuli, making observing responses to sample stimuli, scanning arrays of multiple comparisons, and responding to just one comparison on each trial. If the learner lacks one or more of these skills, she or he is likely to make errors on MTS tasks that might be erroneously interpreted to reflect deficient conditional discrimination skills (Johnson et al., 2000). Similarly, auditory-visual matching and visual-visual matching procedures differ somewhat. If the learner does not know how to do tasks that employ both types of procedures, his or her performance on one or the other may lead to erroneous conclusions about discrimination skill deficiencies (Kelly, Green, & Sidman, 1998).

One very important skill involved in performing MTS is pointing to the sample stimulus (or a designated sample “key” or card) that starts each trial, and pointing to one comparison stimulus on each trial. It is strongly recommended that learners be taught to point to samples and comparisons rather than to place samples on top of or alongside comparisons (“put with same”; Lovaa et al., 1981), for a couple of reasons: (a) Pointing is a much more generally useful skill than “putting with.” Many stimuli that learners are required to match in everyday situations (such as spoken words and corresponding objects, people, or actions) cannot be physically “put with” one another, but learners can readily indicate that such stimuli go together by pointing to them; (b) teaching matching skills by requiring learners to put identical or physically similar stimuli on top of or alongside one another may establish stimulus control by identical outlines or other identical features of the stimuli, because that is all the learner needs to attend to in order to obtain reinforcement consistently. That could block the development of stimulus control by the relevant features of stimuli and put the learner at a distinct disadvantage when he or she is confronted with stimuli that cannot be readily matched by aligning identical features.

9. Use errorless teaching methods rather than trial-and-error procedures to teach conditional discriminations. There is a large body of research on errorless discrimination learning that goes back many years (e.g., Sidman & Stoddard, 1967; Terrace, 1963) and provides rich information about the benefits of, and methods for, minimizing errors early in training. (Few, if any, truly “errorless” training procedures exist, but there are many that can maximize the probability that correct responses will occur.) Some of that research has shown that errors lead to further errors and emotional responses that can interfere with acquisition, can be difficult to correct, and can inhibit skill generalization (see Heckamouron, Alber, Hooper, & Heward, 1998; MacDuff, Krantz, & McClannahan, in press).

Errorless teaching methods generally entail the addition of stimuli that reliably control the target response—that is, prompts—to the target antecedents at the beginning of instruction. Prompts are reduced (faded) systematically across successive trials in an effort to transfer stimulus control to the target antecedents, resulting in final performances that are unprompted. Put another way, errorless teaching methods are most-to-least prompt- and prompt-fading methods: The learner is given the most assistance necessary on initial trials to ensure that the target response occurs so that it can be reinforced frequently, and to minimize errors; the amount of assistance is then systematically decreased as long as the learner continues to respond correctly. If an error occurs, there is typically a provision for “backing up” to the preceding prompt level on the very next trial to reduce the likelihood that another error will occur. Following a correct response, the systematic fading process resumes.

Errorless discrimination training methods can and should be used to teach all kinds of new skills to learners with autism, because virtually all skills entail discriminations. Strategies for minimizing errors and prompt dependency while teaching such things as communication and play skills are discussed further in the section on prompting and prompt fading. Here, some specific methods for teaching discriminations with few errors are highlighted briefly. One category of errorless discrimination training methods is within-stimulus prompts. These methods involve altering the physical characteristics of the stimuli to be discriminated to increase the likelihood that correct responses will occur early in training. For example, simple or conditional discriminations can be taught by making the stimuli differ in intensity on initial teaching trials. With visual stimuli, such as printed letters or line drawings, the S- might be made to appear very faint and the S+ dark. If the intensity difference is an effective prompt, the learner will respond to the more intense stimulus. Over successive trials, the intensity difference is gradually decreased in a series of graded steps—that is, the S- gradually becomes darker (or louder)—until both the S+ and the S- are presented at the same intensity. If the learner continues to respond reliably to the S+ and not to the S-, it is evidence that stimulus control has transferred from the prompt to the target stimulus. This procedure is usually termed intensity fading. Size difference can also serve as a within-stimulus prompt. For example, the S- might be made very small and the S+ large on initial teaching trials. Over successive trials the size difference is gradually decreased, analogous to intensity fading, until the S+ and S- are the same size (sometimes called size fading).

Another within-stimulus prompting procedure involves altering the physical appearance of only those features of the stimuli that differentiate them from one another. An example is exaggerating the vertical parts of the lowercase letters b and p on early training trials and gradually making them appear more and more alike over succeeding trials. Such procedures are often referred to as criterion-related prompting. In general, criterion-related prompting has been found to be
more effective for teaching discriminations to learners with disabilities than noncriterion-related prompting, but the efficacy of the various within-stimulus prompting methods can vary with the characteristics of the stimuli involved, the learner’s skills, and the complexity of the discriminations being trained (for reviews see Demchak, 1990; Etzel & LeBlanc, 1979; MacDuff et al., in press).

A unique within-stimulus prompting procedure for teaching arbitrary MTS has been termed sample stimulus control shaping. In this procedure, the initial teaching trials are identity MTS trials presenting samples that are physically identical to their corresponding S+ comparisons (e.g., identical line drawings). Over successive trials, the sample stimuli are gradually transformed into entirely different stimuli (e.g., line drawings change into printed letters). Sample stimulus control shaping has proven efficacious for teaching arbitrary conditional discriminations to learners who can do conditional identity MTS but have failed to acquire arbitrary conditional discriminations through other training methods (Carr, Wilkinson, Blackman, & McIlvane, 2000; Zygmunt et al., 1992).

One of the major drawbacks of within-stimulus prompting procedures is that a great deal of advance stimulus preparation is required, which can make them difficult to use in typical instructional settings. (Many recent studies on this topic took advantage of computer technology and rather sophisticated software to accomplish very precise stimulus transformations, timing, backing up and advancing through prompt hierarchies, etc.). An alternative errorless teaching method is extra-stimulus prompting, in which prompts are separate from and external to the stimuli to be discriminated (Etzel & LeBlanc, 1979; MacDuff et al., in press). One example of an extra-stimulus prompt in the context of teaching conditional discriminations is an instructor’s gesture (such as a point) toward the correct comparison stimulus on initial teaching trials. In other contexts, extra-stimulus prompts could be models provided by the instructor; for example, to teach picture naming to a learner who reliably imitates spoken words, the instructor might hold up pictures one at a time and simultaneously model the name of each picture.

Extra-stimulus prompts can be faded along any of several dimensions, such as intensity, distance relative to the target stimulus, or time relative to presentation of the target stimulus. When prompts are faded along the time dimension, the procedure is often referred to as time delay (although delayed cue or delayed prompt is more accurate, as it is the prompt rather than time that is delayed). For instance, when an instructor’s point to the S+ comparison is used as an extra-stimulus prompt within MTS procedures, on initial trials the prompt is provided immediately upon presentation of the comparison array. If the learner follows the prompt and responds correctly for a specified number of trials, on subsequent trials the instructor begins to delay the prompt for a short period of time (say, 1 sec) after presentation of the comparison array. After a specified number of correct responses at that delay interval, the delay is gradually increased (e.g., in 1-sec increments) over successive trials. Such a procedure is referred to as progressive delay. Alternatively, after a specified number of trials on which the prompt is provided immediately (0-delay) or after a brief delay (e.g., 1 sec), the delay interval might be increased to a certain value (say, 5 sec) that is maintained for all subsequent trials. This is termed a constant or fixed delay procedure. If delayed prompting is effective, the learner begins at some point to respond correctly before the prompt is provided (sometimes referred to as “anticipations”), probably because preempting the prompt reduces the delay to reinforcement. Delayed prompting has been shown to be an effective method of transferring stimulus control from extra-stimulus prompts to target stimuli in some studies, but it is not universally effective. The main risk in using this method is that learners will not anticipate the prompt but will simply wait for it on trial after trial, probably because waiting for the prompt maximizes the probability of reinforcement. Progressive delay procedures in particular can shape waiting behavior. Therefore, like all prompt and prompt-fading procedures, these should be used judiciously (Etzel & LeBlanc, 1979; MacDuff et al., in press; Oppenheimer, Saunders, & Spradlin, 1993).

Developing Stimulus Equivalence Classes. One of the most exciting areas of research in contemporary behavior analysis is stimulus equivalence. Most of the work on this topic has been conducted within a conceptual and analytical framework developed by Murray Sidman and his colleagues (Sidman, 1971, 1994; Sidman et al., 1982; Sidman & Tailby, 1982). In a nutshell, the Sidman model provides methods for analyzing how physically dissimilar stimuli come to be treated as equivalent to, or substitutable for, one another in certain contexts. Scores of experiments using these methods have shown that after certain arrangements of conditional discriminations are trained (usually, though not always, with MTS procedures), other conditional discriminations emerge without any further training or direct reinforcement. In his first experiment on stimulus equivalence, Sidman (1971) set out to investigate sight-word reading in a young man with severe mental retardation. When he entered the experiment, the young man could match 20 common pictures (e.g., a bed, a hat) to their corresponding dictated English names, but he did not match corresponding printed words to those same pictures, or to the dictated words; that is, he did not have a sight-word reading repertoire with those words. After he was trained with standard MTS procedures to match the printed words to the dictated words, the young man proved immediately capable of matching the pictures to their corresponding printed words and vice versa, without further instruction or reinforcement. Those outcomes documented the development of 20 classes of equivalent stimuli, each consisting of a corresponding picture, dictated word, and printed word. This basic finding has been replicated hundreds of times by many investigators using a wide array of visual, auditory, tactile, and olfactory stimuli with a wide array of learners, including nonhumans, typically...
phenomena that were long considered just a few conditional discriminations are demonstrated by high-functioning individuals with various disabilities (e.g., developing children and adults, and in-

dividuals with various disabilities (e.g., see Green & Saunders, 1998; Sidman, 1994). Much of the interest in the stimulus equivalence model stems from the fact that it enables experimental analyses of phenomena that were long considered outside the realm of behavior analysis, such as concept formation, transitive inferences, symbolic learning, and generative behavior (McIlvane, Dube, Green, & Serna, 1993). For practitioners, stimulus equivalence methods can provide a lot of “bang for the buck,” because after just a few conditional discriminations are established through direct training, many others typically emerge “for free,” without any additional instruction whatsoever. Additionally, generative (untrained) performances, which have been notoriously difficult to produce in learners with autism and related disorders, occur quite reliably when stimulus equivalence procedures are used.

For example, in one experiment an adolescent with severe autism who could match the printed numerals 1 through 6 to corresponding dictated number names was trained with MTS procedures to match quantities of one to six dots (each arranged in three different configurations on cards) to those same dictated number names. He then matched the quantities to corresponding printed numerals and vice versa on unreinforced probe trials, making very few errors. Similarly accurate performances were demonstrated on unreinforced probes with quantities of pennies and of pictures of apples and houses—stimuli that had never been presented in training—appearing as comparison stimuli with dictated number names as samples, as comparisons with printed numerals as samples, and as samples with the numerals as comparisons. Collectively, these performances documented the development of six equivalence classes, each containing a dictated number name, the corresponding printed numeral, and corresponding quantities of dots, pennies, pictures of apples, and pictures of houses (Green, 1992). Equivalence classes of Greek letters and their dictated names were demonstrated by high-functioning preschoolers with autism in another experiment (Eikeseth & Smith, 1992).

Numerous other experiments with participants with learning difficulties have demonstrated the efficacy and efficiency of stimulus equivalence procedures for developing classes of stimuli relevant to such skills as reading, spelling, math, and augmentative or alternative communication (for overviews see Remington, 1994; Sidman, 1994; Stromer, Mackay, & Stoddard, 1992). Like the aforementioned discrimination training methods, the rich technology for developing stimulus equivalence classes does not seem to have made its way from laboratory research into widespread application with learners with autism, so this is an area that is ripe with possibilities for field research and practice.

Promoting Independence and Initiations

Prompting and Prompt Fading. Prompting procedures were discussed earlier in the context of teaching discriminations, but they have broad utility for teaching all sorts of new skills to learners with autism. Prompts, or auxiliary antecedent stimuli, can take many forms: physical guidance, gestures, models, verbal cues, other types of auditory stimuli, colors, pictures of various kinds, written text, and tactile stimuli. Prompts like manual guidance are often necessary to get new responses to occur in learners with autism who are just entering instruction, and it is often necessary to use prompting procedures to make the most efficient use of instructional time. But whenever prompts are used, there is the risk that learners will become dependent on them so that their responding does not come under the control of the relevant environmental stimuli (Demchak, 1990; MacDuff et al., in press). Therefore, considerable research in applied behavioral analysis has focused on instructional techniques that preclude or minimize prompt dependence and promote spontaneous, independent performances in learners with autism. Because adult-delivered prompts (especially verbal cues) can be particularly difficult to fade, some stimulus control research has focused on techniques that either fade adult-delivered prompts very rapidly after they are introduced, or never introduce them in the first place. Again, an exhaustive review is beyond the scope of this article, so just a few recent advances and novel applications are presented here as examples.

Activity schedules. A very powerful and flexible technology for promoting independent performances in learners with autism has been developed primarily by scientist-practitioners at the Princeton Child Development Institute. Learners are taught to use activity schedules consisting of photos or printed words arranged in notebooks to guide extended sequences of behavior in the absence of adult instruction or supervision. Initially, adults deliver nonverbal prompts (usually manual guidance) and reinforcements from behind the learner. In this fashion, the learner is taught to touch a photo or text that represents a particular task or action (such as assembling a puzzle), obtain the relevant materials, complete the task or action, turn to the next page in the notebook, and repeat the process with the photo or text shown there. The manual prompts are faded rapidly as long as correct responding occurs; when they have been completely removed, adult proximity is also faded. Adult-delivered reinforcers are also thinned, and shifted from prompted to unprompted responses. This training is designed to establish each of a series of photos or textual stimuli (rather than adult-delivered instructions) as discriminative for lengthy chains of behavior. Once a basic schedule-following repertoire has been established, the order of stimuli in the activity schedule is varied. Activity schedules can incorporate stimuli that are discriminative for independent performance of a host of self-care, domestic, vocational, leisure, academic, and social activities in a variety of settings. Research and practice have shown that individuals with autism can readily learn to choose and sequence their own activities, and that activity schedules can be transformed into the types of schedules that many of us use routinely, such as calendars, appointment books, class schedules, and “to do” lists (Krantz,
MacDuff, & McClannahan, 1993; MacDuff, Krantz, & McClannahan, 1993; McClannahan & Krantz, 1999). It is important to note that this technology differs considerably from other uses of visual schedules with learners with autism, such as depictions of daily activities for an entire class of students, and pictures or printed words on cards that the learner moves from a centrally located envelope to the physical locations in which each of a series of activities takes place (as in the TEACCH model; e.g., Schopler, Mesibov, & Hearsey, 1995).

Other nonverbal prompts. As noted previously, just about any type of stimulus that reliably sets the occasion for target behaviors can be used in prompt and prompt-fading procedures. For instance, once learners with autism have reliable reading repertoires, prompts in the form of written or typed words can be used effectively to get them to engage in desirable behaviors without verbal or other instructions from adults. Such textual prompts can be as simple as single words or short phrases embedded in an activity schedule (such as “Take a shower” or “Tell Dad a joke”), or as complex as lengthy scripts that specify a series of interactions among two or more people. In one example of the latter, adolescents with autism were taught to initiate and respond to verbal statements (i.e., to engage in conversational exchanges) in the context of everyday activities, such as completing classroom art projects (Krantz & McClannahan, 1993). In another, young children with autism and minimal reading skills learned to initiate comments to others by responding to such textual prompts as “Look” and “Watch me” in their activity schedules (Krantz & McClannahan, 1998). Textual prompts are often faded by gradually removing components (words or letters) from the last component to the first.

One innovative procedure makes use of a tactile prompt in the form of a vibrating beeper. Learners with autism have been taught to initiate verbal play bids and conversations with adults, then with peers, in response to activation of the beeper. Initially, the learner’s hand is placed on the device, and when the device is activated, an adult models a verbal statement for the learner to imitate as an initiation to another person. The verbal model is faded until the learner reliably initiates responses when he or she feels the device vibrate, without an adult-delivered prompt. The device is then placed in the learner’s pocket and used to prompt initiations to peers. This type of prompt has the multiple advantages of being portable and unobtrusive so that it can be used in various settings, such as classrooms, and functional in the absence of adult cues or reinforcer delivery (Hobberton, Taylor, & Levin, 1998; Taylor & Levin, 1998).

Automated auditory prompts. Verbal prompts from adults or other children can impede spontaneity on the part of the learner with autism and can be difficult to fade, but verbal prompts presented via automated devices can be very effective because they do not require the constant presence of another person; learners with autism can be taught to activate the devices themselves. Such prompts can also be faded very systematically and precisely and (unlike textual prompts) can be used with nonreaders.

One useful automated system for establishing and fading verbal prompts is the Language Master (Stevenson, Krantz, & McClannahan, 2000; Taylor, in press). Spoken statements or questions that are to serve as models for the learner are recorded on cards with electromagnetic strips. The cards are run through the Language Master machine, which plays the recorded message. These auditory prompts can be faded gradually by recording several versions of the message, each of which eliminates one word from the end of the previous version, thus fading the prompt across successive versions. Alternatively, the prompt can be removed all at once by activating a blocking option on the Language Master machine that renders the recorded message inaudible when the card is run through it. Studies have shown that after learners with autism learn to imitate verbal models provided via Language Masters, prompt and prompt-fading techniques using those devices are effective for teaching the learners to initiate requests or comments to peers (e.g., “Susie, let’s teeter-totter”) and to engage in conversations. Another automated auditory prompting technique involves recording spoken instructions on audiotape and teaching the learner with autism to deliver them to himself via a self-operated personal tape player and headphones (e.g., Taber, Seltzer, Heflin, & Alberto, 1999). Like the vibrating beeper, this type of prompting system is portable and can be used in various settings without disturbing others or drawing undue attention to the learner with autism. The utility and generality of automated auditory prompting systems remain to be investigated fully.

Video Modeling. A few studies have demonstrated that learners with autism can imitate various skills after viewing videotaped segments of themselves or others performing those skills. For example, three young adults with autism were taught purchasing skills in classrooms and in either their school cafeteria or a nearby convenience store (Haring, Kennedy, Adams, & Pitts-Conway, 1987). Probes conducted in three community settings indicated that very little skill generalization occurred. After the youths viewed videotapes of same-age nonhandicapped peers making purchases in three community settings and responded to an instructor’s questions about what they were viewing, generalization increased substantially. Another set of investigators reported acquisition and generalization of conversational speech (three brief question-and-answer exchanges with therapists) in three young children with autism after the children observed videotapes of familiar adults engaging in such conversations, and then practiced the conversations with a therapist (Charlop & Milstein, 1989). More recently, the efficacy of video self-modeling was evaluated with three children with autism. The children viewed specially prepared videotapes of themselves answering a series of questions presented by adults. The investigators reported that after viewing the videotapes several times, all three children showed increased accuracy of responding to the same questions in vivo.
Video modeling is another potentially promising technique that is ripe for field and laboratory research. Some questions that need to be addressed in careful experimental analyses include (a) whether the initial studies on this topic can be replicated by independent investigators, (b) the entry skills required for learners with autism to benefit from video instruction, (c) the efficacy of video modeling for establishing an initial imitative repertoire (including generalized imitation), (d) factors that may account for the rapid skill acquisition and broad generalization reported in the few studies published to date (if indeed those findings can be replicated), (e) whether simply viewing video models (without practicing the target skills) suffices to establish new skills, and (f) the comparative efficacy of in vivo and video modeling for producing skill acquisition and generalization.

Priming. Another antecedent manipulation that bears further careful investigation with learners with autism has been termed “priming.” This term generally refers to providing learners with a preview of upcoming events by presenting the stimuli and/or activities involved in those events under low-demand, high-reinforcement conditions (Wilde, Kogel, & Koegel, 1992). In one study, for example (Zanolli, Daggett, & Adams, 1996), each of two preschool boys with autism was prompted by a teacher to initiate verbal and nonverbal interactions with a typically developing peer. The peer provided reinforcers to the child with autism contingent on correct responses. These priming sessions were followed immediately by sessions in which the child with autism was given opportunities to engage in preferred activities with a trained peer, without adult-delivered prompts or reinforcers for the child with autism. Unprompted initiations by both boys with autism, which were at near-zero rates during a baseline phase, were reported to increase after the priming intervention. Recently, priming in the form of viewing a commercial toilet-training video was reported to increase the frequency of initiations to use the toilet and of dry diapers with a preschooler with autism (Bainbridge & Myles, 1999). In another study, previewing specially prepared videos of settings in which three young children with autism had exhibited disruptive behavior was reported to substantially decrease the problem behavior exhibited by all three children in the actual settings (Schreibman, Whalen, & Stahmer, 2000).

Many important questions about priming remain to be addressed in well-controlled studies, some of them parallel to the questions about video modeling raised earlier. First, the handful of published studies on this topic need to be replicated. Replications and extensions should specify the entry skills of the learners and address questions about the “active ingredients” in this intervention. For example, is it necessary for learners with autism to practice target skills or otherwise respond actively during priming sessions (as in Zanolli et al., 1996), or is mere exposure to the priming stimuli (as in Schreibman et al., 2000) sufficient to change behavior? What is the relation between the rate or probability of reinforcer delivery in priming sessions and behavior change in the subsequent activity? It has been hypothesized that priming works by making future events predictable for learners with autism (Schreibman et al., 2000). That raises questions as to the comparative efficacy of priming and other, perhaps briefer and simpler methods of previewing what is about to happen, such as providing a simple spoken description or showing the learner a picture. The predictability hypothesis also suggests that the degree of correspondence between the priming activity and the actual activity might be related to the occurrence of the target behavior in the actual situation: Do priming activities that are very similar to the actual situations produce behavior change more reliably than priming activities that bear less resemblance to the actual situations?

Incidental Teaching and Other “Naturalistic” Techniques. No article on behavior analytic methods for promoting independent, unprompted behavior in learners with autism would be complete without a discussion of incidental teaching and related techniques for promoting spontaneous communication. Some popular misconceptions are that traditional applied behavior analysis eschews everything but highly structured, adult-directed instructional procedures, and that only the more “contemporary” behavioral approach has incorporated naturalistic methods drawn from the developmental social–pragmatic approach to communication enhancement (e.g., Prizant & Wetherby, 1998; Wetherby, Schuler, & Prizant, 1997). An even more egregious misrepresentation is that “approaches to enhance spontaneous language use, including incidental teaching and pivotal response training, were developed primarily because of concerns about children’s inability to generalize communicative use of language ‘learned’ in discrete trial training” (Prizant & Rubin, 1999, p. 204).

The fact is that incidental teaching methods were developed in the 1960s by Betty Hart and Todd Risley, who began their long collaboration at the Institute of Child Development at the University of Washington under the leadership of Sidney Bijou, as recounted in the introduction to this article. Working with disadvantaged preschoolers, Hart and Risley found that the children’s spontaneous use of color–noun combinations increased when access to snacks and play materials (naturalistic consequences) were made contingent on language production. They went on to specify incidental teaching procedures for elaborating language, as follows: (a) Make available several items of interest to the child; (b) wait for the child to show interest in an item and initiate an interaction about it; (c) ask the child for approximations to speech, or for more elaborate language if he or she offers some speech (providing a model for the child to imitate, if necessary); (d) when the child makes the requested response, provide her or him with the item for which she or he initiated (Hart & Risley, 1968, 1982, 1995). As mentioned at the beginning of this article, Hart and Risley were among the pioneers who integrated the principles and methods of the experimental analysis of
behavior with work on typical and atypical child development in the early 1960s, establishing the foundations of applied behavior analysis. Their incidental teaching methods have been part and parcel of applied behavior analysis since that time. The efficacy of those methods for teaching learners with autism was first documented in 1983 (McGee, Krantz, MASON, & McClannahan, 1983); several other studies followed (Fenske, Krantz, & McClannahan, in press; McGee, Morrier, & Daly, 1999).

An approach to promoting spontaneous speech in learners with autism that bears a strong resemblance to incidental teaching is the Natural Language Paradigm, or NLP (e.g., Koegel, O’Dell, & Koegel, 1987). In this and similar models, various age-appropriate items found in the child’s natural environment are made available, and the interventionist waits for the child to choose one. The interventionist may label the item or explicitly prompt speech production by the child. All attempts at speech, including approximations, are reinforced immediately by providing the selected item to the child. These teaching trials are embedded in a series of reciprocal interactions between interventionist and child (see Koegel, 1995).

It should be noted that although incidental teaching and NLP procedures are often characterized as child-initiated because learning opportunities begin when the child shows interest in a preferred item, it is often necessary (and desirable) for interventionists to prompt a response. At that point the instruction becomes adult-directed. Adults also arrange antecedents and control access to reinforcers for the development of increasingly effective instructional methods for learners with autism.

Conclusions

The historical antecedents to current applications of behavior analysis with learners with autism included research and theory in child development as well as the principles and methods of the experimental analysis of behavior. The ensuing four decades of field research have produced a very wide array of behavior analytic techniques for building a very wide array of useful repertoires in learners with autism. Other techniques have been developed in laboratory research, particularly in the area of stimulus control, but their potential for application in autism remains largely unrealized. Transfer of behavioral technology for teaching simple and complex discriminative behaviors from the laboratory to the field, together with further field research on some stimulus control techniques that have been developed recently in applied settings, are among the most richly promising avenues for the development of increasingly effective instructional methods for learners with autism.

ABOUT THE AUTHOR

Gina Green, PhD, is director of research at the New England Center for Children and research associate professor, E. K. Shriver Center, University of Massachusetts Medical School. Her current interests include stimulus control, autism and related disorders, and disseminating behavioral science to the public. Address: Gina Green, New England Center for Children, 33 Turnpike Road, Southborough, MA 01772-2108.

REFERENCES


not-discrete-trial teaching procedure. In C. Maurice, G. Green, & R. M. Foxx (Eds.), Making a difference: Behavioral intervention for autism. Austin, TX: PRO-ED.


