Making a Difference

Behavioral Intervention for Autism

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4

Prompts and Prompt-Fading Strategies for People with Autism

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earners with autism and related disabilities pose a number of challenges for those who are concerned about them. Many of the skills they need to live independently and happily are not in their repertoires, and they do not learn the skills through exposure to others. For example, many young children with autism do not respond to simple spoken requests such as "Come here" or "Play pattycake," and they do not turn toward a speaker when their names are called or imitate what they see other people doing. Some skills may be present, but not used in functional ways. For example, responses such as naming objects or singing songs may occur, but not in typical, everyday situations, or at least not under circumstances that most people would consider appropriate.

Research and experience show that to develop useful skills, all learners—whether or not they have been diagnosed with autism—must practice skills frequently and receive some form of feedback about how they are doing. Therefore, the tasks facing parents and teachers of people with autism are not unlike the tasks that face all parents, educators, and trainers: helping learners display new responses and rewarding their efforts when they succeed. However, people with autism, unlike their typically developing peers, often do not learn from everyday events. Indeed, they may not respond to the kinds of cues that are immediately effective for nondisabled learners, such as spoken instructions or others' demonstrations.

The challenge for those involved in developing new skills for learners with autism, then, is to help them display new functional responses, provide frequent and immediate feedback, and arrange many opportunities for skills to be practiced under conditions in which they will eventually be used. All of this must be done in such a way as to ensure that the skills can be performed independently, without frequent extra cues from others. A great deal of research and practice in applied behavior analysis has been devoted to developing techniques for accomplishing this. Most of those techniques have been derived from the principle of *stimulus control*, which means that behavior occurs in the presence of specific stimuli as a result of prior reinforcement. A common example of stimulus control is seen when a person answers a telephone. The ringing that precedes answering (an *antecedent stimulus*) has acquired stimulus control over the responses of picking up the receiver and saying "Hello." Stimulus control was established because, in the presence of ringing, picking up the receiver and saying hello was reinforced on many occasions in the past by the opportunity to talk to someone you really enjoy or by someone reporting interesting news. It is unlikely that you will pick up the receiver and say hello in the absence of the ring because that behavior has not resulted in reinforcement.

To recast some of our earlier comments in stimulus control terms, many types of antecedent stimuli that effectively control relevant behavior for typically developing learners such as spoken requests, models, or printed words—are not effective for learners with autism, at least not without explicit and specialized training. For example, most typical youngsters quickly learn to respond appropriately when greeted; that is, naturally occurring stimuli such as the presence of another individual who says "Hello" readily come to control responses such as replying "Hi." That is not the case for many people with autism, who must be taught how to respond to (as well as to initiate) greetings. Research has shown that an effective way to help people with autism learn new skills is to provide them with extra cues, known as *prompts*.

Prompts are antecedent stimuli that are effective in getting responses to occur. Put another way, a prompt is a stimulus that controls a particular response (i.e., it is a *discriminative stimulus*). The prompt is added to a situation in which the naturally occurring stimulus does not yet control the response (i.e., it is not a discriminative stimulus for that response). For example, to teach a youngster with autism to

respond when someone says "Hello," a parent might model saying "Hi" or instruct the youngster to "Say, 'Hi' " and then reinforce the child for responding "Hi." These additional antecedent stimuli are effective prompts (discriminative stimuli or SDs) only if the youngster reliably imitates the modeled action or reliably follows the spoken instruction. If the response "Hi" is to be functional, however, it must occur in the presence of the relevant natural stimuli, not merely when prompts are provided. For many learners with autism, this is not likely to happen automatically; that is, it is rarely sufficient to prompt a few times and then simply discontinue prompting. Instead, it is usually necessary to withdraw prompts gradually, in small steps, over a series of learning opportunities, until no prompts are provided at all and the response occurs in the presence of the desired stimulus. In other words, stimulus control must be transferred from the prompt to the natural stimulus. Various techniques for transferring stimulus control-also known as prompt fading-are described in this chapter. They are illustrated with examples from experimental research and clinical experience. We conclude with some recommendations for selecting and using prompts and prompt-fading procedures.

Definitions of Prompts

Prompts are often defined as "auxiliary," "extra," or "artificial" stimuli that are presented immediately before or after the stimuli that will eventually cue the learner to display the behavior of interest at the appropriate time or in the relevant circumstances (e.g., Foxx, 1982). McClannahan and Krantz (1999) defined prompts as, "instructions, gestures, demonstrations, touches, or other things that we arrange or do to increase the likelihood that children will make correct responses" (p. 37). For example, the parent or instructor may provide a verbal model to increase the likelihood that a child will respond to the question, "What's your name?" Or, after giving the instruction, "Set the table," the parent or instructor may prompt by manually guiding the learner to correctly arrange plates, glasses, and silverware. Or, when teaching a child to imitate the sound "mm," the instructor may manually mold the learner's lips (the prompt) while simultaneously modeling the sound "mm" (the stimulus that will eventually control the youngster's verbal imitation). Of course, the teacher expects that later the child will respond to the verbal model alone, and the prompt will be unnecessary. In this chapter, we define prompting as an instructional technique used to help students make correct responses until they learn to respond to the stimuli that control the behavior of their typically developing peers.

Although prompting procedures can be classified in a number of ways, classification is mainly a matter of convenience. In practice, different prompting procedures are often combined into "packages."

Verbal Prompts

A review of 268 applied behavior analysis journal articles an book chapters revealed that verbal prompts are the most commonly reported auxiliary cues (G. S. MacDuff, 1999). Verba prompts are words, instructions, or questions that are sup posed to direct a person to engage in a target response. In on study, for example, teachers prompted preschoolers with autism to engage in social interactions with peers using verba prompts such as, "Today I want you to play with John" (Odon & Strain, 1986). Typically, verbal prompts are used in conjunction with other prompts. When a mother gives her son a cookie and prompts, "Say, 'Thank you,' " she is using a verba instruction ("Say") as well as a verbal model ("Thank you") If the prompt is effectively faded (i.e., gradually removed), the child will respond "Thank you" in the absence of auxiliary cues when someone gives him something.

Modeling

G. S. MacDuff's (1999) review of the applied behavior analysis literature indicated that the second most commonly used prompting procedure is demonstrating or modeling a response. Like verbal prompts, models are usually used ir conjunction with other prompts; no studies were found that used only modeling. In one investigation, peer models were used in conjunction with verbal instructions to teach 5- and 8-year-old boys with autism to check out library books, buy snacks, and cross the street (Blew, Schwartz, & Luce, 1985). In baseline, participants were taken to community settings and verbally instructed to complete target tasks. In the modeling condition, the peer tutors performed the tasks in close proximity to the children with autism, but did not help or reward them. None of the target skills was acquired in the modeling condition. During pretraining, the peers directed the children with autism to complete a variety of motor and discrimination tasks. This was designed to establish the peers as familiar persons; the peers provided instructions, redirected stereotypic behavior, and rewarded correct responses. In the final condition (peer tutoring), the peer models completed the assigned tasks in close proximity to the children with autism, and also prompted and rewarded completion of task components. During this condition, both students with autism acquired the target skills. The authors noted that the students' failure to display target responses in the first modeling condition was probably due to the absence of prompts and rewards for attending to the models.

In addition to live models, videotaped models are sometimes used to teach new skills. For example, videotaped models of a person making purchases were used to teach three young adults with autism to purchase food items in their high school cafeteria and in a convenience store, and to promote generalization of purchasing skills from training sessions (in which verbal and manual prompts as well as models were provided) to probe sessions in which none of these procedures was used (Haring, Kennedy, Adams, & Pitts-Conway, 1987). In another study, familiar adults modeled brief conversations on videotapes that were used to teach conversation skills to three 7- and 8-year-old boys with autism. All three youngsters acquired the target conversation skills after exposure to the modeling procedure. These skills generalized to untrained topics of conversation and maintained at a 15-month follow-up (Charlop & Milstein, 1989).

Some studies have suggested that modeling may be most effective when there is similarity between the learner and the model (Barry & Overman, 1977; Cooper, 1987b). For example, Egel, Richman, and Koegel (1981) reported that although 5- to 8-year-old children with autism did not master discrimination tasks that were taught by a therapist, their performance improved when typically developing peers (selected because they were approximately the same age as the participants) modeled correct responses on the same tasks.

Other investigators have achieved favorable behavior change using models who were dissimilar to the participants. In one study, four children with autism (ages 6 to 9) learned to answer "what," "why," and "how" questions when a teacher modeled the correct response, such as, "Why is he wearing a coat? Because it's cold" (Secan, Egel, & Tilley, 1989). Another investigation compared the effects of peer versus adult models on the development of question-answering skills by four boys with autism. The experimenter asked the peer or adult model a question and rewarded a correct response. The same question was then immediately presented to a child with autism. The boys learned to answer questions equally well when exposed to the 27-year-old adult and to the 9-year-old nondisabled peer (Ihrig & Wolchik, 1988).

Of course, people cannot benefit from modeling unless they have learned to imitate others' behavior. Some children and adults with autism may have learned to imitate certain actions or words, but they may not imitate other responses that have never been specifically taught and reinforced; that is, they do not display *generalized imitation* (Cooper, 1987b). Doing what the model does, whether or not that behavior was previously taught, is a necessary prerequisite skill; without it, people cannot benefit from modeling as a prompting procedure.

Manual Prompts

Manual or physical prompting is defined as physical contact from an instructor that is designed to help the learner display a behavior of interest. For example, an instructor may manually guide a youth's hands to the home row of a keyboard, or a parent may guide a young child who is learning to wash her hands to move from the sink to the towel rack. Manual prompts have been used to teach nonimitative children with autism to correctly form manual signs (Carr, Binkoff, Kologinsky, & Eddy, 1978), and parents have used manual guidance to help their children with autism complete photo-

graphic activity schedules (Krantz, MacDuff, & McClannahan, 1993; McClannahan & Krantz, 1999).

Only a few studies have used manual prompts exclusively. In one study, manual prompts were used to teach four youngsters with autism to independently complete hour-long activity schedules that included leisure and homework tasks such as puzzles and handwriting worksheets; no verbal instructions, praise, or tangible rewards were delivered. After training, the boys were on task during 80% to 100% of observations. This level of engagement maintained when the instructor was out of sight, when the pictures in activity schedules were resequenced, and when novel, untrained photographs were added to their schedules (G. S. MacDuff, Krantz, & McClannahan, 1993).

Gestural Prompts

Gestural prompts include pointing, motioning, or nodding toward students, materials, or activities to indicate an action to be performed. Although G. S. MacDuff's (1999) literature search revealed no examples of gestural prompts used in isolation, a number of studies used gestures as components of prompting packages. In one study, for example, three adults with severe mental retardation were taught a side-of-the-foot soccer pass using modeling, verbal prompts, manual prompts, and gestures, but a description of the gestures was not provided (Luyben, Funk, Morgan, Clark, & Delulio, 1986). Because most studies used gestures as components of prompting packages, it is difficult to determine the usefulness of gestures as prompts.

Photographs and Line Drawings

Pictures, photographs, and line drawings have been used to teach assembly tasks (Wacker & Berg, 1983, 1984), meal preparation (B. Johnson & Cuvo, 1981; Martin, Rusch, James, Decker, & Trtol, 1982; Robinson-Wilson, 1977), clerical and laundry tasks (Wacker, Berg, Berrie, & Swatta, 1985), self-care and daily living routines (Spellman, DeBriere, Jarboe, Campbell, & Harris, 1978; Thinesen & Bryan, 1981), time management (Sowers, Rusch, Connis, & Cummings, 1980; Sowers, Verdi, Bourbeau, & Sheehan, 1985), and computer use (Frank, Wacker, Berg, & McMahon, 1985). Most studies combined pictorial cues with other prompts, such as verbal instructions or video models.

One study measured the engagement of three boys with autism as they completed daily living activities, such as setting the table and getting dressed. Prompts included 4- by 6inch color photographs, instructions, and modeling. In the teaching condition, on-task time increased and inappropriate behavior decreased. The boys remained engaged when the instructor was no longer visible and when the photographs in their picture albums were resequenced, and engagement generalized across tasks and settings (from clinic to home). But during follow-up, when the students were instructed to set the table and get dressed in the absence of photographs, all made errors (Pierce & Schreibman, 1994).

In clinical practice, we use photographs to cue students to complete lengthy response chains. For instance, many children and youths learn to prepare their school lunches using photographs. Pictures of bread, peanut butter, jelly, and a knife come to control sandwich making, and photographs of fruit, vegetables, snacks, and a napkin signal young people to place these items in a lunch bag. After these pictorial prompts are faded, students complete these sequences in response to a verbal or written cue to "make lunch," or lunch making may come under the stimulus control of time of day or the availability of lunch-making materials.

Textual Prompts

Textual prompts are written cues such as checklists, scripts, and written instructions. For example, a written checklist may be used to prompt a teenager to refill soap dispensers or to warm a frozen dinner in the microwave oven.

In one study, written task analyses (combined with praise, verbal feedback, and gestures) were used to teach adults with mild disabilities to clean the refrigerator and stove, and to do laundry. With the exception of cleaning the refrigerator, these home-maintenance skills were not acquired when textual prompts were presented alone (Cuvo, Davis, O'Reilly, Mooney, & Crowley, 1992).

Another study used written scripts and script fading to teach three young boys with autism to initiate and elaborate conversation with a teacher. The words "Look" and "Watch me" (which the learners had previously learned to read) were attached to pages of their photographic activity schedules. The boys were manually guided to point to a script, approach the teacher, and say the scripted words. When the students reliably said the scripts without prompts, the textual prompts "Look" and "Watch me" were faded by gradually cutting away portions of the cards on which they were displayed. In the third fading step, the cards and scripts were absent. Subsequently, all three boys displayed increases in unscripted interactions (defined as one or more understandable words uttered in the absence of a script) (Krantz & McClannahan, 1998).

Written scripts also were used to teach children with autism to engage in social interaction with peers during art activities in a classroom setting. In baseline, the instructions "Do your art" and "Talk a lot" were presented on a single sheet of paper. In the teaching condition, these instructions were followed by 10 written statements and questions such as "(Name), did you roller-skate outside today?" or "(Name), would you like to use one of my crayons?" Students were manually guided to pick up a pencil and move it along below the text. If a student did not say the script within 5 seconds, manual guidance was repeated. Script fading began after manual guidance was completely faded, and scripts were faded from end to beginning by gradually and systematically deleting words in five steps. For example, the fading steps for the question "John, would you like some candy?" were (a) "John, would you like some"; (b) John, would you"; (c) "John, would"; (d) "J"; and (e) opening quotation marks ("). As scripts were faded, unscripted initiations (i.e., new combinations of previously taught scripts and novel, untaught utterances) increased. The authors noted that script fading reduces the involvement of teachers and parents during social interaction, thus decreasing the likelihood that learners' interactions will be dependent on prompts from other people (Krantz & McClannahan, 1993).

Other Types of Prompts

A few investigators have used tactile prompts such as letters and numbers drawn with glue and covered with sand (Berg & Wacker, 1989), tones and alarms (Lloyd, Bateman, Landrum, & Hallahan, 1989), and color cues (Dube, McDonald, McIlvane, & Mackay, 1991) to prompt target responses. For example, in one study, three children with autism learned to record their own behavior when their chronograph wristwatches signaled the end of a play interval (Stahmer & Schreibman, 1992).

How To Use Prompts Effectively

Prompts are useful initially in helping people display new, desirable behavior, but new skills are mastered (i.e., performed correctly and independently) only if prompts can be removed. Although many research articles fail to offer details about how prompts were faded, several prompting and prompt-fading procedures are described in the applied behavior analysis literature. Six of these are discussed in the following sections.

Increasing Assistance (Least-to-Most Prompts)

When using increasing assistance, the instructor provides a sequence of prompts that begins with minimal assistance and progresses to more assistance. Initially, the naturally occurring stimulus—that is, the stimulus that should ultimately control the behavior—may be presented without prompts. The teacher provides more help only if the student does not respond correctly within a specified time (often 5 to 10 seconds). Increasing assistance is provided until the student makes a correct response. A common least-to-most prompts system includes verbal prompts, gestures, modeling, and manual prompts.

Suppose a father wants to teach his daughter to put her cup in the dishwasher. On the first trial, the father presents the instruction, "Put your cup in the dishwasher." If the daughter does not respond, or makes an error, the father repeats the instruction, pauses, then points to the dishwasher. If this does not produce a correct response, the father repeats the instruction, pauses, and then models putting the cup in the dishwasher. If this fails to produce a correct response, the father gives the instruction again, pauses, and then manually guides her to put the cup in the dishwasher. This is a least-tomost, or increasing assistance, prompt hierarchy.

Less frequently, parents and professionals use hierarchies that include only verbal prompts or only manual prompts. Here is an illustration of a least-to-most system of verbal prompts to teach an adult with autism to respond to the question "What do you want?" by saying "I want ______." On the first trial the teacher asks, "What do you want?" and waits 5 seconds. If the individual makes an error or does not respond, the teacher repeats the question, pauses, then models "I." Increasingly complete verbal prompts ("I want," "I want soda") are provided until the person makes a correct response. Similarly, a least-to-most hierarchy of manual prompts could be used to teach an adolescent to sort silverware. If a light touch on the elbow does not produce sorting, the parent touches the forearm, then the wrist, and finally uses hand-over-hand guidance.

A frequently cited advantage of increasing assistance is that every trial provides an opportunity for the learner to make unprompted responses to relevant environmental stimuli (Cooper, 1987a; Risley & Cuvo, 1980). In our prior examples, the student may put the cup in the dishwasher or say "I want soda" before any prompts are delivered. This advantage may be overshadowed, however, by the fact that least-to-most prompt hierarchies reliably produce errors, may produce prompt dependence, and typically require more trials than delayed prompting procedures and modeling before students master the target behavior (Godby, Gast, & Wolery, 1987; Karsh, Repp, & Lenz, 1990; Repp, Karsh, & Lenz, 1990).

Decreasing Assistance (Most-to-Least Prompts)

In most-to-least prompt systems, learners receive whatever assistance (prompts) they need to successfully perform a new skill when instruction begins (Cooper, 1987a). Over successive teaching trials, the amount of assistance is gradually reduced until no prompts are provided. Most-to-least prompt systems often include complete physical guidance, partial physical guidance, modeling, gestural prompts, and verbal instructions (Berkowitz, 1990; Csapo, 1981; Goldstein & Cisar, 1992; Green, Reid, Canipe, & Gardner, 1991). When the goal of these procedures is to bring the target behavior under the control of a teacher's directions, each level of prompting is paired with a verbal instruction. Often, however, the goal is to have the learner perform an action or series of actions without instructions or cues, verbal or oth-

erwise, from adults. In these instances, verbal instructions are not used at all, because they can be very difficult to withdraw (fade) and their use can lead to overdependence on prompts.

Suppose a mother wants to teach an adolescent to put his laundry away, using a most-to-least prompts system. The mother begins by instructing, "Put your laundry away." Then she manually guides her son to remove the clean laundry from the basket and put items in drawers. After a specified number of correct responses, the mother gives the initial instruction and provides less and less physical guidance. In the next fading step, she gives the direction and models the correct response. If her son completes the task successfully with this type of prompt during a specified number of trials, she gives the direction and points toward the laundry basket. If he continues to correctly complete the task, his mother fades to the verbal instruction alone.

The majority of most-to-least prompt-fading procedures include several different types of prompts, but one study used only written stimuli to teach children with autism to initiate spoken comments and questions to classmates. Typed scripts were placed on each student's work space. In teaching, the written instruction "Do your art and talk a lot" was combined with a single manual prompt for the student to run his or her pencil under written scripts. Scripts were faded from complete sentences to single quotation marks by gradually removing words, starting with those at the ends of sentences. This fading procedure was effective in increasing unscripted peer initiations and in promoting generalization of conversation skills across settings (Krantz & McClannahan, 1993).

Although few data are available concerning error rates and instructional efficiency (the number of trials required to perform tasks to criterion), some researchers have noted that most-to-least prompt systems result in stable rates of correct responding (Luyben et al., 1986), and are preferred by instructors because they are easy to implement (McDonnell & Ferguson, 1989). In a review of prompting procedures, Demchak (1990) suggested that decreasing assistance is the most efficient prompt-fading procedure because it consistently produces fewer errors and more rapid skill acquisition than least-to-most prompting.

Delayed Prompts

Delayed prompting procedures fade prompts by imposing a brief period of time between the presentation of the naturally occurring stimulus that should ultimately control behavior and the delivery of a prompt (Oppenheimer, Saunders, & Spradlin, 1993). Researchers have repeatedly demonstrated that delayed prompting procedures can be effective, efficient ways to transfer stimulus control from prompts to appropriate environmental cues rapidly and with few errors (Gast, Ault, Wolery, Doyle, & Belanger, 1988; Handen & Zane, 1987; Jones-Ault, Wolery, Gast, Munson-Doyle, & Eizenstat, 1988; Touchette, 1971; Wolery et al., 1992). Suppose a mother decides to use a delayed prompting procedure with modeling prompts to teach her son to respond to the question "What's your name?" During the first 5 to 10 trials, the question "What's your name?" is followed immediately by the model prompt, "John," and the boy is rewarded for repeating "John." In subsequent trials, a 1-second delay is inserted between "What's your name?" and the model "John." If the child responds correctly, the delay is gradually increased (usually in 1-second increments) until he begins to respond before the prompt (model) is presented.

Delayed prompting can also be used to teach a child to point. For example, an instructor says "Point to blue" and simultaneously delivers a manual prompt, guiding the youngster to point. After a specified number of trials, a 1-second pause is inserted between the two stimuli (the instructor says "Point to blue," pauses for 1 second, and then manually guides the learner to point). In subsequent sessions, the delay between the instruction and the prompt is gradually increased in 1-second increments until the child responds before the prompt is delivered, and the prompt is no longer necessary.

Delayed prompt procedures can be effective for teaching new skills. They have one significant drawback, however: Learners with autism may simply wait for prompts rather than anticipating them (i.e., responding before a prompt is provided). In other words, these procedures can produce prompt dependence. In particular, gradually increasing the delay over successive trials can effectively shape waiting behavior, perhaps because the student learns that it is easier to wait for the prompt than to respond independently (Oppenheimer et al., 1993).

Graduated Guidance

In graduated guidance, the instructor provides manual prompts to complete an action, and then fades these prompts by changing their intensity or location. The instructor may begin by using complete hand-over-hand prompts, then use less forceful guidance, and then fade to prompts at the wrist, forearm, elbow, and shoulder (Cooper, 1987a). When prompts are faded to the shoulder, the next fading step may be shadowing, or following the learner's movements without making physical contact. For example, if a youngster is writing, the instructor may hold his or her hand above the child's hand without touching it.

The following is an example of a most-to-least prompt and prompt-fading sequence using graduated guidance: Parents wish to teach their son to push his chair in when he leaves the table. Initially, hand-over-hand prompts (usually light touches) are used to guide the child through the action of pushing his chair under the table. Later, the parents prompt at the wrist. In subsequent sessions, they deliver manual prompts at the forearm, then the elbow, then the shoulder. When the boy reliably pushes his chair under the table with prompts at the shoulder, the parents no longer touch him, but instead stand behind him and follow his movements as he pushes his chair in. Gradually, they move farther away from the youngster, until he completes the task without prompts while they remain seated.

In many studies, graduated guidance has been used in conjunction with other prompting procedures. For example, procedures designed to teach 12- to 20-year-olds with autism to discriminate line drawings of household objects used graduated guidance in a prompting hierarchy that also included gestural prompts (Berkowitz, 1990). Other researchers combined graduated guidance with verbal prompts and modeling to teach children with autism and mental retardation to tie their shoes, brush their teeth, and dress (Matson, Taras, Sevin, Love, & Fridley, 1990). In these studies, it is impossible to assess the effectiveness of graduated guidance per se because it was one component of an instructional package with several components. In one study, however, graduated guidance was used exclusively to teach children with autism to independently complete hour-long photographic activity schedules that included leisure and homework tasks. Manual prompts were completely faded in 6 to 19 sessions. The authors noted that graduated guidance prevented errors and lengthy delays that might have impeded acquisition of the target skills (G. S. MacDuff et al., 1993).

Stimulus Fading

Stimulus-fading procedures exaggerate some physical dimension (e.g., color, size, intensity) of a relevant stimulus to help a person make a correct response. The exaggerated feature is the prompt, which is gradually faded or reduced in order to transfer stimulus control from the prompt to the stimulus that will ultimately control the behavior of interest (Cooper, 1987a; Etzel & LeBlanc, 1979; Fields, 1981; Groden & Mann, 1988). It is critical that the exaggerated cue emphasizes the dimension of the environmental stimulus that is ultimately expected to control responding (Etzel & LeBlanc, 1979). For example, if intensity is used as a prompt to teach color discrimination, both stimuli to be discriminated should be the same size and shape; for example, the instructor might use a blue circle and a red circle of exactly the same size, on the same background. On initial teaching trials, the color of the stimulus that is designated correct is presented at full intensity, while the color of the incorrect stimulus is very faint. Over successive trials, the correct stimulus is made gradually less intense, while the intensity of the incorrect stimulus is gradually increased until both colors are presented at the same intensity level. Their size and shape remain unchanged throughout teaching.

Many studies have demonstrated the importance of exaggerating the most salient elements of training stimuli. In a comparison of two stimulus-fading procedures, learners were exposed to (a) exaggerated aspects of a stimulus that were essential to making the final discrimination (criterion-related cues) and (b) other exaggerated aspects that were not part of the final, correct discrimination (non-criterion-related cues). The non-criterion-related prompting procedures were ineffective in teaching visual and auditory discriminations, but criterion-related fading procedures were effective for the majority of learners with autism. In addition, students who learned new discriminations using procedures that emphasized the critical dimensions of training stimuli later made errors when exposed to stimulus-fading procedures that did not exaggerate these key aspects (Schreibman, 1975).

In most stimulus-fading investigations, target behaviors are usually discrete responses (e.g., pointing to stimuli such as numbers, or naming colors) rather than lengthy response chains. However, one study designed to teach a bathing response chain to an adult with mental retardation used a stimulus-fading procedure. Applying colored liquid soap to the participant's body parts cued him to wash each soaped area without prompts from instructors. With the soap present, unprompted bathing was observed at a 3-month follow-up (Cameron, Ainsleigh, & Bird, 1992).

The small number of published examples of stimulus fading in teaching complex behavioral repertoires may be related to the difficulties of exaggerating relevant dimensions of stimuli that should eventually control desired responses. It is conceivable, however, that stimulus fading could be used in this context. For example, one could teach a child to vacuum and dust by making the carpet and furniture unusually or obviously "dirty" to begin with, and then gradually fading the amount of visible dirt over successive teaching trials. Alternatively, one could teach ironing by providing items with obvious wrinkles, and then gradually fading or diminishing the wrinkles.

Stimulus Shaping

In stimulus shaping, the physical characteristics of stimuli used in teaching are gradually changed (Etzel & LeBlanc, 1979). For example, a seven-step stimulus-shaping procedure was used to teach three youngsters with autism to state dollar amounts that included decimals. Initially, amounts were presented in writing as "\$1 and 55" or "\$4 and 67" which the youngsters could read. When the boys responded with 90% accuracy or better, the word "and" was reduced in size; then, during five stimulus-shaping steps, the word became increasingly "decimal-like" until eventually written amounts were presented as "\$1.55" or "\$4.67," and the youngsters read them accurately (e.g., by saying "one dollar and fifty-five cents") (J. L. MacDuff, MacDuff, McClannahan, Krantz, & MacDuff, 1996).

Although it can be a very effective and nearly errorless prompting and prompt-fading procedure (Mosk & Bucher, 1984; Schilmoeller, Schilmoeller, Etzel, & LeBlanc, 1979), stimulus shaping often requires extensive preparation of stimuli (Cooper, 1987a; Etzel, LeBlanc, Schilmoeller, & Stella, 1981) and may be difficult for many practitioners to implement (Lalli & Browder, 1993).

Prompt Dependence

In a discussion of teacher-training strategies, Koegel, Russo, Rincover, and Schreibman (1982) suggested that (a) a prompt is only a prompt if it works (i.e., it must produce a correct response), and if it does not work it should be replaced, and (b) prompts must be removed and the child or adult must respond to the relevant stimulus in the natural environment. Imagine that a parent decides to use manual (hand-over-hand) prompts to teach a teenager to get out of bed and begin dressing when her alarm clock rings. It is likely that constant use of these prompts will not teach the adolescent to independently respond to an alarm clock, but may increase her dependence on manual prompts.

Prompt dependence means that a person responds to prompts instead of responding to the cues that are expected to evoke the target behavior (Cameron et al., 1992). Suppose a youngster with autism is learning to ask, "How are you?" If the teacher's presence does not evoke the question "How are you?" the teacher may use an expectant look to prompt the response. If the student says, "How are you?" that response is reinforced. Over many trials, both the instructor's presence and the expectant look are correlated with reinforcement for asking "How are you?" Eventually, the response may occur when and only when the expectant look occurs, because the expectant look (not the presence of the instructor) signals an opportunity for reinforcement.

People with autism sometimes respond to irrelevant aspects of the environment. In part, this may be because many teaching procedures do not bring learners' behavior under the control of the key stimuli that control the behavior of most other people (Cuvo & Davis, 1983; Thorwarth-Bruey, 1989; Touchette & Howard, 1984). Consider the following description of discrete-trial teaching:

The teacher gives an instruction or asks a question, and the learner attempts (or does not attempt) to follow the instruction, receives (or does not receive) a reward, and *waits* for the teacher to initiate the next trial. Thus, both passive waiting and adult instructions become discriminative for reinforcement. (McClannahan & Krantz, 1997, p. 271)

In other words, the learner may become dependent on adultdelivered prompts. Prompt dependence may be related to another widely discussed phenomenon, stimulus overselectivity. The stimulus overselectivity hypothesis suggests that when presented with a stimulus that has more than one component (e.g., a relevant cue and a prompt), people with autism often respond to only some of the components (Cook, Anderson, & Rincover, 1982; Groden & Mann, 1988; Hoogeveen, Smeets, & Lancioni, 1989; Huguenin & Touchette, 1980; Koegel et al., 1982). Other studies, however, have shown that overselectivity is not unique to autism, and can be overcome by teaching learners to respond to multiple stimuli (e.g., Allen & Fuqua, 1985; Bailey, 1981; Dube, 1997; Dube & McIlvane, 1997; Huguenin, 1985; Litrownik, McInnis, Wetzel-Pritchard, & Filipelli, 1978).

Antecedent stimuli come to control responding because responding in their presence is reinforced frequently (Bailey, 1981; Bickel, Stella, & Etzel, 1984; Kirby & Bickel, 1988; Schneider & Salzberg, 1982). Sometimes prompting procedures cause people with autism to "attend to the teacher's prompt and learn nothing about the task" (Cameron et al., 1992, p. 329), or they "miscue learners and hence prevent them from responding to the critical stimuli" (Hoogeveen, Kouwenhoven, & Smeets, 1989, p. 344). That is, some prompting and reinforcement procedures may increase the likelihood that people with autism will attend to prompts and ignore relevant cues.

Rewarding Unprompted Responses

Although it may be necessary to reward prompted responses early in teaching, frequent reinforcement of prompted responses may inadvertently cause the response to occur *only* when it is prompted, because the prompt (and not the other stimuli that are present at the same time) reliably signals an opportunity for reinforcement. To illustrate, when teaching a child to follow directions, a teacher often uses spoken instructions ("Stand up," "Sit down"), manual guidance (prompts), and snacks (rewards). Initially, both prompted and unprompted responses are rewarded because the spoken instructions alone are not consistently effective—that is, they do not reliably control the specified responses. If the teacher continues to reward all prompted responses, however, the prompts, not the spoken instructions, may control direction following.

It appears necessary to reward prompted responses frequently in the early stages of teaching a new skill. What can teachers or parents do to help children respond to relevant stimuli other than prompts? One solution is to combine prompting and prompt fading with shaping, or rewarding unprompted approximations of desired responses (Litt & Schreibman, 1981). Suppose a father is teaching a youngster to put on her shoes by herself. The shoes next to her bed should be the stimuli that cue putting them on. Initially, the father puts the shoes on the floor next to the bed and prompts. "Put on your shoes." Because the presence of the shoes, not the instruction, should cue putting on shoes, the teaching and prompting procedures selected must make the presence of the shoes relevant. For several sessions, the father may physically guide his child to perform each of the several components in this skill, and reward each prompted response. Then, the

father may briefly withhold prompts and look for and reward components that are attempted without prompts. For example, the father might prompt one component (bending to pick up a shoe), then pause to give the child an opportunity to attempt the next response (moving the shoe toward her foot). If she does so, the father rewards that response and again pauses to observe whether she attempts the next component (putting the shoe on her foot). If she does not move the shoe toward her foot following the brief pause, her father physically guides her to complete that response, but does not deliver a reward. Over time, her father gradually increases the length of the pauses and continues to reward responses completed without prompts, until the youngster puts on her shoes independently. The father reinforces unprompted manipulation of the shoes to increase the likelihood that the presence of the shoes, not prompts from a parent or teacher, will ultimately control putting on shoes.

A 1980 study examined the effects of rewarding prompted and unprompted responses when teaching children with mental retardation to label pictures (Olenick & Pear, 1980). During prompted trials, the instructor presented a picture, asked the child "What's this?" and immediately prompted by naming the picture (e.g., "Apple"). During probe trials, the experimenter presented a picture and asked "What's this?" but did not prompt. In some teaching conditions, both prompted and unprompted labeling produced the same level of rewards; in other conditions, prompted responses produced fewer rewards than unprompted responses. The research demonstrated that providing more rewards for unprompted than prompted labeling resulted in more correct responses and more rapid learning.

Focusing Teaching on Relevant Environmental Cues

Shifting reinforcement from prompted to unprompted responses helps to avoid or diminish prompt dependence, but teachers must also ensure that their teaching strategies help people focus on the relevant aspects of teaching materials and social stimuli. If teachers want children, adolescents, and adults with autism to respond to the same environmental stimuli that control the behavior of people without disabilities, their prompting strategies must draw attention to the distinctive features of these stimuli (Etzel & LeBlanc, 1979; Etzel et al., 1981; Smeets, Hoogeveen, Striefel, & Lancioni, 1985; Smeets, Striefel, & Hoogeveen, 1990). Put another way, successful teaching means helping people respond to aspects of the environment that will continue to be present when teaching is completed (Zane, Handen, Mason, & Geffin, 1984; Zygmont, Lazar, Dube, & McIlvane, 1992). For example, when teaching a youngster with autism to discriminate red and blue, the relevant aspects of these stimuli are "redness" and "blueness." Other characteristics of the stimuli, such as size, shape, and texture, are not relevant in this context. To help students learn the relevant dimension, a teacher must design instruction to ensure that correct responses can be based only on color. The teacher might accomplish that by presenting two cars, two toothbrushes, or two gummy bears that are identical except for color, and reinforcing responses to the *color* that is designated correct on each trial, rather than responses to the larger, longer, or chewier stimulus.

Before designing instructional programs, it is often helpful to ask, "What stimuli should cue a person to engage in the target behavior?" In typical situations, greeting skills may be cued by a knock on the door, a ringing doorbell, or the approach of a familiar person. Hand washing may be cued by dirty hands, the presence of food, or flushing the toilet. To teach people to respond to all of the relevant stimuli, teachers must use teaching procedures that are likely to bring the target response under the control of environmental stimuli rather than prompts from other people. As a case in point, one might use a photographic activity schedule to teach a youngster to get dressed. In this instance, the schedule, not the presence of another person or prompts delivered by another person, should control dressing. The schedule might include pictures of each dressing skill (e.g., putting on undershirt, underpants, and socks). Manual prompts delivered from behind the boy would be used to teach him to (a) point to the picture in the schedule, (b) obtain the relevant materials, (c) complete that component of the activity, (d) return to the schedule, and (e) turn the page. During initial sessions, rewards would be delivered for every response, whether prompted or not, to establish the pictures as discriminative stimuli for dressing. Hand-over-hand prompts might continue for several sessions, but then would be faded by changing the location of the prompts (from hand-overhand to prompts at the wrist, forearm, and shoulder) and by altering the intensity of the prompts (from a firm grasp to successively lighter touches). When prompt fading begins, reinforcement shifts from prompted to unprompted responses.

Because the boy has often completed the look-then-do sequence described above, he may now point to photographs or turn pages of his schedule book without prompts. Completing these steps without assistance will be followed by rewards, and eventually the teacher will shadow as the boy completes the schedule and continue to reward unprompted dressing. Finally, the teacher will gradually move farther away until the boy dresses independently. Now tangible rewards may be replaced by a photograph (e.g., breakfast). Prompts and rewards, delivered from behind the learner, increase the likelihood that the photographic activity schedule (not the teacher) acquires stimulus control over dressing (G. S. MacDuff et al., 1993; McClannahan & Krantz, 1999).

By ensuring that teaching procedures require and reward responses to relevant environmental stimuli, teachers decrease the likelihood of prompt dependence. Sometimes, however, despite best efforts, a child or adult continues to make errors when prompts are not provided, and does not independently perform the target responses.

Determining Effectiveness of Prompting Procedures

Research has shown that errors often interfere with acquisition, generalization, and maintenance of skills (Albin & Horner, 1988; Godby et al., 1987; Koegel et al., 1982) and may provoke disruptive and emotional responses (Carr & Durand, 1985; Smeets, Lancioni, & Striefel, 1987; Weeks & Gaylord-Ross, 1981). Errors also decrease the amount of time that students are available for instruction (C. M. Johnson, 1977; Lovaas, 1977) and increase the likelihood of further errors (Cooper, 1987a; Demchak, 1990; Richmond & Bell, 1986). Despite the potential side effects of errors, only a fraction of the studies G. S. MacDuff (1999) reviewed measured errors or conducted error analyses (Doyle, Wolery, Gast, Ault, & Wiley, 1990; McDonnell & McFarland, 1988; Stella & Etzel, 1986). Nonetheless, based on the research evidence, it appears important to use teaching procedures that produce few or no errors from the outset (Cameron et al., 1992; Etzel, Aangeenburg, Nelson-Burford, Holt, & Stella, 1982).

Comparisons of most-to-least prompting systems (e.g., decreasing assistance and stimulus fading) and least-to-most prompting systems (e.g., increasing assistance) indicate that least-to-most prompting consistently produces more errors (Gast et al., 1988; Godby et al., 1987; Jones-Ault et al., 1988; Munson-Doyle, Wolery, Gast, & Jones-Ault, 1990).

Another way to evaluate prompting and prompt-fading procedures is to examine their efficiency. Interventions that require fewer trials or less instructional time may be the procedures of choice because they enable learners to master tasks more rapidly. Most of the information available about the efficiency of prompting and prompt-fading procedures is the result of comparative studies. In a comparison of decreasing assistance and increasing assistance, adolescents with profound mental retardation learned to identify coins and kitchen utensils more rapidly when taught with decreasing assistance (Day, 1987). In another comparison, however, increasing assistance was found to be the more efficient means of teaching adolescents with severe handicaps a twochoice discrimination task (Csapo, 1981).

Other researchers have compared most-to-least and least-to-most prompts and delayed prompting procedures. Although both most-to-least prompts and delayed prompting resulted in acquisition and maintenance of banking skills (cashing checks and using an automatic teller) by adolescents with mental retardation, decreasing assistance required less training time (McDonnell & Ferguson, 1989). When compared with increasing assistance, delayed prompting has been deemed the more efficient method of

46 ♦ MacDUFF, KRANTZ, AND McCLANNAHAN

teaching both discrete responses and chained responses (Bennett, Gast, Wolery, & Schuster, 1986; Demchak, 1990; Gast et al., 1988; McDonnell, 1987). As noted earlier, however, delayed prompting procedures may teach learners to wait for prompts (Oppenheimer et al., 1993).

In a comparison of the effects of delayed prompting and increasing assistance for teaching students with mental retardation and autism to respond to the instruction "Point to

<u>"</u>" by pointing to objects such as spoon, soap, or crayon, both procedures produced a desired behavior change, but delayed prompting required fewer sessions and fewer trials per session, and resulted in a smaller number of errors. The investigators suggested that if prompting procedures are equally effective, it is prudent to base the selection of procedures on the amount of instructional time required to produce a criterion performance (Godby et al., 1987).

Other factors that may influence the effectiveness and efficiency of prompting and prompt-fading procedures include (a) characteristics of learners, (b) characteristics of prompts, and (c) the difficulty of implementing procedures. Examining learner characteristics will likely produce useful guidelines; for example, if a person has not acquired generalized imitation skills, he or she is unlikely to correctly respond to model prompts. If an individual avoids or attempts to escape physical contact, manual guidance will probably hinder acquisition. If a child is apt to respond as soon as materials are presented and is unlikely to wait for prompts, delayed prompting may not be the procedure of choice. Effectiveness may also be influenced by a learner's prior history with prompting procedures (Demchak, 1990). For example, previous experience with a procedure may cause that intervention to be more effective than a novel procedure (Wolery, Ault, Doyle, & Gast, 1986).

Characteristics of prompts may affect instructional effectiveness and efficiency (Billingsley & Romer, 1983). One consideration is whether the natural cue (the stimulus that should ultimately control a behavior) and the prompt should be of the same sensory modality. For instance, will people with autism acquire visual discriminations more quickly and with fewer errors if visual prompts (e.g., models) are used rather than verbal prompts? Another consideration is how clearly prompts indicate the target behavior. Can people with autism more readily master response chains such as dressing, bed making, and table setting if separate responses are illustrated with photographs than with line drawings? These issues are yet to be addressed. Research in these areas would contribute to the development of guidelines for selecting the most effective and efficient prompting procedures.

Finally, the effectiveness and efficiency of prompting and prompt-fading procedures may be influenced by the ease or difficulty of implementation. A study that compared decreasing assistance and delayed prompting also included an assessment of teachers' preferences. Although delayed prompting was found to be more effective, decreasing assis-

tance was preferred by instructors because it was easier to implement (McDonnell & Ferguson, 1989). Perhaps less difficult procedures are more likely to be implemented and may therefore be more effective and efficient.

Selection of Prompting Procedures

Although prompts are an essential part of behavioral teaching technology, they must be used carefully to be effective. In his review of staff-training strategies, Jahr (1997) noted, "The fading of prompts is probably one of the more critical elements in the therapeutic process and lack of proficiency in such techniques may have very unfortunate effects on the client" (p. 81). Some of those unfortunate effects include prompt dependence, passivity, and the development of error patterns that can be very difficult to correct. These problems are greatly reduced when prompting and prompt-fading procedures are systematically planned and implemented, with careful, ongoing, direct assessment of learners' responses.

Although current research does not clearly indicate prompting procedures of choice for every learner under every circumstance, it does offer some practical guidelines:

- Prompts should be used judiciously; they should produce correct responses and opportunities for reinforcement when new skills are introduced, but should be faded as quickly as possible. Too many trials at one prompting level may reinforce dependence on prompts.
- On the other hand, prompts should not be faded too abruptly because this may result in errors that impede acquisition.
- Increasing assistance (least-to-most) procedures should be used to assess learners' current abilities to perform certain skills because this affords opportunities to determine what students can do independently or with minimal prompting, and what types or levels of prompts are necessary to the display of target responses.
- Decreasing assistance (most-to-least) procedures are preferred for teaching new skills because this approach produces more rapid skill acquisition, fewer errors, and less prompt dependence than least-to-most prompting procedures.
- When errors occur during teaching, it is usually desirable to return to the previous level of prompting (i.e., on the next learning opportunity, provide enough help to minimize the likelihood of additional errors). This also promotes skill

acquisition because it decreases emotional responses that are frequently associated with errors.

- As quickly as possible, shift reinforcement from prompted responses to unprompted responses, because ongoing reinforcement of prompted behavior is likely to result in prompt dependence.
- Do not assume that the prompting and promptfading procedures that were effective for teaching one skill will be effective for teaching other skills, or for teaching other learners the same skill. Prompting and prompt-fading techniques should be selected through direct observation and measurement. Pretesting the effectiveness and efficiency of different prompting procedures in brief tryouts, and examining the data from these trials for evidence that one procedure results in more rapid acquisition or fewer errors than another, can help to identify prompting methods that are likely to be effective for instruction.

Summary

In this chapter, we defined prompts and examined several different types of prompts. We summarized several promptfading procedures (increasing assistance, decreasing assistance, delayed prompting, graduated guidance, stimulus fading, and stimulus shaping) and noted that fading procedures that help people acquire new skills in the fewest trials and with the fewest errors may be the most useful. We suggested that the likelihood of prompt dependence may be reduced by shifting reinforcement from prompted responses to unprompted responses as early as possible, and by fading prompts rapidly but carefully.

Finally, we underlined the importance of making careful decisions about the selection of prompting and promptfading procedures before teaching begins. Prompting procedures must enable learners to respond to relevant environmental stimuli. In our experience, prompting sequences such as verbal instructions that are faded to phrases, words, syllables, and then expectant looks can be very difficult to eliminate; when the expectant look is absent, the target response often fails to occur. Other prompt-fading strategies, such as graduated guidance delivered from behind children or adults, may be more effective than verbal prompts because throughout training the student responds to relevant environmental cues rather than to an instructor. For the same reasons, delayed prompt, stimulus-fading, and stimulus-shaping procedures may be useful for bringing the behavior of people with autism under the control of the same environmental stimuli that have an impact on the behavior of typical learners. We look forward to new investigations and new data on the effectiveness of prompting procedures. In the meantime,

thoughtful selection of prompting and prompt-fading procedures and careful assessment of their effects may help diminish the prompt dependence that is so often observed in young people with autism.

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