THE TRAINING OF VERBAL AND PERCEPTUAL CUEING STRATEGIES IN PRESCHOOL CHILDREN

by

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TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

*Tables designated by letters appear in the Appendices.

LIST OF FIGURES

Chapter 1

OBJECTIVES OF THE RESEARCH

INTRODUCTION

The development of verbal mediation in the child signals a unique interface between language and cognitive-perceptual organization. This behavioral development refers to the child's use of a cueing strategy to facilitate problem-solving. Previous research demonstrates that when a child learns to transpose the stimulus dimensions of a task into a verbal code, this learned behavior seems to enhance and possibly change his performance on the task, (Kendler and Kendler, 1962). That is, the child's ability to give the relevant stimulus dimensions verbal labels is accompanied by an improved performance on the task. The usefulness of deliberate attempts to train this non-communicative function of language (Rees, 1973) is questionable, however, because the ability to use verbal labels as response mediators is believed to be largely dependent upon an ontogenetic progression or maturational attainment between the ages of four and seven years, (Kendler, Glasman and Ward, 1972).

The younder child may have the verbal labels in his repertoire; he may use them for naming things in his environment; but he is unable to use them as response mediators or as cues to solve a problem. The younger child is viewed as having a "mediational deficiency," (Reese, 1962).

The investigations of Osler and Madden (1973) and Osler, Draxl and Madden (1977) lead to the notion of a developmental progression in the use of cueing strategies. That is, the child, at first unable to use any cueing strategy, develops the use of perceptual cues and then verbal cues. The successful use of any cueing strategy is seen to be largely dependent upon the child's age, again leaving the feasibility of training in doubt.

Researchers generally view these uses of verbal labels to be the result of cognitively based organizational strategies, (Osler and Madden, 1973; Fitzgerald, 1977; Flavell, Beach and Chinsky, 1966), and not linguistic skills. The focus remains on the maturational attainment of cognitive prerequisites, and not on the linguistic requisites of verbal mediation (Kendler and Kendler, 1962), or verbal classification of stimulus subsets (Osler and Madden, 1973). This focus on maturational attainment challenges the role of training and the role of linguistic organization in cognitive-perceptual development.

This study was undertaken to investigate the developmental progression of cueing strategies in preschool children and to examine the role of training and language ability in this progression. The utility of verbal pretraining[1] versus perceptual pretraining is

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[1]Pretraining is defined as the teaching of a behavior, e.g., labeling, prior to the task in which it is to be measured as a potential facilitator.

unclear and seems to be task-dependent to some degree, (Kendler, Glasman and Ward, 1972; Osler, Draxl and Madden, 1977). The use of verbal and perceptual training[2] during task performance has not been consistent and, to the writer's knowledge, has not been contrasted experimentally with the use of pretraining alone. Insofar as normal children have been characterized as having different types of deficiencies in mediational abilities at various points in development, (Reese, 1962; Flavell, Beach and Chinsky, 1966; T.S. Kendler, 1972), it seems unwarranted to conclude that cognitive and not linguistic factors exclusively determine the use of mediational strategies.

GOALS OF THE RESEARCH

The first goal of this research was to examine the developmental progression of perceptual and verbal cues in the performance of two nonverbal tasks, conceptual-sorting and serial recall. Two experimental questions were formulated to address this issue: (1) Do preschool children master perceptual cue pretraining more readily than verbal cue pretraining; that is, do preschool children pretrained to use perceptual cues achieve criterion level of performance on the task in fewer trials than children pretrained to use verbal cues? (2) Do preschool children who have been pretrained and trained to use perceptual cues or verbal cues during

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[2]Training is defined as the reinforcement of the potential facilitating behavior, e.g., labeling, during the administration of the task.

task performance achieve higher scores on transfer tasks than children who have not been pretrained and trained to use either perceptual or verbal cues?

A second goal of the study was to determine whether or not preschool children who had been trained to produce either perceptual or verbal cues during the performance of a conceptual-sorting and a serial recall task would produce these cues spontaneously during respective transfer tasks. Two experimental questions were formulated to address this issue: (1) Do children trained to use either perceptual or verbal cues during task performance produce a greater number of cues during transfer tasks than children who do not receive this training? (2) What is the relationship between the number of cues spontaneously produced during transfer tasks and the scores achieved on these tasks?

The final experimental goal of the study was to determine what the significance of age and linguistic skill was in relation to mediational deficiency, and whether or not age or linguistic skill were variables in training children to produce and use cues as response facilitators. The experimental question asked was: What is the relationship between age or level of linguistic skill and scores achieved on the transfer tasks?

Another important goal of this study went beyond the specific experimental manipulation of variables and dealt with a contrast in approaches for data analysis. After an analysis of the pooled data was completed, data representing each individual

subject was examined and a comparison of the two types of data was made to determine the predictive value of the pooled data and their generality (Thal, 1977) with respect to data for individuals. The comparison of statistically pooled data with individual subject data was designed to point up limitations of the generality of scores when attempting to determine the generality of specific variables present in a particular training methodology. In other words, the variance or lack of variance in the data which might or might not lead to statistical significance could possibly conceal the significance of the variables with regard to individual subjects. Individual variation which is crucial to the clinician might be overlooked. It was hoped that this latter analysis would prove particularly valuable for the determination of the clinical usefulness of these training strategies.

IMPORTANCE OF THE STUDY

The influence of language in the child's intellectual development is a subject of considerable controversy. Currently, the work of Piaget and his colleagues appears to be most readily accepted by the researchers in child language (Morehead and Morehead, 1974; Beilin, 1975). This theoretical position holds that various non-communicative functions of language, such as verbal mediation and stimulus classification, are largely dependent upon the maturational attainment of a particular level of cognitive organization.

In light of some of the contradictory findings in the litera-

ture, it seems necessary to reexamine the point of view expressed by Luria and Yudovich (1971). This theoretical perspective considers the word to be a significant quide in perceptual organization and cognitive development, rather than simply resulting from them. That is, the production of a word in the context of a particular set of stimulus properties may enhance the recognition and classification of that set of properties. This might allow for improved organization and response accuracy for the child. It may not be possible to state unequivocally that verbal mediation results from linguistic organization rather than perceptual-cognitive organization. But it should be possible to examine the interaction of the two, operationally define the process, and determine if verbal mediation is a trainable skill. If this is achieved, the educational value of training this and related skills, such as perceptual cue training, can be assessed for the normal child with implications for the language-disordered child.

The ability to represent attributes and events with verbal cues and manipulate them as a response strategy would seem to be a function highly related to language ability. Its developmental predecessor might involve the use of perceptual cues. Thus, the use of perceptual cues might be easier for the preschool child who has not yet learned this use of words or for the language-disordered child who has difficulty with this use of words. It was hoped that the data collected in this study would enable the clinical speech and language pathologist to define and

isolate a particular noncommunicative use of language, and contrast alternative perceptual strategies. The identification and training of this linguistic function in younger-normal and language-disordered children would have considerable diagnostic and treatment implications for the language-impaired and learning-disabled populations.

Chapter 2

LITERATURE REVIEW

INTRODUCTION

In undertaking the present study, the investigator was concerned with the developmental progression of cueing strategies in preschool children. The literature in this area deals with many assumptions about underlying covert processes and levels of cognitive-perceptual organization. It also presents data which serve to identify and measure observable behaviors objectively. Even here, however, the observable behaviors are frequently viewed as indicators of underlying cognitive processes. It is not the purpose of the present writer to ignore the notion of unobservable underlying processes, but rather to focus on aspects of the literature which would lead to the identification of observable behaviors. The determination of operational definitions of processes is necessary so that appropriate training methodology can result from experimental findings.

Most studies serve to report about the role of verbalization as a mediational device in concept development and problem solving. There are studies of the role of the verbal label with respect to (A) discrimination and conceptual-sorting paradigms (Dietz, 1955; Carey and Goss, 1957; Weir and Stevenson, 1959; Reese, 1972; Fitzgerald, 1977) (B) reversal shift para-

digms (Kendler and Kendler, 1962; Silverman, 1966; Kendler, Glasman and Ward, 1972; T.S. Kendler, 1972; T.S. Kendler, 1974), and (C) serial recall paradigms (Flavell, Beach and Chinsky, 1966; Hagen and Kingsley, 1968; Kingsley and Hagen, 1969; Bernbach, 1967; Daehler, Horowitz, Wynns and Flavell, 1969). Other studies have been directed at the role of perceptual cues in concept-identification tasks, which closely approximate discrimination and conceptual-sorting tasks (Osler and Madden, 1973; Osler, Draxl and Madden, 1977). These investigations were designed primarily in an attempt to approach experimental inclusion or exclusion of either the verbal or perceptual cue from the accomplishment of the task of conceptual-sorting, reversal shift or serial recall. Changes in response accuracy were viewed as indicators that the cues were being used as response mediators or stimulus classifiers.

In the review of the literature to follow, the author will discuss the research that has directly affected the design of the present study. The discussion will proceed so as to relate the following topics to relevant research findings: (A) definition of variables to be studied, (B) selection of stimuli, (C) choice of subjects, (D) choice of research methodology, and (E) treatment of the data.

RESEARCH WHICH SERVES TO DEFINE VARIABLES TO BE STUDIED

Verbal Mediation

The concept of verbal mediation was described by Kendler

and Kendler (1962) when they reviewed single-unit S-R theory and contrasted it to mediational S-R theory in human problem solving and conceptualization. The authors discussed the development of mediational behavior with regard to the performance of children and adults on reversal and nonreversal shift tasks,[1] considering the cue function for a younger as compared to an older child. Because of the ability to use a verbal cue as a mediator, older children and adults will find the reversal shift easier. The child's performance will change when he acquires the ability to utilize a verbal cue as a mediational facilitator. A mediational mechanism is suggested in which the external stimulus evokes an implicit response which produces an implicit cue that is connected to the overt response. The mediator is conceived as being a perceptual or verbal response, often covert, to the relevant dimension which produces cues that determine the overt response (Kendler and Learnard, 1962, p. 572).

The Kendlers examined the effects on a reversal shift task of training children in the age range of four to seven years to use relevant and irrelevant verbal responses. The younger child-

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[1]Reversal and nonreversal shift tasks involve the discrimination of a stimulus dimension as a response choice. In a reversal shift, the correct discrimination response shifts within a conceptual category, e.g., from big to little, where the conceptual category is size. In a nonreversal shift, the correct discrimination response shifts across conceptual categories, e.g., from big to square, representing a shift from the conceptual category of size to that of shape.

ren's scores improved as a result of making the relevant verbal responses while those of the children taught to produce irrelevant verbal responses diminished. The 7-year-old children produced more correct reversal shift responses than the children aged 4 years without the use of any overt verbal responses. By the age of 7 improved performance is taken to mean that children are capable of making the relevant verbal response covertly, and the requirement to verbalize overtly is of little consequence. Of particular interest was the disruption in the performance on the reversal shift task of the 7-year-old children when they were required to produce irrelevant verbal responses. This resulted in an even poorer performance than that of the 4-year-old children. The authors suggest that there are interfering effects of inappropriate mediating responses when one is capable of spontaneously generating a correct one. That is, the overt production of the irrelevant verbal response interferes with the covertly produced relevant verbal response in mediating the correct reversal shift response. However, the generation of the mediator is covert and, thus, not directly subject to observation and measurement. Thus, the authors attribute changes in an overt response to an unobservable mechanism. Substantiation of the mechanism lies in the observation of behavioral correlates. Verbal mediation is not an observable process. There is the suggestion that it is a trainable process in that the younger subjects' reversal shift response accuracy improved by making relevant verbal responses. But does that suggest that training the younger child to label a stimulus is the same as

training him to mediate his response with that label? Further verification of the covert mediating mechanism is supplied by the interference effect of irrelevant verbal labels for the 7-year-old subjects. Some labeling training results in an improved performance on the reversal shift task; other labeling training inhibits that performance. This observation is the basis for an assumption about an underlying mechanism which is said to be mediational in nature. The present study was designed to train even the youngest subjects to mediate their responses by generating a precise definition of the necessary overt behavior rather than assuming the absence or presence of an unobservable mechanism.

Weir and Stevenson (1959) investigated effects of verbalization on an animal picture discrimination task with subjects of increasing chronological age (CA 3 through 9 years). One group of subjects at each chronological age was instructed to verbalize the name of the stimulus prior to each response, while the other group was instructed not to verbalize. The verbal groups had on the average a greater number of correct responses than did the nonverbal group. The authors' prediction that the difference in the average number of correct responses between verbal and nonverbal groups would decrease with increasing chronological age because of the older subjects' production of covert verbal responses was not supported by the data. This would seem to challenge the Kendler study and challenge the notion that, at a later age, the child is capable of producing a covert mediating response and that, therefore, the overt response is inconsequential. It remains unclear as

to what behavior should be trained to insure that verbal mediation is taking place and whether or not training loses its value with increasing age of the subject because of the maturational attainment of the underlying process of verbal mediation and the generation of covert cues. The present study was designed to identify and train preschool subjects to produce overt behaviors that have typically been viewed as response mediators. By training younger children, who were unlikely to produce response mediators on their own, it was hoped that a determination could be made as to how these behaviors come to discriminate and gain control over response choices on nonverbal tasks, such as conceptual-sorting, reversal shift and serial recall.

Silverman (1966) presented subjects at two age levels, 3-4 years and 7-8 years, with a discrimination problem with stimuli that varied on three dimensions. The subjects were then required to perform a reversal shift on one of the dimensions, with the other two present but irrelevant. Subjects who produced verbal labels learned the reversal shift more rapidly, regardless of age. Silverman believes that this counters the assertion made by the Kendlers that, despite the child's ability to produce a verbal label, there is a stage at which he cannot use it as a mediator; that is, the child has a mediational deficiency (Reese, 1962; Flavell, Beach and Chinsky, 1966; T.S. Kendler, 1972).

The studies cited above demonstrate how children of various ages can be trained to produce verbal labels. They vary, however,

in their conclusions about whether or not the children use these labels to mediate responses. The present investigation is designed not only to train subjects to produce labels, but to train them to use these labels to aid response choices.

Stimulus Classification

An alternative interpretation of the role of the verbal label has been presented more recently by Osler and Madden (1973). Their experimental findings support the notion that the verbal label serves to classify stimulus subsets, thus facilitating children's performance on concept-identification tasks. They hypothesize that the facilitation effects are due to stimulus classification rather than stimulus-response mediation. Attributing the facilitation effects to either of these processes requires the assumption of an unobservable underlying mechanism. The determination of which mechanism is, in fact, applicable requires a distinction which is not always apparent from observations of overt behaviors. Thus, the present study focused on what was observable and not merely assumed.

The authors conducted a series of experiments in which they investigated the effects of age, pretraining, and concept on a concept-identification task. They found that verbal and perceptual pretraining produced significant reductions in errors to concept-attainment but that neither type of pretraining was superior to the other. Indeed, merely instructing subjects to partition the stimulus into two subsets resulted in performance as good as

or better than that in the verbal and perceptual pretraining conditions. Their interpretation was that verbal labels function to partition stimulus sets into subsets but that they are not the only cues that can so function. Despite a significant main effect for age, both kindergarten and second grade subjects were found to benefit from perceptual and verbal pretraining.

In a follow-up study, Osler, Draxl and Madden (1977) investigated verbal and perceptual cue pretraining in a concept-identification task with preschool subjects. Their 4-year-old subjects showed no effects of verbal or perceptual pretraining, while 5-year-old subjects were aided by perceptual but not verbal cueing. The authors concluded that the ability to use perceptual cues developmentally precedes the ability to use verbal cues as classifiers of stimulus subsets. Classification of stimulus subsets will facilitate concept-identification, but preschoolers do not appear to use these cues on their own; training is questionable and age-dependent to a large extent.

In a similar study, Kendler, Glasman and Ward (1972) investigated verbal and perceptual cue pretraining on a discrimination and reversal shift task. Their data for 4-year-old children indicated that subjects did learn the reversal shift more rapidly after pretraining and that verbal labeling was more effective than perceptual cue pretraining. Within the context of the reversal shift paradigm, the authors continue to attribute the value of the cue to its use as a response mediator, rather than a stimulus classifier. But the developmental progression

of the ability to use verbal and perceptual cues is contradicted.

Verbal mediation and stimulus classification are hypothetical constructs used to explain the response facilitation of verbal labels and perceptual cues. Insofar as the present study is concerned with cue training, the successful training of these cues in preschool children might be interpreted as the successful training of the processes of mediation and/or stimulus classification. The contradiction in findings stated previously appears, in part, to be related to the task under consideration and to variations in the training methodology, rather that to which underlying process response changes are being attributed.

Serial Recall and Verbal Rehearsal

Another area of investigation has been the role of verbalization in memory. In a serial recall task, the subject is asked to recreate a visual sequence after exposure to the stimulus sequence. Variations of the task include locating the position of a particular stimulus in the sequence after exposure to the entire sequence. Tasks such as this have become the basis of more standardized measures of visual sequential memory (Kirk, McCarthy and Kirk, 1968).

The production of verbal labels during serial recall tasks has been studied frequently. Several studies examined the facilitation effects of verbal labels on recall performance; others investigated the development of verbal labeling as a response strategy in children and the usefulness of training children to

use this strategy. The present study attempted to clarify further the feasibility of training young children to produce and use verbal labels to facilitate recall. The use of verbal labels during serial recall tasks was compared to that during conceptual-sorting tasks. The use of alternate response facilitators, such as perceptual cues, was compared to the use of verbal cues during serial recall tasks. The investigations discussed below helped to determine specific aspects of the design of the present study.

Verbal labeling and rehearsal have consistently been found to increase response accuracy. Keeney, Cannizzo and Flavell (1967) administered a nonverbal serial recall task to 6- and 7-year-old children. Subgroups of "rehearsers" and "nonrehearsers" were identified. The serial recall of the "nonrehearsers" was significantly poorer that that of the "rehearsers". A brief training procedure, involving instructions, induced the "nonrehearsers" to rehearse, thus increasing their recall scores. When given the option in a follow-up task, however, induced rehearsers stopped.

Apparently the behavior of labeling and verbal rehearsal could be trained through procedures involving instructions, but transfer of this training was absent in follow-up tasks. Thus, one might conclude that training to achieve a cueing strategy is minimally effective and short-lived where maturation of the behavior has not occurred spontaneously. An alternate approach might be to reexamine the training procedure for possible modifications which would lead to improved learning of the rehearsal strategy. In the study by Keeney et al. subjects were instructed to label and rehearse the labels during the delay period between

presentation of the stimulus and the response. Subjects were given prizes at the end of the experimental session, but there was no systematic use of response-contingent reinforcement. During follow-up trials, the following instructions were given to subjects in the research of Keeney et al.

> I'm not going to tell you to say the names over and over again any more for a few times. You can say them if you want to, but you don't have to, okay?

Again there was no reinforcement contingency for labeling or rehearsal behaviors. The present study attempted to modify the training procedure so as to maximize the use of reinforcement contingencies and to define precisely the recall and cueing behaviors to be reinforced. The specific research findings that led to these modifications are discussed on pages 36 through 38.

In an earlier study, Flavell, Beach and Chinsky (1966) administered a memory for pictures task to children in kindergarten and in the second and fifth grades. The mean ages for the subjects were 5.75 years, 7.75 years, and 10.75 years, respectively. There was a substantial increase in spontaneous verbal production from kindergarten to grade two, and from grade two to grade five. Since the kindergarten subjects hardly verbalized and all the grade five subjects verbalized, the authors felt that the most significant conclusions about the role of verbalization in serial recall could be drawn from examining the data of the subjects from grade two. There was only suggested, and not statistically significant, support for the hypothesis that spontaneous verbalization improves scores on a recall task. However, the continued increase in spon-

taneous verbalization from subjects in grade two to those in grade five sheds further doubt on the notion that covert labeling replaces the need for overt labeling as a response strategy. This study is questionable as a study of the effects of training insofar as instructions were given to point at and name the stimulus pictures during stimulus presentation and during the subjects' response, but no systematic effort was made to reinforce labeling and rehearsal as a response strategy for any of the age groups. The present study introduced steps to modify these weaknesses in the training procedure. The basis for these changes is reviewed on pages 36 through 38. The specific description of the methodology is presented in the following chapter.

Hagen and Kingsley (1968) investigated the facilitation effects of overt labeling in a serial recall task for subjects in five age groups, 5 years, 6.4 years, 7.5 years, 8.5 years and 10.4 years. They found that although the youngest subjects verbalized overtly, the labels did not facilitate recall. Facilitation effects were found for the 6-year-old subjects, but by age 10, facilitation effects were negligible. The authors view this as supportive of the maturational attainment of mediation. They conclude that overtlabeling is not necessarily indicative of mediation, which explains the lack of facilitation of recall for the youngest subjects. Since it is assumed that the oldest subjects are using covert labels to mediate recall, overt labeling is seen as having little additional value as a response facilitator. Thus, the training of verbal labeling is not synonymous

with the training of verbal mediation. Although overt labeling and rehearsal can improve serial recall, they do not appear to be sufficient for this improvement in the youngest age group or even necessary for this improvement in the oldest age group.

Once again, it is important to note that the study by Hagen and Kingsley did not employ the systematic use of reinforcement in the training of overt labeling or the use of a rehearsal strategy. Verbal mediation in serial recall may not be trainable until certain maturational attainments are reached. But alternate explanations may be as likely insofar as:(1) the necessary observable behaviors to be trained have not been adequately identified and/or (2) the training methodology may not be sufficiently systematic.

In a follow-up study, Kingsley and Hagen (1969) examined the training of more varied behavioral combinations that might aid recall, focusing their investigation on nursery school children. They manipulated two variables: overt versus covert labeling and spontaneous versus induced rehearsal of the labels for the stimuli. The research design included three experimental groups and one control group: (1) overt and induced labeling, (2) overt and spontaneous labeling, (3) covert and spontaneous labeling, and (4) no labeling. In addition, they used response-contingent reinforcement for correct first trial responses. The predicted order of performance on the recall task was confirmed, with subjects who labeled overtly and were induced to rehearse attaining the highest scores. Those who labeled overtly and spontaneously were next, followed

by those who used covert spontaneous labels. An exception to the predicted order was the two groups who interchanged position. The control group in which no labeling was used performed slightly but not significantly better than those who used covert spontaneous labels.

Verbal labeling of the stimulus items does facilitate serial recall, although spontaneous use of a rehearsal strategy is not common among nursery school children. The authors, thus, conclude, in support of their earlier contention, that the overt production of the verbal label will serve to mediate recall when rehearsal is employed. The study more precisely defines the behavioral components of mediation in serial recall and demonstrates that training is feasible for children as young as 5 years of age. However, it is important to note that, in this study, the use of reinforcement was contingent upon a correct recall response; no systematic delivery of reinforcement was made contingent upon the production of the verbal label or rehearsal behaviors. These variations in methodology will be discussed further, on pages 36 through 38, insofar as they were employed in the p_esent study.

Other studies have confirmed the facilitation effects of verbal labeling in serial recall, even for the youngest subjects, Bernbach (1967) reported that requiring preschool subjects (4 and 5 years of age) to label stimulus items makes the children's performance qualitatively very nearly like that of adults. He found that, although the forgetting functions of nursery school children were quantitatively lower than that of college students,

when given labels, their performance was qualitatively similar to that of adults.

Daehler, Horowitz, Wynns, and Flavell (1969) administered tasks of color recall and position recall to determine if different cueing strategies would be employed by their subjects. They were selected from kindergarten, first, second, and fourth grades, with group mean ages of 6-0, 7-0, 7-11, and 10-0, respectively. Verbal rehearsal facilitated recall, and this effect increased with age. It was predicted that gestural rehearsal might be used in position recall tasks. However, gestural rehearsal did not appear to mediate recall and showed inconsistent age trends. Although this was not a training study in which verbal rehearsal was induced, the evidence suggests that, once verbal rehearsal behaviors are produced, they serve as effectively as mediators for younger children as they do for older children. However, the youngest subjects in this study were 6 years of age, an age at which the maturational attainment of verbal mediation is generally felt to be well under way.

Other than the investigation carried out by Daehler et al. (1969) to study gestural cueing strategies in serial recall, the present writer has been able to discover no other systematic investigation of perceptual cueing behaviors as mediators of serial recall. Some work has been performed to investigate methods used by preschoolers to code and store visual and verbal material (Tversky, 1973; Reese, 1975; Perlmutter and Myers, 1975), but there seems to be no research designed to study the training

of perceptual cueing strategies. Such a study may shed further light on the developmental progression of cueing strategies that has been suggested by Osler, Draxl, and Madden (1977) and contradicted earlier by Kendler, Glasman, and Ward (1972). Since different types of tasks are involved in each of these studies, it may be useful to determine the comparative effectiveness of cues in describing the developmental progression, as well as determining the most effective training methodology. The present study was designed to investigate these issues by comparing the usefulness of training subjects to produce verbal cues to that of training subjects to produce perceptual cues. A comparison was also made between cue production training for two different types of tasks, conceptual-sorting and serial recall.

Overt Mediators and Covert Mediators

Several of the studies described above contrast the production of overt verbal labels to covert verbal labels, suggesting that both can serve as response mediators and/or stimulus classifiers. It is generally held that the transition from overt labeling to covert labeling is age-dependent and, thus, maturationally achieved as a response strategy.

Conrad (1972) investigated the question of vocalizing versus naming (labeling). He suggested that vocalizing cannot be accepted as a synonym for naming; that is, it does not mean that verbal mediation is taking place, nor does its absence mean that it is not taking place. The author contends that inducing a subject to vocalize, particularly the young child, may do no

more than focus his attention on the stimulus, which must not be mistaken for generating a mediating response. Indeed, there may be times when forcing a child to vocalize draws attention to the motor act of speech production and interferes with mediation and recall.

By contrasting recall using homophonic (having like-sounding names) and nonhomophonic (not having like-sounding names) stimulus sets, Conrad was able to determine whether the vocalizing by nursery school subjects was indicative of naming or merely attention. He was able to determine more objectively whether silent naming was taking place for subjects who did not name aloud, thus drawing more precise conclusions about the developmental effects of vocalizing with regard to mediation and attention. Since the present study dealt with training very young children (40 to 58 months) to produce verbal labels overtly, it was important to consider the possible competitive effects of vocalization.

Conrad suggests a six-stage developmental model in which there is a variable effect of vocalizing depending upon age. The effect of attention diminishes, the effect of naming (verbal mediation) increases, and the effect of vocalizing changes from detrimental to beneficial. They very young child, perhaps under 4 years of age, whether he labels overtly or not, does not use these labels as response mediators. Thus, there is no effect on recall. However, the act of vocalizing for the very young child is an added task with respect to memorizing and is likely to be detrimental

to memory. But since vocalizing induces attention, these two latter effects approximately cancel each other.

In an earlier study, Conrad (1971) found that, until age 5, it made no difference with respect to recall whether or not the objects which had been memorized had acoustically similar names. He suggests that it is not until about age 5 that children's overt speech reaches a functional stage that allows for internalization. Although the author's work is essentially in the direction of developing of chronology of the development of covert speech, it is also suggestive of the notion of a mediational deficiency hypothesis (Reese, 1962; Flavell, Beach and Chinsky, 1966; T.S. Kendler, 1972).

Mediational Deficiency and Language Ability

Although the first few years of development are largely concerned with the child's use of increasingly complex linguistic structures for the purpose of communication, it is also evident that he will acquire various noncommunicative functions of language as well (Rees, 1973). Verbal mediation and stimulus classification are clearly such noncommunicative functions.

Researchers view these noncommunicative uses of verbal labels to be the result of cognitively based organizational strategies (Osler and Madden, 1973; Fitzgerald, 1977; Flavell, Beach and Chinsky, 1966) and not linguistic skills. Fitzgerald's findings demonstrate that a child's ability to perform various Piagetian classification tasks are predictive of the success of verbal pretraining

on discrimination learning. It was the purpose of the present study to demonstrate that a child's linguistic ability is also predictive of the success of cue production training and a necessary consideration in the definition of mediational deficiency. The focus in the current literature remains on the maturational attainment of cognitive prerequisites and not on the linguistic requisites of verbal mediation or stimulus classification.

Reese (1962) raised the issue of "production deficiency" versus "mediational deficiency." The child who is not utilizing verbal cues to mediate his task performance may be described in one of the following ways: (1) he does not have the verbal labels available with which to organize or mediate his performance (production deficiency), or (2) the verbal labels are available, but he does not manipulate them, overtly or covertly, to organize or mediate his performance (mediational deficiency). T.S. Kendler (1972) similarly contrasts two hypotheses about the young child's difficulty, considering a "production deficiency" versus a "control deficiency."

Two prerequisites seem to emerge for verbal mediation to take place: (1) the production of the appropriate word labels and (2) the application of those word labels to the dimensions of the task at hand, a noncommunicative use for those words, or, perhaps more appropriately, a self-communicative use for the words. Although there are conflicting findings in the literature with regard to age and maturational attainment of mediation versus production (Kendler and Kendler, 1962; Weir and Stevenson, 1959;

Silverman, 1966; Bernbach, 1967; Daehler, Horowitz, Wynns and Flavell, 1969; Flavell, Beach and Chinsky, 1966; Conrad, 1971, 1972), there has been little, if any, effort to examine linguistic skill as a requisite for the maturational attainment of these non-communicative uses of language, or for their training. The developmental progression of perceptual and verbal cueing strategies has not been investigated with regard to language skill. In addition, the success of training one strategy or the other has not been related to linguistic skill, but only to age (Osler and Madden, 1973; Osler, Draxl and Madden, 1977; Kendler, Glasman and Ward, 1972). The present study was designed to examine these issues further.

SELECTION OF STIMULI

After determining which behaviors would be measured and trained, the writer had to decide what type of stimulus figures would be employed in the conceptual-sorting and serial recall tasks. The following literature helped in this determination.

Studies Employing the Concepts of Shape, Color, and Size

Typically, studies involving conceptual-sorting and serial recall tasks employ stimuli which differ along the dimensions of shape, color and size. Some studies utilize familiar categories (Daehler, Horowitz, Wynns and Flavell, 1969; Carey and Goss, 1957; Goss and Moylan, 1958; Lacey and Goss, 1959; Silverman, 1966; Dale, 1969; Osler and Madden, 1973; Osler,

Draxl and Madden, 1977; Fitzgerald, 1977). Other studies utilize unfamiliar categories (Dietz, 1955; Bernbach, 1967; Kendler, Glasman and Ward, 1972; T.S. Kendler, 1972; Reese, 1972). Both of these conceptual categories are likely choices, because they are either most perceptually salient and/or usually mastered by the child during the preschool years (Clark, 1974). Children's attention to and choice of shape or form seems to dominate below the age of 3, and appears to be used most frequently as a main criterion in free sorting tasks (Ricciuti, 1965). Kagan and Lemkin (1961) found that form was always preferred to size; if form was not a factor in the task, color was likely to be chosen over size. Clark (1974) reports on a study by Baley and Witwicki (1948) in which the authors found form to be the preference over size. However, when size and color were the choices, children 3 to 4 years of age selected color more often, while children 5 to 6 years of age selected size more often.

It was not the intent of the present study to teach the subjects a new concept, but rather to find a conceptual category with which it would be reasonable to assume that they could perform a sorting and a recall task. Part of the problem that the preschoolers in the present study faced was the selection of the relevant stimulus dimension which would aid them on both the sorting and recall tasks. The comparative usefulness of perceptual and verbal cue training could thus be determined. Since these children are likely to have mastered the concept of size (big and little), but do not usually attend to its presence when the dimen-

sion of shape is present, stimuli which varied in shape (circles, squares and triangles) and size (big and little) were chosen for the tasks in the present study.

Studies Employing Familiar Object Stimuli

Many conceptual-sorting and serial recall investigations which examine the performance of the youngest subjects utilize pictures of familiar objects(Weir and Stevenson, 1959; Flavell, Beach and Chinsky, 1966; Keeney, Cannizzo and Flavell, 1967; Hagen and Kingsley, 1968; Conrad, 1971, 1972). Since it is likely that children will know the names of the stimulus pictures or can easily be instructed to produce the names, these investigations can more clearly determine whether or not subjects can be taught to use the names as response mediators or stimulus classifiers. In other words, they can better distinguish between a production deficiency and a mediational deficiency (Reese, 1962).

The use of familiar pictures and names, however, allows for the possibility that the child is naming covertly, that is, producing a covert mediator, one which is not subject to the experimentor's observation and measurement (Flavell, Beach and Chinsky, 1966). Since it has been demonstrated that children are not likely to spontaneously generate covert cues prior to the age of 5 (Conrad, 1971, 1972), it seemed reasonable to assume that familiar pictures with familiar names were appropriate for the present investigation and would not be confounded by any covert naming strategy.

Studies Employing Nonsense Stimuli

Several studies have utilized nonsense pictures and nonsense names (Dietz, 1955; Lacey and Goss, 1959; T.S. Kendler, 1972; Reese, 1972) in order to control for prior learning and the possible production of covert labels. Other studies have compared the use of nonsense labels and familiar word labels as performance facilitators (Goss and Moylan, 1958; Carey and Goss, 1957). A third group of studies has used nonsense pictures but familiar word labels (Kingsley and Hagen, 1969; T.S. Kendler, 1972; Kendler Glasman and Ward, 1972).

In general, labeling training, in most of these studies, even for the youngest subjects, is readily achieved. Carey and Goss (1957) do report some difficulty in achieving criterion in a reasonable number of trials, for both familiar word and nonsense label training, for subjects 4 and 5 years of age. It has been reported by T.S. Kendler (1972) that learning the familiar word labels "one" and "two" for the nonsense figures occurred rapidly, but an increase in learning facility was observed with increasing age. The youngest subjects in the study were in kindergarten and, thus, probably older than 5 years of age.

Carey and Goss (1957) found that verbal learning for familiar words was consistently superior to that of nonsense labels, although the difference did not achieve statistical significance. In addition, the authors found that, with reinforcement, children 4 years 6 months to 4 years 7 months old, who had received training on familiar words exhibited the predicted, more rapid acquisition of

the sorting response. This rapid response acquisition was not observed for subjects who had received training on nonsense labels. Oberle (1976) replicated the Carey and Goss study and found a significant difference in correct labeling responses for familiar words versus nonsense labels. The author's data substantiate the finding that nonsense labels were significantly inferior to familiar words in conceptual-sorting.

A pilot study conducted earlier by the present investigator (Gurland, 1977) revealed several useful findings with regard to label training. The study employed the nonsense figures from the Visual Sequential Memory subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968). One group of subjects was trained with familiar word labels for the stimulus figures; a second group was trained with nonsense labels for the stimuli, while a third group received no label training and served as a control. Despite the lack of statistically significant difference in performance, observations about individual subjects were noteworthy. Several of the subjects spontaneously generated their own familiar word labels for some of the stimuli, based upon prior association with the figures. Attempts to train these subjects to use different labels, whether familiar or nonsense, resulted in labeling errors and distraction from the recall response required.

The studies discussed above led to the decision to investigate and compare the effectiveness of training two types of cueing strategies (verbal labeling and perceptual matching) on two

types of tasks (conceptual-sorting and serial recall). Familiar stimulus categories and familiar stimulus names were chosen for the tasks and training procedure.

CHOICE OF SUBJECTS

In establishing criteria for subject selection, two issues became outstanding. One was clearly selection of the age group of the subjects; the second involved the use of normal subjects whose linguistic abilities had been more precisely measured. The following literature guided the author in making such determinations.

Training Studies Employing Preschool Subjects

There is a considerable body of literature which describes the ontogenetic progression of mediating strategies in concept development and problem solving (Kendler and Kendler, 1962; Reese, 1962; Flavell, Beach and Chinsky, 1966; Kendler, Glasman and Ward, 1972; Osler and Madden, 1973; Osler, Draxl and Madden, 1977). The most widely supported conclusion is that verbal mediation is maturationally achieved between the ages of 4 and 7 years (Kendler, Glasman and Ward, 1972).

The investigation of mediating behaviors in preschool children (3 to 5 years of age) allows for the examination of mediational deficiencies (Reese, 1962; Flavell, Beach and Chinsky, 1966; T.S. Kendler, 1972) and the identification of behaviors to be trained (Dietz, 1955; Carey and Goss, 1957; Bernbach, 1967;

Hagen and Kingsley, 1968; Kingsley and Hagen, 1969; Weir and Stevenson, 1959; Silverman, 1966; Kendler and Kendler, 1962; Kendler, Glasman and Ward, 1972; T.S. Kendler, 1974; Osler, Draxl and Madden, 1977; Fitzgerald, 1977).

There is general agreement among investigators that children below the age of 5 do not produce verbal labels spontaneously, either overtly or covertly, in order to cue their performance (Conrad, 1971, 1972). However, there is considerably more controversy as to whether or not training of a verbal cueing strategy is feasible for this age group. Kendler and Kendler (1962) found that 4-year-old subjects did profit from training of relevant verbal responses on a reversal shift task. Other studies examining reversal shift performance confirm the feasibility of verbal training for preschool children (Kendler, Glasman and Ward, 1972; T.S. Kendler, 1974).

In the area of conceptual-sorting performance, variable effects have been observed with regard to training. Carey and Goss (1957) found familiar word but not nonsense label training facilitated sorting performance. Weir and Stevenson (1959) found verbal training to facilitate the response accuracy of even 3-year-old subjects. However, Osler, Draxl and Madden (1977) observed that 4-year-olds were not influenced by verbal or perceptual cue training, whereas 5-year-olds profited by perceptual but not verbal cue training.

Research on serial recall performance also yields conflicting findings for training preschool subjects. Hagen and Kings-

ley (1968) found that training overt labeling did not facilitate performance for the youngest subjects. However, Kingsley and Hagen (1968) observed that training preschool children to overtly label and rehearse did significantly influence performance on the recall task. Conrad (1971, 1972) contends that the training of labeling has negligible effects below the age of 5 years because of the competing effects of vocalizing and attention.

The result is a somewhat confused picture in which interpretation must take into account the type of task involved as well as the precise nature of the training methodology. The issue of age and training must be reexamined with a more precise comparison of tasks and training methodology. Having not yet attained cueing strategies maturationally, the preschool child remains an important area of training research. The present study explored this area of training research, comparing cue production training for a conceptual-sorting and a serial recall task. However, it incorporated a stepwise training procedure to determine if a more systematic training methodology would enhance preschool children's acquisition of this response strategy prior to maturational attainment.

Selection of Normal Subjects

All of the studies reviewed and cited above have utilized normal subjects. The preschool and school-age subjects were selected from various public and private schools. Some of the studies employed measures of intelligence to substantiate the level of functioning for the children. T. S. Kendler (1974)

used the Peabody Picture Vocabulary Test (PPVT) to establish intelligence quotient (I.Q.) scores. Conrad (1971) used the English Picture Vocabulary Test (which is a British standardization of the PPVT) to establish the mental age of his subjects in addition to their chronological age.

The selection of subjects within a range of chronological ages does not insure a similar range of mental ages, and certainly not a similar range of linguistic skills. When measuring behavioral changes that are likely to be very rapid during this developmental stage, it seems incumbent upon the investigator to independently verify levels of functioning along parameters other than chronological age. Fitzgerald (1977) was able to establish levels of cognitive functioning independently for his subjects by administering a series of Piagetian classification tasks. He was then able to correlate these measures with the use of verbal labels in a short-term memory task as well as the effect of verbal pretraining with respect to a discrimination task. The author found a significant relation between performance on a form of class inclusion problem and the demonstration of an effect of verbal training on a critical trial of the transfer task.

The present investigation was designed to verify independently levels of cognitive and linguistic functioning for subjects who were normal. It was also hoped that the predictive value of these measures, with regard to perceptual and verbal cue training would be determined. Three widely used standard-

ized measures were employed for this purpose, each designed to measure a different aspect of development. The Peabody Picture Vocabulary Test (Dunn, 1959) was used to establish an I.Q. based upon receptive vocabulary. The Boehm Test of Basic Concepts (Boehm, 1971) was used to assess conceptual development and as a secondary measure of receptive language skill. The Verbal Expression subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968) was used to establish the level of expressive linguistic skill.

CHOICE OF METHODOLOGY

In designing the study, the writer was concerned with the selection of a methodolgy which would maximize training effectiveness and allow for precise measurement of changes in learning, as well as transfer of learning. A review of the literature will demonstrate how these decisions were guided.

Research Designs Which Facilitate Behavior Modification Procedures

Since Skinner's (1938) publication, the techniques of behavior modication have been employed repeatedly with both research and clinical applications. Although behavior modification is not limited to speech and language behaviors, numerous applications have been generated in the literature concerned with speech and language (Girardeau and Spradlin, 1970; Sloane and MacAuley, 1968).

These techniques involve the reinforcement of a response

emitted in the presence of a particular stimulus. That stimulus, known as the discriminative stimulus, becomes a signal to the subject that a given response will be reinforced. As a result, there is an increase in the probability that the reinforced behavior will occur and occur in the presence of the discriminative stimulus (Skinner, 1938; E.P. Reese, 1962; Ferster, Culbertson and Boren, 1975).

Since much of the difficulty in the verbal mediation and stimulus classification training studies is the lack of a precise definition of the behavior to be established, it was felt that the systematic use of a response-contingent reinforcement paradigm would not only increase the precision with which responses were defined, but also allow for a high degree of experimental control of those responses (Holtz and Azrin, 1966). Although many of the training studies reviewed earlier and reported throughout this discussion utilized some form of reward, it was delivered after a number of trials or after the child had completed the task (Carey and Goss, 1957). The absence of systematic response-contingent reinforcement procedures in these studies may in part explain the failure to train subjects to produce mediating behaviors consistently. Kingsley and Hagen (1969) did use response-contingent reinforcement for a correct recall response; but no reinforcement contingency was provided for the labeling response. T.S. Kendler (1972) used a response-contingent reinforcement paradigm for both verbal pretraining and for the production of labels during the discrimination task, i.e., a chaining procedure (Sloane

and MacAuley, 1968; Ferster, Culbertson and Boren, 1975) was established whereby a correct verbal response became the discriminative stimulus for the discrimination response. Reinforcement of the final behavior in the chain was contingent upon the occurrence of each intervening behavior. A similar procedure was followed by Kendler, Glasman and Ward (1972) and T.S. Kendler (1974).

One of the most valuable aspects of the behavior modification technique is the individual programming that can be developed for each subject, regardless of the behavior in question (Lovaas, 1968; Flanagan, Goldiamond and Azrin, 1965; Shames and Egolf, 1976; Guess, Sailor, Rutherford and Baer, 1968; Gray and Fygetakis, 1968; Wheeler and Sulzer, 1970). This is particularly relevant for research which is done in order to provide clinically useful information.

Baselines

In reviewing many of the studies which employ research designs which facilitate behavior modification, one can observe the frequent use of a baseline measure prior to training. A baseline is an initial series of observations before beginning the reinforcement procedure. This is done to determine the initial frequency of the performance and to serve as a point from which to observe the effect of the experimental procedures (Ferster, Culbertson and Boren, 1975, p. 79). Sloane and MacAuley (1968) also present a description of the baseline procedure and several studies in which it is utilized.

Since the author was unable to control for prior association with the stimulus materials, it was determined that the use of a baseline procedure would be a valuable way in which each subject could virtually serve as his own control. This would also provide useful data for individual subject analysis as well as analysis of pooled data.

Pretraining and Training

Those studies which attempt to induce verbal labeling, rehearsal or perceptual cueing typically employ a pretraining procedure (Hagen and Kingsley, 1968; Kingsley and Hagen, 1969; Kendler, Glasman and Ward, 1972; Osler and Madden, 1973; Osler, Draxl and Madden, 1977; Fitzgerald, 1977). The particular behavior is taught to the child prior to the task in which it is to be measured as a facilitator.

This pretraining approach was followed in the present study. However, a precise response-contingent reinforcement procedure was used (T.S. Kendler, 1972). Another modification of some of the earlier procedures was adapted after T.S. Kendler (1974). In the present study, production of the cue was required during response to the task. Cue production, whether verbal or perceptual, was induced during the task as well as prior to the task. This was felt to be a problem in the Osler and Madden (1973) and Osler, Draxl and Madden (1977) studies. In these studies, subjects were pretrained to produce cues, but not specifically trained to use those cues to discriminate response

choice during the conceptual-sorting task.

Transfer of Training

In order to determine the efficacy of the cue training procedures, a transfer task was administered to the subjects. This is not an uncommon procedure in training studies. The procedure requires the administration of a comparable task, but with the elimination of response-contingent reinforcement. Transfer of learning is essential, so that the child need not specifically be taught to respond to every stimulus situation he will ultimately encounter (Ferster, Culbertson and Boren, 1975; Sloane and MacAuley, 1968; Lovaas, 1968; E.P. Reese, 1962).

Transfer tasks have been employed by Reese (1972) and Fitzgerald (1977) in their studies of labeling and discrimination training. Since many of the other studies in conceptual-sorting and serial recall reported here only employ a pretraining procedure, transfer of learning is largely assessed during task administration (Hagen and Kingsley, 1968; Kingsley and Hagen, 1969; Osler and Madden, 1973; Osler, Draxl and Madden, 1977).

TREATMENT OF THE DATA

The decision as to how to treat the data involved the choice of specific statistical procedures for the analysis of pooled data and the analysis of individual subject data. This allowed for a comparison of the two types of analyses for purposes of determining their relative clinical usefulness.

Treatment of Pooled Data

Several procedures were chosen to provide various analyses of the pooled data. These were largely standard statistical measures for small samples. The use of a two-tailed t-test was chosen to determine significance of the difference between verbal and perceptual pretraining. The choice of a two-tailed test was based upon the a priori uncertainty of the direction of the difference (Ferguson, 1976).

A one-way analysis of variance was computed for each of the transfer tasks, conceptual-sorting and serial recall, to determine main effects for type of training (Edwards, 1968; Kerlinger, 1973; Ferguson, 1976). This also enabled the author to determine comparative usefulness of the training procedures for the two types of tasks. These are pooled data analysis procedures which were found to be used widely throughout the verbal mediation and stimulus classification literature (Carey and Goss, 1957; Hagen and Kingsley, 1968; Kingsley and Hagen, 1969; Kendler, Glasman and Ward, 1972; Osler and Madden, 1973; Osler, Draxl and Madden, 1977).

A Kruskal-Wallis one-way analysis of variance by ranks (Siegel, 1956) was performed for each of the types of cues produced (perceptual matching and verbal labeling) for each of the types of transfer tasks (conceptual-sorting and serial recall). This procedure enabled the investigator to examine any main effect for training with regard to cue production during the transfer tasks. The use of this statistical measure allowed for

an analysis of variance among groups for which the distribution was not normal and in which the standard deviations were unequal.

Descriptive statistics were also used to describe and compare characteristics of the samples where the use of inferential statistics was deemed inappropriate (Ferguson, 1976). This treatment of the pooled data was used to examine mean scores achieved by the groups throughout intermediate aspects of the pretraining and training procedures.

In order to determine the relationships between age and linguistic skill and transfer of learning, a complete Pearson product moment correlation matrix was generated (Nie, Hull, Jenkins, Steinbrenner and Bent, 1975).

Treatment of Data Representing Individual Subjects

Sidman (1952, 1960) presents a rather cogent argument against the use of pooled data analysis and especially instances in which inferences have to be made about individual subjects, as opposed to groups and averages representing those groups. He suggests that pooled data analysis does not necessarily correspond to any individual performance. Typically, the studies reviewed above utilize treatment of pooled data. Several studies involve the collection of data from hundreds of subjects (T.S. Kendler, 1974), making the achievement of statistical significance more likely. Where data collection is limited to small samples, some doubt may be shed on the validity and generality of the statistical analysis, because the variability of the data may be large enough to reduce the likelihood of finding statistical significance

(Ferguson, 1976). Therefore, without a more specific consideration of individual data, valuable information may very well be concealed from the investigator who utilizes small samples. And, even when large samples are used, statistical analysis permits generalizing with respect to a mean but not with respect to individual subjects.

Herson and Barlow (1977) present a comprehensive overview of single case experimental design, presenting a persuasive argument for its use, particularly in clinical research. Thal (1977) demonstrates quite effectively how individual data treatment can be used in a research which is designed to provide useful clinical information. Indeed, the author's comparison of the two types of analyses is particularly valuable in determining clinical usefulness. This strategy was thus employed in the present study.

Chapter 3

METHODS AND PROCEDURES

INTRODUCTION

The present experiment was undertaken to measure the effect of the training of verbal and perceptual cues on the performance of preschool children in conceptual-sorting and serial recall tasks. This was accomplished by measuring the performance of each of two groups of children on a verbal and perceptual pretraining procedure. Following this, measurements of the performance of the two groups of subjects on training tasks were compared with a control group which received no verbal or perceptual pretraining or training. Measures were then taken and compared for the three groups of subjects on transfer tasks. Correlations were then measured between subjects' age, their performance on three widely used measures of language and conceptual skills, and their performance on conceptual-sorting and serial recall transfer tasks.

The implementation of the research plan required that subjects learn either a verbal labeling or perceptual matching response during the pretraining procedure. When subjects responded at criterion level on the pretraining procedure, they were presented with a conceptual-sorting and a serial recall task on which they were trained to produce either a verbal labeling or perceptual matching response which would serve as the discriminative stimulus

for either a sorting or recall response. Subjects who comprised the control group were exposed to the stimulus materials for a period of time equivalent to the pretraining procedure (these exposure activities are described on page 51);they were then trained to produce correct sorting and recall responses on the respective tasks but without the use of either verbal or perceptual cues to serve as discriminative stimuli. When subjects in each group achieved criterion level of performance on the sorting task, and performance of a predetermined number of trials on the recall task, a transfer task was administered for conceptual-sorting as well as for serial recall.

Prior to the implementation of the above procedures, three measures of linguistic and conceptual skills were administered to each subject. Scores on the language tests were then compared to scores on the transfer tasks using measures of correlation. The experimental procedures will be described in more detail below.

SELECTION OF SUBJECTS

Subjects for this study were eighteen preschool children, ranging in age from 40 to 58 months, with an average age of 48 months. They were all attending the Brooklyn Regional YM-YWHA Day Camp, Early Childhood Division. There were 10 male and 8 female subjects. All were judged to be normally functioning children by trained early childhood teachers who were working in the program. Available school records indicated that the

children were from lower-middle to middle class socio-economic backgrounds. All of the subjects were monolingual.

Subjects were randomly divided into three groups, each group having six subjects. The verbal group consisted of three male and three female subjects, ranging in age from 45 to 50 months, with an average age of 48 months. The perceptual group consisted of three male and three female subjects, ranging in age from 40 to 58 months, with an average age of 47 months. The control group consisted of four male and two female subjects, ranging in age from 41 to 57 months, with an average age of 49 months. The verbal group received verbal label pretraining plus training during administration of the conceptual-sorting and serial recall tasks; the perceptual group received perceptual matching pretraining plus training during the administration of the conceptual-sorting and serial recall tasks. The control group received no verbal label or perceptual matching pretraining or training during the administration of the tasks, but they were reinforced for correct responses during the administration of the sorting and recall tasks.

Prior to the pretraining and training procedures, each child received three tests of linguistic and conceptual abilities. The tests administered were the Peabody Picture Vocabulary Test (Dunn, 1959), the Boehm Test of Basic Concepts (Boehm, 1971), and the Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968).

PREPARATION OF EXPERIMENTAL STIMULI

Stimuli used in this experiment were drawings made with black india ink on white cardboard. Stimuli used for pretraining and training varied along the dimensions of shape and size. They consisted of circles, squares and triangles which were either big or little. Big circles were 2 inches in diameter, whereas little circles were 1 inch in diameter; big squares and triangles were 2 inches on a side, whereas little squares and triangles were 1 inch on a side. There were 30 stimulus cards in all, 5 for each category. Stimuli used for the transfer tasks were comparably sized with respect to the pretraining and training stimuli. They consisted of three different shapes, a combined circle and square, a cross and a diamond. Again there were 30 stimulus cards in all, 5 for each category.

The individual stimulus cards were used during the baseline procedure for all subjects, during the pretraining procedure for both the verbal and perceptual groups, and during training for the conceptual-sorting task; they were also used as response cards for replication of the sequence presented during the serial recall task. In addition, a series of test stimuli were created for the serial recall task consisting of cards depicting predetermined sequences of big and little circles, big and little squares, or big and little triangles. Test cards ranged from two to five units, with variations in sequence which were generated randomly. A comparable set of test stimuli was developed for the serial

recall transfer task.

ENVIRONMENT FOR THE PRESENTATION OF EXPERIMENTAL EVENTS

The experiment was conducted in a small classroom at the day camp. The subject and examiner were seated opposite one another across a table. The stimuli were presented manually by the experimenter during baseline, pretraining, training and transfer task administration.

Instructions were presented verbally and through demonstration by the examiner. Responses were made verbally or by manipulation of the stimulus cards placed before the subject on the table. Correct responses were recorded on a tally sheet by the examiner. During reinforced trials a small container was placed next to the subject in which tokens were delivered contingent upon correct responses. These tokens were redeemable for colored stickers on the basis of a predetermined ratio.

CONDUCT OF THE EXPERIMENTAL SESSIONS

Each subject was seen for four one-half hour sessions. These sessions were usually one day apart except where a child's absence necessitated further delay. During the first session the language and conceptual assessment battery was administered. The second session was used to establish baseline measures for the conceptual-sorting and serial recall tasks. The third session was used for verbal or perceptual pretraining and verbal or perceptual training

and task administration for experimental subjects. It was used for stimulus exposure and task administration for the control subjects. The last session was used for the administration of the transfer tasks.

Assessment Session

Each subject was seated on a small chair across the table, opposite the examiner. The language and conceptual assessment procedures were administered in the following order: (1) Peaboy Picture Vocabulary Test (Dunn, 1959), (2) Boehm Test of Basic Concepts (Boehm, 1971), and (3) Verbal Expression subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968). Subjects were given verbal praise and encouragement for cooperative participation. They were also given colored stickers at the end of each activity. This also served to introduce the stickers as reinforcers which would later be used in exchange for the redeemable tokens during the pretraining and training procedures.

Baseline Session

Each subject was seated as previously described and baseline levels of performance were determined for both the conceptual-sorting and serial recall tasks. For the conceptual-sorting task subjects were instructed to place the stimulus cards into two piles, putting the cards that are most alike into the same pile. The stimulus cards were of six different types: (1) big circles, (2) little circles, (3) big squares, (4) little squares, (5) big

triangles, and (6) little triangles. Thirty stimulus cards were to be sorted. A brief demonstration in which the examiner sorted 4 of the stimulus cards into two piles, according to size, was conducted.

For the serial recall task, the subjects were shown a stimulus card depicting a sequence of big and little circles, squares or triangles. Fifteen stimulus cards were presented with an increasing number of units as the task progressed. The cards ranged from two to five units. The stimulus card was exposed for 5 seconds. Subjects were instructed to "make the same picture" using individual stimulus cards. A demonstration procedure was employed if the subject was unable to follow the instructions. Response-contingent token reinforcement was not delivered during the baseline procedures. Subjects were simply praised for their cooperation and given colored stickers at the end of the activity.

Pretraining Session

Verbal pretraining group. Subjects who received verbal pretraining were led to vocalize the label of the stimulus card according to the attribute that was to be relevant during the subsequent tasks, i.e. "big" or "little." The labeling of the relevant dimension, rather than both dimensions, e.g. "big circle" has been demonstrated to be more effective (Osler and Madden, 1973). Ten consecutive correct labeling responses were required to achieve criterion. A correct response was reinforced with social praise and redeemable tokens on a continuous reinforcement schedule.

Perceptual pretraining group. Subjects who received perceptual pretraining were required to match stimuli on the dimension that was to be relevant during the subsequent tasks, big or little. After the presentation of the picture, the subject was asked to select one of two stimuli placed before him. For example, if a big circle was presented, subject was given a choice of a big diamond and a little diamond. He was then required to match according to the size dimension. Ten consecutive correct matches were required to achieve criterion. Correct responses, as in the verbal pretraining, were reinforced with social praise and redeemable tokens. These pretraining procedures have been adapted from Osler and Madden (1973).

Control group. These subjects were given an opportunity to play with the stimulus pictures, e.g. creating designs, copying, tracing, and coloring. Subjects received colored stickers for participating in the activities.

Training and Task Administration

The conceptual-sorting and serial recall tasks were then presented, as stated above in the description of the baseline session. The stimuli that were used during verbal and perceptual pretraining were used during task administration as well. The use of the same stimuli during pretraining and task administration was found to significantly improve performance (Osler and Madden, 1973). The order or presentation of tasks was the same for all subjects, conceptual-sorting followed by serial recall.

Verbal training group. During the conceptual-sorting task

the child was required to label the relevant dimension of the stimulus picture in order to have an opportunity to produce a sorting response. Correct sorting responses were reinforced with social praise and redeemable tokens on a continous reinforcement schedule. The labeling contingency during the task eliminated the issue of production deficiency, taking labeling training a step further (T.S. Kendler, 1972). During the serial recall task, the child was required to label the relevant stimulus dimension of each unit in the sequence, e.g. "big, big, little." The subject was then asked to repeat the sequence so as to produce a rehearsal response. The production of these behaviors was necessary for the subject to have the opportunity to produce a sequencing response. Correct sequencing responses were reinforced with social praise and redeemable tokens on a continous reinforcement schedule.

Perceptual training group. During the conceptual-sorting task, the child was required to match the relevant dimension of each stimulus picture in order to have the opportunity to produce a sorting response. For example, if subjects were given a little circle, they would have to choose to match it with either a little diamond or a big diamond. A correct matching response would enable them to make the sorting response. During the serial recall task, subjects had to match the relevant dimension of each unit in the sequence during exposure to the test stimuli. Subjects were then asked to repeat the matching sequence so as to produce some form of perceptual rehearsal. For example, if the stimulus

sequence consisted of a big circle, big circle, little circle, subjects would have to produce a series of 3 matching responses by pointing first to the big diamond, then again to the big diamond, and finally to the little diamond. The production of these behaviors was necessary for subject to produce a sequencing response. Correct responses were reinforced with redeemable tokens on a continuous reinforcement schedule.

Control group. These subjects were given the conceptual-sorting and serial recall tasks as described above in the description of the baseline session. No verbal labeling or perceptual matching responses were required for either the sorting or sequencing response. Correct responses, however, were reinforced with redeemable tokens on a continuous reinforcement schedule.

Termination of the task. For all subjects, the conceptual-sorting task was discontinued when a criterion level of performance was achieved. Criterion was 10 consecutive correct sorting responses. If a child was unable to achieve criterion in 60 trials, the task was terminated. On the serial recall task, the activity was discontinued when all of the stimulus items (15) were completed.

Transfer of Training

In order to determine if transfer of training had taken place, a follow-up procedure was presented for each type of task, conceptual-sorting and serial recall. These tasks employed size (big and little) as the relevant dimension, but utilized new shapes, a combined circle and square, a cross, and a diamond.

The instructions for the transfer tasks were similar to the

baseline procedure. No reinforcement was used during the administration of the tasks, other than general praise for the cooperation of the child. All spontaneously produced verbal labeling and/or perceptual matching responses were recorded as well as a notation as to the point during the task when the labeling or matching was used.

DATA COLLECTION AND ANALYSIS

The number of correct responses was counted for baseline, pretraining, training, and transfer task administration for the conceptual-sorting and serial recall tasks. The percent correct responses was computed for each of these tasks. Difference scores were computed by subtracting baseline percentage scores from transfer task percentage scores. In addition, spontaneously produced labeling or matching responses used by any of the subjects during any of the tasks were recorded.

Analysis of pooled data consisted of the computation of several standard statistical measures. A two-tailed t-test was carried out to determine whether there was a significant difference between the number of trials to criterion level of performance obtained during each type of pretraining condition. One-way analyses of variance were performed to determine significant main effects for type of training for each transfer task.

A Kruskal-Wallis one-way analysis of variance was performed for each type of cue produced (perceptual matching and verbal labeling) for each type of transfer task (conceptual-sorting and

serial recall) to determine the effect of training with regard to cue production during the transfer tasks. These tests were applied at the .01 and .05 level of significance.

Correlation procedures were also carried out as part of the pooled data analysis. Pearson product moment correlation coefficients were computed to determine the degree of relationship between language and conceptual assessment procedures. Pearson product moment correlations were computed to measure the degree of relationship between chronological age, scores obtained on the language and conceptual assessment procedures and percent correct responses obtained during transfer tasks. Descriptive statistics, as well as inferential statistics were used to measure certain characteristics of the group samples.

The results of the pooled data analysis were then compared to individual subject data analysis of percent correct responses to determine the predictive value of the pooled data and its generality. Results of the data analysis are discussed in Chapter 4.

Chapter 4

RESULTS AND DISCUSSION

RESULTS

The present research was designed to answer six questions. The analysis of results will be discussed in this chapter in the context of these six questions. Each of the six sections of the chapter will be divided into four subsections as follows: the question, the data treatment used, findings, and interpretations.

PRODUCTION OF CUES BY PRETRAINING CONDITION

Question

The first question to be answered was: Did the preschool subjects in this research who were pretrained to use perceptual cues achieve criterion level of performance on the pretraining task in a significantly different number of trials than did the preschool subjects pretrained to use verbal cues?

Data Treatment Used

A two-tailed t-test for independent samples was performed to measure the significance of difference between the number of trials to achieve criterion level of performance for the two pre-training conditions, perceptual cue and verbal cue pretraining.

Findings

Tables 1 and 2 present the individual performance of subjects

on their respective cue-production pretraining tasks. All subjects were trained to criterion (10 consecutive correct responses) and achieved percent correct scores greater than chance. Only one subject in the perceptual pretraining condition, 4P, required a second presentation of the task to achieve criterion.

Table 3 summarizes the results of the two-tailed t-test. The perceptual cue pretraining group achieved a mean of 18.0 trials to criterion level of performance, with a standard deviation of 15.5. The verbal cue pretraining group achieved a mean of 13.7 trials to criterion level of performance, with a standard deviation of 5.8. The t value obtained was 0.65. The test for the difference between means for the two pretraining conditions was not significant at the .05 level.

Interpretation

Each group of preschool subjects achieved criterion level of performance on their respective pretraining task quite readily. The attainment of 10 consecutive correct responses was achieved, on average, in 18 trials for the subjects required to produce a matching response and, on average, in 13.7 trials for the subjects required to produce a verbal labeling response. Only one subject encountered any difficulty in learning to produce the required cue. Subject 4P required 49 trials in order to achieve criterion performance on the perceptual matching cue production task.

Cue production training for preschool children who served as subjects in this research is certainly feasible and readily attain-

Table 1

Performance of Individual Subjects on a Perceptual Cue Production Pretraining Task

Subject	Trials to Criterion Level of Performance	Percent Correct Responses
1P	10	100
2P	14	93
3P	10	100
4P	49	65
5P	10	100
6P	15	67

Table 2

Performance of Individual Subjects on a Verbal Cue Production Pretraining Task

Subject	Trials to Criterion Level of Performance	Percent Correct Responses
1V	20	95
2V	10	100
3V	10	100
4V	10	100
5V	22	86
6V	10	100

Table 3

Differences in Trials to Criterion Level of Performance Between Pretraining Conditions in a Cue Production Task

Pretraining Condition	Number of Cases	Mean	Standard Deviation	Theoretical t Value at .05 Level	Measured Value of t
Perceptual	6	18.0	15.5	2.44	0.65
Verbal	6	13.7	5.8		

able, regardless of whether the cues are perceptual matching responses or verbal labeling responses (Table 3). Thus, "production-deficiency" (Reese, 1962) appears to be easily modified in a sample of preschool children through relatively simple conditioning procedures. The data also indicate that it is not necessarily easier to train a child from this sample to produce one type of cue as opposed to another.

PERFORMANCE ON TRANSFER TASKS BY TRAINING CONDITION

Question

The second question to be answered was: Did preschool children who served as subjects in this research, pretrained and trained to use perceptual cues or verbal cues during task performance, achieve significantly different scores on transfer tasks than those subjects who were not pretrained and trained to use either perceptual or verbal cues?

Data Treatment Used

A one-way analysis of variance was performed for each of the transfer tasks, conceptual-sorting and serial recall, to determine if scores differed as a function of pretraining and training. Following this, a two-tailed t-test for correlated samples was performed to measure the significance of difference between the percentage scores obtained during baseline and transfer measures for each type of task, conceptual-sorting and serial recall. These tests were applied to the data to determine whether

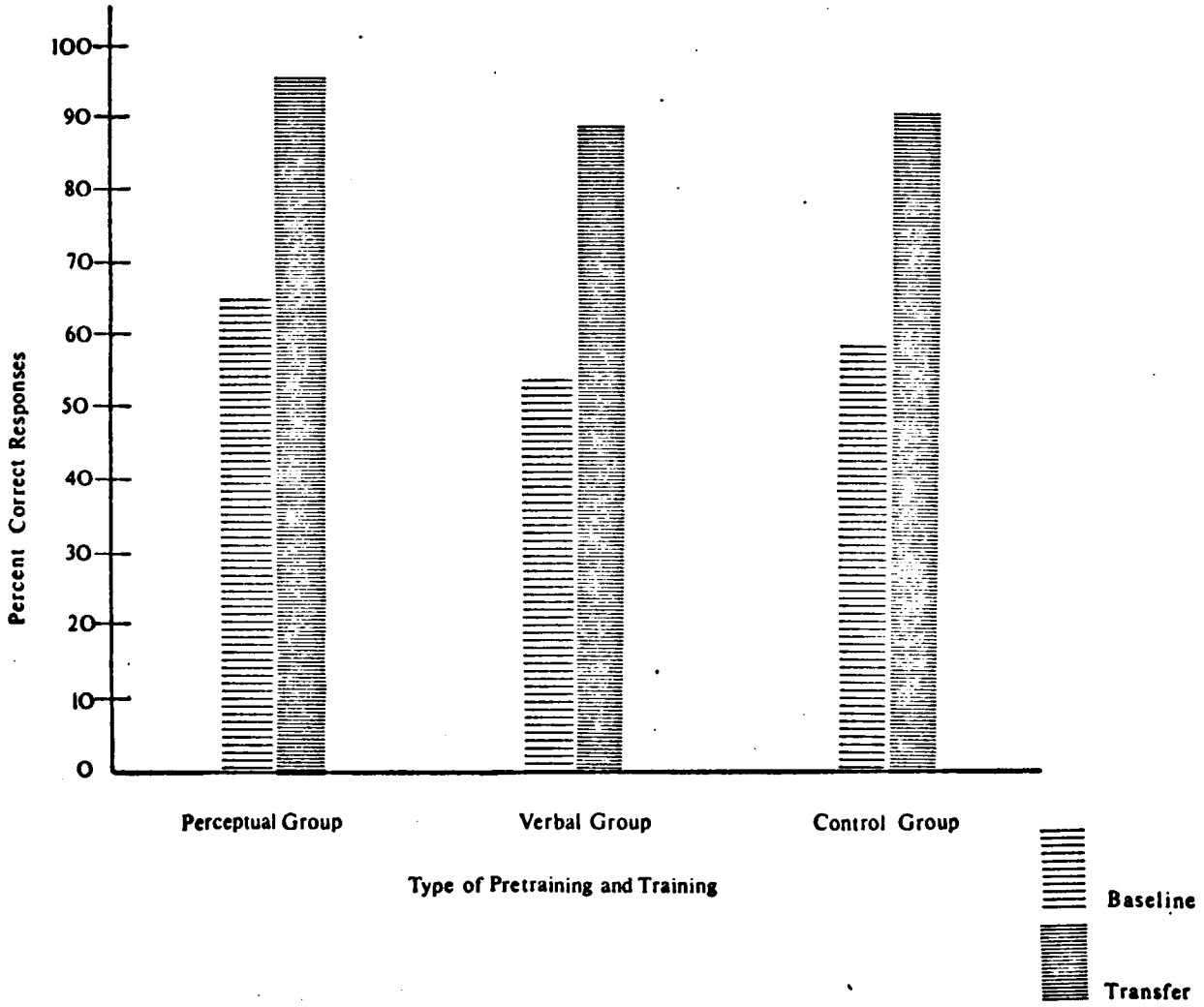
or not subjects' scores changed significantly as a function of the response-contingent reinforcement training procedures.

Findings

Figures 1 and 2 depict the comparison of scores obtained for subjects on the baseline and transfer measures for each of the tasks, conceptual-sorting and serial recall. Figure 3 depicts a comparison of difference scores for the two types of tasks. Differences are evident between performance of subjects on the two measures for the conceptual-sorting task. The perceptual group obtained a mean difference score of 32; the verbal group obtained a difference score of 35; the control group obtained a difference score of 33. Differences are somewhat smaller between performance of subjects on the two measures for the serial recall task. The perceptual group obtained a mean difference score of 18; the verbal group obtained a difference score of 12; the control group obtained a difference score of 8.

The group receiving perceptual pretraining and training obtained a mean score of 95.67 percent on the conceptual-sorting transfer task, with a standard deviation of 9.22; the group receiving verbal pretraining and training obtained a mean score of 88.83, with a standard deviation of 14.55; the control group obtained a mean score of 90.00, with a standard deviation of 13.99.

Table 4 depicts the results of the one-way analysis of variance for the conceptual-sorting transfer task. The F value obtained is 0.49. The effect of cue training was not significant



.Figure 1. COMPARISON OF MEAN SCORES FOR THE BASELINE AND TRANSFER PROCEDURE ON A CONCEPTUAL-SORTING TASK.

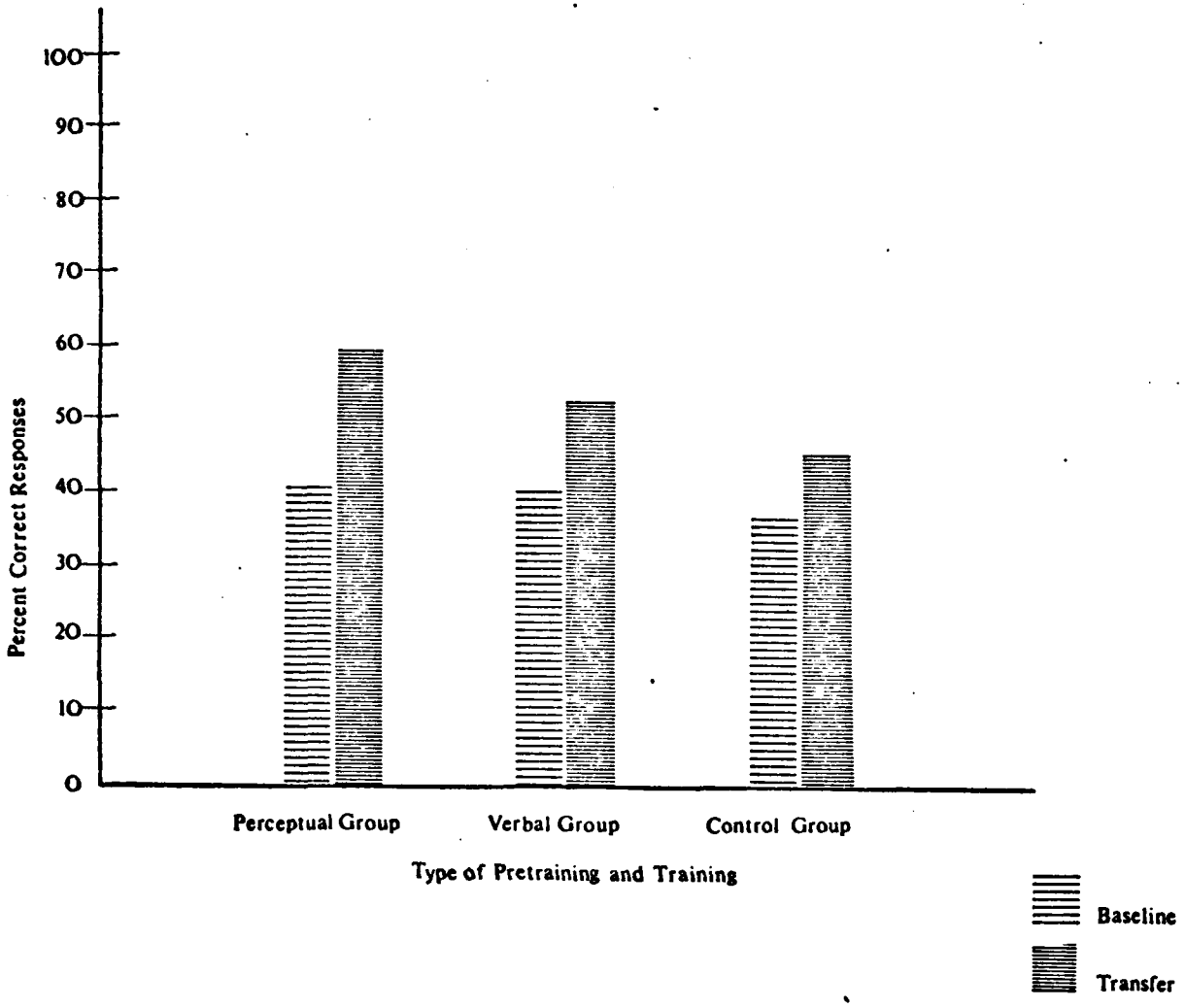


Figure 2. COMPARISON OF MEAN SCORES FOR THE BASELINE AND TRANSFER PROCEDURE ON A SERIAL RECALL TASK.

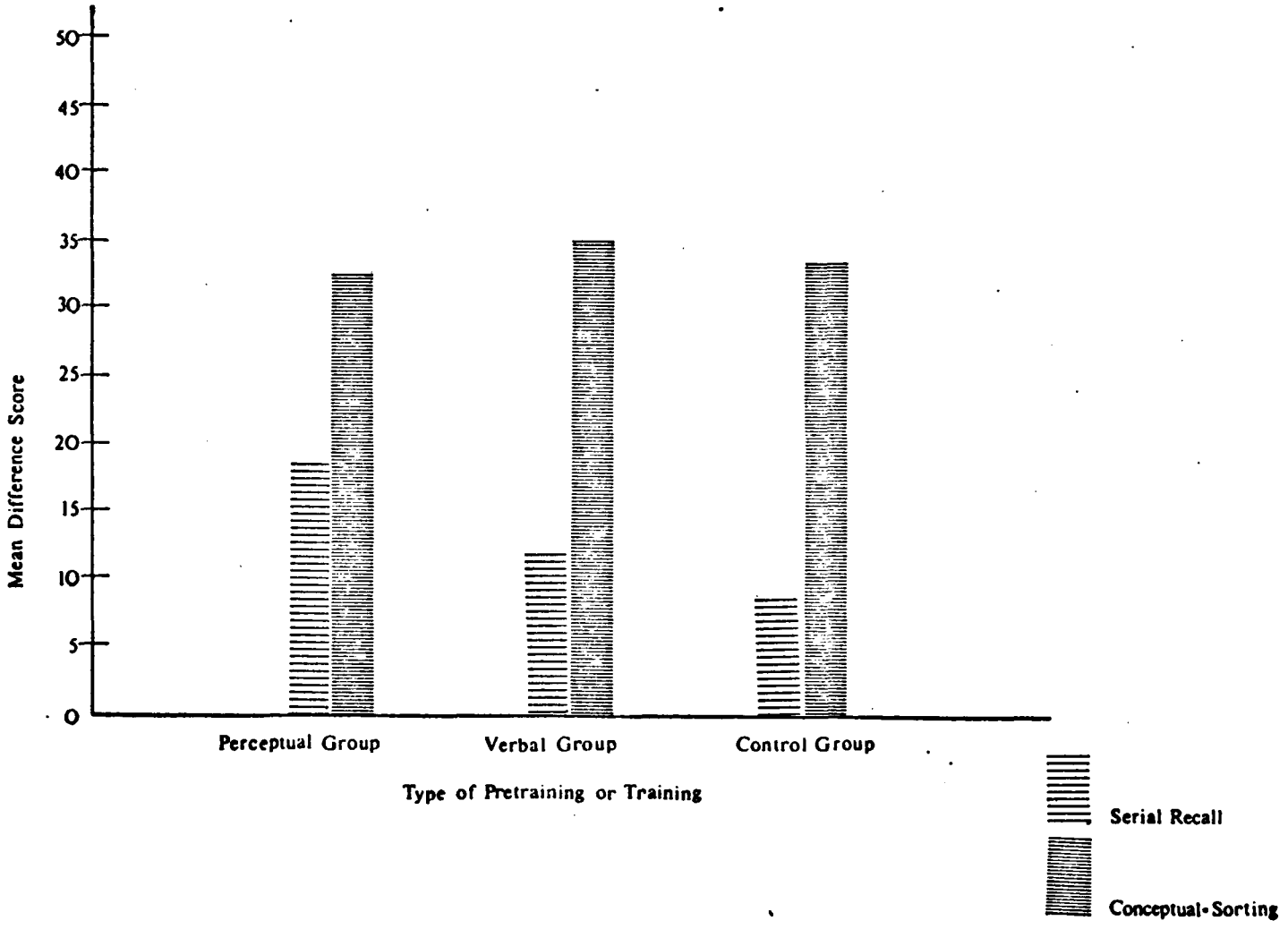


Figure 3. COMPARISON OF DIFFERENCE SCORES BETWEEN BASELINE AND TRANSFER PROCEDURES FOR THE CONCEPTUAL-SORTING AND SERIAL RECALL TASKS.

at the .05 level.

The group receiving perceptual pretraining and training obtained a mean score of 58.83 on the serial recall transfer task, with a standard deviation of 15.98; the group receiving verbal pretraining and training obtained a mean score of 53.33, with a standard deviation of 29.69; the control group obtained a mean score of 45.66, with a standard deviation of 17.78.

Table 5 depicts the results of the one-way analysis of variance for the serial recall transfer task. The F value obtained is 0.54. The effect of cue training was not significant at the .05 level.

Tables 6 and 7 depict the results of the two-tailed t-tests for the differences in percentage scores between baseline and transfer measures for each of the task types, conceptual-sorting and serial recall. The test for the difference between means for the two measures of performance on the conceptual-sorting task was significant at the .01 level. The test for the difference between means for the two measures on the serial recall task was significant at the .05 level.

Interpretation

The analyses of variance (Tables 4 and 5) indicate that there was no significant main effect for type of cue training on either the conceptual-sorting or serial recall task. Figure 1 indicates that all subjects achieved rather high scores on the conceptual-sorting transfer task, with the perceptually trained subjects

Table 4

Analysis of Variance for the Conceptual-Sorting Transfer Task

Source	Sum of Squares	Degrees of Freedom	Mean Square	Theoretical F Value at .05 Level	Measured Value of F
Among Groups	160.33	2	80.16	3.68	0.49
Within Groups	2462.16	15	164.14		
Total	2622.50	17			

Table 5

Analysis of Variance for the Serial Recall Transfer Task

Source	Sum of Squares	Degrees of Freedom	Mean Square	Theoretical F Value at .05 Level	Measured Value of F
Among Groups	524.77	2	262.38	3.68	0.54
Within Groups	7267.50	15	484.50		
Total	7792.27	17			

Table 6

Difference in Percentage Scores Between Baseline and Transfer Measures on a Conceptual-Sorting Task

Type of Measure	Number of Cases	Mean	Standard Deviation	Theoretical t Value at .01 Level	Measured Value of t
Baseline	18	58.33	16.01	2.89	7.95**
Transfer	18	91.50	12.42		

** p is less than .01 (df=17)

Table 7

Difference in Percentage Scores Between Baseline and Transfer Measures on a Serial Recall Task

Type of Measure	Number of Cases	Mean	Standard Deviation	Theoretical t Value at .05 Level	Measured Value of t
Baseline	18	39.66	15.98	2.11	2.46*
Transfer	18	52.61	21.41		

* p is less than .05 (df=17)

achieving the highest mean score, followed by the control group subjects. The verbally trained subjects achieved the lowest mean score on the tasks. The results of the test of the significance of difference between baseline and transfer measures on the conceptual-sorting task (Table 5) demonstrate that the response-contingent reinforcement procedures used during the training of all subjects led to the achievement of significantly higher scores on the transfer task. Performance of subjects, however, was not significantly affected by perceptual or verbal cue training. Figure 2 indicates that subjects achieved higher scores on the serial recall transfer task, with the perceptually trained subjects achieving the highest mean score, followed by the verbally trained subjects and then the control group. The results of the test of the significance of difference between baseline and transfer measures on the serial recall task (Table 6) demonstrate that the use of reinforcement procedures during the training of subjects led to the achievement of significantly higher scores on the transfer task. Once again, however, subjects' performance was not significantly affected by perceptual or verbal cue training.

Despite the successful pretraining and training of subjects to produce perceptual matching and verbal labeling cues as discussed on pages 56 through 60, the production of these cues did not appear to influence their performance significantly on either the conceptual-sorting or serial recall transfer tasks. Improvement on these two tasks was related to the experience common to all

subjects, i.e., training on the tasks rather than cue production training.

SPONTANEOUS PRODUCTION OF PREVIOUSLY TRAINED CUES DURING TRANSFER TASKS

Question

The third question to be answered was: Did children who served as subjects in this research and were trained to use either perceptual or verbal cues during task performance produce a significantly different number of cues during transfer tasks than did subjects who did not receive this training?

Data Treatment Used

A Kruskal-Wallis one-way analysis of variance by ranks (Siegel, 1956) was performed for each of the types of cues produced (perceptual matching and verbal labeling) during each of the transfer tasks (conceptual-sorting and serial recall).

Findings

Figure 4 depicts subjects' spontaneous production of perceptual and verbal cues during the transfer tasks. The perceptually trained group produced a mean of 2 matching cues and 1 verbal cue on the conceptual-sorting transfer task; they produced a mean of 3.3 matching cues and 3 verbal cues on the serial recall transfer task. The verbally trained group produced a mean of 0 matching cues and 8.9 verbal cues on the conceptual-sorting transfer task; they produced a mean of 0

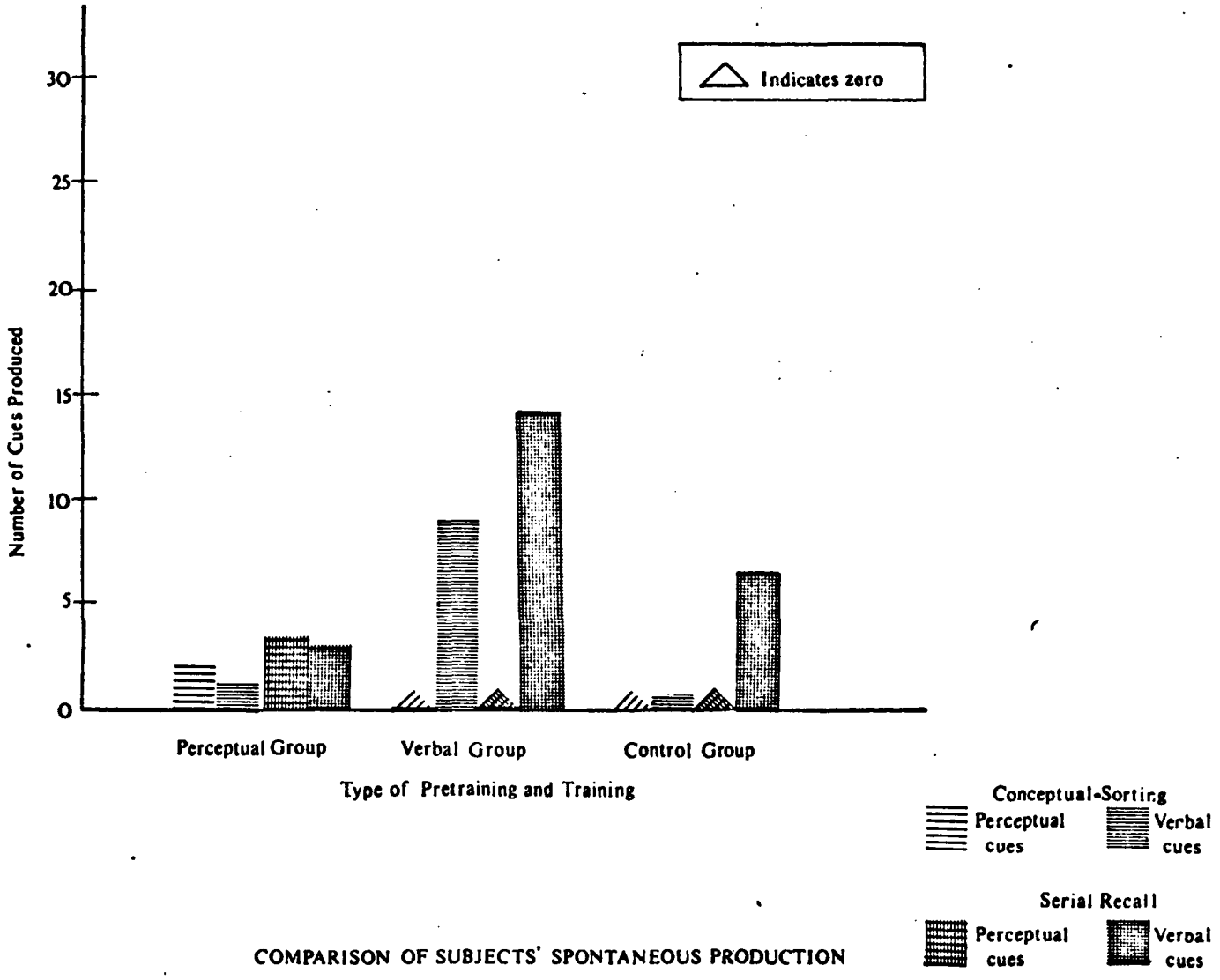


Figure 4. COMPARISON OF SUBJECTS' SPONTANEOUS PRODUCTION OF PERCEPTUAL MATCHING AND VERBAL LABELING CUES DURING TRANSFER TASKS.

matching and 14.3 verbal cues on the serial recall transfer task. The control group produced a mean of 0 matching and 0.5 verbal cues on the conceptual-sorting transfer task; they produced a mean of 0 matching and 6.7 verbal cues on the serial recall transfer task.

Table 8 depicts the results of the four Kruskal-Wallis one-way analyses of variance by ranks. The H values for each of the analyses was significant at the .05 level.

Interpretation

Only the subjects who received perceptual cue production pretraining and training spontaneously produced these cues during the transfer tasks. All subjects produced some verbal cues during the transfer tasks, but those who received verbal cue production pretraining and training clearly produced the most verbal cues. All subjects produced more verbal cues during the serial recall transfer task than during the conceptual-sorting transfer task.

The significance of the H values for all four of the Kruskal-Wallis analyses of variance by ranks demonstrates a main effect for pretraining and training with regard to spontaneous cue production during the transfer tasks. The perceptually trained subjects were more likely to generate perceptual cues than either the verbal or the control groups during the transfer tasks. The verbally trained subjects were more likely to generate verbal cues than either the perceptual or control groups during the transfer tasks. The findings suggest that there was a transfer

Table 8

Values of H Obtained for the Kruskal-Wallis Analysis of Variance by Ranks for Each of the Types of Cues Produced During Each of the Transfer Tasks

Type of Cue	Transfer Task	
	Conceptual-Sorting	Serial Recall
Perceptual	6.73*	6.73*
Verbal	6.47*	8.01*

Theoretical value of H at the .05 level = 5.99

*p is less than .05 (df=2)

of training for both perceptually and verbally trained subjects with regard to cue production.

RELATIONSHIP BETWEEN SPONTANEOUS CUE PRODUCTION AND PERFORMANCE ON TRANSFER TASKS

Question

The fourth question to be answered was: Is there a relationship between the number of cues produced spontaneously during the transfer tasks and the scores achieved on these tasks?

Data Treatment Used

Pearson product moment correlation coefficients were computed between the number of perceptual cues produced during each of the transfer tasks and the scores obtained on those tasks. Similarly, correlation coefficients were computed between the number of verbal cues produced during each of the transfer tasks and the scores obtained on those tasks.

Findings

Table 9 depicts the results of the correlation calculations. Only one of the relationships was significant, that of the scores on the conceptual-sorting transfer task and the number of verbal cues produced spontaneously during that task. This correlation coefficient was -.57 indicating a negative relationship between the two variables. This relationship was significant at the.05 level.

Table 9

Pearson Product Moment Correlation Coefficients Measuring the Relationship Between Scores on the Transfer Tasks and the Number of Cues Produced Spontaneously During the Tasks

Transfer Task	Correlation	
	Perceptual Cues	Verbal Cues
Conceptual-Sorting	.19	-.57*
Serial Recall	-.16	.13

Theoretical value of r at the .05 level = .456

*p is less than .05 (df=17)

Interpretation

There does not appear to be any significant relationship between the spontaneous production of perceptual cues during the transfer tasks and the scores on those tasks. There is no significant relationship between the spontaneous production of verbal cues during the serial recall transfer task and the scores obtained on the task. However, a significant negative relationship was demonstrated between the spontaneous production of verbal cues during the conceptual-sorting transfer task and the scores obtained on the task.

Although subjects did produce both perceptual and verbal cues spontaneously during the transfer tasks, these cues did not positively influence performance on the tasks. To the contrary, the significant negative effect of verbal cue production on conceptual-sorting performance may indicate that the motor act of vocalization has a detrimental influence on the execution of the conceptual task at hand. Training preschool children to produce cues may generalize to a similar task, but may not necessarily be useful in bringing about improved performance on the task.

RELATIONSHIP BETWEEN AGE, LINGUISTIC SKILL AND PERFORMANCE ON TRANSFER TASKS

Question

The fifth question to be answered was: Is there a relationship between age, level of linguistic skill and scores achieved on the transfer tasks?

Data Treatment Used

Pearson product moment correlation coefficients were computed between age of subjects and the scores obtained on each of the transfer tasks. Similarly, correlation coefficients were computed between scores of subjects on each of the language and conceptual assessment procedures (Peabody Picture Vocabulary Test, Boehm Test of Basic Concepts, and Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities) and scores on each of the transfer tasks. In addition, correlation coefficients were computed between each of the assessment procedures.

Findings

There were significant correlations obtained between age and scores of subjects on each of the transfer tasks. The correlation coefficient between age and performance on the conceptual-sorting transfer task was .39, which was significant at the .05 level. The correlation between age and performance on the serial recall transfer task was .41, which was significant at the .05 level.

The only significant correlation between assessment procedures was that between the Peabody Picture Vocabulary Test (PPVT) and the Boehm Test of Basic Concepts. The correlation was .44, which was significant at the .05 level. The correlation

coefficient obtained between the scores on the PPVT and those on the Verbal Expression Subtest of the ITPA was .14, while the correlations coefficient obtained between the scores on the Boehm and those on the Verbal Expression Subtest of the ITPA was .13.

Table 10 depicts the correlation coefficients between each of these assessment procedures and each of the transfer tasks. The relationships that were significant are those between the scores on the PPVT and the serial recall transfer task, the scores on the Boehm and those on the conceptual-sorting transfer task, and the scores on the Boehm and those on the serial recall transfer task. These correlation coefficients were .49, .63, and .47, respectively.

Interpretation

The significance of the correlation coefficients between age and the scores on the transfer tasks indicates that age is a good predictor of the outcome of training. The age range investigated in this study was limited (40 to 58 months). Nevertheless, this age range is a period in which significant progression occurs in developmental abilities, one which is predictive of the ease with which training can be accomplished for these tasks.

Before interpreting the findings for the correlations between each of the three language and conceptual assessment procedures and the scores on the transfer tasks, it is important to examine the relationships between the test procedures them-

Table 10

Pearson Product Moment Correlation Coefficients Measuring the Relationship Between Scores on the Language and Conceptual Assessment Procedures and Scores on the Transfer Tasks

Assessment Procedures	Correlation Coefficients	
	Conceptual-Sorting Transfer Task	Serial Recall Transfer Task
PPVT	.16	.49*
Boehm	.63*	.47*
Verbal Expression Subtest	.006	.09

Theoretical value of r at the .05 level = .456

Theoretical value of r at the .01 level - .575

*p is less than .05

** p is less than .01

selves. The only significant relationship found was between the PPVT and the Boehm. Thus, it can be assumed that both of these tests are tapping similar abilities in the child. While the PPVT is largely viewed as a receptive language test, the Boehm is viewed as a test of conceptual knowledge. Both tests require the child to point to a picture which corresponds to a word or phrase spoken by the examiner. The child must interpret a verbal stimulus by making a nonverbal response. There is very little relationship between the scores on each of these tests and those on the Verbal Expression Subtest of the ITPA. Thus, it can be assumed that this latter test is measuring a different skill area. That is, this particular subtest of the ITPA may not be an adequate measure of language ability. The test does involve the child's talking about and describing various familiar objects, but its low correlation with other language measures sheds doubt on its value as a measure of expressive language.

Both the PPVT and the Boehm demonstrate predictive value with regard to the scores on the transfer tasks. There was no relationship between the Verbal Expression Subtest of the ITPA and the scores on either of the transfer tasks. Since performance of preschool children on measures of receptive language and conceptual knowledge predict the success of training on conceptual-sorting and serial recall tasks, it is likely that an adequate measure of expressive language would have similar predictive value.

THE COMPARISON BETWEEN POOLED DATA AND INDIVIDUAL DATA

Question

The last question to be answered was: Do pooled data for preschool subjects suggest different interpretations than do the data for individual preschool subjects?

Data Treatment Used

Difference scores were computed for each subject for each type of task by subtracting the score obtained on the baseline measure from that obtained on the transfer task. These individual difference scores were compared to the mean difference scores obtained for all of the subjects for each type of task.

Findings

Figure 5 depicts a comparison of the difference scores for individual subjects with the pooled difference score on the conceptual-sorting task. Among the perceptually trained subjects, 1P, 2P and 6P obtained difference scores that contrasted markedly with the pooled difference score. Subject 1P obtained a score considerably lower than the pooled score, whereas subjects 2P and 6P obtained considerably higher scores. Among the verbally trained subjects, 2V obtained a difference score that was considerably lower than the pooled score. Among the control subjects, 2C, 4C and 5C obtained difference scores that contrasted markedly with the pooled difference score. Subject 2C obtained a considerably higher score whereas subjects 4C and 5C

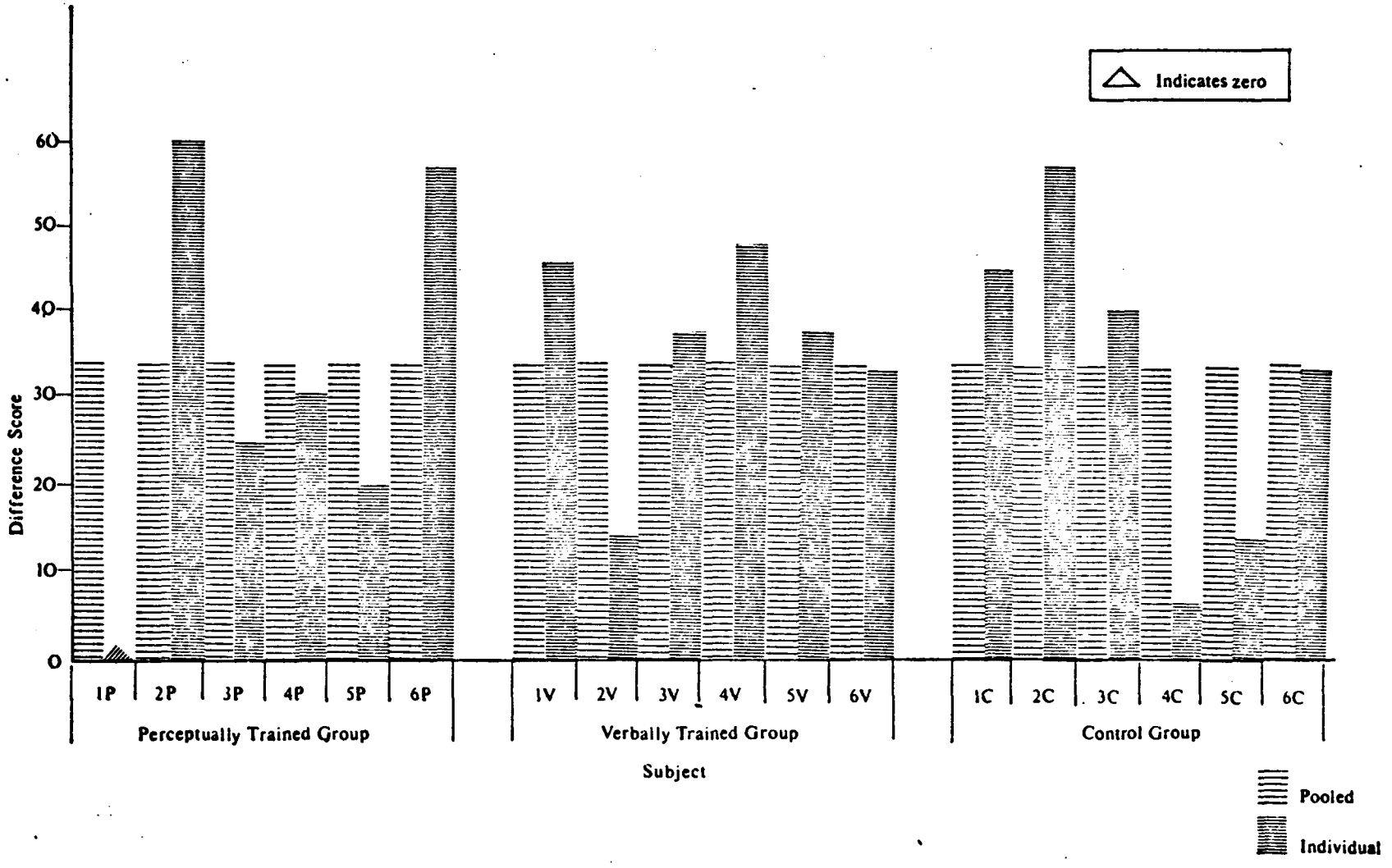


Figure 5. A COMPARISON OF DIFFERENCE SCORES OF EIGHTEEN INDIVIDUAL SUBJECTS WITH RESPECT TO THE POOLED DIFFERENCE SCORE ON A CONCEPTUAL-SORTING TASK.

obtained considerably lower scores.

Figure 6 depicts a comparison of the difference scores for the individual subjects with the pooled difference score on the serial recall task. Among the perceptually trained subjects, 4P and 6P obtained difference scores that contrasted markedly with the pooled difference score. Subject 4P obtained a considerably higher score, whereas subject 6P obtained a much lower score. Among the verbally trained subjects, 1V, 4V and 6V obtained markedly different scores. Subjects 1V and 4V obtained lower scores, while subject 6V obtained a higher score. Among the control subjects, 6C obtained a considerably lower difference score than the pooled score.

Interpretation

There is a marked variation from the mean in the difference scores of some subjects. This is true for both the conceptual-sorting and serial recall tasks. This demonstrates that the pooled data were quite misleading as a predictor of performance of some of the subjects. The pooled data do indeed provide a measure of central tendency and a measure of the degree of variability in the data. They do allow the investigator to make very broad generalizations about the comparative effectiveness of different training procedures. But it was only upon careful examination of changes in individual subject scores throughout the training procedure that an adequate explanation for the variability could be found. The analysis of pooled data does not conceal variability, but it stops short of being helpful in discovering the source of that variability. This information is

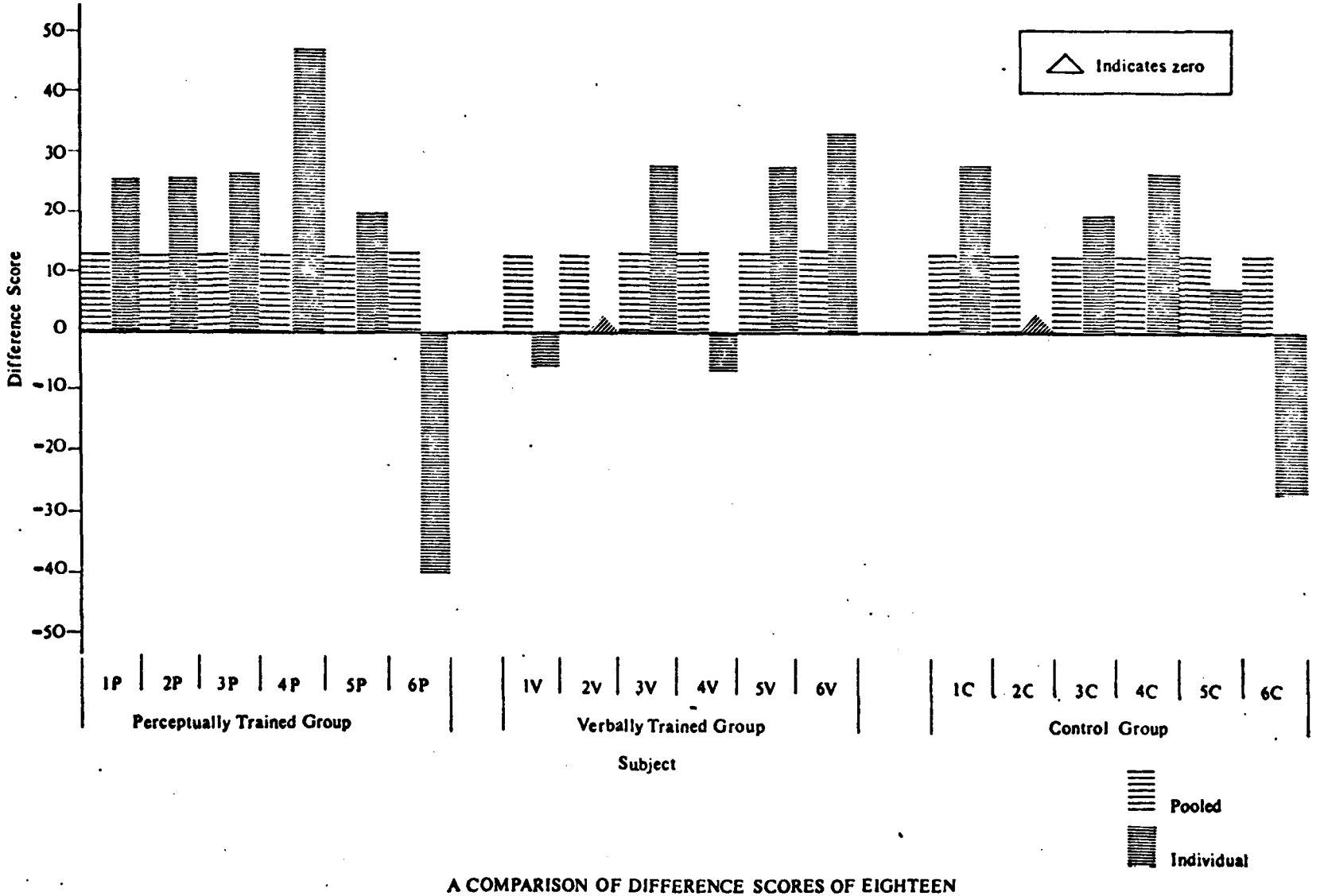


Figure 6. A COMPARISON OF DIFFERENCE SCORES OF EIGHTEEN INDIVIDUAL SUBJECTS WITH RESPECT TO THE POOLED DIFFERENCE SCORE ON A SERIAL RECALL TASK.

invaluable to the clinician in the development of training procedures. In the sections that follow, on pages 87 through 94, the individual subject data are presented so as to examine the information provided by this additional analysis.

Difference scores of perceptually trained subjects showing marked variation for the conceptual-sorting task. Subject 1P obtained a difference score considerably lower than the pooled score. This might be interpreted to mean that the perceptual training procedure was ineffective. However, this subject's baseline score was 100 percent, precluding any improvement as a result of the training procedure. In fact, this subject used both an overt verbal labeling and perceptual strategy periodically during the baseline measure. In response to the examiner's question about why he sorted the stimulus figures in a particular way, he was able to categorize verbally the stimuli that went together as being the same size. This subject, who already used a verbal cueing strategy and obtained a high baseline score, did not receive any benefit from perceptual cue production training.

Subject 2P obtained a difference score considerably higher than the pooled score. This subject named the stimulus figures according to the size dimension during the baseline measure but her sorting responses were made without consideration of the labels applied. She achieved criterion for both the perceptual pretraining and training procedures in relatively few trials, 14 and 13, respectively. However, she did not use the perceptual matching strategy during the transfer task. At the end of the

transfer task she explained her sorting response by saying: "Because they're big ones, because they're little ones." The perceptual cue training seemed to have led to the generation of a covert verbal labeling strategy. It should be noted that this was the oldest subject (58 months) and that she scored an I.Q. of 129 on the PPVT, as well as a score of 21 out of a possible 25 on the Boehm Test of Basic Concepts.

Subject 6P also obtained a considerably higher difference score. This subject achieved criterion for both the perceptual pretraining and training procedures in relatively few trials, 15 and 16, respectively. She used the perceptual matching strategy during the transfer task, as well. She was the youngest of the subjects (40 months) and demonstrated transfer of the perceptual cueing response to discriminate her sorting response.

Difference scores of verbally trained subjects showing marked variation for the conceptual-sorting task. Subject 2V obtained a considerably lower difference score than the pooled score. He achieved criterion for the verbal pretraining procedure in 10 trials, but required 42 trials to reach criterion during the verbal training procedure. He produced the verbal labels consistently prior to his sorting response during the transfer task, but this did not result in any marked improvement on the sorting task. Indeed, his attention appeared to be diverted from the sorting task while he produced the verbal labels.

Difference scores of control subjects showing marked variation for the conceptual-sorting task. Subject 4C obtained

a considerably lower difference score. He occasionally labeled the stimulus figures according to shape and size, but these labeling behaviors seemed to exert no control over his sorting responses during baseline or transfer procedures. He responded as one might have predicted a control subject would have responded in this study. He was never specifically taught to use the verbal label to discriminate his sorting response, and he did not exhibit this behavior. His score on the transfer task indicated minimal improvement as a function of the reinforcement training procedure alone.

Subject 5C also obtained a much lower difference score. His percentage accuracy during the baseline measure was rather high, not allowing for much improvement during the transfer procedure. He did not use verbal labels during either procedure and was unable to verbalize his criteria for the sorting response. During the training procedure, in which he was reinforced for correct sorting responses regardless of his use of any cue, he gave the following reason for his sorting response: "I want to get more stickers." His responses were brought under stimulus control of the size dimension as a function of the response-contingent reinforcement procedure. His high baseline score on the task, however, masked any effect of training.

Subject 2C obtained a considerably higher difference score. He achieved a baseline measure of 43 percent and did not produce any cues during the procedure. After the reinforcement procedure, however, he reasoned as follows, "They're little; if you want a

chip you put big here and little here." He labeled the stimuli occasionally during the transfer procedure, often stating "That's the same size," after making a sorting response. The use of the response-contingent reinforcement procedure alone seemed sufficient to bring the sorting response under the stimulus control of the size dimension and resulted in the production of an overt label, suggesting verbal awareness of the response choice as a by-product.

Difference scores of perceptually trained subjects showing marked variation for the serial recall task. Subject 4P obtained a much higher score than the pooled score. He exhibited no type of cueing strategy during the baseline measure, but used the perceptual cueing strategy about one-third of the time during the transfer task. He demonstrated transfer of training of perceptual cue production and occasional use of these cues to discriminate his recall response. The recall response was not consistently under the stimulus control of the perceptual cues, but continued training may have increased the probability of stimulus control and further enhanced his recall performance.

Subject 6P obtained a much lower score than the pooled score. This observation is of particular interest since this subject achieved oneof the highest difference scores for the conceptual-sorting task. Her baseline measure for serial recall was 73 percent, and was among the highest of scores for the baseline measure. She readily acquired the perceptual matching response during the pretraining procedure, doing so in 15 trials. She also demonstrated

a high degree of accuracy in the matching response during the training procedure, and exhibited the response consistently during the transfer task. However, the attention drawn to the cueing procedure resulted in a diversion of attention from the recall task. Whereas the perceptual matching cueing strategy facilitated her performance on the conceptual-sorting task, it had a detrimental effect on the serial recall task. The training procedure brought the subject's sorting response under the stimulus control of the perceptual cues, but was unsuccessful in bringing about this stimulus control of the recall response. The subject's initially high serial recall score may indicate that she already employed some strategy which was disrupted by the requirement that she generate perceptual cues. Thus, additional training may have been necessary to establish the stimulus control of the perceptual cue in the context of the serial recall response.

Difference scores of verbally trained subjects showing marked variation for the serial recall task. Subjects 1V and 4V obtained much lower difference scores than the pooled score. Subject 1V obtained a typically low baseline measure of 33 percent. She acquired the verbal labeling response in 20 trials during the pretraining procedure. She produced the verbal labels throughout the serial recall training task, although occasional confusion was noted. She also exhibited lip movement which may have indicated covert labeling. During the training task, which employed reinforcement for correct recall responses, her score went up to 47 percent. She exhibited the labeling response throughout the

transfer task, but did not appear to use the labels for rehearsal or in any other way to control her recall response. Her recall score during transfer went down to 27 percent. She was effectively trained to verbally label, but not to use these labels as a response strategy.

Subject 4V was also effectively trained to verbally label during the pretraining and training procedures. Spontaneous labeling was also exhibited consistently during the transfer task. However, during the transfer task, unlike the training task, she labeled the stimuli out of sequence, labeling all of the big ones and then all of the little ones. She was not effectively trained to use the labeling response as a strategy with which to replicate the sequence. Labeling training was successful, but additional training was necessary so that the subject would rehearse these labels in sequence to discriminate the recall response.

Subject 6V obtained a considerably higher difference score than the pooled score. He produced the labels "big" and "little" during the baseline measure, seemingly using these labels in some rehearsal strategy at first, but then discontinuing its use. His recall responses were more likely to be accurate when he applied the labels. He demonstrated consistent use of the labels during the training task and during the transfer task. He did not only produce the labels during the transfer procedure, but used them to control his recall response. This subject's weak control over the verbal cueing strategy during baseline was effectively enhanced by the pretraining and training procedures.

Difference scores of control subjects showing marked variation for the serial recall task. Only subject 6C obtained a considerably different score from the pooled score. She did not demonstrate any cue production during baseline, training or transfer procedures. It was anticipated that control subjects would not show significant improvement because of the absence of cue training. However, the decrease in this subject's serial recall score, from 40 percent to 13 percent, was not predicted by the central hypothesis of the study and was possibly due to fatigue and boredom with the task.

In summary, an analysis of the pooled data alone does not reveal the individual variation that becomes apparent when the comparison is made to individual subject data. The pooled data fall short of predicting the scores of three of the perceptually trained subjects, one of the verbally trained subjects, and three of the control subjects on the conceptual-sorting task. They do not adequately predict the scores of two of the perceptually trained subjects, three of the verbally trained subjects, and one of the control subjects on the serial recall task.

An examination of the pooled data may lead to some misleading impressions about the performance of subjects. Although the analysis of pooled data indicates that response-contingent reinforcement training leads to significant improvement in the performance of subjects on conceptual-sorting and serial recall tasks, it also leads to the interpretation that cue production training does not result in significant changes in the scores of subjects on these

tasks. The analysis of the performance of individual subjects throughout the stepwise procedure of cue production pretraining and training indicates that the performance of some subjects changes markedly as a function of the procedure. For some subjects, the procedure is beneficial; for others, it is detrimental.

To some extent, this appears to be dependent upon the behavioral repertoire of the subject prior to training. In some cases, this appears to be a function of the task under consideration. Without a careful analysis of how and why these subjects' scores differed so markedly, a great deal of clinically relevant information would have been lost. In addition, many limitations of the study, as well as suggestions for further research, would have remained uncovered.

DISCUSSION

The usefulness of research is determined by the extent to which the findings can be generalized to the population under investigation and to the extent to which further investigation is stimulated. The value of clinically relevant research is judged by the extent to which the data lead to the identification of functional relationships which may be manipulated so as to enhance the behavorial repertoire of the individual. This may be viewed as generality of process.

The data from the present study are characterized by considerable variability, and thus, generalizations both to the

population and of the process must be made cautiously. The findings support many view points of earlier studies and offer alternate interpretations from those of others, suggesting directions for future research. The analysis of the data, particularly the comparison of pooled data with data from individual subjects, leads to the identification of several functional relationships which may be generalized to the clinical setting and are potentially useful. The present discussion will elaborate on these points and examine the findings of the study in the context of the current literature.

PRODUCTION OF CUEING RESPONSES IN PRESCHOOL CHILDREN

The preschool children who served as subjects in the present study generally did not produce cues as part of a response strategy during baseline measures. Since children in this age range (40 to 58 months) are viewed as unable to produce these cues covertly (Conrad, 1971, 1972), it is reasonable to assume that the absence of overt cue production indicates that no cues were being produced with which to mediate response choices. In other words, these children may be viewed as having a mediational deficiency (Reese, 1962; Flavell, Beach and Chinsky, 1966; T.S. Kendler, 1972). They can be described more specifically as exhibiting a production deficiency (Reese, 1962) in that they did

not generate cues with which to organize and mediate response choices. There were some exceptions to this general observation in that some subjects occasionally produced cues during baseline procedures. These exceptions will be discussed with regard to the usefulness of training and the notion of maturational attainment.

Training Children to Produce Perceptual Matching Cues

All of the subjects in the perceptual training group learned to produce the perceptual matching response in relatively few trials, with the exception of subject 4P who achieved criterion but who required 49 trials to do so. Following cue production pretraining, subjects were readily trained to produce these perceptual matching responses prior to initiating a sorting or recall response during the respective training tasks. Thus, the production deficiency evident in these children during baseline measures was significantly modified through relatively simple conditioning procedures.

During the transfer tasks, however, subjects demonstrated a low probability of production of the perceptual matching response to discriminate either the sorting or recall response. The mean number of cues produced spontaneously during the conceptual-sorting transfer task was 2; the mean number of cues produced during the serial recall transfer task was 3.3. These numbers significantly exceeded production of perceptual matching cues among subjects who did not receive the training, but fell far short of being of practical value with regard to transfer of training.

Training Children to Produce Verbal Cues

All of the subjects in the verbal training group learned to produce the verbal labeling response in relatively few trials. They were readily trained to produce these verbal labeling responses prior to initiating a sorting or recall response during the respective training tasks. Once again, the production deficiency evident in these children during baseline measures was significantly modified through relatively simple conditioning procedures.

During the transfer tasks subjects demonstrated a higher probability of production of the verbal labeling response than the perceptually trained group did with regard to the perceptual matching response. The mean number of cues produced during the conceptual-sorting transfer task was 8.9; the mean number of cues produced during the serial recall transfer task was 14.3. These numbers significantly exceeded production of verbal labeling cues among subjects who did not receive the training and appear to have more practical value with regard to transfer of training.

There was no significant difference in the number of trials to achieve criterion between the subjects pretrained to produce perceptual cues and those pretrained to produce verbal cues. Cue production training was feasible for this group of preschool subjects, regardless of the type of cue produced. With regard to cue production training, the notion of a developmental pro-

gression in which perceptual cues are attained more readily than verbal cues (Osler, Draxl and Madden, 1977) is not supported by the data. Findings from the transfer tasks, however, suggest that generalization of cue production to a new task is more likely where the cues are verbal labels rather than perceptual matching responses. This would lend support to the work of Kendler, Glasman and Ward (1972) who found that verbal labeling was more effective than perceptual cue pretraining on a reversal shift task with 4-year-old children.

Cue Production and Conceptual-Sorting Performance

Although these preschool children were readily pretrained to produce perceptual and verbal cues and more specifically trained to produce these cues prior to making response choices on the conceptual-sorting task, the production of these cues did not exert a significant influence on the performance of subjects on the task. Subjects' scores on the transfer task improved significantly as a function of the conditioning procedure regardless of cue production pretraining and training.

The production deficiency (Reese, 1962) was dealt with by the training procedure, but within the context of mediational theory, the mediational deficiency (Reese, 1962; Flavell, Beach and Chinsky, 1966) or control deficiency (T.S. Kendler, 1972) persisted. Most subjects did not appear to use the cues, either perceptual or verbal to mediate (Kendler and Kendler, 1962; Carey and Goss, 1957; Weir and Stevenson, 1959; Reese, 1972) or classify (Osler and Madden, 1973; Osler, Draxl and Madden, 1977; Fitzgerald,

1977) their response choices.

The most apparent interpretation is that the training methodology was ineffective in bringing the subjects' responses under the stimulus control of a mediating cue. It is, however, possible that the ease of the concepts (big and little) involved in the task precluded the children's need to rely on mediating cues to signal their response choices. If the children had been required to make a sorting response involving a more difficult concept, then those who had been trained to use cues might have relied more on those cues. The data might then have shown greater differences between subjects' scores on the transfer task as a function of cue production pretraining and training.

If the conceptual-sorting task was too easy, then a ceiling effect would have precluded the observation of significant differences among the groups. However, the one significant relationship found between number of cues produced during the transfer tasks and scores on the tasks was a negative relationship. The correlation coefficient obtained between the number of verbal cues produced during the conceptual-sorting transfer task and subjects' scores on the task was -.57, significant at the .05 level. This would appear to support Conrad's (1971,1972) contention that there is a developmental stage during which vocalization may have a detrimental effect in that the motor act of speech production draws attention away from the task at hand. Although Conrad discusses this problem with regard to memory tasks, it is possible that this detrimental effect applies to conceptual tasks as well.

Cue Production and Serial Recall Performance

The effect of cue production on serial recall performance was similar to that on conceptual-sorting performance. Subjects' scores on the transfer task improved significantly as a function of the conditioning procedure regardless of cue production pretraining and training. Once again, although the production deficiency was dealt with by the training procedure, the mediational or control deficiency was not effectively modified. Most subjects did not appear to use either perceptual or verbal cues to mediate or control their recall responses.

There was no ceiling effect to mask any influence of cue production pretraining and training on transfer task performance. There were no significant relationships between number of cues produced during the transfer task and subjects' scores on the task. The negative relationship between the production of verbal cues and performance on the conceptual-sorting transfer task, reported earlier, did not obtain for the serial recall task. This is a somewhat curious finding considering Conrad's (1971, 1972) position on the detrimental effect of vocalization on the performance of very young children. In this case, perhaps, as he suggests, a trade-off of effects occurs in which the attention drawn to the motor act of speech production is offset by the attention drawn simultaneously to the stimulus sequence.

VERBAL MEDIATION AND STIMULUS CLASSIFICATION AS OBSERVABLE AND TRAINABLE PROCESSES

In order to effectively train a subject to exhibit a particular skill or process, one must precisely identify the observable

behaviors which are viewed as evidence of the existence of the process. That is, the dependent variables must be specified. Then one can proceed with the identification of the independent variables which have to be manipulated in order to bring about changes in the dependent variable.

Verbal mediation (Kendler and Kendler, 1962) and stimulus classification (Osler and Madden, 1973) have been proposed as underlying processes to explain changes in response patterns that occur in children between the ages of 4 and 7 years. They are hypothetical constructs whose appearance is attributed to maturational attainment. Attempts have been made repeatedly by researchers to train subjects to improve or change their performance on tasks in such a way as to attribute these performance changes to these underlying processes. These studies were described in considerable detail in Chapter 2. Rather than viewing improvement and change in responses as an indication of one or another underlying process, the present study was designed to uncover the functional relationships between independent and dependent variables.

Identification of the Functional Relationship Between Independent and Dependent Variables

An examination of the studies involving the training of verbal mediation and stimulus classification revealed several dependent variables. A frequently discussed behavior or variable was subjects' performance on conceptual-sorting and serial recall tasks. The independent variables that were manipulated in order to bring about changes in performance on these tasks included: 1) subjects' production of perceptual cues, 2) subjects' production of verbal cues,

and 3) response-contingent reinforcement of subjects' correct sorting and recall responses.

In the present study, the production of perceptual or verbal cues was a behavior which subjects were taught to emit prior to either a sorting or recall response. Thus, cue production was an antecedent event which could set the occasion for the discrimination of the subjects' response choice. Response-contingent reinforcement was a consequent event which could alter the probability of a particular response choice.

The pooled data suggest that performance of preschool children on conceptual-sorting and serial recall tasks, does not change significantly as a function of cue production whether those cues are perceptual matching behaviors or verbal labeling behaviors. The data do, however, suggest that performance of these children on the respective tasks changes significantly as a function of response-contingent reinforcement.

Identification of a Training Methodology

The functional relationships that are revealed in the present study and described in the previous section may lead to the conclusion that verbal mediation and/or stimulus classification are not trainable processes. The data demonstrate that preschool children can be trained to produce both perceptual and verbal cues; in fact, they can be trained to produce these cues antecedent to sorting and recall responses. The use of a relatively simple response-contingent reinforcement procedure is sufficient to establish this behavioral repertoire. Many of the subjects generalize

this production of cues to transfer tasks. Those who do not generalize probably could be taught to do so with variation in reinforcement schedules so as not to allow for extinction of the behavior during transfer. This and other suggestions for future research is discussed on pages 110 to 111. These children, however, were not effectively trained to control their response choices with the cues produced. This can be attributed to intellectual immaturity or, similarly, to the lack of development of the processes of verbal mediation and/or stimulus classification. Thus, the explanation for the problem could be similar to that inherent in the notion of mediational deficiency (Reese, 1962; Flavell, Beach and Chinsky, 1966) or a control deficiency (T.S. Kendler, 1972).

A more careful examination of individual subject data demonstrates, however, that the above generalizations are of limited value. Some subjects were effectively trained to bring their response choices under the control of either perceptual or verbal cues. The variation in the behavioral repertoires of these subjects provides important information about alternate and/or additional behaviors that may need to be trained. Herein lies the value of analysis of individual data for the clinician. In order to teach the child who has not achieved a particular maturational level, because of age or developmental retardation, more specific behaviors may have to be identified and trained. In other words, performance deficits may be attributable more to the subject's history (i.e., his training and experience) than to imagined covert processes.

COMPARATIVE USEFULNESS OF POOLED AND INDIVIDUAL DATA ANALYSIS

An examination of individual subject data and comparison with the pooled data indicates that the pooled data do not predict the scores of many subjects on both the conceptual-sorting and serial recall tasks. The data obtained are highly variable and thus, generalizations to the population and of the process must be made cautiously. The individual subject data, however, provided information so that the present investigator was able to identify alternate and/or additional behaviors, which if taught to preschool children, might bring sorting and recall response choices under the control of perceptual or verbal cues. In other words, performance deficits often attributed to a covert mediational deficiency or control deficiency could be effectively dealt with by training children to produce the behaviors which have led us to infer that the covert process exists.

The subjects who obtained difference scores that were considerably higher than the pooled difference score exhibited various behaviors that appear to have affected the pretraining and training procedures. Among the perceptually trained subjects, 2P and 6P obtained markedly higher difference scores for the conceptual-sorting task. Subject 2P verbally categorized the stimulus subsets which served to discriminate her sorting response during the transfer task. This suggests that the training procedure may be used to enhance the subject's attention to the stimulus properties to be discriminated, resulting in a self-generated classification of those properties. In other words, continued reinforcement of a response choice results in self-intitiated cue production and stimulus classification or stimulus-response

mediation. However, the cue must be in the child's repertoire in order for it to be generated. This is demonstrated by the data provided by subject 5C. This subject obtained a much lower difference score. He did not use any cueing strategy and was unable to verbally label categories for the sorting response. Response-contingent reinforcement resulted in some improvement in his sorting response, but was not sufficient to generate any overt classifying or mediating behaviors. It appears that some cue production training is necessary along with continued reinforcement of the sorting response in the presence of that cue. The data provided by subject 2C further substantiate this contention. This subject appears to have had the verbal cue in his repertoire. The reinforcement procedure brought the sorting response under the stimulus control of the size dimension and the verbal label.

The data from subject 6P demonstrate transfer of training of cue production and effective use of cues to discriminate the sorting response. Perhaps a modification of the training procedure so as to alter the criterion and the abrupt removal of the reinforcement would result in improved transfer of training, and decrease the likelihood of extinction of cue production.

The data from subject 2V, a verbally trained subject who received a markedly lower difference score for the conceptual-sorting task, also suggest the need for modification of the criterion during the training procedure. Despite his achievement of 10 consecutive sorting responses during the training procedure, he required 42 trials to achieve criterion, resulting in an overall

response accuracy of 69 percent. This is a much lower accuracy level than most of the other subjects, and suggests the need for more individual criteria to insure response consistency and transfer of training.

Individual data analysis for the serial recall task also suggests changes in the behaviors to be trained. The data for subject 6P indicate that the cueing behaviors may divert attention from the recall task, even though they were useful during the sorting task. Thus, the topography of the cue produced must be examined within the context of the topography of the response required by the task. If the motor acts compete for the subject's attention, more time may be needed to practice cue production.

The most consistent finding with regard to spontaneous cue production during the serial recall transfer task was that subjects were not effectively trained to rehearse the sequence of cues as a recall strategy. Even those who produced cues were not likely to repeat the sequence as if to rehearse them. These findings corroborate those of Keeney, Cannizzo and Flavell (1967). When given the option, induced rehearsers stopped. The present training procedure did not deal with this problem adequately. Greater emphasis needs to be placed on response-contingent reinforcement of rehearsal behaviors, whether the cues are perceptual or verbal. This is clearly demonstrated by the data for subjects 4P, 1V and 4V.

The findings for subject 6V demonstrate that where cue production and rehearsal behaviors are already in the child's repertoire, the reinforcement procedure may increase their probability

of occurrence. This indicates that behavior patterns currently employed by the preschool child must be identified so that they can be strengthened as response strategies.

The data for subject 6C indicate that the possibility of subject fatigue must be dealt with in training the very young child. This would suggest that multiple training sessions are likely to be more effective in obtaining valid and reliable data for subjects in this age range.

RELATIONSHIP OF LANGUAGE AND CONCEPTUAL SKILLS TO THE DEVELOPMENT AND TRAINING OF CUEING STRATEGIES

The measurements of the receptive language and knowledge of basic concepts of subjects were predictive of the outcome of the training procedure. Not surprisingly, these two measures, the Peabody Picture Vocabulary Test and the Boehm Test of Basic Concepts correlated significantly with one another. The child's ability to identify verbal labels, a skill measured by both of these tests, appears to significantly co-vary with regard to conceptual-sorting and serial recall performance.

Subjects' scores on the Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities were not predictive of the outcome of the training procedure. This was a particularly interesting finding considering that this test measures the child's ability to verbally label and categorize various stimulus properties of familiar objects. The lack of relationship between the expressive language test scores and the transfer task scores, however,

supports the finding based on pooled data, that cue production training does not significantly influence performance of subjects on either the conceptual-sorting or serial recall task.

The receptive language and conceptual assessment procedures employed in the present study did not predict subjects' initial use of cueing strategies or the success of training them to use cueing strategies. They did predict the improvement in the performance of subjects on two nonverbal tasks. Certain language abilities play some role in the performance of tasks that are typically viewed as nonverbal. Although the data do not specify the exact nature of the function of language with regard to these tasks, they do indicate that this role does not relate to the production of cues. Specific linguistic skill, as well as more general cognitive skill (Fitzgerald, 1977) must be taken into account with regard to performance of children on tasks which are generally considered nonverbal.

ADVANTAGES AND LIMITATION OF THE PRESENT RESEARCH

The research was conducted in a classroom at the Brooklyn Regional YM-YWHA Day Camp, Early Childhood Division. This physical setting and the scheduled activities of children allowed for many distractions during the collection of data. Although training and testing sessions were held in a fairly typical preschool educational environment, the experimenter was not always able to control for interruptions which occasionally drew the attention of subjects away from the task at hand. Because of the random

scheduling of subjects, however, it is safe to assume that these distractions more or less equally affected the performance of all children in the study.

Subjects investigated in this study were very young (40 to 58 months) and, thus, reliability of measurements must be considered carefully. Single measurements were taken for each of the four components of the experimental procedure, and, thus, reliability may be further questioned. Indeed, increasing familiarity of subjects with the examiner, over the course of the four experimental sessions, may have influenced improved performance. The examiner did meet with and familiarize herself with all of the children prior to initiating any experimental procedures so as to increase the likelihood of more reliable and valid measures and to decrease the likelihood of change in performance of subjects because of examiner presence.

The experimental sessions lasted no more than one-half hour and were generally well within the attention span of the subjects. Occasionally, sessions were separated by more than one day because of children's absence. This may have disrupted the continuity in the procedure. An effort was made to conduct all training in a single session to minimize this problem. However, in the case of subject 4V, extensive absence between training and transfer tasks may have influenced measures of the transfer of training. In general, the investigator felt that multiple training sessions and more systematic variation in schedules of reinforcement might have resulted in a greater training effect as well as transfer of

training. This and other suggestions for future research are discussed in the next section.

The study was conducted with a small sample of preschool children (18 subjects) from a limited age range (18 months). However, this allowed for a more precise analysis of individual subjects at a point in their developmental progression where non-communicative uses of language are first becoming evident. This provided for an identification of specific behaviors which need to be investigated further and trained systematically in order to more clearly define functional relationships.

SUGGESTIONS FOR FUTURE RESEARCH

The results suggest several areas which need further investigation. The efficacy of multiple training sessions should be explored with regard to perceptual and verbal cue production and stimulus control of sorting and recall behaviors. Within a multiple session procedure, a more systematic examination could be undertaken of variations in schedules of reinforcement. Perhaps a more gradual fading of response-contingent reinforcement would result in greater transfer of training of cue production and more consistent stimulus control by these cues of the sorting and recall behaviors.

With regard to serial recall performance and cue production, a more systematic reinforcement procedure should be investigated for rehearsal behaviors. Rehearsal behaviors appear to be a necessary component to the successful use of cues to enhance

recall. Rehearsal needs to be further investigated for both perceptual and verbal cues.

The present study grouped subjects together over an 18 month age range. A more precise comparative investigation is needed for groups of subjects over smaller age ranges. Clearly, very rapid developmental changes are taking place during this period of time and the grouping together of children over an 18 month age span may be too gross. Directly related to this issue is that of matching subjects according to linguistic and cognitive measures to clarify further the relative influence of these factors with regard to noncommunicative uses of language.

Finally, a comparative investigation is necessary of subjects whose linguistic skills span a broader range, including language-disordered children as well as younger-normal children. This would allow for a more precise determination of production and mediational or control deficiency among children whose use of language for communicative purposes was not developing normally. With the exception of hard-of-hearing and deaf children, investigations of the noncommunicative uses of language are rare among language-disordered children.

Chapter 5

SUMMARY AND CONCLUSIONS

SUMMARY

The present research was designed to study six questions. The first involved the assumption that preschool children could be taught to produce perceptual or verbal cues with which to facilitate their performance on two nonverbal tasks. The major issue here was whether or not these children learned to produce one type of cue more readily than the other. Thus, the study was designed to measure and compare the number of trials required to train preschool children to produce either perceptual or verbal cues.

The second question involved the assumption that, once these children produced either perceptual or verbal cues, they could be taught to use these cues to discriminate response choices on both a conceptual-sorting and serial recall task. This assumption about the feasibility of training preschool children to use cueing strategies prior to maturational attainment was examined by determining whether or not transfer of training took place, and whether or not transfer of training was greater for subjects trained to produce one type of cue as opposed to the other. This study was, thus, designed to measure performance of children on both a conceptual-sorting and a serial recall transfer task to determine if scores of subjects differed as a function of cue production training.

The third question involved the assumption that the children who were trained to produce perceptual or verbal cues during conceptual-sorting and serial recall training tasks would produce these cues spontaneously to facilitate their performance on the respective transfer tasks. The study was, thus, designed to determine whether spontaneous production of cues during the transfer tasks differed as a function of cue production training.

The fourth question involved the assumption that performance of the children on the transfer tasks would be related to the number of cues produced spontaneously. Therefore, the study was designed to measure correlation coefficients between the number of perceptual and verbal cues produced during the transfer tasks and the scores obtained on those tasks.

The fifth question involved the assumption that there would be a significant relationship between age of the children and the value of training them to use cueing strategies, and between the performance of the children on measures of language and conceptual skills and the value of training them to use cueing strategies. Thus, the study was designed to measure correlation coefficients between the age of subjects and the scores obtained on each of the transfer tasks, and between scores of subjects on each of three measures of language and conceptual skills and scores obtained on each of the transfer tasks.

The final assumption to be examined was that the analysis of data for individual subjects versus the analysis of pooled data

would suggest different interpretation of results. Data were, therefore, analyzed for the performance of individual subjects and pooled to compare suggested interpretations. This comparative analysis was also examined with regard to additional information that might be revealed to the clinician involved in the development of training procedures.

Procedure

Eighteen preschool children, ranging in age from 40 to 58 months were divided into two experimental groups and one control group, each containing 6 subjects, to determine the effectiveness of training cueing strategies to facilitate performance on a conceptual-sorting and a serial recall task. Baseline measures were first taken to determine scores of subjects on each of the tasks prior to training.

Subjects in the perceptual group were then pretrained to produce perceptual matching cues by pointing to one of two shapes which was the same size as a stimulus figure. Subjects in the verbal group were pretrained to produce verbal labels by naming a stimulus figure according to the size dimension. Response-contingent reinforcement, in the form of redeemable tokens, was delivered on a continuous reinforcement schedule. Control subjects were exposed to the stimulus figures for a comparable amount of time, but no cue production pretraining was conducted.

When experimental subjects achieved criterion (10 consecutive correct responses)on the pretraining procedures, they were presented with a conceptual-sorting and a serial recall task on which they

were trained to produce either a perceptual matching or verbal labeling response which would serve as the discriminative stimulus for either a sorting or recall response. Reinforcement during the training tasks was contingent upon the production of either a perceptual or verbal cue followed by a correct sorting or recall response. The conceptual-sorting task consisted of the placement of a stimulus figure into one of two piles according to the size dimension, i.e. either big or little. Prior to each sorting response, the subject had to either match or name the stimulus figure according to the size dimension. The serial recall task consisted of replicating a sequence of big and little shapes. The sequence ranged in length from two to five units. Prior to each recall response, the subject had to either match or name each unit in the sequence according to the size dimension. Control group subjects were trained to produce correct sorting and recall responses, but without the use of either perceptual or verbal cues to serve as discriminative stimuli. When subjects in each group achieved criterion (10 consecutive correct responses) on the sorting task, and performance of a predetermined number of trials (15) on the recall task, a transfer task was administered for conceptual-sorting as well as for serial recall.

Transfer of training was measured by presenting subjects with conceptual-sorting and serial recall tasks which employed size as the relevant dimension, but utilized new shapes. No response-contingent reinforcement was used during the administration of the tasks. Spontaneously produced perceptual matching and/or verbal labeling responses were recorded during the transfer tasks.

Prior to the implementation of the above procedures,three measures of language and conceptual skills were administered to each subject. Correlation coefficients were computed between the scores on each of these tests and scores of subjects on each of the transfer tasks. The Peabody Picture Vocabulary Test (Dunn, 1959) was used to assess receptive vocabulary skills; the Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy and Kirk, 1968) was used to assess expressive language skills; the Boehm Test of Basic Concepts (Boehm, 1971) was used to assess subjects' knowledge of familiar concepts.

Results

In order to present the results clearly, the writer has chosen to discuss them in three separate sections below.

Production of cues and their use as performance facilitators. All subjects were trained to produce either perceptual matching cues or verbal labeling cues to criterion and achieved percent correct scores greater than chance. There was no significant difference between the number of trials required by the subjects trained to produce perceptual cues and those trained to produce verbal cues. Cue production training for these preschool children was feasible and readily attainable, regardless of whether the cues were perceptual matching responses or verbal labeling responses.

Cue production training during the conceptual-sorting and serial recall tasks did not significantly affect performance of subjects on the respective transfer tasks. Results of the one-way

analyses of variance for each of the transfer tasks indicate that there was not a significant main effect for type of cue production training. The scores of subjects in all three groups (perceptually trained, verbally trained and control) improved significantly as a function of the response-contingent reinforcement procedure and experience with the tasks.

Subjects who were trained to produce perceptual cues produced significantly more cues during the transfer tasks than those who did not receive the training. Subjects who were trained to produce verbal cues produced significantly more cues during the transfer tasks than those who did not receive the training. However, correlation coefficients computed between number of cues produced during transfer tasks and scores on the tasks indicate that the only significant relationship was a negative one, that between number of verbal cues produced and scores on the conceptual-sorting transfer task.

Although subjects were readily trained to produce cues, they were not effectively trained to use those cues as performance facilitators. Indeed, cue production may have interfered with performance in certain cases.

Comparison of individual and pooled data analysis. The pooled data did not adequately predict the difference scores for three of the perceptually trained subjects, one of the verbally trained subjects, and three of the control group subjects on the conceptual-sorting task. On the serial recall task, the pooled data did not adequately characterize the different scores for two

of the perceptually trained subjects, three of the verbally trained subjects, and one of the control group subjects. An analysis of scores for individual subjects, during various steps in the experimental procedure, suggests other interpretations for the data. It suggests that certain subjects can be trained to use either perceptual or verbal cues as response strategies and it reveals other behaviors which if taught to subjects might result in successful training of cueing strategies as response facilitators. It also suggests modifications in the training procedure such as variation in criterion, gradual changes in reinforcement schedules, and the use of multiple training sessions.

Relationship between age and performance on the transfer tasks, and between language and conceptual skills and performance on the transfer tasks. There were significant correlations obtained between age and scores of subjects on each of the transfer tasks, indicating that age is a good predictor of the outcome of training. There were significant correlations obtained between the scores on the Peabody Picture Vocabulary Test and those on the serial recall transfer task, and between the scores on the Boehm Test of Basic Concepts and those on each of the transfer tasks. There was not a significant relationship between scores on the Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities and those on either of the transfer tasks. Measures of receptive vocabulary and conceptual knowledge do predict the outcome of training on conceptual-sorting and serial recall tasks whereas measures of expressive language skills do not.

CONCLUSIONS

Interpretation of the Results

Results of the present study may be interpreted to support the hypothesis that preschool children can be trained to produce cues during nonverbal tasks, but it may not be possible to effectively train them to use these cues as mediators or stimulus classifiers prior to maturational attainment. In other words, the training methodology employed in this investigation did not effectively bring response choices on the nonverbal tasks under the stimulus control of either perceptual or verbal cues. The observed improvement of the performance of subjects on the conceptual-sorting and serial recall tasks was a function of the reinforcement contingencies employed and not type of cue production training.

Despite the foregoing general conclusion based upon the analysis of pooled data, results of the analysis of individual subject data may suggest other interpretations. Some of the perceptually trained and verbally trained subjects were taught to use the cues to facilitate their performance on the tasks. Rather than attribute the ability of these subjects to be trained on maturational readiness, the results of the individual data analysis allowed the investigator to identify additional variables and functional relationships which were important to the success of training. Thus, additional behaviors to be trained as well as modifications in the training procedure were revealed.

Results of the study further indicated that certain language as well as conceptual skills relate significantly to the improvement in the performance of preschool children on tasks that are typically viewed as nonverbal. Thus, consideration of specific linguistic skill as well as more general cognitive maturation is necessary when accounting for the variables that relate to problem-solving strategies, even in the very young child. This may suggest that more precise consideration be given to the linguistically impaired child in training him to use language for noncommunicative purposes such as problem-solving.

Suggestions for Future Research

A number of specific areas for future investigation became evident through the experience of doing this research. Those mentioned below are only some of the research issues which may be generated from the present study.

Specific modifications in the training methodology need to be investigated such as (1) the comparative effectiveness of multiple training sessions and the single training session with regard to the establishment of stimulus control of sorting and recall behaviors and transfer of training, and (2) the use of variations in schedules of reinforcement and gradual fading of response-contingent reinforcement.

More precise reinforcement contingencies need to be examined to enhance the establishment of rehearsal behaviors in the preschool child. Transfer of training for rehearsal behaviors was negligible among subjects, making it difficult to conclude whether

or not rehearsal facilitates recall in the preschool child.

A more precise comparative investigation of groups of subjects over smaller age ranges, who are matched for both language and cognitive skills, would further clarify the relative influence of these factors with regard to noncommunicative uses of language. Related to this is the need for an investigation of subjects whose linguistic skills span a broader range, including language-disordered as well as younger-normal children. The noncommunicative uses of language represented by mediation and stimulus classification need to be examined for these groups in order to further clarify clinical intervention procedures.

APPENDICES

APPENDIX A

Scores of Subjects (in Percent Correct) On the Baseline Measures

SUBJECT	TYPE OF TASK	
	Conceptual-Sorting	Serial Recall
1P	100	47
2P	40	47
3P	53	33
4P	67	20
5P	80	27
6P	43	73
1V	47	33
2V	47	27
3V	60	73
4V	53	40
5V	53	33
6V	60	40
1C	53	20
2C	43	47
3C	50	27
4C	57	27
5C	87	60
6C	57	40

APPENDIX B

Scores of Subjects (in Percent Correct) On the Training Tasks

SUBJECT	TYPE OF TASK	
	Conceptual-Sorting	Serial Recall
1P	100	67
2P	97	80
3P	73	40
4P	97	47
5P	100	53
6P	93	33
1V	76	47
2V	69	33
3V	100	87
4V	97	40
5V	86	60
6V	97	60
1C	87	20
2C	93	47
3C	76	33
4C	57	47
5C	90	67
6C	64	33

APPENDIX C

Scores of Subjects (in Percent Correct) On the Transfer Tasks

SUBJECT	TYPE OF TASK	
	Conceptual-Sorting	Serial Recall
1P	100	73
2P	100	73
3P	77	60
4P	97	67
5P	100	47
6P	100	33
1V	93	27
2V	60	27
3V	97	100
4V	100	33
5V	90	60
6V	93	73
1C	97	47
2C	100	47
3C	90	47
4C	63	53
5C	100	67
6C	90	13

APPENDIX D

Number of Perceptual Matching Cues Produced by Subjects During the Transfer Tasks

SUBJECT	TYPE OF TASK	
	Conceptual-Sorting	Serial Recall
1P	3	1
2P	0	0
3P	1	0
4P	0	4
5P	0	0
6P	8	15
1V	0	0
2V	0	0
3V	0	0
4V	0	0
5V	0	0
6V	0	0
1C	0	0
2C	0	0
3C	0	0
4C	0	0
5C	0	0
6C	0	0

APPENDIX E

Number of Verbal Labeling Cues Produced by Subjects During the Transfer Tasks

SUBJECT	TYPE OF TASK	
	Conceptual-Sorting	Serial Recall
1P	4	3
2P	1	0
3P	1	15
4P	0	0
5P	0	0
6P	0	0
1V	11	12
2V	30	15
3V	0	15
4V	6	15
5V	4	14
6V	2	15
1C	0	9
2C	2	15
3C	0	2
4C	1	3
5C	0	11
6C	0	0

APPENDIX F

I.Q. Scores of Subjects on the Peabody Picture Vocabulary Test

Subject	Score
1P	104
2P	129
3P	112
4P	124
5P	119
6P	99
1V	88
2V	98
3V	117
4V	100
5V	101
6V	107
1C	116
2C	104
3C	94
4C	108
5C	92
6C	104

APPENDIX G

Raw Scores of Subjects on the Boehm Test of Basic Concepts

Subject	Score
1P	20
2P	21
3P	15
4P	16
5P	22
6P	17
1V	13
2V	9
3V	20
4V	21
5V	15
6V	18
1C	15
2C	18
3C	16
4C	17
5C	17
6C	15

APPENDIX H

Scaled Scores of Subjects on the Verbal Expression Subtest of the Illinois Test of Psycholinguistic Abilities

Subject	Score
1P	66
2P	60
3P	59
4P	52
5P	56
6P	67
1V	56
2V	58
3V	67
4V	66
5V	51
6V	48
1C	67
2C	66
3C	57
4C	67
5C	49
6C	47

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