A Review of Interventions to Teach a Mand Repertoire

Esther Shafer
The Central School of Speech and Drama, London, England

Interventions which teach developmentally disabled persons to make requests and choices are now widely recommended. Recent changes in general approaches to teaching request-making have been noted which are consistent with theory and research concerning mands. Three categories of interventions, incidental teaching, choice making, and the interrupted behavior chain are also examined with regard to theory concerning the mand and establishing operations (EOs). Several of the critical features of EOs, and in particular the momentary aspect of EOs, have not been well incorporated into interventions. Suggestions for improvement of mand interventions are therefore proposed.

In recent years, many interventions have been designed with the purpose of teaching developmentally disabled individuals to make requests and choices. Although these interventions are not often described as ones designed to establish a mand repertoire, the goal appears to be essentially the same, and for this reason reflects a welcome trend. A change in the nature of services that are provided to developmentally disabled persons and the philosophy underlying these changes may be primarily responsible for this trend. Over the past twenty-five years, the range of services provided to persons with developmental disabilities has greatly increased (Falvey, Bishop, Grenot-Scheyer & Coots, 1988). The criteria of functionality and increased access to the mainstream of society are generally applied to any intervention recommended for this population (Falvey et al., 1988), and the same criteria are used to evaluate the benefits of communication training programs (Reichle, Piché-Cragoe, Sigafoos, & Doss, 1988). Interventions which increase an individual's ability to establish a listener's attention, request desired items, make choices, and reject unwanted items or events are seen as ful-filling the criteria of functionality and are therefore often recommended for this group of learners.

Many benefits of teaching students to make requests and choices have been discussed in the literature, including increases in desirable social behaviors (Peck, 1985) and spontaneous communication (Dyer, 1989). There is also a growing awareness of the relationship between challenging behavior and communication skills (e.g. Durand & Carr, 1992; Dyer, Dunlap, & Winterling, 1990; Johnston & Reichle, 1993; Reichle et al., 1988). Developmentally disabled persons may sometimes acquire strong repertoires of self-stimulation, self-injurious behavior, and aggression toward others. When a functional analysis is made, these behaviors often appear to be maintained by escape or avoidance of certain situations, social attention, or are followed by other tangible consequences (Durand & Crimmins, 1991). Teaching request-making is frequently recommended as part of an overall treatment plan to decrease challenging behavior by developing other response forms which have the same function (Durand & Carr, 1992).

The Need to Evaluate Interventions Designed to Teach Request-Making

Communication interventions for developmentally disabled persons are carried out by professionals from diverse back-

grounds and published in the journals of many related fields (Warren & Reichle, 1992). Despite the increasing amount of research in this area, the possibility exists that many interventions described in the literature have not been influenced by the theory and research concerning mands and the role of motivational variables that are relevant to the mand, or establishing operations (Michael, 1993). As Remington (1991) noted, behavioral interventions for persons with developmental disabilities often become detached from the theoretical and empirical principles from which they were derived.

Because interventions to teach request-making are commonly recommended, a closer examination of these is justified, particularly in regard to the current theoretical and experimental knowledge concerning the mand. This paper will first clarify essential features of the mand and establishing operations with respect to planning treatment programs. General approaches to teaching request-making as well as types of interventions commonly recommended will be reviewed, and suggestions will be proposed for further development of interventions.

FEATURES OF THE MAND THAT ARE IMPORTANT FOR COMMUNICATION TRAINING

In *Verbal Behavior* (1957), Skinner defined the mand as ..."a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (p. 35-36). The mand is unique among the verbal operants because it is the only one in which the form of the response is controlled by motivational variables rather than prior stimuli (Michael, 1988). Michael's (1993) analysis of the establishing operation (EO) has provided clarification of the role of motivational variables with respect to the mand. He defines the EO as "an environmental event, operation, or stimulus condition that affects an organism by momentarily altering (a) the reinforcing effectiveness of other events and

(b) the frequency of occurrence of that part of the organism's repertoire relevant to those events as consequences" (p. 192).

Distinguishing the Two Effects of the EO

The two effects of the EO are important for practitioners to distinguish when planning treatment programs. The first effect of the EO is called reinforcer establishing (Michael, 1993), because it alters the reinforcing effectiveness of other events. Since the reinforcer establishing effect of the EO is transient or momentary, the teacher must make sure that an EO is in effect at the time of training by either capturing or contriving EOs (Sundberg, 1993). To capture EOs, the teacher must take advantage of events that occur naturally in the environment. An opportunity that often arises is to simply note that a period of time has passed since a person has eaten or had something to drink (Sundberg, 1993), at which time food or drink would function as an effective form of reinforcement. EOs may also be contrived, in which the environment is manipulated so that the reinforcing effectiveness of an event is strengthened. Sundberg offers the example of a client who is showing interest in watching a video. By turning the video off momentarily, an EO is established in which the continuation of the video will function as a form of reinforcement.

The second effect of the EO is called the evocative effect (Michael, 1993), and is very different from the reinforcer establishing effect of the EO. When an EO is in effect, any behavior which has been successful in the past in obtaining that form of reinforcement will be evoked. In the example of food deprivation, because the person has not eaten for some time and food now functions as an effective form of reinforcement, the person is likely to produce a mand for food. The behavior that is evoked may take a number of different forms, and will vary depending upon each individual's learning history. Often, individuals with limited verbal repertoires will emit unconventional mands or challenging behaviors when strong EOs are in effect. When such behavior is evoked the teacher

can employ prompting or shaping procedures to modify or replace the initial response forms.

An appreciation of the differences between the two effects of the EO is also important in order to teach mands effectively. Many interventions focus upon the evocative effect of the EO by emphasizing the procedures that are needed to develop new forms of responses. While the ability to prompt and shape new response forms is a necessary skill in conducting successful interventions, the likelihood that new responses can be taught will be severely limited without carefully considering the reinforcer establishing effect of the EO. When attention is focused upon the form of a response rather than the controlling variables, the response may resemble a "request," but may not be a mand.

Types of EOs

EOs fall into two categories: unconditioned establishing operations (UEOs), whose effects are unlearned, and conditioned establishing operations (CEOs) whose effects are a result of the individual's history (Michael, 1993). UEOs such as water or food deprivation are easy to incorporate into mand interventions, since the passage of time establishes food and drink as EOs and the teacher can easily capture these events. UEOs can also be contrived, for instance, by giving someone salty chips to increase the value of liquids (Sundberg, 1993). However, CEOs provide the greatest source of potential items and events to be used as reinforcement for the mand. Michael (1993) described three types of CEOs – transitive, reflexive, and surrogate, and Sundberg (1993) provided examples of how they can be incorporated into mand training programs.

The transitive CEO can be both captured and contrived, and has been utilized in many mand interventions. To capture a transitive CEO, the teacher must take advantage of situations in which one stimulus increases the reinforcing value of a second stimulus. Sundberg (1993) provides the example of a child seeing a highly reinforcing fire truck outside a window, which

increases the value of a second stimulus, an open door. The opportunity now exists for the teacher to prompt for the mand "open" or "out." The transitive CEO can also be contrived, as in the interrupted behavior chain procedure (e.g. Hall & Sundberg, 1987). In this procedure, the learner engages in a chain of behavior, and the situation is arranged so that one essential part of the chain cannot be completed, such as executing the steps to make a cup of instant coffee but not having access to hot water. The hot water has increased in value as a result of engaging in the other behaviors involved in making instant coffee, and the mand for "water" can be taught.

The reflexive and surrogate CEOs often play a large role in instances of challenging behavior. A reflexive CEO is any stimulus condition whose presence or absence has been positively correlated with the presence or absence of any form of worsening, and will function as a CEO in establishing its own termination as effective reinforcement and in evoking any behavior that has been so reinforced (Michael, 1993). Reflexive CEOs can function as warning stimuli, and behaviors that terminate these stimuli are likely to be evoked. For example, many students have had a history of being unsuccessful in instructional situations. In this case, verbal directions that accompany instruction function as a reflexive CEO, because they are correlated with instruction and are therefore correlated with a form of "worsening." The verbal directions are likely to evoke behaviors that result in the student escaping or avoiding teaching activities. To reduce these behaviors, the teacher can remove the warning stimuli (the verbal directions) and present new stimuli, while carefully ensuring success while the new stimuli are presented (Sundberg, 1993). A surrogate CEO is developed when a stimulus is correlated with a UEO and becomes capable of the same reinforcer establishing and evocative effects as that UEO (Michael, 1993). A surrogate CEO can function in the same way as a reflexive CEO by evoking behaviors which result in escaping or

avoiding a situation. For instance, the white coat of a doctor or dentist may have become correlated with painful stimuli, and the sight of someone wearing a white coat may evoke behaviors that result in terminating the stimulus (Sundberg, 1993). When possible, mands such as "no" or "stop" can be taught, thus giving a way to escape or avoid situations without engaging in challenging behavior (Johnston & Reichle, 1993).

Distinguishing the EO from the S^D

The distinction between the EO and the S^D is important to clarify in order to plan effective interventions (Sundberg, 1993). Michael (1993) provides a useful contrast, noting that the reinforcing effectiveness of environmental events is associated with the EO and the availability of an effective form of reinforcement is associated with the S^D. When an EO is in effect, a particular consequence would function as an effective form of reinforcement if it were obtained. This does not mean that a consequence is available, even though that part of the organism's repertoire that has been successful in the past in obtaining that reinforcement is momentarily strengthened. For example, if an EO such as food deprivation is in effect, the learner may mand for food even though food may not be available. In contrast, an S^D is a stimulus condition that has a history of correlation with the differential availability of an effective form of reinforcement, meaning that the relevant consequence is more available in the presence of the S^D than in its absence. The situation could arise in which food may be available and in view, although the learner may not be hungry at that moment and may not mand for it.

An understanding of the difference between the EO and S^D is important in the analysis of many everyday examples of verbal behavior, which often involve joint control by EOs and S^Ds. For example, in a cafeteria, requesting a particular kind of food is controlled by the sight of the food item (an S^D) and presumably, food deprivation (a UEO), making the response multiply controlled (part tact and part mand).

Many similar opportunities arise in the everyday environment which can be used to teach mands, as long as care is taken to ensure that EOs have been captured or contrived. In the above example, a UEO could be captured by conducting training at a time of day when the learner is likely to be hungry.

Distinguishing between the EO and S^D is also important when considering the issue of spontaneity. Although spontaneous communication is widely considered to be a desired outcome of training, many students do not achieve this goal. In order to more accurately define spontaneity, Halle (1987) has suggested arranging the types of stimuli that may control verbal responses along a continuum. One end of the continuum describes the stimuli that might control a verbal response in very structured teaching situations, while the other end considers responses for which such stimuli are absent, or presented in a less obvious way.

The degree to which a request is spontaneous can be further clarified in terms of multiple control and the different verbal operants. For example, a response that is partly controlled by a nonverbal stimulus (presence of a glass of water held very close to the learner's face) and a verbal stimulus ("What do you want?") is considered to have very little spontaneity. This response is part mand (if an EO is in effect), part tact (controlled by an S^D), and part intraverbal (controlled by the prompt "What do you want?"). In a teaching situation such as this one, echoic prompts ("Water") may also be used, thereby adding another source of control. In contrast, the most spontaneous type of response would be a pure mand, which is controlled solely by an EO or CEO. For example, when a child tells a listener that she is thirsty when a nonverbal stimulus is absent (a drink is not in view) and who has not been asked a question (no verbal discriminative stimulus has been presented) the response is presumed to be under control of a UEO (water deprivation).

Many everyday situations fall somewhere in the middle of the continuum by

involving some degree of multiple control, such as asking for an item that is on display in a store. In a classroom setting, teachers often conduct communication training during snacktime or mealtime by offering students a choice of foods and beverages with the items in view. For instance, if water were available, the form of the response "Water" would be jointly controlled by water deprivation (UEO) and the sight of water (S^D), making the response part mand and part tact. Because these types of situations are often encountered throughout a typical day, they provide good opportunities for communication training as long as care is taken to ensure that the relevant EO is in effect. Even though situations involving multiple control are frequent, pure manding, or control solely by an EO, appears to be the most functional for the speaker. The form of the response is not dependent upon supplemental stimulation (i.e., prompts), and may be emitted under a wide range of circumstances. For these reasons, communication programs which include some teaching of pure mands are desirable.

Establishing Mands and Tacts in a Speaker's Repertoire

Skinner (1957) notes that verbal responses of a given form often seem to pass easily from one type of operant to another (pp. 188-190). The acquisition of mands and tacts often occurs very rapidly in young children, and the conditions which are responsible for the development of the two verbal operants can be identified only upon close observation. One possible reason may arise from the fact that the events which reinforce a mand often resemble the discriminative stimuli which control a tact (Skinner, 1957, p. 189). For example, when a child produces the mand for milk, the milk that is received is also a discriminative stimulus for the tact "milk." Although the response remains a mand and is primarily controlled by a state of deprivation, the presence of the milk as a discriminative stimulus is relevant, and is one step toward acquiring the corresponding tact.

Although procedures to explicitly teach mands and tacts seldom need to be deliberately arranged in young children, the need to do so with many developmentally disabled individuals has become apparent. Therefore, an understanding of the differences between the EO and S^D is important in order to design procedures which can facilitate the acquisition of both verbal operants in the most effective manner. Procedures to transfer control from one verbal operant to another have been described by Sundberg (1990), and are now well incorporated into communication training programs for developmentally disabled persons (e.g. Gobbi, Cipani, Hudson, & Lapenta-Neudeck, 1986). Other researchers have begun to investigate the conditions in which specific response topographies may be acquired as one verbal operant, and are then acquired as the other verbal operant without direct training (Goodman & Remington, 1991; Sigafoos, Doss, & Reichle, 1989; Sigafoos, Reichle, Doss, Hall, & Pettit, 1990). These studies have also begun to consider the learning histories of students that can facilitate the development of both repertoires.

CHANGING APPROACHES TO MAND TRAINING

Directly Training a Mand Repertoire

Researchers are increasingly acknowledging that the mand should be trained directly, rather than expecting transfer of stimulus control from other verbal operants to occur (Reichle, Rogers, & Barrett, 1984). The ease by which young children acquire a verbal repertoire may have been the reason why earlier communication training programs for developmentally disabled persons did not emphasize teaching of a mand repertoire. Many earlier communication training programs reported failure in teaching the mand, but these programs emphasized the teaching of other verbal operants such as the tact and echoic with the assumption that the mand repertoire would automatically develop (Hall & Sundberg, 1987; Sundberg, 1990). A careful consideration of

the conditions that are necessary to establish each verbal operant in a speaker's repertoire is consistent with Skinner's (1957) analysis that the verbal operants are functionally independent, and that teaching one verbal operant does not necessarily lead to another. Empirical support for the independence of the verbal operants has been provided by a number of researchers (e.g. Hall & Sundberg, 1987).

Teaching the Mand as the First Verbal Operant

Researchers are increasingly recommending that request-making should be the starting point of training for learners with limited verbal repertoires (Halle, 1987; Reichle, Mirenda, Locke, Piché, & Johnston, 1992). When the characteristics of the mand are compared with those of other verbal operants, the advantages of teaching a mand repertoire become evident. The reinforcement for the mand is the item or event manded and directly benefits the speaker, while the tact is maintained by social and educational reinforcement and primarily benefits the listener (Skinner, 1957, pp. 36 & 84). Since social reinforcement is often not a strong source of reinforcement for developmentally disabled persons (Bondy & Frost, 1993), and the establishing operations that control the mand are often powerful, these factors strongly indicate that a mand repertoire would be acquired more rapidly than a tact repertoire by learners who have limited verbal behavior.

Two studies (Braam & Sundberg, 1991; Stafford, Sundberg, & Braam, 1988) have supported this view. These studies compared the acquisition of signed responses under two conditions, the specific reinforcement condition corresponding to the mand and the nonspecific reinforcement condition corresponding to the tact. Both studies demonstrated that responses in the specific reinforcement condition produced stronger verbal behavior when response strength was measured in terms of latency. Although percent correct responses were similar in both conditions, subjects showed preferences for the specific reinforcement condition by showing more interest and

willingness to participate in the teaching activities.

Research has also supported the view that establishing a mand repertoire assists in the acquisition of other verbal operants. Carroll and Hesse (1987) compared the effects of alternating mand and tact training on the acquisition of tacts. A transitive CEO procedure was implemented with young children, in which they were taught to tact and mand parts of a toy that had to be assembled for the toy to work. They found that fewer trials were needed to meet mastery criteria during mand-tact training than tact only training. Although further research is needed to supplement the small number of studies to date, the advantages of emphasizing the teaching of a mand repertoire to learners with limited verbal behavior seem clear.

Recognizing a Wide Range of Response Forms as Mands

A particular challenge arises when developing interventions for learners with severe sensory and motor impairments. Many students have difficulty in executing the motor movements which would allow them to acquire a mand repertoire using vocalizations, sign language, or gestures. Motoric and sensory limitations can also severely restrict the opportunities a learner has to participate in activities and interact with other persons (Siegel-Causey & Downing, 1987).

In recent years, interventions for these students have been designed which allow them to make requests using response forms such as eye gaze, gestures, facial expressions, and undifferentiated vocalizations (Siegel-Causey & Downing, 1987; Sigafoos & Dempsey, 1992). Despite this, listeners may have difficulty in recognizing the responses that these learners produce as mands. Abnormal reflex patterns and muscle tone is often evident (Guess, Benson, & Siegel-Causey, 1985), resulting in facial expressions and motor movements that appear different from those of other learners or are inconsistently produced. Visual deficits may result in lack of gaze behaviors and eye contact, or the response

of looking at people and objects may not be under operant control. An important aspect of implementing mand interventions with these students is to teach caregivers and teachers to recognize mands that are produced using these response forms, and to respond accordingly (Guess et al., 1985; Siegel-Causey & Downing, 1987).

Evaluating Interventions

When evaluating interventions, the primary consideration should be whether an EO is actually in effect at the time of training. Since the momentary aspect of EOs is critical, interventions should include procedures to capture or contrive EOs. This question is particularly important to consider if an S^D is present, since the trainer will want to be sure that the student is not responding solely under the control of the S^D, making the response a tact rather than a mand. The types of UEOs and CEOs that are utilized should also be noted. Because many interventions have been adapted for learners with limited response forms or challenging behavior, the extent to which these interventions have captured and contrived EOs should also be considered.

INTERVENTIONS TO TEACH A MAND REPERTOIRE

Conducting Training in the Learner's Environment

Conducting communication training in the learner's everyday environment has become a widely adopted practice with developmentally disabled individuals (Caro & Snell, 1989; Halle, 1988; Mirenda & Iacono, 1988). There are some very important reasons why the learner's own environment should be the locus of training. Often, developmentally disabled persons have difficulty in transferring skills to new environments or new persons (Caro & Snell, 1989). Training can take place as opportunities naturally occur, eliminating the need to design additional procedures to facilitate generalization. Most importantly, there are many opportunities to capture and contrive EOs in a learner's nat-

ural environment, and interventions are increasingly being developed which take advantage of these opportunities. Three categories of interventions have appeared in the literature: incidental teaching, choice making, and interrupted behavior chains.

Incidental or Milieu Teaching

Halle (1988) notes that the idea of conducting training in the learner's natural environment grew from incidental language teaching procedures with preschool children (Hart and Risley, 1968), and has since been used with persons diagnosed with autism and developmental disabilities (see Kaiser, Yoder, & Keetz, 1992, for a review). Incidental teaching, also referred to as milieu teaching (Warren & Gadzag, 1990), is characterized by conducting training trials throughout the day instead of in structured teaching sessions. Although a key feature of incidental teaching is that all teaching opportunities are initiated by the learner (Halle, 1988; Mirenda & Iacono, 1988), the environment can be arranged in ways that will encourage requests for materials or assistance (Halle, 1988), such as having preferred items in view but out of reach. Incidental teaching is mainly concerned with capturing EOs, but teachers can also contrive EOs to increase the frequency of requests. Because the requests are initiated by learners, it is likely that EOs are in effect, and the requests are in fact, mands. An understanding of the evocative effect of the EO is important when employing incidental teaching procedures. The EOs themselves may be hard to observe, but it is easier to observe the mands which are evoked by those EOs. In incidental teaching, a skilled trainer can capitalize on naturally-occurring EOs by conducting mand training when unconventional mands are evoked, prompting and shaping new response forms.

Research has indicated that teaching staff should be skilled in several areas in order to successfully implement incidental teaching procedures. Houghton, Bronicki, & Guess (1987) conducted classroom observations of teaching staff and students with severe disabilities. They recorded the

opportunities given to students to express preferences and make choices. Before training, most of the mands that students produced during the day in unstructured situations were not attended to. Staff were more likely to respond to mands during formalized instructional situations, although the frequency of doing so was still relatively low. Houghton et al. offered several reasons for these findings. They noted that incidental teaching is a very different style of instruction from structured teaching sessions, and teachers were not experienced in responding to requests made by students as they occurred throughout the day. The authors also suggested that many of the staff had difficulty identifying these responses as requests. Most of the response forms used by students consisted of body movements and facial expressions, while very few students used sign language, communication boards, or vocalizations. Staff were more likely to reinforce these types of responses in children below five years of age, and less likely to do so with older students, perhaps because the types of responses these children were making are more typical of younger children.

Recommendations for incidental teaching procedures. The results of the Houghton et al. (1987) study suggest that for incidental teaching procedures to be successful, staff must have the ability to recognize mands that include a wide range of response forms, and to be observant for these throughout the day. Although incidental teaching is meant to be structured so that the learner initiates all interactions, capturing and contriving EOs would increase the number of mands produced, and may be necessary for learners whose rate of manding is relatively low. For example, staff can take advantage of times during the day when UEOs for food and water deprivation are likely to be in effect. During these times, staff can ensure that food and drink items are available so that mands are likely to occur. Staff can also note the kinds of items and events in which a student shows interest, varying these to prevent satiation and making

these available throughout the day. Other skills necessary for successful incidental teaching include prompting learners to elaborate on their initial mand, and providing specific reinforcement for that mand.

Choice Making

Interventions designed to teach choice making are often recommended, since they are consistent with the philosophy of functionality and normalization (Guess, Benson, & Siegel-Causey, 1985; Shevin & Klein, 1984). A usual procedure for teaching choice making, as described by Reichle, Rogers, & Barrett (1984) is to display several items and ask the learner "What do you want?". The learner can then indicate a choice through a variety of response forms such as speech or signing before taking the item. This response is part mand (assuming an EO is in effect), part tact (controlled by a nonverbal stimulus) and part intraverbal (controlled by the verbal stimulus "What do you want?"). The practice of rejecting an item as a means of expressing a choice is another skill that is frequently taught. In the Reichle et al. study (1984), students were also taught to sign "no" when presented with objects that teaching staff judged to be unattractive to that student, and asked "Want one?" As in the previous example, the response is also part mand, part tact, and part intraverbal. Choice making interventions are often implemented in conjunction with incidental teaching procedures as part of a treatment package (e.g., Peck, 1985).

Increasing the number of opportunities that learners are given to make choices is often a goal of choice making procedures. Haring, Neetz, Lovinger, Peck, & Semmel (1987) observed that teachers participating in their study generated an average of one choice making opportunity per day across all students in their classroom before a training procedure was implemented. After training, the average number of opportunities presented by each teacher increased to 5.9 per day. Shevin and Klein (1984) suggested a number of ways in which choice making can become integrated into a student's daily routine,

including choosing among activities, whether or not to engage in an activity, when to terminate an activity, alternative means of accomplishing an objective, and choosing partners for shared activities.

Inconsistencies in choice making. Students show inconsistencies in the choices that they make in several ways, as demonstrated in a study by Sigafoos & Dempsey (1992). They structured a choice making situation during which children were given five opportunities to choose between portions of either a food or beverage item. The method by which a choice was indicated varied depending upon the physical abilities of each child, which included looking at the items, maintaining physical contact with the items or reaching toward the items. The children would sometimes refuse the items that were chosen after they were given to them, and one child refused chosen items 19% of the time. Later in the study, a condition was implemented in which the opposite item to the one that the child had chosen was deliberately presented. Children often accepted the item not chosen, with two of the children accepting the unchosen item approximately half the time.

Reasons for inconsistent responding. When students show inconsistencies in choice making, there is a strong possibility that the conditions which define the mand are not in effect (Duker, Dortmans, & Lodder, 1993). Since items are in view while the choice is being made, an S^D rather than an EO may be primarily controlling the response. Reichle, Sigafoos, & Piché (1989) note that in many choice making procedures, the student produces a response form which corresponds to one of the items on view, and that item is then placed in the student's hand. For example, if one of the two items on display is an apple, the student can produce the sign for apple and be handed an apple. In this situation, the student would be likely to refuse to eat the apple if the response had been controlled by the nonverbal stimulus of the sight of the apple instead of an EO.

Accepting the opposite item to the one chosen could also be the result of having two items for which an EO is equally in effect. In the Sigafoos and Dempsey (1992) study, two of the subjects accepted the opposite items approximately half the time. Students were likely to be both hungry and thirsty at the time the choice making sessions occurred. Since the choices were portions of food and sips of a drink, and the usual procedure would be to consume both items during a session, either item may have been equally acceptable at any time during the session. In order to ensure closer correspondence between items chosen and items accepted, Reichle et al. (1989) developed a procedure which initially presented two items with reinforcing values that were presumably very different from each other. One of the two items had often been chosen and accepted by the student in the past, (e.g., a banana) while the second item was one that the student had shown little interest in (e.g., an eraser). During this phase, the student demonstrated a high percentage of correspondence between choosing and accepting the correct object. However, during the next phase when two objects of presumably equal value were presented, the correspondence of choosing and accepting the same object decreased.

Another possible reason for refusals might be explained by the nature of the response patterns made by learners who cannot differentially vocalize or sign. Sigafoos and Dempsey (1992) noted that when a learner looks at or moves toward an object, they may be doing so simply to observe the object, and might not accept it if offered. In addition, because the repertoires of these students are often limited, subtle differences in responses may be difficult for observers to detect. Learners who have difficulty controlling motor movements may, for example, have two slightly different forms of a head nod, one indicating "yes" and the other indicating "no." A person unfamiliar with these response patterns may interpret a "no" as a "yes."

Preferences that change over time. While few studies of choice making directly manipulate EOs, there is increased awareness that reinforcing effectiveness of items

or events can vary due to such factors as novelty of the stimulus and conversely, satiation with the item or event on a given occasion (Kennedy & Haring, 1993). These researchers conducted an assessment of items and events that functioned as reinforcement for students, and then reassessed these students several weeks or months later. At that time, some students chose different items to those originally preferred. The authors recommended that students be reassessed periodically to take into account the changing nature of preference.

Several recently developed procedures for choice making more closely address the momentary nature of EOs. Schweigert and Rowland (1992) used switches to provide a means by which children with multiple disabilities could request and choose between objects and activities, thus teaching a selection-based mand. They conducted assessments at the beginning of each session to determine which items and events the child was interested in at that time by recording behaviors which were felt to indicate preference, such as smiling. An observer continued to monitor the child's affective behavior and rate of switch use throughout the session, in order to change to another activity when interest decreased. Dyer (1987, 1989) used a similar procedure for assessing items and events that can function as reinforcement before each teaching session. In these two studies, caregivers initially provided a list of toys and food judged to be enjoyable by a particular child. Five of these items were chosen to be formally assessed before each teaching session, by observing the responses of the child to the items. For an item to be used in the teaching session, the child had to demonstrate behaviors which indicated that the item would function as reinforcement, such as manipulating the object for more than 15 seconds without prompting, resisting when the item is taken away, reaching for the object when removed, and exhibiting positive affect while manipulating the object. Two of the preferred items were then chosen for use in an incidental teaching session, in which the items could be obtained by requesting

them from a teacher. When sessions using preferred items were alternated with sessions using nonpreferred items, children were more likely to make spontaneous verbal requests in the sessions using preferred items.

Recommendations for choice making procedures. The inconsistencies in responding that have been reported in the literature concerning choice making indicate that many interventions have not taken the momentary aspects of EOs into account. When recommending activities for choice making, the emphasis of many researchers appears to be the range of opportunities that can be offered rather than ensuring that an EO has been captured or contrived when the student is offered a choice. While the results of reinforcer preference inventories can be used as a general guide, conducting such assessments before each teaching session can more closely predict EOs that are in effect at that time. Items and events should also be alternated frequently, and new ones introduced, in order to prevent satiation from occurring. Choices can be offered when UEOs are most likely to be in effect, such as providing the choice of a food or drink item after a period of time has passed since the student has had a snack or meal. When first introducing choice making activities, one item can be presented for which a very obvious EO is in effect, with the other item being a nonpreferred one. Allowing the student to both mand for an item and to then touch or pick up that item if physically possible can also help to ensure that responses are under the control of an EO.

The Interrupted Behavior Chain

In the interrupted behavior chain procedure as described by Hall & Sundberg (1987), the student is presented with the opportunity to complete a chain of behavior. An essential item needed to complete the chain is withheld, thereby contriving a transitive CEO in which receipt of the missing item would function as reinforcement. Two behavior chains used in the Hall and Sundberg study were making instant coffee and instant soup, withhold-

ing the cup for the coffee and the hot water for the soup. Learners entered the study with the ability to tact the cup and the hot water, but they could not emit the same verbal topographies under mand conditions (i.e., when the items were missing and needed to complete the chain). Procedures were then implemented to teach mands directly and to assess transfer from tacts to mands.

The interrupted behavior chain procedure is distinguished from other interventions by its emphasis on contriving CEOs. There are many advantages to using contrived CEOs rather than captured EOs, as discussed by Hall and Sundberg (1987). Most importantly, contriving CEOs ensures that an EO is in effect at the time of training. In contrast, procedures which primarily take advantage of captured EOs cannot be easily controlled, since the teacher must often wait for the EO to come into effect. This is a particular problem in the case of UEOs, which build up slowly and weaken quickly upon delivery of reinforcement. In addition, contrived procedures offer the potential to manipulate the reinforcing effectiveness of many objects or events, allowing for a wide variety of mands to be trained. Contriving EOs also makes manding for missing items easier to teach, because responses are freed from control by S^Ds. Many incidental training procedures use items that are visible, and the resulting response is jointly controlled by S^Ds and EOs (i.e., is part tact, part mand). When items are not visible, the learner does not have to wait for the presence of an item to mand for it.

The interrupted behavior chain procedure has been the basis for a number of recent interventions. A procedure similar to the one described by Hall and Sundberg was used by Sigafoos et al. (1989) in which the response form was pointing to a graphic symbol. The chains of behavior were shorter than those used in the Hall and Sundberg study, consisting of presentation of a food or drink item, but with the necessary utensil or opener missing. The food items were made visible to the learners, but the utensils were not, thereby ensuring that mands for the utensils were under control of a CEO.

Learners with physical and sensory disabilities. Several adaptations of the interrupted behavior chain procedure have been implemented with this group of learners. In a study by Gee, Graham, Goetz, Oshima, and Yoshioka (1991), students had physical disabilities which prevented them from executing motor behaviors that would allow them to complete a behavior chain, so were taught to activate a switch or call button. Accessing the switch allowed them to request continuation of an activity that was momentarily delayed, such as being taken out of a chair, or being assisted to drink from a cup. Before the study, these learners often exhibited behaviors which could be interpreted as mands, including signs of distress or change in body posture when an ongoing activity was ceased or interrupted, although these responses were often ineffective in obtaining assistance from a listener. Another study by Romer and Schoenberg (1991) involved two learners who were occasionally observed to mand with a variety of response forms, but whose sensory disabilities prevented them from engaging in many activities independently. Five different kinds of interruptions were used, including presentation of incorrect or broken items, physically preventing the learner from completing the activity, materials missing from their proper places, and presenting an alternate activity in the middle of an ongoing one.

The type of EO in effect. Although adaptations to the interrupted chain procedure have been developed with the special requirements of learners in mind, in some cases the nature of the EO may be different from the transitive CEO in effect in the Hall and Sundberg (1987) study. For example, in two studies (Alwell, Hunt, Goetz, & Sailor, 1989; Romer & Schoenberg, 1991), teachers prevented students from exiting a room by either physically blocking the door or placing a hand on the student's shoulder. The presence of the teacher when blocking the door has some features of a reflexive CEO. In this example, a CEO has

already been established (e.g., an open door would function as reinforcement). The presence of the teacher functions as a warning stimulus that reinforcement is not forthcoming, and any behavior that terminates this stimulus will be reinforced. Since many learners have a history in which teachers have been paired with punishment and not with reinforcement (Sundberg, 1993), it is important that teachers become paired with reinforcing events and avoid being paired with forms of worsening. Although establishing a transitive CEO often involves some intervention by a teacher in momentarily stopping reinforcement (e.g., turning a video off so the learner will mand for the video to continue), the teacher's role may seem less obvious to the learner than when access to a reinforcing stimulus is directly blocked. An alternative to physically blocking a student from leaving a room may be to find another way to ensure that the door cannot be opened easily by the student, such as a door handle which is difficult for the student to reach or manipulate. Teachers may find other creative ways to distance themselves from situations, such as programming a video by a timer to stop at specified times.

When a reflexive CEO is in effect, a student may exhibit emotional behavior such as crying, but may otherwise have very limited response forms that function as mands. Teaching activities are very difficult to carry out under these circumstances, since emotional behavior may interfere with attempts to prompt and shape new response forms. In order to prevent this problem from occurring, two studies (Alwell et al., 1989; Goetz, Gee, and Sailor, 1985) used a procedure of pretesting activities in order to choose those that could be interrupted without generating a great deal of emotional behavior. A rating scale was used to identify activities in which students showed some degree of interest, such as looking at or reaching for an item, but without accompanying emotional behavior which would interfere with training. By choosing activities that generate the least amount of emotional behavior,

chain interruption procedures can be carried out without teachers being paired with forms of worsening.

Recommendations for interrupted behavior chain procedures. Because the interrupted behavior chain procedure contrives rather than captures EOs, it offers several important advantages. Training opportunities can be arranged throughout the day by manipulating a wide variety of CEOs, therefore teaching a wide variety of mands. Care should be taken that teachers do not become paired with forms of worsening while manipulating CEOs, since this will have detrimental effects on the success of training in general. Consideration should also be given to the nature of the reinforcement that a student receives as a result of completion of the behavior chain. Many studies (e.g., Hall & Sundberg, 1987; Sigafoos et al., 1989) have used chains in which the interruption results in establishing a transitive CEO, making objects valuable which enable the student to eventually consume a food or drink item. Assuming that a UEO is in effect for that particular item, this type of interrupted behavior chain would seem to be a very good choice.

SUGGESTIONS FOR FURTHER RESEARCH

The growing acceptance of the importance of teaching a mand repertoire is a very encouraging trend, since it makes the convergence of theory and practice more likely. Positive developments include the recognition that mands should be introduced as the first step in teaching a verbal repertoire, the establishment of procedures for transfer of stimulus control, the increased development of interventions for learners with severe disabilities, and the emphasis upon teaching mands in the student's everyday environment. At present, however, the momentariness of the EO is not taken into account in the design of many interventions. Since successful mand training depends upon the ability to capture and contrive UEOs and CEOs, this knowledge must become a part of training for those who work with developmentally

disabled individuals. While other important aspects of communication training have received increased attention, such as the ability to recognize a wide variety of response forms as mands and ways to prompt and shape new response forms, the role of motivational variables has been relatively neglected. The EO also plays an important part in the analysis of challenging behavior and the development of more acceptable response forms (Sundberg, 1993), and deserves further consideration for this reason as well.

The difference between the EO and S^D is also not widely understood. Although many everyday situations involve joint control of responses by EOs and S^Ds, emphasis must be placed on ensuring that EOs are in effect when establishing a mand repertoire. An appreciation of the difference between the EO and S^D is also important when facilitating transfer between the tact and mand. Although there is evidence that alternating training between these two verbal operants will facilitate transfer (Carroll and Hesse, 1987), and training the same verbal topographies as both tacts and mands will facilitate transfer (Hall & Sundberg, 1987), there are many questions concerning the relationship between the mand and other verbal operants that require further investigation.

Many questions concerning the relative effectiveness of UEOs and CEOs in mand training remain to be explored. Interventions have incorporated both types of EOs, but the relative merits of each have received very little analysis or direct comparison. UEOs are powerful variables which can be effectively manipulated in individuals with limited verbal behavior, but CEOs offer more flexibility in the variety of response forms that can be taught as well as the scheduling of training. Interventions which utilize a combination of UEOs and CEOs have much to offer, and warrant further study. The recent theoretical advances concerning the EO have opened the way to answering questions such as these, and there is much promise for further development of effective mand interventions.

REFERENCES

Alwell, M., Hunt, P., Goetz, L., & Sailor, W. (1989). Teaching generalized communication behaviors within interrupted behavior chain contexts. *Journal of the Association for Persons with Severe Handicaps, 14*, 91-100.

Bondy, A. S., & Frost, L. A. (1993). Mands across the water: A report on the application of the picture-exchange communication system in Peru. *The Behavior Analyst, 16*, 123-128.

Braam, S. J., & Sundberg, M. L. (1991). The effects of specific versus nonspecific reinforcement on verbal behavior. *The Analysis of Verbal Behavior, 9*, 19-28.

Caro, P., & Snell, M. E. (1989). Characteristics of teaching communication to people with moderate and severe disabilities. *Education and Training of the Mentally Retarded, 24*, 63-77.

Carroll, R., & Hesse, B. E. (1987). The effects of alternating mand and tact training on the acquisition of tacts. *The Analysis of Verbal Behavior, 5*, 55-65.

Duker, P. C., Dortmans, A., & Lodder, E. (1993). Establishing the manding function of communicative gestures with individuals with severe/profound mental retardation. *Research in Developmental Disabilities, 14*, 39-49.

Durand, V. M., & Carr, E. G. (1992). An analysis of maintenance following functional communication training. *Journal of Applied Behavior Analysis, 25*, 777-794.

Durand, V. M., & Crimmins, D. (1991). Teaching functionally equivalent responses as an intervention for challenging behavior. In B. Remington (Ed.), *The challenge of severe mental handicap: A behaviour analytic approach* (pp. 71-95). Chichester: John Wiley & Sons.

Dyer, K. (1987). The competition of autistic stereotyped behavior with usual and specially assessed reinforcers. *Research in Developmental Disabilities, 8*, 607-626.

Dyer, K. (1989). The effects of preference on spontaneous verbal requests in individuals with autism. *Journal of the Association for Persons with Severe Handicaps, 14*, 184-189.

Dyer, K., Dunlap, G., & Winterling, V. (1990). Effects of choice making on the serious problem behaviors of students with severe handicaps. *Journal of Applied Behavior Analysis, 23*, 515-524.

Falvey, M. A., Bishop, K. B., Grenot-Scheyer, M., & Coots, J. (1988). Issues and trends in mental retardation. In S. N. Calculator & J. L. Bedrosian (Eds.), *Communication assessment and intervention for adults with mental retardation* (pp. 45-65). Boston: College-Hill Press.

Gee, K., Graham, N., Goetz, L., Oshima, G., & Yoshioka, K. (1991). Teaching students to request the continuation of routine activities by using time delay and decreasing physical assistance in the context of chain interruption. *Journal of the Association for Persons with Severe Handicaps, 16*, 154-167.

Gobbi, L., Cipani, E., Hudson, C., & Lapenta-Neudeck, R. (1986). Developing spontaneous requesting among children with severe mental retardation. *Mental Retardation, 24*, 357-363.

Goetz, L., Gee, K., & Sailor, W. (1985). Using a behavior chain interrupted strategy to teach communication skills to students with severe disabilities. *Journal of the Association for Persons with Severe Handicaps, 10*, 21-30.

Goodman, J., & Remington, B. (1991). Teaching communicative signing: Labelling, requesting, and transfer of function. In B. Remington (Ed.), *The challenge of severe mental handicap: A behaviour analytic approach.* Chichester: John Wiley & Sons.

Guess, D., Benson, H. A., & Siegel-Causey, E. (1985). Concepts and issues related to choice-making and autonomy among persons with severe disabilities. *Journal of the Association for Persons with Severe Handicaps, 10,* 79-86.

Hall, G., & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. *The Analysis of Verbal Behavior, 5,* 41-53.

Halle, J. (1987). Teaching language in the natural environment: An analysis of spontaneity. *Journal of the Association for Persons with Severe Handicaps, 12,* 28-37.

Halle, J. (1988). Adopting the natural environment as the context of training. In S. Calculator & J. Bedrosian (Eds.), *Communication assessment and intervention for adults with mental retardation* (pp. 155-185). San Diego: College Hill Press.

Hart, B. M., & Risley, T. R. (1968). Establishing the use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis, 1,* 109-120.

Haring, T. G., Neetz, J. A., Lovinger, L., Peck, C., & Semmel, M. I. (1987). Effects of four modified incidental teaching procedures to create opportunities for communication. *Journal of the Association for Persons with Severe Handicaps, 12,* 218-226.

Houghton, J., Bronicki, G. J. B., & Guess, D. (1987). Opportunities to express preferences and make choices among students with severe disabilities in classroom settings. *Journal of the Association for Persons with Severe Handicaps, 12,* 18-27.

Johnston, S. S., & Reichle, J. (1993). Designing and implementing interventions to decrease challenging behavior. *Language, Speech and Hearing Services in Schools, 24,* 225-235.

Kaiser, A., Yoder, P., & Keetz, A. (1992). Evaluating milieu teaching. In S. Warren & J. Reichle (Eds.), *Causes and effects of communication and language intervention* (pp. 9-47). Baltimore MD: Paul Brookes.

Kennedy, C. H., & Haring, T. G. (1993). Teaching choice making during social interactions to students with profound multiple disabilities. *Journal of Applied Behavior Analysis, 26,* 63-76.

Michael, J. (1988). Establishing operations and the mand. *The Analysis of Verbal Behavior, 6,* 3-9.

Michael, J. (1993). Establishing operations. *The Behavior Analyst, 16,* 191-206.

Mirenda, P., & Iacono, T. (1988). Strategies for promoting augmentative and alternative communication in natural contexts with students with autism. *Focus on Autistic Behavior, 3,* 41-56.

Peck, C. A. (1985). Increasing opportunities for social control by children with autism and severe handicaps: Effects on student behavior and perceived classroom climate. *Journal of the Association for Persons with Severe Handicaps, 10,* 183-193.

Reichle, J., Mirenda, P., Locke, P., Piché, L., & Johnston, S. (1992). Beginning augmentative communication systems. In S. F. Warren & J. Reichle, (Eds.), *Causes and effects in communication and language intervention.* Baltimore: Paul H. Brookes.

Reichle, J., Piché-Cragoe, L., Sigafoos, J., & Doss, S. (1988). Optimizing functional communication for persons with severe handicaps. In S. N. Calculator & J. L. Bedrosian (Eds.), *Communication assessment and intervention for adults with mental retardation* (pp. 239-264. Boston: College-Hill Press.

Reichle, J., Rogers, N., & Barrett, C. (1984). Establishing pragmatic discriminations among the communicative functions of requesting, rejecting, and commenting in an adolescent. *Journal of the Association for Persons with Severe Handicaps, 9,* 31-36.

Reichle, J., Sigafoos, J., & Piché, L. (1989). Teaching an adolescent with blindness and severe disabilities: A correspondence between requesting and selecting preferred objects. *Journal of the Association for Persons with Severe Handicaps, 14,* 75-80.

Remington, B. (1991). Behaviour analysis and severe mental handicap: The dialogue between research and application. In: Remington B. (Ed.), *The Challenge of Severe Mental Handicap.* (pp. 1-22). Chichester: Wiley & Sons.

Romer, L. T., & Schoenberg, B. (1991). Increasing requests made by people with developmental disabilities and deaf-blindness through the use of behavior interruption strategies. *Education and Training of the Mentally Retarded, 26,* 70-78.

Schweigert, P. & Rowland, C. (1992). Early communication and microtechnology: Instructional sequence and case studies of children with severe multiple disabilities. *Augmentative and Alternative Communication, 8,* 273-286.

Shevin, M., & Klein, N. K. (1984). The importance of choice-making skills for students with severe disabilities. *Journal of the Association for Persons with Severe Handicaps, 9,* 159-166.

Siegel-Causey, E., & Downing, J. (1987). Nonsymbolic communication development: Theoretical concepts and educational strategies. In: L. Goetz, D. Guess, & Stremel-Campbell, K. (Eds.), *Innovative Program Design for Individuals with Dual Sensory Impairments.* Baltimore: Paul H. Brookes.

Sigafoos, J. & Dempsey, R. (1992). Assessing choice making among children with multiple disabilities. *Journal of Applied Behavior Analysis, 25,* 747-755.

Sigafoos, J., Doss, S., & Reichle, J. (1989). Developing mand and tact repertoires in persons with severe developmental disabilities using graphic symbols. *Research in Developmental Disabilities, 10,* 183-200.

Sigafoos, J., Reichle, J., Doss, S., Hall, K., & Pettit, L. (1990). "Spontaneous" transfer of stimulus control from tact to mand contingencies. *Research in Developmental Disabilities, 11,* 165-176.

Skinner, B. F. (1957). *Verbal behavior.* Englewood Cliffs, NJ: Prentice Hall.

Stafford, M. W., Sundberg, M. L., & Braam, S. J. (1988). A preliminary investigation of the consequences that define the mand and the tact. *The Analysis of Verbal Behavior, 6,* 61-71.

Sundberg, M. L. (1990). *Teaching verbal behavior to the developmentally disabled.* Pleasant Hill CA: Behavior Analysts, Inc.

Sundberg, M. L. (1993). The application of establishing operations. *The Behavior Analyst, 16,* 211-214.

Warren, S. F., & Gadzag, G. (1990). Facilitating early language development with milieu intervention procedures. *Journal of Early Intervention, 14,* 62-86.

Warren, S. F., & Reichle, J. (1992). The emerging field of communication and language intervention. In S.F. Warren & J. Reichle (Eds.), *Causes and effects in communication and language intervention.* Baltimore: Paul H. Brookes.