Stimulus-Specific and Stimulus-Nonspecific Reinforcement: Effects on Tact Training with Severely Mentally Impaired Young Adults

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STIMULUS-SPECIFIC AND STIMULUS-NONSPECIFIC REINFORCEMENT: EFFECTS ON TACT TRAINING WITH SEVERELY MENTALLY IMPAIRED YOUNG ADULTS

by

Steven J. Braam

A Dissertation
Submitted to the Faculty of The Graduate College
in partial fulfillment of the requirements for the
Degree of Doctor of Philosophy
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
December 1990

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STIMULUS-SPECIFIC AND STIMULUS-NONSPECIFIC REINFORCEMENT: EFFECTS ON TACT TRAINING WITH SEVERELY MENTALLY IMPAIRED YOUNG ADULTS

Steven J. Braam, Ph.D.
Western Michigan University, 1990

The effects of specific or similar physical properties between discriminative stimuli and reinforcers in tact training were studied. Stimulus-specific reinforcement and stimulus-nonspecific reinforcement conditions were compared using a matched-groups design. When subjects correctly tacted in the former condition, the experimenter gave reinforcers with identical physical properties to the training stimuli. When subjects correctly tacted in the latter condition, the experimenter delivered reinforcers with different physical properties from the nonverbal training stimulus.

The subjects demonstrated no overall differences in learning trials. Only one subject, trained with stimulus-specific reinforcement learned tacts in consistently fewer trials than his counterpart trained with stimulus-nonspecific reinforcement.

Subjects demonstrated generalized responding respective to their training. Subjects trained with stimulus-nonspecific reinforcement demonstrated increased general-
ized mand responding during probe sessions. Subjects trained with stimulus-specific reinforcement demonstrated increased generalized mand compliance responding during probe sessions.

The results suggest that training tacts with stimulus-specific reinforcement does not significantly increase acquisition rates compared to training tacts with stimulus-nonspecific reinforcement. However, the tacts trained in this study were controlled by both discriminative and motivative variables and had the effect of facilitating the transfer of control for learned behavior to different, untrained stimulus conditions. Subjects demonstrated increased functional repertoires (tact, mand, and mand compliance) as a result of tact training alone.
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Stimulus-specific and stimulus-nonspecific reinforcement: Effects on tact training with severely mentally impaired young adults

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Steven J. Braam
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CHAPTER I

INTRODUCTION

Functional language skills give an individual the ability to manipulate and react to the environment through another person or group of people. They are important skills for Developmentally Disabled (DD) individuals. Yet, due to the complexity of teaching these skills, they are often overlooked or underemphasized in educational programming.

Several factors may account for this tendency to neglect the training of effective language skills. One factor seems to be the focus of educators on mental prerequisites. Often language training is not emphasized with DD individuals because they lack intellectual abilities as measured by standardized tests. From a radical behavioral perspective (Skinner, 1957) these tests are usually not regarded as good predictors of an individual's potential to learn language. According to this view language is verbal behavior and a functional repertoire can be taught to many different organisms regardless of their cognitive sophistication. The main task of teaching is to bring verbal responses under the control of the relevant antecedent stimuli.
Another factor which seems to limit verbal behavior applications with DD individuals is a popular tendency to focus on "receptive language" as a prerequisite to functional language expression. These behaviors of discriminating and indicating (usually by pointing to) named objects or events are certainly important to a DD person's repertoire, but are not prerequisites to establishing functional verbal behavior. A third factor is the assumption made by educators that the language needs of DD students are being adequately met by speech and language therapists. Too often the emphasis of traditional speech and language therapy on articulation, grammar, and syntax detracts from the acquisition of functional skills. Furthermore, a potpourri of verbal responses, unrelated to functional usage, are often initially targeted for training. Some examples of these responses are: (a) "yes/no," (b) "please/thank you," and (c) "your/my."

Skinner (1957) analyzed verbal behavior in terms of antecedent stimulus conditions, that is, stimuli which evoke responses. Subsequently, researchers have reported training procedures based on the verbal operants which Skinner identified (Braam & Poling, 1983; Carr, Binkoff, Kologinsky, & Eddy, 1978; Carr & Kologinsky, 1983; Carroll & Hesse, 1987; Hall & Sundberg, 1987; and Simic & Bucher, 1980).

Attention has also focused on the effectiveness of
different procedures to teach the same verbal operant. In training tacts or naming (Skinner, 1957) investigators have examined the role of degrees of specificity or similarity between the physical features of discriminative stimuli, responses, and reinforcers. This term and its root, specific, are introduced to refer to similar physical properties of objects. For example, two identical silver spoons share the most specific features. In comparison, a silver spoon and a white plastic spoon share fewer specific physical properties. Photographs and drawings of spoons share even less specific properties. In addition, a fork shares a remote degree of specificity with a silver spoon, but a chair does not.

One line of research has examined the effects of specificity between the discriminative training stimulus and other discriminative stimuli. Welch and Pear (1980) in training tacts found that using actual objects as language training stimuli, as opposed to pictures of the objects, increased response generalization to similar objects in preschoolers' environments.

Another line of research has examined the effects of specificity between discriminative stimuli and responses in tact training. Griffith and Robinson (1980) demonstrated that Sign Language (signed) responses which physically resembled the training stimuli were trained to criteria in fewer trials than when stimuli and responses
did not resemble one another. For example, the sign for cup (C handshape on top of a flat palm) looked like a cup and the sign for ball (the curved fingers of both hands in a 5 handshape touching one another at the fingertips) looked like a ball. In a further comparison of discriminative stimulus and response specificity in language training Hurlbut, Iwata, and Green (1982) compared two symbol systems across several parameters including tact training. Iconic symbols, which the subjects pointed to, were compared with Blissymbols. Iconic symbols, which most closely depicted the training stimuli in line drawing form (contrasted with the more abstract Blissymbols), produced increased response acquisition, maintenance, and generalization.

A third line of research examined the effects of specificity between a response and a related reinforcer in learning conditional discriminations. Saunders and Sailor (1979) examined the effects of two forms of generalized reinforcement, which they called specific reinforcement and nonspecific reinforcement, on the acquisition of behavior under the control of verbal stimuli. Traditionally referred to as receptive language, the behavior may be simply described as doing what one was asked to do, but may be more precisely referred to as "mand compliance" (Michael, Whitley & Hesse, 1983). Saunders and Sailor (1979) presented severely retarded children
with toys that appeared to function as reinforcers. Two toys (training stimuli) were presented and the subjects were asked to point to each one when named by the experimenter. In the specific reinforcement condition, the subjects' correct responses were followed by an opportunity to play with the toys to which they had pointed. In the nonspecific reinforcement condition, subjects' correct responses were followed by an opportunity to play with toys that were not training stimuli. There was also a variable reinforcement condition where, following a correct response, subjects were given either specific or nonspecific reinforcement (as defined above and in a randomized order). The results showed that the percentage of correct responses (conditional discriminations) were greater in the specific reinforcement condition than in either the nonspecific or variable reinforcement conditions.

Although Saunders and Sailor (1979) studied the use of these types of reinforcement with nonverbal behavior, the application of the techniques to verbal behavior training has also been observed. Again, note that mand compliance is nonverbal behavior and not necessarily a prerequisite to establishing a functional verbal repertoire. In tact training with DD individuals, it appears that there are two general teaching procedures differentiated by the relationship between discriminative and...
reinforcing stimuli. One procedure is typified by using reinforcers bearing no specificity to the discriminative stimuli evoking the responses. For example, when shown a cup or a picture of one and a learner said "cup," a teacher delivered small and quickly consumable edible reinforcers, such as M&M candies (Faw, Reid, Schepis, Fitzgerald & Welty, 1981).

In a second approach to tact training, reinforcers specific to the discriminative stimulus were given contingent on correct responses. In this approach, when shown a ball and a learner said "ball," s/he received the object to play with or in the case of edibles, the food to eat (Carr et al., 1978). In another variation of this procedure a learner was shown a picture of an object or event and the actual object or event depicted by the picture being trained is given to the learner following a correct response.

Each of the above three procedures for tact training involved an identical conditional discrimination. That is, a correct response was under the control of two or more discriminative stimuli (Mackintosh, 1977; Rilling, 1977). In each case, the trainer presented a nonverbal (object or picture) stimulus with a verbal ("What is that?") stimulus. The critical difference between the three tact training procedures described above was in the relation between the antecedent and consequent nonverbal
stimuli. The physical features of the discriminative stimulus (cup) and the reinforcer (candies) were different in the first example. In the subsequent example and its variation the physical features were identical. That is, the ball served both discriminative and reinforcing functions.

Despite the common use of the different reinforcement techniques described above, the comparative effectiveness of each has only recently been studied. The effects of specificity between discriminative stimuli and reinforcers in tact training was studied by Stafford, Sundberg, and Braam (1988). In this study, the terms specific reinforcement and nonspecific reinforcement referred to specificity between antecedent stimuli and reinforcers. A within-subject multielement design was used to study a mentally-retarded youth. Tacts in two distinctly different stimulus conditions were taught. Responses consisted of two-to-five component signed tacts such as: (a) "food-cup," (b) "food-blue-cup," (c) "food-blue-cup-table," and (d) "food-blue-cup-on-table." In both conditions stimuli which also functioned as reinforcers were shown to the subject and placed in the condition-respective container (a cup in one condition and a bowl in the other). At the same time the experimenter asked the youth, "What do you want?" Following a correct response in the specific reinforcement condition, the
experimenter gave the youth the reinforcer in the cup. In the nonspecific reinforcement condition, following a correct response, the experimenter delivered a reinforcer different from that in the bowl.

Stafford et al. (1988) found no difference in the percentage of correct responding across the increasing levels of difficulty between the two conditions. However, they found less response latency in the specific reinforcement condition. Furthermore, the subject chose the specific reinforcement condition more frequently when allowed to choose between training conditions. Although the data demonstrated that responses trained with specific reinforcement were not acquired more rapidly than responses trained with nonspecific reinforcement, the differences in latency and condition preference indicated that such training may affect verbal repertoires in unique ways.

Using specific reinforcement in tact training is an approach to language training used by parents and teachers. Parents ask their children to name objects which are shown to them. Once the child correctly names the object, the parent reinforces the behavior by giving the child the object. Although commonly used, researchers have yet to identify the rationale for using this technique.

The reduced latency of responding and increased
condition preference with specific reinforcement tact training demonstrated by Stafford et al. (1988) was clear. However, those distinctions have limited practical applications. The current study was designed to investigate if the two different reinforcement procedures might have other unique consequences of more pragmatic relevance for language trainers. The two conditions were named stimulus-specific reinforcement and stimulus-nonspecific reinforcement to avoid confusion with response-reinforcer specificity. Using both a within-subjects and between-subjects design, eight subjects were trained to tact a variety of foods. Of particular interest were measures of maintenance of reinforced responding during extinction as well as generalization of the trained responses to different antecedent stimulus conditions.
CHAPTER II

METHOD

Subjects

Eight severely mentally impaired young adults, ages 18 to 24 years (mean=22), served as subjects. Standardized testing conducted with the Stanford-Binet (Terman & Merrill, 1973) and the Vineland Social Maturity Scale (Doll, 1965) indicated that they functioned at a level (commonly referred to as intellectual functioning) which measured more than three standard deviations below the mean (IQ below 25). All subjects were ambulatory, toilet-trained, and self-feeding. They resided in the community, either with their families or in group foster care, and attended daytime programming at a special education facility.

These individuals were chosen because of their extremely limited repertoires. Isolated examples of mands (requests), tacts (names), and mand compliances (pointing to named objects) were observed. However, these behaviors were under poor stimulus control. Prior to the start of this study, the subjects received no systematic language training either vocal or signed.
Setting and Apparatus

The study was conducted at the Croyden Avenue School, a special education facility in Kalamazoo, Michigan. All sessions were conducted in a 4' X 6' partitioned area of the subjects' classroom. The experimenter (author) worked daily with each of the eight subjects on an individual face-to-face basis. To the experimenter's left was a table on which training stimuli were displayed or manipulated. Also, to the experimenter's left was a small bookshelf used to store subsequent training stimuli out of sight during training or testing with another stimulus.

Procedures

A two matched-pair group design was used. Between-groups and between-subjects statistical analyses of the number of tact training trials to criterion were made using A-tests. In addition, within-subject and between-groups visual analyses were made across behaviors (mand, tact, and mand compliance) in post-training probes.

Assignment to treatment groups

Subjects were matched according to their ages and functioning levels. This procedure yielded four matched-pairs of subjects. Using a random numbers table, one
subject of each pair was assigned to an experimental condition. That subject's corresponding pair was then automatically assigned to the opposite condition. For example, if the first subject of a pair was assigned to the stimulus-specific reinforcement condition, his/her pair would automatically be assigned to the stimulus-nonspecific reinforcement condition.

**Reinforcer sampling**

Foods used for training stimuli were demonstrated to be functional reinforcers for the subjects in classroom activities. To assess relative levels of deprivation and satiation and also to provide a basis for selecting training stimuli, 10, two-phase reinforcer sampling sessions were conducted with each subject prior to the start of training.

For each subject, five of the reinforcer sampling sessions were conducted during the mornings and five were conducted during the afternoons of 10 consecutive school days. At the start of a reinforcer sampling session, each of the 10 food items were individually presented in a random order. During this first phase of sampling the experimenter placed a piece of food on a 13 cm paper plate directly in front of the subject. If hesitant, the subject was encouraged to pick up the food from the plate and eat it. Afterwards, the next item was presented in
exactly the same way. This procedure continued for all of the 10 items.

Immediately following the above procedure, the second phase of reinforcer sampling began. Ten items identical to those previously presented and eaten were simultaneously placed in front of the subject. Each item was on an identical paper plate and arranged in an arc so that each was relatively equidistant from the subject's dominant hand. Since some of the subjects had gross and fine motor movement limitations, this arrangement was an attempt to ensure that an equivalent response effort would be required to choose each item.

The experimenter then directed (by pointing) the subject to look at each item and touch the corresponding plate (observing response). Any attempts to pick up the food were discouraged. After an observing response was made to all 10 stimuli, the experimenter allowed the subject to choose and eat any one item s/he wished. Once the chosen item was eaten, the procedure began again and continued until all the food was eaten. The numerical order of the selections was recorded, yielding a hierarchy for that session. This information was used to choose training stimuli, as explained in the subsequent section.
Selection of training stimuli

Following the 10 reinforcer sampling sessions, the numbers corresponding to each subject's selection order for each reinforcer were summed across the 10 test sessions (e.g., peach = 1+3+2+1+6+2+4+3+2+1=25). These summed scores were averaged and rank-ordered, yielding each subject's satiation/deprivation level for each reinforcer. The ranks of all subjects' reinforcers were summed according to reinforcers and averaged across subjects, yielding a rank-order measure of satiation/deprivation levels of reinforcers for all subjects.

The experimenter selected training stimuli and reinforcers (these were identical for stimulus-specific reinforcement subjects) in a balanced fashion from the rank-order list. Initially, one-half of the stimulus-nonspecific reinforcement subjects were trained with cookie (ranked first) reinforced by popcorn (ranked ninth) and peach (ranked seventh) reinforced by pudding (ranked third). The other two subjects were trained with cereal (ranked tenth) reinforced by banana (ranked second) and pop (ranked fourth) reinforced by bean (ranked eighth). When criteria were met, paired training stimuli and reinforcers were switched between the stimulus-nonspecific reinforcement subjects. One-half of the stimulus-specific reinforcement subjects were trained with
identical stimuli and reinforcers ranked first (cookie) and seventh (peach) and one-half with those ranked fourth (pop) and tenth (cereal). When criteria were met, the training stimuli were switched.

Pretesting

After reinforcer sampling and assignment to groups, pretesting was conducted to control for untrained acquisition of the target responses prior to training. A three-trial pretest occurred prior to the start of the first training session for each stimulus. A pretest trial was identical to a training trial, as described in the following section, but was not systematically reinforced. Responses were recorded as correct or incorrect during the pretest.

Training sessions

The experimenter placed a piece of food on a paper plate on a colored mat. He then prompted the subject to look at the food by pointing at it. After waiting for the subject to look at the food, he said/signed, "What is this?" Thus, the training stimulus had four components: (1) a nonverbal stimulus (food), (2) an observing prompt, (3) a verbal stimulus ("What is this?"), and (4) the colored mat. A correct response was a signed tact corresponding to the nonverbal training stimulus and occurring
within five seconds of the experimenter saying/ signing, "What is this?". The experimenter praised and gave the subjects food (reinforced) following correct unprompted signed responses (tacts). After three consecutive tacts, training ended for that stimulus in that session.

A graduated prompt procedure was instituted for incorrect or no responding. Modeling the correct response was the first level of prompting. First, following an incorrect response or no response within five seconds, the experimenter re-presented the training stimulus and modeled the correct signed response. He reinforced correct responses.

At the second level of prompting, following an incorrect or no response, the experimenter re-presented the four-component training stimulus and immediately took the subject's hands and helped him/her form the correct signed tact. As before, the experimenter reinforced correct responses.

Two tacts were consecutively trained daily with each subject. After the daily criterion was met for the first training stimulus, training with the second stimulus was conducted in exactly the same manner. Daily training continued until the subject gave three consecutive tacts or 10 training trials occurred (session end-of-training criterion).

The end-of-training criterion for each target re-
sponse was three consecutive sessions at or above 90% unprompted correct accuracy. For practical purposes, if the training criterion was met for one response prior to the other, training continued for both until the other's criterion was met or the end-of-training limit (25 sessions) occurred. This procedure allowed a trained response to be minimally maintained while training of the second response continued.

Reinforcement procedures differed between conditions. In the stimulus-specific reinforcement condition following a correct tact (prompted or unprompted) the experimenter gave the subject food identical (specific) to the nonverbal training stimulus. For example, the experimenter gave subjects pieces of peaches when real pieces of peaches were used as training stimuli. In the stimulus-nonspecific reinforcement condition, the experimenter gave subjects food that was different (nonspecific) from the nonverbal training stimulus. For example, if subjects correctly tacted peaches, the experimenter gave them pudding. Nonverbal stimuli used during the stimulus-nonspecific reinforcement condition remained consistently paired throughout training. For example, the correct response "pop" always resulted in delivery of a bean. Additionally, a different colored paper mat was placed underneath each nonverbal training stimulus to clearly distinguish between training stimuli changes.
Post-training probe sessions

Probe sessions were used to measure resistance to extinction of reinforced responses and, also, to assess generalized responding across mand, tact, and mand compliance repertoires. Sessions were conducted every five to seven days after the criterion for a particular stimulus was met. The experimenter said/signed one of the following: (a) "What is that?" (tact stimulus); (b) "What do you want?" (mand stimulus); and (c) "Show me the ________." (mand compliance stimulus). The experimenter simultaneously presented the training stimuli (pieces of food) with each of the verbal probes. Additionally, as before, the experimenter placed the training stimuli on different colored paper mats to distinguish clearly between probe stimulus changes. Probe trials were not reinforced and were presented in random order.

Data collection and interobserver agreement

The experimenter collected data on correct signed tacts corresponding to the nonverbal training stimulus and occurring within five seconds of the verbal stimulus, "What is that?" For example, a correct tact for the training and probe stimuli of corn was the sign "corn." The experimenter also collected data on correct mands and mand compliances during probe sessions. A correct mand
for the experimenter's presentation of corn and saying/signing, "What do you want?" was the subject signing "corn." A correct mand compliance for the experimenter's presentation of corn and saying/signing, "Show me the corn," was the subject touching or pointing to the corn.

A second observer independently recorded the subjects' responses during 33% of pretest, training, and probe sessions. Interobserver agreement was calculated according to the formula: 

\[
\text{Agreement} = \frac{\text{Number of Agreements}}{\text{Number of Agreements} + \text{Disagreements}} \times 100
\]

Agreement was 100% for pretest sessions, 96% for training sessions, and 100% for probe sessions.
CHAPTER III

RESULTS

Number of Learned Verbal Responses

Stimulus-specific reinforcement subjects learned 13 out of 16 (81%) tacts to criterion (see Table 1). Stimulus-nonspecific subjects learned 12 out of 16 (75%) tacts to criterion. No significant difference in the data between groups was found using an A-Test.

Table 1

Summary of Training Results by Subjects and Stimuli

<table>
<thead>
<tr>
<th>Training stimuli</th>
<th>Cookie</th>
<th>Peach</th>
<th>Pop</th>
<th>Cereal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>B-SP</td>
<td>+</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>J-NS</td>
<td>+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pair 2</td>
<td>JD-SP</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>F-NS</td>
<td>+</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Pair 3</td>
<td>M-SP</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>MK-NS</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Pair 4</td>
<td>K-SP</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>MO-NS</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

+ response learned to criterion
0 response not learned
Trials-to-Criterion

No significant differences were found between trials-to-criterion for acquisition of any of the four training stimuli (see Table 2). In addition, no significant differences in the number of training trials-to-criterion were found for three of the four subject pairs. However, in the case of Subject Pair 2, JD-SP learned responses in fewer trials than F-NS.

Table 2

Number of Response Trials-to-Criterion by Subjects and Stimuli; Values of A-test Results by Subject Pair and Group Comparisons

<table>
<thead>
<tr>
<th>Training stimuli</th>
<th>Pair Subject</th>
<th>COOKIE</th>
<th>PEACH</th>
<th>POP</th>
<th>CEREAL</th>
<th>Mean</th>
<th>A(p=.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 B-SP</td>
<td>200</td>
<td>260*</td>
<td>230</td>
<td>220*</td>
<td>228</td>
<td>A=.83</td>
</tr>
<tr>
<td></td>
<td>J-NS</td>
<td>160</td>
<td>230*</td>
<td>220*</td>
<td>200</td>
<td>200</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>2 JD-SP</td>
<td>210</td>
<td>130</td>
<td>130</td>
<td>170</td>
<td>160</td>
<td>A=.29</td>
</tr>
<tr>
<td></td>
<td>F-NS</td>
<td>240</td>
<td>200</td>
<td>220*</td>
<td>210</td>
<td>218</td>
<td>s</td>
</tr>
<tr>
<td></td>
<td>3 M-SP</td>
<td>100</td>
<td>110</td>
<td>90</td>
<td>240*</td>
<td>135</td>
<td>A=.82</td>
</tr>
<tr>
<td></td>
<td>MK-NS</td>
<td>240</td>
<td>140</td>
<td>70</td>
<td>250*</td>
<td>175</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>4 K-SP</td>
<td>100</td>
<td>100</td>
<td>140</td>
<td>120</td>
<td>115</td>
<td>A=22.1</td>
</tr>
<tr>
<td></td>
<td>MO-NS</td>
<td>30</td>
<td>210</td>
<td>90</td>
<td>100</td>
<td>108</td>
<td>ns</td>
</tr>
</tbody>
</table>

A=7.5  A=.58  A=1.11  A=1.0
ns  ns  ns  ns

s = statistically significant result
ns = statistically nonsignificant result
* = response not acquired; training-end criterion met

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The trials-to-criterion for each group's training were compared with an $A$-test. The results supported the null hypothesis. That is, no significant differences were found between the number of training trials-to-criterion in antecedent stimulus-specific and stimulus-nonspecific reinforcement tact training techniques. $A(p.05)=.281$ was less than the obtained value of $A=.879$.

Resistance to Extinction and Generalization to Untrained Verbal Stimuli

Subjects demonstrated resistance to extinction for some, but not all trained responses (see Table 3). Stimulus-nonspecific reinforcement subjects, as a group, averaged a greater percentage of correct tacts (81% compared to 75% for stimulus-specific reinforcement subjects) in probe sessions.

Limited generalized responding was demonstrated by all subjects during the other probe conditions (see Tables 4 and 5). Stimulus-nonspecific reinforcement subjects averaged a greater percentage of correct mands during probe sessions (63%) than did stimulus-specific reinforcement subjects (50%). As a group, stimulus-specific reinforcement subjects averaged a greater percentage of correct mand compliances during probes (75%) than did stimulus-nonspecific reinforcement subjects (31%).
### Table 3
Percent Correct Tacts in Probe Sessions

<table>
<thead>
<tr>
<th>Pair</th>
<th>Subject</th>
<th>CEREAL</th>
<th>COOKIE</th>
<th>PEACH</th>
<th>POP</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>B-SP</td>
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<td>50</td>
<td>0*</td>
<td>100*</td>
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<tr>
<td></td>
<td>J-NS</td>
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<td>50</td>
<td>25*</td>
<td>0*</td>
</tr>
<tr>
<td>2</td>
<td>JD-SP</td>
<td>67</td>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>F-NS</td>
<td>100</td>
<td>20*</td>
<td>0</td>
<td>0</td>
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<tr>
<td>3</td>
<td>M-SP</td>
<td>67*</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>MK-NS</td>
<td>33*</td>
<td>100</td>
<td>100</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>K-SP</td>
<td>13</td>
<td>67</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>MO-NS</td>
<td>80</td>
<td>100</td>
<td>0</td>
<td>80</td>
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</tbody>
</table>

* response not learned to criterion

### Table 4
Percent Correct Mands in Probe Sessions

<table>
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<th>Pair</th>
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<th>PEACH</th>
<th>POP</th>
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<tr>
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<td>J-NS</td>
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<td>75</td>
<td>25*</td>
<td>0*</td>
</tr>
<tr>
<td>2</td>
<td>JD-SP</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>F-NS</td>
<td>100</td>
<td>40*</td>
<td>20</td>
<td>0</td>
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<td>0</td>
<td>25</td>
<td>50</td>
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<tr>
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<td>MK-NS</td>
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<td>0</td>
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<td>67</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>MO-NS</td>
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<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

* response not learned to criterion
### Table 5

Percent Correct Mand Compliances in Probe Sessions

<table>
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<th>Pair</th>
<th>Subject</th>
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<th>COOKIE</th>
<th>PEACH</th>
<th>POP</th>
</tr>
</thead>
<tbody>
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<td>0*</td>
<td>0*</td>
</tr>
<tr>
<td></td>
<td>J-NS</td>
<td>0</td>
<td>0</td>
<td>0*</td>
<td>0*</td>
</tr>
<tr>
<td>2</td>
<td>JD-SP</td>
<td>67</td>
<td>33</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>F-NS</td>
<td>100</td>
<td>100*</td>
<td>20</td>
<td>0</td>
</tr>
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<td>M-SP</td>
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<tr>
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<td>MK-NS</td>
<td>17*</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>K-SP</td>
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<tr>
<td></td>
<td>MO-NS</td>
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<td>0</td>
</tr>
</tbody>
</table>

* response not learned to criterion
CHAPTER IV

DISCUSSION

The current study found no significant differences between four matched-pair groups in rates of acquisition for tacts learned under stimulus-specific reinforcement conditions versus tacts learned under nonspecific reinforcement conditions. The results supported those of Stafford et al. (1988) using a single subject.

One of the eight subjects (JD) trained with stimulus-specific reinforcement acquired each of the trained tacts in consistently fewer trials than his counterpart who was trained with stimulus-nonspecific reinforcement. In contrast, no subjects trained with stimulus-nonspecific reinforcement acquired target responses more quickly than his/her counterpart trained with stimulus-specific reinforcement. These findings suggest that individual differences occur in the DD population, although on the whole, differences are not statistically significant.

The results, along with those of Stafford et al. (1988), do not support those of other researchers suggesting that increased specificity between terms of a verbal contingency improved response acquisition. This
discrepancy may be due to the fact that the current study, along with Stafford et al. (1988), examined increased specificity between discriminative stimuli and reinforcers. The other studies (e.g., Griffith & Robinson, 1980; Hurlbut et al., 1982) examined increased specificity between discriminative stimuli and related responses. These latter studies demonstrated that specificity between discriminative stimuli and responses facilitated language learning rates. It might be noted that the temporal distance between a discriminative stimulus and a response is shorter than that between a discriminative stimulus and a reinforcer. The increased temporal distance between a discriminative stimulus and a reinforcer, although small, may have been a factor which accounted for the lack of differentiation in acquisition rates between conditions in the current study.

The current study extended the work of Stafford et al. (1988) by measuring behavior presumed to have more practical applications to language trainers than response latency and preference. Measuring the resistance to extinction of reinforced responses and the generalization of trained responses to different antecedent controlling stimuli (mand and mand compliance) provided those data. Generalized responding during probes, although unexpected, was demonstrated by both groups. The author's previous experience in language training with DD individuals
suggested that during early training little transfer of learning occurred between different verbal and nonverbal repertoires. Yet, as the learner's verbal repertoire expanded and a more extensive history of reinforcement for responding under different stimulus conditions was established, transfer between repertoires occurred. The current subjects clearly did not have functional verbal repertoires at the outset of this study, yet they demonstrated generalized responding.

Subjects demonstrated generalized responding to some, but not all of the untrained mand and mand compliance stimuli. In mand probes subjects trained with stimulus-nonspecific reinforcement performed slightly better (63%) than subjects trained with stimulus-specific reinforcement (50%). This pattern of increased correct responding in the mand condition may have been due to the nonspecific subjects' restricted access to the previously unavailable reinforcers. This contrived state of deprivation and being asked, "What do you want?" in the presence of the food—a novelty effect—might have been responsible for some of the increased responding.

Subjects trained with stimulus-specific reinforcement performed significantly better than subjects trained with stimulus-nonspecific reinforcement during mand compliance probes (75% vs. 31%, respectively). Sometimes stimuli may serve multiple contingency functions in in-
teerelated behaviors. When a stimulus consistently and repeatedly evokes the same reinforced response, the response acquires evocative strength and becomes a stimulus for the new response (the former stimulus). For example, the experimenter consistently paired the nonverbal (food) stimulus with the subjects' verbal (signed) response in the stimulus-specific reinforcement condition. Through this repeated pairing, the verbal stimulus alone may have evoked the correct mand compliance response (pointing or touching in the presence of the food and the verbal stimulus, "Show me the _____"). Thus, both components of the trained conditional discrimination were present in the new mand compliance task and may have facilitated a related nonverbal response (pointing to the food).

A shortcoming of the current study was the lack of reinforcement of correct responses in the probe sessions. However, despite this shortcoming, generalized responding occurred. Antecedent stimulus control seemed to be more of a determinant of correct responding than reinforcement. These results suggest that DD individuals can make finer-grained discriminations than previously thought.

The results also suggest that one of the unique effects that tact training with stimulus-specific reinforcement may encourage is the transfer of trained stimulus control across untrained repertoires. For example,
after only learning to tact a peach, M-SP could sign "peach" when he saw it (tact), when it was specifically available as a reinforcer (mand), and when he was asked to point to it (mand compliance). Cognitive psychologists might explain these results as promoting the subject's understanding of the meaning of the signs (words). From a behavioral standpoint, however, understanding the meaning of verbal behavior can be defined as multiple stimulus control of related responses.

Another type of generalized responding also occurred. As correct tacts were emitted and reinforced more frequently in a training session, the same response was sometimes emitted (although incorrectly) to other training stimuli. For example, as F-NS increasingly correctly tacted a peach and was reinforced, he later signed "peach" in response to cookie. Similar patterns of responding (for different stimuli and responses) were demonstrated by each subject. Although considered incorrect tacts, this type of responding suggested reinforcement carryover effects and verbal stimulus control of a thematic nature. It was possible for the subjects to emit different tacts such as "dog" or "cup" or no response at all; however, a verbal response from the same thematic category (both peaches and cookies are food) was given instead. Antecedent stimulus control was indicated by this pattern of incorrect responding (i.e., when shown...
food and asked to name it, a food name is given). This pattern is similar to that reported by Braam and Poling (1983). They found that as training progressed and correct intraverbals increased, more incorrect (thematically unrelated) intraverbals were given in response to untrained verbal stimuli during intraverbal generalization probes. For example, after training intraverbals to the verbal ("colors") stimulus, the verbal ("red" or another color) response might be said/signed to the next training stimulus (e.g., "animal"). Regardless of the thematic nature of the response, it was an intraverbal and indicated that some degree of verbal stimulus control had been established (i.e., when a verbal stimulus is presented, a different verbal response is given). The results of Braam and Poling (1983) and the current study suggest that learning might be facilitated by concurrently training groups of thematically related responses across different stimulus conditions (e.g., train "toys" as mands, tacts, and intraverbals). This is a language training strategy that merits further investigation.

Although both Stafford et al. (1988) and the current investigator studied antecedent and consequent terms of tact relationships, the reinforcement employed suggested that there was a mand component in the training procedures. In the current study, food (which often demonstrates stimulus control in motivational states) and
praise were both used in reinforcement. Furthermore, attempts were made to control the average satiation/deprivation levels (establishing operations; Michael, 1983; 1986; 1988) for the food used as training stimuli and in reinforcement. However, the effects of establishing operations (EOs) are not usually considered in tact training.

By employing stimulus-specific reinforcement and stimulus-nonspecific reinforcement in the current study, a comparison can be made between the reinforcement effects characteristic of mands and tacts. Since antecedent control in both conditions was exerted by a nonverbal stimulus with motivative controlling properties (in addition to a verbal stimulus), it is possible that the operants studied were not "pure" tacts, but multiply controlled tacts. In the stimulus-specific condition, reinforcement resembled that of a mand (specific to what was wanted and available). In the stimulus-nonspecific condition, reinforcement resembled the generalized conditioned reinforcement of the tact—effective but not specific to the antecedent stimuli. Since the effectiveness of the mand comes from the speaker's ability to manipulate the environment in an expected way, perhaps the stimulus-specific reinforcement condition has a motivational advantage in facilitating learning. This may have been the implied reasoning of language trainers who
used this procedure (e.g., Carr et al., 1978).

In the current study, if pop was available, functioned as a reinforcer, and was given after a correct response, "pop" was expected to occur more frequently in the future under the same (stimulus-specific reinforcement) conditions. Therefore, a subject was not expected to sign "pop" more frequently in the future when pop was available but s/he had no history of obtaining it in that (stimulus-nonspecific reinforcement) context unless the value of pop as a reinforcer was high or novel. The results did not support this analysis since both forms of reinforcement were equally effective during tact acquisition. The use of food might have produced some idiosyncratic effects in the current study. Therefore, replication with other objects and events which function as reinforcement may produce different results. However, stimulus-nonspecific reinforcement subjects performed with slightly greater percentages of mands in probes suggesting that novelty and/or reinforcer value may influence the results.

In summary, the results suggest a strategy for tact training. Techniques involving increased specificity between discriminative training stimuli and responses, such as using real objects versus pictures or iconic versus abstract symbols, should be employed to facilitate acquisition and generalization of responding with DD pop-
ulations. Stimulus-specific reinforcement should be arranged when possible to facilitate the transfer of learning to mand compliance tasks. In addition, tact training with stimulus-nonspecific reinforcement should be concurrent since it might be expected to facilitate generalized mand responding.

Finally, isolated tact training appeared to have limited effectiveness in the establishment of effective verbal and nonverbal repertoires. The combined, concurrent training of the same sign or word under conditions with different controlling variables may have a more dramatic impact in establishing related responses under the control of multiple stimuli. Given these results, the procedures of the current study, Stafford et al. (1988), and Carroll and Hesse (1987), suggest a direction for future research.
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