

OPERANT METHODOLOGY IN SPEECH PATHOLOGY

by

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Chapter I

Introduction

There is an increasing interest in the application of operant techniques to the area of speech pathology. This is evidenced by the frequency of publications concerned with this application. The application of operant techniques to speech pathology is a natural and welcome occurrence. Holland (1967, p. 11) has stated, "Since speech is behavior just as is walking or pressing a lever, methods used to change the frequency or form of other behaviors can also be used to modify speech."

This paper will review the use of operant techniques for modifying speech and language in the clinic as well as in the laboratory. The speech pathologist may not have convenient access to much of the literature concerned with operant applications as the reports have appeared in diverse experimental and clinical journals.

The three steps involved in applying operant techniques to a clinical situation are obtaining baseline measures of the behavior of interest, behavior modification, and expansion of stimulus control. These steps are analogous to diagnosis, treatment, and carry-over. Clinical speech pathology has not been rigorous in including all three steps, with steps one and three, obtaining baseline measures and extending stimulus control, often being slighted. Behavior modification objectives suffer when deficiencies exist in any of the three areas (Brookshire, 1967, p. 218-219). The speech pathologist will find

behavior modification techniques to be a more efficient and thorough method of accomplishing the goal of modification of speech disorders.

This review presents a historical overview of the use of operant techniques for the modification of verbal behavior and reviews research in which operant techniques have been used to modify speech disorders. Studies are included to demonstrate that language behavior as complex as the content and order of conversations can come under operant control, the attention of adults as reinforcement and other forms of reinforcement can increase the rate of vocalizations of infants and speech of children, and operant techniques can be used to modify maladaptive verbal behavior of adult psychotics and disturbed and retarded children. Additional studies pertain to the application of operant techniques to stuttering, dysphasia and articulation disorders.

Chapter II

Modification of Verbal Behavior

Adult Verbal Behavior

Prior to a study conducted by Greenspoon (1955), most experiments using the operant conditioning paradigm were with non-human subjects. Greenspoon and others who conducted similar research found that operant procedures could not only be used with human subjects, but could be used to control behavior as complex as language behavior. In the following studies, operant procedures were utilized to manipulate the content and order of the subjects' conversations.

Greenspoon (1955) studied the effects of two types of reinforcement, "mmm-hmm" and "huh-uh" on two responses, plural nouns and any word not a plural noun. The subject was instructed to say single words of his choosing for 50 minutes. A response contingency of "mmm-hmm" for plural nouns was used in one condition, and in the second condition, "huh-uh" was the response contingency for plural nouns. The results indicated that the contingency "mmm-hmm" increased the frequency of plural responses and the contingency "huh-uh" decreased the frequency of plural responses. Both reinforcers tended to increase the frequency of non-plural responses. Verplanck (1955) studied the control of the content of conversation to determine if it was possible to bring this complex behavior under operant control without the subjects' knowledge. Seventeen examiners carried on conversations with 24 different subjects on a wide variety of topics. Each subject increased his rate of spoken opinions

when reinforced by paraphrase or agreement. Attempts to replicate this study by Azrin, Holz, Ulrich, & Goldiamond (1961) and by Ulrich (1962) were not as successful. Levin and Shapiro (1962) brought the order of speakers in a conversation under experimental control by manipulating the variable of group reinforcement, success or failure. In this task, the group made a number of unanimous decisions about a number of hypotheses. In each of the groups studied, a conversation sequence became established within a half-hour.

These studies were among the first to demonstrate the operational application of the operant method to verbal behavior. The fact that such subtle language behaviors as noun class, opinion statement and conversation order could be brought under operant control provided a starting point for the educator and clinician to apply such techniques to speech and language problem areas in the classroom and in the clinic.

Verbal Behavior of Infants and Children

The previous studies (Greenspoon, 1955; Levin and Shapiro, 1962; Verplanck, 1955) demonstrated experimental control of adult verbal behavior. More important to the clinician, educator and parent, however, is verbal behavior of infants and children. Speech and language are learned in infancy and childhood, and the influence of the adults in a child's environment can have an effect on this learning which can be helpful or detrimental. The studies presented in this section demonstrate that the vocalizations of infants and the speech of children can be brought under operant control through adult and mechanical reinforcement.

Rheingold, Gewirtz, and Ross (1959) studied 21 normal infants, three months of age. During the baseline sessions, the examiner leaned over the infant with an expressionless face and the number of subject vocalizations was tallied. During the conditioning sessions, the examiner reinforced vocalizations by simultaneously smiling, clucking, and touching the subject's abdomen. During the extinction sessions, the examiner returned to baseline conditions. Reinforcement increased the rate of vocalizing above the baseline rate, while during extinction sessions vocalization rate decreased until it approximated the baseline level. The authors suggested that the social vocalizing of infants and, more generally, their social responsiveness may be modified by the responses adults make to them. The results of this study were confirmed in a similar study by Weisberg (1963). A study by Salzinger, S., Salzinger, K., Portnoy, Eckman, Bacon, Deutsch, and Zubin (1962) was concerned with conditioning continuous speech in children. The spontaneous continuous speech of children ranging in age from five to seven years was reinforced by an apparatus which consisted of a clown whose nose was a red light bulb. The children's speech rate increased as a result of the administration of reinforcement (illumination of the clown's nose) and decreased or stabilized when reinforcement was withheld.

By applying systematic reinforcement to vocalizations of infants and speech of children, the researchers have demonstrated that the rate of output of these behaviors can be increased. These results are significant for parents and educators because they indicate that the

reinforcement provided by the parent or teacher in the form of attention or approval can have a positive influence on the speech and language development of the young child.

Verbal Behavior of Adult Psychotics

Operant techniques have been used to manipulate verbal behavior of adults and to increase the rate of vocalizations of infants and the speech of children. More importantly, similar techniques have been applied in the modification of maladaptive verbal behavior. The studies in this section demonstrated methods for reinstating verbal behavior in previously mute adult psychotics. The establishment of verbal behavior is a necessary prerequisite for many other types of treatment for psychotics.

Isaacs, Thomas and Goldiamond (1960) reported treatment sessions with two psychotics who had been mute for 19 and 14 years. Shaping and successive approximation were used with these individuals to elicit speech. One patient was reinforced with chewing gum for eye movements, then facial movements including mouth and lip movements, then vocalizations, word utterances, and finally for speech. An attempt was then made to generalize the stimulus to other people on the ward such as nurses and volunteer workers. This was successful. The second patient was also reinforced with chewing gum. Receipt of the gum was first made contingent upon going to the group room. After this behavior was established, the receipt of gum was made contingent upon participation in the announced group activities which included verbal responses to questions. This patient responded to questions in the group sessions

but would not do so on the ward. Sherman (1963) also successfully used techniques of shaping and successive approximation with Mr. G. a mute, hospitalized psychotic. The steps were first to nod head, then nod head and grunt and then say either "huh-uh" indicating "no" or "uh-huh" indicating "yes" in response to questions, and finally speech. Reinforcement was with pennies and promises by the examiner to write letters for the patient.

The case studies reported (Isaacs et al., 1960, & Sherman, 1963), demonstrated that operant techniques can be effective in reinstating verbal behavior in psychotics. The fact that psychotics are typically withdrawn and disinterested may mean that the clinician will have to try several reinforcers before one is found for which the client will respond. Isaacs et al. (1960) had good results with one client in generalizing his speech behavior to situations outside of the treatment sessions. When this can be accomplished, better results can be expected in many aspects of the client's treatment because of his increased ability to communicate with the people treating him. A psychotic exhibits considerable behavior which is abnormal and very little normal behavior. If normal behavior, such as speech, can be increased, attempts to decrease abnormal behavior should be more successful.

Verbal Behavior of Disturbed and Retarded Children

Techniques to increase verbal behavior of disturbed or retarded children are perhaps even more important than for adults because the development of verbal behavior can often be the starting point for development in many other areas, such as improving social relationships

or accomplishing new learning tasks. Therefore, the results accomplished using operant procedures, as reported in this section, are very promising for training disturbed and retarded children.

Lovas, Berberich, Perloff, and Schaeffer (1966) reinforced two mute schizophrenic children with food for closer and closer reproductions of an attending adult's speech. A reward, contingent upon imitation, was necessary for development of imitation, and newly established imitation acquired rewarding properties for these children. Kerr, Meyerson and Michael (1965) reported a case study of a mute, three-year-old girl with multiple physical and behavioral deficits. Initially, the child was held on the experimenter's lap and reinforced after each vocalization by being joggled gently while the experimenter sang a nursery song. Later echoic behavior was established by reinforcing the child's vocalizations when they occurred soon after the experimenter's vocalizations, but not at other times. The child's antisocial behavior was altered in the direction of spontaneous vocalizations under the control of adult vocal stimuli.

Operant conditioning procedures are one of a few treatment techniques to meet with success in the complex area of dealing with behavior problems and establishing speech in autistic children. Wolf, Risley and Mees (1964) reported on their work with an autistic boy, Dicky. Dicky had no socially appropriate verbal behavior but was not mute. In the beginning treatment sessions, the attendant showed Dicky pictures, told him what they were and asked him to repeat what she had said. When he mimicked her she would say "good" and give him a bite

of his meal. Then he progressed to naming pictures in books and household objects and answering abstract questions such as "What did you do outside?". Food reinforcers were necessary for the initial conditioning, but adult attention and approval were effective for maintaining and expanding the original repertoire. The authors suggested that Dicky's ability to mimic entire phrases and sentences was crucial to the rapid progress in verbal training. Schell, Stark and Giddan (1967) used social reinforcement and candy with a nonverbal autistic boy in tasks designed to teach him to attend, increase his responsiveness to people, effect discriminative responses to a variety of controlled auditory and visual stimuli, increase the extent and rate of his vocal and nonvocal behavior, and to increase the control of his behavior by verbal commands. The results showed an increase in the variety of the child's verbal and nonverbal behavior, his behavior came under more appropriate stimulus control, and people became sources of discriminative and reinforcing stimuli for him more often. A second report by Stark, Giddan and Meisel (1968) told of additional treatment sessions with the same child. Reinforcement was used to teach the child nonvocal imitation, vocal imitation, verbal labeling and verbal discrimination.

Hollis and Sherman (1967) reported a unique project in which operant techniques were shown to be effective with profoundly retarded children. Relatively high rates of vocalization were elicited in the children when reinforcement was provided in the form of candy and/or Kool-Aid.

Operant techniques have been shown to be successful in establishing vocalizations and speech in children with emotional disturbances and mental retardation. Development of understanding and use of speech and language is an important aid for a disturbed child in making behavioral adjustments. Development of speech and language is essential for a retarded child to reach his maximum level of intellectual functioning.

The problems of instating or increasing verbal behavior of adult psychotics or of disturbed or retarded children are not frequently encountered by the speech pathologist. However, the previously discussed research suggests that the speech pathologist could achieve significant gains with these cases by utilizing operant techniques.

Chapter III

Modification of Speech Disorders

Stuttering

Many books and articles have been written describing and attempting to explain stuttering. The various explanations often conflicting, can create confusion and frustration for the clinician. Stuttering is definitely a complex behavior; it distresses and frustrates the stutterer himself and is annoying to others, and yet in spite of these negative aspects of stuttering, it persists. Shames and Sherrick (1963, p. 9, 16) stated that stuttering is "maintained by positive and negative reinforcements on complex, multiple schedules." They suggested that if the clinician makes a careful analysis of the history and current behavior of the stutterer, the clinician can make available to the stutterer or withhold from him those specific occasions and reinforcing contingencies which are related to the emission and extinction of his stuttering response.

In treating a stutterer, the clinician should study him in his environment, and attempt to discover what is maintaining the stuttering. It may be some form of positive reinforcement such as the fact that the stutterer receives attention when he stutters or some form of negative reinforcement such as not having to take certain responsibilities because of the stuttering. The clinician may be able to shift some of the reinforcing contingencies available to the stutterer in his environment,

or it may not be possible to identify contingencies which support the stuttering. The clinician can also set up a clinic program, using operant techniques, in which punishment is made contingent upon stuttering or reinforcement is provided for fluent speech. In the clinic situation, the punishment or reinforcement will exert control over the stuttering, and this control can often be extended into the client's environment external to the clinic.

Several experimental studies have been done to test the effects of various forms of punishment delivered contingent upon stuttering. Flanagan, Goldiamond and Azrin (1958) used noise to punish stuttering. Two response contingent periods were used, aversive and escape. During the aversive period, when the subject stuttered while reading, a loud blast of noise was presented. During the escape period, such a blast was continuously present, and stuttering caused it to be removed for 5 seconds. When onset of a noxious stimulus was made contingent upon stuttering, response suppression occurred, and when termination of a noxious stimulus was made contingent upon stuttering, response rate rose. Goldiamond (1965) used delayed auditory feedback as a response-contingent consequence of stuttering. Delayed auditory feedback functioned as a punisher, and there were procedures in which the auditory feedback was eliminated and others in which it was avoided. Goldiamond reported almost total elimination of nonfluencies upon introduction of the "Elimination-Avoidance Delay" procedure, coupled with machine control or reading rate. The nonfluency rate was maintained when the delay was faded out and when the reading rate was speeded up beyond the baseline rate.

Martin and Siegel (1966a) studied the effects of response-contingent shock on stuttering. When experimental control of stuttering by contingent presentations of shock was demonstrated, various other manipulations were introduced. These were removal of shock or extinction, punishment of a second stuttering behavior and conditioning of a neutral stimulus. The introduction of response-contingent shock resulted in an almost total reduction of stuttering. Removal of shock was followed by a return to base rate frequency. Two specific stuttering behaviors in the same subject were manipulated, and conditioning of a neutral stimulus was also successful. In research reported by Daly and Cooper (1967), stutterers read under three conditions. In the first condition, electro-shock was administered during each moment of stuttering. In the second condition, the shock was administered immediately following each stuttered word. During the third condition, no electro-shock was administered. Although the results were not significant, less stuttering occurred in the electro-shock conditions.

The next studies suggest that a verbal reprimand can also be an effective punisher. Noise, delayed feedback and shock have been shown to be effective punishers in a laboratory setting, but verbal punishment is more natural, can be administered without special equipment, and the control achieved with it can be extended more easily to situations outside the laboratory. Quist and Martin (1967) studied the effect of the word "wrong" when it was made contingent upon stuttering. For two of their three subjects, "wrong" resulted in a 30 per cent to 40 per cent reduction in stuttering frequency. For a third subject it produced

almost total suppression of stuttering. The behavior suppression resulting from punishment may be only temporary. One way of extending the suppression is to reinforce, simultaneously, an alternative response. This method was used by Martin and Siegel (1966b). In this study, subjects were told "not good" for each stuttering emitted as they read, and were told "good" contingent upon a 30-second period of fluency. Presentation of response-contingent verbal stimuli resulted in a decrease in stuttering frequency, and removal of the verbal stimuli resulted in an increase in stuttering frequency to the base-rate level. Also, a wrist strap was found to function as an effective discriminative stimulus. This suggests that after control over stuttering has been achieved in the clinic, it may be possible to facilitate carry-over of the control into situations outside the clinic by conditioning of discriminative stimuli.

Research results, even though they may be impressive, are close to meaningless to the clinician if they do not have application in a clinic situation. Furthermore, for techniques to accomplish their purpose fully, it must be possible to extend their control to the client's environment outside the clinic. The three studies reported next were case studies conducted in clinics and demonstrated that operant techniques could be utilized to control stuttering in a setting other than a laboratory. In each of the studies, some attempt was made to generalize the clinic controls to the subject's environment outside the clinic. These studies differed from the previously reported studies (Daly & Cooper, 1967; Flanagan et al., 1958; Goldiamond, 1965;

Martin & Siegel, 1966a, 1966b; Quist & Martin, 1967) in that they used positive reinforcement for fluency and did not punish stuttering. However, verbal punishment and other forms of punishment, such as shock if equipment for presenting it is available, should be equally adaptable to a clinic situation.

In a case study by Rickard and Mundy (1965), a nine-year-old boy received social reinforcement and points, leading to extrinsic rewards such as ice cream, following the production of nonstuttering behavior. Stuttering behavior was ignored. The boy progressed from simple units of verbal behavior, such as phrases and sentences, to free conversation with the parents serving as experimenters. He showed marked improvement on the units of verbal behavior and on reading tasks. Initially, success generalized to the home and school situations, but a six month follow-up indicated that the environmental gains were only partially maintained. Leach (1966) also attempted to modify disfluency by reinforcing fluent vocalizations. The client was a twelve-year-old boy. During the 30-minute sessions, he was reinforced with pennies at the rate of 2 cents a minute, for simply talking to the examiner. Later the sessions were divided into two 15-minute periods, and during the second half the boy also earned 2 cents a minute for talking, but a fluency contingency was added. The fluency contingency consisted of an additional penny for each 15-second period of fluent speech. No direct statement was made to the stutterer concerning the fluency-contingent period. After 42 sessions, his rate of disfluencies was considerably reduced, and his mother reported an improvement in the boy's

overall behavior. However, a follow-up of his speech two months after dismissal indicated a partial return of the disfluent behavior.

In another case study conducted at a treatment center, Browning (1967) sought to eliminate stuttering in a schizophrenic child. The treatment program was composed of three steps. First, the experimenter made correct speech available to the child by a procedure of successive approximation while simultaneously counter-conditioning the anxiety associated with speech tasks. When correct speech was available in the experimenter's presence, the subject practiced speaking under conditions which were increasingly comparable to his daily environment. Finally, the staff of the treatment center were used as social reinforcers whose attention and verbal praise were contingent only on correct speech. The child's rate of words stuttered declined from 22 per cent to 2 per cent in reading and 4 per cent in conversation. Of particular significance was the step in which correct speech was made available to the subject. If correct speech is demanded of a child when such responses are not available to him, the demands may cause random behavior and increased anxiety. The schizophrenic child is likely to increase his withdrawal and may become mute.

Operant procedures have also been used to induce and eliminate disfluencies in normal speakers (Brookshire & Martin, 1967; Flanagan, Goldiamond, & Azrin, 1959; Siegel & Martin, 1965a, 1965b, 1966, 1968). However in another study using normal speakers as subjects, Savoye (1959) reported that punishment did not decrease disfluencies. This study differed from the others in that punishment was not made contingent upon the disfluency.

Operant conditioning is a controlled and orderly method for dealing with a complex behavior problem. The studies reviewed demonstrated the use of operant techniques to modify stuttering in laboratory and clinic settings. Many of the laboratory techniques, especially verbal punishment, and praise for periods of fluency, could be utilized in a clinic. Controls achieved in the clinic could be extended to the stutterer's environment outside the clinic by such methods as conditioning a discriminative stimulus or training parents as clinicians.

Dysphasia

The person who has suddenly become dysphasic will be extremely upset and frustrated by the fact that his life has changed so drastically and that he can no longer perform many simple tasks which he took for granted before. Therefore, language training should be concerned with the dysphasic as a person, not simply with the mechanics of language training. Operant techniques can be quite significant for the dysphasic client because language training is accomplished step by step. Very few dysphasics have total loss of effective communication. Therefore, a program can be designed to begin with what the client can accomplish in terms of communication. This may be a word, a single speech sound, or merely a gesture. Using operant techniques, reinforcement is first provided for a minimal communication response such as a word, then for a phrase and finally for a sentence. This decreases the frustration experienced by the dysphasic because it emphasizes what he can do, it lets him view his progress, and it gives him a feeling of accomplishment.

The ability to make correct discriminations is an essential prerequisite for further language training for the dysphasic. In three studies (McReynolds, 1966, 1967b, 1967a), operant techniques were utilized to study the discrimination abilities of dysphasic or language impaired children. In the first study (McReynolds, 1966) dysphasic children ranging in age from four to eight years were compared with normal children on six sound discrimination tasks. A correct discrimination was reinforced with candy or a trinket. Dysphasic children discriminated between isolated sounds as frequently as normal children, but performed significantly more poorly in discriminating sounds within a phonetic environment. McReynolds suggested that in language-like tasks, the dysphasic child may have experienced constant failure and need more time to learn to listen to previously ignored signals. The dysphasic children did demonstrate discrimination ability in a reinforcing situation, however, and it is probable that this ability could be extended through the use of positive reinforcement. In the second study (McReynolds, 1967b), language impaired children were given a training program, which included three tasks, to train verbal sequence discrimination of two and three word sequences. Marbles were used to reinforce appropriate responses. A steady increase in the number of correct responses resulted from the correct responses being reinforced. A third study (McReynolds, 1967a), emphasized training appropriate discriminative behavior in the presence of an increasingly greater number of units within a vocal verbal stimulus. Six discriminations were taught, and correct responses were reinforced with marbles which

were later exchanged for toys. The subjects were language impaired children, and all reached 80 per cent correct responding in each task. A study by Lane and Moore (1962) reported conditioning an adult dysphasic to discriminate between /d/ and /t/. The procedure involved measurement of the probabilities of /do/ and /to/ responses to the speech stimuli before and after a training interval. Two stimuli from a spectrogram which was converted into sound were used to condition the discrimination. The stimuli were the two extremes of the continuum. When stimulus O was presented, and the subject pressed a button labelled DO, he received a flash of light; when stimulus 60 was presented, pressing an alternate button labelled TO was similarly reinforced. Differential responding was obtained after a few minutes of conditioning, and considerable improvement in the discriminative responses of the subject was then observed. These studies indicate that dysphasic children and adults can be trained in discrimination tasks and that operant techniques can be used to facilitate this training.

The studies by McReynolds (1966, 1967b, 1967a) and the study by Lane and Moore (1962) used operant techniques to teach discrimination to dysphasic and language impaired subjects as a part of broader research projects and demonstrated that operant techniques facilitate discrimination learning in a laboratory situation. Operant techniques can also be used to facilitate more advanced language training and can be used in a clinic situation as well as in the laboratory, as the three following studies will reveal.

Holland and Harris (1968) designed a training program for a male dysphasic client who had formerly been a graduate student. The language tasks were presented as programmed instruction. The client used these programs in the clinic and at home for a period of eight months. The various steps in the programs required reading aloud, writing and speaking. Reinforcement for auditory items consisted of hearing the correct response on tape. Visual items were reinforced with the correct response which was written on the next card. As a result of the program, the young man's language skills improved to such an extent that he could audit graduate courses and was planning to return to graduate school. Bloom (1962) treated dysphasic patients in group sessions during which functional situations were recreated. Appropriate responses were reinforced by their effect upon the other members of the group. Because the group situation resembled the dysphasic's environment outside the group, it is likely that responses reinforced in the group sessions will carry over into other situations. Goodkin (1966) used operant techniques in treatment programs with two dysphasic clients. With one client, Mr. M., the goals were to increase the frequency of understandable words and phrases in response to relatively unstructured question, to decrease the frequency of unintelligible utterances, and to decrease perseveration. Good responses were defined as utterances that included a minimum of one clearly distinguishable word following the stimulus question. Bad responses were defined as those continuous utterances that contained no new words and consisted only of repeated words or indistinguishable sounds. Effective changes in behavior

resulted from the following reinforcement procedure. After a good response, the experimenter complimented Mr. M., repeated the good response, and pointed to a box of blue poker chips from which Mr. M. took one chip. Following bad responses, the experimenter told the client the nature of his error and pointed to a box of red poker chips from which the client took a chip. At the end of the session, the experimenter added up the pile of blue chips in front of the client. During later sessions, Mr. M. was instructed to take a blue chip after each good response and a red chip after each error without being told whether his responses were good or bad. There was close agreement in the responses judged good and bad by Mr. M. and by the experimenter. A similar approach was used with Mrs. S. Mrs. S. used many words, but tended to shift very quickly from one topic to another. She also responded quite inappropriately to questions asked of her. After a question from the experimenter, Mrs. S. was reinforced verbally and with a blue poker chip for each 15-second period, during a 2-minute period, which included some material relevant to the question. She was instructed that she was off the topic and received a red chip after each 15-second period during a 2-minute period, which failed to include any relevant material. After less than 15 sessions, Mrs. S. had shown a marked reduction in irrelevant responses to the stimulus questions.

The dysphasic child and the dysphasic adult experience frustration because of their inability to communicate effectively and are often deprived of positive reinforcement from their environments. When reinforcement is provided in the laboratory and in the clinic, the

dysphasic can learn to discriminate and can learn to increase desirable language behavior and decrease undesirable language behavior. Receiving this reinforcement results, from clients' reports, in a feeling of accomplishment on the part of the dysphasic because he can view his progress.

Articulation Disorders

As a child learns to speak, he learns to produce the various phonemes which make up his language. Sometimes certain phonemes are not learned or are learned incorrectly. The people in the child's environment may not like a misarticulation made by the child, but nevertheless they reinforce it, and it can easily become firmly established. Operant techniques can be very useful in correcting articulation defects by providing reinforcement for correct responses and withholding reinforcement or providing punishment for incorrect responses. This is often accomplished through successive approximation. For instance, the client may move from an omission to a substitution to a distortion which gradually approximates the correct phoneme more and more closely. Several research studies have shown that operant techniques can be used effectively in correcting articulation disorders and that the techniques used in the laboratory are often adaptable to the clinic.

Articulation therapy frequently begins with discrimination training. Winitz and Lawrence (1961), Winitz and Bellerose (1962, 1963a, 1963b, 1965), Winitz and Preisler (1965), and Baer and Winitz (1968) studied children's sound learning abilities and discrimination learning abilities. Reinforcement was presented to the children when the desired sound or discrimination was learned. This appeared to be a helpful aid in sound

learning and discrimination learning. Berlin and Dill (1967) tested 24 Negro and 21 white, lower-class children on the Wepman Auditory Discrimination Test. An experimental group of 10 white and 12 Negro children received feedback and verbal reinforcement for correct responses, while a control group of 11 white and 12 Negro children received only a second trial. Reinforcement improved the discrimination scores of the Negro experimental children, and, while not statistically significant, many of the white experimental children reduced their scores on the second trial. No change was observed in the group of control children who received neither reinforcement nor feedback on the second trial.

Teaching machines offer promise of becoming an effective aid for the speech pathologist. Teaching machines use successive approximation, present reinforcement immediately and provide stimulus support which is gradually withdrawn. All of this is done automatically. In an article by Holland and Matthews (1963), teaching machine concepts were explained, and the results of an experiment using teaching machines to teach discrimination of the /s/ sound were presented. Three different programs were used. Program I was the most thorough and presented /s/ discrimination tasks in a full range of contexts. Program II trained discrimination of isolated speech sounds. The task of Program III was discriminating correct from misarticulated /s/ sounds within words. Only the children who worked through Program I showed significant improvement in /s/ discrimination, but children working through all three programs improved their /s/ articulation scores. A follow-up study of these programs was made by Bloom (1963) one year later. Five of the original nine subjects

in each group were re-tested using the same procedures. He found that the children in Program I retained their /s/ discrimination skills. He also interviewed the children and found that most of them liked working with teaching machines. In a subsequent study of teaching machine techniques, Holland (1967) designed programs encompassing several discrimination tasks for 10 different consonant sounds. Children with articulation disorders were given programmed auditory discrimination training appropriate to their misarticulations. As a result of the programs, the children showed improvement in discrimination of specific consonants, general discrimination, articulation of specific defective consonants, and general articulation.

Operant techniques can produce significant results in a brief amount of time as shown by the next two studies. In each of the studies, the subjects' faulty articulation was modified in only three sessions. Mowrer, Baker and Schutz (1968) constructed a written instructional program to extinguish the lisping response, /th/, in children and replace it with the /s/ response. The three-part program taught correct production of the /s/ in isolation and extended this to all positions in words and to connected speech. The children received visual feedback, and correct responses were reinforced with redeemable tokens. Of the 10 children who received the program, seven achieved perfect or near perfect scores on a test administered after the program was completed. Of the three remaining subjects, two substituted /t/ rather than /th/ for /s/, and the program was not as effective for them. The third subject had severe emotional problems which may have inhibited

his performance. The program was completed in three sessions. Griffith (1965) studied modification of articulation errors through the use of instrumental conditioning. Five experimental groups, three comprised of children with a faulty /s/ sound and two comprised of children with a defective /r/, were used. In three 45-minute sessions, each child listened to three stimulus words and attempted to imitate each. If successful, the child was reinforced with candy. This application of conditioning principles was successful in modifying faulty articulation.

Two studies conducted at Parsons State Hospital demonstrated that operant procedures can also be used effectively to improve the articulation of mentally retarded subjects. In a study by McLean (1965), an 11-year-old mentally retarded male was subjected to four treatment conditions with the goal being correct articulation of /l/. The subject did not correctly articulate any of the 10 /l/ words when he was presented with the picture prior to any training. There were no changes in articulation of good quality when an aversive stimulus (removal of candy) was made contingent upon an incorrect response to the picture. The pairing of an auditory-visual stimulus with the picture resulted in correct articulation responses which were generalized to picture stimuli alone if the picture stimulus conditions followed the dual-stimulus conditions immediately, and correct responses increased in frequency when followed by positive reinforcement. McLean and Spradlin (1967) reported a program for modification of articulation disorders in high-level mentally retarded males. Correct articulation responses on defective phonemes were generated in four different stimulus conditions

of increasing difficulty. The four conditions were echoic stimuli, pictures, graphemes of the words, and interverbal chains. When correct responding reached a high level of occurrence under one stimulus condition, a shift was made to the next condition. Correct responses were reinforced with pennies. This program changed articulation with relatively high efficiency, and the phoneme learning which was accomplished generalized to untrained words in three of the four subjects.

Whether automatic programming devices are used or reinforcement is provided by the clinician, operant procedures can be used effectively to improve both discrimination ability and articulation. The programs are easily administered and produce results quickly. These techniques should be very useful for the average clinician with his large load of articulation cases. Operant techniques have been effective in modifying the articulation and discrimination of a variety of subjects which included normal children from all socioeconomic classes as well as mentally retarded children. Similar procedures should be effective with adults who have articulation disorders.

Chapter IV

Discussion

Girardeau (1967, p. 1) recently commented that the procedures the speech clinician uses are primarily behavioral modification techniques. The clinician stimulates, urges, and praises the attempts of the child. He continued, "Since speech clinicians want to be more effective, clinical activities must be directed toward (1) determining what aspects of speech are essential to adequate communication within the community and (2) developing a set of behavioral principles for modifying speech." It is evident from the previously reported research that operant methodology is a means of behavior modification which is especially applicable to modification of speech. Operant techniques have been successfully used to modify specific speech disorders such as stuttering, dysphasia and articulation.

Ullman and Krasner (1965, p. 1-2) presented three questions which could be helpful to the speech clinician in using behavior modification principles as part of the therapy program.

1. What behavior is maladaptive, that is what subject behaviors should be increased or decreased;
2. What environmental contingencies currently support the subject's behavior (either to maintain his undesirable behavior or to reduce the likelihood of his performing a more adaptive response);
3. What environmental changes, usually reinforcing stimuli, may be manipulated to alter the subject's behavior.

To restate these questions specifically for speech pathology, the clinician must first decide through diagnostic techniques and careful observation of the client what speech behavior is maladaptive and what aspects of that behavior to attempt to modify. The clinician will have occasion to both increase and decrease specified behaviors. For example, with a stutterer the clinician attempts to decrease the rate of stuttering behavior and increase the emission of fluent speech. The client with an articulation disorder may articulate an /s/ correctly on some occasions and on others substitute a /th/ for the /s/. In this situation, the clinician seeks to increase the frequency of the /s/ and decrease the substitution of a /th/ for the /s/.

The implication of the second question, what environmental contingencies currently support the maladaptive behavior, is that the clinician must study the client outside of the clinic environment. Observations of the client's speech in all situations and knowledge of the environmental contingencies which are supporting the behavior under study are necessary for effective modification of that behavior. For example, a speech disorder may persist if its presence elicits sympathy from other people or reduces the expectations placed on the person by his environment.

In terms of the third question, the clinician must determine what environmental changes can be manipulated. The speech clinician may occasionally attempt direct modification of the client's social environment. Often however, the client's behavior is first modified in the clinic, and the clinician then attempts to generalize these

controls to situations in the client's environment. Reinforcing stimuli are often used to effect this change and to maintain the desired behavior. Two variables concerned with reinforcement must be kept in focus. First, the reinforcer must be presented immediately following the desired response to enable the client to discriminate which behavior is reinforced. The second factor is that the stimulus designated as a reinforcer be reinforcing for the client. Some commonly used tangible reinforcers are food, money and toys. Also effective in many cases are social reinforcement and praise. A tangible reinforcer along with social reinforcement may be used to condition a response. Then the tangible reinforcer is gradually faded out to facilitate generalization of the response to situations outside the clinic. Different contingencies must be tested to determine which is the most reinforcing to a particular client. Deprivation and satiation are also important. For example, pennies may be reinforcing for a child until he has saved up enough to make a desired purchase; then he will no longer work for them. Reinforcement may be delivered each time the desired response is emitted or intermittently according to several schedules. After the response has been conditioned, intermittent reinforcement is more desirable because the response is less likely to extinguish when reinforcement is no longer given. This resistance to extinction also facilitates generalization of the desired behavior to environmental controls extrinsic to the clinic environment.

Operant techniques hold great promise of being very useful for the speech clinic. Operant techniques are a precise and controlled way of

dealing with stuttering and programs can be designed to suit the individual client in terms of the reinforcement and punishment contingencies operating for him in his environment. Operant techniques can aid the dysphasic patient not only by increasing his ability to use language but by reducing his frustration by providing him with feedback and positive reinforcement and a feeling that he is accomplishing something. Operant techniques used for articulation disorders can accomplish more lasting results in less time. If the steps are designed and used carefully, there is little danger of moving to the second step before the first step is completely learned. Automatic programming devices are a useful aid in using operant procedures, but the procedures can be used without special equipment if the clinician carefully designs a program for the client and carefully carries it out. Operant techniques do not eliminate the human aspects of the therapy program. On the contrary, the clinician himself can be the most effective reinforcer of all. If the clinician gives the client understanding, patience and attention, the client will often work hard for the praise of the clinician. This starts a positive chain of events because the client's improved speech will then receive further reinforcement from the other people in his environment.

The quantity of operant research related to speech pathology is not large, but the results so far are encouraging. More programs such as Holland's discrimination program (Holland, 1967) are needed. To use operant techniques to their best advantage, specific study of the techniques is necessary. Interested speech pathologists would find

The Analysis of Behavior by Holland and Skinner (1961), the appendix of Tactics of Scientific Research by Sidman (1960), Science and Human Behavior by Skinner (1953), and the glossary of Schedules of Reinforcement by Ferster and Skinner (1966) helpful in acquiring an understanding of the use of operant principles.

Operant procedures have been effective in the studies reviewed and will be effective in future clinic applications because of their step by step approach to achieving the desired behavior, because they force the clinician to carefully observe and record the client's behavior, because they allow the clients to observe their own progress, and the observed progress provides reinforcement for both the client and clinician.

Chapter V

Summary

The purpose of this paper was to review the research concerned with the operational application of operant methodology to speech pathology. The review was divided into two sections. The first presented a historical overview of the use of operant techniques for the modification of verbal behavior. This section was divided into four parts, the first of which was adult verbal behavior and included studies in which the content and order of the subject's conversations were brought under operant control. In the second part, research was reviewed which demonstrated that applying systematic reinforcement to vocalizations of infants and speech of children resulted in increasing the rate of output of these behaviors. The third part dealt with research which demonstrated how operant procedures were utilized to reinstate verbal behavior in previously mute adult psychotics. The fourth part presented research in which operant techniques had been used to modify verbal behavior of disturbed and retarded children.

The second section of the paper reviewed research in which operant techniques had been used to modify speech disorders. The three parts were stuttering, dysphasia, and articulation disorders. The research presented in the part on stuttering indicated that stuttering could be manipulated through the response contingent presentation of punishment or positive reinforcement, both in the laboratory and in the clinic. In the part on dysphasia, the studies reviewed indicated that when

reinforcement could be programmed in the laboratory and in the clinic, the dysphasic client learned to discriminate and increased desirable language behavior and decreased undesirable language behavior. In the third part, it was demonstrated that whether automatic programming devices were utilized or reinforcement was provided by a clinician, operant procedures effectively improved both discrimination ability and articulation.

It was suggested that many clinicians and researchers have found operant techniques to be an efficient and successful way of modifying verbal behavior in a wide range of applications, and specific guidelines for application of operant methodology to speech pathology were discussed.

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OPERANT METHODOLOGY IN SPEECH PATHOLOGY

by

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