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An experimental analysis of generative manding in preschool children : a thesis ...

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An Experimental Analysis of Generative Manding in Preschool Children

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Abstract

This study examined the development of mands for missing objects. Two female children and two male children (ranging from 2 years, 1 month to 3 years, 5 months) were selected on the basis of screening probes that indicated an absence of manding. A mand probe consisted of instructions to complete a response chain when one of the needed objects was missing. For every response chain, each child was: (a) taught to label (tact) the objects, (b) then taught to use the objects in reinforced response chains, and (c) then given mand probes for the stimuli just trained.

Results for all children indicated correct responses to tact and operation probes but incorrect responses to the mand probes. After pretraining, mands were trained one at a time until generalized manding developed. The efficacy of the training procedures was established by using a multiple probe design. These results are discussed in terms of mands and tacts representing distinct response classes.

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An Experimental Analysis of Generative Manding in Preschool Children

Operantly oriented language research has stressed the need for training functional responses that provide a means for the child to gain maximal control of the environment (Goetz, Schuler & Sailor, 1979; Guess, Sailor & Baer, 1974; Hart & Risley, 1968; McCoy & Buchholt, 1981). Functional responses are defined as "responses that occur naturally in the nontraining environment and that have the potential for being intrinsically reinforcing" (Goetz et al, 1979, p. 335). Because functional responses are likely to be reinforced outside of the training setting, generalization and maintenance are more likely (Baer & Wolf, 1970; Guess, Keogh & Sailor, 1978; Hart & Risley, 1968; Simic & Bucher, 1980).

Some types of functional responses, such as requests, are more likely to be emitted as spontaneous speech, speech not prompted by an adult model or by adult questions (Hart & Risley, 1968; Lovaas, 1977). Requests have been defined as a child wanting something such as an action, object, or compliance and then adequately specifying what is wanted (Bruner, Roy & Ratner, 1982; Hart & Risley, 1968). Thus, in a classroom setting, the initiation of spontaneous requesting is not dependent on teacher prompts but rather is controlled by the preschool materials that currently function as reinforcers and by the presence of a listener.

In general, preschool children use a high frequency of requests (Hart & Risley, 1980; Levine & Rubin, 1983; Prinz, 1982; Rom & Bliss, 1981). In fact the percentage of requests made by older children was not greater than that for preschool children (Levine & Rubin, 1983), nor did the percentage of requests in relation to other statements change over a year for children in three preschools (Hart & Risley, 1980). In an observational study of preschooler's requests, Prinz (1982) reported that language was used to "organize activities and each other's behavior" (p. 83).

The relationship between the speaker and the listener underscores the social value of requests. Interactions between persons that are a function of requests are cooperative and require knowing when to request, the likelihood that the listener will comply, and a host of other contextual cues (Bruner et al, 1982; Prinz, 1982). The learning of successful requesting strategies at this young age may be related to other indices of social skill. Prinz (1982) reported that language-delayed children used grammatically incorrect requests more often than normal preschool children and that the language-delayed children had more difficulty discriminating polite from impolite requests.

Functional responses such as requests may stimulate later language acquisition. Sundberg (1980) reported that requests for objects were learned more quickly than names for objects. Hart and Risley (1968, 1974, 1975, 1980) have reported using preschool children's requests as effective opportunities to teach other kinds of descriptive language such as adjective-noun combinations and compound sentence usage. Mithaug and Wolfe (1976) and Hart and Risley (1975) have reported the successful manipulation of environmental contingencies such that requests were used to explicitly teach and reinforce social/language interactions between preschool children. However, despite the interest in requests, very little research has been done on the development of requesting (Bruner et al., 1982).

Some operantly-oriented researchers have recently begun to use Skinner's (1957) term, the mand, to describe responses known as requests (e.g., Hall, Sundberg & Stafford, 1979; Hart & Risley, 1980; Lamarre & Holland, 1983; Sundberg, 1980; Simic & Bucher, 1980). Skinner suggested the mand as a unit of verbal behavior. He defined verbal behavior as responses that are reinforced through the mediation of other persons. That is, important controlling variables are found in the interaction between speaker and listener. Reinforcement mediated by a listener is particularly important in requests or mands where the listener is asked to cooperate by providing what was requested. For example, consider a child who when thirsty requests water, or a child who when given a bowl of cereal but no spoon, asks the mother for a spoon. By definition, mands specify their own reinforcement and are commonly referred to as requests, commands, demands, or in some instances as questions. The mand may be important in early language development because the child learns that these behaviors can be effective in manipulating his/her environment to obtain reinforcement.

A mand is a class of verbal responses defined not by topographical similarity of the responses, but by the relationship of the response class to the contingencies of reinforcement, including relevant setting and discriminative stimuli. Thus, a single response such as the word "fire" might function as a mand ("Fire the guns!"); however, under different circumstances the same word would have different functions (e.g., "Fire!" as a label for a blaze; "fire" as an answer to a question or as an imitative response). Thus, the classification of a verbal response as either a mand or some other verbal response class is not based on the form of the response but on the contingencies of reinforcement prevailing at the time it is emitted.

Skinner (1957, pp. 36, 185) suggests that a person tends to mand things that are reinforcing and that the topography of the mand and its probability of occurrence are greatly influenced by variables that determine the effectiveness of a reinforcer. Privation/deprivation and satiation are among the situational variables that would be important in controlling mand variables using Skinner's definition. These variables are understandable with unconditioned reinforcers, but require extension in order to account for mand behavior under the control of conditioned reinforcers.

Michael (1982) outlined the establishing operation which he hypothesizes to be the major controlling variable of the mand. An establishing operation is defined as a stimulus change that alters the value of some object or event as a reinforcer as well as changing the probability of the responses that have led to this type of reinforcer in the past. For example, water deprivation could have two effects--the altered effectiveness of water as a reinforcer could be changed, and the increased probability of occurrence of behaviors previously reinforced by water.

Skinner (1957) outlined other classes of verbal behavior in terms of their reinforcement contingencies. This thesis focuses on conditions sufficient to promote the emergence of mand behaviors. A summary of the theoretical properties of the mand, echoic, and tact behaviors is shown in Table 1.

Table I

Theoretical Properties of Mands, Echoics and Tacts

Behavior Class	Antecedent Events	Consequent Events
MAND	Unspecified	Correlated with topography of mand
ECHOIC	Discriminative stimulus that matches echoic response	Unspecified
TACT	Non-auditory verbal discriminative stimulus lacking a clear topographical correspondence to the tact	Unspecified

Consider the example where a child says "fire" in response to an adult who says "fire." This is a contingency that Skinner (1957, p. 55) called an echoic. The defining features of the echoic contingency are that the response matches a prior stimulus in topography and that the stimulus and response be in the same sense mode (in this case, auditory). The echoic is instrumental in early language development.

The response "car" when a car is present is an example of another verbal operant, the tact. Tacts are often labels or names of objects, events actions, and properties of objects. The tact has been defined as a response under the discriminative control of a nonverbal stimulus; that is, some object or event (Skinner, 1957, p. 81). Discriminative control is developed through the social reinforcement of tact responses in the presence of the nonverbal stimuli. Educational systems typically structure a listener to reinforce tacts, particularly during language acquisition.

Multiple Control of the Mand

Very often a response is under the simultaneous control of a number of different variables (Skinner, 1953; 1957). For example, within a single verbal operant such as the mand, response probability varies from moment to moment depending on different (multiple) sources of control. The different sources of control can be illustrated by a child who is thirsty; i.e., in a state of deprivation. A "pure" mand is primarily under the control of motivational variables (deprivation/satiation) or what Michael (1982) calls an establishing operation. That is, under extreme deprivation for example, the mand "water" may be emitted independent of discriminative stimuli and may even be emitted in the absence of a listener (Skinner, 1957, p. 52).

However, "pure" mands are rarely achieved. Responses are usually controlled by multiple variables. For example, with a thirsty child who is shown a glass of water and responds "water," the response is under the control of water deprivation, the audience and the glass of water (tact). Although properly classified as a mand, the presence of the glass of water acts as a discriminative stimulus and thus increases the probability of a mand response. Additional sources of multiple control include prior verbal stimuli such as when a parent says to a child, "Do you want water?" Here discriminative control is exerted by the question as well as by the echoic stimulus "water."

Practical implications for an analysis of the mand in terms of multiple sources of control are important for both the assessment and training of the mand. For example, does the child mand objects or events that are desired? Does the child ask for water when thirsty? Does the child ask for a coat when cold? Does the child spontaneously request needed objects that are present and missing? If nonverbal behavior such as crying is emitted, does the child emit a mand when prompted with a question ("What do you want?")? These potential sources of control can also be used to create effective training procedures. Many studies that taught mands first reported establishing responses to echoic prompts and then transferring control to some other verbal or nonverbal prompts (Hall et al, 1979; Lovaas, 1977; Simic & Bucher, 1980; Sundberg, 1980).

Review of the Literature

Although investigators have agreed on the importance of manding (Hart & Risley, 1968, 1974; Lovaas, 1977; Skinner, 1957; Sundberg, 1980; Sundberg, Ray, Braam, Stafford, Rueber & Braam, 1980), in general the methodologies employed by these investigators have been varied. No single experimental procedure has emerged to measure mands for experimental purposes. Part of the reason is that some studies have been more concerned with teaching labels than requests. For example, Hart and Risley have used access to desired preschool materials contingent upon requests. This situation was then used successfully to teach language expansion by prompting adjective-noun combinations (1968, 1974) and compound sentence usage (1975). Reinforcement for this elaborated language consisted of praise and the receipt of the object.

In his report on intensive language instruction with autistic children, Lovaas (1977) trained mands for food items. Through the use of echoic prompts, the control of the mand response was transferred to the visible food item and the question prompt, "What do you want?" The next step in the program was to teach spontaneous manding; that is, mands that were not prompted by teacher verbal behavior. However, no specific procedures were reported to train spontaneous mands other than suggesting the teacher wait for them to occur.

Waiting for a response to occur by not providing a verbal prompt has been called a time delay (Halle, Marshall & Spradlin, 1979; Sundberg, et al., 1980; Touchette, 1971). Halle et al., (1979) investigated the role of a time delay in evoking mands. The delivery of institutionalized children's breakfast trays were delayed fifteen seconds. For most of the children the time delay was a sufficient condition to evoke food requests not only at breakfast but at lunch time.

Simic and Bucher (1980) examined the development of mands for food items with retarded children. Mand training occurred at a table in the training room. The target response was saying "I want" and touching the food item. This mand training was not a sufficient condition for mands to be emitted to the trainer or other persons when they stood five ft away from the children, both in the training room and a playroom. However, when mand training occurred in the training room with the trainer standing five ft away, mand responses transferred to the playroom and to other people.

Sundberg and his colleagues (e.g., Hall et al, 1979); Sundberg, 1980) have approached language training based on Skinner's (1957) operant analysis of verbal behavior and thus have employed procedures closely reflecting this theoretical orientation. These studies have used response chains under discriminative control to establish conditions appropriate to evoke and measure a mand response. First a child learned a response chain (operation) in which he/she manipulated several objects appropriately and received reinforcement contingent upon completion of the response chain. A mand was evoked by presenting the instructions to engage in this learned response chain and, in addition, by keeping one of the objects either out of reach or out of sight. Because the absent object is necessary to complete the response chain that leads to reinforcement, it will function as a reinforcer for responses that procure it. For example, suppose an adult gives a child a coloring book but no crayons and tells the child, "Color some pictures." If coloring is a reinforcing activity, the missing object (the crayon) will function as reinforcement for any requests or mands.

These contrived situations for investigating mands are valuable because they create a context in which mands are likely to be evoked and reinforced. Mands under the control of a response chain and a missing element from that response chain are spontaneous in the sense that the child's language is not prompted by the adult or teacher, but by contingencies that are associated with completion of a response chain.

In a series of studies, Sundberg (1980) taught Skinner's verbal operants using sign language with retarded children. He reported that mands were learned more quickly than tacts, perhaps due to the special response-reinforcer relationship the mand has. He also identified procedures for training the mand.

Using the same response chain methodology, Hall et al., (1979) examined procedures to train mands for missing objects. The mands were measured by probes that consisted of the trainer presenting all the objects except one, and the instructions to begin the previously learned response chain. Mand training, the independent variable, was implemented sequentially across different response chains. After training, the participants were able to mand the missing elements from a response chain. Thus, the mands came under the control of the contingencies associated with the completion of a response chain.

In general all the studies except Hall et al., (1979) have examined mands when the putative reinforcer was present. Because reinforcers can have discriminative properties, most of the investigations relating to mands have employed procedures with mands under discriminative control. Hall et al. provide the only analysis of contingencies that bring about manding in the absence of corresponding discriminative stimuli (i.e., a missing object in a response chain). Sundberg (1980) has also reported the development of requests for missing objects although limited data were presented.

The response chain techniques used by Hall et al. (1979) and Sundberg (1980) seem to offer reliable and practical ways to create appropriate conditions to control and reinforce a request. The dependent variables have typically consisted of mand probes, the presentation of previously learned response chains with one object missing. This behavioral assessment procedure allows the investigation of a number of independent variables: Response chain control, echoic stimuli, reinforcers and discriminative control over mand-related tacts (Skinner, 1957; Sundberg, 1980). Because of the potential number of independent variables, the mand probes can be constructed in different ways to provide dependent measures of many combinations of controlling variables. Thus, the response chain technique provides a means of looking at generalization and the variables of which generalization may be a function.

Generative Responding

One criticism leveled against a behavioral analysis of language is that it does not adequately account for the fact that children emit novel language (Chomsky, 1959; Lennenberg, 1962). This is generative responding or generativity) and refers to the production of novel verbal behavior.

Behavioral researchers have also noted their inability to obtain consistent transfer of training or generalized responding (Guess et al., 1978; Lovaas, 1977; Spradlin & Siegel, 1982). Investigators have recognized that they cannot passively hope for generalization but must actively explore procedures that will facilitate generalization (Stokes & Baer, 1977).

Two kinds of generalization have been described. The first, stimulus generalization, is defined by the occurrence of trained responses in nontraining conditions; that is, in new settings with new people or with new contingencies (Guess et al., 1978). When a verbal response is reinforced in the presence of certain stimuli, stimulus generalization occurs to the extent that the same response now occurs in different stimuli. Prior to training these stimulus response relationships were not evident. Simic and Bucher (1980) obtained stimulus generalization of the mand to a new setting and to people other than the trainer. Hall et al., (1979) obtained generalization to persons other than the trainer.

The second kind of generalization refers to the emergence of novel responses as a function of prior training and is called response generalization or response induction. The concept of response class has been used to account for response generalization. A response class is a set of responses functionally related to a common reinforcement contingency, including antecedent variables. Thus, when one member of a response class is reinforced, the probability of occurrence of other, unreinforced members may increase (Skinner, 1953, 1957).

The generative responding concept fits clearly with a behavioral analysis of response generalization. In an early study, Guess, Sailor, Rutheford and Baer (1968) attempted to demonstrate the role of imitation and differential reinforcement in the development of generativity. The experimenters chose the plural morphene to represent a response class. A retarded child was taught to label single objects and then pairs of those objects. After training a few objects in a sequential manner, pairs of objects began to control the plural morphene response without any direct training. Similar procedures have replicated the establishment of generative responding with verbs in the past and present tense (Schumaker & Sherman, 1970), and the generative use of sentence answers to different kinds of questions (Clark & Sherman, 1975). Because these experiments identify modeling and differential reinforcement as variables capable of producing generative language, potential teaching procedures are available for addressing children's language deficits. All these studies used what Stokes and Baer have called the training of sufficient exemplars; that is, generativity was obtained by repeated training with different examples.

Generative responding may also be under discriminative control by stimulus classes or concepts. Sidman and his colleagues have been concerned with the development of stimulus equivalences and examined their subsequent effect on the emergence of new behavior (Lazar, 1977, 1984; Sidman, 1971; Sidman, Cresson & Wilson-Morris, 1974; Sidman & Tailby, 1982). In general, this area of research has focused on mediated transfer, equivalent stimuli and derived stimulus relations. These concepts refer to the development of new relationships between two stimuli that are associated with a third stimulus but not with each other. For example, if stimulus A and stimulus B, which have not been associated, are each associated with stimulus C, then a new relationship between A and B results. The new A-B relationship is mediated by the A-C and B-C associations. Stimuli A, B and C may become functional members of the same stimulus class.

In general the mediated transfer research has indicated that stimulus classes are formed and the stimulus instances become equivalent or substitutable for each other within a given context. A stimulus class can be defined as a set of stimuli that control a similar response (Goldiamond, 1962). Thus, if one member of the stimulus class is conditioned to control a new response, the other members of the stimulus class will exert similar control even though there has not been a history of reinforcement for the new stimulus response relations. The concepts, stimulus class and stimulus equivalence also provide the potential for talking about and understanding the occurrence of novel responses in human verbal behavior.

The mediated transfer concepts may be useful in a behavioral analysis of the variables controlling the production of novel mands; that is, the development of mands that do not require direct training. Consider a group of stimuli (A, B, C, D) defined by an operation such that a child places these four stimuli in the box when given instructions to do so. Reinforcement is contingent upon putting these objects in the box. Thus, stimulus equivalences between stimuli A, B, C and D are established. Initially the subject would be unable to mand any of the stimuli comprising this operation. These mands would be assessed by giving the participant instructions to begin the operation but not supplying one of the objects necessary to complete the operation. Suppose the participant were then trained to mand object A when it was absent. Once the absence of stimulus "A" controls a mand, then the absence of another stimulus such as "B" might function to control a mand response because of mediated transfer under the control of equivalent stimuli "A" and "B." If this were the case, then stimulus equivalences may help explain the development of new mands in the absence of direct training. This model of generative manding would focus on a stimulus-class model rather than a response-generalization model.

The Present Study

This study investigated the development of generative manding for objects that were not present, using the response chain methodology that Sundberg (1980) has employed. Each preschool child was taught a number of response chains that led to reinforcement and the name (tact) of each object utilized in the chain. Training proceeded across the response chains in a multiple baseline fashion until the child emitted mand-tact verbalizations saying "I want" with object names that had not been previously involved in mand training.

Children were selected who did not emit mand-tact verbalizations although they could tact all objects incorporated in the response chains.

The dependent measures were assessed for each of the baselines (response chains) and included (a) the child's ability to name (tact) each object in the response chain, (b) the child's ability to execute a particular response chain when given appropriate trainer instructions, and (c) the child's ability to mand each object from each response chain when that object was not present.

The present study extended the analysis of the variables controlling mand behaviors in a number of ways. First, the study replicated the effectiveness of the response chain methodology. Previous studies using this technique analyzed sign language responses of retarded individuals (Hall et al., 1979; Sundberg, 1980). This study analyzed English language vocal behaviors by intellectually normal preschool children who were being trained by instructors who used spoken English instructions.

A second major extension of the present study was to examine mand-tact verbalizations that were not under the discriminative control of the tacted object. That is, the study examined the development of mands for objects when those objects were not present.

The last major contribution had to do with generative responding (Guess, et al., 1978; Schumaker & Sherman, 1970). No studies to date have conducted an experimental analysis of generalized manding for missing objects. Thus, the analysis of generative verbal responding was extended to a new functional behavior class.

Method

Participants

The participants were four preschool children from three different schools. They were Brian (2 years, 1 month), Brandon (3 years, 5 months), Stacy (3 years, 4 months) and Gwen (2 years, 2 months). Potential participants were identified by asking the classroom teacher which students did not request frequently. Participants were then screened by the trainer and an assistant. Screening consisted of training the child to complete one or two response chains. This was done by modeling the desired response and then presenting the two objects from a response chain and praising the praising the child for completing the response chain when instructed. Trials asking the child to label the objects from the response chain were interspersed with response chain trials. These training trials continued until the child had achieved three consecutive correct response chain trials and three consecutive correct labelling trials. At this point the trainer presented the child with instructions to complete a response chain but kept hidden one of the objects necessary to complete the response chain. If the child did not request the missing object on three trials, he or she was selected for the study. The respective parents were each given an announcement letter outlining the purpose of the study and requested to return a permission slip (see Appendix A-1 and A-2).

Setting

The experiment was conducted in three different preschools. Brian was trained in the lunch room of the Wee Care preschool while it was not in use. Brandon and Stacy were trained in the Small World preschool; Brandon sitting at a small table in the coat-room away from the other students, and Stacy at her regular table in the classroom when the other students were outside playing.

Gwen was trained at a small table in the classroom away from the other students in the Kindercare preschool.

Design

This study used a variant of the multiple baseline design called the multiple probe (Horner & Baer, 1978). Like the multiple baseline design (Baer, Wolfe & Risley, 1968; Hersen & Barlow, 1976), the multiple probe demonstrates the reliability of the independent variable by introducing it sequentially across a number of baselines. The multiple baseline and multiple probe not only provide successive replications of the effects of the independent variable but also provide an analysis of the baselines within which interventions are not occurring.

The multiple probe differs from the multiple baseline in that it provides an alternative to continuous measurement, especially when a high frequency of repeated measures is impractical or reactive (Horner & Baer, 1978). The alternative is to use intermittent probes. A probe is defined "as a change in conditions at some arbitrary point in an experiment made to evaluate or test for the conditions currently in control" (Verhave, 1966, p. 529).

In this study three different kinds of probes assessed responses to the stimuli in the different response chains. Each of these probes assessed whether the child could (a) execute the response chain when given instructions (operation probe), (b) name the objects in the response chain (tact probe), and (c) mand the missing object when instructed to start a response chain (mand probe).

After the probes indicated the child had learned the operations (operation probes) and learned to label the objects (tact probes), the independent variable, mand training, was introduced sequentially across the different stimuli from the response chains.

Procedures

Overview. The subjects and response chains for each operation were selected prior to the introduction of the independent variable, mand training. During pretraining Phase I (Table 2), the trainer taught the names (tacts) for all the objects in at least two different response chains. The criterion for tact training was seven consecutive correct (unprompted) responses. After tact training had been completed, operation training (Phase II) began. Operation training continued until the child correctly used the objects to complete a response when instructed to do so. The criterion was seven

Table II

Experimental Phases and Manipulations

Phase	Manipulation
Phase I	Tact Training
Phase II	Operation Training
Phase III	Mand Probes
Phase IV	Mand Training
Phase V	Post Training Mand & Tact Probes
(Repeat Phases IV and V with additional objects)	

consecutive correct responses.

After tact and operation training had been completed, baseline measures for manding were collected (Phase III). These consisted of seven mand probes for each of the objects in both response chains. If no mands emerged for any of the objects in either response chain, then during Phase IV mand training for object A began. After mand training had been completed, an assessment phase (V) began. This assessment consisted of the following sequence of probes for each object in all response chains: One mand probe, followed by one tact probe, and ending in another mand probe identical to the first. This sequence permitted an assessment of a prior tact probe on responses to a subsequent mand probe.

When necessary a second mand was trained in Phase VI with object B from the same response chain. Phase VII followed and was identical to Phase V. Mand training was scheduled to occur until the child manded all the stimuli as measured by the mand probes following mand training.

These same phases, I through VII, were repeated with additional response chains. The same sequence of phases was replicated with additional children.

Pretraining. During pretraining the children were trained to tact all the experimental stimulus objects from four or five response chains. These were the same stimuli that the children later learned to manipulate as part of a response chain (operation training) and to mand (mand training).

Tact training proceeded in two parts--an immediate prompt procedure followed by a delayed prompt procedure. In the immediate prompt procedure (Figure 1), training trials consisted of presentation of the object by the

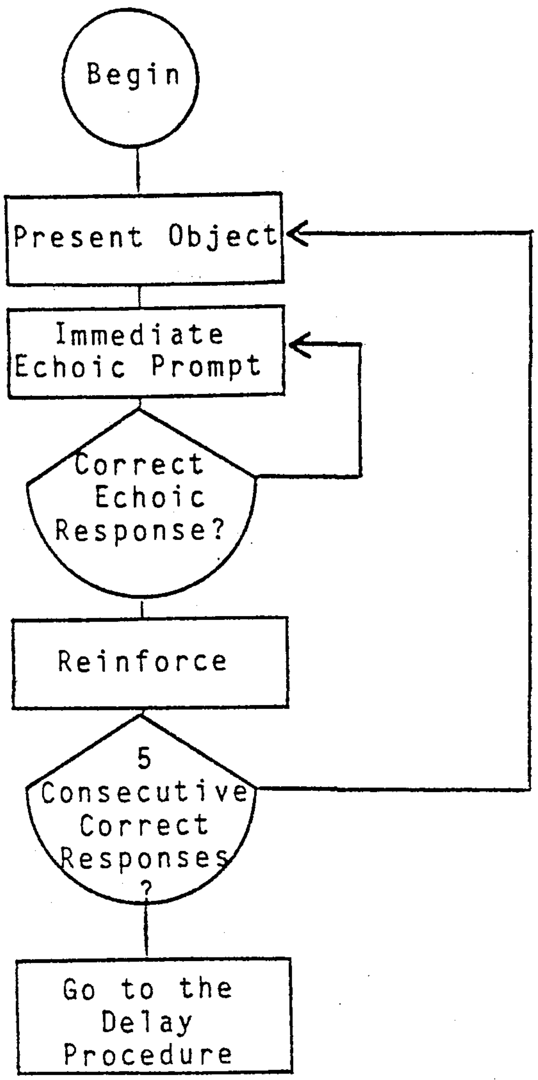


Figure 1. Tact Training: Immediate prompt procedure. These procedures were used to achieve transfer from echoic (prompt) to tact (object) variables (see text).

trainer, the echoic prompt, the child's response and reinforcement. Each trial was followed by an intertrial interval of approximately 5 s. The stimulus objects were removed during the intertrial interval (approximtely 5 s) and then presented again at the beginning of the next trial.

For example, in the immediate prompt procedure, the trainer presented an object (e.g., an eraser) and said, "What is this?" followed immediately with the echoic prompt, "Say eraser." The controlling variables were a question prompt followed by an echoic prompt with the eraser (nonverbal stimulus) present. An incorrect response (no echoic response within 5 s) resulted in redelivery of the echoic prompt by the trainer. Correct echoic responses were reinforced. Training continued until five consecutive correct echoic responses occurred. When this happened the delay procedure began.

The delay procedure (Touchette, 1971) is a transfer of stimulus control procedure and was employed in this study because of its effectiveness and speed (Sundberg, 1979). The procedure was identical to the above immediate prompt procedure except that the echoic prompt was delayed an additional second so that the trainer waited 2 s instead of 1 before delivering an echoic prompt. The trainer anticipated that responses would occur before the prompt was given. When responses occurred before or at the 2 s prompt, the prompt was then delayed an additional second so that 3 s passed before the echoic prompt was delivered. Using this procedure, responses came to be emitted in the absence of the trainer prompt.

Tact training with a particular stimulus was terminated when the child correctly labeled the stimulus object on seven consecutive trials without a trainer prompt.

After all the tact training had been completed, operation training began. The operations were response chains that involved manipulating two objects such that the topography of the response chain was appropriate to the trainer's instructions. The operations used are listed in Table 3.

The training of a response chain for a particular operation began with the appropriate trainer instructions and a correct model. If modeling was not enough then the trainer immediately provided a physical (manual) prompt in order to help the participant execute the correct response. Correct responses, whether prompted or not, were reinforced. The trainer prompts were faded over successive trials using minimal guidance

Table 3

Response Chain Stimuli and Instructions

	STIMULI	RESPONSE CHAIN/INSTRUCTIONS
I	Comb/Mirror	The chain involved placing the Comb inside the Mirror when instructed to "Put it together."
II	Indian/Horse	The chain involved putting a small toy Indian on top of the Horse when instructed to "Ride."
III	Ring/Post	The chain involved putting a plastic Ring on top of a Post when instructed to "Stack it."
IV	Frog/Net	The chain involved placing a plastic Net over a small plastic Frog when instructed to "Catch it."
V	Car/Track	The chain involved placing a small toy car on a strip of plastic racing track and pushing the car when instructed to "Drive."
VI	Car/Garage	The chain involved putting a small car inside a cardboard Garage when instructed to "Park it."
VII	Sticker/Book	The chain involved putting a Sticker inside a plastic book made especially for stickers when instructed to "Put it on."

until trainer instructions elicited the correct response chain.

A trial was defined by the presentation of the trainer instructions, the child's response and the consequences of the response (reinforcement). The inter-trial interval was approximately 5 s. The stimuli were not presented during this interval but were presented again at the beginning of the next trial.

Mand Training. Mand training trials (Figure 2) began by having the trainer give the child instructions to engage in a particular operation with two objects. However, only one of the two objects were placed on the table. The other object was kept out of sight.

Prior to beginning mand training, the trainer told the subject, "Ask for what you need." The first training trials employed an immediate prompt procedure similar to that described in the tact training section. Immediate echoic prompts were given until five consecutive correct echoic responses occurred. A correct response was defined as an audible echoic response within 5 s following the echoic prompt. For example, the trainer said, "Color," then immediately said, "Give me crayon." If the subject responded, "Give me crayon" within 5 s, the child was praised and given the crayon. The child was allowed to complete the operation

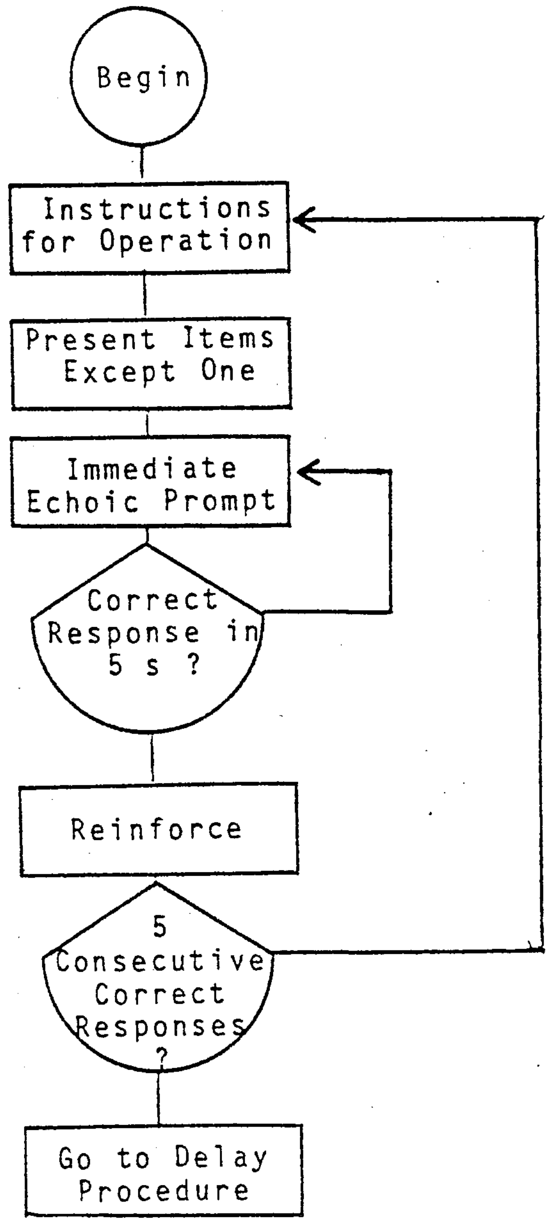


Figure 2. Mand Training: Immediate prompt procedure.

(coloring in the circle on the paper) and then reinforced. An incorrect echoic response resulted in delivery of the echoic prompt.

When the criterion was obtained, a delay procedure was used similar to that described in the pretraining section. When control over responding had been achieved at the shorter delay, the echoic prompt was delayed an additional second. Gradually the responses began to occur prior to the echoic prompts. Transfer of control had then occurred from the echoic prompt to instructions to begin the operation. Mand training was terminated when five consecutive correct responses without an echoic prompt had been achieved.

Reinforcement. Whenever reinforcement is indicated in the text, it refers to a number of consequences. These included trainer eye contact, verbal praise (e.g., "good") and smiling. Gwen was given stickers for eye contact and appropriate sitting.

Measures and Probes

The dependent measure was a correct request for an object that was necessary to complete a response chain but was missing. Correct requests were assessed during operation probes, mand probes and tact probes. The probes assessed the child's ability to complete the nonverbal response chain as well as tracking the development of mands and tacts for each object in the response chains.

An operation probe began when the trainer presented the objects necessary to complete a given response chain. The trainer then gave the instructions to engage in the response chain. For example, the trainer might have presented a ring and a post and said, "Stack it." A response was scored as correct if the child placed the ring on the post within 10 s.

A tact probe began when the trainer presented an object to the participant. The trainer pointed to the object and asked, "What is this?" A correct response was defined as an auditory naming response within 10 s. An incorrect response was scored if no response was emitted or if the object was incorrectly labeled by the participant.

Mand probes could only be scheduled after an operation had been trained. A mand probe (Figure 3) began when the trainer gave the instructions to engage in a particular response chain. For example, the trainer said, "Stack it," but presented only one object (the post), keeping the other object (the ring) out of sight. The child was given 10 s to mand the ring. Correct

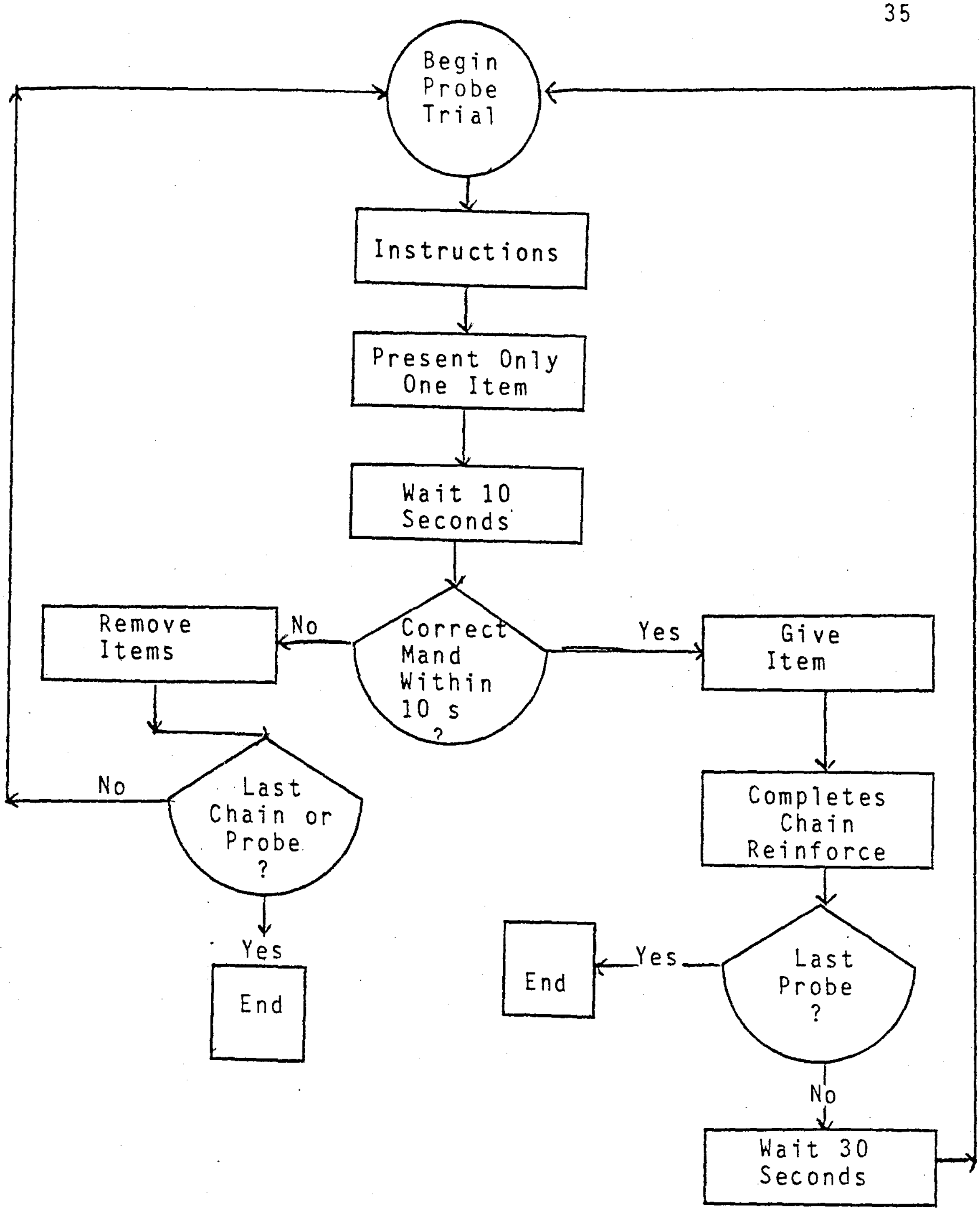


Figure 3. Mand Probe.

responses included the object name by itself, the object name with a verb (want, give, need, etc.) or the object name with "please."

Reliability

Two independent observers scored the trials in each phase of the experiment. Each trial was scored as either correct (not prompted) or incorrect (prompted). The experiment was broken down into pretraining (tact, operation and mand probes), mand training and post-mand training probes (mand and tact). The scorer agreement measure used was a percentage agreement formula which was calculated for each of the different kinds of probes in pretraining or post-training. In some cases where there were many trials, not every trial was used for purposes of calculating interobserver agreement.

A minimum of 20% of the total trials was used to arrive at a percentage agreement. A die was rolled for each response chain to determine whether the trials used to calculate agreement were drawn from the initial trials or from the last trials, when the criterion was reached.

During pretraining with Brian, the observers obtained 100% agreement on the tact probes, 93% agreement on operation probes and 100% agreement on mand probes. During mand training, there was 83% agreement and during the post-training trials, the interobserver agreement was 100% for mands and 87.5% for tacts.

For Brian the observer agreement during pretraining was 100% for tact probes, 100% for operation probes and 100% for mand probes. Mand training agreement was 89.7% and post-training data yielded scores of 100% reliability for both tact and mand probes.

The interobserver agreement for Stacy was 100% across all conditions: Pretraining tact, operation and mand probes; mand training probes and post-training mand and tact probes.

For Gwen the pretraining agreement scores were 97.7% for tact probes, 95.5% for operation probes and 100% for mand probes. Interobserver agreement was 100% for mand training and post-training tact and mand trials.

Results

The results of the present study indicate that tact and operation training produced accurate object labeling and instruction (following the completion of response chains). Manding did not develop during pretraining for any of the objects. Subsequent mand training was effective in producing mands for the training stimuli when they were missing. In addition, after two mands were trained, correct mand responses generalized to untrained stimuli.

Figures 4 through 7 show the cumulative number of correct responses to tact, operation, and mand probes for the four children. For each operation and for all children, the sequence of tact, operation and mand probes revealed similar behavioral patterns. First, the tact training resulted in the children correctly labeling the objects in a particular response chain. Operation training resulted in the children completing the required response chains. However, these procedures did not result in the children requesting the missing objects during mand probes. Thus, mands for missing objects did not develop as a result of the combination of training object labels (tacts) and training object use (operation training). No functional relationship between tact/operation training and subsequent manding was observed with seventeen operations (34 stimuli) across four children.

For any particular response chain, the criterion was seven consecutive correct tact probes for each of the two objects of the response chain (minimum of 14 tact

Figure 4. Cumulative correct responses by Brian to tact, operation and mand probes for each of the stimuli/operations. The stimuli are grouped by operations; individual stimuli are represented by open and closed data points. A "c" next to a data point indicates when a training criterion was reached.

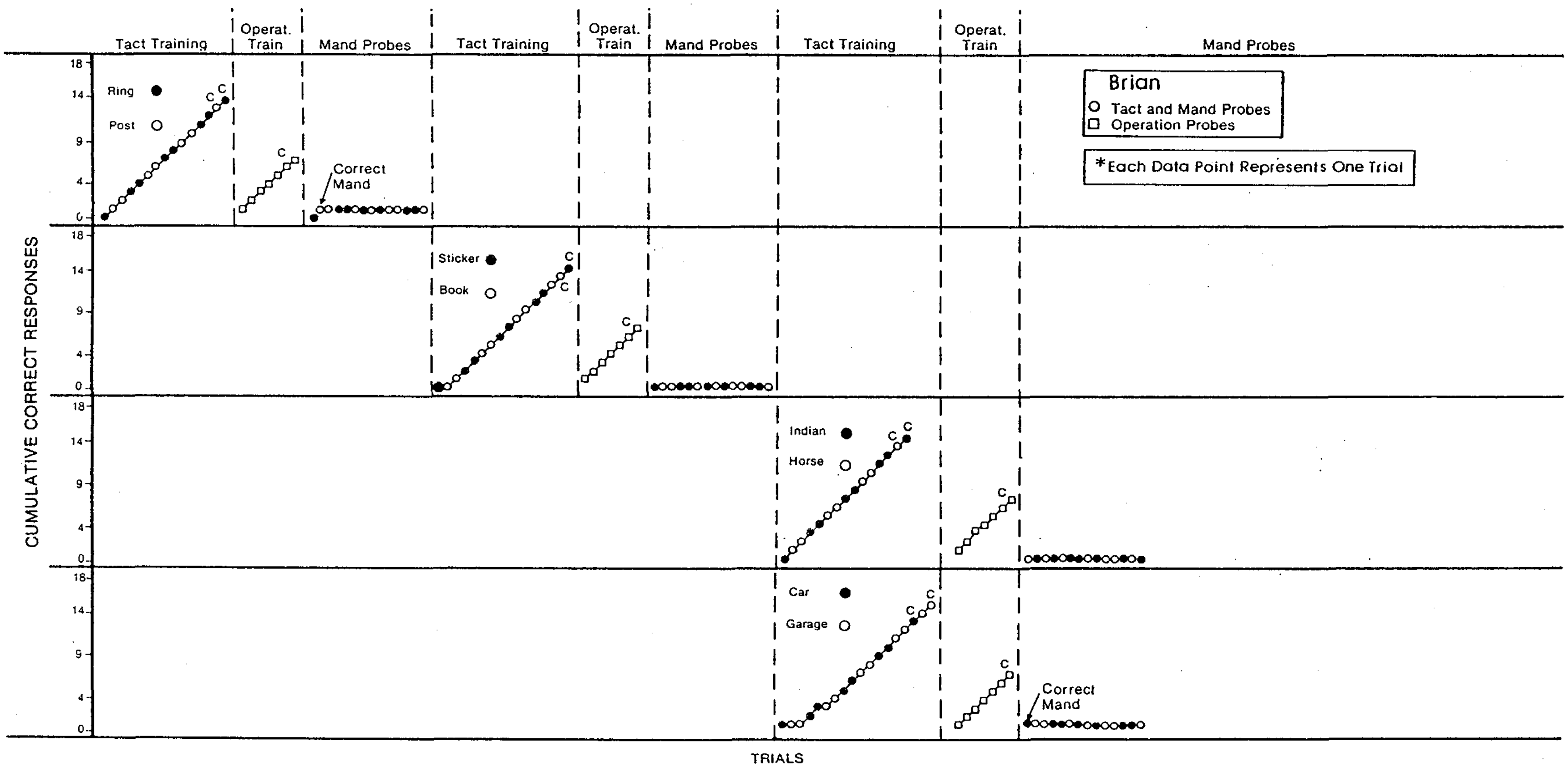


Figure 5. Cumulative correct responses by Brandon to tact, operation and mand probes for each of the stimuli/operations. The stimuli are grouped by operations; individual stimuli are represented by open and closed data points. A "c" next to a data point indicates when a training criterion was reached.

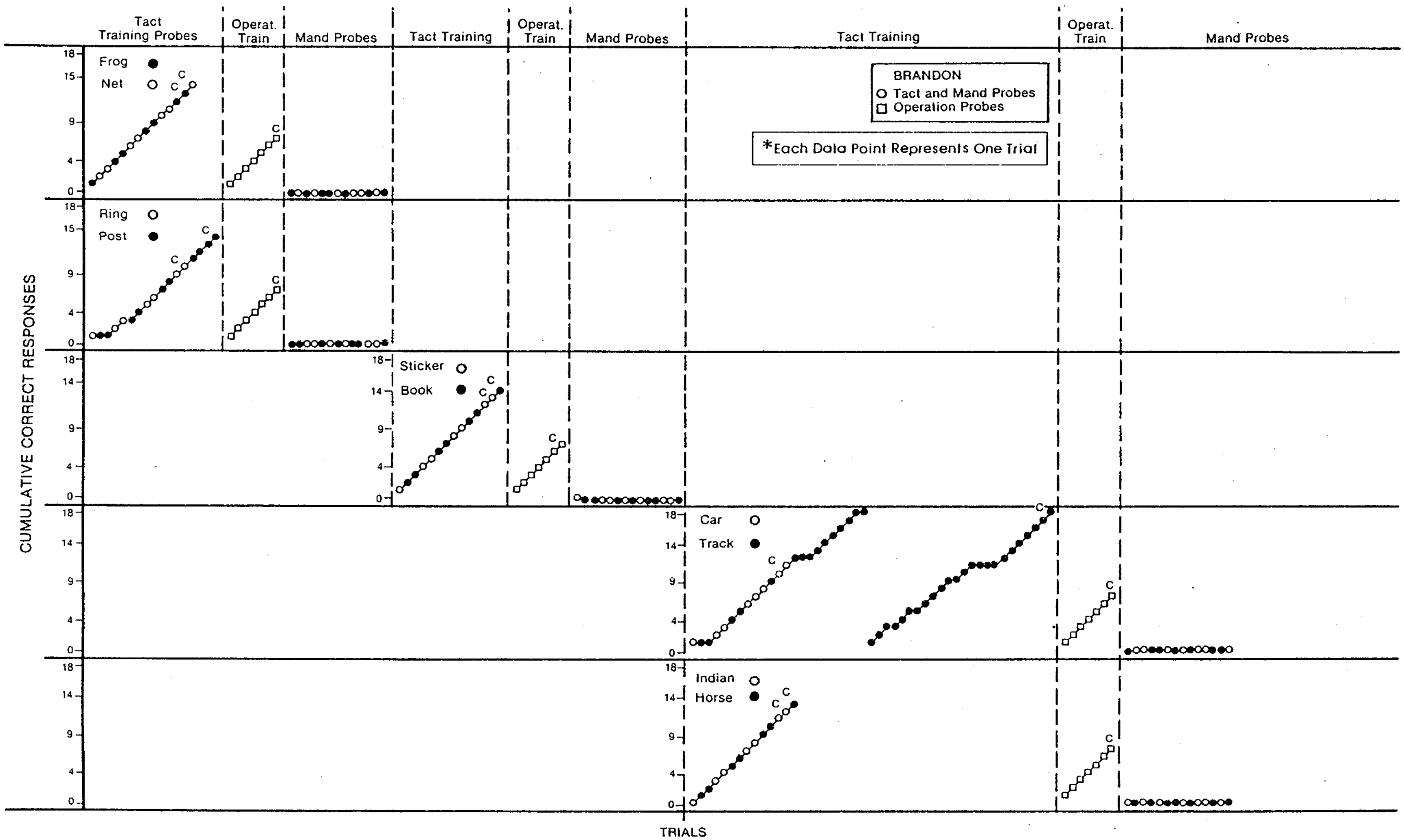


Figure 6. Cumulative correct responses by Stacy to tact, operation and mand probes for each of the stimuli/operations. The stimuli are grouped by operations; individual stimuli are represented by open and closed data points. A "c" next to a data point indicates when a training criterion was reached.

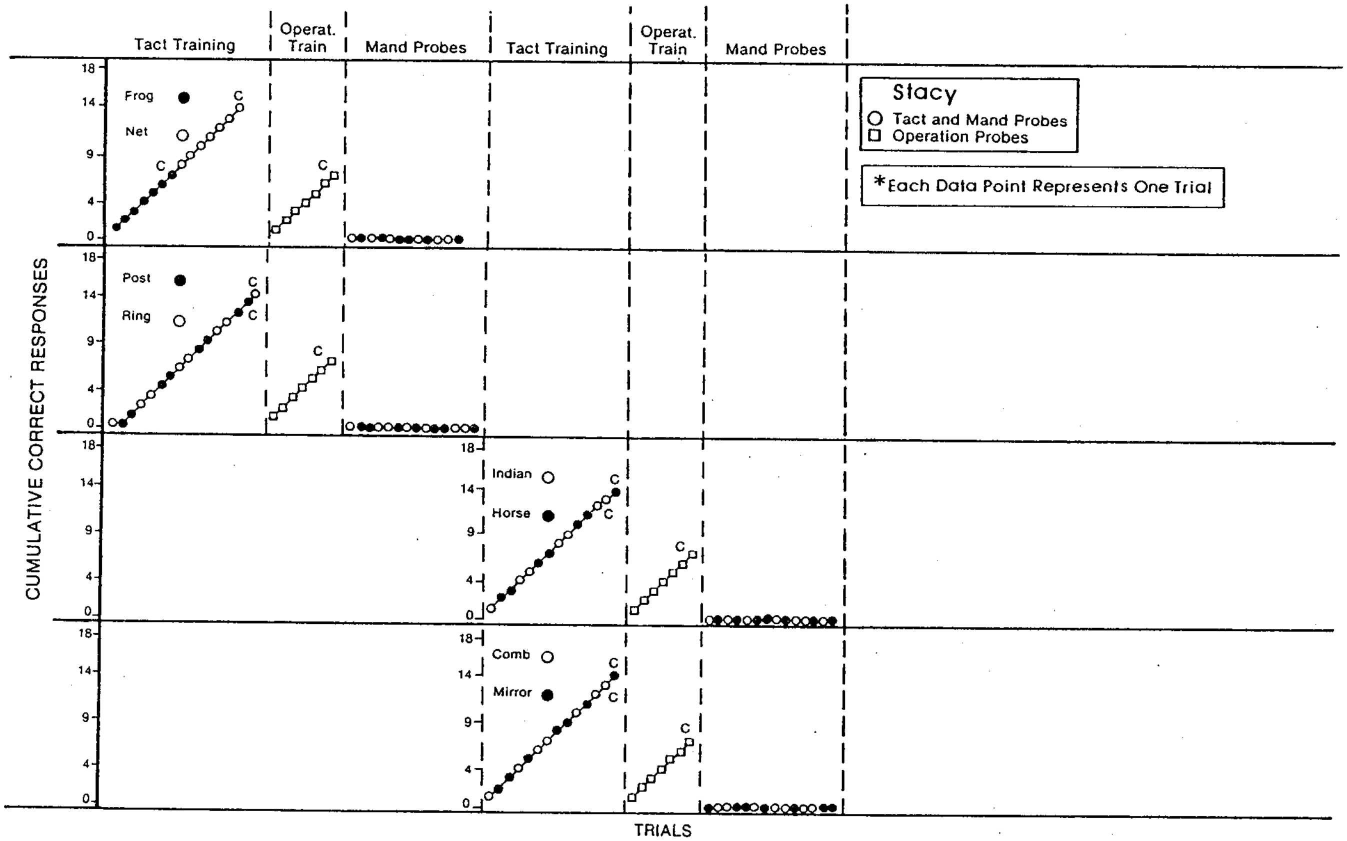
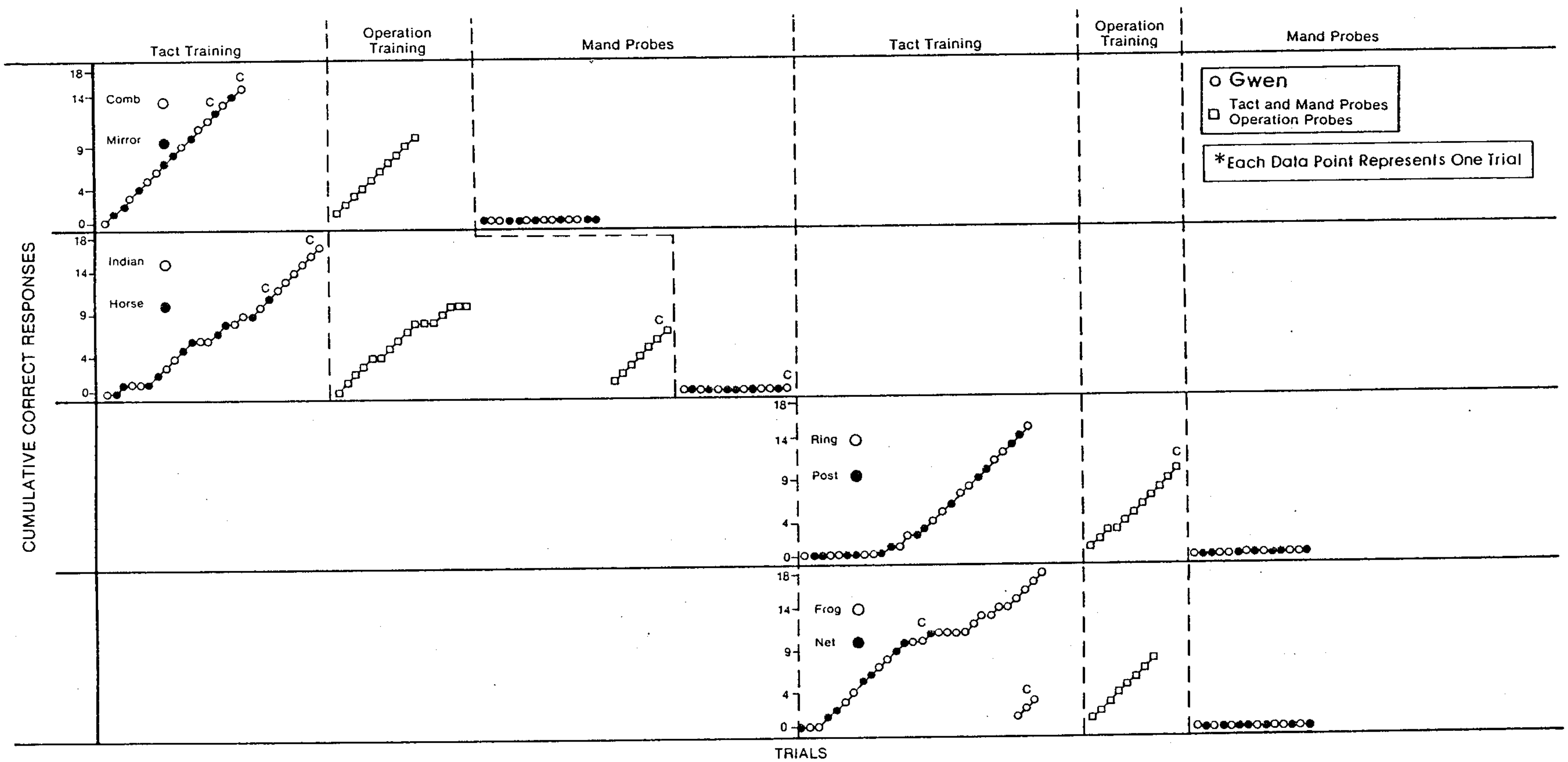


Figure 7. Cumulative correct responses by Gwen to tact, operation and mand probes for each of the stimuli/operations. The stimuli are grouped by operations; individual stimuli are represented by open and closed data points. A "c" next to a data point indicates when a training criterion was reached.



probes per operations); seven consecutive correct operation probes that involved both stimuli (minimum of seven probes), and seven mand probes for each of the two objects (a minimum of 14 mand probes). The number of mand probes was essentially the same across all four children--approximately seven per stimulus object.

However, the number of tact and operation probes could and did vary among the children. Table 4 shows the number of tact trials per operation for each of the children. In addition, the mean number of tact trials per operation per child are reported in the far-right column. Only two operations (Indian and Horse, Ring and Post) were used with all four children. These four children required a total of 69 tact trials for Indian and Horse, and 80 for Ring and Post. The means were 17.2 and 20.0 respectively.

Three children used the Frog and Net response chain. On the average, 18.6 tact trials were required per child to reach criterion for the Frog and Net. Comb and Mirror required 15.5 tact trials on the average for a child to achieve criterion. The means for the other response chains were similar. Only the Car and Track operation differed greatly from the rest in terms of the number of trials to reach criterion. On this operation, Brandon required a total of 46 tact trials to reach criterion: 7 for Car and 39 for Track.

TABLE 4

Number of Tact Trials per Operation by Subjects

Operation	Stimuli	Brian	Brandon	Stacy	Gwen	Mean
I	Comb/Mirror			14	17	15.5
II	Indian/Horse	15	14	14	26	17.2
III	Ring/Post	15	17	16	32	20.0
IV	Frog/Net		14	15	27	18.6
V	Car/Track		46			46.0
VI	Car/Garage	18				18.0
VII	Sticker/Horse	16	14			15.0

Table 5 shows the total number of tact trials Brian took to reach criterion with each object from operations II, III, VI and VII. For each object a minimum of seven tact training trials was possible. The stimulus objects from operations III and VIII were trained first. Ring required seven tact training trials; Post, 7; Sticker, 8, and Book, 8. Next the stimuli from operations II and VI were trained. Indian took 8 trials; House, 7; Car, 8, and Garage, 10. All the operations were learned in approximately the same number of trials, suggesting there were no major differences between the stimuli or among the response chains.

Stacy (see Table 6) required a minimum of 7 tact trials (five objects) and a maximum of 8 tact trials (three objects) to reach criterion with her eight objects. She had the fewest tact trials per response chain: 14 for Comb and Mirror; 14 for Indian and Horse; 16 for Ring and Post, and 15 for Frog and Net.

Table 7 shows the number of tact training trials Brandon took to criterion for each stimulus object. Brandon required 7 trials for Horse, 7 for Indian, 10 for Post; 7 for Frog, 7 for Net, 7 for car; 39 for Track, 7 for Sticker and 7 for Book. All tacts reached

TABLE 5

Tact Training Trials to Criterion for Brian

Operation	Stimuli	Trials	Total Trials/Operations
II	Indian	8	15
	Horse	7	
III	Ring	8	15
	Post	7	
VI	Car	8	18
	Garage	10	
VIII	Sticker	8	16
	Book	8	

TABLE 6

Tact Training Trials to Criterion for Stacy

Operation	Stimuli	Trials	Total Trials/Operations
I	Comb	7	14
	Mirror	7	
II	Indian	7	14
	Horse	7	
III	Ring	8	16
	Post	8	
IV	Frog	8	15
	Net	7	

Table 7

Tact Training Trials to Criterion for Brandon

Operation	Stimuli	Trials	Total Trials/Operations
II	Indian	7	14
	Horse	7	
III	Ring	7	17
	Post	10	
IV	Frog	7	14
	Net	7	
V	Car	7	45
	Track	39	
VII	Sticker	7	14
	Book	7	

the training criterion with the minimum number of trials possible except for Track and Post. Brandon had problems learning the label for a small strip of plastic racing track used with toy cars. Other than Car and Track, Brandon reached criterion with his stimuli in a number of trials similar to that required by Brian and Stacy.

Gwen (Table 8) required 8 tact trials with Comb, 7 with Mirror, 16 with Indian; 10 with Horse, 13 with both Ring and Post, 8 with Frog and 24 with Net. For the other three subjects combined, only one object took more than ten trials to reach criterion. Gwen, by herself, had four stimuli that required over ten trials to reach criterion (Indian, Ring, Post and Net). Gwen's data are different from the other children because of the greater number of trials to reach criterion. However, Gwen's data are also similar in that none of her stimuli or response chains were very different from each other. She required more tact trials, but this was evident with most of the stimuli.

Mand training and the subsequent assessment of generalization began after completion of the pretraining tact, operation and mand probes. The mand training trials for each subject are presented in Table 9. All

Table 8

Tact Training Trials to Criterion for Gwen

Operation	Stimuli	Trials	Total Trials/Operations
I	Comb	8	15
	Mirror	7	
II	Indian	16	26
	Horse	10	
III	Ring	13	26
	Post	13	
IV	Frog	8	32
	Net	24	

Table 9

Mand Training Trials to Criterion

Subject	Stimulus Object	Mand Training Trials
Gwen	Comb	99
	Ring	15 (and an additional 25 retraining trials)
Stacy	Net	12
	Frog	6
Brandon	Frog	43
	Net	38
Brian	Car	6
	Garage	22

children received mand training with two stimuli before generalized manding developed for both trained and untrained stimuli. Stacy required 12 mand-training trials to reach criterion with Net and then only 6 trials with the second object trained (Frog). Brandon required 43 trials with the Frog and then 28 with the Net. Brian took 6 training trials to acquire the mand for Car and then 22 trials for the Garage. Gwen manded the Comb after 99 training trials and the Ring after 15 trials. (Ring had to be retrained and required an additional 9 trials.)

Stacy, Brandon and Gwen showed fewer training trials to acquire their second mand. In contrast, Brian required more trials to learn his second mand (Garage).

Figures 8, 9, 10 and 11 show the extent of generalization as a result of mand training. After mand training with a single stimulus, a series of mand and tact probes assessed generalization to the other operations. For every operation, the assessment consisted of a three-probe sequence: (a) A mand probe for the missing object followed by (b) a tact probe for the same object when present, and (c) a second mand probe identical to the first. In Figures 8 through 11, the mand probes are depicted by circles and tact probes by triangles. Mand

Figure 8. Correct or incorrect manding and tacting for Brian to trained and untrained stimuli. Triangles are tact probes and circles are mand probes.

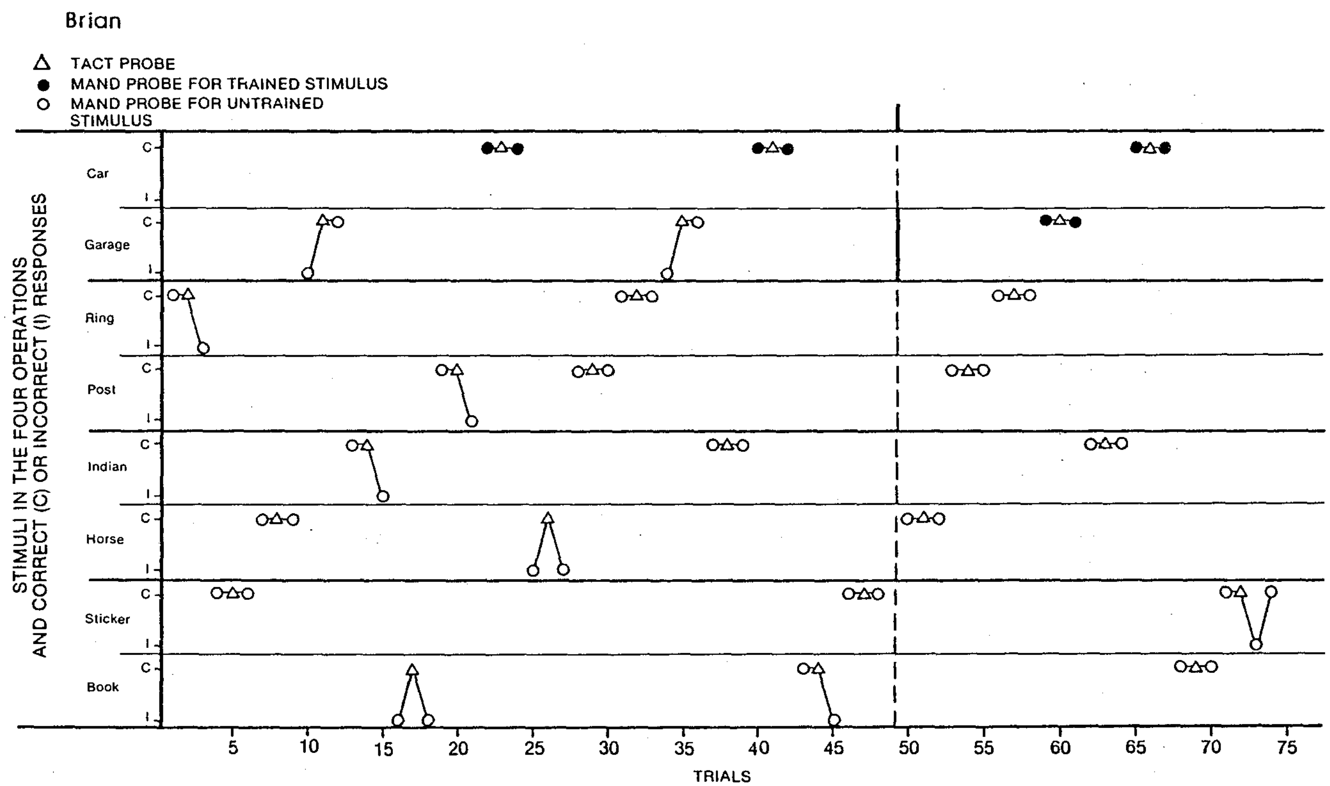
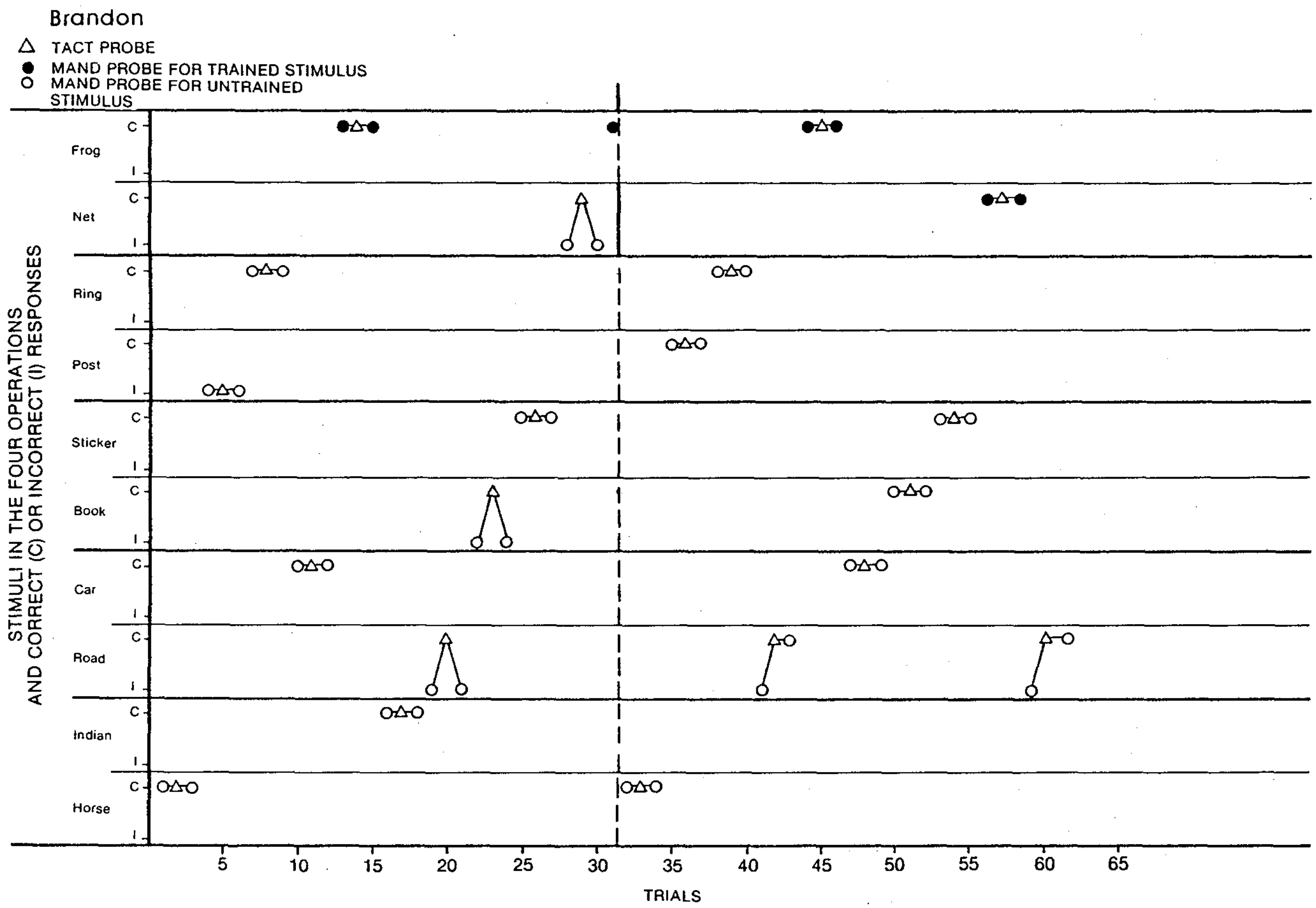
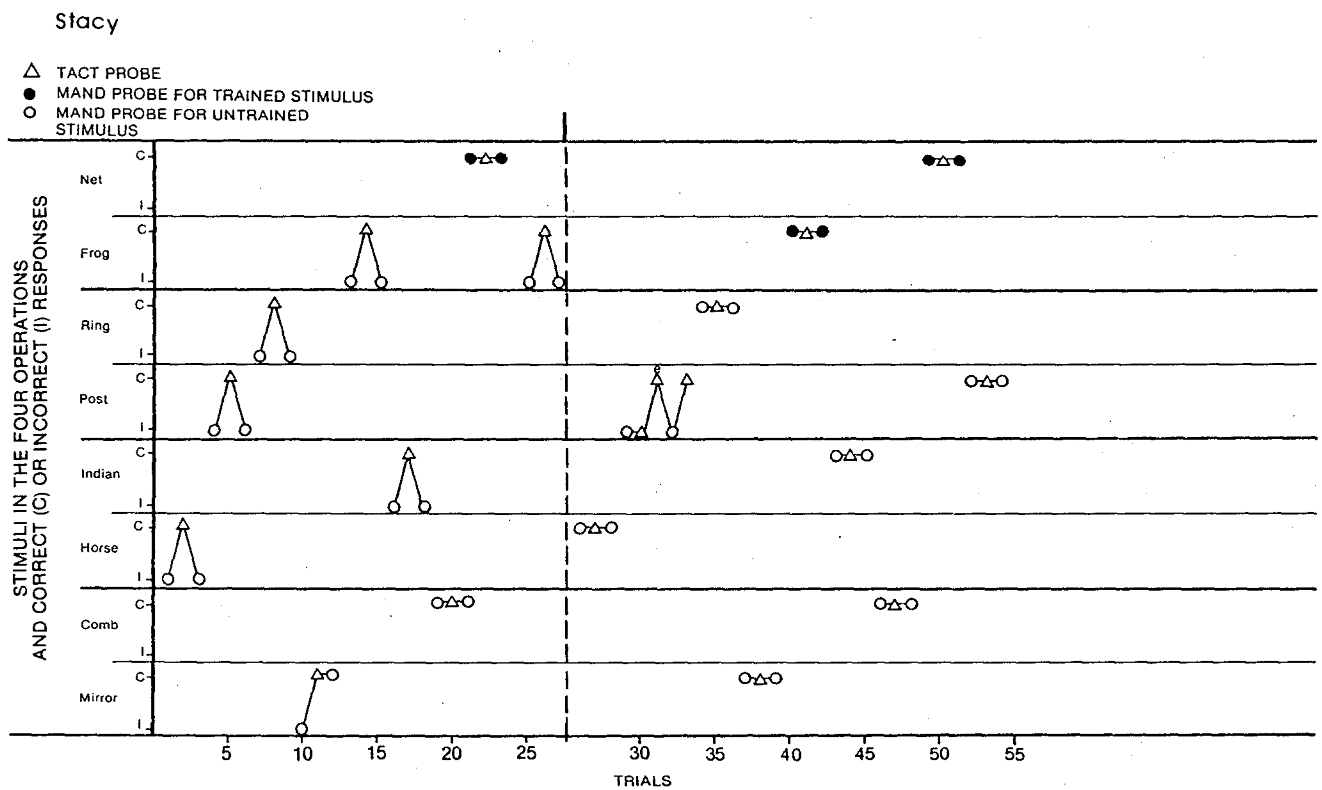


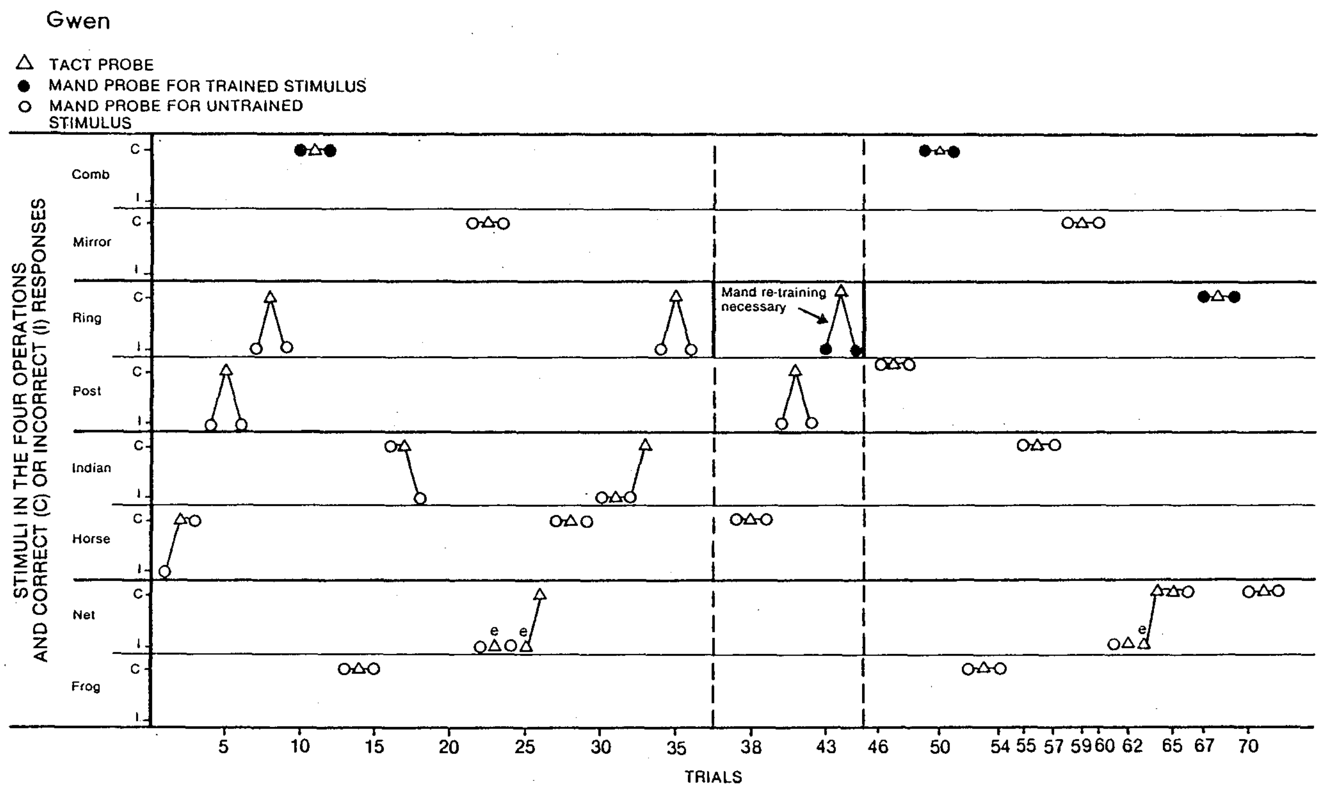
Figure 9. Correct or incorrect manding and tacting for Brandon to trained and untrained stimuli. Triangles are tact probes and circles are mand probes.



<u>Figure 10</u>. Correct or incorrect manding and tacting for Stacy to trained and untrained stimuli. Triangles are tact probes and circles are mand probes. A small "e" indicates an echoic prompt.



<u>Figure 11</u>. Correct or incorrect manding and tacting for Gwen to trained and untrained stimuli. Triangles are tact probes and circles are mand probes. A small "e" indicates an echoic prompt.



and tact probes were scored as either correct (C) or incorrect (I). The stimuli that received mand training are represented by darkened circles while those probes for untrained stimuli are open circles.

Figure 8 shows Brian's probes after the mand for Car was trained. The data show substantial generalization across operations on the initial probes (e.g., Sticker and Horse). Generalization across operations, however, did not occur with all objects (e.g., Book, Ring, Indian and Post). Within operation generalization was incomplete to Garage (one of two mand probes was correct). This incomplete generalization between objects in the same response chain occurred despite evidence of complete generalization to objects in other response chains (e.g., Sticker).

For Brian there appeared to be some improvement with repeated testing (e.g., Ring, Post, Indian and Book). Brian's data showed more variability than the other subjects. Note, for example, that the response to the initial mand probes for Horse were correct (Trials 7 and 9) but that the responses to the later mand probes (Trials 25 and 27) were incorrect. In addition, a number of mand responses within a three-probe sequence were initially correct but later incorrect (e.g., Ring, Trials 1 and 3; Post, Trials 19 and 21; Indian, Trials 13 and 15). This variability may have been due to two factors. First, Brian appeared to be easily distracted. Secondly, Brian's sessions were run in a large room and occasionally other children and/or adults would enter the room. Although Brian would respond to probes at these times, he often did not appear to be paying close attention to the trainer.

The second mand, Garage, was then trained as a mand (22 trials). Subsequent mand and tact probes indicated complete generalization. The only indication of a lack of generalization occurred with Sticker (Trial 72) but this object had the most complete generalization before Garage had been trained (Trials 4-5 and 46-48). Thus, the error on Trial 72 may have been the result of Brian's inattentiveness.

Figure 9 (Brandon) shows the mand and tact probes after mand training with Frog (trained first) and with Net (trained second). After the initial mand training with Frog, there was extensive across operation generalization (e.g., Ring, Post, Sticker, Book, Car, Indian and Horse). However, there was no within operation transfer to Net as indicated by Trials 28 to 30. There was also no evidence of generalization to one other stimulus, Track. Net was trained next as a mand. The following probes indicated complete generalization to all stimuli except the stimulus for Track, to which partial generalization was obtained.

Figure 10 shows the effect of mand training for Stacy with the Net and Frog stimuli. After training with the first stimulus (Net), there was very little generalization across operations although some was evident; that is, correct responses to Comb and Mirror. However, despite this across operation transfer, there was no within operation generalization. The child did not emit correct responses to mand probes for Frog but the tact response was correctly emitted. Because of this unexpected finding, the probe sequence was repeated for Frog (Trials 25 to 27). Again there was no transfer of the mand response to the mand-tact-mand sequences.

Frog was trained next. The post-training mand and tact probes in Figure 10 are all correct except for some to the stimulus Post. An incorrect mand probe on Trial 31 was followed by an incorrect tact probe on Trial 32. On the next trial, an echoic prompt was given by the trainer and a correct response was made by Stacy. Although the mand probe on Trial 34 was incorrect, the three-probe sequence was assessed later (Trials 55-57) and all correct responses were obtained.

Figure 11 shows the results of mand and tact probes for Gwen across four operations after mand training with Comb. The trainer ran into trouble training the response, "Comb, please," because the child emitted the mand only following an echoic prompt. Ninety-nine trials elapsed before Comb was trained to criterion. The subsequent assessment of generalization indicated both kinds--across operation generalization and within operation generalization. Gwen was the only child to evidence complete generalization within the operation after training to mand one of the stimuli. She was trained to mand Comb and she manded Mirror without mand training for that stimulus.

The mand for Ring was trained second. However, the initial probes (Trials 43-45) indicate that additional mand training with Ring was necessary. After retraining, complete generalization across operations was in evidence. Correct tact and mand probes were emitted to all objects except Net (Trials 61-66). An incorrect tact probe was emitted on Trial 62. On Trial 63, no tact was emitted to the tact probe. An echoic prompt was then provided by the trainer and Gwen said, "Net." On Trials 64-65, Gwen emitted correct tact responses. A correct mand response was subsequently emitted on Trial

67. Trials 70, 71 and 72 were all correct mand and tact responses.

Discussion

The present study is important because it provides information about the variables controlling the mand. First, the pretraining data show that tact training and operation training were insufficient conditions for the emergence of manding. The two responses (mand and tact) though similar in form were demonstrated to be behavioral units controlled by different environmental variables. Second, the mand training procedures were effective in developing mand responses for missing objects. The mand training established new controlling variables for each response--instructions to begin a previously reinforced response chain when a particular object was missing. Additionally the post-training data also provided evidence for functional independence between mands and tacts, thus supporting the pretraining data.

The pretraining data show that naming an object and manipulating an object in a response chain were not adequate to evoke a request for that same object when it was missing. The interpretation of this result, within the framework of a functional analysis, is that mands and tacts can be acquired separately. Use of a word in one way, such as a label for an object, does not assure its use in other contexts such as a request for a missing object.

These results--that mands and tacts of similar form were acquired separately--have recently been reported by other researchers. Lamarre and Holland (1985) called the phenomenon "functional independence." Whether mands were trained first or tacts were trained first, there was no change in the other verbal operant despite formal similarity between the responses. Similar results were also reported by Hall (1979) who trained object labels (tacts) without the concomitant development of mands for the same object.

This study and others (Hall, 1979; Sundberg, 1980; Lamarre & Holland, 1985) present an analysis of language that views the units of verbal behavior as defined by the contingencies of reinforcement. Different response classes are delineated by different controlling variables, thus the same spoken word can exist as a member of more than one response class. Such an analysis does not regard words as the functional units of behavior. As the results of these studies suggest, words as units of behavior do not make distinctions among the different responses they may represent. Therefore, following Skinner's (1957) functional analysis of verbal behavior, these studies argue that the units of verbal behavior should not be defined along structural parameters, but should be defined by the contingencies of reinforcement: Antecedent, consequent and motivational variables. The mand and tact stand out as different response classes because they are functionally defined by different controlling variables.

The post-mand training data also provide evidence of functional independence. The three-probe sequence of mand probe, tact probe and mand probe sometimes resulted in the juxtaposition of correct tact probes and incorrect mand probes. For each child there were instances where this occurred (e.g., Figure 10, Indian and Horse; Figure 11, Ring and Post). On these occasions no mand response was made to the final probe despite having just labeled the object in addition to have just completed mand training, although with a different object.

The definitions for the mand and tact in this study are very close to Skinner's (1957). The controlling variables for the tact are the presence of a discriminative stimulus (the object that is labeled) and generalized reinforcement. In the present study the object to be labeled was presented with the prompt, "What is this?" and reinforced by praise from the trainer.

The controlling variables for the mand are more related to motivational variables. Motivation to mand the missing object was established by giving the child instructions to engage in a previously reinforced response chain that required the object for completion. Thus, the primary controlling variable for a tact response (the object or discriminative stimulus) was not present as a variable controlling the mand. The reinforcement for the tact (praise or generalized reinforcement) was different from the consequence of the mand response which was to obtain the object.

Further, for a mand response to be functional, certain conditions had to exist. This was accomplished by giving the child instructions to begin a previously reinforced response chain while at the same time keeping out of sight one of the objects necessary to complete the response chain. In a functional analysis, these kinds of distinctions among controlling variables serve as the basis for defining functional units of behavior, or as Skinner (1957) called them, verbal operants.

The second purpose of the present study was to ascertain what procedures would bring about mands for missing objects. The mand training procedures had three important aspects. First, training was carried out in a situation where the child was motivated to mand the missing object; i.e., the child was given instructions to complete a previously reinforced response chain when one of the objects was missing. Second, the student was given an echoic prompt to ask for the needed object. A time delay procedure (Sundberg, 1979; Touchette, 1971) was used to fade out the echoic prompt and to bring responding under control of the response chain instructions and the missing object. Third, all correct responses, whether prompted or not, were reinforced by presenting the child with the missing object. The child then finished the response chain and was praised by the trainer.

The efficacy of these procedures was demonstrated by using a multiple probe design across stimuli. For each child, the mand training was introduced sequentially across two stimuli. Additional within subject replications were not possible because generalized manding developed in each child after mand training with the second object. Given the children's ages in this study, generalized manding would be expected to develop quickly. Bruner (1983) and Harris and Liebert (1984) report an acceleration in labeling at the end of the second year. Bruner relates this to the development of requests for absent objects which begins at about 18 months. By the end of the second year, Bruner reports that children begin to use names only in order to request absent objects and the use of gestures or reaches begin to drop out.

Two of the children in the present study (Gwen and Brian) were young two-year olds and therefore close to the time when requests for absent objects normally develop. Stacy and Brandon were three-year olds but not necessarily more advanced in terms of requesting. As Harris and Liebert (1984) point out, there are large individual differences in the speed of language development.

After each mand was trained, probes were given to assess the mand and tact repertoires for each stimulus. The post-training data not only permitted an assessment of mand training with a particular stimulus but also assessed generalization both within and across operations. A related purpose of the present study was to train mands one at a time and measure generalization both within and across operations. Generalization across operations was judged to have occurred when the child correctly manded either of the two objects from a response chain that did not receive any mand training. Within-operation generalization was defined as training the child to mand one of the objects from a response chain and then get correct mands for the untrained companion object.

For all children there was nearly complete across operation generalization or generalized manding after two objects were trained. For Brian, the only exception was one incorrect mand probe for Sticker which, as mentioned earlier, may have been due to distractions. For Brandon there were two incorrect mand probes to the stimulus Track. Brandon had a great deal of difficulty learning this tact (see Table 7).

For Stacy the final mand probes were all correct except for two mand probes for the stimulus Post. The data indicate these incorrect responses were due to the absence of the tact repertoire. All of Gwen's final mand probes were also correct with the exception of one mand probe which was due to the absence of the appropriate tact. Also, for all children there was some across-operation generalization after only one object had received mand training.

Contrary to expectations, there was little within-operation transfer. When a child received mand training with one of the two objects from an operation, there was no evidence of a mand repertoire with the untrained companion object. This result was true for three of the four children. For the one child who did demonstrate within-operation transfer, mand training took 99 trials. Given such extended mand training with a stimulus from one operation, transfer within the operation would seem likely. For the other three children who did not show generalization within an operation, they did show generalization across operations.

Within-operation generalization was hypothesized to occur before across-operation generalization. Generalization was expected to be facilitated by the development of stimulus equivalences between the objects used in an operation. If both stimuli from an operation became equivalent and manding was trained for one stimulus, then generalization to the other stimulus object would be expected. However, this did not occur. For three subjects incomplete or no within-operation generalization occurred during the three-probe sequence, while at the same time across-operation generalization was evident.

A possible reason for the lack of within-operation generalization may be that generalization occurs as a result of interactions between mand training and the individual stimuli. These relationships might obscure the emergence of equivalent stimulus classes. Also, certain stimuli might be preferred over others either due to a prior conditioning history and/or due to intrinsic values such as color, moving parts, etc. If so, generalization might occur to the preferred objects and would be less likely to occur to the less preferred objects.

If generalization occurs to the more preferred stimulus, then the three objects in this study to which there was no within-operation generalization would be judged as less preferred than those stimuli in other operations to which there was transfer. Such an analysis could predict generalization as a function of preference with initial generalization to the most highly preferred objects and later generalization to those objects which reside at the bottom of the preference hierarchy. This makes sense because the mand is closely tied to motivational variables.

Skinner (1957), Michael (1982) and Segal (1977) describe the mand as closely tied to motivational variables. Michael discusses in detail the controlling variables for mands for unconditioned as well as conditioned reinforcers. Just as a mand for food is controlled by levels of food deprivation and satiation, mands for conditioned reinforcers also have their own controlling variables.

The procedures in the present study were designed explicitly to evoke mands for conditioned reinforcers. First the names of the objects were taught (tact response) and then the child was taught to use the two objects in a response chain that was reinforced by the trainer. Finally, the trainer presented one of the two objects and gave instructions to complete the response chain. When the instructions to complete the response chain were given, they established the objects in the response chain as discriminative stimuli and as conditioned reinforcers. These objects, and not others that were potentially available, were being singled out as related to a reinforcement contingency. Responses that normally obtain these objects (e.g., looking, reaching, grasping, etc.) are momentarily increased in probability of occurrence. When one of the objects (conditioned reinforcers) from a response chain is missing, then the previously reinforced motor behavior is no longer tive. At this point, vocal responses that label (tact) the missing object can function as mands.

These, according to Michael (1982), are the conditions necessary to evoke a mand for a conditioned reinforcer. Some stimulus change or establishing operation must alter the value of some object or event as reinforcement and, as a result, increase the probability of those responses that have led to this reinforcement in the past.

Reinforcement of the response chains in the present study consisted of trainer praise for completion of the response chains. However, trainer praise for completion of a response chain does not guarantee equivalence among operations and stimuli in terms of their preference or ranking in a hypothetical hierarchy. Operations and stimuli could be scaled according to preference from highly preferred to least preferred. Scaling stimuli by preference was not done in the present study, but it is feasible.

Some stimuli may have more "motivational" value and thus predict generalization, whether it is within or across operations. This analysis does not rule out the role of stimulus equivalences or stimulus classes. They may still play an important role in generalization but the effects may be obscured by the motivational aspects of the stimuli.

A logical extension of the present study would be to construct measures of preference for a large number of stimuli before operation and mand training. Operations might be constructed with two preferred stimuli (high/high) or two less preferred stimuli (low/low), or a combination (high/low). Such arrangements would provide an interesting situation to evaluate generalization after mand training. Functional relationships between measures of preference and the generalization of mand training might help detect orderly changes in generalization. In effect, one might be able to predict generalization across stimulus classes in future research.

These results extend the analysis of the controlling variables of the mand. First, the use of the response chain methodology was systematically replicated with different subjects and response topographies. Previous studies employed sign language and retarded participants (Hall, 1979; Sundberg, 1980). The present study used spoken English language with intellectually normal preschool children.

Secondly, responses of similar form were brought under functional control of different controlling variables thus demonstrating the functional independence of two verbal operants, the tact and mand. In addition, controlling variables were identified to train mands for conditioned reinforcers that were missing. The training procedures were effective not only in obtaining mands for the training stimuli but also resulted in generalized manding for untrained stimuli.

The present study is also important because the methodology is relevant to language instruction/remediation. The teacher wants to promote language that is contextually appropriate (Hart & Risley, 1980). The response chain methodology of the present study does just that by teaching responses that are under the control of the contingencies for completing a response chain. Hart and Risley utilized the request situation to teach language expansion. Its power lay in the fact that the incidental teaching procedures were tied to the momentary strength of some reinforcer. In effect the child determined when teaching interactions took place by requesting a pre-potent reinforcer. The response chain methodology, on the other hand, is important because it provides a way for the teacher to prompt teaching interactions by creating pre-potent reinforcers. Thus, when a teacher announces a reinforcing activity, but purposely holds back one of the objects, the conditions have been established where mands for the missing object are more likely. Whereas the incidental teaching procedures of Hart and Risley were best suited for teaching language expansion (tacts), the response chain methodology employed in the present study is suited for both purposes. Mands can be prompted and reinforced and/or language expansion can be taught.

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DEPARTMENT OF PSYCHOLOGY

APPENDIX A-1

To parents of Kinder-care children,

My name is Guy Tidwell and I am currently a graduate student in psychology at the University of the Pacific. For a number of years I have been interested in language development and language teaching. During the 1982/83 school year I worked for Stockton Unified school district at Pulliam school as a special education teacher. I am currently looking at how children learn to ask for things they want or need. Requesting things is a large part of children's social behavior as it allows them to get what they want without grabbing, crying, pointing, tugging, and pushing.

I am interested in teaching children how to request objects that are missing; the missing objects will be necessary to complete various tasks such as coloring with a crayon. The students will then be taught how to appropriately request the unavailable objects. The instruction should last about seven days and I believe the time the children will spend in these sessions will be productive and worthwhile.

Your child will be in the Kinder-care classroom so that my teaching can be observed by their staff and Dr. Michael Davis of U.O.P. Two women will assist me in the teaching, Becky Bryant and Kay Tim, who both have experience in language teaching.

In order for your child to participate in this individual language instruction, you should sign and return the permission form below. Thank you very much, and if you have any questions please call me at 462-5322 or Dr. Davis at 466-4316.

Sincerely yours,

W. Guy Tidwell

APPENDIX A-2

PARENT PERMISSION SLIP FOR UOP LANGUAGE PROJECT

I have read and understand the above statement. I am also aware that either I or my child may withdraw our participation at any time during the course of the study.

Yes, I grant permission for my child, ____________________ to take part in the UOP languge study.

Signed:________________________________ Date:______________

No, I do not wish my child, ______________________, to participate in the UOP language study.

Signed:________________________________ Date: _____________

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