Operant Techniques for Teaching Speech Behavior to Severely Language Handicapped Children: A Review

Summer 1979

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OPERANT TECHNIQUES FOR TEACHING SPEECH BEHAVIOR TO SEVERELY LANGUAGE HANDICAPPED CHILDREN: A REVIEW

BY

JAMES ARCHBOLD
B.A., S.U.N.Y. at Stony Brook, 1973

SPECIALTY PAPER

Submitted in partial fulfillment of the requirements for the degree of Master of Science: Community/Clinical Psychology in the Graduate Studies Program of the College of Social Sciences of the University of Central Florida at Orlando, Florida

Summer Quarter
1979
Abstract

This paper is a detailed review of published research related to the use of operant procedures and techniques in the development of speech behaviors in severely language handicapped children. Review of this literature suggests that there currently exists an operant technology for the development of speech behaviors in a great many severely language handicapped children. Based on the procedures reviewed, a general program for the development of speech behaviors is suggested, which includes behavioral referents by means of which a therapist may both determine the potential utility of the recommended techniques and decide upon an appropriate starting point for training.
Acknowledgement

I wish to thank the chairman of my Graduate Committee, Dr. Richard Tucker of the Department of Psychology, and the other members of my Committee, Dr. James Brophy of the Department of Psychology and Dr. David Ingram of the Department of Communicative Disorders, for their assistance in preparing this Specialty Paper. The time and effort which they willingly gave on my behalf greatly simplified my task, and their comments, criticisms, and suggestions have significantly improved the contents.
# Table of Contents

INTRODUCTION ............................................. 1

REVIEW OF LITERATURE ................................. 7

  Effectiveness of Operant Techniques ............... 8
  The Importance of Imitation ....................... 16
  How Imitation Is Taught ......................... 18

Variables Affecting the Acquisition and Generalization of Vocal Imitation ..................... 41

Vocabulary Building ................................... 54

Training Functional Use of Speech .................. 57

Generalization of Speech Behavior .................... 75

Complex Language Behaviors ......................... 121

Practical Considerations ............................ 125

SUMMARY AND DISCUSSION ............................. 144

A SPEECH TRAINING PROGRAM ......................... 148

FUTURE RESEARCH NEEDS .............................. 158

CONCLUSION ............................................. 159

REFERENCES ............................................. 160
Operant Techniques for Teaching Speech Behavior
To Severely Language Handicapped Children:
A Review

Of all the phenomena observable during the first developments of a child perhaps the most astonishing is the facility with which he learns to speak. When one thinks that speech, which is without question the most marvelous act of imitation, is also its first result, admiration is redoubled for that Supreme Intelligence whose masterpiece is man, and who . . . [made] speech the principal promoter of education . . . (Itard, 1894/1962, p. 85).

To Jean-Marc-Gaspard Itard, teacher, physician, and philosopher, man was the noblest of creatures who, through education and reason, could attain that perfection which was his birthright. He believed that a man's speech was "a prolific and sublime means of improvement which causes his thought to blossom even in the cradle, and which he uses all his life without appreciating what it is to him and what he would be without it" (p. 37).

Current thought among teachers of speech to the severely language handicapped, while continuing to acknowledge the great importance of speech, tends to be somewhat more prosaic. Risley and Wolf (1968) believe that "appropriate verbal behavior is the most important aspect of a normal child's repertoire. Verbal skills are a prerequisite for a large share of a child's social and academic education as well as being instrumental in a great deal of his day-to-day activities. Without verbal skills a child is doomed to 'develop-
mental retardation' no matter what other advantages may accrue to him" (p. 157). This specter of developmental retardation reappears in the reports of other researchers (Hargrave & Swisher, 1975; Hartung, 1970; Hewett, 1965; Lovaas, 1977; and Lovaas, Berberich, Perloff, & Schaeffer, 1966).

One of the more dramatic ways in which the importance of speech may be demonstrated is by observing the effects, for example, of teaching a few words to a retarded child. Those few words may prove to be a key by which marked improvements may occur not only in the subject child, but also in peers, and, perhaps most importantly, in the attitudes and expectations of those who work with the child: teachers, therapists, institution personnel, and parents. These "fallout" effects are of great importance for they make it possible for new behaviors to be fostered, reinforced, and maintained.

Bricker and Bricker (1970b) put it succinctly when they state that "language behavior is a critical component of human development and consequently children who are handicapped in their language development need explicit remedial training" (p. 148). Procedures currently used in speech training programs for severely language handicapped children are generally divided into two basic parts. The first is concerned with developing verbal imitative behaviors and prerequisite skills. The second part is concerned with transforming imitation into more normal appearing speech behaviors such as naming objects and answering questions. Typically, these programs have utilized operant techniques for their training procedures (Bricker & Bricker, 1970b; Cook & Adams, 1966; Garcia & DeHaven, 1974; Hartung,
This tendency to utilize operant procedures has not met with universal approval. Chomsky (1972a), for example, disagrees with what he sees as the "quite erroneous conception that knowledge of language can be accounted for as a system of habits, or in terms of stimulus-response connections, principles of 'analogy' and 'generalization' and other notions that have been explored in twentieth-century linguistics and psychology and that develop from traditional empiricist speculation" (p. 122). In particular, Chomsky (1967) is not satisfied with Skinner's (1957) formulations of verbal behavior. "The questions to which Skinner has addressed his speculations are hopelessly premature. It is futile to inquire into the causation of verbal behavior until much more is known about the specific character of this behavior; and there is little point in speculating about the process of acquisition without much better understanding of what is acquired" (Chomsky, 1967, p. 169).

Skinner would, I believe, agree that little is to be gained from speculating about the process of acquisition until there is a better understanding of the behavior acquired. Indeed, Skinner (1957) says that "our first responsibility is simple description: what is the topography of this subdivision of human behavior?" (p. 10). In Skinner's (1957) proposal of a new formulation of verbal behavior, "the emphasis is upon an orderly arrangement of well known facts, in accordance with a formulation of behavior derived from an
experimental analysis of a more rigorous sort. The present extension
to verbal behavior is thus an exercise in interpretation rather than
a quantitative extrapolation of rigorous experimental results" (p.
11). Skinner (1957) further states that "the book is not theoreti-
cal in the usual sense. It makes no appeal to hypothetical explana-
tory entities" (p. 12). It is, apparently, a first approximation of
a theory of verbal behavior in which "no assumption is made of any
uniquely verbal characteristics, and the principles and methods
employed are adapted to the study of human behavior as a whole" (p.
11).

Chomsky (1972a) disagrees with such an approach. "The fatal
inadequacy of all such approaches, I believe, results from their un-
willingness to undertake the abstract study of linguistic competence.
Had the physical sciences limited themselves by similar methodologi-
cal strictures, we would still be in the era of Babylonian astro-
nomy" (p. 112). Further, Chomsky (1972a) states "I believe that the
inability of modern psychology to come to grips with the problems of
human intelligence is in part, at least, a result of its unwilling-
ness to undertake the study of abstract structures and mechanisms
of mind" (p. 112).

Lovaas (1968) appears to agree with Skinner's (1957) position.
"We would propose that central, organizing, behavior-initiating con-
structs . . . may not provide an easy out for the work which the
therapist or teacher will have facing him when he attempts to esta-
blish speech in psychotic children" (p. 151). Lovaas believes that
"there might even be an advantage in dealing directly with behavior,
rather than concentrating on hypothetical inner determinants. If one concentrates on behavior, as a subject matter in its own right, then one is unlikely to make mistakes which involve too unrealistic demands on the patient, or unrealistic hopes for the family" (p. 151).

Paradoxically, Chomsky (1967) appears, at least to some extent, to agree with Lovaas (1968) and Skinner (1957) in that he states that "the behavior of the speaker, listener, and learner of language constitutes, of course, the actual data for any study of language" (p. 170). He further states that "as far as the acquisition of language is concerned, it seems clear that reinforcement, casual observation, and natural inquisitiveness (coupled with a strong tendency to imitate) are important factors" (p. 158).

Skinner (1957) maintains that his "formulation is inherently practical and suggests immediate technological applications at almost every step" (p. 12), and, indeed, some researchers explicitly acknowledge his contributions. Bricker and Bricker (1970b) state that "the specific procedures described in this article are not unique, but have been used by a large number of investigators. The basis for their development can be largely attributed to Skinner, 1938; 1957; 1959. He initiated the empirical support and structure of the principles of behavior used in these procedures and it is his interpretation of language that has aided in its description" (p. 109). Lovaas (1968) states that his program for the establishment of speech in autistic children "is based on a learning (reinforcement) theory paradigm. It relies heavily on a step-by-step, graduated progres-
sion of tasks, stimulus fading techniques, positive reinforcement withdrawal contingent upon incorrect behavior" (p. 152). More recently, Lovaas (1977) noted that when one tries to help children learn to talk, one is fairly well restricted to attempts to manipulate the child's environment. Furthermore, if one seeks to manipulate the child's environment to facilitate language learning, then one is largely restricted to those operations specified within modern learning theory, certainly if one wants to base one's teaching efforts on experimentally validated procedures. Within modern learning theory, it is those operations which define operant conditioning or reinforcement theory that have been most explicitly related to the acquisition of human behavior. It is probably the case, then, that we have no choice at this time but to work within modern learning theory to try to teach language (p. 10).

Risley and Wolf (1967), in describing the level of achievement of one of their subjects state "now the naturally occurring rewards of verbal behavior (see Skinner, 1957, for a discussion of these) appear to be the most important factors in maintaining and expanding his verbal repertoire" (p. 75).

Skinner's (1957) formulations, then, have, at a minimum, stimulated technological applications to the problem of developing speech behavior in severely language handicapped children. Hence, while operant procedures may not be perfect, they are a reasonable method by which to attempt speech training.

The scope of the applicability of operant techniques is illustrated by Risley and Wolf (1967). "The procedures described in this paper have been developed from work with echolalic children with almost every conceivable diagnosis. Indeed, the records of each of these children usually contained diagnoses of retardation and brain-damage as well as autism, each label applied to the same child by a
different diagnostician. For our procedures, the diagnostic classification of the child is largely irrelevant" (p. 73). Lovaas (1968) is substantially in agreement. He states that "our experience has been that autistic and schizophrenic children form a very heterogeneous population, and that the diagnosis is a poor discriminator" (p. 149).

Operant procedures, then, in addition to being reasonable methods for attempting speech training, appear to have broad applicability in therapeutic intervention with severely language handicapped children. For these reasons the emphasis in this review will be on operant procedures.

This review is intended (a) to review current primary source literature of operant techniques used to teach speech behaviors to severely language handicapped children, and to critique this literature methodologically and in terms of the appropriateness of methods used; (b) to assess the effectiveness of these techniques; (c) based on this critique and assessment, to propose a program for teaching speech to severely language handicapped children; and (d) to suggest areas in which further research is needed.

Review of Literature

The theoretical reasoning noted above, provides a rational for attempting to teach speech behaviors to severely language handicapped children via operant techniques. However, the continued use of these operant techniques can only be justified if it can be experimentally demonstrated that operant techniques can, in fact, alter the verbal behavior of severely language handicapped children. The critical
importance of this question requires that it be addressed first.

One of the studies to be presented in this section will be explained fully. This is done to acquaint the reader with some of the procedures used in the development of speech behavior as well as to demonstrate typical single subject designs used to test the functional relationship between treatment and any changes in behavior. For the remaining studies, only those factors directly related to the experimental demonstration of the effectiveness of the operant technique are included in this section. This is done to simplify any discussion of the efficacy of the techniques.

The Effectiveness of Operant Techniques

Butz and Hasazi (1973) worked to develop verbal imitative behavior in a profoundly retarded girl, Gail, who had no known language or verbal imitative skills. Prior to the beginning of the studies, Gail's rate of spontaneous vocalization in the presence of the experimenter was increased to approximately six vocalizations per minute.

The experiment consisted of nine phases, divided into two major parts. The first four phases constituted an ABAB design to assess the importance of contingent reinforcement in the maintenance of Gail's vocalizations. Two training sessions were held each day, at Gail's noon and evening meals. Reinforcement consisted of spoonsful of these meals and verbal praise. Five training sounds were used throughout the experiment, and each sound was presented 10 times per session in random order. The experimenter emitted one vocalization every 15 seconds. A vocalization was defined as any orally-produced response that was audible to the experimenter. An imitative response
was defined as a vocalization that bore a point-to-point correspondence with the preceding experimenter-vocalization.

Phase one was designed to obtain a baseline measure of Gail's vocalizations under experimental conditions. The experimenter presented training sounds as per above, and gave Gail a spoonful of food five seconds after each modeled stimulus, regardless of her performance, that is, reinforcement was provided noncontingently. In phase two, reinforcement was made contingent on any vocalization occurring within five seconds of an experimenter-vocalization. Only the first vocalization made within this time limit was reinforced, and all vocalizations occurring outside of this five second period were ignored. Phases three and four were replications of phases one and two, respectively.

Data on vocalizations and imitations were recorded on each trial by the experimenter. Reliability judgements were obtained by having an independent judge rate the occurrence of these two behaviors. The percent agreement was obtained by dividing the number of agreements between the experimenter and the independent judge by the number of trials. For vocalizations, the mean percentage of agreement was 92.4%, and for imitations, it was 90.8%. The authors do not mention how frequently reliability measures were made.

For the three sessions of phase one, baseline, the average vocalization rate was 30.7%, which was not appreciably different from chance expectation (33.3%) (chance expectation being a temporal coincidence between the experimenter's vocalization and the child's vocalization). In phase two, when reinforcement was contingent on
vocalization, the average vocalization rate for the last four sessions was 94.5%. During phase three, a replication of baseline, the average vocalization rate was approximately 36%, while in phase four, a replication of phase two, the average vocalization rate was approximately 88%. (These last two percentages are estimated by this author from data presented by Butz and Hasazi, 1973, in Figure 1, page 391.) Butz and Hasazi (1973) conclude that these data "provide strong evidence that Gail's vocalizations were brought under the control of the experimenter's vocalizations by the contingent reinforcement procedures" (p. 391).

The last six phases followed a multiple baseline paradigm to demonstrate the importance of contingent reinforcement in the development of vocal imitation, per se. Phase four, mentioned above, in which reinforcement was unrelated to the form of vocalizations, was used as the initial baseline in this multiple baseline design. In this paradigm, reinforcement was first made contingent on one of the five sounds, then on two of the sounds, and so on. Reinforcement was continued on a non-contingent basis for any vocalization in the case of the other sounds. In addition, only imitative responses which occurred within the five-second limit were reinforced; imitative responses which occurred outside of this time limit were ignored.

In phase five, reinforcement continued for all sounds as in phase four, except that after the experimenter presented an "i" vocalization, only imitative responses of that sound were reinforced. In each subsequent phase, one additional sound was added. Phases
five, six, seven, eight, and nine were all 10 sessions in length. Butz and Hasazi (1973) in discussing the data from phases four through nine, state "that the number of imitative responses for each sound increased obviously and directly when the reinforcement contingency for the relevant sound was introduced" (p. 392). They further state that "the sequence of performance changes and experimental manipulations is highly correlated, providing clear evidence of the effects of contingent reinforcement on the development of the imitative repertoire" (p. 392). They conclude, and this author agrees, that "the results show that the subject's verbal development was related directly to the contingent reinforcement procedures, thus strengthening the contention that operant conditioning theory and technique provide a useful framework for approaching children's language problems" (p. 392).

Schell et al. (1967) worked with a four-and-one-half-year old boy variously diagnosed as deaf, mentally retarded, autistic, and aphasic. They examined the effectiveness of the contingent reinforcement used in one of their techniques in maintaining production of the work "go". A baseline measure, obtained before the institution of the reinforcement contingency, showed that about 20% of the sounds the child made were close approximations of "go". During treatment, the production of "go" sounds increased to approximately 40% of the sounds the child made. The treatment phase was followed by a phase in which all vocalizations except "go" sounds were reinforced (a differential reinforcement, DRO, procedure), and "go" sounds returned to baseline level. This phase was followed by four additional ses-
sions in which reinforcement was contingent on "go" sounds. The production of "go" sounds in these sessions ranged from approximately 45% to approximately 75%. In addition to the ABAB demonstration of the effectiveness of the contingent reinforcement, a statistical test showed that during each of the five sessions in which reinforcement was contingent on "go" sounds, there was a significant ($p < .05$) increase. Unfortunately, Schell et al. (1967) neglect to mention the test used in determining this statistic. Further elaboration of the procedures used by Schell et al. (1967) is presented in subsequent sections of this paper, but the part presented here demonstrates the effectiveness of the operant techniques in the establishment and maintenance of the child's verbal responding.

Risley and Wolf (1967) present two demonstrations of the effectiveness of contingent reinforcement in the maintenance of verbal responding in echolalic children. In the first case, they taught a child to appropriately name an object. Each correct response was reinforced with an edible such as ice cream. When the child was producing approximately eight correct responses per minute, a DRO procedure in which the child was reinforced for not naming a picture for 10 seconds, was begun. Under these reinforcement conditions, picture naming responses dropped to zero. The procedure was then changed back to the original contingency, and the picture naming response quickly increased to approximately its original rate.

The second demonstration also involved a picture naming task. The child was producing approximately eight correct responses per minute, with an edible such as ice cream being used as the contingent
reinforcer. The procedure was then changed. The child was given a spoon and a bowl of ice cream and allowed to eat at his own rate. Pictures were presented by the experimenter, and the child was asked to name them. Correct responses received praise from the experimenter. The child's rate of responding dropped to approximately two responses per minute. When the original contingencies were reinstated, the child's rate of correct responding increased to approximately 10 per minute.

These two demonstrations again illustrate the functional relationship between the operant techniques used and the changes in the children's behavior. Further elaboration of the procedures used by Risley and Wolf (1967) is presented in subsequent sections of this paper.

Sloane et al. (1968) report on their work with retarded children. They present two demonstrations of the effectiveness of contingent reinforcement on the accuracy of, first, correct imitation of speech sounds, and, second, correct naming of pictures. In the first demonstration, the child had been receiving contingent reinforcement for correct echoic responses, and accuracy ranged between 81% and 87%. The procedure was then changed. The child continued to receive reinforcers, but they were delivered after arbitrary time intervals, rather than contingent on correct responding. The time intervals were selected so that the number of reinforcers delivered was approximately equivalent to that given previously. During these sessions, accuracy dropped to a low of 30%. When the original contingency was reinstated, accuracy quickly returned to its original
For the second demonstration, the authors trained a child to name five pictures. For six sessions, reinforcement was contingent on correct responses. For the next three sessions, contingent reinforcement was continued for three of these five pictures. The reinforcer was given on a noncontingent basis for the two remaining pictures. In the first six sessions, the child's rate of correct responding was over 85% for both the group of three pictures and for the group of two pictures. In the final three sessions, the rate of correct responding for the two pictures that received noncontingent reinforcement fell to a low of 25%, and averaged 50% for the three sessions. The rate of correct responding for the group of three pictures that continued to receive contingent reinforcement averaged 89% for the three sessions. The results of these two demonstrations show that it was the operant technique of contingent reinforcement which was responsible for the increase and maintenance of the child's correct responding.

Nelson, Peoples, Hay, Johnson, and Hay (1976) present a comparison of two methods of teaching verbal imitation to four retarded subjects. The two methods had in common the presentation of a verbal imitative stimulus, the prompting of the child to produce an imitative response, and the contingent reinforcement of correct imitative responses. The differences in the methods, and their differential results, will be discussed in a subsequent section of this paper.

Three stimulus lists of equal difficulty, List A, List B, and
List C, were constructed. Lists A and B were directly trained, and will be discussed here. List C was used to test for generalization, and will not be discussed here.

The children were randomly assigned into two groups. Group A was first taught List A by Method A. Subsequently, they were taught List B by Method B. Group B was first taught List B by Method B, and subsequently they were taught List A by Method A. This was done to control sequence effects. The children were tested on the three lists prior to training, after the first list had been learned, and again after the second list had been learned. Reliability checks were taken during 75% of test sessions. The overall reliability was .96. An analysis of variance showed a significant interaction among training sequence, stimulus list, and test session ($F = 14.24; df = 4,8; p < .01$). That is, when the children were trained on List A by Method A, their test scores improved on List A. When they were trained on List B by Method B, their test scores improved on List B. Nelson et al. (1976) conclude that "the results demonstrate that speech training procedures based on the principles of operant conditioning are effective in establishing verbal imitation responses in speech-deficient children" (p. 38).

These studies have shown that operant techniques can be used to effectively increase, decrease, and maintain a variety of vocal behaviors in severely language handicapped children. Among these vocal behaviors are vocalization rate, vocal imitation, object naming, and picture naming. In each case, changes in the experimental procedures were consistently followed by changes in the children's
behavior. These results clearly show that operant techniques may be successfully employed to alter the verbal behavior of severely language handicapped children, and, therefore, it may be concluded that the continued use of operant techniques has been experimentally justified.

In subsequent sections of this paper, additional experimental demonstrations of the effectiveness of operant techniques will be elaborated.

The Importance of Imitation

As was indicated in the studies cited above and will be demonstrated in the studies to be presented later, the development of verbal imitation is a commonly used technique in speech training programs. "Learning theorists generally agree that the deliberate development of functional speech in nonverbal children is to be accomplished in two major phases of training. The first phase is directed towards the establishment or improvement of imitative verbal behavior as discriminated verbal responses" (Garcia & DeHaven, 1974, p. 169).

To a large extent, this reliance on verbal imitation appears to be intuitive. "Casual observation suggests that normal children acquire words by hearing speech; that is, children learn to speak by imitation. . . . Thus, the establishment of imitation. . . appeared to be the most beneficial and practical starting point for building speech" (Lovaas, et al., 1966, p. 705). Schell et al. (1967) state that their "efforts have been based on the assumption that children first learn to speak by imitation" (p. 53). This intuitive
approach is echoed again in Stark, Giddan, and Miesel (1968) when they say "we assumed that children learn many activities, including speech, by imitating the behavior they observe" (p. 43).

A second reason for relying on vocal imitation is practicality. "It is clear that novel behaviors can be produced in a child's repertoire merely by providing an appropriate model for those behaviors, as well as by lengthy training methods such as those involved in shaping behavior (reinforcing successive approximations to some terminal state or topography)" (Sherman, 1971, p. 246). The major drawback to shaping is the time required.

In alleviating any deficit in behavior, the most time-consuming task is the teaching of new topographies of behavior. When a child's repertoire does not include a particular behavior and the child cannot be taught by conventional means, training can be carried out by the behavior modification technique called shaping. This procedure involves the long and intricate process of reinforcing behaviors which resemble (although, perhaps only remotely) the desired terminal behavior, and then, in successive steps, shifting the reinforcement to behaviors which more and more closely resemble the terminal behavior (Risley & Wolf, 1967, p. 73).

In attempting to teach such a highly complex behavior system as speech, the sheer number of responses to be taught makes shaping an imposing task. Lovaas (1968) reports that "although our patients learned a few words in this manner, it became apparent that despite extensive efforts we would produce only a very restricted vocabulary" (p. 132). Sherman (1971) is in substantial agreement. "If, for example, an experimenter had to rely exclusively upon differential reinforcement, it would have meant that each response exhibited by the child would have had to be trained by shaping procedures, involving reinforcement for behavior closer and closer to a target response."
Given that the children had imitative repertoires, this would seem to be highly inefficient, since a correct response could be produced merely by providing an appropriate model or demonstration of the response" (p. 266).

The advantage that imitation has over shaping, then, is that it is faster. "Once a child accurately imitates most words, phrases, and sentences, then any topography of verbal behavior (i.e., any word, phrase, or sentence) can be produced when desired by presenting the child with the prompt to be imitated" (Risley & Wolf, 1967, p. 74). That is, the arduous shaping process is not needed once verbal imitation has been established. Hence, "the basic reason for the emphasis on imitation as a process in the initial development of speech seems clear; it provides a mechanism or basis for the relatively rapid acquisition of new vocal responses" (Sherman, 1971, p. 274).

Hartung (1970) is more emphatic in his appraisal of the role of imitation. He says that "not only is imitative verbal behavior considered a prerequisite to functional speech, but functional speech cannot be developed in a non-speaking child unless that child first imitates the verbal responses of others consistently. Once the child can imitate most words, phrases, and sentences, a diversified topography of verbal behavior can be produced by individual prompting" (p. 205).

How Imitation is Taught

"The technique of establishing a vocal imitative repertoire is a crucial part of all procedures for remediating language deficits."
Consequently, speech training always has included preliminary vocal imitation training" (Garcia & DeHaven, 1974, p. 170). A number of procedures have been suggested for training vocal imitation.

Hewett (1965) worked with a four-and-one-half year old autistic boy. Training procedures were conducted in a specially constructed booth consisting of two sections joined by a movable shutter. The child, Peter, sat in one side of the booth while the teacher occupied the other side. The only lights were focused on the teacher such that when the shutter was down Peter's side was in darkness, and when the shutter was raised the light illuminated a shelf in front of Peter. A ball drop mechanism with a dim light above served as Peter's means of signalling to the teacher that he was ready. The teacher controlled Peter's access to the ball.

Training was divided into four phases, three of which will be discussed here. The first was the introduction during which Peter was familiarized with the booth and taught to operate the ball drop mechanism. He was taken to the booth at meal times and was fed by the teacher in the booth through the shutter. Peter obtained one spoonful of food or sip of drink each time he used the ball drop mechanism to signal the teacher. On the third day of this introduction phase, Peter was required to establish eye contact with the teacher before the reinforcer was delivered.

Phase two was called social imitation. Training sessions were held twice daily in the booth. During this phase Peter learned to follow simple verbal directions and to imitate the teacher's hand movements. Other reinforcers were introduced to the training ses-
essions, for example, a color cartoon movie and children's music. The shutter was lowered whenever Peter was inattentive or failed to respond within five seconds. Only Peter's responses which were in direct imitation of the teacher were reinforced, random responses were ignored.

In phase three, verbal imitation training was begun. Peter had begun to spontaneously vocalize during phase one and two. A vocal cue, three notes of a tune Peter has spontaneously hummed during the previous phase, was presented by the teacher who then waited for Peter to respond. If he did not respond within five seconds, the shutter was closed for five seconds and then Peter was allowed to again signal his readiness. The cue was then presented again. When Peter correctly responded he was reinforced with candy. After Peter had successfully imitated the cue, a second sound, which Peter had emitted in phases one and two, was trained using the same procedure.

Once this vowel sound was successfully imitated, Peter was shaped by the method of successive approximation to say the word "go". Peter learned the response in two days. On the sixth day Peter stopped responding appropriately, and for seven days he did not say "go". The procedure was continued unchanged and on the eighth day Peter began to imitate the vowel sound and was reshaped to say "go".

A second word, "my", was introduced and was reinforced with Bingo markers which were used in a number matching game Peter liked. "During training of the new word, careful attention was given to systematically reviewing the previously learned word 'go', and Peter
discriminated well between the two words" (p. 932). Once these first two words were successfully imitated by Peter, he "readily attempted to imitate all words the teacher said" (p. 922). Over a six month period Peter acquired a 32-word vocabulary using these procedures.

The procedure as described by Hewett (1965) is a sketchy outline of a program. It is lacking in detail, particularly with respect to precisely what the teacher did to establish motor (social) imitation, and vocal imitation. For example, Hewett (1965) says that "Peter learned to place his hand on the teacher's face in order to obtain a segment of children's music" (p. 931), but he does not explain how this was done. It is presented as an accomplished fact.

Data presentation is minimal. We are told, for example, that "the giving of an alternate reinforcer for the new word (e.g., Bingo marker) instead of candy appeared important in aiding discrimination" (p. 932), but no data are presented to support this contention. There is no mention of how data were collected, nor is there mention of who collected the data. There is, of course, no mention of reliability checks on data collection.

Hewett's (1965) presentation is very much in story form. It is easily readable and the material is quite interesting from a "clinical" point of view. Unfortunately, he does not specify how he did what he claims to have accomplished, nor does he offer any evidence to support his contention that the experimental manipulations were responsible for the changes in Peter's vocalizations. Hence, it must be concluded that, while Hewett (1965) offers some potentially useful techniques, the effectiveness of his methodology remains to be demon-
strated.

Schell et al. (1967) worked with a four-and-one-half year old boy with whom speech therapy had been attempted for six months and was discontinued because of lack of improvement. The child, Kipper, gave no reliable response to any form of auditory stimuli, that is, his base rate of responding to auditory stimuli was essentially zero. Kipper had three 75 minute training sessions per week. There was extensive preliminary training. Kipper was first taught a visual discrimination task via differential reinforcement and physical guidance (prompting). He was taught to place a block on a tray, and, subsequently, to place a blue block in the compartment on the tray marked with a blue block and a yellow block in that compartment marked with a yellow block. These blocks were presented in random order, and, after Kipper had made eight consecutive correct responses, the sample stimuli were also randomly alternated. After this task he was given two additional color discrimination tasks, one involving blue and yellow chips, and the other using patches of color (blue and yellow) on index cards. For these last two tasks, the correct responses were modeled for Kipper, but he was not prompted. He reached criterion on both tasks in the first 10 trials. In the next 25 training sessions additional visual sorting tasks were trained. These tasks included discriminating visually different letters (O, K, and S) and discriminating visually similar letters (t, f, and k).

After about three weeks, an auditory discrimination task was introduced to part of each sessions. The apparatus consisted of a panel from which protruded two levers. At the end of each lever was
a soft rubber ball, one red in color, the other blue. Kipper was shown how to push the levers and given practice at pushing the blue lever. He was then taught to push the lever when a light on the panel went out for two seconds. When he was responding consistently, a loud "click" sound was presented simultaneously with the bulb dimming for two seconds (but not going out). Next the light dimming was discontinued, leaving only the click as a cue. Once Kipper was responding the the click, the word "push" was paired with the click. The click was subsequently discontinued and Kipper was required to respond to the spoken word "push".

Verbal imitative training was begun shortly after the auditory discrimination training had begun. Kipper initially learned to stand up in imitation of the trainer, then he was required to look at the clinician's face before standing up. He was next required to open his mouth in the shape of an "O" in imitation of the trainer. This response was at first physically prompted by the trainer and the prompts were gradually faded. Kipper began to occasionally made sub-glottal and aspirate sounds when he opened his mouth. At this point it was elected to try to get Kipper to emit an "O" sound. When Kipper imitatively opened his mouth, the clinician pushed on his abdomen, to force a vocalization, and simultaneously made an "O" sound. As soon as Kipper uttered any sound, the trainer again produced the "O" sound and reinforced Kipper.

The authors used an ABA design to demonstrate the importance of contingent reinforcement. A baseline measure of the proportion of "O" sounds produced by Kipper was obtained. Treatment was begun, and
after the prompts had been faded, Kipper continued to receive reinforcement for "O" sounds produced in imitation of the trainer; the relative proportion of such sounds was maintained for two sessions. Next, reinforcement was made contingent on all vocalizations except those similar to the "O" sound (a DRO procedure), and the proportion of "O" sounds declined to baseline level.

In spite of this apparent success, this training procedure was discontinued because the "O" sounds "were not strongly voiced sounds, did not seem natural for him, and showed little indication of becoming any more frequent" (p. 59).

Although some data are presented, no mention is made of the methods used in collecting the data, of the people who collected it, nor of reliability checks on the data collection procedures. In addition, the data which are presented are not clearly explained. For example, in the two figures used to illustrate data, there are no units of measure given, and in the text, these figures are alluded to, but not fully explained. These omissions make it difficult to assess the amount of change in the child's verbal behavior and the relationship of the authors' procedures to those changes.

Stark et al. (1968) report on a continuation of the work begun by Schell et al. (1967) with Kipper. With Kipper and the clinician seated opposite each other, the clinician modeled a response and prompted Kipper by physically moving him through the required motion. Correct responses were immediately reinforced verbally and with edibles such as candy or cereal. The initial training focused on gross body movements. "More discrete stimuli, such as movements
of the tongue, lips and jaw, could then be introduced and a gradual transition from nonvocal imitation of mouth movements to imitation of sounds could be accomplished" (Stark et al., 1968, p. 43). This transition was begun by gradually directing the discriminative stimuli toward the face and mouth. Among the movements trained were nodding the head and protruding the tongue in lateral and vertical planes. Vocal imitation training was begun when Kipper copied these more discrete motor movements.

Vocal imitation training continued the "game-like procedures" begun by Schell et al. (1968), and the training began with single sounds. These were alternated between vowel sounds and consonant sounds. When Kipper could successfully imitate single sounds, they were combined in CV and VC combinations. Stimuli were presented as a series of phonemes in which one element remained constant, for example /ma/, /moo/, /mi/, etc. Next, stimuli were presented as CVC combinations, again with one element, the vowel, remaining constant. Stark et al. (1968) note that many of the sounds had to be shaped by physical prompts and differential reinforcement. They also note that imitation seemed to be facilitated when the trainer exaggerated the movements of the oral musculature and the differential visual cues.

Their account is simply a description of what was done, with brief statements to the effect that Kipper performed the desired response. No data are presented to indicate that their procedures were responsible for the reported changes in Kipper's vocal behavior, making it difficult to assess the amount of behavior change and the role of the procedures in causing those changes.
Bricker and Bricker (1970b) worked with approximately 50 children over a five year period. The majority were classified as severely and profoundly retarded. They tested the hearing of each child via a procedure they called operant audiometry to determine whether hearing was adequate for speech sound reception. Operant audiometry is a process whereby a child is shaped into making a response to audible stimuli used in testing hearing, viz., pure tones of different frequencies and intensities. They then developed what they call a rote receptive vocabulary in the children via a two-choice paradigm. Using either the Wisconsin General Test Apparatus (WGTA) or an automated press panel console, they shaped the appropriate response. With the WGTA, for example, the child was shaped to take food from a stimulus tray, which was then progressively covered with a stimulus object. The reinforcer was randomly shifted between the two wells on the stimulus tray.

When the child consistently responded to the baited tray, receptive vocabulary training began. Groups of five words and corresponding objects were trained until the child made five consecutive correct choices to each of the five objects. The training items were paired so that each object was the named and reinforced stimulus as often as it was the distracting stimulus. No object was the named/reinforced stimulus on two consecutive trials. After one set of five words was learned, a new group of five words was trained using the same procedure. This procedure established the rote receptive vocabulary.

Next, Bricker and Bricker (1970b) transformed the rote receptive
vocabulary into a concept vocabulary. They maintained that "the key to shifting from a rote receptive vocabulary to a concept vocabulary is to reinforce an act of discrimination based on relevant dimensions and to extinguish the child's responses to the irrelevant components" (p. 106). For example, any object is composed of many dimensions such as size, color, and shape. Each dimension is systematically varied to determine that the child is not responding to an irrelevant dimension. Responses to appropriate dimensions are shaped via differential reinforcement and extinction.

Imitation training begins with motor imitation. The authors recommend movements which will be of use to the child in social situations as well as being precursors to speech sound imitation. A consistent cue, such as "Do this", is recommended for use with motor imitation training so that it becomes a discriminative stimulus for an imitative response from the child. Following the command, the trainer executes the movement to be imitated while an assistant prompts the child to imitate the response. When the child holds the correct position, the assistant reinforces the child. Over succeeding trials the prompts are faded until the child imitates the response spontaneously in the presence of the cue. After one motor imitation has been trained, a second response is trained using the same procedures. When the second response has been learned, the first response is rehearsed and then the two responses are presented in a random sequence to the child to promote discrimination. A third response is trained and the process is repeated. Essentially the same training procedure is used for mouth movement imitation and
speech sound, word, and phrase imitation.

Bricker and Bricker (1970b) describe a set of language training procedures that have been used with severely language handicapped children. Their concern is to describe the procedures, and they do not offer any experimental evidence in support of their program. However, they describe their procedure in much greater detail than does Hewett (1965). This is particularly important to the teacher of speech to the severely language handicapped child for it makes it possible to duplicate the procedures they used, whereas anyone attempting to replicate the work described by Hewett (1965) would have a great deal of improvising to do.

The procedure described by Bricker and Bricker (1970b) has a significant advantage over the procedures described by Schell et al. (1967) and Stark et al. (1968). These latter two reports read like a trial and error approach rather than a comprehensive, step-by-step, unified procedure. Bricker and Bricker's (1970b) procedure is a refinement of Hewett's (1965), Schell et al's. (1967), and Stark et al's. (1968) procedures. This refinement seems attributable to two factors. First, Hewett (1965), Schell et al. (1967), and Stark et al. (1968) each used one subject only, whereas Bricker and Bricker (1970b) report on procedures which evolved through application to approximately 50 subjects. The second factor is the amount of time devoted to development, application, and evaluation of the procedures. Hewett (1965) made his report after six months of training, Schell et al. (1967) made theirs after approximately four months, and Stark et al. (1968) present their report after an additional
four months, whereas Bricker and Bricker (1970b) report that their procedures were developed over a five year period, that is, Bricker and Bricker (1970b) had more time in which to both assess the effectiveness of and to refine their procedures.

A weakness common to these four studies is their dearth of evidence to support the claimed effectiveness of the procedures. There is only one demonstration (Schell et al., 1967) of the importance of contingent reinforcement in the maintenance of vocal imitation. Nowhere are the observation and data recording procedures described, and there is not mention of an attempt to establish the reliability of such recording procedures.

This common flaw makes it difficult to accurately assess the utility and effectiveness of the procedures described. Based on the evidence presented, it must be concluded that neither Hewett (1965), nor Schell et al. (1967), nor Stark et al. (1968), nor Bricker and Bricker (1970b) have presented an experimentally adequate procedure for developing verbal imitation in severely language handicapped children. They have made some interesting suggestions, but, as there is little experimental evidence, the utility of these suggestions in promoting change in verbal behavior is open to serious question. Experimental demonstrations of the effectiveness of operantly conditioned imitation in promoting changes in verbal behavior are essential if imitation is to be considered a viable speech training tool.

Lovaas et al. (1966) describe a procedure used with two schizophrenic boys selected for training because they did not speak.
Training, which was conducted separately for each child, was carried out six days a week, seven hours a day, with a 15-minute rest period each hour. The child and trainer sat facing each other, with the trainer holding the child's legs between his own to prevent the child from leaving. Reinforcement consisted of single spoonsful of the child's meals, and were delivered contingent on correct responses. Punishment (spanking, shouting by the trainer) was delivered for inattentive, self-destructive, and tantramous behavior that interfered with training, but children were never punished for incorrect verbal responses. The authors report that all such disruptive behavior was suppressed within one week.

Training was divided into four steps. In the first step, the child was reinforced for all vocalizations, to increase the frequency of vocal responses, and also for fixating on the trainer's mouth. When the child emitted one verbal response every five seconds and was fixating on the trainer's mouth more than 50% of the time, step two was introduced.

Step two was concerned with teaching a temporal discrimination to the child. The trainer emitted one vocalization approximately every 10 seconds. The child was reinforced only if he vocalized within six seconds after the adult's vocalization. Imitation of the adult's vocalization was not required at this step, and any vocalization occurring within the six second limit was reinforced. When the child's vocalizations within the six second limit were three times their initial rate, step three was begun.

Step three was similar to step two, but had the additional
requirement that the child actually match the trainer's vocalization before being reinforced. Sounds selected for imitation training during this step and subsequent training were selected from a pool of possible sounds which had met one of three criteria. First, sounds which could be prompted, that is vocal behaviors that could be elicited by a cue prior to any experimental training, such as by manually moving the child through the behavior; second, during the early stages of training, the criterion was based on a sound's concomitant visual components, such as those of the labial consonant "m", and the open-mouthed vowels like "a"; the third criterion was sounds which the child emitted most frequently in step one.

Step four was a recycling of step three with the addition of a new sound. A sound which was very different from the sound trained in step three was selected to facilitate discrimination. The sound trained in step three was randomly interspersed with the sound being trained in step four in a randomized ratio of about one to three. This intermingling of the two sounds forced the child to discriminate between them in order to obtain his reinforcement.

All steps beyond step four consisted of replications of step three, in which new sounds, words, and phrases were used. In each subsequent step, previously learned material was rehearsed along with the new sound in a randomized ratio of one to three. A new step was introduced when the child had made 10 consecutive correct imitations of the adult's vocalization. Each new introduction of sounds and words required increasingly fine discrimination by the child and hence provided evidence that the child was in fact match-
ing the adult's speech.

To determine if it was the reinforcement given for imitative behavior that was crucial to learning, Lovaas et al. (1966) introduced a DRO procedure. The trainer presented sounds as in the training procedure, but the reinforcement was presented contingent on the amount of time since the last reinforcement. In this way the number of reinforcements given to the child was kept constant in the different conditions. The authors report that the data show a deterioration in imitation behavior whenever reinforcements were shifted from response-contingent to time-contingent delivery. They conclude that reinforcement contingent on correct, imitative behavior and withholding of reinforcement following incorrect responding is a crucial variable in maintaining imitative behavior with their subjects.

Risley and Wolf (1967) report on a procedure for establishing speech in echolalic children. The procedures were initially developed in working with an autistic child named Dickey (Wolf, Risley, & Mees, 1964). Risley and Wolf (1967) summarize their work in training Dickey to vocally imitate, and present information on four additional children. Two of these additional children were diagnosed as autistic, one as autistic, retarded, and brain damaged, and the fourth as severely retarded and brain damaged. All of these children were echolalic, that is, they sporadically and usually inappropriately imitated words, phrases, and snatches of song.

Dickey's training began with an attendant presenting five pictures, one at a time. The attendant would prompt Dickey by naming the pictured object and encouraging Dickey to repeat the name, for
example, "This is a cat. Now say cat." After all five pictures had been presented, their order would be mixed, and they would be represented. On those occasions when Dickey mimicked the attendant, he was verbally reinforced and given a bit of his meal. "As a result Dickey began mimicking more frequently, until after about a week he was mimicking practically every prompt in addition to almost everything else the attendant said during the session" (p. 74).

Risley and Wolf (1967) maintain that "imitation must reliably occur immediately after a word or phrase prompt is presented before significant advances in speech can be made" (p. 78). The procedure for the establishment of control over imitation in an echolalic child is a variation on that procedure used with Dickey. The therapist presents a selected word or sound every four to five seconds. Whenever the child says this word he is reinforced. They recommend that the therapist "wait until the child is silent before again presenting the word to be imitated. In this manner only imitation is being reinforced" (p. 79).

Once the child is reliably imitating the word, extraneous behavior can be extinguished by the trainer presenting the prompt only when the child is sitting quietly and attending to the trainer. Risley and Wolf (1967) feel that this is important because the probability of immediate imitation is greater when the child is attending to the trainer.

After the child reliably and immediately imitates one word, a new word is introduced, and the procedure is repeated. When this second word is also reliably and immediately imitated, the two words
are alternately presented. Once the child is reliably imitating both words, new words are presented interspersed with the two original words. Risley and Wolf (1967) feel that "usually by the second or third word, a general imitative response class will have been established, i.e., the child will then reliably and immediately imitate any new word" (p. 79).

Risley and Wolf (1967) present a cumulative record showing an increase in appropriate mimics as an indication of the effectiveness of their training procedure. They also present cumulative records of various inappropriate behaviors to demonstrate the effectiveness of the extinction procedure. They write at length on the usefulness of data in therapy and give examples of several different methods for gathering data. Unfortunately, as with many of the other studies reviewed, they do not say what data collection method they used, nor do they give any indication of the reliability of their data recording method.

Lovaas (1968) reports on a procedure for establishing speech in psychotic children. The procedure is a refinement of the procedure described by Lovaas et al. (1966). The major change is in the punishment used for behaviors that interfered with training from spanking and shouting by the trainer to a five-second removal of all positive reinforcers, or, when the disruptive behavior proved particularly resistant to extinction, by a loud, stern "no," or a slap on the hand. Again, interfering behaviors were suppressed within one week. Punishment was never given for incorrect verbal behavior.

Training was conducted several days a week, from two to seven
hours daily. Lovaas (1968) reports that the children varied greatly in their rate of acquisition. In general, if a child had some vocal imitative behavior at the start of training, acquisition was very rapid, yielding "rather elaborate imitative behaviors within one or two weeks of training with one or two hour training sessions per day" (p. 135). With children who had no imitative behavior, "only extensive training efforts have brought about imitative speech" (p. 135). That is, the presence or absence of an initial imitative repertoire proved a reliable indicator of the relative ease of acquisition.

In referring to the figure in which some of the data are presented, Lovaas (1968) notes that the positive acceleration of the curve indicates the acquisition of imitation. The data collection procedure is not mentioned, nor is there any mention of the reliability of the data recording procedure.

Hung (1976) worked with three severely retarded children to develop vocal imitation. These subjects made no vocal sounds except crying noises, gutteral sounds, and one or two simple syllables. Training was conducted five days per week, with two 20-minute sessions per day. Eight residential counselors, who were institution staff, rotated the responsibilities of trainer and recorder for six to seven sessions with each subject. Occasionally the trainer also recorded the data.

The training stimuli consisted of 10 single-syllable sounds, for example /ma/, /paw/, /ee/. Each of these sounds was presented consecutively seven times or until a correct response was made, whichever occurred first; this group of up to seven trials is refer-
red to as a training block. After a training block had been given for one sound, another sound was trained. If, after all 10 sounds had been given one training block, time still remained in the 20-minute session, the sounds could be represented. Food reinforcement was presented contingent on a correct response occurring within four seconds after the trainer had presented a vocal stimulus. Only the first response made during this four second period was recorded.

Vocal responses by the subject were recorded as being in one of the following four categories. (a) A "minus" was scored if the subject did not emit a vocal response within four seconds. (b) A "vocal" response was recorded if the subject emitted a vocal response that contained no vowels or consonants similar to the vocal stimulus provided by the trainer. (c) A "correct response" was scored if a nonprompted vocal response containing all the vowels and consonants of the vocal stimulus, with the order of these vowels and consonants identical to that in the training stimulus, was emitted by the subject. (d) A "vocal imitative" response was recorded if the subject emitted a vocal response that had all the phonemic characteristics of a "correct response" but was preceeded by a prompt; or a vocal response that contained only part of the vowel or consonant components of the vocal stimulus.

The reliability of data recording was checked by having two or three observers record a subject's responses simultaneously and independently for a given session. A total of seven reliability scores were obtained with the scores ranging from 82% to 90%.

The schedule of reinforcement for each type of response varied
with the subject's performance. Initially, all vocal responses received continuous reinforcement (CRF). "Minuses" were not reinforced. For the purpose of shifting reinforcement criteria, 10 training blocks for a given sound were considered as a unit. When the total number of "vocal," "vocal imitative," and "correct" responses for a sound exceeded 45, or the number of "correct" responses alone was greater than two in 10 training blocks, the reinforcement schedule for "vocal" responses was changed to variable ratio three (VR3), but remained CRF for "vocal imitative" and "correct" responses. When the number of "vocal imitative" responses exceeded 45 or the number of "correct" responses was greater than three, reinforcement was discontinued for "vocal" responses, and was changed from CRF to VR3 for "vocal imitative" responses. "Correct" responses continued to receive CRF. When the number of "correct" responses reached four, only "correct" responses were reinforced. When the number of "correct" responses reached eight or more for three consecutive units of 10 training blocks, the sound was considered to have been learned.

A discrepancy may be noted in the above paragraph. Two of the criteria for change of reinforcement ratio appear to be the same. Specifically, the criterion which says when the number of "correct" responses "exceeded three" appears remarkably similar to the criterion which says when the number of "correct" responses "reached four." This is all the more remarkable since Hung (1976) emphasizes that "in order for institution staff to apply the shaping paradigm for vocal imitation training, classification of the various vocal re-
sponses as well as objective criteria for differential reinforcement and contingency change are important" (p. 85). One can only hope that the objective criteria for differential reinforcement and contingency change were more clearly explained to the residential counselors.

A particularly useful section of Hung’s (1976) paper is the specific prompting techniques he explains. The first technique is differential emphasis of the sound component. This technique is used if the child imitates only one component of a vocal stimulus. In such cases, the trainer over-emphasizes those components missed by the child and under-emphasizes the component the child does repeat. For example, if the vocal stimulus is /boot/, the child might respond with only the first sound, /boo/, leaving off the ending /t/. The trainer then overemphasizes the final component, e.g., /boo-TA/. When the child is reliably imitating the over-emphasized component, the stress is faded. The second technique is exaggeration of mouth shape and manual assistance. Labial consonants and front vowels are visually exaggerated by the trainer exaggerating his mouth shape to provide easily discriminated cues for imitation. The formation of the child’s mouth or lip shape was manually prompted by the trainer if the child did not correctly imitate these sounds. The prompts were then faded when the child began to reliably imitate. The third technique consists of approximation of responses through training of similar sounds. Consonants that cannot be visually or manually prompted may be trained by first training imitation of other more easily prompted sounds similar to the desired sound. For example,
the sound /ch/ was achieved by first prompting the child to imitate
/ss/, then /sh/, and finally /ch/.

The data presented are a part of the data collected for each sub-
ject. Data on the imitation training of 10 sounds are presented,
three sounds each for subjects one and two, and four sounds for sub-
ject three. The overall frequency of minuses was low. Hung (1976)
notes that a general reciprocal pattern of responding is present in
the data: as "vocal imitative" responses rose, "vocal" responses
declined; and as "correct" responses rose, "vocal imitative" responses
declined. This pattern is present in eight of the 10 sounds dis-
cussed. The pattern was different for two of the sounds for subject
three, where the pattern seems to be between "vocal" responses and
"correct" responses.

Hung (1976) concludes that these data indicate that the pro-
cedure was effective in teaching imitation of single-syllable sounds
to the three subjects. He adds that "another indication of training
effectiveness was that the number of 'minuses,' 'vocal responses,'
and 'vocal imitative' responses diminished by the end of the training
to less than half the number in the initial training stage" (p. 88),
and that "this diminishing trend suggested that as training progres-
sed, fewer shaping trials were needed before the subjects achieved a
'correct' response in each training block" (p. 88).

Unfortunately, the procedures described by Hung (1976) and the
data he presents do not constitute experimentally sufficient proof
that it was the experimental manipulations that were responsible for
the reported changes. He has failed to convincingly demonstrate
consistent changes in the subject's behavior associated with the experimental manipulations. Because all of the manipulations occur at the same time, there was no opportunity for the children's responses to covary with the experimental manipulations.

Risley and Wolf (1967) and Hung (1976) present data indicating that there were increases in the verbal behaviors of their subjects. Unfortunately, the data they present and the procedures they utilized are not experimentally adequate to demonstrate that their procedures are responsible for the noted changes in behavior, although they do strongly suggest that this is, in fact, the case.

Lovaas et al. (1966) describe experimental manipulations which showed that contingent reinforcement was responsible for the maintenance of vocal imitation by their subjects. Butz and Hasazi (1973) describe experimental manipulations which provide a very good experimental demonstration showing that the operant procedures they utilized were responsible for the increase in and maintenance of vocalization rate and vocal imitation. Hence, it can be concluded that operant techniques can be used to develop vocal imitative repertoires in severely language handicapped children.

A phenomenon common to many of the studies discussed above is the development of generalized imitative responding. Butz and Hasazi (1973) note that "work on the development of both verbal and nonverbal imitative behavior shows that such generalized imitation is not unusual" (p. 393). Lovaas et al. (1966) postulate that since reinforcement was contingent on the child making responses that were increasingly similar to the adult model, similarity, which was con-
sistenty associated with the food reinforcer, should become "symbolic of reward, should eventually provide its own reward" (p. 707).

To test this hypothesis, both of their subjects were exposed to Norwegian words. Intermixed with the Norwegian words were English words. Correct imitation of English words was reinforced by the trainer; imitation of Norwegian words was not extrinsically reinforced. At first, the children were unable to imitate the Norwegian words, but, over time, the children improved in their imitation "as if they were rewarded for correct behavior" (p. 707). This generalized vocal imitation is reported in numerous other studies (Butz & Hasazi, 1973; Hartung, 1970; Hewett, 1965; Lovaas, 1968; Nelson et al., 1976; Risley and Wolf, 1967; 1968).

Lovaas et al. (1966) hold that "there is one implication of this finding which is of particular interest for therapeutic reasons: children may be able to acquire new behaviors on their own" (p. 707). That is, a child who has learned generalized vocal imitation can, with proper training, develop new language skills independently of the therapeutic milieu.

Variables Affecting The Acquisition And Generalization of Vocal Imitation

Because of the differences in procedures used, a number of variables which could potentially affect the acquisition and generalization of vocal imitation have come to light. These variables are, for the most part, partially researched and incompletely understood, and include the following.

Kerr, Meyerson, and Michael (1965) worked with and three-year-
old girl, Jane, diagnosed as mentally retarded, cerebral palsied, epileptic, and emotionally disturbed. They investigated the effect allowing 10-seconds to respond vs. allowing five-seconds to respond had on Jane's responsiveness to experimenter presented vocal imitative prompts. The procedure used was similar to stage two of the procedure used by Lovaas et al. (1966). Kerr et al. (1965) report that under the 10-second condition, the shape of the response curve was "grossly irregular. Performance under the five-second contingency was much more regular" (p. 369), suggesting that the shorter time period appeared to produce more consistent responding. Because only one subject was used and the procedure is not experimentally rigorous, additional research is needed to substantiate this finding.

Nelson et al. (1976) investigated the relative effectiveness of two training techniques in establishing verbal imitation in four retarded children. Method A followed the procedure of Lovaas et al. (1966). Method B substituted kinesthetic prompts for the tactile prompts used in Method A. For example, using Method B to teach the "N" sound, one of the child's index fingers is placed alongside the therapist's nose while the other is placed alongside the child's own nose. Hence, the "central difference in the training methods consisted of the types of prompts used to engender the correct imitative responses" (p. 35). The results indicated that the two methods were equally effective based on the number of correct responses to verbal stimuli. Method B, however, "appeared to produce a lower variability in the number of training trials required to meet criterion" (p. 38). While Nelson et al. (1976) is experimentally more rigorously control-
led than the Kerr et al. (1965) study, additional research is needed to replicate and employ this finding.

The studies presented in the section on how vocal imitation is trained may be divided into two groups, those which begin imitation training with motor imitations, and those which begin immediately training vocal responses. These procedural variations raise a question of some practical importance: since the training of motor imitation required additional time and effort, of what value is such training?

Hartung (1970) reviews procedures used to increase verbal imitation skills and functional speech in autistic children. He recommends that imitation training begin with motor imitation training because autistic children "appear to learn motor imitations more readily than verbal imitations, especially at the beginning of an operant conditioning program" (p. 208). After the subject imitates almost every new motor performance, verbal training can begin. He recommends that a constant cue, such as "Do this," precede each trial to facilitate the transition from motor to verbal imitation.

Garcia, Baer, and Firestone (1971) examined the development of generalized imitation within topographically determined boundaries. Their subjects were four mentally retarded children who were able to respond correctly to simple verbal commands, but had no apparent spontaneous imitative and verbal repertoires. Training sessions were held once or twice daily for 15- to 30-minutes, two or four days per week. Reinforcement consisted of verbal praise and an edible placed in the child's mouth. The children were successively trained
to imitate three different types of responses demonstrated by the examiner. These response types were: (a) small motor responses, involving simple hand movements while seated; (b) large motor responses, which were gross motor movements involving standing and walking; and (c) short vocal responses, which were vocal sounds.

Two imitations, of the same type, were trained concurrently. That is, two responses were presented in alternation during a training session. Imitation was shaped on a CRF schedule. Garcia et al. (1971) did not use a constant cue, e.g., "Do this," to precede each trial, in contrast to the procedure recommended by Hartung (1970). The first two subjects were first taught small motor responses, then large motor responses, and finally small vocal responses. The two remaining subjects were taught only motor responses, and so will not be considered further here.

The training of motor imitations followed the shaping and fading procedures described by Risley and Wolf (1967). Vocal imitation training involved a shaping procedure of reinforcing successively closer approximations of the vocalized model. The children were trained to look at the experimenter, and were reinforced for any vocalization that occurred immediately after a vocal stimulus was presented. Training on each pair of responses was continued until one of two criteria was met: either (a) six successive correct imitations, three for each response, occurring within 10-seconds after the demonstration; or (b) 15 complete sessions of training a pair of responses. Training on the first pair of responses in each category continued until the child reached criterion one. A main-
tenthance procedure was applied after criterion had been reached. Each previously trained response, excluding the pair just trained, was modeled twice, and correct imitations were reinforced on a CRF schedule. Then the pair just trained to criterion was gradually placed on a VR3 schedule.

At various points during the study, a check by an observer was made of the experiment's scoring. Correct imitation was defined as a response topographically similar to that of the demonstration. For the motor behaviors, the boundaries of similar topography were given specific definitions. Reliability was calculated as the percentage of trials scored the same by both the experimenter and observer, either as being a correct or an incorrect imitation. The reliability scores for all behaviors ranged between 95% and 100%.

The first subject learned the first pair of motor responses in 100 trials (criterion one), and trials to criterion on subsequent pairs of motor responses decreased to a low of 15. The first pair of vocal responses required approximately 3000 trials to meet criterion one. Subsequent pairs of vocal responses required 900 trials (criterion two). The second subject learned the first pair of motor responses in 60 trials, and the range of trials to meet criterion one on subsequent pairs of motor responses was between 15 and 30. This subject learned the first pair of vocal responses in 1200 trials, and was trained to criterion two on subsequent pairs of vocal responses. During the maintenance procedure, the accuracy rate for each subject was close to 100% for previously trained responses. On the basis of these results, the authors conclude that a
topographically restricted imitative repertoire was established which was controlled by the recent training history of imitative response topographies.

Nelson et al. (1976), as pertaining prior to the start of their study, taught their subjects to imitate 10 motor responses. Five of these were considered gross motor responses, and overlap Garcia et al. (1971) small motor and large motor categories. The remaining five responses were considered fine motor responses, and consisted of sticking out the tongue, opening mouth wide, smiling, puffing cheeks, and puckering lips. The mean number of trials required to learn each of these 10 motor responses ranged between 5.6 and 22.8 for the four subjects.

Then Nelson et al. (1976) subjects were subsequently trained to vocally imitate 12 sounds, four phonemes and eight morphemes, using the procedures described earlier. The mean number of trials required to learn each of the 12 sounds ranged between 32 and 295 for the four subjects.

In both of these studies, the number of trials required to learn the vocal responses is greater than the number required to learn the motor responses. However, in the Nelson et al. (1976) study, the range of the number of trials required to learn the vocal imitation is markedly lower than the range in the Garcia et al. (1971) study. Unfortunately, these two studies were designed to investigate very different questions, and the information given in each precludes more than a superficial comparison.

The most obvious difference is that Nelson et al. (1976) train-
ed motor imitations involving the mouth and face muscles, while Garcia et al. (1971) did not. If Garcia et al. (1971) are correct about topographically restricted imitative repertoires, then the procedure of training motor responses involving face and mouth muscles would seem to have considerable face validity as an important part of a speech training program.

Garcia et al. (1971) examined the possibility that imitation is not one large class of responses, but may be made up of different, topographically distinguishable subclasses which thus defines or restricts its overall generalization. Their procedure has in part been described above. The third subject was first taught large motor responses and then small motor responses, as a control for any training order effect. The fourth subject became a "special case" and will be discussed below.

A probe procedure in a multiple baseline design was used to test for generalization of imitative responding. Unreinforced probes in four categories were presented in a single session each time a subject reached criterion on a pair of trained responses and was reliably responding on the VR3 reinforcement schedule. Each probe was presented twice during a session. Probes were randomly placed in the VR3 schedule, replacing one of the nonreinforced responses, such that no two probes were presented consecutively. The probes consisted of four responses similar to the trained small motor responses, four responses similar to the trained large motor responses, four responses similar to the trained short vocal responses, and four responses labeled long vocal responses, consisting of words
containing consonant sounds preceding and following those vowels used as short vocal probes.

The results for the first subject indicated that increased imitation of probes was restricted to responses similar to those being trained, and that the number of imitated probe responses increased as a greater number of similar responses were trained. The results were similar for the second subject. "Restricted generalization of probe imitation was evident in both subjects: increased probe imitation was always a close function of the type of responses undergoing training" (p. 107). For the third subject, who had received only motor imitation training and in a different training order from the first two subjects, the pattern of generalized imitation only to probes similar to responses currently being trained occurs again.

The fourth subject was treated as a special case because he exhibited little generalization after receiving training in eight small motor responses. He was again trained in these same eight responses. When no increase in generalization was observed, he was trained in an additional six new small motor responses. He was then trained in eight large motor responses. Both the third and fourth subjects received training in short vocal imitation, but this was discontinued after two months because of the failure to produce useful progress.

The results from the fourth subject indicated that responding to small motor probes increased during small motor training, but that the increase was not as great as had been observed with the
previous subjects. Large motor training, however, did produce an increase in imitation of large motor probes, but had no effect on small motor probes. A further examination of the trained small motor responses and of the four small motor probes revealed that each pair of responses consisted of two topographically different types: (a) "non-body" responses, which required manipulation or hitting of objects, and (b) "body" responses, which required touching different parts of the body. An examination of the results indicated that the fourth subject imitated approximately 80% of the "non-body" probes, but imitated only approximately seven percent of the "body" probes.

Garcia et al. (1971) conclude that "the multiple baseline technique demonstrated that imitation of similar topographical responses remained unaffected until training was instituted for responses representative of these types" (p. 109). They further conclude that "for each topographical response type, a topographically corresponding imitative response class was demonstrated" (p. 109-110).

While these results are intriguing, they are not conclusive. Garcia and DeHaven (1974) put it succinctly when they state that "whether an initial motor imitative skill facilitates the acquisition, retention, or generalization of vocal imitative behavior remains an unanswered empirical question" (p. 171).

Using a different approach, Schroeder and Baer (1972) investigated the generalization of imitation as a functional class of operant behaviors. This concept of a functional class "is descriptive; it merely identifies a set of topographically different responses whose probabilities of occurrence vary together, even though
only some of the responses are directly controlled by an effective stimulus" (Garcia et al., 1971, p. 102). That is, "the results of imitation training may generalize durably to never trained and never reinforced examples of imitative behavior. The probability of this unreinforced imitation usually varied directly with the reinforcement of the other imitative responses, and is enhanced as the number and accuracy of the reinforced imitative responses increase" (Schroeder & Baer, 1972, p. 293). This is essentially the result obtained by Garcia et al. (1971).

Schroeder and Baer (1972) examined the effects of concurrent and serial training on the generalization of vocal imitation in two retarded girls. The girls initially showed some vocal imitation, but at low accuracy. Training sessions were conducted twice each weekday, before the noon and evening meals, and usually lasted about 20 minutes. Reinforcement usually consisted of ice cream or sherbet, and occasionally cookies or candy. A sample of each subject's vocal imitation was made prior to the start of training. Two judges independently listened to the recorded probe items and rated each vocalization by the subject for accuracy. The judges' ratings were averaged to produce the final percentages of imitation accuracy score. Particular probe items, ranging from low to relatively high imitation accuracy were chosen from the initial group of items presented to the subjects. The probe items were used as an index of the generalization of accurate imitation from trained items to untrained items. The probes were used repeatedly throughout the study.

The children were taught, successively, groups of three items,
by alternating serial and concurrent training procedures, with four
groups of items being taught by each procedure. Subject 1 was taught
the first group by the concurrent training procedure, while subject
2 was taught the first group by the serial training procedure. Any
single training item was identical in both training procedures.

The experimenter held the food reinforcer in front of his face
until the child was attending to his face. He then presented the
imitative prompt. A correct response received both verbal praise
and the food. If the child gave an unacceptable response or failed
to respond within five-seconds, the experimenter looked away from
the child for five-seconds, and then repeated the procedure. If a
vocal stimulus was not imitated on the first trial, it was broken
down into its component phonemes, which were then taught individu-
ally and later combined using a procedure as suggested by Risley
and Wolf (1967). There were two criteria for ending training: (a)
three consecutive 100% correct imitations of the entire item, or
(b) 200 training trials. Once an item had reached criterion,
reinforcement was faded from CRF to FR4 as quickly as possible with-
out losing correct responding. The schedule was then changed to
VR2, to facilitate the presentation of unreinforced probe items.
Each probe item appeared in the probe sequence once after each
training word had reached criterion and been shifted to the VR2
schedule.

In the serial training, each item was taught to criterion, the
reinforcement schedule changed, and the probe sequence inserted
before the next training item was introduced. For the concurrent
training, all three items of the training group were presented repeatedly until all three had reached criterion. When one item of the three had reached criterion, the reinforcement schedule for that item was changed and the probe sequence inserted for that item, while that training of the other two items continued. That is, the probe sequence of any one item was intermixed with the training and/or probing of the other two items. When the probe sequence for one item was complete, the reinforcement schedule for that item was changed to VR3, while the items still undergoing training remained on the CRF schedule.

The reliability of the imitation accuracy ratings ranged from 90% to 93% per probe for all probes. The results indicate "that imitation accuracy for the probe items increased from the preceding level following concurrent training, and usually decreased or remained constant following serial training. This pattern was repeated over the four replications of the concurrent-serial alternations of training procedures for both subjects over all probe items" (p. 298). The mean number of trials needed to reach criterion for the three item groups did not differ consistently between concurrent and serial training procedures. Schroeder and Baer (1972) then calculated the percentage of reinforced responses during the probe sequences following each serial and concurrent training phase, to ensure that the VR2 schedule had been equally maintained during those times. The results of 43% and 45%, respectively, were not significantly different.

Schroeder and Baer (1972) speculate about the possible reasons for the greater degree of generalization associated with the con-
current training procedure, but conclude that "although the advantages of concurrent training displayed here may be advantages only because of the way that training interacts with the probe techniques used to measure its effects, that in itself is a valuable outcome, one worthy of further research" (p. 301).

The studies discussed in this section suggest a number of procedural variations which may be of benefit in the training and generalization of vocal imitation including the length of time available for the child to respond (Kerr et al., 1965), a variation in prompting technique (Nelson et al., 1976), the use of motor imitation as a precursor to vocal imitation (Garcia et al., 1971; Hartung, 1970; and Risley & Wolf, 1967), the use of facial motor imitation (Nelson et al., 1976), and concurrent vs. serial training (Schroeder & Baer, 1972). They offer the possibility of training procedures which produce more consistent responding from subjects, facilitate the acquisition of imitative skills, and enhance the probability that the imitative repertoire will generalize. Because of the potential practical application of these variables, further research on them is warranted.

Imitation is the cornerstone upon which the vast majority of speech training programs are founded. For that reason it has merited this extended investigation. There remain many unanswered questions about the role of vocal imitation, but it is by far the most promising method for teaching speech to severely language handicapped children.
Vocabulary Building

Lovaas et al. (1966) report that both of their subjects had reached a point in their imitation training at which they "had learned to imitate new words with such ease and rapidity that merely adding verbal responses to their imitative repertoire seemed pointless. Hence, the children were then introduced to the second part of the language training program, wherein they were taught to use language appropriately" (p. 706). One of the earliest steps in teaching severely language handicapped children to use speech appropriately is the development of a naming vocabulary.

Naming is defined as the emission of an appropriate verbal response in the presence of some stimulus object (Hartung, 1970; Risley & Wolf, 1967; 1968). The development of a naming vocabulary involves the transition of stimulus control from the trainer's verbalization to the picture or object to be named. The paradigm commonly used to accomplish this transition is as follows.

Once the child can imitate verbal prompts reliably and with short latency after the prompt has been presented, the shift of stimulus control can begin. A picture or an object is presented along with the verbal prompt, and the child is reinforced for imitating the name. The verbal prompt is gradually faded while the child continues to receive reinforcement for saying the name of the picture or object. For example, a ball is held up before the child and he is asked "What is this?" If the child does not respond, he is prompted, "Say ball", and reinforced when he imitates the word "ball." The pairing of the object with the verbal prompt is repeat-
ed several times until the child is responding reliably (Bricker & Bricker, 1970b; Hartung, 1970; Risley & Wolf, 1967; 1968; Sloane et al., 1968).

The fading of the verbal prompt, by which the transfer of control is accomplished, may be completed by one of several methods. Bricker and Bricker (1970b) recommend that probes, consisting of "What is this? Say _____," be inserted during training. If the child does not respond within a few seconds, he is prompted, "ball," and reinforced for imitating correctly. This process is repeated until the child spontaneously fills in the blank by naming the object. When the child reliably responds to this procedure, "say" is faded using the same technique.

Risley and Wolf (1967; 1968) recommend that the time between the question "What is this?" and the prompt be gradually lengthened to more than five-seconds. If, after several trials, the child continues to wait for the prompt, a partial prompt is presented, for example, "b". If the child fails to respond within five-seconds, the complete prompt is presented. A correct response is then verbally praised and the partial prompt is immediately repeated. A correct response to the partial prompt is reinforced with food. After the child is reliably responding to the partial prompt, the partial prompt is presented more softly. The loudness of the partial prompt is varied with the responsiveness of the child. This continues until the trainer "mouths" the partial prompt and, finally, discontinues it altogether. A similar procedure is recommended by Hartung (1970).
In a variation on this procedure, Lovaas (1968) does not suggest the use of the question "What is this?" Instead, the child is taught to name the object when it is presented. Sloane et al. (1968) used the question "What is this?", but note that it was often omitted, and the child responded spontaneously when shown the object.

There has been no systematic study of the differential effect of using the question "What is this?" vs. not using that question; however, it would appear advantageous for the child not to be limited strictly to one cue for naming.

After the child is reliably naming the first object, he is taught to name a second object, using the same procedure. Then the two objects are randomly alternated, and when reliable responding is established, a third object is taught and the procedure is recycled.

Throughout the procedure, whenever the child inappropriately imitates the question "What is this?", the trainer withdraws the object and looks away from the child. When the child has been quiet for a few seconds, the trainer continues the procedure.

Risley and Wolf (1967; 1968) note that once the child has been taught to name several pictures or objects, naming any new picture or object can be quickly established. They caution that a new response cannot be considered to have been learned until the child can name an item when it is presented again after other items have been trained, and following a passage of time.

By recycling these procedures, it is possible to build the child's vocabulary to virtually any desire size, with the limits
typically being established by the resources available for the continuation of training. While the procedures described in this section can produce an impressive vocabulary, they typically do not result in functional speech. That is, the resultant vocabulary does not enable the child to better function within and manipulate his environment. The naming vocabulary, produced via the above described procedures, in many respects resembles the speech of a parrot: it is produced by rote; it occurs only when a few specific cues are presented; it is, in short, nonfunctional.

Training Functional Use of Speech

The training of functional speech involves the development of a complex of behaviors including both expressive and receptive capabilities. "The complexity of language necessitates dividing the training process into components which have separate training procedures" (Bricker & Bricker, 1970b, p. 102).

Receptive Vocabulary Training. In a receptive vocabulary, "the stimulus controls a particular response which is reinforced only in its presence; different responses are not reinforced. In this way, a word becomes discriminative for a particular response, indicating that the child 'knows' the meaning of the word" (Bricker & Bricker, 1970b, p. 105). "The ability to point at, pick up, or otherwise differentially and correctly respond to named objects, people, events, or concepts is the goal of receptive vocabulary training" (Bricker & Bricker, 1970b, p. 105).

Schell et al. (1967), in their work with Kipper, taught him to respond to verbal commands. Kipper was first taught to come to the
experimenter when his name was called. At the beginning of training, if he did not respond to his name, the sound of a tap on the chair was also used. When Kipper turned toward the sound, the trainer called his name again and gestured for him to come. He was reinforced for coming to the trainer socially and with candy. The tap was eventually dropped. Subsequent commands have been aimed at bringing already established behaviors under verbal control. In some instances, Kipper's initial skill was crude and he was given active instruction and practice. When necessary, visual cues were supplied by pointing or gesturing. The additional cues were eliminated as soon as possible. This portion of Schell et al.'s (1967) report is in the form of a case study. No data are presented which would help amplify the explanation of the procedures involved.

Stark et al. (1968) continued Kipper's receptive training. They trained him to place a marker on a printed M or O when these sounds were verbalized to him. The stimuli became increasingly complex, both verbally and visually. This technique was expanded to include about 30 nouns. When these responses had been established, they were incorporated into the phrase "Get the ____." This procedure was then used to teach motor imitation to Kipper, supplementing their initial procedure. At first the verbal stimulus was presented along with a model of the desired response. The authors report that Kipper was soon responding to the verbal stimulus alone, and that there was an abrupt increase in responding to two verbal commands accompanied by the learning of two new commands. They do not give any information about how the data were collected.
Lovaas (1968) reports his receptive vocabulary training as a part of his naming vocabulary. That is, the procedure described above for training a naming vocabulary was run concurrently with the procedure to be described here. The receptive procedure was begun after the expressive training had been successfully established. The adult asked the child to nonverbally identify a particular object, for example to point to a ball. The child was physically prompted to perform the requested task by having the trainer manually move the child through the response. The prompt was faded following the same procedure used in the expressive training. When the first response was learned, the child was taught to identify a second object via the procedure. These two objects were then displayed to the child simultaneously in order to make certain that the child was in fact discriminating the stimuli. In order to insure that the child discriminate the particular attribute of the object involved, and to form concepts at the verbal receptive level, numerous examples of each object were introduced to the child (e.g., many different toy cars).

Lovaas (1968) notes that echolalic children often persist in repeating the verbal stimulus given. In order to extinguish the inappropriate echoing, a variation in the procedure was introduced in which the inappropriate repeating was consequated with the removal of positive reinforcers or the presentation of a noxious stimulus, as described above in the naming vocabulary procedure.

Bricker and Bricker (1970a) report on the comparison of two methods for developing verbal control over object choice in severely
retarded children. Forty institutionalized, retarded children who had passed a screening test which showed that they could perform the required response were divided into four groups of 10, two training groups and two control groups. Each subject was given a pretest on the 25 objects to be used in training. Each object was presented 10 times, five times as the named stimulus and five times as the distracting member of the stimulus pair in a two choice discrimination. The left and right placement of the objects was predetermined so that both positions were represented equally and neither position contained the reinforced object for more than three consecutive trials. The order of presentation of the stimulus pairs was predetermined and remained the same across subjects. The testing utilized the Wisconsin General Test Apparatus (WGTA) for the presentation of the stimulus pairs.

The two training procedures also utilized the WGTA to place the subject's object selection under the control of an auditory cue. The random training procedure was similar to the pretest procedure in that no item was presented as the named choice on two consecutive trials. Hence, the only reliable cue for selecting the correct object was the name of the object. The 25 objects were divided into five groups of five objects and training was carried out with one group at a time. Training was carried out with a single group of objects until a criterion of 23 correct responses out of 25 trials during one session, or until five training sessions had been completed. Then the next group of objects was introduced. The order of presentation of the object groups was counterbalanced across the
10 subjects in this random training group.

For the sequential training procedure, the same five groups of objects was used. A single object was presented as the named choice on consecutive trials until a criterion of five consecutive correct choices was reached or one session was completed. This procedure, then, contained two cues for correct choice, the name of the reinforced object and the consistent relationship between a particular choice and the presentation or nonpresentation of reinforcement. When training was ended for one object, another object from that group currently being trained was introduced. The presentation of objects in each group was counterbalanced so that the order of training would not be a factor in interpreting the results. This same procedure was continued until each object in the group had been the named choice. Then the next group of objects was introduced. The order of presentation of the groups of objects was also counterbalanced across the 10 subjects in the sequential training group.

A Hawthorne control group was added to control for attentional factors. The 10 subjects in this group participated in 25 sessions of interaction with an adult during which they played with duplicates of the stimulus objects used in training and were frequently told the name of each object. Candy was given to these subjects throughout these sessions in an amount approximately equal to that given to the subjects in the experimental groups. The candy was not made contingent on any specific behavior performance. The second control group was a no treatment group that was given the pretest
and posttest with no intervening training or interaction.

A posttest, which was a replication of the pretest, was administered to each subject after the subject had completed training. The subjects from the no treatment control group had the administration of their posttest randomly interspersed among the administration of the posttests given to the other 30 subjects.

The pretest data indicated that two groups could be formed which transcended the experimental and control groups. Specifically, the subjects could be divided by the improvement shown in the second half of the pretest when compared with the first half. For some subjects, there was a consistent tendency to show improvement. These subjects were called learners. Those subjects whose performance remained at essentially chance level in both halves of the pretest were called non-learners.

Statistical analysis indicated that the most consistently significant variable was the learner/non-learner dichotomy, which was not an experimental variable. There was no significant difference between the two experimental groups. A comparison between the two control groups indicated that the experimental manipulation had no significant effect, but again the level (learner vs. non-learner) was significant. Interestingly, the authors do not report a test of differences between the experimental and control groups.

Bricker and Bricker (1970a) note that "those children who were identified as non-learners during the pretest tended to remain non-learners even when given 25 individual training sessions. Their mean performance in all phases of this investigation was essentially
at chance level" (p. 604). For the learners, they note that the individual training sessions "maintained, but did not seem to improve, the level of performance" (p. 604). In sum, Bricker and Bricker (1970a) seem to have demonstrated that the procedures they used were completely ineffective in developing a receptive language vocabulary.

Whitman, Zakaras, and Chardos (1971) studied the utility of a physical guidance procedure used in conjunction with a reinforcement procedure for producing appropriate motor responses to verbal instructions in two severely retarded children. For the first child, Roger, a list of 22 instructions, which his teacher felt he was capable of performing, was prepared. Roger's initial operant response level to these instructions was assessed over a five day baseline period. The commands were presented, in the same order, twice each day, with a brief rest between the two presentations. Each command was presented slowly, and Roger was allowed 15-seconds in which to respond. Responses during this phase were not consequated.

Baseline was followed by training for 20 consecutive school days. The training periods lasted approximately 30 minutes. The 22 verbal instructions were divided into two sets of 11 instructions. Roger was trained on one set of instructions while the other set was used to assess generalization. This latter set and the procedures attendant to it will be discussed later. The two instructions to which Roger had most frequently responded during baseline were included in the training group, as was the command "look at me", which was included to enable the experimenter to better maintain the subject's attention.
The trainer presented a command and physically guided Roger through the required motions. Roger was then reinforced with praise and edibles (cereal or candy). The trainer subsequently reduced his assistance by gradually withdrawing his guidance, first from those physical movements associated with the completion of a given response and then progressively from those movements which were farther from the completion of the response until Roger was able to initiate the response with only the verbal instruction as a cue.

Each training session began with the presentation of an instruction to which Roger had previously and correctly responded. After he had responded correctly four out of five times to the initial instruction, a different instruction from the training set was introduced. If Roger consistently failed to respond to one of the instructions, the trainer discontinued that instruction and moved on to the next one. No specific criteria were established for terminating training in this fashion. If Roger failed to respond correctly to three successive instructions, the experimenter returned to an instruction Roger was already capable of successfully completing.

After each training session, the operant response level to all 22 instructions was determined following the procedure used during the baseline period. During this test period, reinforcement and prompting were not used. The order of the presentation of instructions was the same as in baseline. At the end of the 20-day training period, baseline procedures were re-established for five days. This second baseline period was followed by a reinstitution of training for a 15-day period.
The procedure followed with the second subject, Mary, was essentially the same as that used with Roger. A separate list of 20 instructions was prepared. Baseline levels of responding were established over a five-day period. Training sessions were conducted over 35 consecutive school days. The instructions were divided into two groups of 10, with one group used for training and the other used as a test for generalization. The reinforcement, physical guidance, and fading procedures were essentially the same as those used with Roger. The operant response level to all 20 instructions was re-assessed after each training session. A second baseline period, lasting 15 days, was conducted after the completion of the training period. This second baseline was followed by a second training period lasting 10-days.

Reliability checks of the accuracy of the data collected were made twice during each phase. In all instances, the percentage of agreement between independently made ratings exceeded 95%. The data presented indicate that for both subjects there was a marked increase in responding during the first training period, followed by a decrease during the second baseline period, with a subsequent increase during the second training period. Whitman et al. (1971) conclude that "the performance of the two subjects suggests that functional relationships were developed between a majority of the specific motor responses and the corresponding training instructions given by the experimenter" (p. 288).

Striefel and Wetherby (1973) taught a profoundly retarded boy to make specific responses to specific verbal instructions. Training
sessions were conducted once or twice a day, Monday through Friday. The verbal instructions were divided into two groups, one to serve as training stimuli and the other to assess generalization. These latter instructions will be discussed later.

The subject's operant response level to the commands was determined during the initial baseline. The experimenter placed four objects on the table and called the child's name. When the subject had established eye contact, a verbal instruction was given. The child was allowed five seconds to respond. During the first three baseline sessions, no consequences followed correct responses. For the final three baseline sessions, each correct response was followed immediately by verbal praise and ice cream.

A probe sequence occurred immediately prior to the training of each behavior, and consisted of three trials on each of the three behaviors at the top of the subject's list of behaviors to be trained.

A training trial consisted of the trainer establishing eye contact with the child as in baseline, presenting the verbal instruction, allowing five-seconds for the child to respond, and delivering verbal praise and ice cream if a correct response occurred. Each of the training items was broken down into a series of steps for shaping purposes, which the trainer physically prompted as needed. The trainer systematically faded his physical guidance until the child would complete the response on his own after being given only the verbal instruction. If the subject failed to complete the response when the trainer had provided partial physical assistance, he was
returned to the previous step for five consecutive correct trials.
A correct response on a new step of the program resulted in going to
the next higher numbered step on the next trial. This series of
graduated steps is referred to as the putting through procedure.

A random sequence consisted of 10 training trials presented in
a random order. For five of these trials, the trainer presented the
verbal instruction that was currently being trained. For the other
five trials, the trainer presented verbal instructions that the child
had previously learned.

The training sequence began with a probe sequence on the top
three behaviors on the list of behaviors to be learned. If the sub-
ject correctly performed the behavior at the top of the list on all
three probes it was considered learned, and the probe sequence was
repeated using the second and third behaviors from the first probe
sequence plus the next item from the list of behaviors to be learn-
ed. Correct responding to the first verbal instruction on one or
two of the probes was followed by training trials. If the child
made no correct responses to the probes, the putting through pro-
cedure was initiated. After making 10 consecutive correct responses
in the last step of the putting through procedure (verbal instruc-
tion alone) a random sequence was begun. The subject was presented
three random sequences over three sessions. If the child made 14
of 15 correct responses in the three random sequences, the behavior
in training was considered learned. An error by the child during a
random sequence resulted in a physical prompt being given. A second
error resulted in the child returning to the last step of the appro-
appropriate putting-through procedure for five consecutive correct responses. Once the child had learned to make the appropriate response to a verbal instruction, the next three behaviors at the top of the list of behaviors to be learned were probed and the cycle begun again. All correct responses during probe sequences, training trials, putting-through trials, and random sequence trials were reinforced with social praise and ice cream.

Starting with session 84, the subject was given one trial on each of five previously learned behaviors during each session. The behaviors reviewed were rotated randomly from session to session to insure that all learned behaviors were reviewed. Three behaviors were trained a second time.

After all 25 training items had been trained, additional probes were given to determine which verbal instructions now controlled specific responses on the part of the subject, and what part of each verbal instruction controlled the subject's behavior. This involved the random presentation of different variations of each instruction, with each variation presented twice. A number of variations were used, including presentation of the noun alone, the verb alone, and the verb with the pronoun or preposition. On a variable schedule, about every fourth trial consisted of a complete verbal instruction. Correct responses to these complete verbal instructions were reinforced. For the partial verbal instructions, a response was considered correct if the child made any response that had been trained to a specific verbal instruction of which the presented variation was an integral part, or a response that was appropriate for the
specific verbal stimulus,

During the initial baseline, correct responses occurred on three verbal instructions on all days. For the final probe sessions, correct responses occurred on 23 of the 25 training items. On the probes that initiated the training sequence, the child responded correctly on all three trials of the probe sequence for three behaviors. No other correct responses occurred during any probe sequence.

The study of the effect of variations of each verbal instruction indicated that the complete verbal instruction elicited the greatest number of correct responses, approximately 91%. Three of the variants, the noun alone, the noun plus the pronoun or preposition, and the complete verbal instruction with the verb transposed to the last word, elicited correct responses on approximately 41% to 45% of trials.

Reliability of the accuracy of observation was assessed on three sessions of the initial baseline, 10 training sessions, and on four of the final probe sessions. Reliability ranged from 93% to 100%, with a mean of 98%.

Striefel and Wetherby (1973) conclude that a useful relationship was established between 20 of 22 motor responses and their corresponding verbal instructions as a result of the training procedures. The figures they present are somewhat confusing. Of the initial 25 training stimuli, the child responded correctly to three on all days of the initial baseline. These three were considered learned, and were not trained, leaving 22 training stimuli.
During the probe sequences, the child responded on all three trials to three behaviors, meeting the learning criterion. That leaves 19 of the original 25 stimuli. The subject failed to learn to respond to two of the stimuli that were actually trained, leaving 17 responses that were successfully trained via the experimental procedure. That is, the child learned to make a motor response to approximately 90% of the commands trained.

Craighead, O'Leary, and Allen (1975) taught a four-year-old "autistic" boy to follow instructions. The experiment was conducted in a 12 ft. x 15 ft. playroom connected to an observation booth via a one-way glass, through which observers scored Mark's responses. Each instruction was preceded by the child's name. If Mark initiated the correct response within five-seconds, it was scored correct; if he did not begin the correct response within the five-second limit, the response was scored as incorrect. The sessions were conducted late in the afternoon, prior to Mark's evening meal. He had had no food during the three to four hours preceding the sessions.

During Phase I, a baseline was conducted on 36 instructions. Each instruction was given once during each of the first two experimental sessions. A correct response was followed by praise. Two observers independently rated Mark's responses during Phase I.

Training began with Phase II. Phase II-A consisted of five sessions, 30 to 45 minutes in length, during which Mark was trained to follow 10 of the original 36 instructions. Each instruction was presented twice during each of the five sessions. Every correct response was
with a primary reinforcer (candy or a corn snack) and praise. Phase II-B consisted of three sessions, 30 to 45 minutes in length, during which the procedure was the same as in Phase II-A except that correct responses were followed with verbal praise only (no primary reinforcer). Phase II-C was two sessions, 30 to 45 minutes in length, during which the reinforcement conditions of Phase II-A were reinstated. Phase III was a test for generalization and will be discussed later. During Phase IV, which was two sessions in length, a second baseline was obtained on the 36 original instructions. If Mark followed an instruction, he was praised; no primary reinforcers were given. Phase V was also concerned with generalization and will be discussed later.

The interobserver reliability of instruction-following during Baseline I was .92. The data indicate that Mark did learn, in the five training sessions of Phase II-A, to follow the 10 training instructions. During Baseline I, he had responded correctly to 35% of the 10 instructions. On the fifth day of training he correctly responded to 95% of them. During Phase II-B, the rate dropped to 67%, but returned to 92% of the 10 trained instructions during Phase II-C.

On the basis of these results, the authors conclude that the child had been successfully taught to follow instructions. They also note that the pairing of the primary reinforcers with praise appeared to result in the establishment of the experimenter as a positive social reinforcing stimulus.

As had been noted in earlier sections of this paper, the experimental rigor of the studies under discussion varies considerably.
Fortunately, there are some reports which are experimentally rigorous enough to support the conclusion that the operant procedures used are indeed responsible for the noted changes in the subject's behavior, and that these same procedures can be successfully utilized in receptive vocabulary training.

Training Productive Functional Speech. If speech training is to be of any significant value to a severely language handicapped child, it must be made functional, that is, the child must be taught that speech can be used to effect change in his environment. During the course of their training, children often reach a point at which social and natural reinforcers can be used to maintain the responses they have learned. "If the child can be shown that his verbal responses change something in his immediate environment, leading to a personal satisfaction, then it is more probable that language will become spontaneous and situationally appropriate" (Hartung, 1970, p. 213). That is, a previously learned response may be made functional by changing the consequences from those used to maintain that behavior in the laboratory to the social and other natural reinforcers available in the child's day to day environment.

Typically, training productive functional speech begins after the establishment of an imitative repertoire and/or a naming repertoire. Sloane et al. (1968) describe two methods for making the transition from rote speech to functional speech. In the first method, the child is taught to name the reinforcer. Then the reinforcement for saying that name was obtaining the reinforcer. "This was done when there was independent evidence suggesting that the
item in question was currently a strong reinforcer; for example, the child might have been reaching for the water, or pointing at it and grunting" (p. 82). The child would then be verbally prompted to say water and would be reinforced for doing so with a sip of water.

The second method was employed after a naming repertoire had been established. After a child had learned to reliably name an object, the use of that name was required in appropriate situations, and nonverbal equivalents, e.g., pointing and grunting, were not reinforced. "If a child had learned to name doors, and was seen trying to open a door, adult help would not be given unless the correct verbal response was emitted. The adult might 'cue' this by telling the child to 'say door!'" (p. 82).

Bricker and Bricker (1970b) include the transition of functional speech as a part of training a naming vocabulary, and suggest a procedure similar to the second method used by Sloane et al. (1968). Their suggestions are included as a part of training the child to answer the question "What do you want?" They note that some form of behavior by the child must signal the appropriateness of the situation. For example, if a child is pointing at or trying to get a glass of milk, the trainer would say "What do you want? Say milk." When the child correctly says "milk" he is reinforced with a sip of milk. When the child is reliably responding in this fashion, time delays are included in the statement so it becomes, for example, "What do you want? (delay) Say (delay) Milk." "The length of the delay depends on the child's tendency to emit the response without the prompt" (p. 108). Bricker and Bricker (1970b) also suggest
that training "be extended to situations outside the training room in order to maximize the functional aspects of language for the child in his natural environment" (p. 108).

Risley and Wolf (1967; 1968) begin the transition to the functional use of speech after the establishment of phrases. The procedure they recommend differs from that recommended by Sloane et al. (1968) and Bricker and Bricker (1970b) in that Risley and Wolf (1967; 1968) structured the environment in such a way that there were more chances for the child to use his speech appropriately rather than relying on a chance behavior by the child to begin the transition. For example, when the child would reliably imitate "Out the door," that phrase was required before the therapist would open the door of the training room. After several successful trials, the cue provided by the trainer would be faded; for example, instead of saying "Out the door," the trainer would say "Out." This partial prompt was gradually faded until the therapist put his hand on the door knob and looked at the child and the child said "Out the door."

The same procedure is recommended by Hartung (1970), who points out that the particular likes and dislikes of a child may serve as natural reinforcers. That is, the reinforcing event is not necessarily a positive reinforcement; negative reinforcement may work as well. For example, Hartung (1970) reports on one autistic boy for whom having a hand placed on top of his head was aversive. The trainer took advantage of this by placing his hand on the boy's head and simultaneously saying "Stop it." When the child repeated that phrase, the trainer immediately removed his hand. Within 30 minutes,
the child no longer needed the prompt to respond correctly.

It should be noted that none of the procedures described in this section is a new procedure per se. They are, rather, extensions of previously used training procedures in which the reinforcement which maintains the behavior is shifted from the "artificial", laboratory derived reinforcers, which are necessary, in many cases, for the establishment of the verbal behaviors, to the more "natural", more normal appearing reinforcers of the child's day-to-day environment for the maintenance of the new verbal behaviors. Concurrent with this shift in reinforcers, is a shift in the stimuli that signal when to make a response from the trainer's verbal prompt to more normal appearing cues.

Generalization of Speech Behavior

"In the area of language, the occurrence of trained behavior outside the formal therapeutic settings is of extreme interest. It is of little use to spend hours of therapeutic time in the acquisition or maintenance of verbal behavior if it is of no use to the patient outside that environment" (Garcia, Bullet, & Rust, 1977, p. 532). Hence, "although the establishment of speech is an important therapeutic goal, the use of speech in contexts other than those originally trained should be a concomitant goal of any speech program" (Garcia & DeHaven, 1974, p. 175). That is, speech training must generalize.

Craighead et al. (1973) tested to determine if Mark's training on instruction-following would generalize to a set of nontrained instructions. After Mark had been taught to respond to 10 verbal
instructions, he was tested on 14 generalization instructions. Seven of these were similar to the trained instructions, for example, "Bring the train" was a trained instruction, and "bring the doll" was one of the similar nontrained instructions. The remaining seven generalization instructions were different from the trained instructions, e.g., "Stand up." These generalization instructions were part of the original 36 instructions presented during Phase I (Baseline I).

Phase III, during which this test for generalization was made, consisted of two sessions, 30 to 45 minutes in length. During each of these two sessions, the 10 trained instructions were each presented twice, and six (randomly chosen) were presented for an additional trial, making a total of 26 trained instructions presented. During the first session, three similar and four different generalization instructions were presented for two trials each. In the second session, the remaining seven generalization instructions were presented twice each. The trained and generalization instructions were presented in random order. Each completed trained instruction was followed with praise and primary reinforcers, and each completed generalization instruction was followed by social reinforcers only.

During the two sessions of Phase IV, a second baseline was conducted on the original 36 instructions. At the end of each Phase IV session, Mark was presented with 10 completely new instructions. Each of these new instructions was presented once in each session and correct responses were praised.

In the previous sessions, the training and testing for general-
ization was done by a single experimenter. Phase V was designed to test for generalization to different trainers. During each of the six 30 to 45 minute sessions of this phase, each of the 36 original instructions was presented once. In the first, third, and fifth sessions, the original experimenter conducted the procedure using primary and social reinforcers. In the second session, a psychology graduate student presented each of the 36 instructions for one trial each. In the fourth and sixth sessions, the same procedures were followed, with Mark's father being the trainer in session four and his mother the trainer in session six.

The data showed that in Phase III, Mark obeyed 90% of trained instructions, 85% of similar instructions, and 77% of different instructions. A comparison of performance in Baseline I with performance in Baseline II shows that Mark followed 17% of the nontrained instructions in Baseline I and 67% in Baseline II. In the test for generalization to entirely new instructions, Mark followed 80% during Phase IV. In Phase V, Mark followed 70% of the instructions presented by the graduate student, 64% of the instructions presented by his father, and 84% of those presented by his mother.

Craighead et al. (1973) conclude that the response of instruction-following generalized to instructions which Mark had not been trained to follow, and that instruction-following taught by one individual seemed to generalize to other people.

Striefel and Wetherby (1973) report on the stimuli controlling instruction-following behavior in a retarded boy. After 77 sessions of training instruction-following, the experimenter daily probed
three behaviors that were yet to be trained and two generalization items. Responses to these daily probes were never reinforced, and the generalization items were rotated from a list of 10 items so that all 10 behaviors were probed every few sessions.

The data showed that two correct responses occurred on training items on the daily unreinforced probes. No correct responses occurred on any generalization item during either the initial baseline or final probes. Only one correct response occurred on daily probes of the generalization items. Striefel and Wetherby (1973) conclude that the child in their study did not respond correctly to generalization items as a function of training on other behavior, that is, generalization did not occur.

The probe procedure used by Striefel and Wetherby (1973) is analogous to the "completely new" generalization items used by Craighead et al. (1973). Even though these procedures are similar, the results were quite different: in one instance the training spontaneously generalized to untrained instructions, while in the other instance there was no generalization. This discrepancy in generalization results is common in speech training programs. Risley and Wolf (1967), in commenting on this phenomenon, note that "while newly acquired appropriate speech often will 'spontaneously' generalize widely, the therapist need not passively rely on this phenomenon" (p. 87).

Hewett (1965) began generalizing Peter's speech behavior as soon as he had learned to say his first word, "go." The teacher required Peter to say "go" before opening the door to his ward to take him to
the training room. A ward nurse was later brought into the teaching booth, and Peter quickly generalized his "go" response to her. After several training sessions, the nurse required Peter to say "go" before taking him off the ward to the dining room and on walks. A preschool teacher was also brought into the training booth for several training sessions. Later Peter was required to say "go" in order to enter the schoolroom door. He was also required to say "my" before he could obtain a desired object during school periods. Items, such as juice and crackers, served in the schoolroom were also given to Peter only when he asked for them. These words were not introduced in the training booth. Still later in training, both of Peter's parents were brought into the training booth and successfully evoked Peter's repertoire. The parents, and occasionally Peter's brother and sister, joined the teacher for weekly training sessions. Peter was sent home on weekends, and the entire family became involved in reinforcing his speech.

Sulzbacher and Costello (1970) worked with a boy, Teddy, who had diagnoses of mental retardation, infantile autism, organic brain damage, emotional disturbance, and arrested hydrocephalus. Teddy had been taught to say "That's a" in labeling single objects and "Those are" in labeling plural objects. In testing for generalization, the 15 objects used in "That's a" training and the 15 objects used in "Those are" training were presented in both singular and plural form, for a total of 60 stimuli. A stimulus was placed on a table and Teddy was asked, "Teddy, what do I have here?" Correct responses were not reinforced. Teddy made only three "Those are" responses,
and no "That's a" responses. "Obviously, these responses had not generalized and more teaching was necessary" (p. 272).

Another 60-item probe was administered using the questions, "Teddy, what's that?" or "Teddy, what are those?" to see if these stimuli would provide cues for differential responding. All but one of Teddy's responses were single words.

Analysis of Teddy's responding suggested that the stimulus events that controlled Teddy's sentence responses were absent during the generalization probes, and it was postulated that his responding was specific to the CRF schedule used during training. Therefore, the schedule was thinned from CRF through VR2 to VR12 over three sessions. The 60-object generalization probe was presented again with the question "Teddy, what do I have here?" and with nondifferential reinforcement. Teddy emitted 100% correct responses.

Sulzbacher and Costello (1970) speculate that the reinforcement schedule might be a functional discriminative stimulus. They suggest that using the training reinforcer in other settings would enhance generalization of the newly acquired behavior, not necessarily because of the reinforcement value of the edible, but because of its stimulus properties.

Garcia et al. (1977) conducted an experimental analysis of the generalization of trained speech to settings outside the speech training environment. Two mentally retarded children were taught to use complex sentences to describe pictures. Cue cards were xerox copies from the Peabody Picture Language Kit Level Two, depicting men doing the action phase of the sentence. All training by the trainer
was conducted in a five-foot square tutoring booth with one door and no windows. Sessions conducted by the teacher in the classroom were located in a public school for the emotionally and mentally handicapped. Sessions conducted at home by the parents were done across the kitchen table.

For the training trials, a cue card and a verbal cue, "(Name), Tell me about this picture."", were presented simultaneously. A correct response was followed by verbal praise and a token. If the child made an incorrect response, he or she was told "Stop!" or "No!", and was then asked to repeat the correct verbal response after it was modeled by the trainer. Training done by the parents and the teacher was done either in the training booth or in their respective settings.

Phases 1-3 were designed to demonstrate the nonexistence of the trained response usage outside of the training situation. The trainer taught the first response to a learning criterion of each subject, while the teacher and parents sampled the usage of this response in the classroom and in the home (Phase 1). When no generalization was observed, the teacher (Phase 2) and then the parents (Phase 3) began to train this same response within the training booth. Again, generalization of the first response was not observed.

In Phases 4-6, training of the first response was continued by the trainer who also trained a second response which was similar to the first response (Phase 4). The second response was then trained by the teacher in the classroom (Phase 5) and by the parents in the home (Phase 6). Use of the first response did not generalize to
In Phases 7 and 8, the trainer continued to train the first response while the teacher (Phase 7) and then the parents (Phase 8) began to train (i.e., to consequate and/or correct) the usage of the first five-word component of the first response (the "if" portion of an "if, then" statement) in their respective settings. In this way training was extended beyond the training setting for the first response, but only for the first five-word component. The response did not generalize.

During Phases 9-17, a "minimal" extended training technique was introduced. Five samples of the response being trained by the trainer were introduced to the classroom (Phase 10) and home (Phase 11). One of these five responses received training, that is, the complete response was trained. In Phases 12 and 15, the trainer taught a third and fourth response which were introduced, following the above procedure, to the classroom and home in subsequent phases.

During probe sessions, i.e., those sessions conducted in the classroom and home, the probers, the teacher and parents, presented the cue card along with a verbal cue. The probers waited 10-seconds, and then presented the cues for the third and fourth responses. This series was repeated five times per probe session. Probe sessions were held twice in each setting prior to the beginning of any training and once on each training day.

Garcia et al, (1977) note that the near 100% correct responding within the training sessions had little or no effect on the use of the trained response outside the training session. In addition, the
training of that same response by the teacher and parents in the same training environment, the training booth, had no effect in producing the use of that response outside the training environment. It was only after the teacher and parent had become involved in the actual training of one complete response in the other settings that a general increase in responding within these settings occurred. They conclude that "the empirical objective accomplished by this study indicates that language generalization is therapeutically elusive and continues to require further research efforts" (p. 545).

These studies illustrate some of the complexity involved in the generalization of newly acquired speech behaviors. Included in this review have been examples of generalization of responding to one trainer in different settings or environments, to different trainers in one environment, and to different trainers in different environments. All of these are properly termed generalization, and they illustrate two of the major generalization dimensions: the generalization of trained responses to other persons, and the generalization of trained responses to other settings. Each of these dimensions is of critical importance if a speech training program is to yield any functional value for the child beyond a highly restricted training environment. The generalization of newly acquired behaviors must be considered as an integral part of every speech training program.

Generative Response Class. Most students of children's language development would agree "that very early in the development of language, children appear to exhibit 'generative' repertoires. That is, children emit language that has not appeared in their repertoire pre-
viously, and that apparently has been neither directly taught nor demonstrated to them by other speakers" (Schumaker & Sherman, 1970, p. 273). "To the behavioral psychologist, the linguist's use of generative language is probably analogous to the terms generalized or functional response class. A generalized response class exists when all responses in the class show an effect of a manipulation (e.g. extinction or differential reinforcement) which is made in relation to only a few members of the class" (Wheeler & Sulzer, 1970, p. 139).

"The importance of the response-class phenomenon lies partly in the amount of new behavior produced, and partly in the fact that this new behavior can result from a properly unified sequence in instructions" (Guess, Sailor, Rutherford, & Baer, 1968, p. 297).

Whitman et al. (1971) used a physical guidance procedure in conjunction with a reinforcement procedure for producing appropriate motor responses to verbal instructions in two severely retarded children. In their procedure, two sets of instructions were used. One set was for training purposes, and the other set was to measure the extent of generalization. After each training session, a new operant level was established for all instructions in both sets for each subject. The trainer presented the entire list of instructions, 22 for Roger and 20 for Mary, twice without any type of primary or social reinforcement, physical guidance, or fading procedure being used, as in the initial baseline. After the initial training phase (20 days for Roger and 35 days for Mary), a second baseline phase was conducted, lasting five days for Roger and 15 days for Mary. When this second baseline was completed, training was reinstituted, along with the
daily measure of the operant response level. This second training phase lasted 15 days for Roger and 10 days for Mary.

In Baseline I, both subjects' responding was quite low. In the first training period, both subjects showed a marked increase in responding to both the trained and untrained stimuli. During Baseline II, Roger showed a marked decline in responding to both sets of instructions. Mary showed only a slight decrement. In Training II, both subjects showed increases in responding to both sets of instructions.

Considering the subjects' responses to the generalization instructions, it is evident that an extensive generalization effect occurred. Although responses to these instructions were never reinforced, both subjects showed a marked increase in the number of such responses during the training periods. That responses to these generalization instructions were brought under control of the reinforcing stimulus is also suggested by the fact that the trend of response increments during the first training period, response decrements during the second baseline period, and subsequent response increments during the second training period were quite similar to the trend of responses to the training instructions during these same periods (p. 288-289).

This last sentence is, in essence, the definition of a response class.

Baer and Guess (1971) taught the receptive use of adjectival inflections to three severely retarded children. The subjects were screened by a test of correct receptive use of adjectival inflections. The three subjects chosen for the study were either near or below chance level when pointing to the comparatives or superlatives included in the screening test. The training materials consisted of 19 sets of pictures, each set containing four cards. Each card of a set displayed a quantitatively different picture of the same basic stimulus, for example, circles of different sizes (diameters).
Three sequential training conditions were used within each set of stimuli. First, using two cards of a set, training established the receptive identification of two opposite adjectives. The subject was trained to point correctly to one of the two pictures labelled by the trainer as opposites, e.g., "big" and "small". The two pictures were placed in front of the subject and the trainer said, "Point to ______." If the child made an incorrect response, the experimenter said "No", pointed to the correct card, removed the cards, and presented them again after 10-seconds. The positions of the training cards were changed unsystematically and the order of requesting the two opposites was random. Second, using three cards from the set, one of the opposites, e.g., "big", underwent comparative training, e.g., "big", "bigger". The three stimulus cards included those originally trained as opposites plus a new card which, quantitatively, represented the comparative of one of the opposites. The subject was reinforced for pointing to the picture previously taught as one of the opposites when requested, e.g., "big", and the new stimulus card when the experimenter asked for its comparative, e.g., "bigger". These requests were made in random order. No requests were made for the remaining stimulus card. The positions of the cards were changed unsystematically. Third, the other opposite then underwent comparative training. The procedure for training the second comparative was the same as used in training the first comparative. The subject was shown the two cards originally taught as opposites, plus the card depicting the comparative for the second opposite, e.g., "smaller".

These three sequential training conditions were also followed
in the Superlative Phase. First, the opposites were trained as in the Comparative Phase. The subject was then shown the two stimulus cards trained as opposites plus an additional card which represented the superlative of one of the opposites. This logically converted the stimulus previously trained as the other opposite to the anchor item of the superlative series to be trained, e.g., "deep" became "shallow", "shallow" became "shallower", and the new stimulus represented "shallowest". On the first trial only, the trainer re-labelled the "deep" card as "shallow" ("This is shallow.") and then began a random series of requests to point to either "shallow" or "shallowest". The position of the cards was shifted unsystematically. The second superlative was trained by the same procedure. Criterion for successful performance in all training conditions was 10 consecutive correct responses.

Subjects were reinforced for correct responses on a VR3 schedule with tokens that were redeemed at the end of a session. The VR3 schedule was established gradually with the first set of opposites taught to the subject. Thereafter, it was quickly established for each training condition that followed.

One or another of three types of probes was given to the subject, interspersed within the training trials, following that point at which the subject had reached criterion in the particular training condition to be probed. Responses to all probes were never reinforced. The VR3 schedule allowed for the insertion of the probes without an obvious change in reinforcement probability.

The transpositional comparative probes measured the extent to
which the subject applied the comparative rule to stimulus combinations that had not been taught directly in the comparative training conditions. The subject was asked to point to one of two different stimuli, now labelled as a comparative. Eight transpositional comparative probes were given for each stimulus series, covering pairs of stimulus cards not directly trained as comparative in the preceding conditions.

Nontranspositional superlative probes were taken as a second baseline during the early comparative training conditions. The subject was presented with the same three stimulus cards used in training, and he was requested to point to the stimulus card which, quantitatively, would be the superlative. For example, the subject was shown the three cards originally labelled as "big", "small", and "smaller", and he was asked to point to the "smallest". After the second comparative training condition, the subject was asked to point to the "biggest" of the three stimuli. These probes were presented four times after the training of the first comparative, and four times following training of the second comparative.

Transpositional superlative probes followed the same procedure as the nontranspositional superlative probes, but used different sets of cards. Whereas the nontranspositional superlative probes used the same three cards used in the training condition, the transpositional superlative probes included every other possible trio of stimuli contained in each four cards. Each of the three possible transpositional superlative probes was presented twice, and the nontranspositional superlative probes were introduced to each subject
three stimulus sets before the beginning of superlative training.

The results indicate that during the training sessions the number of trials required to reach criterion performance during training of successive sets of opposites, first and second comparatives, and first and second superlatives decreased for each subject as more sets were trained. For the probes, the three subjects responded accurately to the comparative probes from the outset. Superlatives were generally not identified correctly until they were taught directly. Concurrent with superlative training, there was a rapid increase in correct responding to the untrained superlative probes.

Baer and Guess (1971) conclude that the severely retarded children had been taught to identify comparatives and superlatives via differential reinforcement, and that this learning generalized to stimulus combinations which had not been trained directly, but which exemplified the same dimensions that characterized the original training experiences.

These studies, Whitman et al. (1971) and Baer and Guess (1971), along with the study by Craighead et al. (1973), provide evidence that receptive speech behaviors can be trained in such a way that they become generative. These demonstrations covered the discrimination of adjectival inflections by mentally retarded children, and instruction-following by both retarded children and an "autistic" child. The practical significance of this finding is that at least some severely language handicapped children can be taught a speech related behavior which approximates a capability of normal children. Specifically, these children could, independently, apply a previous-
ly learned "rule" to novel stimuli. There are numerous limitations to this capability, but this progress represents a significant start.

Studies of the development of generative repertoires of expressive speech behaviors have also been conducted. One of the earliest is that of Guess, et al. (1968), which investigated the productive use of the plural morpheme /-s/. The subject was a severely retarded girl, Janet, who had previously undergone a verbal training program and had developed a small, well articulated verbal repertoire of single words and simple phrases. She had not been provided with any type of systematic training in the use of plurals. On several tests before the study, Janet gave only singular responses.

Experiment one was conducted in a soundproof room connected by a one-way mirror and intercom system to an adjoining observation room. An observer stationed in the observation room recorded data, as did the experimenter. Experimental sessions were conducted twice daily and ranged in length from 15 to 45 minutes. Stimuli for the study consisted of various small objects which were placed on the table in front of the subject. The order of object presentation followed a daily, three stage sequence.

For Stage 1, Janet was shown a single object and asked "What do you see?" If she correctly named the object in its singular form within 20 seconds of its presentation, she was given a bite of food. If she failed to respond within 20 seconds, the experimenter correctly labeled the object, withdrew it from sight for 10 seconds, and then presented it again. This was repeated until Janet named the object correctly. If Janet incorrectly labeled the object, the ex-
perimenter said "No", and followed the procedure for no response. Criterion performance for this stage was three consecutive correct responses.

During Stage 2, Janet was presented with two of the same objects and asked "What do you see?" Reinforcement was contingent on a plural response. If Janet made a singular response, the experimenter said "No", stated the correct plural label, and withdrew the objects for 10 seconds. Criterion performance was three consecutive correct responses.

In Stage 3, a random sequence of single and pairs of objects was presented. Criterion performance required a sequence including three correct singular responses intermixed with three correct plural responses, without intervening errors.

Criterion for each stage was to be reached before the next stage was begun. Completion of the third stage constituted the end of a session. Each session was devoted to the training of the singular and plural labels of one item, and each sessions involved a new item not used before. These three stages were repeated for each item presented throughout each of the experimental conditions.

In Condition I, Janet was trained to respond correctly with singular or plural labels. In Condition II, the reinforcement contingencies were reversed such that Janet was required to give a plural response to single objects and a singular response to pairs of objects. Condition III re-established the contingencies of Condition I.

During Condition III, Janet was shown five objects whose labels
were governed by irregular or different plural rules than her training had encompassed, e.g., man-men, leaf-leaves. These probes were conducted to see if her experimental plural training would control her production of normally irregular plurals. These probes were conducted at the ends of five consecutive sessions late in Condition III, one object per session. Correct responses to single object presentations were reinforced; responses to pairs were never reinforced.

The reliability data indicated that the 1,345 responses emitted by Janet throughout the study, the observer and experimenter disagreed on one. It should be noted that the observer saw and heard both Janet's responses and the experimenter's reactions to these responses.

Two measures of the extent to which a generative repertoire had developed were derived from Janet's performance. One was based on the number of trials required to bring her to the multiple criterion of singular-plural usage for each new word she was taught. The other measured the probability that on the first presentation of items in pairs, rather than one at a time, she would consistently shift to their plural label without training or correction. The first measure was calculated as a percentage of correct responses displayed in achieving the criteria throughout training. The second measure was scored as a successful plural shift if, on the first item of Stage 2, Janet correctly supplied the plural label.

Productive plural usage was achieved by the third word of Condition I and maintained for the remaining seven words of that condition. With the reversal of contingencies (Condition II), Janet's
percentage of correct response dropped markedly, but gradually rose as she developed a reversed singular-plural usage. Upon the return to the normal contingencies (Condition III), Janet almost immediately recovered her previously mastered singular-plural usage. On the second measure, it was again demonstrated that productive plural usage was achieved by the third word of Condition I. The disruption of plural usage and acquisition of reversed plural usage is again shown in Condition III.

To the irregular probe items, Janet consistently added an "s" to the end, e.g., "mans". For the probes that required an /ez/ sound for pluralization, Janet simply repeated the singular label.

Experiment two was arranged when it was noticed that, with one exception, the items used in experiment one had labels that ended in a consonant. Session 45 was made the first session of a second experiment aimed primarily at examining the possibility that the terminal sound of a label could affect Janet's ability to use its singular and plural forms correctly and productively.

The basic procedures of presenting items and scoring Janet's responses to them were identical to those used in experiment one. The major variations were the nature of the label endings used, their choice from previous parts of experiment one, or their presentation in trios instead of pairs.

Item labels with terminal vowels were presented in Conditions IV, VI, and VIII. Item labels with terminal consonants were presented during Conditions V and VII. The final four sessions of Condition V were used for the presentation of words mastered in Condition II,
when the reversed plural rule had been learned. The words chosen were ones that Janet had pluralized according to that reversed rule without error. During Stage 3 of the four final sessions of Condition VII, trios of objects were presented interspersed with the usual pairs, approximately half of the time.

A comparison of those conditions involving terminal consonants with those conditions involving terminal vowels suggests that the terminal sound of a label did affect Janet's performance in the productive differentiation of its singular and plural usage. She achieved errorless performance on 26 of the 32 items with terminal consonants, but on only 8 of the 20 items involving terminal vowels.

On those words which she had previously learned under the reversed plural usage, Janet responded according to the conventional pluralization rule. When the trios of objects were interspersed with pairs of objects, Janet showed errorless performance.

Guess et al. (1968) conclude that the productive use of plurals can be taught to a severely retarded child through imitation and differential reinforcement. The acquisition of conventional plural usage in Conditions I and III and its reversal in Condition II provide strong evidence that it was the experimental manipulations which were responsible for that acquisition.

Sailor (1971) noted Janet's differential responding to labels ending in consonants vs. labels ending in vowels (Guess et al., 1968). He studied the extent to which differential reinforcement from an adult model could control the acquisition of appropriate or inappropriate plural allomorphs by two retarded children.
A screening procedure tested the subject's ability to produce the component allophonic sounds, and subjects were selected on the basis of their articulation ability on these components as well as on their demonstrated absence of plurals.

Both subjects began the experimental procedure with reinforcement training to establish the plural response class. Sessions were held twice per day, once in the morning and once in the afternoon, and lasted 30 minutes. Stimuli for the study consisted of various small objects held up in front of the subject either one at a time or as a pair of the same objects. The order of object presentation followed the three stage sequence used by Guess et al. (1968).

A VR3 schedule of reinforcement was established during the second and third stages of object training about midway through both conditions with both subjects, to enable the insertion of unreinforced probe objects within each condition. Each subject received two experimental conditions, which were defined by the type of plural noun ending to which the subject was exposed on the training list.

In Condition I, Subject 1 received initial training on a list of objects which required the /-z/ plural allomorph according to the rule of English morphology. Criterion was at least 10 consecutive objects on which the subject made correct "plural shifts", that is, a correct plural response to the first pair of objects presented in Stage 2 of training. After the criterion of at least 10 plural shifts, a series of probe objects was intermixed with the training list objects. In order to insure that the subject knew the names of the probe objects, they were trained in the same manner as training
list objects in the first stage. During Stage 2, multiples of probe objects were simply presented for five seconds and withdrawn with no reinforcement or training given. Probe objects for Condition 1 for Subject 1 consisted of objects requiring the /-s/ plural allomorph according to English morphology. Probe objects were presented in the same manner as the training objects in the second stage. Probe objects were presented on alternate trials after criterion had been reached and consisted of 3 replicates of 12 probes for a total of 36.

In Condition 2, the training and probe lists were interchanged. Subject 1 was trained on a list of objects calling for /-s/ plurals and probed with objects calling for /-z/ plurals. Otherwise the procedure was exactly the same as for Condition 1.

The procedure for Subject 2 was exactly the same as for Subject 1 except that Subject 2 was trained on /-s/ ending words in Condition 1 and /-z/ ending words in Condition 2 to counter-balance for possible effects of the initial training list.

Reliability was determined by having two speech pathologists rate tape recordings of the subjects’ responses to probe words for the presence of the /-s/ or /-z/ allomorphs. The raters performed independently and conditions, as well as words within conditions, were scrambled and presented to the raters in random fashion. Only those words on which the raters were in agreement about the allomorphic endings were used in evaluating the hypothesis. The reliability for Subject 1 was 100%, and for Subject 2 was 98%.

The data show that, in Condition 1, Subject 1 made 25 plural responses to the 36 probes, all of which used the inappropriate /-z/
allomorph; Subject 2 made 32 plural responses, all of which used the inappropriate /-s/ allomorph. These results clearly indicate generalization of responding.

In Condition 2, Subject 1 was trained on /-s/ ending words and probed for inappropriate generalization to /-z/ ending words. Subject 1 made a plural response to all 36 objects and all 36 had the /-s/ allomorph. Subject 2, trained on /-z/ ending words and probed for inappropriate generalization to /-s/ ending words, made a plural response to all 36 objects and all had the /-z/ allomorph.

Sailor (1971) notes that many of the words that made up the probes for Condition 2 for both subjects were from the same list of stimulus objects that had been presented to them as training objects in Condition 1. He concludes that the effects of immediate plural training override the effects of previous training in producing a stable and reliable generalized response class.

Schumaker and Sherman (1970) taught three retarded children to produce past and present tense forms of verbs in response to verbal requests. These children were chosen because, when questioned, they emitted appropriate phrases about their environments with approximately correct articulation of words but did not exhibit the proper use of regularly-formed past tense verb forms.

In English, three types of regular endings or inflections can be added to verb stems to form the simple past tense, depending on the sound that terminates the verb stem. Verb stems ending in most voiceless phonemes (/p/, /k/, /f/) require a /-t/ inflection to form the past tense, e.g., stopped. Verb stems ending in voiced phonemes
other than /d/ require a /-d/ inflection, e.g., climbed. Verb stems ending in either /t/ or /d/ require a /-d/ inflection, e.g., painted and graded.

During the initial phases of this study it was found that the production of the past tense form /-d/ following the voiceless /t/ had to be taught separately from the /-d/ ending following the voiced /d/. Because of this, two distinct behavioral classes were defined within the /-d/ inflection for this experiment. They are referred to as the "ted" class and the "ded" class. The remaining two classes are referred to as the "t" class and the "d" class.

Schumaker and Sherman (1970) note that as the formation of the present progressive tense is completed through the addition of the same inflection, "ing", to all verbs, it was questionable whether several behavioral classes existed within this formation. On the assumption that these classes might exist, four classes were designated to correspond to the four past tense classes. The classes were: -ing following stems that end in the voiceless /t/, e.g., painting; -ing following stems ending in the voiced /d/, e.g., grading; -ing following all other voiceless phonemes, e.g., baking; and -ing following all other voiced phonemes, e.g., playing. These classes are referred to as the "ting", the "ding", the "ing (t)" , and the "ing (d)" present tense classes, and they correspond respectively to the "ted", the "ded", the "t" and the "d" past tense classes.

The verbs chosen were only those that were included in the above mentioned classes. No irregular forms were used. Care was taken to choose as many non-rhyming verbs as feasible.
Subjects came to the experimental room once or twice each day, depending on their individual class schedules. On arrival, the subject chose an item to earn during the experimental session from an array of small toys and penny candy. The subject was told how many tokens it would cost to buy the item, and the tokens and the chosen items were placed on a table and the session began. When the subject had earned all of the designated chips, he traded them for the item and the session ended. Experimental sessions lasted approximately 30 minutes.

There were two types of experimental sessions: training sessions and probe sessions. Each subject was trained on a verb in both its past and present tense form until a criterion performance was reached. Then the subject was probed to determine if this training had generalized to the production of the two tenses in untrained verbs. Another verb was then trained and the subject probed again for generalization of this training. This sequence was repeated throughout the whole experiment.

In the training sessions, the subjects were trained not only to discriminate when to use the past or the present tense of a verb in response to verbal cues, but also to use the classes of inflections within each of these tenses. In general, the subjects were trained on verbs within one class of inflections, next on verbs within another class of inflections, and then on a discrimination between verbs of these two classes. When one class was being trained, only one verb from that class was employed in each training session. When discrimination between two classes was being trained one verb from
each of these classes was employed in each session.

The basic format of all training with one of the subjects, Jimmy, consisted of the experimenter presenting a verb by saying, for example, "Now the man is painting. Yesterday he . . .?" The subject could correctly respond to this by saying, "Yesterday he painted." Verbal praise and a token were given after each correct response in the training sessions. Incorrect responses were followed by "No, that's wrong" and a five-second period of silence, after which the same stimuli were presented again. If the subject did not respond within five-seconds of the experimenter's request, the stimuli were presented again. If the subject failed to respond correctly after four successive presentations of the same stimuli, the experimenter modeled the correct response. The subject received praise and a token for correctly imitating this response. A variation in the form of presentation was used with the other two subjects, Patty and Ruth, because they seemed unable to discriminate between the cue words, "Now" and "Yesterday". The form of stimulus presentation was shortened. For example, presentation of the word "paint" became, "Paint. Yesterday . . ." for the past tense and, "Paint. Now . . ." for the present tense. These two subjects could correctly respond to these presentations by saying, "Yesterday, painted" and, "Now, painting", respectively.

During training sessions, requests for the past tense and for the present tense were randomly sequenced in a nonalternating pattern. Training of both tenses continued until the subject met criterion performance. When training the first two or three verbs within a new
condition, subjects were initially given a series of 10 requests for the past tense form, then a series of 10 requests for the present tense form. The number of consecutive requests for each form was then gradually reduced until the sequence was random.

A probe session followed every training session in which a criterion was met. In the probe, previously trained verbs were interspersed with untrained (probe) verbs from each of the four classes of inflections. The same stimulus presentation form was used as in the training sessions. After each criterion training session, the newly trained verb plus verbs previously trained within the same class of inflections were randomly interspersed among the probe verbs on an average of one trained verb for every probe verb. For each probe session, the probe verbs were newly randomized.

Different consequences followed probe session responses to trained and untrained verbs. Correct responses to trained verbs produced verbal praise and a token. Incorrect responses to trained verbs produced, "No, that's wrong", followed by five-seconds of silence, after which the same stimuli were represented. This was repeated until the subject produced a correct response. All responses to untrained verbs were followed by a short period of time in which the experimenter looked down at the recording sheet and recorded the response.

Each of the subjects' responses during training and probe sessions was written down by the experimenter. A response to either trained or untrained verbs was scored as correct if it was inflected according to the morphological rules of spoken English. All other
responses were scored as incorrect.

Tape recordings of the probe sessions were independently scored by two research assistants to estimate the reliability of the experimenter's recording. The reliability scores ranged between 94% and 99%.

The experimental design involved multiple baselines, one for each of the four classes of inflections, running through several experimental conditions. The basic design was to train a series of verbs from one class (Condition I), next to train a series of verbs from a second class (Condition II), next to train a series of verb pairs, one verb from each of the first two classes (Condition III), and so forth. The data show that, in general, large initial increases in correct responses to untrained verbs occurred only when other verbs from that class were trained.

Schumaker and Sherman (1970) conclude that the performance of the three subjects indicates that the generative use of verb inflections can be taught to retarded children through the use of imitation and differential reinforcement. They also note that current training conditions appeared to override past training such that verb stems that previously had been inflected correctly were now inflected with a new form currently being trained. These results are similar to those obtained by Sailor (1971).

Wheeler and Sulzer (1970) taught a boy, variously diagnosed as brain damaged, autistic, and retarded, to use a particular sentence form to describe a set of standardized pictures. The stimuli consisted of 13 picture cards from the Peabody Language Development Kit.
Seven of the cards were selected for use throughout all experimental phases. Five of these cards were selected for training. Two cards were selected for generalization trials. The remaining six cards, the test cards, were to be presented only during the first baseline phase of the experiment and during the last part of the final phase.

The seven cards could be adequately described by a particular sentence form (Form I), which was defined as including the article "the" followed by a noun subject, followed by a verb phrase consisting of the auxiliary verb "is" and a present participle, followed by an object phrase consisting of the article "the" and a noun object. A second sentence form, Form II, was defined as consisting of the same key words presented in the same order as in Form I, but omitting the article "the" and the verb "is".

The experimental manipulations took place during the first 10 minutes of each 30-minute speech training session. Sessions were held four days a week. Reinforcement during all types of training consisted of the immediate presentation of tokens. When four tokens were accumulated, Tod was allowed to count them out into the experimenter's hand in order to gain access to one of several toys in the room, have something to eat, or be tickled or rocked by the experimenter. Each back-up reinforcement period lasted for 30-seconds after which work was resumed.

The initial baseline phase lasted four sessions, during which all 13 cards were presented. The trainer presented each card by holding it up and saying "What do you see?" No other instructions were given and no reinforcement was available.
During the five sessions of the first training period, Tod was trained to use the Form I response on the five training cards. The Form I response was treated as a three-component chain. The correct completion of each component was the discriminative stimulus for the beginning of the next, and completion of the terminal component resulted in the delivery of reinforcement. If Tod failed to use Form I in any component of his response, he was stopped and given an imitative prompt for the missed component. He was then required to emit the Form I response before he was allowed to go on to the next component or to receive reinforcement. No shaping by successive approximations was ever used in the training because imitative control over Tod's verbal responses was good enough that an imitative prompt delivered after a wrong response reliably occasioned the correct response.

The two generalization cards were presented throughout this phase, but without any prompting or reinforcement. Thus, baseline conditions were maintained with these two cards throughout the phase.

In the next phase, baseline conditions were reinstated for six sessions. Then, the Train Form I conditions were repeated for seven sessions. There was a return to training for the five training cards, and a continuation of baseline conditions for the two generalization cards.

Form II sentences were trained in the next phase, which lasted five sessions. Training was conducted on the five training cards, and baseline conditions continued for the two generalization cards.

In the last phase, Train Form I conditions were repeated. This
phase lasted 11 sessions. Training was conducted on the five training cards, and baseline conditions continued for the two generalization cards. The six test cards that had not been presented since the original baseline were presented as a post-test without any prompting or reinforcement during the eighth, ninth, and tenth sessions of this phase.

Reliability checks were made during the first and second baseline phases, during the first and third Train Form I phases, and during the Train Form II phase. A total of seven checks were made, and the percentage of agreements ranged between 88% and 100%.

For both training and generalization cards, correct Form I responses increased from a range of 7% to 33% during baseline to 83% and 100% respectively by the fifth session of Train Form I. The next two manipulations produced little effect. The Train Form II manipulation produced a large and rapid drop in the use of the Form I response. Recovery of the use of Form I on both training and generalization cards was rapid upon the return to the Train Form I condition. For the six test cards, performance improved from a mean of 21% during baseline to a mean of 67% during the final Train Form I phase.

Wheeler and Sulzer (1970) feel that their study demonstrated that a complex verbal response could be trained in a speech-deficient child, that the response was measured with an acceptable level of reliability, and that the response generalized to untrained and novel stimuli. They conclude that the experimental manipulations demonstrated that the training procedures, a combination of chaining,
imitative prompting, and differential reinforcement, were the crucial factors in the development of the response.

Garcia, Guess, and Byrnes (1973) also studied the development of a syntactical form with a severely retarded child. Sue was non-verbal initially, but she had completed an intensive imitation training program before this study began. The training resulted in a small verbal repertoire consisting primarily of single word labels. She was seen five days a week in 10- to 15-minute sessions. During the sessions, two adults were present; one acted as a model and the other as the experimenter. Sue was seated at a table next to the model, and the experimenter sat at the end of the table closest to Sue. Primary reinforcers consisted of such sweets as pieces of cookies and candy.

In a pretraining session, an experimental check of phrase and sentence production was completed. Sue was shown a number of objects used later in the experiment and was asked "What do you see?" as each item was presented. Sweets were noncontingently dispensed on a variable interval (VI) 30-second schedule during this session.

In Experiment I, experimental sessions consisted of both imitation training trials and probe trials. During training trials, the experimenter showed an object to both Sue and the model, and asked the model, "What do you see?" After a response from the model, the experimenter asked Sue the same question. Sweets and verbal praise were delivered on a VR2 schedule for imitation of the model. If the subject failed to imitate the model correctly, or did not respond at all, the experimenter waited 10 seconds before going on to the next
trial. Each session contained 20 training trials and all trials had the same item. The model's responses during training trials varied systematically over two conditions. In Condition 1, the model responded with the singular declarative sentence "That is one ____." In Condition 2, the model responded with singular word label appropriate to the item displayed, e.g., "hat". A reinstatement of Condition 1 followed Condition 2. There was no interaction between the experimenter and the model other than the question-answer interaction. Interaction between the subject and the model was minimal.

Probe trials were intermixed between imitation training trials. For probe trials, the experimenter displayed an item to Sue and asked "What do you see?", without a preceding response from the model. No consequences were scheduled for probe responses. There were two types of probe trials. (a) Probe trials that made use of trained items were intermixed among training trials each session. They consisted of two probe trials that displayed the item used in training trials during that particular session, and an additional number of probe trials that displayed, singly, those items used in training trials of previous sessions. The number of these additional items varied between zero and four, depending on the number of previously trained items. These probes measured the transfer from imitation of the model to labeling of an object, with two measures, the same item receiving training, and other items not receiving training. (b) Probe trials that made use of untrained items were intermixed among the probe trials and training trials in the last session of each condition. These probes consisted of six items, each individually dis-
played twice. In all cases, probes were intermixed among training trials such that a probe trial was always preceded and followed by a training trial.

The model scored all responses. Reliability measures were taken from recorded tapes of the session. An observer listened to a random selection of sessions, with at least two sessions from each condition. Reliabilities for imitation training trials and probe trials were 98% and 88% respectively.

The results indicate that Sue's imitation of the model was uniformly high in all conditions. The probe data indicates that in the pretraining session, all items were labelled in the singular word form. During Condition 1, Sue responded with high level of correct sentence usage for both types of probes. During Condition 2, there was a decrease in the use of sentences for both types of probes to 0%, and an increase in the use of single word labels during probe trials. When Condition 1 was reinstituted, there was an increase in sentence labels for each type of probe, and a concurrent decrease to 0% in single word labelling. Garcia et al. (1973) note that singular sentence and singular word labeling were brought under experimental control, and that the control was extended to the labeling of items not immediately preceded by a model's responses and also to items that were never labelled by the model.

Experiment II replicated Experiment I by investigating the development of a simple declarative sentence in plural form with the same subject. Only two changes were made in the training procedure designed for Experiment I. Pairs of items were now displayed in all
trials and the model's response was either the plural sentence form or the single word plural form. The training items were those used in Experiment I.

Reliabilities for training trials and probe trials were 92% and 84% respectively. Initially, Sue's imitation was low, but increased rapidly from zero per session to the maximum of 20 per session in the first six sessions. Consequently, imitation was high in all conditions.

The data indicate that during the pretraining session, Sue did not use any plural labels. In Condition 1, plural sentence responses increased to above 80% for both types of probes. Single word plurals remained at 0%. In Condition 2, plural sentence responses for both types of probes returned to 0%, while, concurrently, single word plural labels increased to above 70% for both types of probes. Re-instatating Condition 1 resulted in an increase in plural sentence responses for each type of probe and a decrease in one-word plural labels to 0%. Garcia et al. (1973) note that the results of Experiment II replicate the findings of Experiment I: the use of a specific plural sentence label and single word plural label were brought under experimental control.

Neither of the two previous experiments examined the function of the scheduled consequences for imitation of any specified labelling response. Experiment III was designed to determine if the modeling of the response alone might have the same effect as modeling and reinforcement.

The training items used in the previous experiments were also
used in Experiment III. A second model was introduced into the experimental setting. Each session consisted of 20 training trials in which the experimenter held up a single object and directed the question "What do you see?" first to one model, then to the other, then to the subject. Which model was asked first on each trial was determined randomly. Model I answered "That is one ___." Model II answered "These are two ___ sa." The plural label was overemphasized because Sue had an articulation problem.

There were four conditions in this experiment. Premeasure (baseline), during which all items were displayed to Sue twice each without any response from the models, and sweets were delivered on a noncontingent VI 30-second schedule; Condition I, in which consequences were provided for singular sentence imitation, that is, imitating Model I; Condition 2, in which consequences were provided for plural sentence imitation, that is, imitating Model II; and a reinstatement of the Condition I contingency.

The probe technique was similar to that used previously. During a probe trial the experimenter displayed an object and directed the question "What do you see?" to Sue without any previous response from the models. During each session there were six probe trails consisting of displays of those items used either presently or previously in imitation training trials. When Sue had met 70% correct imitation criterion on a item being trained, 12 additional probe trials were inserted in the succeeding session. These probes used the same never-trained items used previously.

Data were recorded by both models and their trail-by-trial
agreement was used to compute interobserver reliability.

Reliability between the two models ranged between 80% and 100% with a mean of 96.4% for training trials, and 67% to 100% with a mean of 86.5% for probe trials.

During reinforcement for singular sentence labelling, a gradual increase was seen in Sue's singular sentence labels, with a concurrent decrease in plural sentence labelling. In Condition 2, there was a gradual increase in plural sentence labels accompanied by a gradual decline of singular sentence labels. Reinstating Condition 1 resulted in an increase in the singular sentence labels and a decrease in plural sentence labelling.

In the premeasure session of probe labelling, Sue responded only with plural sentence responses to both types of probes. In Condition 1, there was a shift in probe responding from plural sentence labelling to singular sentence labelling. Concurrently, plural sentence labelling decreased to 0% for both probe types. In Condition 2, plural sentence responding reached 67% for trained items and 58% for untrained items, while singular sentence responding decreased to 0%. With the reinstatement of Condition 1, singular sentence labelling reached a high of 83% for trained and 75% for untrained probe items. Plural sentence responding decreased to 0%.

Garcia et al. (1973) feel that these data demonstrate the function of the reinforcer in controlling selection between the sentence behavior of two models and suggest its importance in the generalized use of that sentence structure. They state that the cumulative results of these studies indicate the experimental development and con-
trol of simple syntactical usage, and that this usage was shown to generalize beyond those items specifically trained. They note that when the teaching technique of modeling and differential reinforcement of imitation combined as one procedure was applied, accompanying control over non-trained exemplars of the trained behavior was also demonstrated.

The practical implications of these results are, they feel, apparent: "training a specific example of syntax leads to additional uses of similar syntax under conditions not specifically trained" (p. 309-310).

The studies discussed here provide strong evidence that productive speech behaviors can be trained in such a way that they become generative. This supplants the finding that receptive speech behaviors can also be trained as generative response classes. Together, these findings suggest that perhaps a great many speech behaviors may be conceptualized and trained as response classes.

Wheeler and Sulzer (1970) feel that "much of language other than imitative responses can be at least theoretically analyzed in terms of the response class model" (p. 140). It is not entirely clear, however, why Wheeler and Sulzer (1970) wish to exclude imitative responses. Indeed, several of the studies presented earlier in the examination of the phenomenon of generalization of imitative responding demonstrate that imitative responding can indeed meet the definition of a response class, viz., "A generalized response class exists when all responses in the class show an effect of a manipulation... which is made in relation to only a few members of the class"
It is concluded, therefore, that imitation can be taught in such a way that it, too, becomes a generative response class.

The studies of generative response classes reviewed above have treated receptive and expressive skills independently, while, as Guess (1969) notes, a "commonsense analysis would suggest that receptive language is highly influential in the development of productive speech" (p. 55). If this in fact is true, it would behoove the teacher of speech to language handicapped children to begin with receptive training.

Guess (1969) conducted a functional analysis of receptive language and productive speech with two retarded children. He selected the acquisition of the plural morpheme as the class of behaviors to be studied. The subjects were screened to determine that each did not already have a plural concept, and that he could articulate the phonemes /s/ and /z/, which were necessary to express plural words. Bob's expressive speech was characterized by the use of single words and short, simple phrases. Ken was quite verbal and often used simple sentences.

The study was performed in a small, soundproof room connected by a one-way mirror to an adjoining observation room. The subject was seated at a table directly across from the experimenter. Each session was taped to allow later verification of scoring.

Pre-training procedures, in which the children were taught a size discrimination, were used to establish an intermittent reinforcement schedule (VR3). This was done to accommodate unreinforced
probes used in subsequent sessions. Chips were used as reinforcers for correct responses. They were redeemed at the end of each session for a variety of sweets and/or small toys.

In Condition I, receptive auditory training of the singular-plural word dimension followed the establishment of stable performance on the VR3 schedule of reinforcement. This training followed the three stage sequence used by Guess et al. (1968) and by Sailor (1971). Criteria on all three stages had to be met before the next object was introduced. Each new object thus required its own training series. As many as four objects were presented during some sessions. A pool of 30 different objects was used for this training. Most objects were represented by one or two syllable words.

A verbal probe for plural acquisition was given at the end of the training series for each object. For this probe, the subject was presented the object(s) of the preceding auditory training series and the object(s) to be used for the subsequent training series. The subject was first shown the single object used in the prior training task and asked, "What do you see?" He was then shown a pair of those objects and the question was repeated. The subject was then presented with the object(s) to be used in the subsequent training task in the same manner. The subject's responses to these probes were not reinforced. The child was corrected only if he mislabeled the single object.

In Condition II, productive plural training took place. Instead of pointing to the object(s), the child was required to respond verbally with their singular or plural labels. The sequence of present-
ations was identical to that used in Condition I. The subject was shown either one or a pair of objects and asked, "What do you see?" The same criteria were required for correct labeling responses. There were no probes of any sort.

For Condition III, reversed receptive plural training was conducted wherein reinforcers were delivered for pointing to a single object when given its plural label and for pointing to the pair of objects when presented with their singular label. Expressive plural probes were used as in Condition I.

Condition III was followed by training sessions that reversed the children's receptive singular-plural responses and left them with a normal use of singulars and plurals at both the receptive and expressive levels.

Performance of the two subjects indicated that their receptive comprehension was functionally independent of their expressive speech in the grammatically productive acquisition of the plural morpheme. In Condition I, the auditory discrimination of singular and plural words, while grammatically generative, did not generalize to the productive speech of either subject. In Condition III, each subject continued to correctly use singulars and plurals in the unreinforced expressive probes while, at the same time, they were receptively reversing their pointing response in answer to singular and plural labels from the experiment. Guess (1969) concludes that the study suggests that receptive language and expressive speech can be two separate and functionally independent classes of behavior.

Guess and Baer (1973) note that the Guess (1969) study was not
competent to demonstrate that training one language repertoire, either productive or receptive, would not facilitate acquisition of the other repertoire, even though there was no direct generalization from one to the other. In Experiment I of their study, Guess and Baer (1973) examine whether a plural rule would generalize between two language modalities, receptive and productive, if both modalities were being maintained and extended simultaneously. Experiment II was to determine how to produce appropriate generalization if it failed to emerge, or how to analyze any appropriate generalization that did occur.

Four severely retarded children were selected as subjects. A pretest established that each subject was able to label objects and articulate the -s and -es sounds necessary for plurals, but did not display already generalized plural usage at either the receptive or productive level.

The study was conducted in a small soundproof room connected by one-way mirror and intercom system to an adjoining observation room. All trials requiring a verbal response from the subject were tape recorded to allow later verification of scoring. A small store, located across the hall from the experimental room, contained numerous commodities which served as back-up reinforcers that could be purchased with tokens earned in the sessions.

The training materials used were 74 trios of identical objects. Forty sets of objects required -s endings in the formation of plurals; 34 sets required -es endings. Training sessions were held each weekday except for occasional unavoidable absences of the sub-
jects and experimenters. In general, each session lasted 30 minutes. Each successive object trained was a new one, not previously used in training, until the 40 objects requiring -s-ending plurals and 34 objects requiring -es-ending plurals were exhausted. Then the objects were re-used in the same order; these cycles were repeated until the end of the study. Evidence of generative plural usage was examined before the lists were repeated.

The basic experimental procedures consisted of concurrent training of both speech (labelling) and receptive comprehension (pointing) as separate training baselines. Training in one modality was restricted to objects requiring -s-endings for pluralization; training in the other modality was restricted to objects requiring -es-endings for pluralization. The procedures for receptive plural training were identical for items requiring either -s or -es pluralization. Training followed the three stage sequence used by Guess et al. (1968), Guess (1969), and Sailor (1971) for each object involved. The procedures followed for productive training were identical for objects requiring either -s or -es pluralization. Productive plural training followed a three stage sequence similar to that used for receptive plural training.

Possible generalization of either type of training to the other modality within the same plural-ending baseline was measured by repeated probes interspersed among training trials within each training baseline. These probes were presented in the response modality opposite to the one being trained in that baseline. Thus, if an object had been trained productively (as a label), the interspersed
probes demonstrated any generalized receptive (pointing) response to that object and a new one. Receptive probes were administered in a manner identical to receptive training trials, but without any reinforcement of correct responses, correction of incorrect responses, or repetition after no response. Similarly, productive probes were presented exactly as for the productive training trials, but again without reinforcement, correction, or repetition.

Two subjects were trained to use -s-ending plurals productively and respond to -es-ending plurals receptively. For one of these subjects, the first item of each session was taught productively, and the second receptively, alternating thereafter. For the other subject, the reverse order was used. The remaining two subjects were trained to use -es-ending plurals productively and respond to -s-ending plurals receptively. For one of these subjects, the first item of each session was taught productively, and second receptively, alternating thereafter. For the other subject, the reverse order was used.

The results indicate that despite the fact that the subjects had learned near-perfect generative pluralization rules concurrently in both receptive and productive modalities, and were receiving reinforcement for maintaining these rule-bound behaviors, as a group they showed relatively little tendency to generalize these rules across those modalities. For these subjects, automatic generalization across modalities in either direction remained more the exception than the rule.

In Experiment I, one subject, Gary, showed clear generalization
of training rules to probes of the same rules in opposite modalities, while the other three subjects, David, Dan, and Kevin, showed partial, weak, or no such generalization.

In Experiment II, the same four baselines were observed within each subject as were observed in Experiment I. In Experiment II, however, whenever probe performances failed to show generalization of the trained rules, correct responses to the probes were reinforced to see if the desired level of performance could be separately produced, and if so produced, whether it would remain stable when the responsible reinforcement of the probe responses was discontinued. When probe performances showed generalization of the trained rules, the probes were separately treated to see if the generalization could be separately undone, and if undone, whether it would be recovered after the contrary reinforcement of the probe responses was discontinued. Otherwise, experimental procedures remained identical to those used in Experiment I.

For David, Dan, and Kevin, the desired performance was produced by temporarily reinforcing correct responses to the probe, following exactly the same procedures used in training trials. For Gary, an analysis was made of the durability of his generalization by temporarily reinforcing incorrect probe responses. Specifically, a reversal of the pluralization rule was taught for these probes. These reinforced reversals of each of the two types of probes were conducted at separate times during the study, so the success of modifying each could be evaluated separately, and so that any effects of undoing generalization in one case could be observed on the current general-
ization for the other case. Otherwise, the training procedures used in these reversals of correct responses were identical to those used in the training baselines.

Reliability was uniformly high across all conditions and subjects, varying between 94% and 100%, with a mean of 99%.

The results indicate that the three subjects who showed only partial or no generalization were trained to a high and durable level of correct response in probe trials, and thereby were made to resemble the fourth subject who did show generalization at the end of Experiment I. It was further shown that the range of individual differences in performance could be either produced or eliminated by appropriate reinforcement.

Overall, it was seen that while the within-modality performances were generative, there was little or no cross-modality generalization. Guess and Baer (1973) conclude that while generalization between the two modalities can occur, it "by no means is an 'automatic' phenomenon" (p. 328).

The results of the Guess and Baer (1973) study are in some ways similar to the results of Garcia et al. (1971) who found that the generalization of imitative responding occurred only within topographically determined boundaries. The practical implication of these findings is that the generalization of a learned response cannot be expected to happen on its own. Generalization, whether within a response class, to different trainers, or to different environments, must be an integral part of any speech development program, and, apparently, each of these different types of generalization must
be individually programmed.

Complex Language Behaviors

The majority of the studies discussed above are concerned with the development of simple, basic verbal behaviors. While these basic skills can be of great value to the severely language handicapped child, the ability to utilize more complex speech behaviors would allow the child to appear more normal, and increase the probability that he would be able to engage in more normal social intercourse.

One of the common strategies in developing more complex speech behaviors is to extend the procedures used to establish a naming vocabulary to develop the use of short phrases. Risley and Wolf (1967) note that this expansion frequently occurs without explicit training. Where training is needed, the same procedures as used to teach individual words are employed (Hartung, 1970; Risley & Wolf, 1967; Sloane et al., 1968). Bricker and Bricker (1970b) and Sulzbacher and Costello (1970) suggest the use of "pivotal" phrases. These are usually two word utterances, one word of which comes from the naming vocabulary, while the other word denotes some function or action, such as "want milk", "want doll", "go out", "go potty", etc. The first step in establishing pivotal phrases is the selection of a group of pivot words which can be sequenced with a number of other words. It is suggested that the words selected as pivot words be ones which will be maximally useful to the child in his day-to-day environment. Then the child is taught to say the two word sequences. The use of phrases is quickly introduced to the child's day to day
environment to promote both their functional value to the child and their generalization (Bricker & Bricker, 1970b; Hartung, 1970; Risley & Wolf, 1967; Sloane et al., 1968; Sulzbacher & Costello, 1970).

The ability to answer questions is a skill which is used daily by most people, and is, therefore, of considerable importance. Several methods have been reported successful in developing a question answering skill. In general, these techniques rely on the child having a verbal imitative repertoire and on differential reinforcement and fading techniques. In one method, the child is first taught to imitate the question and the answer, e.g., "How are you? Fine." Then the question is faded by lengthening the time between the question, "How are you?" and the answer, "Fine", to more than five seconds. The child will frequently anticipate the response and say, "Fine" before the trainer prompts a response. Prompts, if needed, are quickly faded (Hartung, 1970; Risley & Wolf, 1967). In a variation on this technique, Bricker and Bricker (1970b) use a probe, e.g., "How are you? Say _____", to cue the child to respond. When the child does spontaneously say, "Fine", the prompt, "Say" is faded. A second technique involves presenting both the question and answer, while emphasizing the answer, e.g., "How are you? FINE." This added emphasis is soon faded (Hartung, 1970; Hewett, 1965). Freeman, Ritvo, and Miller (1975) suggested a procedure in which the trainer presented the answer to the question followed by the question. After the child had imitated the answer but before he could imitate the question, he was reinforced. Then the question alone was presented,
These authors report that on a pretest measure, the subject inappropriately imitated the question on 73% of trials, while on a posttest, this was reduced to 3%. The basic criteria for selecting a method are the capabilities of the subject and the capabilities of the trainer. Tramontana and Shivers (1971) and Tramontana and Stimbert (1970) report on procedures used to develop a question answering skill with two subjects who were precocious readers. The procedure involved presenting a verbal question and a written response. The subjects would read the responses and be reinforced. The visual prompts were later faded. Once established, the question answering behavior is introduced into the child's day-to-day environment as quickly as feasible (Risley & Wolf, 1967).

The procedures used in developing the use of phrases and question answering have been combined to develop the use of simple sentences (Garcia et al., 1973; Risley & Wolf, 1967; Wheeler & Sulzer, 1970). Stevens-Long and Rasmussen (1974) developed the generative use of four different types of sentences to describe pictures in an autistic child by the use of imitation and differential reinforcement. The authors used an ABAB design to demonstrate the importance of contingent reinforcement in maintaining the child's responsiveness. During training, the child was required to give two simple sentences describing a picture in response to the question, "What do you see?" After the second training phase, the child was taught to say "and" between the first and second sentences, thereby producing a compound sentence. These results were replicated and the generative nature of the sentences demonstrated by Stevens-Long,
Schwarz, and Bliss (1976). Garcia (1974) used imitation and differential reinforcement in a procedure similar to that used by Garcia et al. (1973) to teach a conversational speech form to two nonverbal profoundly retarded children. Each of three simple sentences was taught individually to the children; then these sentences were chained together with experimenter supplied cues, viz., the experimenter displayed a picture and the child asked, "What is that?"; the experimenter said, "This is a (label); what do you see?", and the child replied, "It's a (label)"; the experimenter asked, "Do you want the (label)?", and the child replied, "Yes, I do." This response pattern was shown to be generative; it also generalized to different experimenters in different settings after the use of an "intermix" procedure similar to the probe procedure of Garcia et al. (1973).

Stevens-Long et al. (1976) note that their subject began to use the sentence forms he had acquired during training in his classroom and playground conversations. When the boy was taught the compound sentence form, his teachers reported that he began to describe everyday objects and events using compound sentences. None of the other studies that taught sentence usage reported such spontaneous, i.e., unplanned, generalization. Lovaas (1968) notes that the majority of the children who have been in his program for a considerable time rarely volunteer to speak, that is, there was little indication of spontaneous speech. Lovaas (1968) set out to remedy this, and reports on two procedures he used to increase the probability of spontaneous speech. The first procedure is similar to the methods used in developing the functional use of speech; essentially, the child
receives no reinforcers unless he asks for them. The second procedure is similar to the "games" used by Schell et al. (1967) and Stark et al. (1968). The child was trained to give the adult orders, e.g., "clap you hands", "stand up", "sit down", etc., "which invariably become very reinforcing for the child, generating considerable spontaneity" (Lovaas, 1968, p. 146).

The studies discussed in this section have demonstrated that a variety of complex speech behaviors can be developed in severely language handicapped children via the use of relatively simple operant techniques. It was also shown that, with proper training, these behaviors can generalize to a variety of settings and people, thereby approximately normal language.

Practical Considerations

A number of issues have come to light in the course of the above review which, while not necessarily a part of the training process, have practical implications for training. Some of the more common of these issues will be discussed here.

Training Environment. At the onset of training, a room with limited possibilities for distractions is typically used. Such a setting will be sparsely furnished, usually containing only simple, nonbreakable furniture consisting of chairs for the child and trainer, and a table (Garcia, 1974; Garcia et al., 1973; Hartung, 1970; Hewett, 1965; Risley & Wolf, 1967; Sloane et al., 1968; Stevens-Long & Rasmussen, 1974; Stevens-Long et al., 1976). As noted in the sections on generalization and developing functional speech, behaviors learned in the training environment are introduced to the
child's day-to-day environment as quickly as feasible.

Trainers. Who may effectively serve as a trainer is dependent primarily on the child's repertoire. In children with little or no language skills, the trainer is typically highly skilled (Lovaas, 1968; Lovaas et al., 1966; Risley & Wolf, 1967), with experience in differential reinforcement of successive approximation, prompting, fading, extinction, time-out, and stimulus control, as well as being able to identify reinforcing stimuli (Bricker & Bricker, 1970b).

The use of such highly skilled personnel in the initial training of speech skills restricts the number of children who can receive such training because the number of such skilled personnel is limited. It would be advantageous to have procedures that could be successfully conducted by less highly trained personnel. Guess, Rutherford, Smith, and Ensminger (1970) report the use of two former psychiatric aides, trained as "language developmentalists", in teaching speech behaviors to institutionalized retarded children, and Hung (1976) reports the use of eight regular ward staff in developing verbal imitation in mute retarded children. These two studies suggest that, with relatively simple training, non-professional or paraprofessional personnel may be capable of implementing speech training programs. Hung (1976) notes that "for institution staff to apply the shaping paradigm for vocal imitation training, classification of the various vocal responses as well as objective criteria for differential reinforcement and contingency change are important" (p. 85). He further notes that "a data collection system which will describe and analyze the process of successive approximation is also essential" (p. 85).
That is, the use of paraprofessional personnel requires additional preparation before the speech training program begins.

Cheseldine and McConkey (1979) report on the use of parents as intervention agents with retarded children. The children in this study had repertoires of at least 20 clear words, and were starting to use a few two-word utterances. The development of two-word pivotal phrases was selected as the target behavior. Seven children and nine parents participated in the first part of the study. The parents were given a language objective to use with their child, but no specific instructions as to how they should attain that goal; they were told to conduct at least four 10-minute sessions over one to two weeks, and to tape record the sessions. With these minimal instructions, three of the seven children showed a marked increase in their use of target words. Based on an analysis of the differences in the behavior of the parents of the "improvers" vs. the "nonimprovers", a second experiment was conducted. Three of the nonimprovers participated in the second experiment. Parents of two of the children were asked to continue for four sessions as before. For the parents of the remaining child, the experimenters demonstrated the techniques with the child and discussed them with both parents in one 30-minute session in their own home. The parents were provided written instruction which told them that they should describe what they are doing or what the child is doing (that is, as the behavior was occurring), and model the target sentences or words clearly; that they should give information in the form of statements, rather than as demands or questions; that they should use shorter, less complex
utterances; that they should regulate the amount they talk, to allow
the child a chance to initiate the interactions; and that they should
follow the child's lead, develop the theme of the interaction, and
give appropriate feedback.

The results indicate that only this child showed a marked in-
crease in his spontaneous use of the target words over the four ses-
sions. The authors conclude that by altering parental language
strategies in an appropriate manner, it is possible to produce a
corresponding improvement in the child's language. That is, when the
child already has some degree of language capability, it is possible
for minimally trained individuals to successfully intervene with the
child.

This fact has been implicitly acknowledge by the various authors
who report the incorporation of a child's parents into the training
program once the child has reached some degree of speech proficiency
(Hewett, 1965; Lovaas, 1968; Sloane et al., 1968; Stark et al.,
al. (1968) note that although the mothers of language handicapped
children do not do as skilled a job as professionally trained teach-
ers, they can do an effective job. They further state that although
training a mother initially required a large time investment per
child, this rapidly declined, and they contend that a much higher
yield is returned when an hour of professional time is spent train-
ing several mothers than when it is spent seeing one child.

Another example of the use of "non-professional" in a speech
training program is provided by Hargrave and Swisher (1975) and by
Jeffrey (1972), who used a Bell and Howell Language Master as an adjunct to their procedures. Hargrave and Swisher (1975) worked with a boy who exhibited "autistic" behaviors. During half of the training sessions, a Language Master was placed on the table between the therapist and the child. The Language Master Cards were placed in the machine by the therapist. Peabody Language Development Kit pictures representing the words were used as the visual stimuli in all sessions. The primary reinforcers used were pieces of breakfast cereal, paired with praise. Initially, reinforcement was provided after each correct response, but this was faded until only 10% of correct responses were reinforced. In the first phase, Robbie was required to hand the therapist the picture representing the word spoken. Next, Robbie was required to imitate immediately after the word and picture were presented. In the third stage, he was required to name the picture presented when the therapist asked "What is this?" Training sessions lasted approximately 30-minutes per day, three days a week. The 10 words selected for training were randomly assigned to the two presentation conditions. On days one, three, and five, the stimulus presentation was by live voice; on days two, four, and six, the presentation was made by the Language Master. The pretest, posttest, and follow-up were all administered by live voice, and Robbie was required first to immediately imitate the therapist's model, and then to name the pictures in response to the question, "What is this?" The pre- and posttest measures indicate that Robbie learned to imitate and name the pictures. The data also indicate that Robbie's percentage of correct responses during the Language Master presentation
(mean = 97%) was higher than for the live-voice presentation (mean = 90.66%). The authors report that Robbie became very excited during the Language Master sessions and refused all food reinforcement, whereas he readily accepted food during the live-voice presentations. The results show that his percentages of correct responses were consistently higher with the Language Master presentations.

Jeffrey (1972), working with a retarded girl, used procedures similar to those of Lovaas (1968) and Sloane et al. (1968) to teach the child to reliably imitate a vocalized sound and to name some objects. To help maintain the behaviors she had learned and to help promote generalization beyond the training setting, Judy practiced on a self-managed language program. She was taught how to use the Bell and Howell Language Master by the therapist first modeling how to use the machine and then fading control over to the child until she could operate the machine independently. Use of the Language Master involved a four step sequence. First, Judy looked at the word card and then sent it through the Language Master and orally recorded her response. Second, she sent the card through the machine on the instruct button which played her card back to make the discrimination of whether she had a correct or incorrect response. Fourth, if her response was correct, she placed that card in the "good pile", and if incorrect she placed it in the the "not so good pile". She was taught to go through the same procedure for each card in her pack without the therapist being in the room. This procedure was started after Judy had established a high rate of vocal imitation; it was continued one to three times a week for about 10-minutes duration.
throughout the treatment phase. Unfortunately, this report is in the form of a case study, and no information is presented on the relative contribution of this technique; nor is there any data indicating that the child did, in fact, follow the prescribed procedure.

These two studies suggest that it is possible to use electronic/mechanical devices as an adjunct to the training process, thereby freeing the therapist while simultaneously providing additional practice for the child. While the effectiveness of the technique is unproven, it is of sufficient clinical interest to warrant further study.

Training in Groups. In the vast majority of studies, training has been conducted on a one-to-one basis. Sloane et al. (1968) contend that it "is nearly impossible to maintain precise contingencies when working with a group of children" (p. 99). They note that while there are many well known pressures towards working with groups, such as limited time, they "believe that short individual sessions are of more value than a long group session" (p. 99). Perhaps because of this sentiment, group treatment has rarely been attempted. However, while rare, such reports do exist. Guess et al. (1970) and Rutusnik and Rutusnik (1976) report on training procedures involving groups of students.

Guess et al., (1970) worked with 80 children in four unequal-sized groups; Group 1 received language training and special education, Group 2 received language training only, Group 3 received special education only, and Group 4 received neither language training nor special education. The dependent measures were changes in
test scores on the Stanford-Binet Intelligence Scale and the Illinois Test of Psycholinguistic Abilities. Training was conducted by the two "language developmentalists", mentioned above. The 40 children who participated in the language development program, Groups 1 and 2, were divided into eight classes of five children each. The grouping within the classes was determined by mental age and chronological age, not by experimental group. The four high level classes were taught from the Level #1 Peabody Language Development Kit. The lesson plans for the four low level classes were developed by the trainers and the authors. The only comment on the specific techniques used was that the use of fading and shaping seemed to be the most valuable teaching technique available in achieving the goals set for the low level classes. Tokens were utilized, but the contingencies for their dispensation are not specified. The results indicate that Group 1 did significantly better than Group 4 on the two dependent measures. No other differences were significant. Unfortunately, the information presented in this report is of minimal utility from a practical point of view. Not only are the procedures vaguely specified, but there are no direct measures of the children's progress in the actual training groups.

Ratusnik and Ratusnik (1976) worked with four psychotic children. They note that a "control group was not used in this clinical study. It was felt that withholding services from children who required and might benefit from treatment was impractical and contrary to the basic philosophy of a state mental health facility" (p. 72). The children participated in a one-hour language group pro-
gram twice a week and received individual language therapy for half an hour twice a week. The primary activities presented in the group format included a roll call and calendar task, an interactive language story presented by the clinician, a story presented by the children, and a visual-motor activity. The language story presented by the clinician was composed of syntactic and morphological forms slightly in advance of each child's current level of language usage. At the conclusion of a language story, the children were allowed to manipulate a flannel board and figures to formulate their own stories. Adjuncts to the group program were individual speech and language therapy sessions administered by the speech clinician and carry-over programs implemented by child care counselors, special educators, and parents. Professional staff and parents were provided with specific language modeling suggestions and activities in order to extend the children's communications skills beyond the clinical sessions. Also included in the "therapeutic milieu" were counselors, a school program, medication, and family therapy. The dependent measures were scores on a battery of tests including the Peabody Picture Vocabulary Test, Form B, The Northwestern Syntax Screening Test, receptive and expressive portions, the Stanford-Binet Intelligence Scale, digit span, and the Developmental Sentence Analysis. Also, "an assessment of concept of body image (Goodenough Draw-A-Man) and a nonspeech and language measure of fine motor skills and eye-hand coordination (Beery-Buktenica Developmental Test of Visual-Motor Integration) were used because all four psychotic children presented defects in ego functioning and developmental delays in all areas of
functioning" (p. 75). "Thus, the Goodenough Test was used to measure growth of the ego indirectly through changes in the child's self-concept as reflected in his drawings of human figures" (p. 75). The authors "feel that interactive language story technique in a group setting eliminated the echolalic responses and disordered prosody and also contributed to development of higher level grammatical transformation usage" (p. 90). The data from the repeated measures of the nine dependent variables are quite complex and will not be presented here, but they do not support the author's conclusion. In fact, based on the information presented in this report, the only reasonable conclusion that can be reached is that, over time, the children's performance improved for a reason or reasons unknown.

In each of these studies, the independent measure has been indirect, that is, changes in test scores have been measured, but the actual progress in the training setting had not been delineated. In addition, there was no comparison made between progress in one-to-one training vs. progress made in group training. This lack of information makes it impossible to determine the relative effectiveness of group treatment procedures. Hence the practical utility of group language training for severely language handicapped children remains a moot question.

Reinforcement. The importance of reinforcement in the establishment and maintenance of vocal behaviors was demonstrated in a number of the studies reviewed above (e.g., Butz & Hasazi, 1973). Generally, reinforcement in a speech training program serves two functions: first, it tells the child that he is right, that he has
emitted the desired response; second, it increases the probability that that response will occur again, that is, it strengthens the desired response. A question of some practical import is what to use as a reinforcer. In the studies reviewed above, a variety of materials were reported as the reinforcing stimuli, including a bite of the child's meal (Wolf, et al., 1964), various sweets, such as ice cream, candy, raisins, and breakfast cereals (Freeman, et al., 1975; Jeffrey, 1972; Sailor, 1971; Whitman et al., 1971), and tokens, for which a variety of back-up reinforcers were used, including sweets, games, toys, clothing, books, cosmetics, records, costume jewelry, liquids, and privileges (Baer & Guess, 1971; Bricker & Bricker, 1970a; Guess, 1969; Guess & Baer, 1973; Schumaker and Sherman, 1970; Wheeler & Sulzer, 1970). Risley and Wolf (1967) note that while attention and praise can be used as consequences to strengthen behavior in normal children, such "sophisticated consequences often are only weak positive reinforcers for a severely abnormal child. For this reason food must often be relied upon as a reinforcing consequence for modifying speech and other behaviors of deviant children" (p. 75-76). Lovaas (1968) is substantially in agreement, "Without primary reinforcers, the program would not work with many psychotic children" (p. 150). Risley and Wolf (1967) consider ice cream and sherbet to be, in many respects, ideal food reinforcers because these are generally a favorite food of children, can be eaten in quantity, and disappear rapidly from the mouth. Whatever food reinforcer is used, small amounts are given so that large numbers of responses may be reinforced before the child becomes satiated. Risley and Wolf (1967)
note that for "the most rapid and significant changes in deviant children the necessity of using powerful extrinsic reinforcers, made more effective by sufficient deprivation, cannot be overemphasized" (p. 76).

Tangible reinforcers are never presented alone; they are always accompanied by social reinforcers such as verbal praise. This is done for two major reasons: first, since the delivery of a tangible reinforcer requires some time, the use of the verbal reinforcer allows the trainer to immediately reinforce the correct response while the tangible reinforcer is still in the process of being delivered, that is, the verbal reinforcer bridges the temporal gap between the occurrence of the desired response and the presentation of the tangible reinforcer; second, the continued pairing of the social and material reinforcers serves to strengthen the control that verbal reinforcers have over the child's behavior, thereby smoothing the transition from the artificial appearing primary reinforcers to more normal appearing social reinforcers. Lovaas (1968) notes that is has been possible to shift from primary to secondary reinforcers after two or three months of training. He cautions that early shifts in reinforcers, "such as might be attempted during the first days of training, are invariably accompanied by substantial deterioration in performance, necessitating the reinstatement of primary reinforcers" (p. 150-151).

What may be used as a reinforcer during speech training, simply put, is anything that works, or, perhaps more appropriately, anything the child is willing to work for. Sloane et al. (1968) note that a variety of reinforcers were used during the course of their program,
and that the reinforcers were changed based on what worked. "When a reinforcer no longer 'worked,' new ones were tried until something was found that seemed to exert control" (p. 84). In this respect, it should be noted that the use of tokens as reinforcers has a significant advantage over other tangible reinforcers because the large variety of back-up reinforcers available for use in conjunction with the tokens obviates the problem of a child no longer responding for any one reinforcer; there are always a number of reinforcers from which to choose. (For a more complete discussion of token economies, the reader is referred to Ayllon & Azrin, 1968.)

Controlling Disruptive Behavior. Severely language handicapped children frequently exhibit behaviors which are incompatible with speech training, such as inappropriate vocalizations, temper tantrums, and attempting to leave the training session. One commonly used procedure for controlling such inappropriate behavior is time-out from positive reinforcement (Hartung, 1970; Lovaas, 1968; Risley & Wolf, 1967; Sloane et al., 1968), in which the child is deprived of the opportunity to earn positive reinforcement. Typically, such a procedure involves looking away from the child when he exhibits mild inappropriate behavior; for highly disruptive behavior, the therapist takes the primary reinforcers and leaves the training room until the disruptive behavior subsides. McReynolds (1969) describes a procedure in which time-out was used with a brain damaged boy to reduce inappropriate vocalizations. The child was taught vocal imitation via a backward chaining procedure. It was noted that the child would often emit vocalizations resembling English phonemes,
which are referred to as jargon. These jargon emissions occurred after a response had been emitted and before a new model was presented. In this technique, after jargon was emitted, the trainer took the reinforcer, turned in her chair, and sat with her back to the child. Turning to face the child again was contingent on his ceasing the jargon and remaining quietly in his chair for approximately 30 seconds. The results indicate that the use of jargon declined to almost zero for an extended period each time the procedure was employed.

Sailor, Guess, Rutherford, and Baer (1968) note that the timeout procedure may have the disadvantage of subtracting from the time available for training, and describe a different technique for controlling disruptive behavior. The authors taught verbal imitation to a retarded girl. The basic unit of speech selected for acquisition was the word or phrase, graded into levels of ascending difficulty, that is, into levels of increasing numbers of words and syllables in each unit of stimulus material. The training procedures were similar to those of Guess et al. (1968). Sixteen sessions of verbal training were conducted before the tantrum-control procedure was initiated. That procedure consisted of alternating the difficulty of stimulus units in either of two possible contingencies. Each contingency was applied twice over a series of four successive conditions. In Conditions I and III, the occurrence of a tantrum produced two consecutive presentations of new stimulus units of decreased difficulty (shorter length) relative to the stimulus units currently being presented. In Conditions II and IV, the procedure
was reversed; a tantrum resulted in two consecutive presentations of new stimulus units of increased difficulty (greater length). The first of these new units was presented when the tantrum ceased. Each additional tantrum during these contingency words caused two additional units of equal difficulty to be presented. In general, the results indicate that changes from high-difficulty to low-difficulty stimuli for two trials contingent upon disruptive behavior increased the rate of that behavior; changes from low-difficulty to high-difficulty stimuli for two trials contingent upon disruptive behavior decreased its rate.

The results of these studies indicate that disruptive behavior can be effectively and relatively quickly controlled by the application of relatively simple techniques. The efficacy of these techniques can usually be enhanced by the simultaneous use of powerful reinforcers to strengthen desirable behaviors. The techniques for controlling disruptive behavior should never be used alone; they should only be used in conjunction with the reinforcement of desirable, preferably incompatible behaviors. It is important to note that incorrect vocal responses were not punished; only behaviors which interfered with the training were punished.

Selecting Verbal Behaviors To Train. The choice of verbal behavior to be trained depends on a number of factors, including the child's verbal abilities, the child's day-to-day environment, and the needs and expectations of significant others, such as parents and teachers. For severely language handicapped children, three criteria for initial sound training are commonly recommended: first, it is
recommended that sounds the child spontaneously emits be brought under imitative control; second, sounds which can be physically prompted, such as the plosives "b" and "p"; third, sounds which have easily discernible visual features, such as "m" and "o" (Hartung, 1970; Lovaas, 1968; Lovaas et al., 1966; Stark et al., 1968). With children who have relatively more complex verbal repertoires, such as echolalic children or children who have been in training for some time, the selection criteria are more numerous. Early training commonly begins with developing a naming vocabulary, and, typically, the words chosen for this are ones associated with visual cues, such as everyday objects, personal possessions, body parts, and common actions (Hewett, 1965; Lovaas, 1968). The concerns of parents and educators are of importance, especially in teaching instruction-following and the selection of environmentally useful words for the child, that is, selecting words that will potentially be of functional value to the child (Craighead et al., 1973; Hartung, 1970; Palyo, Cooke, Schuler, & Apolloni, 1979; Sulzbacher & Costello, 1970). Stark et al. (1968) feel that it is important to include sounds and words which are in the presumed order of articulatory maturation for normal children. In seconding this, Palyo et al., (1979) state their belief that it is crucial to incorporate developmental as well as functional considerations, and recommend that cognitive and linguistic assessments precede the selection of target behaviors. A final criterion, recommended by Weiss and Born (1967), is the selection of sounds, words, and phrases that will facilitate or are prerequisites of future training goals.
Time Required For Training. The time required in training a child will depend principally on two variables, the desired terminal level of speech behavior, and the initial capabilities of the child. The first variable is self-evident; the more one wishes to teach to a child, the more time required to complete the training. For the second variable, Lovaas (1968) notes that if a child had some imitative vocal behavior at the onset of training, the acquisition was relatively rapid, but in those children who evidenced no imitative behavior of any form, extensive efforts were required to bring about imitative speech. Wolf, Risley, and Mees (1964), in acknowledging the contribution made by Dickey's initial capabilities, note that his ability to mimic entire phrases and sentences was crucial to the rapid progress in verbal training. How intensive the training effort should be is not known. Schell et al. (1967) compare the three 75-minute training sessions per week which they used with the six seven-hour training days per week used by Lovaas et al. (1966), and conclude that it "may well turn out that such extensive and intensive involvement in the life of a profoundly disturbed child is required throughout or during certain periods of treatment or, at least, that it is more necessary than many professional people currently believe" (p. 63). Lovaas (1968) notes that one of the disadvantages of his program is the large amount of time consumed in accomplishing its ends. It is not possible to specify in advance how long a particular speech training program will require, but anyone contemplating conducting a speech training program with a severely language handicapped child should anticipate spending a con-
siderable amount of time, potentially several years, in that endeavor.

**Fallout: Side Effects of Speech Training.** Potentially, a con-
siderable investment of time, money, and effort will be made in
teaching a child to speak. It is important, therefore, to consider
what benefits will accrue to the child as a result of his speech cap-
ability, that is, what return will there be on the investment?

Among the reported side effects of speech training programs have
been spontaneous generalization of trained material to new persons
and environments (Stevens-Long et al., 1976; Tramontana & Shivers,
1971), and increases in social behaviors (Tramontana & Stimbert,
1970). Hewett (1965) reports that the "children in the preschool
became very interested in Peter's attempts at speech and provided
constant reinforcement of his words by prompting him. One older boy
would hold a toy car at the top of a slanting block runway and let
it 'go' only when Peter directed him verbally. Peter proved a will-
ing participant in such games" (p. 934). The author concludes that
a sizeable communication breakthrough occurred between an isolated,
autistic boy and the social environment,

Not only did this breakthrough make Peter more aware of his
social environment, but it also altered the reaction of others
toward him. This was clearly seen when nursing staff sought
him out for verbal interaction, providing cues for imitation
and holding him for speech before granting requests. Although
many problems exist between Peter and his family, his newly
acquired speech seems to hold promise for improving their re-
lationship (p. 935).

Stark et al. (1967) report that the consensus of professional per-
sonnel who had observed Kipper was that "He looks more like a normal
boy" (p. 62); he more frequently laughed and smiled appropriately,
responded to his name, to gestures, and to comments, payed attention to people and things around him, asserted himself, and performed simple tasks. Kipper's parents reported that he interacted more frequently with them, and that he was generally more alert and responsive. Craighead et al. (1973) report that Mark's parents were trained in operant procedures and a home training program was established, and that "at last report the subject was a student in a 'normal' public school classroom" (p. 176). Sulzbacher and Costello (1970) report that in the three-and-one-half years since the initiation of treatment, Teddy has completed three years of school. He has advanced rapidly, skipping the equivalent of one grade, and is currently in an intermediate level (grades four and five) special education class. "Psychological testing in the school has confirmed the report of his teacher that his reading, spelling, and arithmetic skills are all at or above grade level" (p. 273). They further report that during his third year of school, Teddy "began to acquire social skills appropriate for his age and routinely played with other children in school and in his neighborhood. His favorite game is baseball and he plays it well enough to be included in sandlot games in his neighborhood" (p. 273). They conclude that it is expected that Teddy will continue in his special education class for the next year and it is expected that he will enter a regular education program at the junior high school level. There is no question at the moment that this previously untestable child with grossly deviant autistic behavior can now look forward to a meaningful and productive role in society. It is gratifying to note that all the behaviors that were programmed for Teddy have remained in his repertoire, which has in turn expanded beyond the specifically programmed responses (p, 273).
Summary and Discussion

Of all the phenomena observable during the first developments of a child perhaps the most astonishing is the facility with which he learns to speak. When one thinks that speech, which is without question the most marvelous act of imitation, is also its first result, admiration is redoubled for that Supreme Intelligence whose masterpiece is man, and who made speech the principal promoter of education (Itard, 1894/1962, p. 85).

So strongly did Itard believe in the importance of speech that he spent several years attempting to teach Victor, his "wild boy", to speak. Itard's attempts proved to be an extended exercise in futility, for Victor never learned to speak. Victor's circumstances, that of a "feral" child, were unusual, but his failure to speak is considerably more common, and the search for both a theoretical understanding of speech and language behaviors and practical methods by which such behaviors may be taught continues today.

Two very different approaches to a theory of language acquisition are exemplified by Skinner (1957) and Chomsky (1972a; 1972b). Skinner (1957) believes that the emphasis must be on finding "the functional relations which govern the behavior to be explained" (p. 10), while Chomsky (1972a) feels that the "fatal inadequacy of all such approaches... results from their unwillingness to undertake the abstract study of linguistic competence" (p. 112). While a study of the theoretical implications of these approaches is beyond the scope of this paper, the practical implications are very much germaine: Chomsky (1972a) emphasizes "the study of abstract structures and mechanisms of mind" (p. 112); Skinner (1957) maintains that his proposed new formulations of verbal behavior "is inherently
practical and suggests immediate technological applications at every step" (p. 12). Chomsky (1972b) is almost certainly correct when he says that "it goes without saying that any theory of grammar that can be formulated today must be highly tentative. Many questions remain totally open and many partially so" (p. 92). However, the preceding review of literature on operant procedures used in developing speech behaviors in severely language handicapped children strongly supports Skinner's conclusion of the immediate technological applications of his proposal, for it seems appropriate to conclude that an operant technology presently exists for the establishment and maintenance of expressive speech and receptive language skills.

This operant technology is founded on differential reinforcement used in conjunction with shaping, fading, chaining, and modeling. With these tools, a variety of verbal skills may be taught to a great many severely language handicapped children. The initial step in a speech development program is the establishment of a verbal imitative repertoire, which is the corner stone upon which all further speech development is based. This verbal imitative repertoire should be taught in such a way that it becomes generative, that is, in such a way that the child begins to imitate verbal behaviors that are not explicitly reinforced. With some children, pretraining on motor imitation skills may be necessary before verbal imitation training may be successfully implemented. The establishment of the verbal imitative repertoire is typically followed by the development of either a naming vocabulary or a question-answering capability, although these may be combined into one procedure. The use of the
naming vocabulary and/or question-answering capability should be quickly generalized to other persons and other settings wherein the functional utility of these skills may be demonstrated, taught, and maintained. It is very important that the functional utility of speech skills, at all levels of complexity, be emphasized as soon after the onset of training as possible, preferably as soon as the first word is learned, for this enhances the probability that the skills will be used and maintained, that other people will attempt to communicate and interact with the child, and that the child will be exposed to additional, informal speech training. The limiting factor in the speed of transfer from the training reinforcers, e.g., food, to the more natural reinforcers by which functional speech is maintained is the relative strength of these reinforcers. For example, whether opening the door to the training room contingent on the child saying "door" will actually reinforce that behavior depends to a large extent on what associations the child has with the training room, i.e., his past experience in that room; a large number of positive associations enhances the probability that opening the door will be an effective reinforcer.

Once the verbal imitative repertoire, naming vocabulary, question-answering capability, and the functional use of these skills have been established, the next step in training depends on a number of factors, including the child's capabilities (which may be estimated by the amount of time and effort required to reach this point), the resources available to the trainer, and the willingness of others to participate. If the child has progressed slowly and with great
effort, it may be best to accept a limited terminal goal, such as the functional use of single words or pivotal phrases. If the child's progress has been relatively quick and easy, much more complex speech forms may be considered. The trainer's skill, time available for the task, and inclination to pursue the speech training, all have a bearing on the child's terminal training level. Where the trainer is highly skilled, the time is readily available, and the enthusiasm is high, much more may be attempted than when the trainer himself is poorly trained, or has only limited time available, or the trainer has other, more pressing interests. Many of the constraints imposed by the trainer's limits may be mitigated by the willingness of others to participate in the training process. If, for example, the parents or ward personnel are willing to speak with the child, to help the child rehearse learned materials, to require the child to use his speech to obtain his meals or before going on walks, to participate in activities, in short to function in his environment, then, again, much more may be attempted than when this participation is lacking.

Whatever terminal level of training is desired, the generative, generalized usage of the new skills must be continuously emphasized and developed. Speech behaviors that are generative and have been generalized to persons other than the trainer and settings other than the training room have no further need of explicit training and reinforcement for their maintenance and expansion. Naturally occurring consequences applied to a small portion of a generative response class may be sufficient to maintain responding for the entire
class. That is, the child may be able to learn and use new speech behaviors independently of any formal speech training. When this occurs, the clinician's efforts can be devoted to overcoming other deficits without significant risk that the previously acquired behavior will be lost.

The children who participated in the studies reviewed above have had all manner of labels applied to them. Often, an individual child has had multiple labels. These labels, though, have had little obvious effect, for training techniques have remained constant across diagnostic categories, while in terms of results, the most commonly mentioned variables affecting acquisition rate have been the child's level of verbal behavior prior to training, and the presence or absence of an imitative repertoire, both of which transcend diagnostic categories.

Overall, then, the results of the studies reviewed above indicate that it is possible to develop an operant based, step-by-step program for the establishment of functional speech behaviors in severely language handicapped children which will have a good probability of achieving at least partial success, if not full language capability. The variations in both the procedures used and the results obtained indicate that it is not likely that any one program will be applicable to all children, and that allowances for individual variability must be made.

A Speech Training Program

In this section, a general speech training program, based on operant techniques presented in the material reviewed above, will
be outlined. These recommendations are advanced without references to specific studies, but represent an integration of many of the sources previously reported. It is the author's intention to outline procedures which will be applicable to a wide range of language handicapped children. An attempt will be made to note distinguishing behavior characteristics of the child which indicate the need for or possible utility of each of the suggested procedures. That is, not all of the procedures are needed for all language handicapped children. In attempting to utilize these recommendations, the reader should select those procedures which appear best suited to the individual child's capabilities and needs.

Any procedure designed to teach speech behaviors to a language handicapped child must take into consideration the individual abilities and needs of the child to be trained. The child's needs and abilities should be expressed in terms of observable behaviors rather than in terms of hypothetical internal structures, for this focuses the clinician's attention on the behavioral strengths and weaknesses, simplifying the process of selecting behaviors and words or sounds to be trained, as well as establishing the appropriate level at which to begin training.

Assessment

The initial step in starting a speech training program is to assess the child's current level of performance and to evaluate his needs in his day-to-day environment. This assessment should determine, first, that the child's hearing is adequate for speech sound reception. Determination of hearing acuity may be made in a number
of ways. A relatively simple method is to present words within the normal speech and hearing limits and to note if the child makes any consistent response to the sounds. This may be done by talking to the child, or by using simple music toys. Should this prove inconclusive, a professional hearing assessment and/or operant audiometry (Bricker & Bricker, 1970b) should be considered. Then the child's expressive skills, such as the frequency and complexity of vocal sounds and whether these sounds are used appropriately, and the child's receptive skills are evaluated, for example, whether the child will follow simple verbal instructions or respond to his name. Included in the assessment process should be a determination of reinforcing stimuli which appear sufficiently powerful to establish and maintain responding.

Disruptive Behavior

Since many deviant children exhibit behavior which is incompatible with the behaviors involved in speech training, it is important that these behaviors be reduced or eliminated. Time-out from positive reinforcement, when used in conjunction with powerful reinforcers, can usually be relied on to reduce or eliminate disruptive behaviors within one to two weeks. Time-out has a disadvantage in that it reduces the amount of time available for training, but this may be offset by the fact that it is very easy to use, which makes it suitable for use by persons with minimal training, such as parents and ward personnel. It is important to emphasize that no matter what method is chosen for controlling disruptive behavior, it should never be used alone. Punishment should only be used in conjunction with a
program to establish a desired, or more appropriate response. Incorrect verbal responses, I believe, should not be punished, at least not during initial speech training, for it could result in the suppression of the very behaviors the trainer is attempting to elicit, and constitutes an unnecessary risk.

**Gaining the Child’s Attention**

Before operant procedures can be utilized satisfactorily, the clinician must have the attention of his subject; it is imperative that the clinician establish some sort of control over this behavior. The child's attention may be maintained by the clinician holding the reinforcer in front of his own face. Initially, it may be necessary to accompany this with a loud noise and/or manual guidance. In later stages of training, applying time-out for not paying attention to the trainer may be sufficient to maintain the child's attending behavior.

**Establishing An Imitative Repertoire**

The establishment of an imitative repertoire depends on differential reinforcement used in conjunction with shaping, prompting, fading, and modeling. The procedure selected depends on the child's initial repertoire.

For children with little or no imitative skills and no spontaneous vocal behavior, training should begin by establishing a motor imitative repertoire. In this method, a verbal cue, such as "Do this", is presented followed by the modeling of the desired motor response, e.g., raising the left arm. The child is then physically guided through the motion and is reinforced. The prompts are then progressively faded over subsequent trials. When the child reliably
Imitates the first response, a second is trained. When the second response is learned, these first two responses are nonsystematically alternated to establish a discrimination. Then a third response is taught, and procedure recycled. When the child is reliably imitating new motor responses on the first presentation, vocal training is begun. It is recommended that motor movements involving the face and mouth be included to ease the transition from motor to vocal imitation. Vocal training should begin with any sounds the child spontaneously emits, or sounds which have easily discernible concomitant visual components, such as "m" and "o", if the child continues to remain mute. In the latter case, training continued with the presentation of the visual component of the sound by itself. When the child is reliably imitating this response, the sound component is added. Initially any vocalization by the child is reinforced. Then reinforcement is shifted to those responses which are progressively closer and closer approximations of the cue, until the child is matching the trainer's vocalization. This is followed by the training of a second vocal response, discrimination training, a third response, and so on until the child is reliably imitating new vocalizations within the first few presentations.

In the case where the child began to spontaneously vocalize, or for children with little or no imitative skills and some spontaneous vocal behavior, the vocal imitative repertoire is taught directly. The child's initial spontaneous vocalizations are reinforced to increase their frequency. When the child emits a vocal response approximately six to 10 times per minute, imitative control is established.
by the clinician presenting a verbal cue and reinforcing any vocal response the child makes within five-seconds; other responses are ignored. When the child is reliably responding within five-seconds of the trainer's vocalization, imitation training is continued by reinforcing only those responses which are progressively closer and closer approximations of the cue, until the child is matching the trainer's vocalization. Then a second response is trained following the same procedure. When the child is reliably imitating the second sound, these first two sounds are nonsystematically alternated to establish a discrimination between them. A third sound is then trained, and the cycle repeated. This is continued until the child reliably imitates new sounds within the first few presentations.

**Conditioning Functional Speech**

The procedures for conditioning functional speech depend on teaching the child that his verbal responses can change something in his immediate environment, leading to some reinforcement, reward, or personal satisfaction. This may be done in a number of ways, including the "game" procedure of Schell et al. (1967) and Stark et al. (1968), in which an imitative prompt is presented while the trainer is playing with the child, and continuation of play is contingent on the child responding correctly. It is important to note that it is not necessary to wait until the child can exhibit a complete response before beginning to condition functional speech. Even if the child reliably imitates only the initial sound of a word, the functional use of that sound may be conditioned, and then, gradually, the response can be elaborated as training continues. The conditioning of
functional speech should be considered as an integral part of all subsequent procedures.

**The Transition From Imitation to Naming**

The child will eventually reach a point at which he imitates new words on the first presentation. When this occurs, it is time to begin the transition from an imitative repertoire to a naming vocabulary. The procedure involves teaching the child to emit an appropriate verbal response in the presence of some stimulus object. A picture or an object is presented along with a verbal prompt for the name of the object, and the child is reinforced for imitating the name. Then the imitative prompting is faded until the child names the object when it alone is presented. For example, the clinician holds up a ball before the child and prompts "Say ball". The child is reinforced for imitating "ball". When the response reliably occurs, the time between the first and second words is gradually lengthened to more than five-seconds, "Say (pause) ball." If the child does not spontaneously respond "ball" within the five-second pause, a partial prompt is presented, "ba". When the child is reliably responding to the partial prompt, it, too, is gradually faded. After the child is reliably responding, the initial prompt "Say" is faded by the process of introducing partial prompts, e.g., "S" is presented rather than the complete word "Say". Eventually, the child will respond "ball" when the ball alone is presented to him. By repeating this process with a variety of objects, a simple naming vocabulary may be established. It is recommended that initial naming training emphasize words which will have a high functional
value for the individual child.

Generalization of Trained Responses

Teaching the child to respond to persons other than the trainer and in situations other than the training room must be actively encouraged. Initially, this is done by introducing, one-by-one, persons who will work with the child in other settings, such as a parent or teacher, into the training room to teach the child to respond to the new person. After the child is reliably responding to the new person in the training room, training is shifted to that environment in which the new person will usually work with the child, such as the home or school classroom. A second person is then introduced to the training sessions, and the procedure is recycled. Generalization can be facilitated by initially selecting words to be taught which can be asked for frequently during the day, such as the names of toys, articles of clothing, and furniture, and which are immediately functional in the child's environment, such as the names of foods and beverages. The continued conditioning of functional speech will also facilitate generalization. It is recommended that generalization of trained responses begin when the child is capable of saying complete words, as it will be easier for nonprofessionals and paraprofessionals to respond to a complete word from a child. Generalization of training should continue as an integral part of all subsequent phases of training.

The Establishment of Phrases

The procedure used to establish phrases will depend on the verbal imitative repertoire of the child. With children who are capable
of imitating several words in succession, the procedure is the same as that used to teach individual words: the child is reinforced for mimicking the phrases until they are consistently imitated, then control is shifted to appropriate circumstances via prompting and fading. For children who imitate only single words, a chaining procedure is used. It is suggested that with these children two word phrases be taught initially, using words from the naming vocabulary. First, mimicking the last word in a phrase is reinforced until it is imitated consistently, then the first word of the phrase is presented and, after the child imitates it, the second word is immediately prompted. The child is reinforced after imitating the second word. When the child reliably imitates the two words presented in this fashion, the words are presented sequentially, without pause, and the child is prompted, if needed, to say both words. Reinforcement is delivered contingent on saying both words. When the phrases are consistently imitated, control is shifted to appropriate circumstances via prompting and fading. The shift of control to appropriate circumstances should incorporate the functional use of generalization of the phrases.

Answering Questions

Initial development of a question-answering skill should utilize the child's naming vocabulary for the answers to the questions. For example, the trainer asks, "What is this?" and presents an object the child reliably names. When the child responds by naming the object, he is reinforced. The question is next presented with a second object, and then with a third. The presentation of the object
is nonsystematically alternated among these first three objects until
the child reliably and correctly names each object in response to the
question, then three new objects are introduced. This procedure is
repeated until the child reliably names objects from his naming voc-
abulary on their first presentation, that is, until a generative re-
response class has been established. Then a second question is intro-
duced, and the process recycled. With questions for which a generative response class does not exist, the question is presented, the
child is prompted, and the prompts are faded as in the procedure
used in establishing the naming vocabulary. For example, the trainer
prompts "What is your name? Say John", and when the child imitates
"John", he is reinforced. After the child is reliably imitating
"John", the time between "Say" and "John" is gradually increased to
more than five seconds. The child is prompted, and the prompts faded
as appropriate. The establishment of the functional utility and gen-
eralization of the question-answering skill should be encouraged
throughout this training.

Complex Speech Behaviors

Speech behaviors which are more complex than those described
above may be developed by utilizing essentially these same proce-
dures. The basic paradigm is as follows: the child is prompted to
imitate a desired response; when the desired response occurs re-
liably, the prompts are faded, and control is shifted to appropriate
environmental variables. For example, the techniques described above
for developing the use of phrases and for developing question-
answering skills may be combined to produce simple sentences and
simple conversational speech patterns.

**General Considerations**

These procedures **should not** be considered fixed and unvarying; the child's individual needs and capabilities must be taken into consideration in selecting an appropriate speech training strategy. The behaviors selected for training should be readily usable in the child's day-to-day environment, for this will enhance the probability of generalization. The training of a new response class should utilize previously learned responses and skills to facilitate generalization between response classes. It is strongly recommended that, whenever feasible, training of a particular response class be continued until a generative response class has been established, as this will enable the child to increase his repertoire independently of the structured training environment, thereby approximating normal speech development. Whenever a new response class has been learned, previously taught response classes should be reviewed to both insure retention of the material and the check for overgeneralization of the newly learned response class; discrimination training should be conducted as needed.

**Future Research Needs**

In the studies reviewed here, a number of independent variables have been combined into procedures and the effectiveness of these combinations of variables have been assessed, but no single variable has been systematically manipulated. While the implications of this fact are mostly theoretical, since in practical applications combinations of the variables will normally be used, there are areas of applied importance in which further research could prove very benefi-
cial. Among these areas are the function of training motor imitation prior to vocal imitation, particularly the value of training facial/oral motor movements; an analysis of the development, limits, and maintenance of generalization of trained speech behaviors and of generative response classes; an analysis of those who benefited from speech training and those who showed little improvement to target those subjects most likely to benefit from this training; a comparison of one-to-one training vs. group procedures, to determine whether group training is a viable alternative, and, if so, under what circumstances; and a determination of the cost/benefit ratios of differing amounts of speech training.

Conclusion

It seems appropriate to conclude that there currently exists an operant technology for the development of speech behaviors in a great many severely language handicapped children. Whether the operant paradigms by means of which these speech behaviors are learned are also responsible for speech acquisition in normal children is, at present, unknown. But while the theoretical importance of these procedures in normal language acquisition is moot, the practical implications are clear: language handicapped children may be taught speech behaviors by means of which they may function in, interact with, and manipulate their day-to-day environments.
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