

MANIPULATING ESTABLISHING OPERATIONS TO TEST FOR STIMULUS
CONTROL DURING MAND TRAINING

By

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Acquisition of verbal behavior is a major goal of interventions for children with developmental disabilities. Although many training methods exist, little research has focused on evaluating the effectiveness of those methods to produce functional discriminated mands (requests). The purpose of this study was to manipulate the establishing operation to test the efficacy of traditional mand training using two picture cards. In this study, six individuals with developmental disabilities participated in a training procedure designed to teach two separate mands for two separate reinforcers. First, a simple discrimination was taught, in which using a correct card was reinforced and using an incorrect card was not reinforced. Following training, an establishing operations test was used to assess for discriminated manding, in which both of the previously learned picture cards were placed together in front of the participant.

Participants were given free access to one of the items they had been taught to mand for but the other item was out of reach and in view (establishing operation). Responses that occurred when the establishing operation was in place were reinforced with access to the item and responses when the establishing operation was not in place were not reinforced. Five of the six participants acquired discriminated manding using topographically similar responses (picture cards or representative items). One participant did not acquire a discriminated mand response until topographically distinct mands were taught (vocal and picture card). Results of the study suggest that discrimination training is not necessarily sufficient to teach discriminated manding when more than one card showing preferred items is used. In addition, the establishing operation manipulation served as an appropriate assessment tool for the identification of discriminated manding. Based on the results of this study, practical implications, limitations, and future research extending the results are discussed.

CHAPTER 1 INTRODUCTION

A delay in verbal behavior is one of the essential features of autism disorder and is commonly observed in persons with mental retardation, with the more severely impaired lacking any form of functional communication (American Psychiatric Association, 2000; McCoy & Buckhalt, 1990). A large number of young children with autism enter school programs without speech or other communicative behavior (Bondy & Frost, 1994). In the population at large, language delays are common for children under the age of 3 (10% to 15%) and by school age it is estimated that 3% to 7% experience a language disorder (American Psychiatric Association, 2000).

The acquisition of language for children with developmental disabilities is seen as a major goal of training programs because it is believed that language underlies most learning in typically developing children (Sundberg & Michael, 2001) and the acquisition of communication skills is often an indicator of long-term success (Bondy & Frost, 1994; Lovaas, 1966), and social development (Carr & Kologinsky, 1983). In order for children with developmental disabilities to learn to gain access to desired items, communicate their needs and desires, request information, obtain others' attention, and generally control their environments, it is important that they acquire a functional form of communication (McCoy & Buckhalt, 1990).

Some teaching procedures aimed at increasing communicative behavior in children with developmental disabilities have been designed to increase speech while others

have been used to develop nonvocal (e.g., sign-language) forms of communication (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002). Vocal and nonvocal forms of communication can both be conceptualized as forms of verbal behavior. Skinner (1957) defined verbal behavior as “behavior reinforced through the mediation of other persons” (p.14). Skinner goes on to explain that in defining verbal behavior “we do not, and cannot, specify any one form, mode or medium. Any movement capable of affecting another organism is verbal” (p.14).

Skinner (1957) outlined two broad categories of verbal behavior, the tact and the mand. “A tact may be defined as a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or property of an object or event” (pp.81-82). In other words, the tact is a verbal response that names or identifies an object or event. The occurrence of the tact is preceded by the object or event the tact names or identifies. In contrast, the mand “is defined 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. 36). In other words, a mand is a verbal response that specifies its reinforcement. For example, the mand “water please” is reinforced by receiving water.

The mand is a special form of verbal behavior because it benefits the speaker by producing access to specific items, often reinforcers. The mand enables an individual to access reinforcers that are mediated by other individuals in the community. This is contrasted with the tact, which does not produce this benefit to the speaker. Tacts produce social approval and do not produce access to specific reinforcers. Because of its usefulness, the mand is considered to be the first type of verbal behavior acquired by

children. The control over the environment provided by the mand makes it a reasonable choice for the focus of early language training (Sundberg & Michael, 2001). In addition, mands are likely to be learned quickly due to the fact that they are maintained by specific and effective reinforcers (Bondy & Frost, 1994).

Because mands specify their reinforcer, mands are under the control of relevant states of deprivation and satiation. These states of deprivation and satiation are called establishing operations (EOs). Establishing operations (EOs) play a large role in the occurrence of a mand. Michael (1982) defined EOs as “any change in the environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behavior that has been followed by that reinforcement” (pp.150-151). Skinner explained that when a response is reinforced by a specific consequence, the likelihood of that response occurring is a function of the deprivation associated with that reinforcer (Skinner, 1957). In other words, establishing operations, such as deprivation or satiation, directly affect the occurrence of a mand. For example, an individual is not likely to ask for food after having eaten a large meal. The establishing operation is not in effect, the individual is not food deprived, and the mand for food is not likely to occur.

Behavioral interventions have been used in developing training programs designed to increase verbal behavior in children with developmental disabilities (Charlop-Christy et al., 2002). Some interventions, such as mand-model procedures (Mobayed, Collins, Strangis, Schuster, & Hemmeter, 2000), incidental teaching (Hart & Risley, 1974; 1975; 1980; Hemmeter, Meyer, Ault, & Collins, 1996), and time delay procedures (Halle, Marshall, & Spradlin, 1979; Halle, Baer, & Spradlin, 1981; Charlop,

Schreibman, & Thibodeau, 1985), have been used in an effort to increase speech, while other interventions have been used to develop nonvocal communicative behavior for children who did not develop speech normally. Because “any movement capable of affecting another organism...” (Skinner, 1957 p. 14) is verbal behavior, verbal behavior can be established for individuals with developmental disabilities by training different topographies when vocal responses have not been acquired. Some of these interventions include sign language (Carr, Binkoff, Kologinsky, & Eddy, 1978; Carr & Kologinsky, 1983; Schepis, Reid, Fitzgerald, Faw, Van Den Pol, & Welty, 1982), voice output electronic devices (Durand, 1999; Schepis, Reid, Berhman, & Sutton, 1998), and picture-communication systems (Hurlburt, Iwata, & Green, 1982; Sigafos, Doss, & Reichle, 1989; Bondy & Frost 1993, 1994, 2001; Frost & Bondy 1994; Schwartz, Garfinkle, & Bauer, 1998; Liddle, 2001; Kravitz, Kamps, Kemmerer, & Potucek, 2002).

One highly specific form of mand training involves the use of symbol cards, such as the Picture Exchange Communication System (PECS) training (Bondy & Frost, 1993, 1994, 2001; Frost & Bondy, 1994). The PECS training system teaches individuals to hand a picture of an item to a communicative partner in exchange for the item. Before the various training phases begin, an informal preference assessment is conducted to identify the highly preferred items the individual will be taught to request. During phase 1, individuals are physically guided to hand the instructor the picture of a preferred item in exchange for access to the item. During phase 2, the physical guidance is faded over time until the individual is able to independently initiate the exchange with a variety of people. Training continues as the trainer gradually moves away from the individual in order to establish more independent manding. Once the simple mand

response has been established for one item, additional pictures are introduced into training to establish a larger manding repertoire. During this phase of training the individual is taught to mand for several items using different picture cards. During phase 3, the individual is taught to discriminate between two or more picture cards in order to establish complex manding. During this phase, the individual is presented with two or more picture cards at the same time, one picture card corresponding to a highly preferred item and the other to a less preferred or “neutral” item. As PECS training progresses, individuals are taught to build sentences by placing the picture on a communication board with the words “I want ___” on it, and also to respond to a direct question such as “what do you want” by placing pictures on the communication board (Bondy & Frost, 1994, 2001; Frost & Bondy, 1994; Schwartz et al., 1998).

When the complex mand training is complete, it is important to evaluate whether individuals are able to request items they “want” or are randomly handing picture cards. Because picture cards typically correspond to preferred items and known reinforcers, it is possible that any response will result in access to a reinforcer and individuals are not discriminating among the picture cards. In addition, individuals might “scroll” through cards until the desired object is received. In either case, a true complex discrimination has not been established.

One way to ensure that individuals are able to mand for specific items is to conduct correspondence checks (Bondy & Frost, 1994, 2001; Frost & Bondy, 1994). Correspondence checks involve placing two items in front of the individual as well as the two corresponding picture cards. When the individual hands the therapist a card, the trainer allows the individual to pick up the item he/she has manded for. If the individual

selects the appropriate item (i.e., the item that corresponds to the selected picture card), the therapist allows the participant to consume or engage with the item. If the child attempts to select an item that does not correspond to the selected picture card, the trainer corrects the individual and prompts him or her to select the picture card corresponding to the item they attempted to pick up. The correspondence checks are conducted periodically during the PECS training.

Although correspondence checks as described by Bondy and Frost (1994, 2001) may identify instances in which the PECS training has failed to produce discrimination between two picture cards, it is not clear how efficient the correspondence checks are at teaching complex discriminations between two or more picture cards. In addition, it is not clear how often such correspondence checks should be conducted to ensure picture card discrimination. It may be the case that infrequent checks may slow down the acquisition of a large manding repertoire. Schwartz and colleagues (1998) reported that it took students an average of 3 months (range = 1-6 months) to complete the discrimination phase, which included the correspondence checks. In addition, it is not known whether a student may have already learned the complex discriminations merely as a result of simple discrimination training. If so, a potentially lengthy evaluation process could be circumvented.

A more serious potential limitation of the correspondence checks is that it may also be possible to establish a chain of responses that involves the individual handing the incorrect card and then being prompted to hand the correct card, resulting in access to the reinforcer. In other words, the individual may continue to hand the therapist the wrong card and still ultimately, almost immediately, receive access to a preferred

reinforcer. This potential for chaining of incorrect responding may be another factor slowing down acquisition of picture card discriminations between two or more picture cards. Again, a repertoire of “scrolling” might be reinforced.

There are also potential limitations regarding the discrimination training that takes place during phase 3 of PECS training. During this phase, individuals are taught to discriminate between two or more picture cards. However during training, one picture card corresponds to a highly preferred item while the other corresponds to a less preferred or “neutral” item (Bondy & Frost, 1994, 2001; Frost & Bondy, 1994). It can be argued that this form of discrimination is different from a discrimination between two picture cards corresponding to preferred items. The need to discriminate between two or more picture cards corresponding to preferred items may be encountered more often during natural conditions when an individual will use a large picture vocabulary made up primarily of reinforcers. It is the ability to discriminate between two or more picture cards corresponding to preferred items that would indicate that the individual has learned a functional mand as opposed to a generalized mand for a variety of items. This skill is critical if the individual is to discriminate between the varieties of picture cards that will ultimately be placed in the communication book as part of the communicative vocabulary. It is not likely that the communicative vocabulary will include mands for less preferred items, much less for neutral items. For this reason, it is important that a discrimination between two or more picture cards corresponding to preferred items is established as part of communication training.

In order to address these problems associated with teaching discriminated manding in the context of two or more picture cards, it is necessary to evaluate the

extent to which individuals are manding or requesting specific items. In other words, it is important to determine if individuals are learning to request items they “want” as opposed to randomly handing over picture cards. The purpose of this study was to manipulate the establishing operation to test the efficacy of traditional mand training using two picture cards.

CHAPTER 2 REVIEW OF THE LITERATURE

Overview

Skinner (1957) defined verbal behavior as “behavior reinforced through the mediation of other persons” (p.14). In addition, Skinner explained that any form of behavior that affects another organism or is mediated by another organism is verbal behavior. Therefore, vocal and nonvocal forms of communication were both conceptualized by Skinner as forms of verbal behavior. Skinner (1957) outlined two broad categories of verbal behavior, the “tact” and the “mand.” A tact is “a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event, or property of an object or event” (pp.81-82). In other words, the tact names or labels an object or event. In addition, its occurrence is preceded by the presentation of that object or event. For example, stating “that is a dog” is considered a tact because it labels the presence of a dog. The tact is contrasted with the mand, which is defined 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. 36). In other words, the mand is a requesting response, which specifies its reinforcer. For example, making the statement “food please” is considered manding because it is requesting access to food.

Skinner (1957) distinguished between the two classes of behavior (tacts and mands) and argued that they are functionally independent from each other. He explained that tacts and mands are defined by their function or consequence. The mand enables an individual to access reinforcers that are mediated by other individuals in their community. The tact functions to produce social approval from individuals in their community. Because tacts and mands are discriminated based on their function, it is therefore possible for tacts and mands to share identical response topographies. For example, the word “water” can function as mand if it is reinforced by access to water, or as a tact if it is reinforced by social approval.

Because of the difference in the function of tacts and mands, being able to label an item would not necessarily ensure that the same verbal response could be used to request that item. Conversely, being able to utilize a verbal response to request would not necessarily ensure that term could be used to label.

Some studies support the conceptualization that tacts and mands are functionally independent (Lamarre & Holland; Sigafos et al., 1989). Lamarre and Holland (1985) taught one group of individuals to mand when prompted by the experimenter’s question “where do you want me to put the (object)?” Responses of “on the left” or “on the right” were reinforced by proper placement of the item (left or right). A second group of individuals were taught to tact when prompted by the experimenter’s question “Where is the (object)?” Correct responses were reinforced with praise and a marble. Following training, emergence of the untrained response was assessed. Individuals who had been taught to mand were presented with the question requiring a tact as a correct answer “where is the (object)” and individuals who had been taught to tact were

presented with the mand question “where do you want me to put the (object)?” Results of the study indicated that individuals taught the tact response did not acquire an untrained mand response, and likewise, individuals taught the mand response did not acquire the untrained tact response. In this case, the acquisition of one verbal operant did not result in acquisition of the other.

In a similar study, Sigafos and colleagues (1989) evaluated the independence of tacts and mands, by examining whether teaching tacts facilitated the acquisition of an untrained mand response. In this study, individuals were taught to tact food, beverage, or utensils by pointing to symbols representing the items. Correct responses were followed by descriptive praise. Once tacts for the items had been acquired, the experimenters assessed for the acquisition of a manding response using the same symbols. Items were presented outside the individual’s reach and pointing to the symbol corresponding to the item resulted in access to the item. Results of the study showed that while individuals acquired a tact response using symbols, they were not able to use symbols to mand for the same items. Again, responses taught as tacts did not spontaneously occur as mands. Results of these studies lend experimental support for Skinner’s classification of mands and tacts as functionally independent verbal operants. This is an important distinction for teaching because it shows that teaching individuals to tact items will not result in their learning to mand for items. Furthermore, it shows that it is necessary to teach mand responses under the appropriate conditions using the specific items (the items manded for) as reinforcers in order to acquire a mand response.

Teaching Verbal Behavior

Because language is believed to be critical in development (Sundberg & Michael, 2001) and identified as an indicator of long-term success for children with disabilities (Bondy & Frost, 1994; Lovaas, 1966), behavior analysts have attempted to overcome delays in verbal behavior using behavior analytic procedures. Behavior analysts have applied Skinner's conceptualization of verbal behavior into training programs designed to teach verbal behavior to non-verbal individuals. Methods used to teach verbal responses go beyond vocalizations to include symbolic (Bondy & Frost 1993) and gestural (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002) forms of communication. In this chapter, two methods used by behavior analysts to teach verbal behavior will be reviewed. The two methods reviewed are discrete trial training and incidental teaching. In addition, three forms, or topographies, of verbal behavior commonly taught to individuals with language delays will be outlined. These forms include sign language, voice output devices, and picture communication systems.

Training Methods to Teach Verbal Behavior

Discrete Trial

One approach to teaching communicative behavior is the discrete trials method. The discrete trials method involves conducting training sessions several days a week, for several hours a day in a highly structured environment, in an effort to deliver intensive communication training. Discrete trial sessions typically occur in a one to one student to therapist ratio, where the therapist and child typically sit facing each other. The therapist sits in close proximity to the child in order to deliver prompts, physically

prevent the child from leaving the training session if necessary, and deliver reinforcers (Lovaas, 1966).

One of the proposed benefits of discrete trial training is that the methods allow control over training variables (e.g., number of training trials and length of sessions). By conducting a high number of training trials, discrete trial methods increase the number of learning opportunities and possibly increase the rate of skill acquisition. Lovaas (1987) provided children with 40 hours per week of intensive language and behavioral intervention that produced improvements in communicative behavior as well as improvements in academic skills. Simic and Bucher (1980) taught children to mand for items using procedures similar to those described by Lovaas (1966). Training resulted in increases in mands responses. However, mand responses did not readily generalize to untrained settings (Simic & Bucher, 1980).

Although discrete trial training approaches have been successful at teaching verbal behavior to individuals with language delays (Lovaas, 1966; 1987; Simic & Bucher, 1980) there are some concerns regarding generalization of the skill to the natural setting. The goal of communication training programs is to teach verbal behavior that is functional and appropriate (Hart & Risley, 1968, 1980). However, some researchers argue that discrete trial training results in mechanical and non-functional verbal behavior due to a lack of response generalization to natural settings (Harris, 1976; Hart & Risley, 1980; Charlop, Schreibman, & Kurtz, 1991). To overcome the limitations of discrete trial training procedures, naturalistic language interventions provide methods for teaching functional verbal behavior (Schepis et al.,

1998) designed to promote generalization of the skill to the natural setting (Hart & Risley, 1980).

Incidental Teaching

A second approach of teaching communicative behavior is to use naturalistic language interventions, or incidental teaching methods, that aim to teach language skills in the child's natural environment. Naturalistic language interventions involve using naturally occurring opportunities to teach communication (Schepis et al., 1998) that is useful or functional (Carr, 1982). Hart and Risley (1974) describe incidental teaching as language training that is conducted during normal childhood activities involving toys and other children.

Several studies (Hart and Risley 1968; 1974; 1975; 1980) have evaluated the effectiveness of incidental teaching procedures to establish and maintain verbal behavior. Hart and Risley (1968) evaluated the effectiveness of incidental teaching by making children's access to free-play materials contingent on vocal request using color-noun combinations (e.g., "brown crayon"). Fifteen children participated in the study during which teachers made access to free-play materials (e.g., balls, snacks, blocks, and toy animals) contingent on vocal requests using color-noun combinations. Teachers placed their hands over the materials and prompted the response by asking the child "what do you want" while delivering praise and access to the requested materials contingent on correct responding. In this case, making access to play items contingent on verbal responses resulted in an increase in the frequency of children's verbal responses.

A follow-up study (Hart & Risley, 1974) extended the incidental teaching procedure to include the use of more complex sentences. In this study, access to the materials in the natural environment was made contingent on the use of compound sentences (e.g., "I want a block, so I can play with it"). Results of this study replicated the findings of the previous study, showing a marked increase in the verbal responses when access to materials was made contingent on responding. In addition, maintenance of responding occurred following the removal of the reinforcement contingency. The results of both studies lend credence to the use of incidental teaching methods to increase verbal responding.

Additional studies by Hart and Risley (1975, 1980) provide further support for the use of incidental teaching. For one, incidental teaching methods were useful in not only increasing verbal responses directed towards the teacher, but were additionally useful in increasing verbal responses directed towards other children in the class (Hart & Risley, 1975). Also, Hart and Risley (1980) were able to demonstrate that with incidental teaching procedures, disadvantaged, language-delayed children were able to increase several aspects of verbal behavior such as elaborations, the variety of words used, and the frequency of complex sentences used.

Incidental teaching methods offer several benefits over alternative teaching methods. The primary benefit of incidental teaching is that it promotes generalization of verbal behavior across the natural environment (Hart & Risley, 1980). Hart and Risley (1980) point to several features of incidental teaching that utilize generalization techniques outlined by Stokes and Bear (1977). One important variable of incidental teaching that may result in generalization is the variety of stimulus conditions under

which the training occurs. For one, incidental teaching procedures aim to establish vocal responding in the natural conditions in which the behavior is to occur and is to be maintained. Second, the occurrence of incidental teaching is conducted throughout the day at various times and settings. The variability in training schedule limits the development of stimulus control based on setting or time. Finally, conditions present during incidental teaching are less discriminable than the conditions present during typical training sessions. Incidental teaching procedures allow for training to occur whenever the opportunities present themselves in the availability of the reinforcer and child initiation.

A second benefit of incidental teaching is that it allows the child to initiate the teaching opportunity as well as specify the reinforcer, which can vary from moment to moment, based on the child's preference. Throughout the day a child can initiate interactions with a wide variety of stimuli resulting in a variety of training opportunities. Given the benefits of incidental and discrete trial approaches, one possibility for future application would be to merge or combine the two approaches.

Forms of Communicative Behavior Taught to Individuals with Language Delays Sign Language

Often, children with developmental delays do not acquire vocal-verbal skills despite intensive training (Carr & Kologinsky, 1983; Carr, 1982; Carr et al., 1978). Therefore, individuals with language delays are often taught to use signs to request items as well as label items in their environment. Sign language training procedures involve teaching children to communicate by way of sign configurations using their hands, typically based on the American Sign Language for the deaf (Carr et al., 1978).

Carr and colleagues (1978) used prompting and fading techniques to teach sign language to four autistic children who lacked communicative behavior. Children were taught the signs for five food items following an auditory and visual presentation of the food item. Correct responses were reinforced with praise and a small amount of the food item. If the child did not respond correctly, the correct response was physically guided and the response was reinforced with praise only. The physical prompt was faded until the child signed following the auditory and visual prompt. Following training, children were presented with the auditory and visual prompt and correct responses were not reinforced. Results showed that nonvocal children were able to acquire verbal behavior utilizing sign language, and did so to communicate a request for food items.

Additional research shows that sign language can be successfully taught using incidental teaching strategies (Schepis et al., 1982). In this case, direct care staff taught autistic children sign language to gain access to preferred items. Signs were taught using auditory prompting, manual guidance, and reinforcement sequence, while participants were in their natural setting. Results showed that incidental teaching of sign language was effective at increasing the use of manual signs. In addition, the results were maintained at 5- and 17-week follow-up observations.

Voice Output Devices

Voice output devices have recently been developed to assist children with language delays to acquire verbal behavior (Schepis et al., 1998). Voice output devices, also known as voice output communication aids (VOCAs) involve the activation of a device that produces recorded speech. Some advantages of VOCAs over other

communication systems (e.g., signing and picture communication systems) is that they allow for the recording of a variety of messages that can be understood by individuals who are not familiar with the user of the device (Schepis et al., 1998). This differs from sign language which may not be interpretable by persons who are not familiar with American Sign Language.

Schepis and colleagues (1998) evaluated the effectiveness of VOCAs to teach children to request items, make statements, social comments, and answer yes and no questions. Four children were taught to use the devices using a prompt sequence that began with verbal and gestural prompts and graduated to physical prompts when necessary to physically guide correct responses. Results showed an increase in the frequency of communicative behavior for all 4 children. In this case, VOCAs were an effective tool to teach verbal behavior to children with language delays

Additionally, Durand (1999) conducted a series of studies to evaluate the use of assistive devices to teach individuals with language delays to gain access to objects and activities. Students were taught to use a voice output device through verbal and physical prompts which were gradually faded using delayed prompting as training progressed. Results showed an increase in the unprompted use of the voice output devices as well as a reduction in problem behavior exhibited by the children. In addition, the use of the devices generalized to untrained settings.

Picture Communication Systems

Another alternative to teaching vocal-verbal behavior for individuals with disabilities is the use of picture or iconic communication systems. This approach involves teaching students to point to graphic symbols (Hulburt et al., 1982; Sigafoos et

al., 1989) or exchange pictures or symbols (Bondy & Frost, 1993, 1994, 2001; Frost & Bondy, 1994; Schwartz et al., 1998; Liddle, 2001; Kravits et al., 2002). One advantage of picture communication systems that has been proposed is that it does not require some of the orientation (e.g., eye contact) and imitation skills (vocal or motor) that other communication systems require (Bondy & Frost, 1994, 2001) possibly resulting in faster acquisition. Also, because picture communication systems use two-dimensional pictures of items that are easily recognized, it is not necessary to find a communicative partner that is able to understand the form of communication as might be the case with sign language (Schwartz et al., 1998).

One specific form of picture communication systems is the Picture Exchange Communication System (PECS) developed by Bondy and Frost (1993, 1994, 2001). One of the proposed advantages of PECS is that because the individual has to hand the cards to a "listener," the behavior is directed towards a communicative partner (Bondy & Frost, 1993, 1994, 2001). A second benefit of the PECS training is that because requesting is the first skill taught, powerful reinforcers maintain communicative responding. In addition, the PECS system does not require any prerequisite behavior and the training is based on child initiation of the communicative response (Schwartz et al., 1998). Bondy and Frost (1993, 1994, 2001) reported on the successful implementation of PECS training for children with language delays, and several studies have evaluated the effectiveness of PECS training to teach verbal behavior to individuals with language delays and have found positive increases in communication as a result of training (Schwartz et al., 1998; Liddle, 2001; Kravitz et al., 2002).

Bondy and Frost (1993) reported on the successful implementation of PECS training for 74 students in Peru. In a similar publication, Bondy and Frost (1994) reported that of 85 children who had been taught to use picture cards using PECS training at the Delaware Autism Project, over 95% learned to use two or more pictures to request items. Data for one individual were reported, which showed acquisition of the request response using picture cards. After 11 months of PECS training, the individual's vocal speech had improved and was able to communicate using only vocal speech.

Several studies have been conducted to evaluate the effects of PECS training on picture card responding as well as vocal responding (Schwartz et al., 1998; Liddle, 2001; Kravitz et al., 2002). Schwartz and colleagues (1998) evaluated the effectiveness of PECS training on children's use of picture cards to communicate with adults and peers. In addition, the effects of PECS training on children's vocal behavior was evaluated. In study 1, 31 children were taught to use picture cards to mand for items using PECS. Children were taught to use the picture cards with teachers and peers to receive access to items. Training was conducted using forward and backward prompting techniques to teach the children to place picture cards on a poster board next to a symbol meaning "I want," and hand the board to the communicative partner. This response was reinforced with access to the item represented by the picture card. Training continued until responding reached the mastery criterion of 80% or higher independent correct responding over 3 sessions. Results showed that all the children in the study learned to use the picture cards with adults and peers in the classroom. Results also showed that, on average, acquisition of the 5 phases of the PECS training (Exchange, Distance and Persistence, Discrimination, Sentence Building, and Peers)

required 14 months (range 3-28) of training. In study 2, 18 children who had participated in study 1 were observed during snack time and free choice time. Communicative behavior (gestures, vocalizations, manual signs, PECS exchanges, and verbal) was recorded for each child. Results of study 2 showed that children who had been taught to use picture cards in the classroom also used the picture cards during snack time and free choice time. In addition, results showed that 44% of the children in study 2 demonstrated unprompted, non-echolalic spoken communication.

Liddle (2001) taught 21 children with language delays to use the PECS to request and label items in their classroom. The training sequence included 6 phases of PECS training (Exchange, Distance and Persistence, Discrimination, Sentence Building, Answering Questions, and Commenting). Results showed that, of the 21 children who participated in the training, 20 completed phase 1 and learned to request items using PECS cards, however, only 8 children completed phase 6. Results also showed that, on average, children received PECS training for 10 months (range 1-15). In addition, results showed that 42% of the children were observed to have increases in vocalizations, with some children using single words.

Kravitz and colleagues (2002) evaluated the effects of PECS training on the spontaneous verbal behavior of one child with autism. The participant was able to communicate using 1 to 2-word utterances when prompted with very low frequency of independent responding. The child was taught to use picture cards using the PECS system during two free play activities at school (centers and journal) and at home. Training was implemented using a multiple-baseline design across settings. Results showed acquisition of the picture card response to gain access to preferred items as well

as an increase in spontaneous language (vocal and picture card) following the introduction on PECS training across three settings.

Although the literature includes a wide range of examples of mand training (Carr et al., 1978; Kravits, et al., 2002; Liddle, 2001; Schepis et al., 1998; Sigafoos et al., 1989; Schwartz et al., 1998), such training usually involves a specific mand in a specific context. An experimental question remains regarding the effectiveness of training to produce appropriate, or discriminated manding. In most cases, the success of mand training is evaluated based on the participant's ability to make the desired communicative response (e.g., hand a card). In other words, if a child hands a "cookie" card to the therapist, and then gains access to the cookie, it is presumed that the child was appropriately manding for a cookie. However, on closer examination, the appropriateness of the individual's mand cannot be entirely presumed based upon his response. Rather, it remains unclear if the child is actually requesting a "cookie" or if the response of handing a card has been sufficiently reinforced with access to preferred items, such that a child hands a card in order to gain access to reinforcement in general. Because the picture cards typically correspond to preferred items, a response using any card will result in access to a reinforcer. If individuals are not able to discriminate among the picture cards they have been taught to use to request items, then training has not resulted in a functional, discriminated mand response.

Unlike vocal mand training or sign language training, picture card training uses the same response form (handing a card). Therefore, when teaching students to use picture cards to mand for items, it is possible that individuals may learn to hand any picture card to receive access to any item, rather than to gain access to specific items. Teaching

students to use picture cards to request items may be limited by an individual's ability to discriminate between picture cards. Therefore, it may be necessary to evaluate the extent to which individuals are able to discriminate between picture cards in order to assess the effectiveness of mand training using picture cards. The current study was designed to evaluate the extent to which mand training using picture cards will result in discriminated manding in the context of two picture cards. The technique of this study was to manipulate the establishing operation to test the efficacy of traditional mand training using two picture cards. Although the relative merits of picture card systems can be debated, additional research is warranted due to the widespread use of these systems

CHAPTER 3 METHOD

Participants

Six individuals who did not ordinarily request items either vocally or nonvocally participated in the study. Mario was a 13-year-old male diagnosed with mental retardation, Millie was a 4-year-old female diagnosed with Autism, Will was a 5-year-old male diagnosed with Autism, Malcolm was a 6-year-old male also diagnosed with Autism, Pablo was a 20-year-old male diagnosed with mental retardation, and Erin was a 16-year-old male diagnosed with Down syndrome. Participants had minimal exposure to picture cards prior to the start of the study as picture cards had been placed in some classrooms (e.g., picture card for bathroom outside the bathroom). However, formal training of picture card communication system use had not taken place for any participant prior to the start of the study. Teachers or staff referred all participants following an announcement at the school that the study was underway to teach and evaluate communication using picture cards. These were the first six individuals referred.

Setting

All sessions were conducted at the participant's school. Blocks of sessions lasted for approximately 30 minutes and were conducted 3-5 days per week. During sessions, participants were seated at a table across from the therapist and data collector(s). Sessions were conducted in a small room reserved for the study. Sessions

Except for the preference assessment, sessions consisted of ten trials. During each trial the participants were presented with the opportunity to emit a mand and receive access to preferred items. After participants were allowed access to items for approximately 30 seconds or were allowed to consume the food items, the card position was counterbalanced in an array of two quasi randomly and the cards were presented to the participant to start the next trial (specific procedures varied by condition, to be explained below).

Data Collection and Response Definition

Two trained graduate and undergraduate observers independently recorded correct and incorrect responses. During training, correct responses were defined as handing the therapist the picture card or approaching (reaching for) the representative item. Incorrect responses were defined as handing the therapist the distracter card or approaching (reaching for) the empty board or empty hand. During the EO manipulation (explained later), observers recorded the card that was handed to the therapist or the representative item approached. During the EO manipulation with topographically different responses (explained later), observers recorded the response emitted by the participant, handing picture card or vocal response.

Interobserver Agreement

During all phases of the study, two trained observers collected data simultaneously and independently during 34% of the sessions. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements in each session and multiplying by 100%. An agreement was defined as a

trial in which both observers recorded the same occurrence of behavior. Mean agreement for all sessions was 99% (range, 80% to 100%).

Materials

Two picture cards and two other distracter cards were used during training. The picture cards corresponded to preferred items that were identified for each participant during a preference assessment. Distracter cards contained an “X” or an “O” on them.

Procedures

Participation in each phase of the study was determined by participant performance in the prior phase. As participants completed each phase, they either moved on to the next phase of mand training or moved to a supplemental training phase. Figure 1 shows the order of phases for the study.

Phase 1: Preference Assessment

The purpose of this phase was to identify items to be used as reinforcers. A free operant preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) was conducted in order to identify highly preferred items for each participant. Participants were presented with an array of food and leisure items during one or two 5-minute sessions. Separate assessments were conducted for Will and Millie to identify preferred items or activities as well as consumable items. The two separate preference assessments were conducted to avoid a possible “displacement” of non-consumable items that might function as reinforcers by consumable items (DeLeon, Iwata, & Roscoe, 1997). Data collectors recorded the amount of time participants spent interacting with each item. Items with which participants spent the most amount of time were chosen as preferred items to be used during mand training.

Phase 2: Single Card

The purpose of this phase was to establish a card-handing repertoire. Participants were seated with a single picture card in front of them. During this phase, handing the therapist the picture card resulted in access to the item for approximately 30 seconds or (when food or drink was the preferred item) a small amount of the consumable item. Participants were taught to use picture cards to mand for preferred items during this phase using a four step sequence (5-second pause, verbal instruction, physical model, physical guidance).

Phase 3: Distracter Card Probe

We conducted a probe for all participants in which a picture card with a picture of an item on it and a card with an "X" or an "O" on it were presented. The purpose of this phase was to evaluate whether participants were more likely to select a card with a picture on it, as a point of comparison to a subsequent differential reinforcement phase. Participants were seated with the two cards in front of them (picture card and card with an "X" or an "O"). During this phase, responding using either card resulted in access to the preferred item. After the participant responded, the item was delivered and both cards were removed. Access to the preferred item lasted for approximately 30 seconds and in the case of consumable items, a small amount was delivered. After each trial, the position of the cards was reassigned quasi randomly, the cards were then presented to the participant again, and the next trial began.

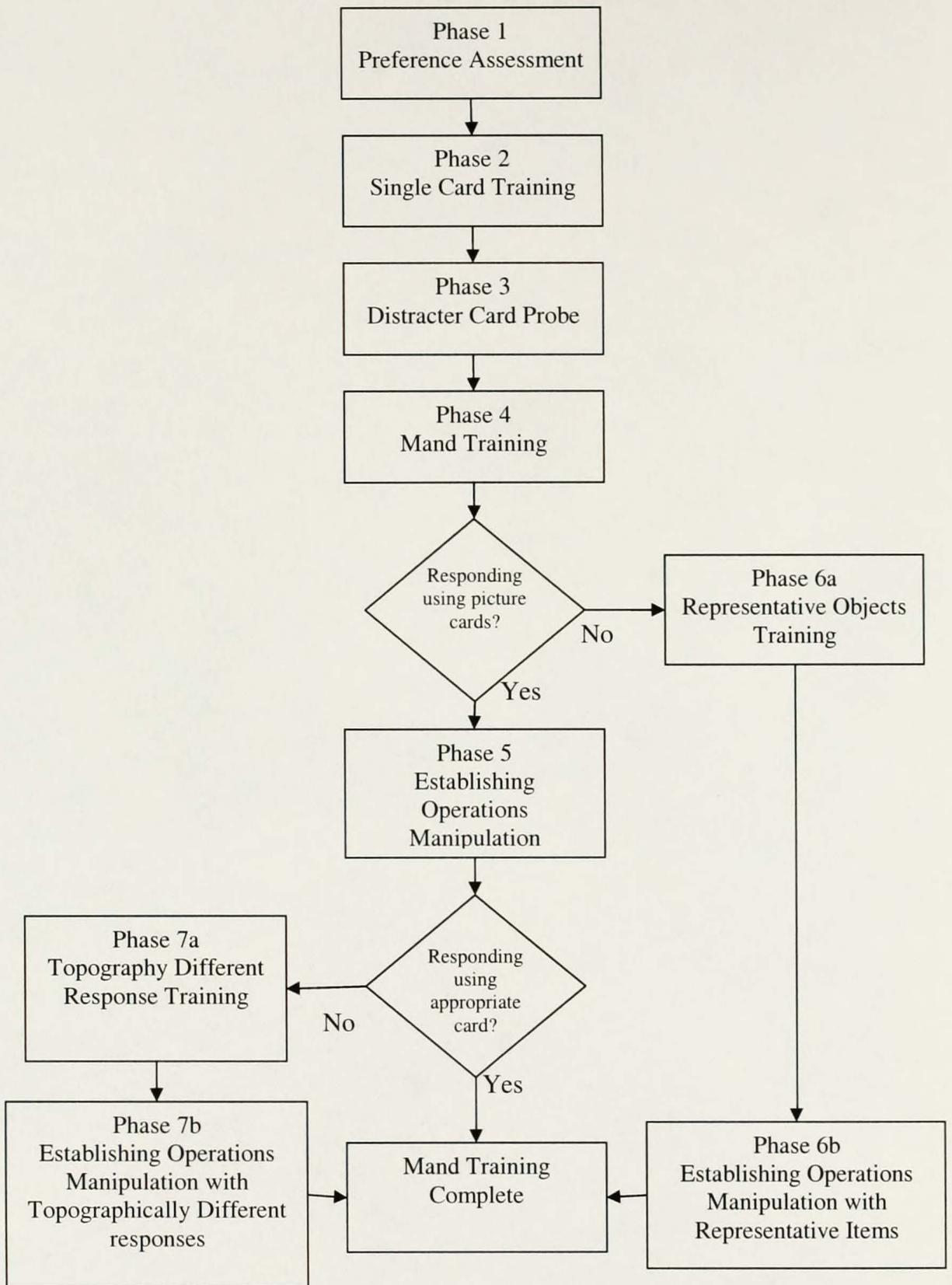


Figure 1: Flow chart depicting the order of phases during the study.

Phase 4: Differential Reinforcement (Mand Training)

The purpose of this phase was to differentially reinforce responses using picture cards, in order to establish a simple discrimination between the target card and distracter cards or at least to provide a history of reinforcement for the picture card response. There was no intention to show acquisition, as in some cases there already was a bias towards selecting the cards with pictures. During differential reinforcement sessions, only responses using the picture card resulted in reinforcement while responses using the distracter card resulted in extinction. The experimental design was a concurrent schedules design, in which experimental control is demonstrated by differential responding across choice alternatives (Sidman, 1960). During these sessions the participant was seated with two cards placed in front of him or her, the picture and the distracter card. Requests using the picture card resulted in access to the item for approximately 30 seconds or a small amount of the edible item. Requests using the distracter card resulted in extinction (and a brief time-out from the session) during which the therapist removed the cards and turned away from the participant for approximately 5 seconds. After each trial the position of the cards was reassigned quasi randomly and the trial was restarted. Participants were taught to use picture cards to mand for two different preferred items during this phase. Participants who passed this phase were deemed to have completed the initial discrimination screening and had demonstrated performance of the discrimination skills necessary to move to phase 5 of the study.

Phase 5: Establishing Operation Manipulation

The purpose of this phase was to evaluate the effectiveness of the initial mand training to establish complex manding in the presence of two picture cards, each corresponding to preferred items. Four participants who completed the initial discrimination screening and acquired the discrimination skills taught in phase 4 participated in this phase. The EO manipulation phase differed from the differential reinforcement phase in two respects. First, the two previously trained picture cards were placed in front of the participants, there were no distracter cards present. Second, participants had free access to one of the items they were previously taught to mand for during differential reinforcement. The EO phase was conducted using a combination of a concurrent schedule and multi-element design (Sidman, 1960) in which we compared the effects of the EO (EO on vs. EO off) on manding. During EO manipulation sessions, participants were allowed free access to one of the items they were previously taught to mand during the differential reinforcement sessions, while access to a second item was restricted. The mand for the second item also had been taught previously. For example, if a participant was previously taught to mand for the radio and a drink, during this phase the participant was allowed free access to the radio during the session (radio EO off) and access to the drink was restricted (drink EO on), or vice versa. When access to one of the items was restricted (e.g., radio) and the EO for that item was on (e.g., radio EO on), access to the other item was made available (e.g., drink) and the EO for that item was off (e.g., drink EO off). Sessions in which one EO was on or off were alternated. Also, during the EO manipulation phase, requests using the picture card corresponding to the restricted item resulted in access to that item for approximately 30

seconds or a small amount of the consumable item. Requests using the picture card corresponding to the item to which the participant already had access resulted in the therapist removing the cards for approximately 30 seconds (but they maintained access to the item they already had). This was done to avoid “teaching” during the EO phase. After each trial the position of the cards was reassigned quasi randomly and a new trial was started.

Phase 6a Representative Objects Training

The purpose of this phase was to establish a simple discrimination (representative object versus distracter) for two participants who did not develop a simple discrimination with picture cards. Two participants (Pablo and Erin) who did not pass the initial discrimination screening in phase 4 participated in this phase. Representative objects corresponding to preferred items (e.g., empty bag of chips) and a blank board or a therapist’s empty hand (distracters) were used to teach the initial discrimination. Responding by touching or reaching for the representative object resulted in access to a small amount of the item while responses of touching or reaching for the blank board or therapist’s empty hand resulted in extinction during which the therapist turned away from the participant for approximately 5 seconds. After each trial the position of the cards (or empty hand) was reassigned quasi randomly and the trial was restarted.

Phase 6b Establishing Operation Manipulation with Representative Objects

The purpose of this phase was to evaluate the effectiveness of mand training using representative objects to establish complex manding in the presence of two representative items each corresponding to preferred items. This phase was similar to

the EO manipulation in phase 5, and was used to test the complex discriminations for the two participants (Pablo and Erin) using representative objects. This EO manipulation phase differed from the EO manipulation in phase 5 in one respect, representative objects corresponding to preferred items were placed in front of the participants instead of picture cards. During EO manipulation sessions, participants were allowed free access to one of the items they were previously taught to mand during phase 6a, while access to a second item was restricted. The mand for the second item had also been taught previously. For example, if a participant was taught to mand for the radio and a drink, during this phase the participant was allowed free access to the radio during the session (radio EO off) and access to the drink was restricted (drink EO on), or vice versa. When access to one of the items was restricted (e.g., radio) and the EO for that item was on (e.g., radio EO on), access to the other item was made freely available (e.g., drink) and the EO for that item was off (e.g., drink EO off). Sessions in which one EO was on or off were alternated. Also, during the EO manipulation phase, requests using the representative object corresponding to the restricted item resulted in access to that item for approximately 30 seconds or a small amount of the consumable item. Requests using the representative items corresponding to the item the participant already had access to resulted in the therapist removing the representative items for approximately 30 seconds (but they maintained access to the item they already had). This was done to avoid “teaching” during this phase. After each trial the position of the cards was reassigned quasi randomly and a new trial was started.

Phase 7a Topographically Different Response Training (Vocal & Card)

The purpose of this phase was to develop two distinct mand forms (vocal & card). Only one individual (Millie) participated in phase 7 because she was the only one of the five participants in phases 5 or 6b who showed no sensitivity to the EO manipulation. It is possible that the topographical similarity between handing responses may have impeded discrimination during the EO manipulation (Carbone, personal communication). One picture card and two distracter cards were used during a training phase. The picture card corresponded to a preferred item and distracter cards contained an "X" or an "O" on them. The participant was also presented with vocal mand training designed to produce differential responding during the EO phase. During this phase, the participant was taught to request an item using a picture card and was taught to request a second item by saying the word corresponding to the item (e.g., saying "chips"). The participant was taught to respond vocally by first presenting a vocal prompt (e.g., "say chips") and delivering the reinforcer (chips) following the imitative response ("chips") (Bourret, Vollmer, & Rapp, 2004). During the vocal manding sessions, the participant was seated at a table and no cards were present. Requests using the vocal mand resulted in access to a small amount of the item. Requests using any other word resulted in extinction during which the therapist turned away from the participant for approximately 5 seconds. The participant was taught to use the picture card to mand for the item corresponding to the picture (music) and to vocal mand to mand for the item corresponding to the vocal mand (chips). The participant was taught to use the picture card to mand for the preferred item during this phase using a three-prompt sequence (verbal instruction, physical model, physical guidance) followed by access to the item.

The participant was taught to mand vocally using prompts and modeling followed by access to the item.

Phase 7b Establishing Operation Manipulation with Topographically Different Responses (Vocal & Card)

The purpose of this phase was to test for complex discriminations using two distinct response forms (vocal & card) instead of card versus card. Two topographically different responses were used to overcome the possible discrimination problem caused when topographically similar responses were used. For the one participant (Millie), the EO manipulation was similar to that used in study phase 5, however, only one picture card was placed in front of the participant. There were no distracter cards present and the participant had free access to one of the items she was previously taught to mand for during phase 7a, while access to a second item was restricted. The mand for the second item had also been taught previously. During this phase, requests using the mand corresponding to the restricted item resulted in access to that item for approximately 30 seconds or a small amount of the consumable item. Requests using the mand corresponding to the item to which the participant already had access resulted in the therapist removing the card for approximately 30 seconds (while the participant maintained access to the item she previously had).

CHAPTER 4 RESULTS

Phase 1 Preference Assessment Results

Figure 2 shows the outcomes of the free-operant preference assessment for Mario and Will. The item identified as most preferred for Mario was the radio and most preferred for Will were cookie and radio. A second item (drink) was identified for Mario based on multiple observations not related to this study and was used during the subsequent training sessions. Figure 3 shows the outcomes of the free-operant preference assessment for Millie, Erin, and Pablo. The items identified as most preferred for Millie were music and chips, for Erin were drink and chips, and most preferred for Pablo were chips and drink. A preference assessment was conducted for Malcolm (not shown in a figure); results of that assessment identified T.V. and chips as most preferred items for Malcolm. The observers inadvertently only recorded the outcome of the assessment, therefore percentages of session time data are not available for Malcolm, and, hence, are not depicted graphically.

Phase 2 Single Card Results

All participants acquired the single card response within one very brief session (data not depicted in figures). In all cases, the last several responses occurred with no prompting.

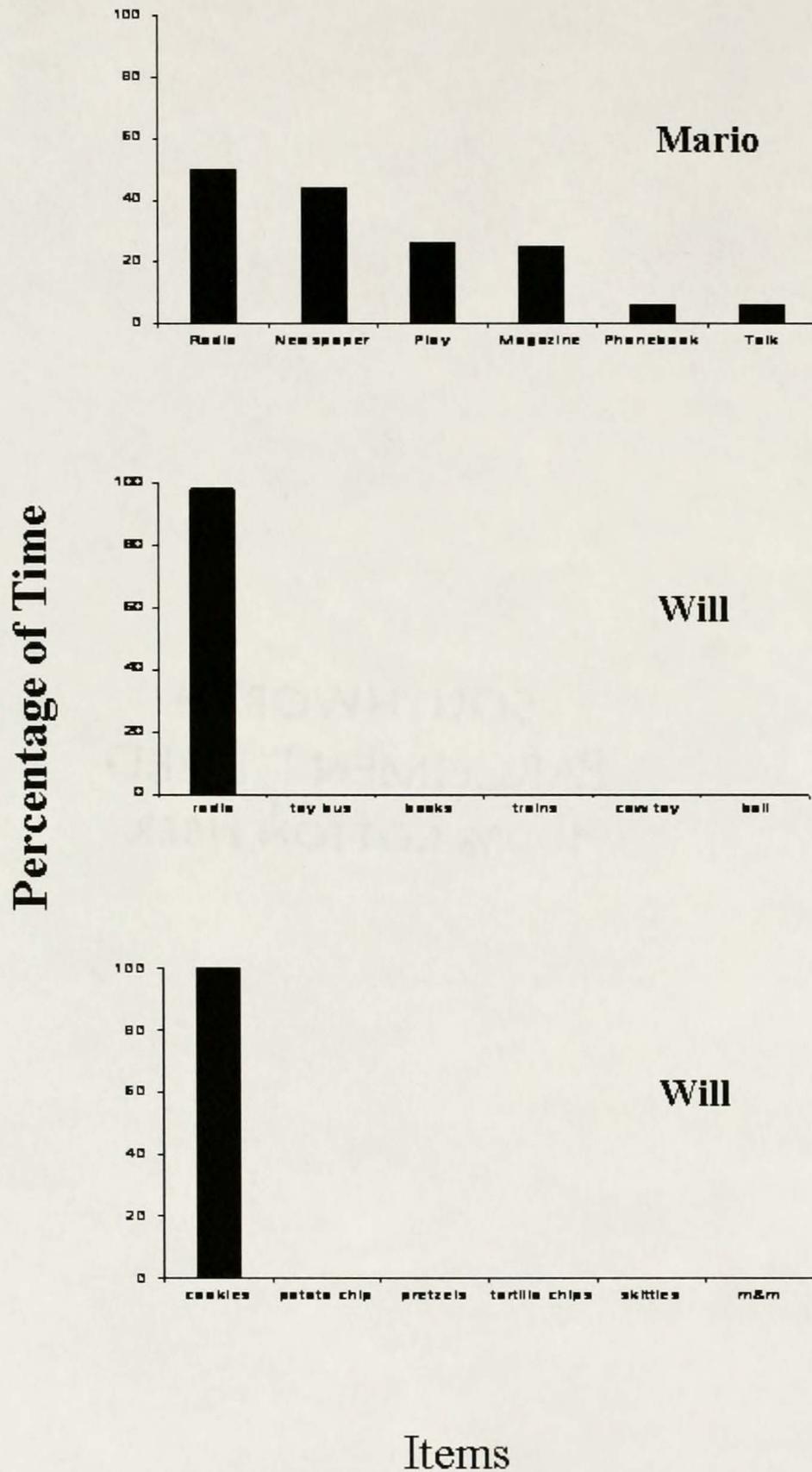


Figure 2: Percentage of 5-minute sessions of item manipulation during free-operant preference assessment.

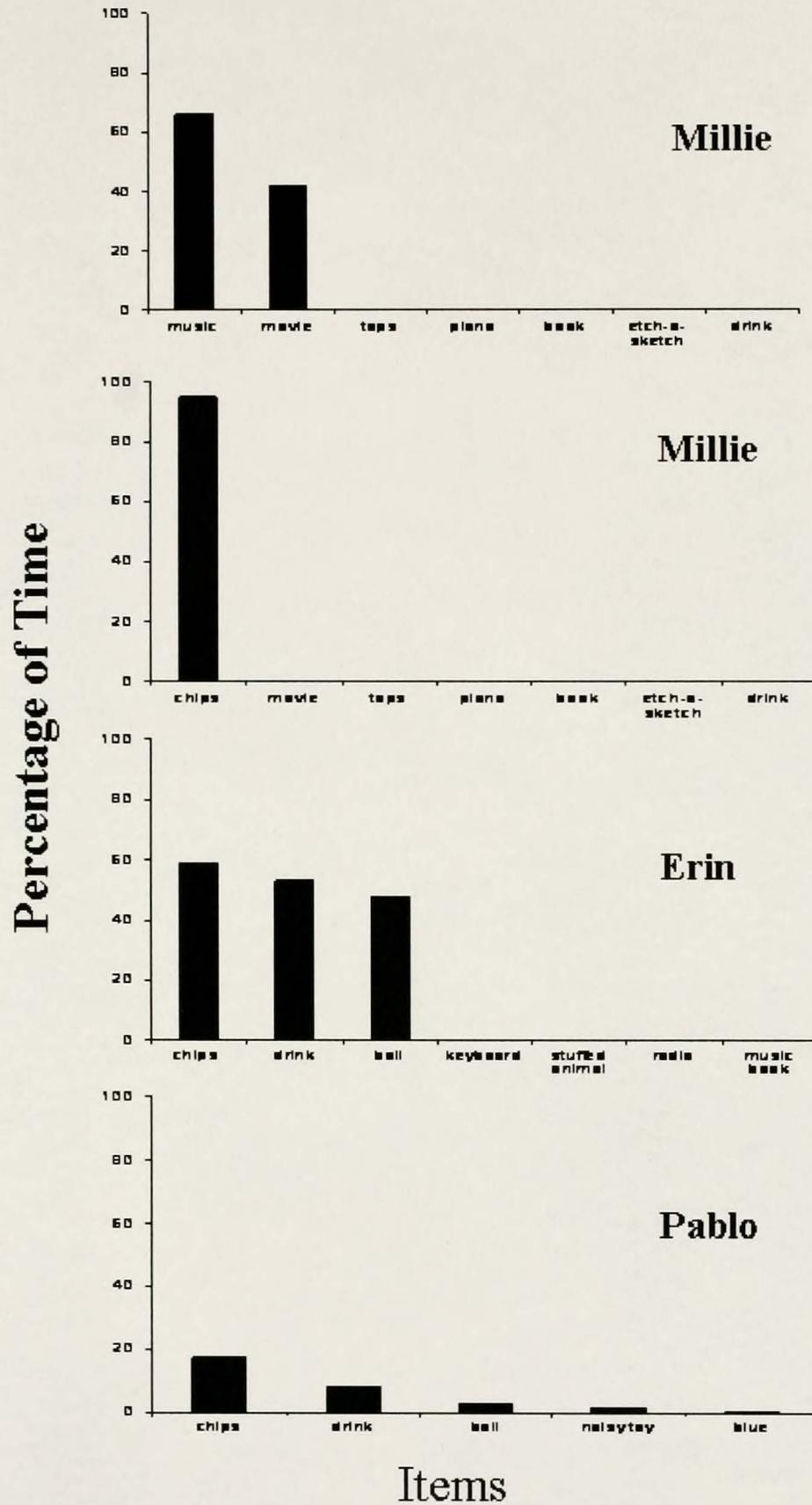


Figure 3: Percentage of 5-minute sessions of item manipulation during free-operant preference assessment.

Phase 3 Distracter Card Probe Results

Figure 4 shows the percentage of trials with cards selected for Mario and Will during the distracter card probe phase. The filled circles represent responses using what would eventually be the picture card and the open circles represent responses using the distracter card. Recall that during the distracter card probe phase, responding using either the picture card or the distracter card resulted in reinforcement, access to the preferred item. The top two panels show the percentage of cards selected by Mario. The first panel shows responses using the radio and the distracter card and the second panel shows responses using the drink and the distracter card during the distracter card probe phase. During the distracter card probe phase, Mario selected both the picture card and the distracter card during both radio and drink sessions but showed a slight bias for the picture card during the drink ($M=63\%$) and radio sessions ($M=68\%$). The next two panels of figure 4 show the results for Will during the distracter card probe phase. The third panel shows responses using the cookie card and the distracter card and the fourth panel shows responses using the radio card. During the distracter card phase, Will responded using the distracter card almost exclusively during the cookie ($M=95\%$) sessions and showed a bias for the distracter card during the radio ($M=73\%$) sessions.

Figure 5 shows the percentage of trials with cards selected for Malcolm and Millie during the distracter card probe phase. The top two panels show the percentage of cards selected by Malcolm. The first panel shows responses using the T.V. and distracter card and the second panel shows responses using the chips and distracter card. During the distracter card probe phase, Malcolm showed a bias for the picture card, he responded using the T.V. card more often ($M=72\%$) than the distracter card during the

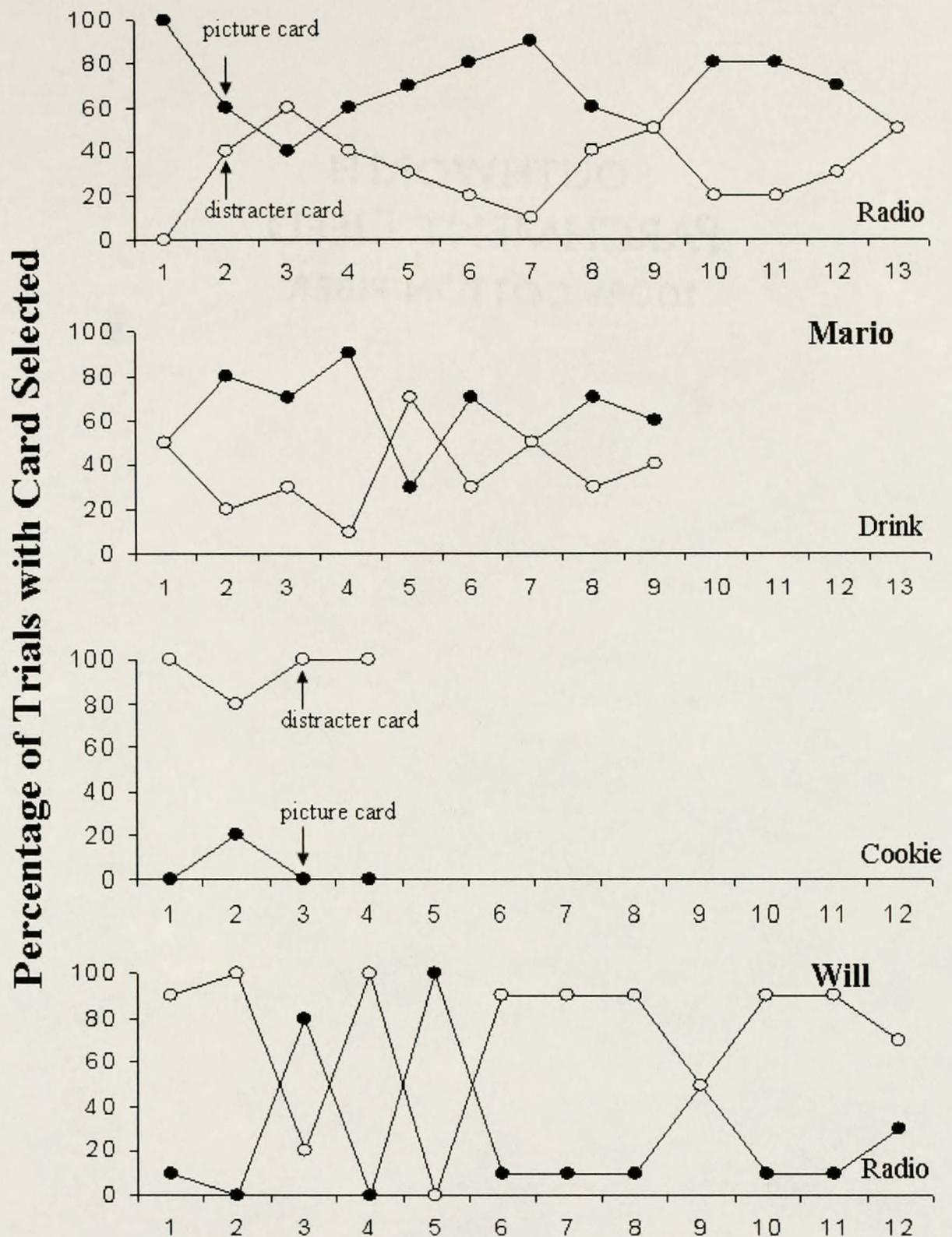


Figure 4: Percentage of trials with picture card and distracter card selected during the distracter card probe phase for Mario and Will.

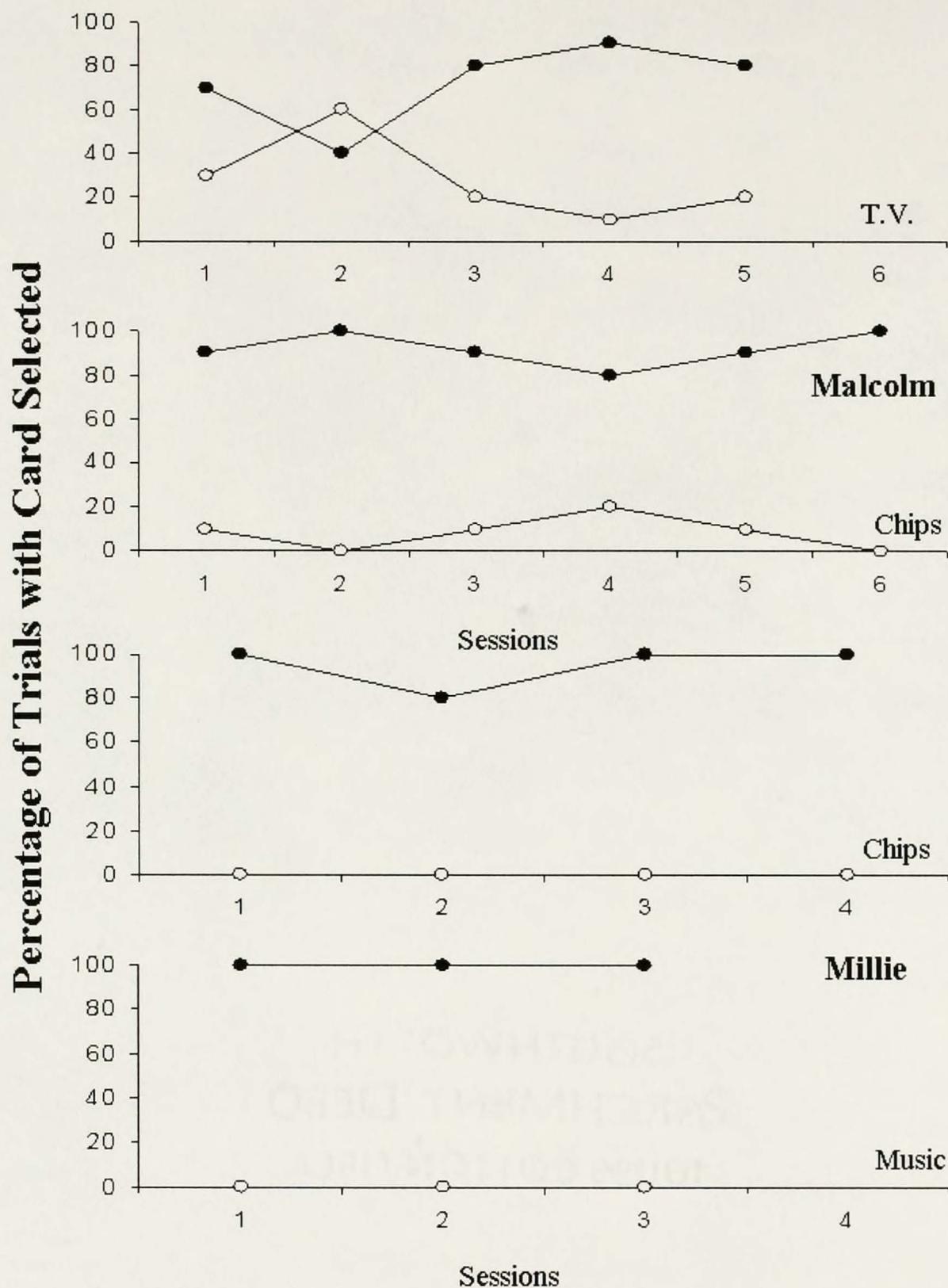


Figure 5: Percentage of trials with picture card and distracter card selected during the distracter card probe phase for Malcolm and Millie.

T.V. sessions and selected the chips card almost exclusively ($M=92\%$) during the chips sessions. The next two panels of figure 5 show the data for Millie. The third panel shows responses using the chips and distracter card and the fourth panel shows responses using the music and distracter card. Millie responded using the chips card exclusively during the chips sessions ($M =95\%$) and the music exclusively during the music sessions ($M=100\%$).

Figure 6 shows the results for Erin and Pablo during the distracter card probe phase. The top two panels show the percentage of cards selected by Erin. The first panel shows responses using the chips and the distracter card and the second panel shows responses using the drink and the distracter card. Erin selected both the picture card and the distracter card during both drink ($M= 53\%$ selection of drink) and chips ($M=43\%$ selection of chips) sessions. The next two panels of figure 6 show the results for Pablo. The third panel shows responses using the chips and distracter card and the second panel shows responses using the drink and distracter card. Pablo selected both the picture card and the distracter card during both chips ($M=48\%$ selection of chips) and drink ($M=50\%$ selection of drink) sessions.

Phase 4 Mand Training Results

Figure 7 shows the percentage of trials with cards selected for Mario and Will during the distracter card probe and differential reinforcement phases. In the differential reinforcement phase, the filled circles represent correct responses (responses using the picture card) and the open circles represent incorrect responses (responses using the distracter card). Recall that during the differential reinforcement phase, only responses using the picture card resulted in reinforcement while responses using the distracter

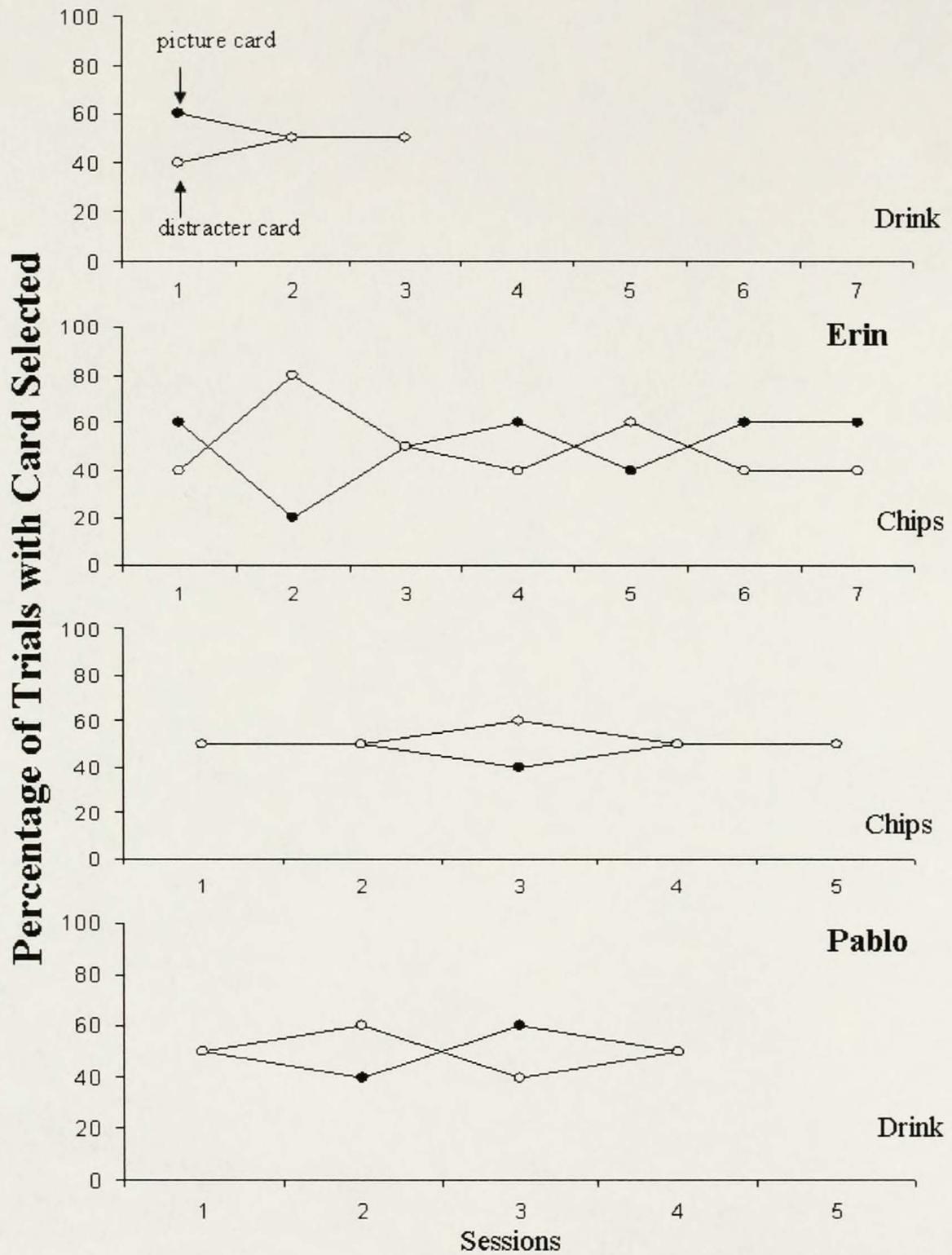


Figure 6: Percentage of trials with picture card and distracter card selected during the distracter card probe phase for Erin and Pablo.

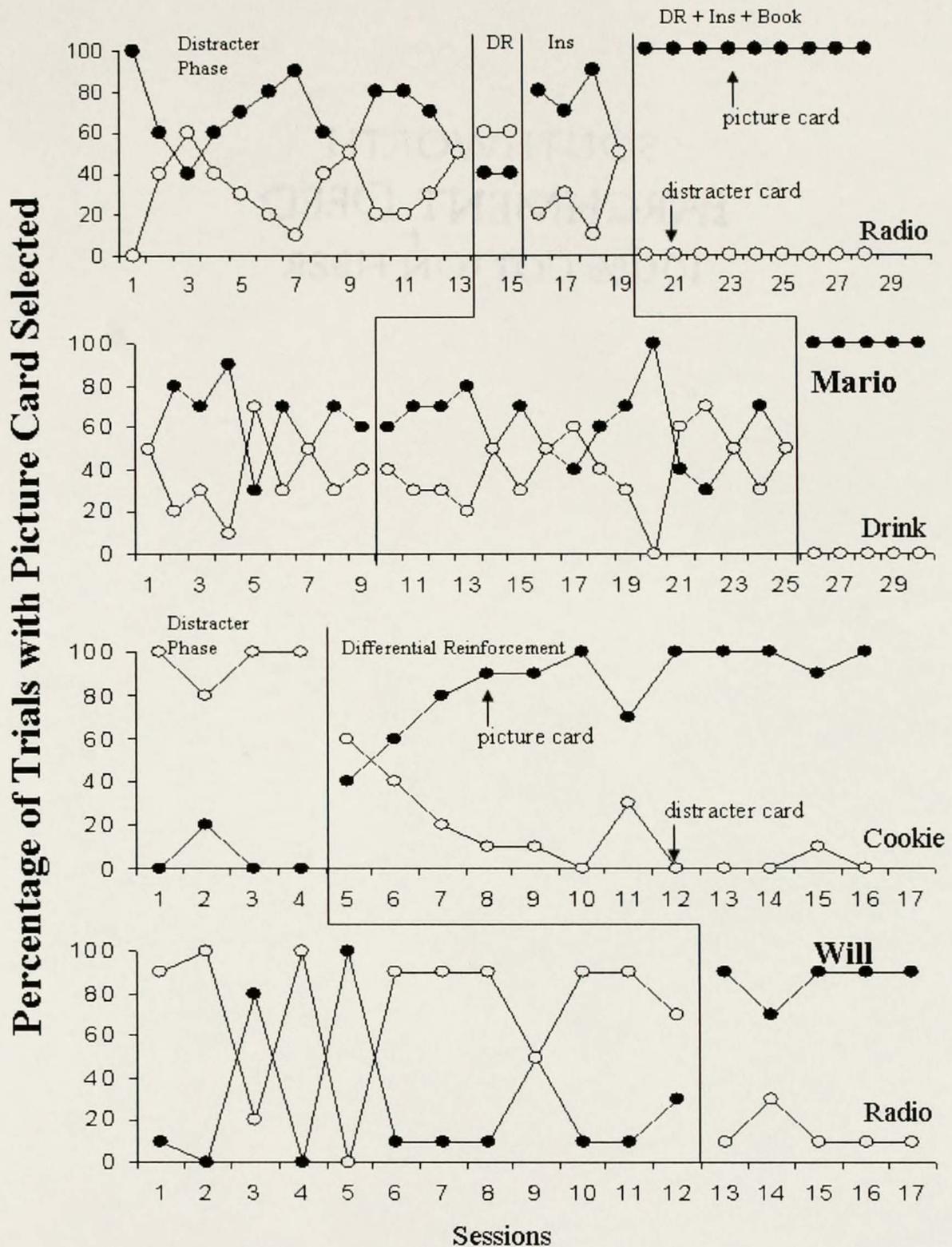


Figure 7: Percentage of trials with picture card and distracter card selected during the distracter card probe and differential reinforcement phases for Mario and Will.

card resulted in extinction. The top two panels show the percentage of cards selected by Mario. The first panel shows responses using the radio and the distracter card and the second panel shows responses using the drink and the distracter card during the distracter card probe and differential reinforcement phases. Mario selected the distracter card more often than the picture card when differential reinforcement was implemented during the radio sessions and drink sessions ($M=60\%$). We observed that during this phase, Mario was not looking at the cards. He was handing the therapist a card without looking down at the card he was handing. We then provided Mario with instructions during the radio sessions to hand the picture card in order to gain access to the radio. However, this manipulation was not effective at producing 100% correct responding ($M=73\%$) and Mario was still not looking at the cards consistently. In order to ensure that Mario would look at the cards before handing them to the therapist, we placed the cards in a small photo album to create a communication book. This required that Mario open the book and find the correct card to hand to the therapist. This intervention was immediately effective at producing 100% correct responding during the radio and drink sessions. The next two panels of figure 7 show the data for Will. The third panel shows responses using the cookie card and the distracter card and the fourth panel shows responses using the radio card. When differential reinforcement was implemented, Will responded more often using the picture card rather than the distracter card during both cookie ($M=85\%$) and radio ($M=86\%$) sessions.

Figure 8 shows the results for Malcolm and Millie during the distracter card probe and differential reinforcement phases. The first two panels show the results for Malcolm. The first panel shows responses using the T.V. and distracter card and the

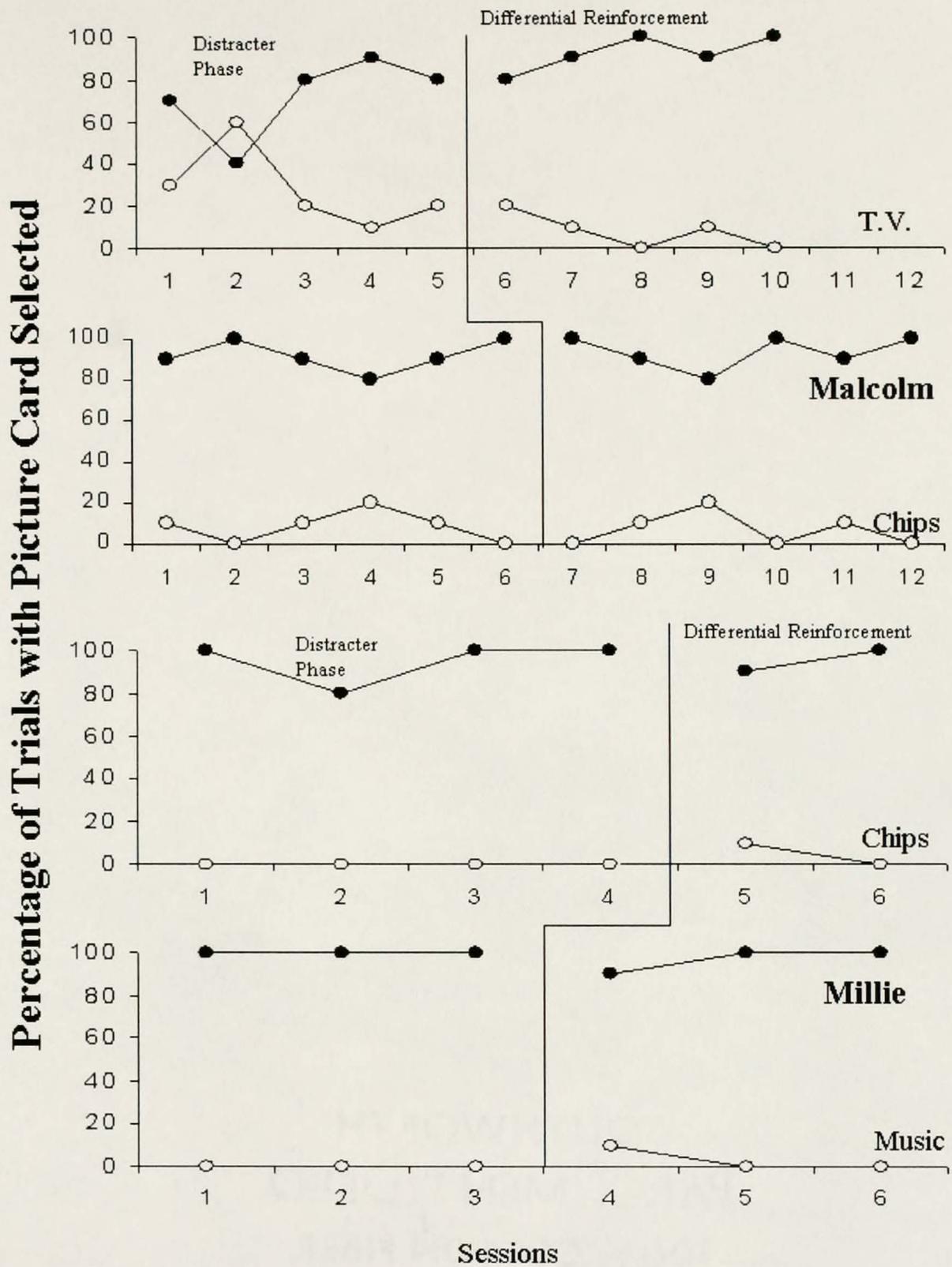


Figure 8: Percentage of trials with picture card and distracter card selected during the distracter card probe and differential reinforcement phases for Malcolm and Millie.

second panel shows responses using the chips and distracter card. When differential reinforcement was implemented, Malcolm responded using the picture card for the majority of the trials during both the T.V. (M=92%) and chips (M=93%) sessions. The next two panels of figure 8 show the results for Millie. The third panel shows responses using the chips and distracter card and the second panel shows responses using the music and distracter card. When differential reinforcement was implemented, Millie responded using the picture card rather than the distracter card during both the chips (M=95%) and music (M=97%) sessions. Recall that Millie had already responded mostly using the picture card even prior to differential reinforcement (see phase 4). Figure 9 shows the results for Erin and Pablo during the distracter card probe and differential reinforcement phases. The first two panels show the results for Erin. The first panel shows responses using the drink card and the distracter card and the second panel shows responses using the chips card and the distracter card. When differential reinforcement was implemented, Erin responded using both the picture card and the distracter card during the drink (M=53%) and chips (M=51%) sessions. The next two panels of figure 9 show the results for Pablo. The third panel shows responses using the chips card and the distracter card and the fourth panel shows responses using the drink card and the distracter card. When differential reinforcement was implemented, Pablo responded using both the picture card and the distracter card during the drink (M=53%) and chips (M=51%) sessions.

In summary, when differential reinforcement was implemented for responding using picture cards, four out the six participants responded using the picture card to gain

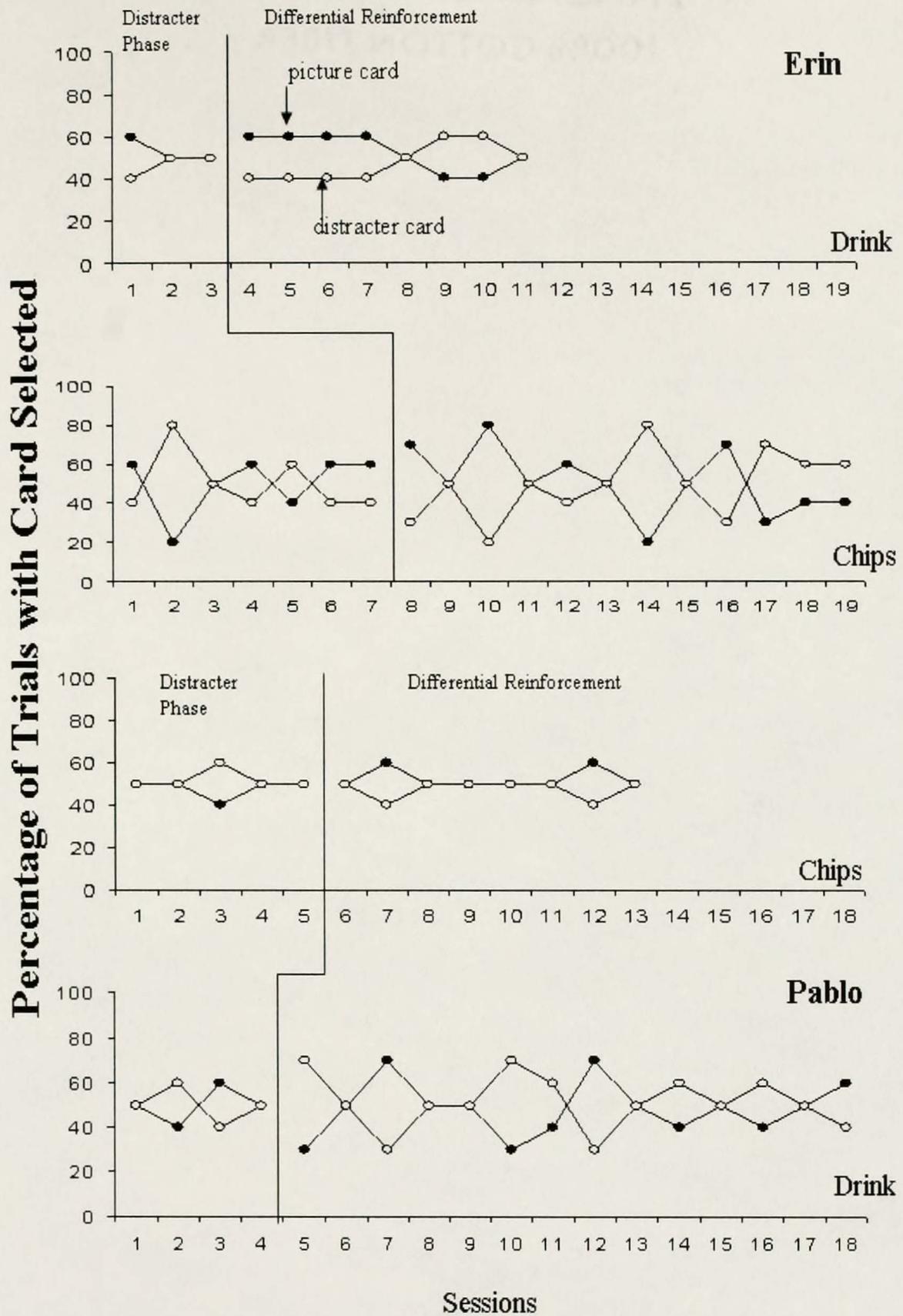


Figure 9: Percentage of trials with response emitted during the distracter card probe and differential reinforcement phases for Erin and Pablo.

access to preferred items. This was not intended to be a demonstration of acquisition (recall that two individuals already selected picture cards prior to differential reinforcement). Rather, differential responding was a pre-requisite to getting to the EO test. The four individuals who responded differentially demonstrated the prerequisite skills necessary for inclusion in phase 5 of the study, Establishing Operation Manipulation. Differential reinforcement was not sufficient to teach the simple discrimination between the picture card and distracter card for Erin and Pablo. Thus, Erin and Pablo participated in phase 6.

Phase 5 Establishing Operations Manipulation Results

Figure 10 shows the percentage of trials with the picture card selected for Mario and Will during the EO phase. The filled circles represent responses using the picture card in sessions when the participant did not have access to the item (EO on), and the open circles represent responses using the picture card in sessions when the participant already had access to the item (EO off). Recall that EO on and EO off sessions were alternated between the two cards. So, the EO on session for one card was the EO off session for the other card. Responses using the picture card when the EO was on resulted in reinforcement while responses using the picture card when the EO was off resulted in the therapist removing the cards for approximately 30 seconds (but the participants maintained access to the item they already had). After each trial the position of the cards was reassigned quasi randomly and a new trial was started. The first two panels show the results for Mario, the first panel shows responses using the radio card when the radio EO was on and off and the second panel shows responses using the drink card when the drink EO was on and off. During the radio EO on sessions, Mario

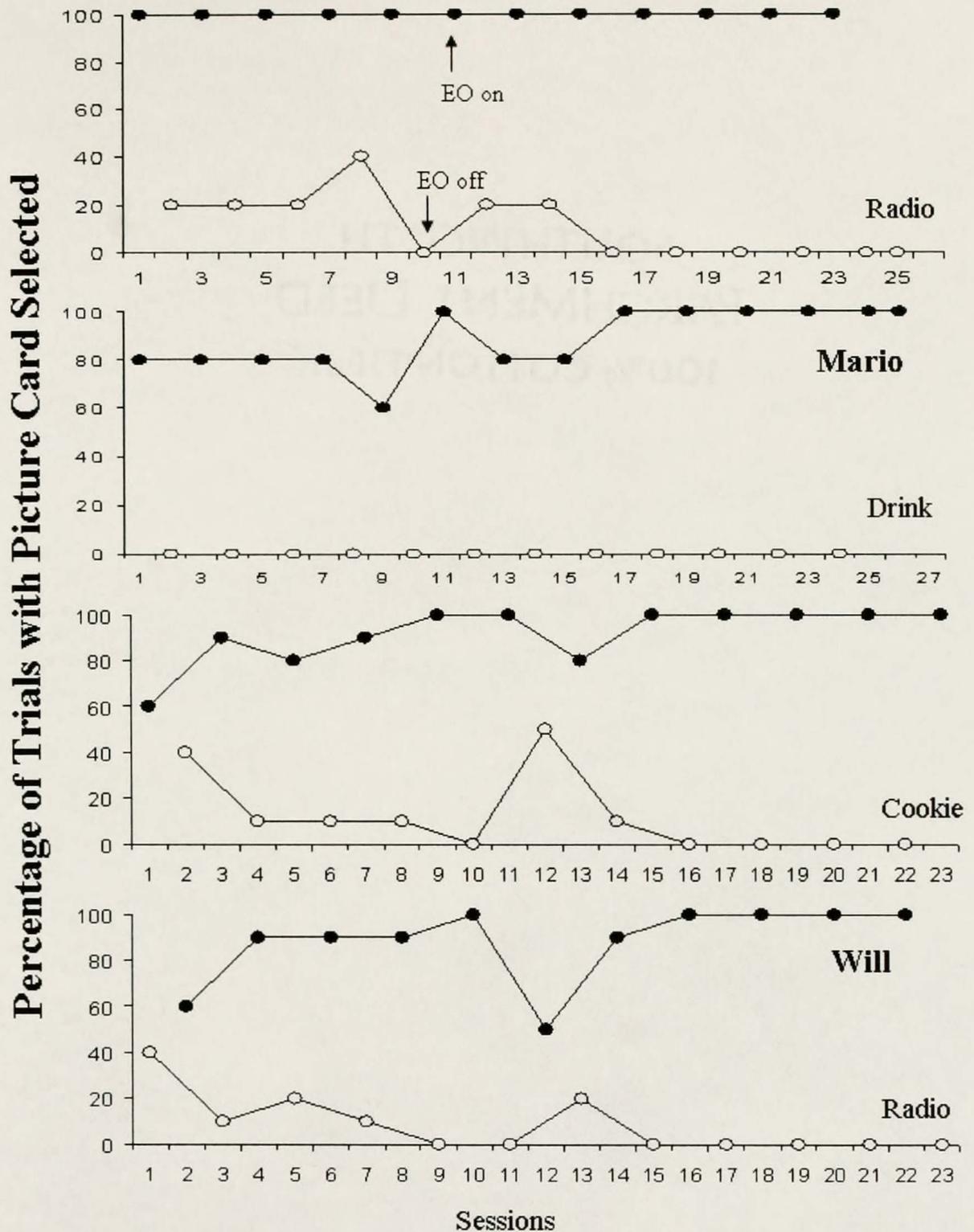


Figure 10: Percentage of trials with picture card selected during the establishing operations manipulation phase for Mario and Will.

responded using the radio card 100% of the time. Mario responded using the drink card during the drink EO on sessions approximately 80% of the time during the first 8 sessions and 100% of the time the remainder of the sessions (overall $M=89%$) and 0% of the time in sessions when the EO was off (overall $M=0%$). The next two panels of figure 10 show the results for Will. Initially, during the cookie EO on session Will responded using the cookie card slightly more often when the EO was on than when the EO was off. However, during the last 5 sessions Will responded using the picture card only when the EO was on (Overall $M=92%$). During the radio EO on sessions, Will responded using the radio card most of time ($M=88%$) and rarely during the radio EO off.

Figure 11 shows the percentage of trials with the picture card selected for Malcolm and Millie during the EO phase. The first two panels show the results for Malcolm. During the T.V. EO on sessions, Malcolm responded using the T.V. card more often ($M=83%$) than when the EO was off. Malcolm responded using the chips card during the chips EO on sessions more often ($M=83%$) than when the EO was off. The last two panels of figure 11 show the results for Millie. During the chips EO on, Millie responded using the chips card ($M=55%$) versus ($44%$) during chips EO off and the music card ($M=82%$) when the EO was off.

In summary, results of this phase showed that 3 of the 4 participants accurately responded for two different items using picture cards in the context of two picture cards. Three participants (Mario, Malcolm, and Will) were able to respond using a picture card representing an item when the establishing operation for that item was on and did not typically respond using the picture card for an item when the establishing operation was

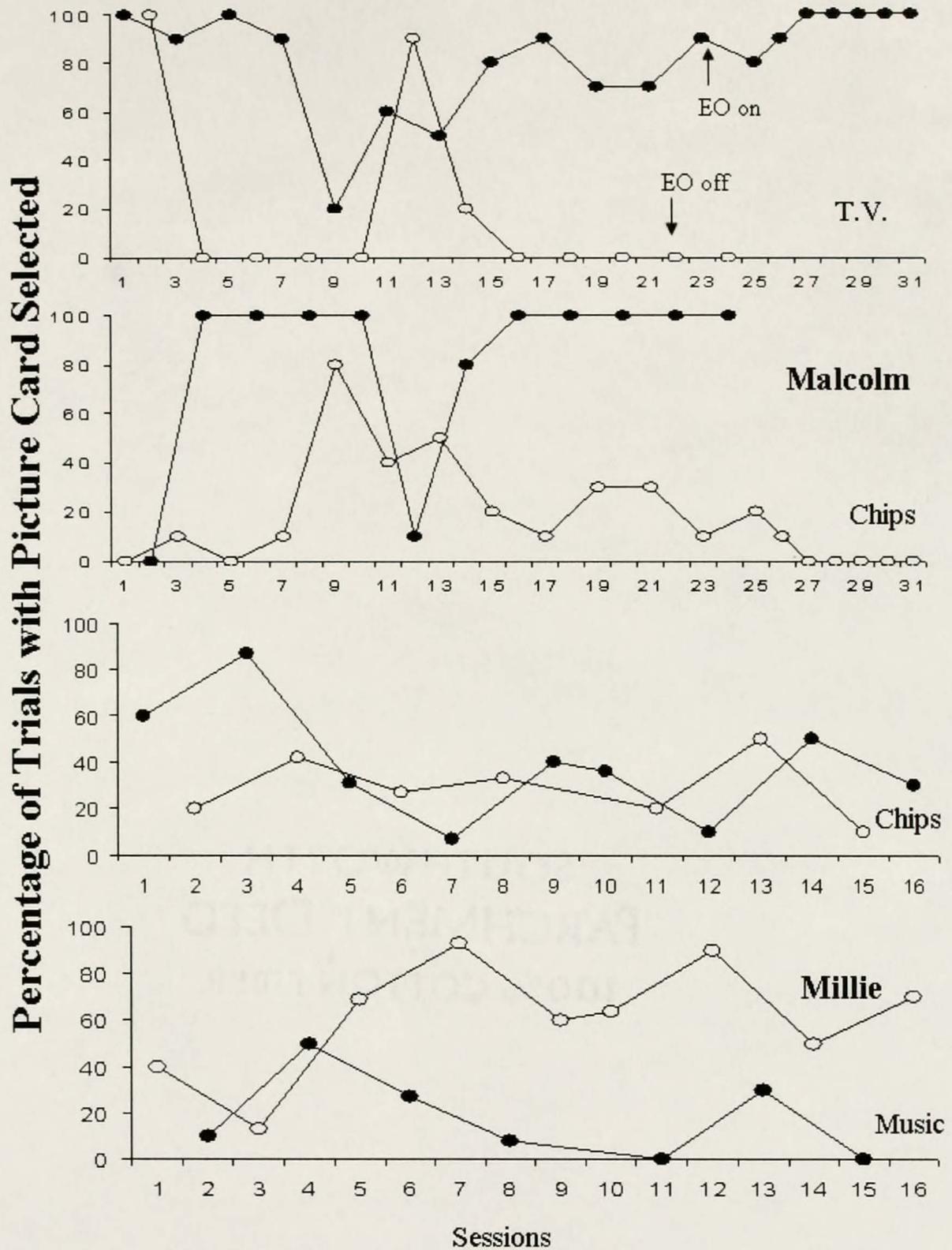


Figure 11: Percentage of trials with picture card selected during the establishing operations manipulation phase for Malcolm and Millie.

off. One participant (Millie) did not learn to mand for two items using picture cards in the context of two picture cards. Millie responded using a picture card representing an item when the establishing operation was on and off. This pattern of responding suggested that Millie had not acquired the complex discrimination between the two picture cards that was necessary for discriminated manding in the context of two picture cards. It was necessary to teach Millie a discriminated manding response in order for her to effectively mand for two different items. Therefore, Millie participated in phase 7 of the study, where she was taught to mand using two topographically different responses in order to teach a discriminated mand response in the context of two different items.

Phase 6a Representative Objects Training Results

Recall that the purpose of this phase was for the 2 individuals who did not learn the simple discrimination in phase 4 (Pablo and Erin) to make available an extremely obvious discrimination in order to move toward the EO test, which was of primary interest. Figure 12 shows the percentage of item approached for Erin and Pablo during the representative objects distracter probe and differential reinforcement phases. Filled circles represent approach responses to the representative object and open circles represent approach responses to a blank cardboard. The first two panels show the results for Erin. The first panel shows approach responses to the chips representative object and the second panel shows approach responses to the drink representative object. When differential reinforcement was implemented, Erin approached the representative object 100% of the time during both chips and drink sessions. The last two panels of figure 12 show the results for Pablo. When differential reinforcement was implemented, Pablo

approached the representative object most of the time during the chips sessions (M=83%) and the drink sessions (M=88%). During the last 11 chips differential reinforcement sessions Pablo was presented with a choice of approaching the representative object or the therapist's empty hand and this manipulation resulted in 100% of the approaches being made to the representative item. This manipulation was conducted during the last 12 drink differential reinforcement sessions and this resulted in 100% of the approaches being made to the representative item during the last 7 sessions. The reason for this change was that the main purpose of the study, which was to conduct the EO manipulation between two relevant objects, so the use of a blank board versus an empty hand was somewhat incidental unless we were unable to see differentiated responding. Given that the empty hand produced 100% allocation to the representative item, Pablo, like Erin, was ready for phase 6b. There is no claim that Pablo and Erin were "taught" this discrimination. Rather, a very easy discrimination was identified in order to move to the EO test manipulation.

Phase 6b Establishing Operations Manipulation with Representative Objects Results

Figure 13 shows the percentage of trials with the representative object approached for Erin and Pablo during the EO phase. The filled circles represent approach responses to the representative object in sessions when the EO was on and the open circles represent responses to the representative object in sessions when the EO was off. Approach responses to the representative object the participant did not already have access to (EO on) resulted in reinforcement while approach responses to the representative object the participant already had access to (EO off) resulted in the

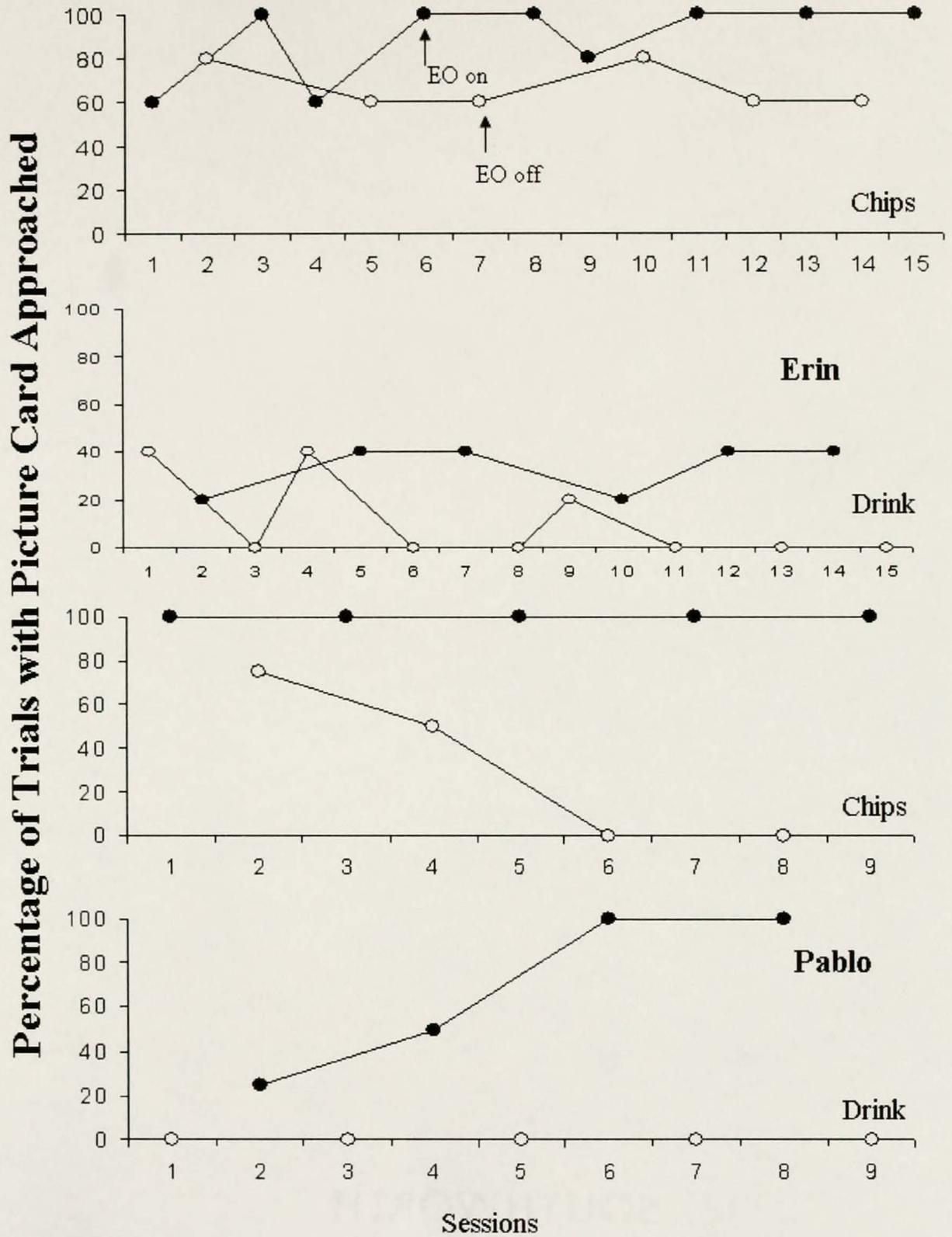


Figure 13: Percentage of trials with item approached during the establishing operation manipulation phase for Erin and Pablo.

therapist removing the representative objects for approximately 30 seconds (but they maintained access to the item they already had). After each trial the position of the representative objects was counterbalanced quasi randomly and a new trial was started. The first two panels show the results for Erin, the first panel shows approach responses to the representative object for chips and the second panel shows approach responses to the representative object for drink. During the chips EO on sessions, Erin responded by approaching the chips representative object 89% of the time, which was slightly higher than during chips EO off. During the drink EO on sessions, Erin responded by approaching the drink representative object 33% of the time, which was slightly higher than during drink EO off. The next two panels of figure 13 show the results for Pablo. Pablo responded by approaching the chips representative object during the chips EO on sessions 100% of the time and 30% of the time during chips EO off sessions. He selected the drink representative object most of the time when the EO was on ($M=68%$) during the drink EO on sessions and 0% of the time during the drink EO off sessions.

In summary, results of this phase showed that both participants were more likely to mand for items when the EO was on (versus off for that item) using representative items in the context of two representative items. Erin and Pablo were able to respond by approaching the representative item for which the EO was on, the item they did not have access to, more often than when the EO was off in the context of two representative items.

Phase 7a Topographically Different Response Training (Vocal + Mand Training) Results

During phase 5 (Establishing Operations Manipulation) only one of the 4 participants, Millie, did not mand using the appropriate picture card. Her behavior in phase 4 (Differential Reinforcement) indicated that Millie was able to mand for items using picture cards, however, the establishing operation manipulation demonstrated that Millie had not learned to mand for specific items in the context of more than one picture card. In other words, Millie had not learned to discriminate from among the picture cards. In an effort to teach Millie to mand for the relevant item during the establishing operation manipulation and to teach her to respond differentially to gain access to preferred items, we taught Millie a topographically different response to establish the discrimination between mands for preferred items. Figure 14 shows the vocal mand training data for Millie. Closed circles represent independent responses, saying “chips” and the open circles represent prompted responses when Millie was instructed to say “chips” to gain access to the chips using a model prompt. Millie responded independently using the vocal mand “chips” as training progressed ($M=66\%$) and by the last 4 sessions she was responding independently on average 85% of the time (100% in the final session).

Phase 7b Establishing Operation Manipulation with Topographically Different Responses (Vocal + Card) Results

Figure 15 shows the data for Millie during the EO with two topographically different responses phase. The top panel shows the results for the chips utterance. The closed circles represent vocal responses, saying “chips,” when she did not have access

Percentage of Trials with Response Emitted

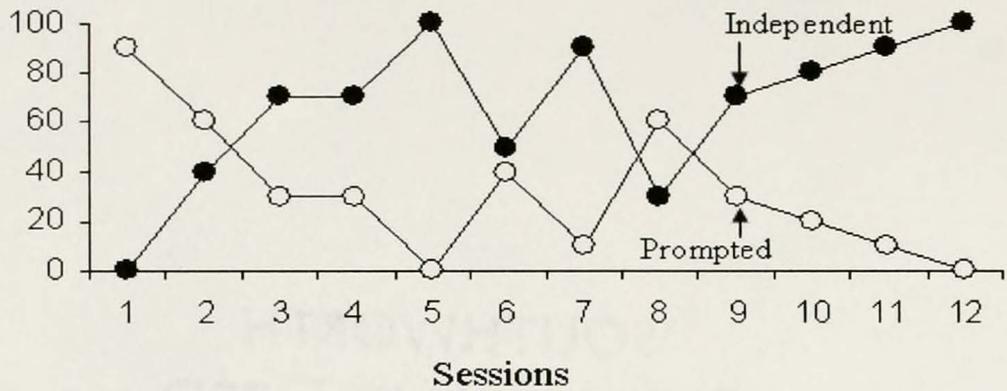


Figure 14: Percentage of trials with response emitted during vocal mand training for Millie.

to the chips but had access to the music (chips EO on) and the open circles represent responses saying chips when she already had access to the chips but did not have access to the music (chips EO off). The Xs represent responses during booster sessions.

Booster sessions consisted of supplemental mand training (of the sort done in phase 4 for cards and 7a for vocals) and were conducted when Millie returned to sessions after having missed school for a substantial amount of time. The bottom panel of figure 15 shows the results for the music picture card. The closed circles represent responses using the music picture card when Millie did not have access to the music but did have access to the chips (music EO on) and the open circles represent responses using the music card when she already had access to the music but not chips (music EO off). In the first sessions, Millie responded by saying chips and using the music card more often

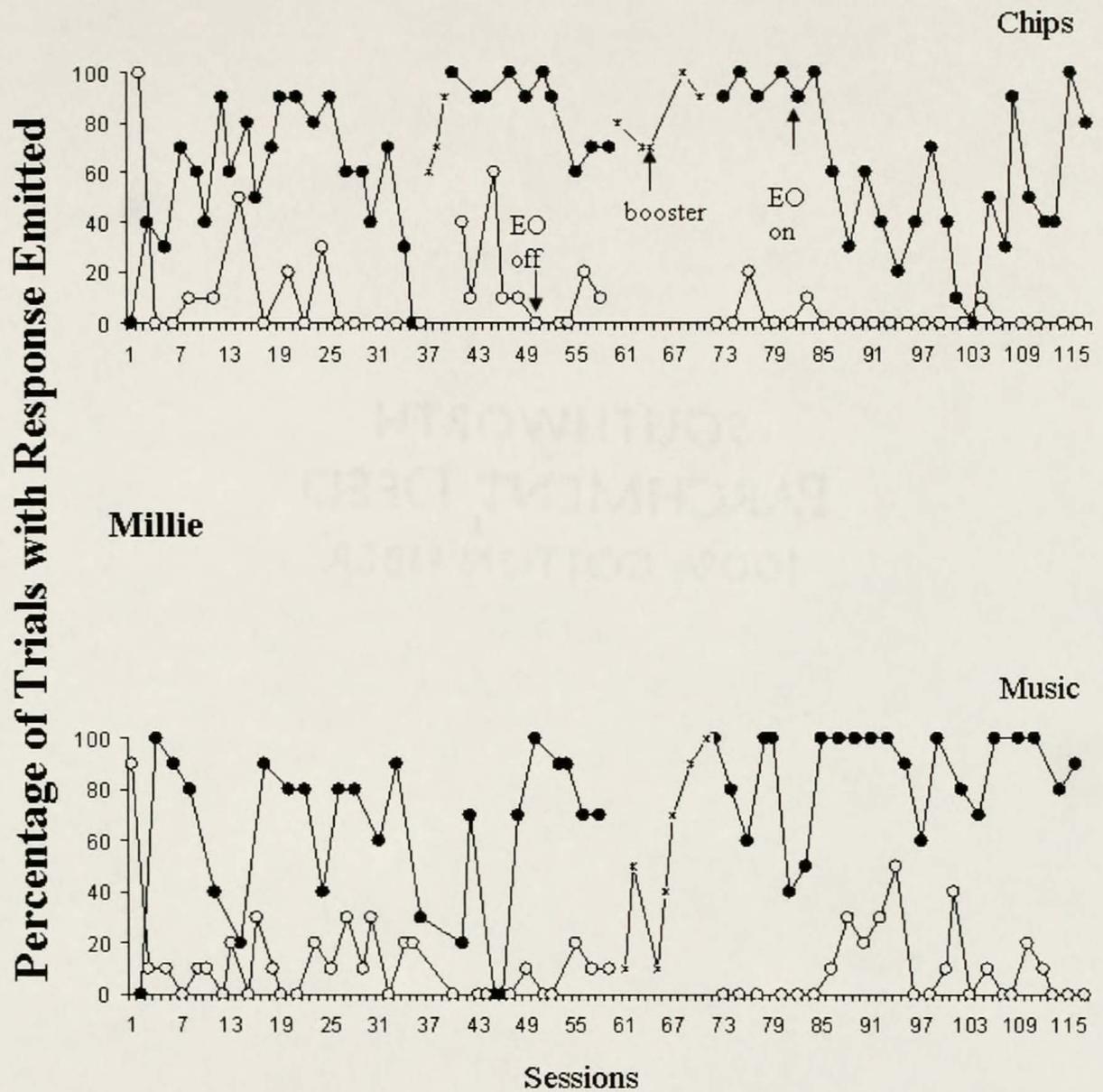


Figure 15: Percentage of trials with response emitted during the establishing operation manipulation with topographically different topographies phase (vocal + mand) for Millie.

when the EO was off but as sessions continued Millie responded more often when the EO was on for both the chips (M=77%) and the music (M=84%).

In summary, results of this phase showed that Millie accurately manded for two different items using a picture card and a vocal response in the context of two preferred items. Millie was able to respond using a picture card representing an item or a vocal response for an item when the establishing operation for that item was on and rarely responded using the picture card or the vocal response for an item when the establishing operation for that item was off.

CHAPTER 5 DISCUSSION

The purpose of this study was to determine if mand training resulted in discriminated manding using picture cards when more than one picture card was available. In other words, at the completion of mand training, individuals ideally would be able to selectively mand for desired items using a picture card. An establishing operation (EO) manipulation phase was used to assess for discriminated manding. The EO manipulation was designed to determine if individuals manded for a preferred item that they did not have access to (for which the EO was in place) and conversely did not mand for items that they had access to (for which the EO was not in place).

The results of this study showed that for three participants (Mario, Malcolm, and Will) mand training using picture cards resulted in discriminated manding in the context of two picture cards. For these individuals, the mand response was under the control of the establishing operation (i.e., they most frequently manded for the items they were deprived of and not for the items they had access to).

For one participant, mand training using picture cards did not result in discriminated responding. Millie successfully completed the mand training phase of the study using picture cards, but did not accurately discriminate between two picture cards when presented with the EO manipulation. Rather, she continued to mand for the item that she already had access to. At the end of the mand training phase, Millie's data suggested that mand training had been effective in teaching her to mand for two items

using picture cards. However, the establishing operation manipulation phase showed that mand training had not been effective in teaching discriminated manding in the context of two picture cards.

Subsequently, in order to establish discriminated manding, Millie was presented with additional discrimination training. During additional training, Millie was taught to use two topographically different responses (picture cards and vocal). Following this additional training, Millie was able to mand appropriately for the two items during the EO manipulation. The mand response using two topographically different responses was under the control of the establishing operation (i.e., Millie more frequently manded for the item she was deprived of than for item she had access to).

For two individuals, (Erin and Pablo), mand training using picture cards was not successful using simple reinforcement procedures. Erin and Pablo did not acquire the discrimination between the picture card and distracter card. Therefore, in order to establish a mand response, Erin and Pablo were no longer presented with picture cards, but instead were presented with representative items and much more obvious distracters in order to ensure discrimination. Both Erin and Pablo acquired the discrimination between the representative items and the blank board (Erin) or an empty hand (Pablo). In addition, both responded appropriately in the EO manipulation phase (i.e., Erin and Pablo more frequently manded for the item when they were deprived of it than when they were not). Although Erin's results reflected frequent "errors," the mand response using representative items was under the control of the establishing operation, although only to a small (but consistent) degree.

In the present study, three individuals displayed complex discriminated manding using picture cards. In addition, the implementation of an EO manipulation phase yielded additional validity to the appropriateness of discrimination training in teaching individuals to mand for preferred items. Conversely, three individuals were unable to acquire discriminated manding (Erin, Pablo) or complex discrimination (Millie) using picture cards. For two (Erin and Pablo), a discrimination between the picture cards and distracter cards was never acquired during training. For Millie, discrimination between the picture cards and distracter cards was established in training, but did not result in discriminated responding when presented with the EO manipulation. In both cases, lack of appropriate responding warrants further interpretation.

One possible explanation for a lack of appropriate responding in three participants (Erin, Pablo, and Millie) is that there may have been a lack of control over the stimuli controlling responding. McIlvane and Dube (2003) explain that the stimulus the experimenter has designed to control responding and the stimulus that is functionally controlling responding may not be the same. For example, when presented with a picture card, the stimulus intended to control behavior is the two-dimensional drawing on the face of the card. However, the actual stimulus controlling behavior could be some other stimulus such as the colors, shape, etc. The degree to which the experimenter's intended stimuli and the stimuli relevant to the participant are the same is called Stimulus Control Topography (SCT) Coherence (McIlvane & Dube, 2003).

According to McIlvane and Dube's (2003) conceptualization, Erin's, Pablo's, and Millie's failure to acquire discriminated responding may be a function of the experimental conditions rather than some inherent inability on the participant's part to

discriminate. In other words, there was an apparent lack of SCT coherence. For Millie, the participant who responded inappropriately in the EO manipulation, it is possible that the specific two-dimensional drawing on the picture cards was not controlling behavior. It is relevant to point out that when the distracter card was used, Millie showed a preference for the picture card. In this case, the stimuli controlling behavior may have been a less strictly defined stimulus, perhaps picture cards in general. Regarding Erin and Pablo, again SCT coherence may not have occurred. Erin and Pablo may have learned to hand over cards independent of the stimulus on the card. Thus, cards per se had acquired stimulus control properties.

Such an explanation lends credence to the subsequent interventions for Erin, Pablo, and Millie. In all cases, the presented stimuli themselves were altered and may have produced coherence between the experimenter's intended stimuli and the stimuli controlling behavior. For Millie, SCT congruence may have been established with the addition of a topographically distinct response (vocal vs. picture card). By using two response topographies, each associated with a different reinforcer, discriminated manding during the EO manipulation phase was established. Similarly, SCT coherence may have been established for Erin and Pablo with the addition of representative items. In this case, stimulus control was no longer linked to a single stimulus (cards) but had been established between representative items and alternative items (i.e., blank board or empty hand).

In addition to SCT incongruence, the schedule of reinforcement during training may be a variable contributing to inappropriate responding for Erin and Pablo. During the study, the intended schedule of reinforcement was a fixed-ratio 1 (FR 1) or

continuous reinforcement (CRF) for correct responses, in which each correct response resulted in reinforcement, and incorrect responses resulted in extinction (Ferster & Skinner, 1957). Although not systematically included as a component in this study, schedules of reinforcement inevitably produce specific patterns of responding. In this case, a post-hoc analysis of the reinforcement schedule reveals that while responding with the appropriate card was reinforced on an FR1 schedule, responding in general (i.e., handing cards to the experimenter) may have been maintained on a variable-ratio (VR) or intermittent schedule of reinforcement (Ferster & Skinner, 1957). During a VR schedule of reinforcement, the number of responses required for reinforcement varies according to a series of ratios having an average value (Ferster & Skinner, 1957). Pablo gained access to the reinforcer on average of 53% of the trials during the chips sessions and 47% of the trials during the drink sessions. Erin gained access to the reinforcer on average of 53% of the trials during the drink sessions and 51% of the trials during the chips sessions. This is approximately a VR 2 schedule of reinforcement for Pablo (VR 1.9 for chips and VR 2.1 for drink) and Erin (VR 1.9 for drink and VR 2 for chips). Variable-ratio or intermittent schedules of reinforcement maintain higher rates of responding than fixed schedules of reinforcement and are more resistant to extinction (Skinner, 1953). A VR 2 schedule of reinforcement may have been sufficient to maintain the response of handing either of the two cards, while minimizing the salience of differential reinforcement.

Another possible explanation for Millie's initially undifferentiated responding during the EO phase is that she may not have been emitting the verbal operant intended by the experimenter. The goal of this study was to teach the mand response

(requesting). However, Skinner (1957) describes other verbal operants (e.g., tacts, echoics, etc.) each serving its own function. In the case of Millie, failure to respond appropriately during the EO manipulation was initially interpreted as inability to appropriately mand using the picture card. It is, however, possible that Millie may have been tacting (labeling) items she had by using the picture card. This would explain why during the EO manipulation she most frequently handed the picture card corresponding to the item she already had access to (EO off) rather than manding for the item she did not have access to (EO on). A second, but similar, possibility is that Millie was emitting a mand response but may have been manding for “more” of the item she had access to, such as when a restaurant customer asks for a refill before his drinking glass is empty.

The results of this study have several implications for the practical use of mand training using picture cards. At present, picture card training has been used successfully to treat language delays and increase communicative behavior (Schwartz et al., 1998; Liddle, 2001; Kravitz et al., 2002). Despite the literature on the application of picture card training, far less literature has been focused on factors related to the effectiveness and efficiency and, conversely, the ineffectiveness and inefficiency with which picture card training produces discriminated manding. Literature describing picture card training outlines methods of teaching discriminations, and this procedure is typically comparable to the methods presented in this study. However, despite typical discrimination training, half of the present participants failed to acquire discriminated manding.

In three cases, modifications to the initial training procedure were made to establish appropriate responding. Modifications included the addition of

topographically dissimilar responses (picture cards and vocal), as well as modification of the stimuli (from cards to representative items). From a practical standpoint, clinicians utilizing picture cards in isolation may fail to produce discriminated manding with some participants. Rather than focusing on extensive, repeated exposure to picture cards, manding may be more quickly and accurately established with modifications in the training procedure.

Additionally, results of this study revealed that mand training may not be sufficient to establish a discriminated mand (as in the case of Millie). Therefore, the use of a post-training assessment, such as the EO manipulation, may be of practical use in determining if the desired response has been established. For Millie, the use of a book full of picture cards may have “fooled” others into believing she was successfully making complex discriminations given that she likely would have pulled out cards and handed them to an adult. The EO manipulation showed that more training was needed.

The results of this study contribute to the literature on communication training for individuals with language delays. However, there are several potential limitations of the study that should be taken into account when interpreting the results. One potential limitation was the possible variation of schedules of reinforcement in effect during some phases of the study. As previously discussed, the actual delivery of reinforcement on a VR schedule for 2 participants (Erin and Pablo) may have resulted in inappropriate responding during the discrimination training phase. The schedule of reinforcement designed to be in effect throughout the study was a fixed-ratio 1 (FR 1) or continuous reinforcement schedule (CRF) for correct responding. Under optimal conditions, the

schedule of reinforcement intended by the experimenter would be the schedule of reinforcement controlling responding.

An additional limitation of the study was the lack of experimental control during the representative drink item training phase for Pablo. During this phase, the initiations of two variables (differential reinforcement and presenting the empty hand) were implemented at the same time. By introducing two variables at the same time, it remains unclear which variable was responsible for the acquisition of the mand response during this training phase. The results of this phase were interpreted such that using representative items resulted in the acquisition of the mand response for the drink. However, it is possible that the presentation of the empty hand may also have been an important variable in establishing responding. A preferred alternative would have been to present each variable independently. However, because the goal of this phase was to create a discrimination in order to move to the EO test, determining which variable (differential reinforcement or presenting the empty hand) was responsible for the acquisition of the mand response was not undertaken.

A third limitation of the study is the isolated occurrence of a participant (Millie) who demonstrated incorrect responding during the EO manipulation. Though not a limitation of this study's experimental design, the fact that only one participant displayed opposite effects in this phase makes it difficult to determine the extent to which such responding may occur in others. The results of Millie's response patterns in the EO phase were interpreted as a potential need to conduct assessments (similar to the EO phase) to determine if participants acquire discriminated manding using the discrimination training. However, given that only one participant displayed such

patterns, it is unclear how prevalent inappropriate responding during the EO manipulation would be among individuals who successfully complete mand training using picture cards.

A fourth limitation of this study is that criteria for participant selection were not sufficiently stringent to yield participants appropriate for all intended phases of the study. The participants selected were all individuals with developmental delays as well as language delays. However, two participants, Erin and Pablo, did not acquire the discrimination during training using picture cards. Although Erin and Pablo were able to hand the picture cards to the therapists, other pre-requisite skills that may be necessary for successful picture card communication training (e.g., attending to the image on the card, discriminating colors and shapes) may not have been present in their repertoire. Therefore, it was never possible to have Pablo and Erin complete the EO manipulation phase using picture cards. Had more stringent participant selection procedures been established (perhaps an assessment of pre-requisite skills) all selected participants may have been able to complete all phases of the study.

The results of this study yield additional questions that may be examined through future research. One finding in the present study was that Millie was unable to engage in discriminated manding in the context of two picture cards, but was able to do so with two topographically different responses (picture cards vs. vocals). This finding is worth further evaluation in that it suggests teaching topographically different responses may be beneficial for some learners who are acquiring communicative responses. If so, response forms such as sign language and vocalizations may have advantages over picture cards, in that signs and vocals inherently involve unique

response forms across “words.” Future studies may compare the acquisition and generalization of communicative skills by teaching topographically similar responses as compared to topographically different responses. For example, an experimenter may conduct discrimination training sessions using topographically similar responses (e.g., two picture cards) for 2 preferred items, while concurrently teaching 2 topographically different responses (e.g., picture cards and sign language) for 2 different preferred items. Such a comparison would allow researchers to determine if there is a difference in acquisition time (or number of trials) when using similar or different topographies of responding. Similarly, an EO manipulation and/or generalization probes following training, might yield additional information regarding the efficacy of each training method.

Another finding in the present study was that two participants (Erin and Pablo) were unable to complete discrimination training using picture cards, yet were able to acquire responding using representative items (a seemingly easier discrimination task). Given the importance of communicative skills for persons with developmental disabilities, it seems relevant to identify which form of communication training is most appropriate for each individual. Researchers may attempt to develop assessment procedures in order to identify which is the most appropriate form of communication for each individual, so that extended periods of time are not spent in discrimination training without success. Assessments could include discrimination training probes of multiple topographies of communication (e.g., signing, vocalization, picture cards) in order to identify which form an individual acquires most rapidly. In addition, social validity screening would be conducted to evaluate which mode of verbal behavior

parents and teachers find to be most useful (Wolf, 1978). Similarly, students could be allowed to “choose” communication modes by having one mode reinforced in one area of the room and another mode in another area of the room.

Finally, future research may extend the results of the present study by evaluating whether discriminated mand responses acquired through discrimination training persist under less controlled settings. The ultimate goal of any communication training is that the individual will be able to communicate in his or her natural environment.

Therefore, an extension of the present study may include generalizations probes in more natural settings (e.g., classroom, home). The EO manipulation phase could be easily replicated in natural settings by providing access to one of the items, while withholding access to the other. Then, in the presence of two or more picture cards, if the individual hands over the picture card of the unavailable item, then generalization outside the experimental setting would be demonstrated.

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BIOGRAPHICAL SKETCH

Anibal Gutierrez Jr. was born in Panama City, Panama, in 1972 to Guadalupe and Anibal Gutierrez. Anibal lived in Panama until the age of 9 when he and his family moved to Miami, Florida. Anibal attended the University of Florida and in 1996 graduated with a Bachelor of Arts degree in anthropology. In 1997, he entered a graduate program in psychology at the University of Florida. He was awarded his Master of Science degree in psychology in 2001.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Associate Professor of Psychology

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Henry S. Pennypacker, Co-Chair
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Brian A. Iwata
Professor of Psychology

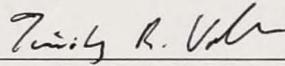
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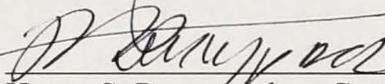
Maureen Conroy
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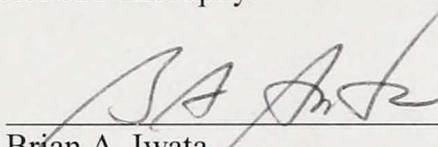
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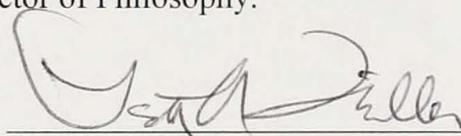
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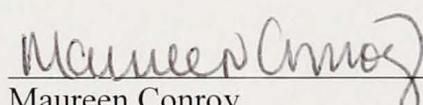
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Maureen Conroy
Associate Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 2004

Dean, Graduate School

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