Teaching a Mand Repertoire to Deaf Individuals:
Transfer of Stimulus Control from Imitative or Tact
Variables to the Establishing Operation

Genae A. Hall
Western Michigan University

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TEACHING A MAND REPertoire TO DEAF INDIVIDUALS:
TRANSFER OF STIMULUS CONTROL FROM IMITATIVE OR TACT
VARIABLES TO THE ESTABLISHING OPERATION

by

Genae A. Hall

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Master of Arts

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Genae A. Hall
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WESTERN MICHIGAN UNIVERSITY, M.A., 1979

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1979
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Skinner's (1957) book *Verbal Behavior* provided a functional analysis of language from the perspective of an individual speaker. This approach was scientific in that it was based upon well established principles of behavior discovered in the laboratory with lower animals and because it made no appeal to hypothetical explanatory entities. However, the analysis was theoretical in the sense that behavioral principles found to be operating under strictly controlled conditions were extrapolated to complex human behaviors in the natural environment; little direct experimentation on human verbal behavior had been conducted.

Skinner's approach departed radically from the linguistic tradition of studying the grammatical structure and "meaning" of verbal responses, regardless of the controlling circumstances for the behaviors. According to Skinner (1957), "The 'languages' studied by the linguist are the reinforcing practices of verbal communities . . . . In studying the practices of the community rather than the behavior of the speaker, the linguist has not been concerned with verbal behavior in the present sense" (p. 461). In other words, the behaviorist and the linguist were interested in different subject matters.

In 1959, the linguist Chomsky published an extremely negative review of *Verbal Behavior*, where he essentially denied the legitimacy of its subject matter. He asserted it was futile to analyze the complexities of language with principles derived from the animal laboratory, that it was premature to inquire into the causation of verbal behavior, and that Skinner's analysis was incomplete because he
neglected the important role of the innate structure of the organism. Chomsky also rejected the possibility of prediction and control of verbal behavior. The review showed basic misunderstandings of many of Skinner's points, and MacCorquodale (1970) was led to conclude that "Chomsky's review did not constitute a critical analysis of Skinner's Verbal Behavior" (p. 98). However, it was well received by linguists, who still deny the legitimacy of verbal behavior as a subject matter separate from linguistics.

Despite the controversy that the book aroused and despite Skinner's (1957) contention that, "the formulation is inherently practical and suggests immediate technological applications at almost every step" (p. 12), his analysis has yet to be systematically tested. The problem is not that research per se in the area of language is lacking; Gutman (Note 1) prepared a "Bibliography of Articles on Language Training and Language Development for the Language Delayed," which included 103 entries, about 62 of which were behavioral. Instead, the problem is that most behavioral language research has not been controlled by Skinner's analysis.

According to Peterson (Note 4), the reason for this problem is that most readers of Verbal Behavior (whether or not they are researchers in the area of language) lack the prerequisites to "understand" or respond appropriately to the analysis. These requirements include an extensive knowledge of radical behaviorism and of the formal analysis of language. One could also speculate that applied behavioral researchers typically avoid control by potentially "theoretical" variables and may not have attempted to read Verbal Behavior.
A consequence of this lack of interdependence is that much behavioral language research has been partly controlled by the linguistic model, which focuses on topography rather than on controlling variables. Theorists in the field of linguistics, such as Chomsky, Lenneberg, and Bellugi have traditionally been considered the "experts"; and, without the alternative of a functional approach to language, many of their formulations still control research behaviors. Although much of the research was designed to solve applied problems, it has been partly controlled by an approach which does not generate practical solutions and is no less theoretical than Skinner's analysis. The linguistic analysis of language does not generate practical solutions to applied problems of teaching language to those in which it is absent or defective for two reasons: It is based on the assumption that language acquisition is innate and, therefore, not significantly modifiable by direct training; and it focuses on verbal topographies irrespective of their relations to controlling variables. The linguistic approach is also no less theoretical than Skinner's analysis—neither is based on empirical data from studies on human verbal behavior, and the linguistic approach postulates hypothetical constructs to explain behavior (e.g., Chomsky's "language acquisition device").

It appears that applied researchers typically question the practicality of only one aspect of the linguistic approach, the contention that language acquisition is mostly innate (Chomsky, 1965; Lenneberg, 1964). They rarely question the importance or functionality of dependent variables which are ultimately traceable to a linguistic analysis. For example, in a discussion of teaching syntax to autistic children,
Lovaas (1977) stated, "While many investigators think that differential reinforcement and modeling play some role in the acquisition of semantics, they feel that syntax (grammar) is too complex to be understood in terms of learning processes as we now know them" (p. 110). Lovaas was apparently concerned with showing that syntax could be trained using behavioral techniques but not with the conditions under which syntax would be a functional dependent variable. It seems doubtful, however, that acquisition of grammatical responses would greatly benefit an impaired child, unless s/he could then gain access to objects and actions which currently function as reinforcement. The typical consequence for correct syntax under tact conditions (when the form of the response is controlled by a non-verbal stimulus) would be extended social interaction, which does not function as strong reinforcement for many autistic or otherwise impaired children.

Of course, it would be possible to construct an environment consisting of strong consequences (utilizing food deprivation and punishment of incorrect or inappropriate responses) where the child would be motivated to acquire grammatical responses. Such environments have been described in language training programs for autistic children (Lovaas, 1966; Lovaas, 1977), but there were indications that the children may not have acquired especially functional language under those conditions. Lovaas (1977) acknowledged that "perhaps because of the highly controlled nature of our language training and its reliance on experimental rather than 'natural' reinforcers, many of the children showed verbal behavior that had come under very restricted environmental control. Too often his language occurred in response to the
experimental situations, such as the teacher's questions, and very seldom otherwise" (p. 17).

Skinner's approach would suggest that in order to provide the greatest benefit for the speaker, manding should be trained (assuming that the child can already imitate particular topographies). Skinner (1957) defined a mand as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the control of relevant conditions of deprivation and aversive stimulation" (pp. 35-36). These conditions of deprivation and aversive stimulation and other (secondary) motivating variables have been called "establishing operations" by Michael (Note 2). According to Skinner (1957), the mand is the most functional of all the verbal operants for the speaker. He stated that "when we come to consider other types of verbal operants, we shall find that the behavior functions mainly for the benefit of the listener . . . . The mand, however, works primarily for the benefit of the speaker" (p. 36).

Recently, a few authors (Buddenhagen, 1971; Hartung, 1970) have emphasized the importance of teaching manding. Some manding components have also been included in recent language training programs (Gray & Ryan, 1973; Guess, Sailor, & Baer, 1976). However, manding is not usually presented early in the training sequence but after the corresponding tact has been learned or near the end when "spontaneous" speech seems desirable to train (Lovaas, 1977). Another issue in mand training has been that typically the researcher must "capitalize on the opportunity, when it arises" to train mands for objects and activities which the child has already learned to tact (Pear, Plante, McLean,
Olenick, Rowan, Welch, & Werk, Note 3). Some researchers who have employed this approach are Risley and Wolf (1967); Sloane, Johnston, and Harris (1968); and Hartung (1970). More recently, the Guess, Sailor, and Baer (1976) and Lovaas (1977) language programs have employed a somewhat more structured approach.

Very recently, there have been a few studies conducted specifically on the mand by itself. Stafford, Sundberg, and Braam (Note 6) demonstrated the different strengths of two five-component responses. One set of contingencies involved specific reinforcement (characteristic of the mand) while the other involved non-specific reinforcement (characteristic of the tact). Responses were stronger under mand conditions. Simic and Bucher (in press) trained two manding responses, "I wanna" and "out," when the presence of the items to be manded was the only $SD$ for the response. (The $SD$ for "I wanna" was the experimenter's presence with a tray of food items, and the $SD$ for "out" was the tray visible through a window in the door to the room.) Plante and Pear (Note 5) investigated whether it is first necessary to train an item as a tact before it can be learned as a mand and vice versa. It was found that either operant could be trained first. They also studied whether a response would transfer from tact to mand conditions and vice versa. It was found that transfer occurred, but their mand and tact conditions were very similar; the objects manded or tacted were present in both conditions. According to Skinner (1957), such similarity would be expected to lead to transfer; and, without it, transfer would not be expected.

A critical issue concerning mand training is related to Skinner's
(1957) definition and has not been addressed by any of the recent research or training programs. The form of a mand is controlled not by SD's (although they may indicate when a mand is likely to be reinforced) but by conditions of deprivation or aversive stimulation (establishing operations). None of the research articles or training programs present systematic procedures to train manding entirely under the control of the establishing operation. The items manded have always been visible to the subjects; and tact variables have, therefore, been involved. "Manding" has been dependent on the presence of objects that would function as reinforcement. If these objects were missing, the speaker (student) would need to wait until they happened to appear, lead the listener (teacher) in search of the objects, or perhaps engage in aggressive or disruptive behaviors until the listener (teacher) went to look for the items. It would seem to be a more functional target response for the speaker (student) to emit a mand in the absence of the objects and, thereby, gain access to them.

One problem in developing a training procedure for manding missing items is the difficulty in establishing, when an item is not present, that it would function as strong reinforcement at a particular moment. Many attempts to artificially generate establishing operations with humans would be clearly seen as unethical. For example, one could not create the conditions under which a coat would function as reinforcement by putting a child outside in the snow. Two prerequisites for a manding procedure would, therefore, be its ability to specify what object functions as reinforcement at a particular time and its professional acceptability. The following procedure (roughly outlined)
appears to satisfy these requirements:

1. Train a chain of behaviors leading to reinforcement, involving a set number of objects which are necessary for completion of the chain.

2. After the subject can complete the chain (with some assistance, but can independently initiate the necessary actions with objects which will later be trained as mands), present all the objects except one on a given trial.

3. Receipt of the missing item should currently function as reinforcement, since only by getting it can the child complete the chain and obtain a strong reinforcer at the end. At this point, the child can be prompted in some manner to mand for this missing item.

One population which is generally recognized to be deficient in functional language skills and to require direct language training is the deaf (Vernon & Koh, 1969; Prickett & Hunt, 1977; Moores, 1978). The deaf may be particularly deficient in the area of manding. Unless deaf children also have deaf parents who begin signing to them early in life, the children may not acquire much language until they enter school (Vernon & Koh, 1969). Meanwhile, they learn to do things for themselves (acquire reinforcement directly) rather than coming under the control of reinforcement mediated by others. Once these children are in school, they are frequently exposed to language programs which teach tacting rather than manding, with the assumption that learning particular topographies will lead to their "use" under all conditions. If generalization from tact training conditions to other conditions does not occur, the children may never acquire a manding repertoire.

The purpose of this study was to investigate the following research questions with two deaf, mentally impaired and language delayed students:
1. Whether teaching specific verbal topographies under tact conditions is sufficient to produce emission of the same topographies under mand conditions (when the objects are missing and presenting them to the subject would currently function as reinforcement).

2. If teaching a tact repertoire is insufficient to produce manding, whether an imitative or tact prompt transfer-of-stimulus-control procedure (both containing the features mentioned above in the roughly outlined training procedure) is more effective to teach manding.

3. Whether the present procedures will produce generalization of manding to untrained mands and novel stimulus situations.

4. Whether maintenance of manding across time will be demonstrated.
METHOD

Subjects and Setting

The subjects were two deaf students, one male and one female, enrolled at the Kalamazoo Valley Multihandicap Center, a facility for the mentally and/or physically impaired. In addition to being profoundly deaf, they were diagnosed as mentally impaired. They were 16 and 17 years old and were chosen because of their observed extremely low rates of manding behaviors. Both subjects had begun learning language late, had extensive tacting repertoires, and had received some training on manding for items which were present, using a "mand frame" (e.g., "I want ____"). However, they never manded in the absence of a verbal S^D; and, when asked, "What you want?" in sign when no reinforcing objects were present, each would emit a single stereotyped response. Subject 1 would mand "walk," and Subject 2 would mand "coloring book." They had no other mands for missing items or actions in their repertoires. The form of these stereotyped manding responses did not frequently appear to be controlled by what would function as strong reinforcement at the moment, since the students would make these responses at any time during the day (early in the morning, before lunch, whenever they counted their tokens to exchange for back-up reinforcers).

Observation and Reliability

The experimenter conducted all primary observations, and two other staff members at the Center served as reliability observers. One class...
of behaviors to be observed during pretraining, baseline, and training conditions consisted of manual signs in American Sign Language. Other responses which were observed, during pretraining only, were actions which the subjects were required to independently initiate with one object in each chain of behavior. The reliability observers were shown any signs they did not already know, although both were familiar with sign language. If a student's sign was judged recognizable, it was scored as correct; if unrecognizable or the wrong sign, it was scored as incorrect if no correct mands also occurred during the 10-second observation period. If a correct mand occurred at any time during this interval, the trial was scored as correct. The occurrence of incorrect mands per se was not considered important and was not con- sequated in any way. The focus of the experiment was on the presence or absence of correct manding during baseline and on strengthening correct manding during training. The response definitions for actions initiated with one object for each chain are presented in the Procedure section, in conjunction with the objects and actions involved in the chains.

Reliability was taken during pretraining, both in the later "chain completion" sessions, where data were collected to establish that the students had met criterion on initiating actions with particular objects in the chains, and in tact training sessions. Reliability was also taken during mand probes in baseline and training conditions. Reliability observers were instructed to score correct responses immediately—the primary observer waited one second, reinforced the student by presenting the item manded, and then scored the response.
Incorrect mands were not scored immediately; they were ignored unless a correct mand did not occur during the entire observation period. The primary and reliability observers were seated at the same table as the student, about two yards away from each other, with their data sheets faced in different directions.

Design

The designs used were a multiple baseline across subjects and behaviors (Baer, Wolf, & Risley, 1968) and a multielement design (Ulman & Sulzer-Azaroff, 1975). The multiple baseline across subjects involved training Subject 2 on the first two behaviors at the point that Subject 1 met criterion on his first two behaviors. The same sequence was used with the second two behaviors. Two behaviors were trained at one time in order to compare their acquisition in a multi-element design.

Procedure

Pre-training

Prior to the baseline conditions, students were trained to criterion on the following prerequisite skills:

1. They both were taught to complete four chains of behavior leading to strong reinforcement. The trainer provided some assistance in completing the chains, but the students were required to independently initiate the first action for each object that would later be trained as a mand at a criterion of 100% accuracy for two consecutive days. Physical guidance was used initially and was faded until criterion was reached. The four chains of behavior, the objects and actions involved, and the response definition for "initiating the first action with the object" are presented below.
Subject 1

a. Making instant soup. The objects involved were instant soup, hot water, bowl, and spoon. The actions consisted of tearing open the package of instant soup, pouring it out into a bowl, pouring hot water on it from a plug-in pot which had already been heated, stirring the soup, and eating it with a spoon. The object from this chain that would later be trained as a mand was the hot water. It was, therefore, required that the student initiate an action with the water. This action consisted of picking up the pot and pouring at least one drop into the bowl.

b. Opening a can of fruit. The objects involved were a can, can opener, bowl, and spoon. The actions consisted of taking the can opener, opening the can, pouring the fruit into the bowl, and eating the fruit with a spoon. The object from this chain that was to be trained was the can. Initiating an action with the can consisted of touching the top of it with the can opener.

c. Wiping up water spilled on the table (a dry table had been demonstrated to be reinforcing to the student). The objects involved were water and a paper towel. The chain consisted of the trainer spilling a small amount of water on the table from a glass that was too full. The student then took the paper towel which was present and wiped up the water. The object to be trained was the paper towel. Initiating an action with the paper towel consisted of picking it up and at least touching the water spilled on the table.

d. Operating a vending machine to get candy. The objects involved were the vending machine and money (a quarter). The chain consisted of the student taking the quarter and putting it in the slot. The trainer then assisted the student in pressing the right button to get a candy bar. The object to be trained was the money. Initiating an action with the money consisted of taking it and making contact with the money slot on the machine.

Subject 2

a. Making instant soup. The objects, actions, and response definition for initiating the action were the same as for Subject 1.

b. Opening a can of fruit. Again, the objects, actions, and response definition were the same as for Subject 1.

c. Making instant coffee. The objects involved were instant
coffee, hot water, cup, and spoon. The chain consisted of opening the jar of coffee, taking out a teaspoonful of coffee, putting it in the cup, pouring hot water in the cup, and stirring the coffee with a spoon. The object to be trained was the cup. Initiating an action with the cup consisted of putting some (any) amount of instant coffee in it.

d. Coloring a large picture. The objects involved were a large, partly uncolored picture and colored pens. The chain consisted of selecting a pen from the container and coloring a small section of the picture. The object to be trained was the pen. Initiating an action with the pen consisted of taking a pen and touching the picture with it.

2. Students were tested to determine whether they had correct tacts for all items necessary to complete each chain. The experimenter successively presented each item and signed, "What that?" Correct responses were reinforced with tokens. If a tact was incorrect, the experimenter modeled the correct response and re-presented the SD. This correction loop was repeated until the student emitted a correct response without the imitative prompt. Tacts which were not initially at strength were trained until a criterion of 100% correct for two consecutive days was met.

Baseline

Baseline consisted of mand probes, where all items necessary to complete a chain, except for one item, were presented to the student. Then, the trainer manually signed a specific SD to begin each chain. The following SD's were used:

1. Soup chain--"Make soup. Start."
2. Can chain--"Open. Start."
4. Vending machine chain--"Get candy. Start."
5. Coffee chain--"Make coffee. Start."
6. Coloring chain--"Make picture. Start."

After the SD was given, the trainer provided some assistance for
the student in completing the chain up to the point that the missing item was needed. The assistance consisted of the minimal amount of physical guidance necessary to ensure that the steps in the chain were completed. At the point where the missing item was needed to continue, the trainer provided no assistance and waited 10 seconds; this period was timed by watching the second hand of a large clock on the wall. If the missing item was manded within 10 seconds, it was presented; and the student could complete the chain and obtain the reinforcement. If an incorrect mand or no response occurred within the time period, all items were removed; and the next chain was presented.

Training

Mand probes continued during training and were conducted the first time a particular chain was presented, for each session. If students failed to mand within the time period in the probe situation, training was conducted.

Two transfer-of-stimulus-control training procedures, tact transfer and imitative transfer, were compared in a multielement design. Of the four mands eventually trained for each subject, two were trained only with the tact transfer procedure; and two only with the imitative transfer procedure. First, two behaviors were simultaneously trained using different procedures; and, after the behaviors were mastered, two more were simultaneously trained. The behavior that was trained first each session was alternated randomly.

The tact transfer procedure is depicted in flowchart form in Figure 1. First, a mand probe was conducted, as described in the
Baseline section. If the correct mand did not occur, the trainer presented the missing item, signed, "What that?" and the student tacted the item. If a correct tact did not occur, the trainer modeled the topography and re-presented the question. After a correct tact, the item was left in front of the student, the trainer signed, "What you want?" and the student repeated the topography. If the correct response (partly mand and partly tact) did not occur, the trainer modeled it and re-presented the question. After a correct response to, "What you want?" all items were removed for 5 seconds, then re-presented except for the previously missing item. At this point, the stimulus situation was identical to the previous probe condition, where the student could mand without prompts and receive specific reinforcement in the form of the missing object. If the correct mand did not occur, training was continued by repeating the correction loop. All correct responses during training except correct mands under unprompted probe conditions were reinforced with tokens. Both students were already on a token economy and tokens had been established as conditioned reinforcers. At the end of each session, the tokens were exchanged for back-up reinforcers that the students typically earned, such as edibles or activities different from those used in the chains.

The imitative transfer procedure differed from the tact transfer procedure in only two ways:

1. Instead of presenting the missing item after a failure to mand within 10 seconds and signing, "What that?" the trainer did not present an item but instead signed, "Do this."

2. After signing, "Do this," the trainer presented an imitative prompt. If a correct imitation of the topography occurred, the subject could go on to the next step, which was, "What
you want?" If not, the trainer physically prompted the response and re-presented the instruction.

---

Insert Figure 1 about here

---

Generalization probes

When the target response was a mand which had been previously trained, stimuli slightly different from those used in training were presented. When the target response was a topography which had not been previously trained as a mand (it was trained under tact, but not mand, conditions), stimuli which were the same as those used in training were presented. In a few cases, the stimuli used in generalization probes and the target responses were both different. The specific stimuli and target responses are shown in Table 1 of the Results section.

The general procedure for probes remained the same as during baseline and training, except that the $S^D$'s to begin the coffee chain and the coloring chain for Subject 2 needed to be slightly modified. Since the new target response for the coffee chain was "coffee," the $S^D$ was changed from "Make coffee. Start," to "Make drink. Start," so that it did not provide an imitative prompt. Likewise, the new target response for the coloring chain was "picture"; it was, therefore, necessary to change the $S^D$ from "Make picture. Start," to "Draw. Start."
FIGURE CAPTION

1. Tact transfer procedure. Diamonds represent decision points in the sequence; rectangles represent specific responses to be performed.
BEGIN NEW CHAIN

PRESENT ALL ITEMS EXCEPT ONE

GIVE S°

CORRECT MAND?

YES

PRESENT MISSING ITEM

"WHAT'S THAT?"

CORRECT TACT?

NO

"WHAT YOU WANT?"

CORRECT MAND?

NO

REMOVE ALL ITEMS 5 SEC.

GIVE ITEM MANDED

S COMPLETES CHAIN

NO

GIVE ASSISTANCE

YES

LAST CHAIN?

YES

END SESSION

YES

GIVE / s, COM - GIVE ITEM ---* P L E T E S / a A S S I S T A N C E

M A N D E D /

CHAIN / N T /

"W H A T'S THAT?"

NO MODEL

CORRECT R

"W H A T YOU WANT?"

NO MODEL

CORRECT R

Figure 1
RESULTS

Reliability was taken in pretraining, baseline, and training conditions. In pretraining, reliability was taken in 49% of tact training sessions and 100% of chain completion sessions used to establish that subjects had met criterion on the chains. Reliability was taken in 29% of baseline sessions and 29% of training sessions. There were no instances of disagreement in any of the conditions.

As shown in Figure 2 for Subject 1 and Subject 2, little correct manding occurred during baseline probes. Correct mands reliably came to strength only after training was implemented. Teaching topographies under tact conditions and arranging stimuli so that the previously tacted objects currently functioned as reinforcement was not sufficient to produce the same topographies under mand conditions. This did not appear to be a tact maintenance problem, because when the tact transfer procedure was initiated after baseline, students made the correct tacts three out of four times without prompts. Only one behavior (the third trained for Subject 2) appeared to be acquired during baseline, after training for the first and second behaviors had been completed. The incidences of correct manding of "water" during baseline for Subject 1 and "pen" for Subject 2 were not maintained. No other correct manding responses occurred during baseline. After training on the four mands for each subject, correct responding across time was maintained, with the exception of one incorrect response for Subject 1, which was retrained in one trial.

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As shown in Table 1, three types of generalization occurred after completion of training on all four mands. Subject 1 emitted trained mands in the presence of both the same stimuli (except for the item that was missing from the chain) and different stimuli with respect to the training conditions. He also emitted trained mands in the presence of slightly different stimuli. Subject 2 emitted different mands in the presence of the same stimuli (except for the missing item) and different mands in the presence of different stimuli.

In terms of comparing the two transfer-of-stimulus-control procedures, they produced similar results. Both were effective in training manding, and neither was markedly superior.
FIGURE CAPTION

2. Performance on mand probes during baseline and training and number of training trials to transfer during both training conditions for Subject 1 and Subject 2.
Figure 2

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Table 1  
Generalization Probes: Specific Stimuli Used, Target Responses (Mands) and Whether the Responses Were Correct

<table>
<thead>
<tr>
<th>Session</th>
<th>Stimulation during Generalization Probes</th>
<th>Trained Responses</th>
<th>Generalization Responses</th>
<th>Correct?</th>
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<tr>
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<tr>
<td><strong>Subject 1</strong></td>
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<tr>
<td>Session 1</td>
<td>1. Soup chain items, plus $S^D$</td>
<td>Water</td>
<td>Bowl</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2. Can chain items, plus $S^D$</td>
<td>Can</td>
<td>Can opener</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>3. Vending chain items, plus $S^D$ (different machine)</td>
<td>Money</td>
<td>Money</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>4. Wiping table chain items, plus $S^D$ (different table)</td>
<td>Paper towel</td>
<td>Paper towel</td>
<td>+</td>
</tr>
<tr>
<td>Session 2</td>
<td>1. Coke chain items (entirely different chain and $S^D$—items were coke and cup; the $S^D$ was, &quot;Drink pop. Start.&quot;</td>
<td>None for this chain</td>
<td>Cup</td>
<td>+</td>
</tr>
<tr>
<td>Session 3</td>
<td>1. Empty table, no $S^D$. Reinforcement period after session.</td>
<td>Soup, water, bowl, spoon, can, can opener, paper towel, walk, money, run, sit, eat</td>
<td>Soup, water, bowl, spoon, can, can opener, paper towel, walk, money, run, sit, eat</td>
<td>all +</td>
</tr>
</tbody>
</table>

| **Subject 2** |                                           |                   |                          |          |
| Session 1 | 1. Soup chain items, plus $S^D$ | Water             | Bowl                     | +        |
|          | 2. Coffee chain items, plus $S^D$ (different $S^D$) | Cup               | Coffee                   | 0        |
|          | 3. Can chain items, plus $S^D$ | Can opener        | Can                      | +        |
|          | 4. Picture chain items, plus $S^D$ (different $S^D$) | Pens              | Picture                  | +        |
DISCUSSION

The present results indicate that manding for missing items can be trained using a structured and relatively simple procedure. Control of the dependent variable was demonstrated through a multiple baseline design across subjects and behaviors; reliable manding responses occurred only after direct mand training was introduced. Teaching subjects to tact objects during pretraining and establishing conditions under which those objects functioned as reinforcement during baseline were not sufficient to produce manding, even though the subjects had histories of mand training under partial tact control.

There were several indications that subjects were affected by the motivating conditions during baseline but simply did not have appropriate manding responses. For example, Subject 1 needed to mand for the missing item "money" to operate a vending machine and get candy. Instead of emitting the conventional topography (which was a part of his repertoire as a tact), he tried putting his hand in the experimenter's pocket. With the other chains, both subjects sometimes attempted to get up and find the items themselves or to mand with unconventional topographies, such as tapping the experimenter's arm. Another possible type of unconventional mand occurred during baseline. On the wiping water chain, Subject 1 did not have the mand "paper towel" in sufficient strength and aggressed towards the experimenter. At that point, it appeared that baseline might be aversive; and training was initiated the next day. There were additional indications that the chains led to strong reinforcement. Both subjects ate the
consumables and engaged in reinforcing activities quickly and repeated mands vigorously when there was a one-second delay to reinforcement. Also, during training, there was no aggression with either subject, although both had histories of aggressive behaviors and periodically aggressed in their regular classroom settings in order to escape tasks. They smiled frequently during training and appeared to enjoy the procedures.

These results would support Skinner's (1957) analysis of the mand and the tact as separate operants. Although Skinner described how acquiring one operant may increase the probability of emitting a different operant of the same topography, he emphasized that this transfer of stimulus control will only occur under certain conditions; for example, when the stimuli which control a tact resemble the stimuli which reinforce a mand. The present results support the interpretation that mands and tacts may need to be trained separately with deaf, mentally impaired students. Plante and Pear (Note 5) obtained different results, but their mand conditions strongly resembled tact conditions.

When compared simultaneously in a multielement design, the tact and imitative transfer-of-stimulus-control procedures were about equally effective as measured by the mand probes and trials-to-transfer during each training session. While one behavior was trained using the imitative prompt procedure, a second was trained using the tact prompt procedure (in the same session, with the order of presentation of each procedure randomized). It was somewhat surprising that these procedures produced comparable results; since both subjects had a history of some mand training under partial tact control, it might have been
predicted that the tact transfer procedure would be more effective with these subjects. One potential advantage to the imitative prompt procedure would be that it is not necessary for students to acquire the tact for an item before manding can be trained; correct imitation of the topography is sufficient. It would seem desirable to have such a procedure available, since the greater functionality of manding would suggest that it be trained as early as possible and Plante and Pear (Note 5) found that either mands or tacts can be trained first.

One interesting aspect of both procedures was that it was possible to ignore incorrect responses and reinforce correct responses as soon as they occurred, without shaping a chain of incorrect responses which culminated in one correct response. As the study progressed, the subjects were observed to make fewer errors before the correct mand was emitted until, finally, only the correct response occurred. In fact, at the end of the generalization sessions, Subject 1 was specifically manding for each successive item that he needed to complete each chain of behaviors. Response latency was handled in a similar manner to incorrect responding, and similar results were noted. The subjects had a full 10 seconds to mand for each missing item, from the point in the chain where the item was needed. Within this 10-second time limit, long latencies to responding were ignored; and correct responses were reinforced when they occurred. During training and maintenance, the latencies of responding were observed to decrease, although systematic data were not collected on this. Both incorrect and long-latency responding dropped out without any explicit contingencies to reduce them.

After training one mand for each of four chains, generalization
probes were conducted to test whether untrained mands would be emitted when different items were missing, whether trained mands would occur in slightly different stimulus situations, and whether untrained mands would occur in the presence of novel stimuli. For Subject 1, generalization occurred in all of these areas much earlier than was expected (see Table 1). One particularly interesting result was that after a few generalization sessions this subject began manding before the $S^D$ to begin the chain was presented and before any items were placed on the table. After each mand, the item manded was provided; and he continued manding for all the necessary items to complete the chain. When they were all present, he made the sign for the $S^D$ to start the chain and proceeded to complete it. After the chain was completed and the reinforcement obtained, he then manded to engage in activities that generally occurred after the session (walk, run, sit, eat). Manding apparently generalized from missing items to actions that would currently function as reinforcement. None of these responses were dependent upon verbal $S^D$'s.

For Subject 2, some generalization occurred before all four mands were trained. The third mand occurred without any direct training but after the first two mands had been trained. After all four mands were acquired, generalization sessions were conducted with different items missing from the same chains. In seven out of eight probes, Subject 2 manded for items that had never been directly trained. Generalization of untrained mands to slightly different stimulus conditions was assessed when the $S^D$'s for some of the chains were changed; however, generalization was not assessed in a different setting. Further
generalization sessions were not conducted for Subject 2 because her training occurred later than the training for Subject 1 and there was not enough time.

In general, there was a great deal of generalization with a relatively small amount of training (four mands), especially considering that neither subject had a history of manding for missing items. The subjects also had not been trained to initiate actions with all the objects in the chains. This might have been expected to lead to their waiting for the experimenter's help with the untrained items, rather than simply manding for them. If this had occurred, the subjects would have been trained to initiate actions with the necessary objects before direct mand training was implemented. However, generalization to untrained mands occurred without further procedures being necessary.

With one exception, all four manding responses were maintained at 100% accuracy once they had met the criterion of being emitted without prompts for two consecutive days. The mand that did not initially maintain with Subject 1 ("can") was retrained in one trial and maintained successfully after that point. Once responses were trained to criterion, the time lapse between probes was gradually lengthened. The maintenance data were especially interesting for Subject 1, since he had a long history of inconsistent responding during tact training in his regular academic sessions (averaging around 70%) and of failing to maintain behaviors he had acquired. Four months after termination of the study, his teacher reported that he was still consistently manding for missing items in a novel stimulus situation (a different room) and with a novel trainer. He would mand "paper towel" and then wipe the
sink. He also was manding for activities to engage in (eat, walk, sit). Maintenance data remained at 100% for Subject 2.

There are several directions for future research. First, the design of the present study could be improved. One area of refinement could be in the actual training procedures used. It appeared that both training procedures would be more efficient if the length and number of verbal SD's were reduced. The subjects initially appeared to be "confused" by the SD's; that is, they sometimes made imitative responses to the SD's rather than responding to the tact or imitative prompts. For example, during the imitative prompt procedure, the imitative prompt "water" is preceded by the SD, "Do this." Instead of correctly responding to the imitative prompt, Subject 1 in particular would often imitate, "Do this." The problem can be seen in hearing children who are echolalic; they echo the SD as well as the prompt. When this happens, it is necessary to present the SD as a very weak stimulus initially and the prompt as a very strong stimulus. Such problems could perhaps be avoided by using as few SD's as possible in the training procedure, especially with subjects who have strong imitative histories.

The design of the present study could also be improved by measuring response latencies throughout the experiment; assessing generalization with all subjects to novel topographies, different stimulus conditions, different trainers, and other types of manding (e.g., social manding); and by taking maintenance data for a longer period of time. Explicit procedures for freeing control of manding from the SD to begin the chain could also be developed, if this process did not occur on its own (as it did for Subject 1).
Further studies could also include other independent variables. One could explicitly test whether manding for missing items can be taught using "items present training," which is found in most language training programs that do teach manding (Guess, Sailor, & Baer, 1976; Lovaas, 1977). The present subjects had learned a "mand frame" (e.g., "I want ___.") and had been exposed to mand training when the items were present, but the training was not specifically conducted on the items used in this study. One might not expect "items present training," or training partially under the control of tact variables, to lead to manding entirely under the control of the establishing operation, since the subjects had not been manding under establishing control before the study. This question could be explicitly tested, however.

Finally, other dependent variables could also be investigated, such as social manding, manding at appropriate times (when it is more likely to be reinforced and thus maintained), and the occurrence of aggressive/disruptive behaviors throughout the day. As children gain more control over their environments through appropriate verbal behavior (manding), it might be expected that aggressive/disruptive behaviors would decrease. This possibility could be tested by collecting data on the inappropriate behaviors before, during, and after mand training with several subjects, perhaps in a multiple baseline across subjects design.

In conclusion, this study demonstrated that manding for missing items can be trained in a structured situation, that tact training is not sufficient for production of mands, and that generalization and
maintenance can be obtained without further procedures. Both the tact and imitative prompt procedures were relatively straightforward and did not require a large expenditure of time or money. Sessions took from 15-30 minutes to conduct, once per day; and the items that were purchased for the experiment were inexpensive. These procedures would seem to be practical for teaching children to better control their environments through appropriate language.
REFERENCE NOTES


REFERENCES


