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ABSTRACT

This publication reports on research which has investigated phoneme acquisition and carry-over in a programmatic fashion. This research began with investigations of the effect of an extension of stimulus control of new phoneme responses through a systematic operant procedure. After quantifying the effect of such procedures in terms of stimulus generalization, the program of research moved to the investigation of additional systematic procedures which were applied to such factors as phoneme position in words; phoneme responses embedded in sound-loaded sentences; and phoneme-responding in sentences under enforced time limits. Measurement of the effects of such training variables was made in terms of correct phoneme-responding in controlled samples of connected speech and in spontaneous conversation. The goal of the research has been to identify, empirically, the treatment variables which function to attain the carry-over of new phoneme learning into nonprogrammed conversational speech. The results of the research indicate that systematic procedures which treat certain stimulus and response variables result in high degrees of correctness in new-phoneme responses in conversational speech. These variables are: (1) antecedent stimulus variables ranging from imitative models to nonimitative evoking stimuli, such as pictures and intraverbal chains; and (2) response configuration variables, such as word-position of phonemes and sentence-production performance. (Author/DB)

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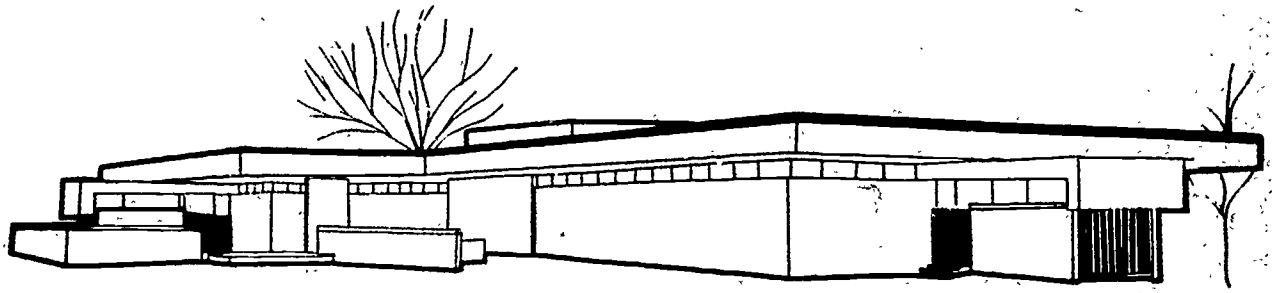

Report No. 6 July, 1972

PROGRAMMATIC RESEARCH ON A SYSTEMATIC ARTICULATION THERAPY PROGRAM: CARRY-OVER OF PHONEME RESPONSES TO UNTRAINED SITUATIONS FOR NORMAL-LEARNING PUBLIC SCHOOL CHILDREN

by

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TABLE OF CONTENTS

Introduction 5

Research Subjects, Materials, and Procedures for Generalization Training Component 11

Subjects 11

Materials 12

Equipment and Environment 15

The Generalization Training Program 15

Probe Tests for the Effects of Training 24

Recording and Analysis of Data 29

Results of the Current Research 32

Pre-Training Probe 34

Training 36

Post-Training Probe 66

Summary. 67

References 69

Appendix A i

Appendix B v

Appendix C xiv

Introduction

The numbers of children who demonstrate some phonemic deviations are extremely high. Our initial testing in the public schools of Parsons, Kansas, showed nearly 10 per cent of the children in grades one through six with disruptions in their phonological system. To be sure, not all of these were severe problems: approximately 5 per cent could be classified as having severe problems. These facts mean, however, that in Parsons there are many children who are vulnerable to the potentially aversive effects of deviant speech patterns. While it is true that the aversive effects of such problems have not been easily quantified in terms of educational failure or emotional problems, it does seem obvious that one would be hard-put to state that deviant speech does not have the potential to evoke penalizing reactions from peers, parents, and/or teachers. It also seems obvious that our culture prefers to minimize through prevention those child problems which are potentially penalizing or handicapping.

In spite of a relatively thorough cultural conditioning toward prevention, we often find speech pathologists rationalizing away the effects of such deviant phonological systems--until children are older. These experts say that no one can spend the time working out standard phonological systems for young school-age children. They cite norms to show that some children may take up to age seven to develop an acceptable phonological code. Such philosophical stances are difficult to combat. No one really says that children should talk with deviant phonological codes until they are at least seven, nor that adequate codes are not possible before age seven. No one says a child learns good things because his speech often evokes ridicule from his peers; laughter from his father; and/or clucking noises from his grandmother. They say only that, given the huge caseloads and time-consuming methodology of articulation therapy, it seems best to wait until a child is seven before a professional attempts to intervene in his phonological system.

If these views of the expedient nature of our educational philosophy seem radical and/or ill-founded, one might test them by posing the following question: if phonological errors of a young school child could be erased in one week by a machine-presented program utilized for fifteen minutes per day, would this philosophy remain the same? It seems clear that it would not be; effective and efficient alternatives effect change in philosophies. Many traditional selection criteria for treatment were first established because of a lack of effective and efficient alternatives.

If we look at the factors which would support the development of such alternatives, we can see that many of these are technological in nature. We know that we can modify articulation behavior; the principles are available to us. If we could, therefore, find procedures of articulation therapy which apply these principles with more effectiveness and efficiency, we could alter the standard patterns

of speech therapy services--thereby altering the rationale by which such services are distributed. Concommitantly, we would alter the economics of such services.

The Technology of Articulation Therapy

The methods of articula ion therapy have remained relatively static during the past fifteen years, when these are compared to the burst of reform and change which has been evident in both general and special education. The general therapy methods as well as the traditional delivery system--a clinician with an individual or with small groups of children--have not been significantly altered. Yet, the economics of speech therapy services has consistently worsened. School clinicians are now required to have a master's degree in most states, and the salaries of all professionals employed by the schools have made public schools the victim of a steadily increasing cost/service ratio which is of critical importance today. As a result of the intellectual, professional, and economic demands for changes in educational methods--including special education and speech therapy--professionals must look at their current procedures and delivery systems and try to improve them in both effectivess and efficiency.

The work in functional analysis of behavior and its influence on both learning theory and delivery systems has brought about tremendous activity in these areas. Such activity has an amazing breadth in its influence. In light of such development, the professional must re-examine his theory, his principles and procedures, and his delivery system. In this process, he must generate more empirical evidence than the teachers-are-born-not-made modes of the operation of the past demanded. The overall effect of behaviorism has been stimulating to professionals and, importantly, *it has finally directed the focus of teaching methods toward accountability in terms of the improved behavioral repertoires of children rather than the philosophical system of the teacher.*

In speech pathology, much of this new focus has been on articulation therapy--surprisingly, because this is probably the area where traditional speech pathologists have felt most secure. Yet, because the incidence of phonological deficits is so high, and because the area of phonology is a microcosm of other areas of linguistic complexity, phoneme articulation has attracted much attention.

Our initial research at Parsons was generated primarily by attempts to improve the effectiveness of articulation therapy for mentally retarded children. The results (McLean, 1970; Raymore and McLean, (1972)) of our initial and continuing work with the retarded child, however, appeared to be so applicable throughout the population of children with speech deficits that we have extended our research to normal children. As our programing procedures developed, so did

our interest in, and need for, improved delivery systems with technological implementation. All of these needs, then, move us linearly into systems planning; into instrumentation; into specific training methods for clinicians who want to utilize these new approaches; into more appropriate forms of materials; and into efficient dissemination methods. Our work in the past has provided the impetus for expanded efforts in technological mediation of the elements of this linear movement. The research reported herein is a part of this effort.

Basic Components of Articulation Therapy

Our research has led us to identify three basic components in articulation therapy. If one begins at the terminal goals of such therapy and chains backward, one can structure a sequence which specifies the components quite clearly.

Generalization or Carry-Over. The final goal of articulation therapy is a phonological system in which all English phonemes can be adequately produced in whatever situation they are called for by an individual's language output. Since it is impossible to teach for every possible emission form or situation, a child must acquire the linguistic rules which generate appropriate phoneme-response behavior. This means discovering the linguistic construct of a phoneme; the variation of phoneme positions in words; allophonic variations brought about by certain co-articulation contexts with other phonemes; and several other phonological and morphological rules. Articulation therapy, therefore, must bring about learning or acquisition of the linguistic structure of English phonology in such a way that the differential features of this structure are fully learned and are, thus, available in whatever speaking situation a child may find himself.

Such a state of learning has often been described in speech pathology as carry-over of the therapy instruction into novel situations. Such learning might be better quantified in terms of stimulus generalization of trained responses and the transfer of training on responses acquired in articulation therapy to other responses of the same class but of a different form or configuration, i.e., allophonic variations caused by specific co-articulation contexts. The attainment of such a state of generalization and transfer requires a treatment component which is specific to that task.

Response Development. Continuing the backward chaining from the terminal goal of therapy: if generalization is the final goal of therapy, development of the specific behavior which is to be generalized must necessarily be another component of the therapy process. In our work, we have specified this second component of therapy as the

response development component, and, if it is needed, we sequence it, naturally, just preceding the generalization training component. The response development component of therapy programs includes the arrangement of the antecedent stimulus cues which have been demonstrated to be functional in evoking the correct topography of the new phoneme responses in isolation, nonsense syllables, and words. These stimulus cues include auditory, visual, and tactile cues of varying types. Auditory and visual models of the response, verbal instructions about the response, and proprioceptive cues obtainable from phonemes which the child can already produce are all utilized in this component of therapy. Some of these stimulus cues are subtle, and sometimes even the more obvious cues are difficult for a child to discriminate. If a child demonstrates that the response development programs provided are inadequate to evoke the necessary changes from incorrect phoneme production to correct phoneme production, another component of therapy becomes appropriate. This third component has been labeled in our work as the stimulus discrimination component.

Stimulus Discrimination. In Stimulus Discrimination, the task is to train the child to discriminate the differential features of the desired phoneme response in all of the sensory modes and stimulus forms which are to be used in response development training for that phoneme and/or its features. This component is the least defined at this point in our research. Speech therapists have traditionally provided programs in which stimuli pertinent to therapy tasks have been discriminated. For the most part, however, these programs have been directed toward only the auditory sensory mode--and even then the programs have not covered all of the different types of stimuli provided within that mode. The discrimination programing task becomes one of seeking the discrimination of stimulus cues which are pertinent to the specific phoneme response to be trained. In this area, pertinent features of manner, placement, and voicing of the desired phoneme are cued, in all appropriate sensory stimulus modes. The goal in this work is differential responding by the child to the difference features of the stimulus through nonvocal responses such as pointing, matching, and/or button-pressing. With nonvocal, differential responding under the control of the specific difference features of the phoneme, the clinician can proceed again to the response development component and seek the translation of this stimulus discrimination into production of the correct topography of the phoneme response in place of the nonvocal responses used in the training of the discrimination.

REPORT ON CLINICAL RESEARCH

At this point in time in our research, the generalization program has received the most attention. It is this work which will be covered in this report.

In this work, it has been our basic contention that generalization and/or carry-over of a new-phoneme response into spontaneous speech is not so much a single behavioral event as it is a comulative chain of events. As such, carry-over is the empirical evidence that a new phone response has been acquired as a motor response and that it has finally come under the linguistic-system control necessary for it to be available as an integrated unit of spontaneous speech behavior. It is our assumption that intervention variables which effect such acquisition and integration can be empirically identified and, following this, can be incorporated into a systematic program of therapy.

Our experimental work, then, has been designed to identify the appropriate variables; to develop treatment procedures which utilize each variable; and to provide data which documents the functional effects of each segment of the treatment program on the target-behavior phoneme carry-over.

Our data has indicated to us that three variables are basic to the attainment of carry-over after a new phone response is available as a motor act. These are

1) extension of the stimulus control of the response;
2) correct responding across the word-position distribution of the new phoneme; and
3) extended performance on the phoneme in speech configurations at least as complex as sentences.

Each of these variables will be discussed briefly in following sections.

Extension of Stimulus Control. The extending of control of phoneme responses from stimuli which contain specific topographical information to those which only cue the correct response creates an environment conducive to the process of generalization or carry-over. This process of shifting stimulus events involves a gradual extension of phoneme responding from highly supportive imitative situations in which there is a point-to-point relationship between the stimulus and response to situations in which the external cues for supporting correct phoneme production are minimal--as they are in spontaneous conversation.

McLean (1970), McLean and Spradlin (1967) and Spradlin and Girardeau (1970) have discussed the ways in which speech pathologists use stimulus control in their procedures to modify speech behavior. The initial research on this first dimension of generalization is fully reported elsewhere by McLean (1970) and, therefore, will only be summarized here. In this research, four retarded institutionalized male subjects were trained on phonemes in the initial word position and correct phoneme responding was evoked by echoic stimuli on ten words. These correct responses were systematically shifted to emission in the presence of picture, printed word, and incomplete sentences as antecedent stimuli.

The results of this experimental procedure indicate that

1) Phoneme responses in words evoked by echoic stimuli and positively reinforced through a series of paired and single-stimulus conditions effect efficient shifts in the stimulus control of the response.

2) Spontaneous generalization to new and untrained stimulus conditions was shown.

3) Three of four subjects were able to generalize to new words requiring the trainined phoneme in the same word-position in which it was trained.

4) Three of the four subjects overgeneralized to new words which, when correctly produced, required the previously substituted phoneme.

5) The subjects did not generalize the trained phoneme to a word position different from that in which it was trained.

6) The responses and generalization patterns acquired in the stimulus-shift training program were maintained at least over a short period of time.

Word-Position Training. The second dimension of generalization, correct phoneme production in all three word positions, was examined later by Raymore (1970) with four institutionalized,retarded subjects (three males, one female). In this investigation, new phonemes were trained in the initial position, final position, medial position, and in a randomized treatment of all three positions. This research is reported in detail by Raymore (1970) and Raymore and McLean (1972). The results indicated

1) A training program which includes not only specific phoneme training in all three word positions, but also randomized presentations of stimuli in all three word positions, increases and stabilizes the level of responding to trained and untrained items.

2) A training program which includes specific phoneme training in all three word positions increases the level of responding to untrained words with the trained phoneme in all three positions, but the level of responding remains inconsistent and varied.

Sentence Configuration Training. The inconsistencies still present in phoneme production after both extension of stimulus control and word-position training indicated the need for additional treatment. The effect of the stimulus and position treatment has been considerable: phonemes

were easily produced and were properly distributed in the various word positions in single words. In addition, the training phoneme was being generalized to new words which had not been directly trained in therapy.

In many cases, when generalization to this extent was attained, children manifested carry-over into conversation without further training. There were many cases, however, in which conversational carry-over was not attained after stimulus and position training. It appeared that the remaining constraint was the difference between production of the new response in single words and the requirements imposed by speech configurations which were more complex--such as phrases and sentences. Thus, new research, reported herein, has provided data which validate programing variables beyond those covered in the research already described. The data in this report document the acquisition and generalization patterns effected by the additional treatment of the configuration variable of sentence-training and the additional variable of extended performance across all of the stimulus and configuration variables included in the program. *Specifically, the objective of this study is to attempt to validate, empirically, a systematic treatment procedure which results in situational carry-over of correct responses on previously defective phonemes with elementary school children.*

Research Subjects, Materials, and Procedures for Generalization Training Component

Subjects

For the public school pilot study, conducted during June and July, 1971, teachers and public school nurses were asked to refer all children in the primary grades whose speech might be classified as deviant from the norm due to articulation errors. All the children referred were given the initial screening test.

The screening consisted of evoking the following information from each child: name; address; date; school; teacher; grade; age; colors. Also during screening, loaded questions were used to evoke phoneme samples which were not produced in the above categories. Each child was seen for approximately two minutes. Any child whose speech appeared to be deviant with the latter defined as that calling attention to the manner of speech due to misarticulated phonemes, was classified as having failed.

A total of 68 children were seen during screening in the spring of 1971. Thirty of these children failed the screening. Seventeen of these children were seen in the Speech and Hearing Clinic of Parsons State Hospital and Training Center for further evaluation. At this time, each child was given the Goldman-Fristoe Test of Articulation,

the McDonald Deep Test, and biographical information was obtained from the accompanying parent.

From this second screening nine children were selected for participation in the pilot study. Table 1 lists each subject's sex, grade completed in school, the phoneme selected for training, and the word positions affected by the error. These children were given systematic programing to attain situational carry-over on phonemes which were stimulable (Milisen, 1954).

Table 1
Subjects Selected for Training

Initials	Sex	Grade	Phoneme	Word Position
B.B.	M	2	/ts/	IMF
B.D.	M	1	/s/	IMF
S.D.	F	K	/l/	IMF
L.F.	F	K	/l/	IF
D.H.	M	K	/l/	IMF
T.M.	M	K	/l/	IMF
L.P.	M	3	/l/	IMF
M.S.	F	1	/l/	IMF
B.S.	M	K	/l/	IMF

Materials

Results of our work during previous investigations of the stimulus-shift program demonstrated a need for a semi-automated management of stimulus materials. Slide projection of 35 mm slides of all pictured stimulus words was instituted. A total of 3,500 slides were created for use in the training program. Words selected for the programs were chosen on the basis of the following criteria:

1) Words used in the program had to be nouns which were picturable, i.e. with a simple line drawing representing the word which could evoke the appropriate verbal response.

2) Words used in the program had to contain (a) the selected phoneme in the initial position (10 words); (b) the selected phoneme in the medial position (5 words); and (c) the selected phoneme in the final position (5 words).

The complexity of discussion of such materials for training can be reduced considerably by reference to Table 2 which describes the materials in terms of stimulus condition, word position, and stimulus type. Appendix B contains materials used in the training program for the /s/ phoneme as examples.

Table 2

Materials Needed for Training

STIMULUS CONDITION	PHONEME POSITION in WORDS	STIMULUS TYPE
S^1 (Echoic)	Initial	List of 10 training words and 5 Phoneme Boundary words
	Final	List of 5 training words
	Medial	List of 5 training words
S^2 (Picture)	Initial	Slides of the 10 training words and 5 Phoneme Boundary words
	Final	Slides of the 5 training words
	Medial	Slides of the 5 training words
S^2 (Picture) S^3 (Grapheme)	Initial	Slides of S^2 and S^3 for the 10 training words and 5 Phoneme Boundary words
	Final	Slides of S^2 and S^3 for the 5 training words
	Medial	Slides of S^2 and S^3 for the 5 training words
S^3 (Grapheme)	Initial	Slides of 10 training words
	Final	Slides of 5 training words
	Medial	Slides of 5 training words
S^4 (Intra-verbal)	Initial	10 incomplete sentences with each training word at the end
	Final	5 incomplete sentences with each training word at the end
	Medial	5 incomplete sentences with each training word at the end
S^5 (One-Word Sentence)	Initial	4 S^4 sentences with cueing picture of word containg phoneme
	Final	3 S^4 sentences with cueing picture of word containing phoneme
	Medial	3 S^4 sentences with cueing picture of word containing phoneme
S^6 (Two-Word Sentence)	Initial Final Medial	10 sentences with two words in each containing training sound Each is picture or grapheme cued
S^7 (Three-Word Sentence)	Initial Final Medial	10 sentences with three words in each containing training sound Each is picture or grapheme cued
Paragraph	Initial Final Medial	Heavily sound-loaded and presented in written form

Because this phase of the project was aimed at empirical validation of the systematic programing, in addition to training materials, each program calls for testing/evaluation materials. Table 3 describes the testing materials in terms of stimulus condition, word position, and stimulus type.

Table 3
Materials Needed for Testing Each Training Phoneme

STIMULUS CONDITION	PHONEME POSITION in WORDS	STIMULUS TYPE
S^2 (Picture)	Initial	5 training words
	Final	5 training words
	Medial	5 training words
S^2 (Picture)	Initial	5 untrained words and 5 untrained Phoneme Boundary words
	Final	5 untrained words
	Medial	5 untrained words
S^7 (Three-Word Sentence)	Initial Final Medial	10 training sentences with 3 words in each containing training sound. Each is picture or grapheme cued
Paragraph	Initial Final Medial	Heavily sound-loaded and presented in written form
Story	Initial Final Medial	Sequenced sound-loaded pictures presented in book form
Cartoon Board	Initial Final Medial	Heavily sound- loaded picture
Conversation	Initial Final Medial	General conversation with researcher loading questions which might yield answers containing the training sound

Not included in these two latter tables is the randomization treatment. To include this treatment (for slide-tabulation purposes) we double the number of slides needed for the following stimulus conditions: S^1; S^2; S^2S^3; and S^3 for training and testing materials.

Each training program (including the testing materials) contains 320 slides. Programs were prepared for the following six phonemes: /l/; /s/; /r/; /ʃ/; /tʃ/; and /k/. The phonemes were selected for training on the premise that they represent the phonemes most often misarticulated in a public school population.

Equipment and Environment

The equipment utilized for therapy sessions included the following:

Mirrors
Show and Stow Carousel remote controlled slide-projector
(see Appendix A) includes: rear projection screen
projector
carrying case

Tape recorder and microphone
Poker Chip Dispenser - Gerbrands, Model B - and box (see Appendix A) with supply of poker chips
Slide trays
Stop watch

Supplies needed for each session included:

Audio tapes
Extra supply of tokens (red, white, blue)
A roll of pennies
Box of stars
Progress "Star" Chart
Data collection sheets
Probe sheets

In the therapy room, the child sat to the immediate right of the experimenter. The Show and Stow screen was slightly to the right of the child. Both the child and the experimenter faced the mirror. The token box was placed to the experimenter's left. The microphone was placed directly in front of the child. The Show and Stow manipulator switch and token box dispenser switch were on the left of the experimenter. The extra poker chips, stop watch, stars and pennies were placed directly in front of the experimenter. (See Appendix A for a picture of the therapy setting.)

The Generalization Training Program

Figure 1 illustrates the entire procedure for generalization training as applied for the /s/ phoneme. Following then, is a narrative presentation of the procedure described in the same organizational terms of Figure 1, & 2, Multiple Stimulus Control; Configuration Contexts; and Performance Across Trained and Untrained Stimulus and Configuration Constraints.

I. Multiple Stimulus Control: Initial Position

Condition I. *This first training step (echoic stimulus only) is used ONLY if the child demonstrates difficulty in reaching criterion on the paired echoic/picture stimulus condition (Condition II).* Ten training words with the training phoneme in the initial position are presented as echoic models by the experimenter to the child. The child is instructed to repeat each word after the experimenter. Correct responses (correct production of the training phoneme) receive immediate positve reinforcement (a token or point) while incorrect responses do not. On the occasion of an incorrect response, the experimenter moves on to the next stimulus word. *The ten-word list is presented until the child reaches a criterion of 50 per cent correct on four successive training blocks of 10 words each; Condition I is terminated.*

Condition II. Using the same 10 training words of Condition I, the experimenter simultaneously presents the echoic stimulus (S^1) and a picture stimulus (S^2) on each word. On any one stimulus item, the child is exposed to the echoic stimulus and the picture of the stimulus word. Each correct response is reinforced with a token. *When the child reaches the criterion of 20 correct phoneme responses in 20 attempts, the use of the paired S^1S^2 presentation is terminated.* The echoic stimulus is withdrawn and only the pictured stimulus is presented. The child is asked to name each picture and correct responding is, as before, followed by delivery of a token. *When the child reaches the criterion of 38 correct responses out of 40 attempts a change in the schedule of reinforcement is made.*

At this point in the training program, it is explained to the child that before each training block of ten words is presented, he will receive ten tokens. During the training of each block of ten words, a token will be deducted from the ten whenever an incorrect response occurs. With our current equipment, the deduction of a token with a token dispensing box produces a loud buzzing noise further signalling the error. The child is allowed to keep only those tokens of the original ten which remain in the dispensing tube after the completion of each training block. Ten new tokens or points are then presented for the next training block and the procedure continues. The cost-contingency schedule of reinforcement is maintained throughout the remainder of the program.

If a child shows a downward trend of correct responses on S^2 (picture only) or any of the treatment conditions, the experimenter repeats the previous stimulus condition until the child again meets the criterion assigned for that condition. The failed stimulus condition is then presented to the child again with the appropriate criterion applied. When the criterion is finally met, the next stimulus condition (Condition III) is presented. It might sometimes be necessary to return to a previously successful stimulus condition several times before a criterion can be met on a new condition.

FIGURE 1
DETAILED PROCEDURE
FOR GENERALIZATION TRAINING PROGRAM ON /S/ PHONEME

I. MULTIPLE STIMULUS CONTROL

INITIAL STIMULUS CONDITIONS AND CRITERION

TRAINING WORDS	S^1	S^1 S^2	S^2	S^2 only *c.c.	S^2 S^3	S^3	S^3 S^4	S^4
saddle, safe, sailor, seal, sign, slingshot, star, ceiling, suit, sack	20/40 correct	20/40 correct	38/40 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

*Cost contingency schedule introduced

II CONFIGURATION CONTEXTS

A Phoneme Boundary Training

	S^1	S^1 S^2	S^2	S^2 S^3	S^3
threat, sailor, thief, suit, theatre, safe, thirty, saddle, thermos, ceiling	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

B Position Training

FINAL

	S^1	S^1 S^2	S^2	S^2 S^3	S^3	S^3 S^4	S^4
chops, fox, gas, ice, lace	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

MEDIAL

	S^1	S^1 S^2	S^2	S^2 S^3	S^3	S^3 S^4	S^4
racer, faucet, pistol, policeman, basket	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

RANDOMIZED

	S^1	S^1 S^2	S^2	S^2 S^3	S^3	S^3 S^4	S^4
sack, basket, suit, ice, policeman, ceiling, lace, star, slingshot, gas, sign, pistol, fox, seal, faucet, sailor, racer, safe, chops, saddle	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

C. Word-Sentence Transfer Training

* ONE-WORD SENTENCES

	S^1 S^2 S^5 paired	S^2 R^5 only
The cowboy bought a new saddle My money is in the safe A Navy man is called a sailor I watched a trained seal A cowboy wears chops I shot a fox For cold pop, you need ice I saw a racer Turn on the faucet The cowboy wears a pistol	40/40 correct	38/40 correct

* TWO-WORD SENTENCES

	S^1 S^2 S^6 paired	S^2 R^6 only
I want some salt Did you see my sandwich? A saw will cut ice I'll see you in school She's a nice nurse You use scissors to make a dress The milk spilled from the glass Did you swing at the baseball? The old rooster is sick. You scoop dirt with a dustpan	40/40 correct	38/40 correct

III PERFORMANCE ACROSS TRAINED AND UNTRAINED STIMULUS AND CONFIGURATION CONSTRAINTS

A. Trained

	S^2 only
soap, soup, squirrel, six, cross, purse, bus, whistle, lipstick, pencil	20/20 correct

* THREE-WORD SENTENCES

	S^1 S^2 S^7 paired	S^2 R^7 only	S^2 R^7 only	S^2 R^7 only
Put some soap on the spot I want some stars in my soup The circus squirrel got up I saw six skirts On Sunday, I saw a cross I have cigarettes in my purse The stone stopped the bus A whistle sounds nice She puts lipstick on her lips He saw a pencil on his desk	20/20 correct	18/20 correct	8/10 correct 10 blocks Last 4 blocks timed	8/10 correct Two 10% Time Cuts

B Untrained

	Untrained Reading Material
Three to Five Minutes of Reading	90% ratio between Correct Responses Opportunities on Target Phoneme

	Sound-loaded, Untrained Materials
Two to Five Minutes of Discussion of Picture Stimulus Materials	90% ratio between: Correct Responses Opportunities on Target Phoneme

IV EVALUATION

	Classroom	Home
Three to Five Minute Tape Recorded Samples of Child's Speech (Weekly for 6-8 Weeks)	90% Correct Phoneme Responses After Six Weeks in All Stimulus Conditions	

KEY TO STIMULUS TYPES

S^1 = ECHOIC STIMULUS
S^2 = PICTURE STIMULUS
S^3 = GRAPHEME STIMULUS
S^4 = INTRAVERBAL STIMULUS
S^5 = *ONE-WORD SENTENCES
S^6 = *TWO-WORD SENTENCES
S^7 = *THREE-WORD SENTENCES
C.C. = COST CONTINGENCY
* = NUMBER OF SOUND-LOADED WORDS PER SENTENCE

Condition III. The textual/picture stimulus (S^2) and the printed word (S^3) are paired *until the child has emitted 20 correct responses out of 20 attempts*. The two stimulus items (picture and grapheme) are presented on one stimulus slide. The child is given instructions to attend to both items briefly then the grapheme stimulus only is presented on the next slide. The child is instructed to attend to the grapheme stimulus until he is told to respond. He is then asked to make verbal response in the presence of the grapheme slide. A correct response is constituted by correct phoneme production and correct grapheme identification. When the criterion has been met, only the printed word is presented. *The criterion to be achieved during presentation of the printed word only is 38 correct responses out of 40 attempts.*

Those children who are unable to read, move from Condition II (correctly responding to pictures [(S^2)] only) to Condition IV in which the pictures (S^2) are paired with the intraverbal (S^4).

Condition IV. The printed word (S^3) (or the picture [(S^2)] for non-readers) is paired with the intraverbal stimulus (S^4) until the child reaches the established *criterion of 20 correct responses in 20 attempts*. The experimenter presents an intraverbal stimulus (*At night I see the moon; during the day I see the* ___). At the appropriate time, the therapist cues the correct response by showing the child a grapheme or picture representation of the word needed to complete the sentence. When the criterion has been attained, the grapheme or picture is withdrawn and the child receives only the intraverbal chain as a stimulus. When the criterion *(38 correct responses in 40 attempts)* is achieved, the training sequence for the phoneme in the initial position is terminated.

II. Configuration Contexts

Phoneme Boundary Training. After the completion of training in the initial position, a probe of the child's speech behavior at that point is made. Along with other information, the probe demonstrates the presence or absence of an over-generalized response in the initial position. If over-generalization has not occurred, the child moves on to position training. If, however, over-generalization has occurred, the following procedure is used.

Five training words with the training phoneme in the initial position are randomized with five words appropriately containing the previously substituted phoneme in the initial position. A training block, then, includes a randomized presentation of the ten words. The actual training procedure is the same as that used in the initial position training with the omission of the presentation of the cost contingency schedule of reinforcement (this schedule is, however, still maintained in this portion of the program). In addition, training at this level is terminated immediately after grapheme (S^3) training for the reading

child or textual-picture (S^2) training for the non-reading child. Position training is then initiated.

Position Training: Final and Medial Phoneme Position

A procedure identical to that used in the training of the selected phoneme in the initial position is employed in the training sequence of both the final and medial word positions using the cost contingency schedule of reinforcement. The only exception is that five, rather than ten, training words are used in each position treatment. The criteria and the method of application are maintained by presenting each of the five words twice within the 10-item training block. When the criterion applied in Stimulus Condition IV (Intraverbal) in the final position is achieved, the training sequence for the medial position is initiated. When the criterion employed in Stimulus Condition IV in the medial position is achieved, the training sequence for the medial position is terminated.

Initial, Medial and Final Position Randomization

Again, using the same training items and procedures, the child is presented with the 20 stimulus words used in the previous position training programs, randomized with regard to phoneme position (10 words, initial position; 5 words, medial position; 5 words, final position). The criteria remain the same in all four stimulus conditions and the cost contingency schedule of reinforcement remains in effect.

Word-Sentence Transfer Training

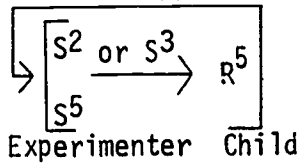
The procedure at this point of training changes and requires a response from the child in the form of an entire sentence rather than a single word. The cost contingency schedule is still used. Two stages of training are involved at each level of sentence complexity: an imitative stage and a non-imitative stage.

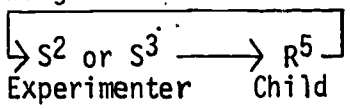
One-Word Sentences. Ten sentences are selected from the intraverbals (S^4) used in previous training at the word level. Four sentences containing the training phoneme in the initial position; three sentences, final position; and three sentences, medial position.

Imitative stage. Training at this level involves the echoic presentation of the sentence (S^5) paired with a picture (S^2) or grapheme (S^3) which cues the sentence. The child responds by saying the entire sentence. A correct response requires reasonable imitation of the syntactic features of the sentence and correct phoneme production in the appropriate word in the sentence. *The criterion requires 40 correct responses out of 40 attempts.* When the criterion has been met, the non-imitative stage of training is begun.

Non-Imitative stage. During the non-imitative stage of training, the picture (S^2) or grapheme (S^3) is presented without echoic support. The child is instructed to respond by uttering the entire sentence (R^5) when shown the picture stimulus. *The criterion for this stage of training is 38 correct responses out of 40 attempts.* One-word sentence training is terminated when the criterion is met.

A schematic representation of this phase of training for one-word sentences would appear as the following:





Imitative

40 correct responses out of 40 attempts

Non-Imitative

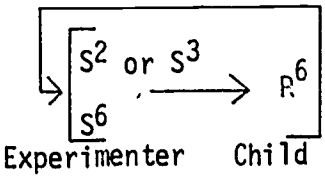
38 correct responses out of 40 attempts

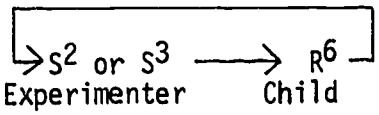
S^1-Echoic
S^2-Picture
S^3-Grapheme
S^5-Sentence Stimulus
R^5-Sentence Response

Two-Word Sentences. The procedure at this stage of training calls for the presentation of ten sentences, each including two words containing the training phoneme. As near as possible, an equal distribution of the phoneme in each word position across the ten sentences is used. The training format is the same as that of the one-word sentences. A sentence is judged correct only if both phoneme-contained words are correct and the syntactical structure of the sentence is reasonably appropriate.

The criterion for the imitative stage calls for 40 correct responses out of 40 attempts. When this criterion is met, training on the non-imitative stage is initiated. *Criterion for this second stage is 38 correct responses out of 40 attempts.*

The following illustrates schematically two-word sentence training:





Imitative

40 correct responses out of 40 attempts

Non-Imitative

38 correct responses out of 40 attempts

S^6-Sentence Stimulus
R^6-Sentence Response

III. Performance Across Trained and Untrained Stimulus and Configuration Constraints (Three-or-More-Word Sentences).

Five stages of training are involved at this level; all are centered around ten sentences including three or more words containing the training phoneme in an equal distribution of word positions. The five stages are 1) single word stage responding to pictures (S^2) or graphemes (S^3), 2) imitative stage, 3) non-imitative stage, 4) performance stage, and 5) time-cut stage. Cost contingency reinforcement is still in effect. A sentence is judged correct only if all words containing the training phoneme are correct and the syntactical structure is reasonably appropriate.

Single-Word stage. Ten new training words (four with the training phoneme in the initial position; three, final; and three, medial) are presented with the stimulus in the form of textual pictures (S^2) or textual graphemes (S^3). The child is to respond to the stimulus by naming the stimulus with a word containing his training sound. *The criterion for this stage of training is 20 correct responses out of 20 attempts.* Termination of this stage occurs when the criterion is met. The imitative stage on new, more complex sentences is then initiated.

Imitative stage. Ten sentences (see Appendix B) each containing three or more words with the training phoneme equally distributed in terms of position, are presented to the child using the same format as that for the one- and two-word sentences. A sentence is judged as correct only if the words containing the training phoneme are produced correctly and the syntactic structure is appropriate. *The criterion for the imitative stage is set at 20 correct responses out of 20 attempts.* When this criterion is met, the non-imitative stage of training is initiated.

Non-Imitative stage. The same procedure as in previous non-imitative stages is followed. *The criterion is set at 18 correct respones out of 20 attempts.* When this criterion has been met, the fourth stage of three-word sentence training commences.

Performance stage. Using the same mode of stimulus presentation as in the previous stage (picture or grapheme stimuli) the child responds in the same manner. *The child is required to meet a criterion of 9 correct responses out of 10 attempts for ten consecutive training blocks (each training block represents responding to each of the ten sentences once). Each of the last four of these ten blocks are timed.* When the criterion for this stage has been recognized, the child moves to the fifth stage.

Time-Cut stage. By averaging the time needed by the child to complete each of the last four training blocks in the preceding stage, the experimenter can determine the mean training-block length. That figure minus ten per cent provides a *maximum time limit for completion*

of each of four consecutive training blocks while maintaining a criterion of nine correct responses out of ten attempts. As an example, let us say that a child completed the last four training blocks of the preceding stage (Performance stage) in 70 seconds, 80 seconds, 60 seconds, and 70 seconds:

A.)	B.)		C.)	D.)
70"	$\frac{280"}{4}$ =70"	(average time needed to complete training block while meeting criterion during the performance stage)	70"	70"
80"			x10%	-7"
60"				
+ 70"			7"	63"
280"				First Time Cut: Maximum Time Limit Per Training Block

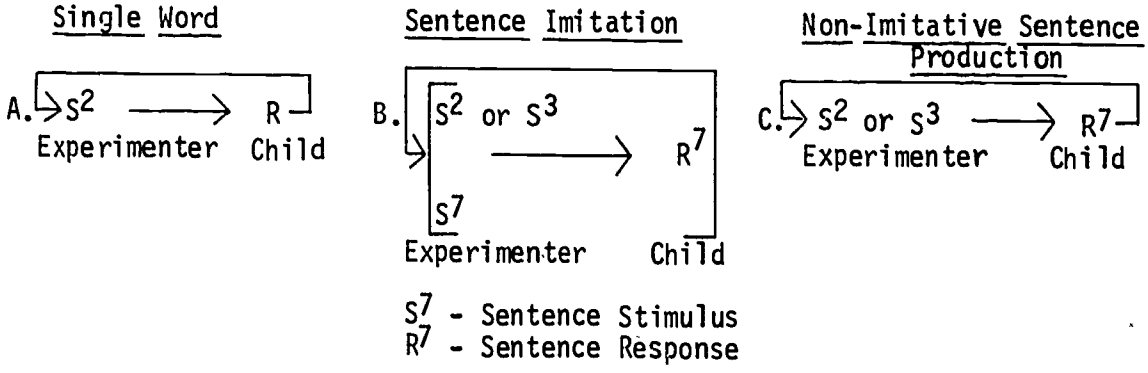
In the above example, the first time cut has a criterion of 9 correct responses out of 10 attempts on four consecutive training blocks with not more than 63 seconds elapsed time for <u>each</u> of the four blocks.

When the criteria have been met, our procedures call for a second 10 per cent time cut. Continuing the previous example, the child met the first time-cut criterion in the following times: 62 seconds; 58 seconds; 61 seconds; and 59 seconds.

A.)	B.)		C.)	D.)
62"	$\frac{240"}{4}$ =60"	(average time needed to complete training block while meeting criterion on the first time cut)	60"	60"
58"			x10%	-6"
61"				
+ 59"			6"	54"
240"				Second Time Cut: Maximum Time Limit Per Training Block

According to our example, then, the child must maintain the criterion of 9 correct responses out of 10 attempts on four consecutive training blocks with no more than 54 seconds needed to complete each of the four training blocks. Training at this level is terminated when these criteria are met.

A schematic representation of training at the level of sentences which include three or more words containing the training phoneme would appear as follows:



Criterion:

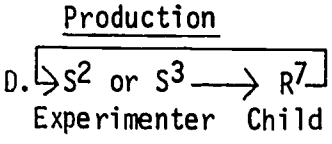
20 correct responses out of 20

Criterion:

18 correct responses out of 20 attempts

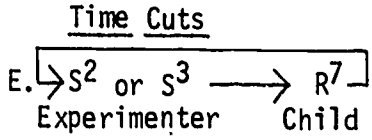
Criterion:

18 correct responses out of 20 attempts



Criterion:

9 correct responses out of 10 on 10 consecutive training blocks. Average time needed for last 4 blocks



Criterion:

Two 10 per cent reductions of time on 2 groups of 4 training blocks maintaining a minimum of 9 correct responses out of 10 attempts on each block

Novel Emissions

The last phase of the training program involves two stages: 1) untrained reading material and 2) sound-loaded untrained pictures. Both stages require *90 per cent correct production of the training phoneme.* The cost contingency schedule of reinforcement is still in effect.

Untrained Reading Material. Using a sound-loaded sample text, the child who reads is required to read in 3 to 5 minute segments until he reaches the *criterion of 90 per cent correct production.* When the criterion is met, the second stage is initiated.

Sound-Loaded Untrained Pictures. Using the picture as a stimulus, the child is instructed to discuss or tell a story about the contents of the picture for a period of 3 to 5 minutes. The procedure must be repeated until he meets the *90 per cent specified criterion.* At that point, the therapy program is terminated.

Probe Tests for the Effects of Training

In order to examine each subject's unreinforced phoneme responses prior to, during, and following the training sequence, a series of probe tests were used to allow an evaluation of the effects of training. Figure 2 illustrates the order of presentation of these probes. This order is presented within the same organizational structure as the program description given in Figure 1.

The following discussion mentions the use of "trained" and "untrained" words. Some explanation is needed to define the somewhat unique characteristics of this labeling. "Trained" words are those words containing the desired sound which are used in the actual clinical training program. Such words are subject to reinforcement. "Untrained" words, however, are used only in the probe tests, and their emissions are not reinforced.

The number and the extent of the probe-tests may seem overwhelming. The experimenters believe, however, that each stage of the program must be carefully evaluated in terms of its effectiveness. In addition, the thoroughness of the overall probe system allows careful analysis of acquisition trends, alternative measures, and needs for further training. As trends and effects prove consistently replicable, future studies will need fewer probes. In fact, the final product, ready for dissemination, will probably contain a maximum of four probes:

1) pre-training;

2) intra-training I (placed immediately after initial position training to check for over-generalization);

3) intra-training II (placed immediately after the randomized position treatment); and

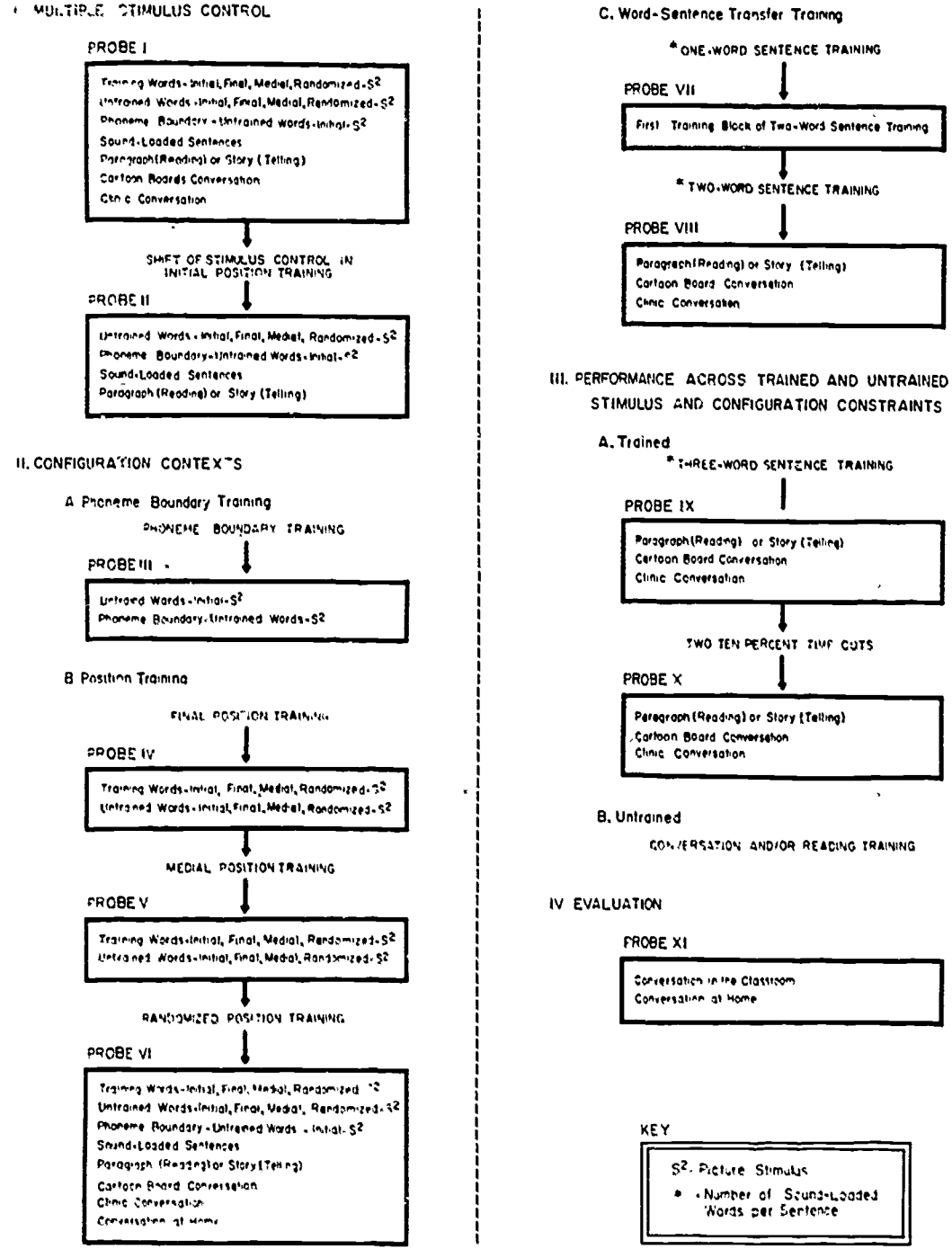
4) post-training.

Pre-Training or Baseline (Probe I)

Baseline data are collected to determine the level of performance of each subject before the commencement of training. Each subject is probed at the word, sentence and conversational configurations. The entire

FIGURE 2

SEQUENCE OF TEST PROBES WITH RELATIVE POSITION OF TRAINING SEQUENCE INDICATED



probe takes no more than 30 minutes to complete and is usually terminated by the end of the first session. Specifically, this probe evokes phoneme responses to each of the following stimuli:

1) Pictures of all training words with the training phoneme in the initial (10 words), final (5 words), medial (5 words), and randomized (20 words) word positions;

2) Pictures of all untrained words with the training phoneme in the initial (5 words), final (5 words), medial (5 words) and randomized word (15 words) positions;

3) Pictures of all untrained phoneme boundary words (5 words) with the substituted sound in the initial position;

4) Echoic and picture presentation for ten sentences to be used in training S^2S^7 with each sentence containing three or more words with the training sound in initial, final and medial word positions;

5) If the subject is able to read, he is given a short paragraph containing words with the training sound in all three word positions. If the subject is unable to read, he is given a sequenced-picture book, from which he is instructed to tell a story;

6) Each subject is shown a 12" x 17½" cartoon board heavily sound-loaded with characters, objects and actions containing the training sound. The subject is instructed to discuss what he sees in the picture; and

7) A 3-to-5 minute sample of a conversation between the experimenter and child is collected with minimal verbalization from the experimenter.

Following this procedure initial position training is begun.

Intra-Training Probe Tests (Probes II through X)

After the completion of Initial-position training, Probe II is given. The contents of the probe are as follows:

1) Pictures of all untrained words with the training phoneme in the initial, final, medial and randomized word positions;

2) Pictures of all untrained phoneme boundary words with the substituted word in the initial position;

3) Echoic and picture presentation for ten sentences (S^2R^7) with each sentence containing three or more words with the training sound in initial, final, or medial word positions; and

4) If the subject is able to read, he is given a short paragraph containing words with the training sound in all three word positions. If the subject is unable to read, he is given a sequenced-picture book, from which he is instructed to tell a story.

If data from the phoneme boundary probe demonstrates overgeneralization, the subject is given phoneme boundary training to train appropriate discrimination between and production of the training sound and the previously substituted sound. However, if the subject has not over-generalized, he begins position training with the training sound in the final word position.

For those subjects who require phoneme boundary training, Probe III is given after the completion of training with the subject responding to:

1) Pictures of all untrained words with the training phoneme in the initial position (10 words); and

2) Pictures of all untrained phoneme boundary words (5 words) with the previously substituted word in the initial position.

The subject then begins final position training.

After the completion of training with the training phoneme in the final position, Probe IV is given. The contents of the probe include:

1) Pictures of all training words with the training phoneme in initial, final, medial, and randomized word positions; and

2) Pictures of all untrained words with the training phoneme in the initial, final, medial, and randomized word positions.

Medial position training is then introduced.

After the completion of medial position training, the subject is given Probe V. Exactly the same as the previous probe, this probe contains:

1) Pictures of all trained words in all three word positions and in randomized order; and

2) Pictures of all untrained words ir all three word positions and in randomized order.

The program then calls for the commencement of randomized-position training.

The termination of the randomized treatment signals the end of training at the single-word level. Before the presentation of word-

sentence transfer training, the subject is given the entire probe battery. Probe VI includes:

1) Pictures of all trained words in all three word positions and in a randomized presentation;

2) Pictures of all untrained words, in all three word positions and the randomized sequence;

3) Pictures of all untrained phoneme boundary words with the previously substituted word in the initial position;

4) Echoic and picture presentation for ten sentences with each sentence containing three or more words with the training sound in all three positions;

5) Subject reads a short story or, if he is a non-reader, he tells a story from a sequenced-picture book;

6) Subject discusses what he sees in a heavily sound-loaded cartoon board;

7) Subject and experimenter take part in a 3-to-5 minute conversation; and

8) The subject's parents are given a cassette tape recorder and tape and are instructed to record a 5-to-10 minute sample of conversation "at the dinner table" with minimal verbalization from members at the table other than the subject.

Word sentence transfer training is then begun.

When the subject demonstrates termination criteria for training on the ten S^2S^5 sentences, Probe VII is given. This probe is made up of the first training block of the ten sentences used in two-word sentence training (S^2R^6). As in all probes, the subject's responses are not reinforced. After a sample of his responses to each of the ten sentences has been collected, two-word sentence training (reinforcement in effect) is commenced.

After the conclusion of two-word sentence training, Probe VIII is presented. The contents of Probes VIII, IX, and X are the same and will be discussed here as one. These probes include:

1) Subject reads a short story or if he is a non-reader, he tells a story from a sequenced-picture book;

2) Subject discusses what he sees in a heavily sound-loaded cartoon board; and

3) Subject and experimenter take part in a 3-to-5 minute conversation.

Probe VIII is given prior to three-word sentence training; Probe IX, prior to the two 10 per cent time cuts; and Probe X, prior to conversation and/or reading training.

When the subject has completed training in conversation and/or reading, he has finished the program. At that point, the Post-Training Probe Test is given.

Post-Training Probe Test

In order to evaluate the effects of the entire stimulus shift training program, Probe XI is given. This probe involves the collection of a five minute conversational speech sample in the classroom, i.e. in the reading group, and a 5-to-10 minute sample conversational speech at home, i.e. around the dinner table.

The subject is then dismissed from therapy. However, Probe XI is repeated once a week for a period of six to eight weeks to check for the long-range retention and use of the trained phoneme. If analysis shows that correct production falls below 95 per cent, the subject is recalled for therapy, evaluated to determine at which configurational level the breakdown of correct production occurs, and begins retraining at that level.

Recording and Analysis of Data

The critical element of any research is the accuracy with which the collected data is recorded and subsequently analyzed. Table 4 illustrates the overall details and methods of data recording and analysis involved in the present studies.

Recording of Data. With the exception of conversation, all phoneme responses are judged by the experimenter as either correct (+) or incorrect (-) in the training sessions. The per cent of correct responses per training block is then transferred to a linear graph to demonstrate the trends of acquisition for each subject. Information shown on the curve is illustrated below in Table 5, a hypothetical example.

Analysis of Data. The information in the hypothetical curve shown in Table 5 demonstrates a slow, but rising learning curve in the paired echoic (S^1) - picture (S^2) stimulus condition. The black triangle (▲) indicates the end of the first session. The beginning of the second session shows the recognition of the criteria for the S^1S^2 stimulus condition (20 correct responses out of 20 attempts) and a marked decrease in correct responding when the echoic (S^1) stimulus is withdrawn. All acquisition data is repeated in this fashion in later sections of this report (Figures 4, 5 and 6).

Table 4

Method of Recording Data and General Analysis
Procedure for Generalization Programs

Configuration	How data Recorded	Analysis
Words	+	After each training block, the number judged correct is placed at the bottom. At the end of the training session, this information is transferred to an acquisition curve.**
	-	
Sentences 1. One-Word	+	Judgement is made only on the word containing the training sound in each sentence. The number correct is placed on the acquisition curve for each training block.
	-	
2. Two-Word	+	Judgement is made only on the two words containing the training sound in each sentence. The number correct is placed on the acquisition curve for each training block.
	-	
3. Three-Word	+	Judgement is made only on the three or more words containing the training sound in each sentence. The number correct is placed on the acquisition curve for each training block.
	-	
Conversation	Word Spoken + - Position of Sound in Word	Judgement is made on all words containing the training sound. Words are written down and analyzed in terms of correctness and position of the sound in the word. Percentage of correct sounds in each position is figured and charted to show slope (properant).

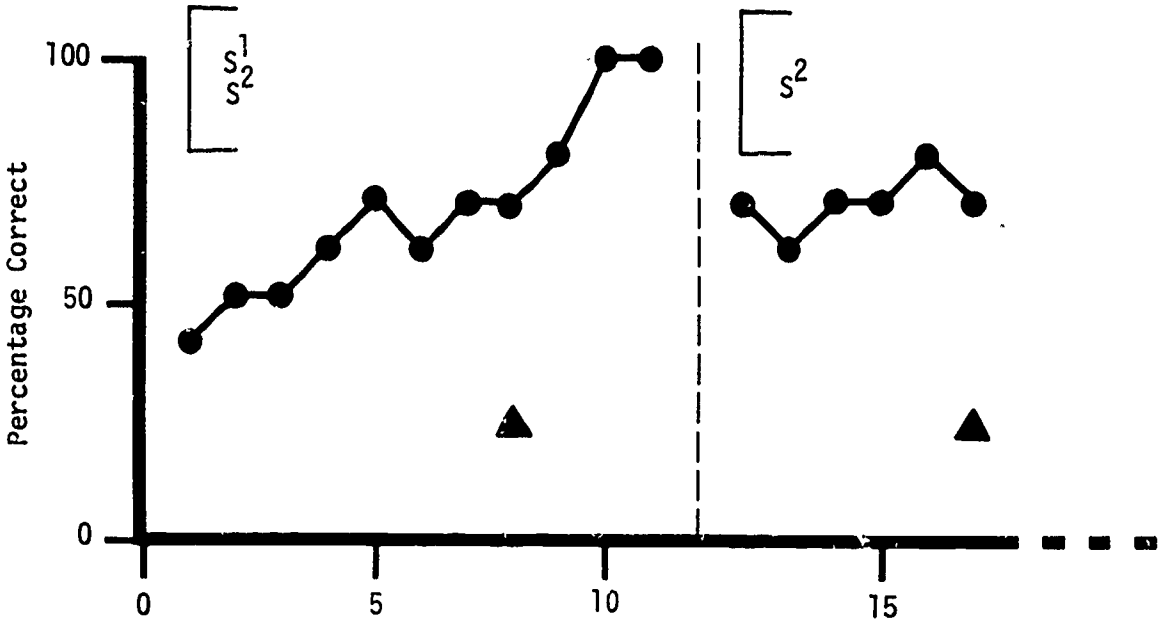
* (+) = Correct

(-) = Incorrect

** Data collected on probes are not shown on the acquisition curves.

Table 5

ACQUISITION CURVE FOR A HYPOTHETICAL SUBJECT



All conversation samples are recorded on video or audiotape. After the session, the experimenter analyzes the taped sample--writing the word, judging it as correct or incorrect, and noting the position in which the trained sound occurred. For example,

saw	+	I
niece	-	F
grass	-	F
Misses	-	M
Sister	+,-	I, M (blend)

This sample reveals correct responding only in the initial position in conversational speech. The correct/incorrect information is then transferred to a cumulative graph where the slope of the curve is equal to the per cent of correct phoneme productions. This method of analysis reveals a "properant" (Garrett, 1965) and is discussed in terms of an "84 per cent properant" as shown in Figure 3.

Also, this analysis includes the number of correct phoneme productions in each word position and in blends in each word position. This method allows close study of all occurrences of a particular phoneme in words as well as uncomplicated comparisons of samples as training progresses.

Results of the Current Research

Eight of the nine selected subjects were given training on the stimulus-shift program. The subject not included in training (B.B.) was dropped from the program due to extremely low responding under echoic stimulus control. He was then given Response Development training rather than Generalization training. He is currently receiving generalization training after obtaining the behavior required for entry into that program.

Due to the complexity and amount of data compiled on each subject during training and probing, three representative subjects will be discussed: L.P. (Subject A); M.S. (Subject B); and B.D. (Subject C). Each subject illustrates a different pattern and level of training needed to meet criteria for termination of training.

Subject A experienced more difficulty than the others and required more training on the selected phoneme (/l/). The articulation evaluation revealed that he omitted the phoneme in initial and final positions and had a d/l substitution in the medial position. On the Goldman-Fristoe Test of Articulation, he correctly produced 55 per cent of the consonant phonemes. On the Peabody Picture Vocabulary Test, Form B, the following information was obtained: CA: 9-5; MA: 10-5; and IQ: 112.

Subject B was selected because, in relation to the other children in the study, she appeared to perform at an average level. She was trained on the /l/ phoneme; she had previously produced a sound resembling the /l/ acoustically but had made the sound inappropriately by contact of the back of the tongue with the velum. On the Goldman-Fristoe Test of Articulation, this subject correctly produced 80 per cent of the consonant phonemes. Responses on the Peabody Picture Vocabulary Test, Form B, yielded the following: CA: 7-4; MA: 10-10; and IQ: 142.

Subject C was selected for reporting purposes because he generalized correct phoneme production to conversational speech after less training than that required by subjects A and B. With a [tʃ/ʃ] substitution in all three word positions, Subject C correctly produced 77 per cent of the consonant phonemes on the Goldman-Fristoe Test of Articulation. On the Peabody Picture Vocabulary Test, Form B, the following scores were obtained: CA: 6-9; MA: 7-7; and IQ: 106.

The results of the pilot training program are discussed in detail for each of the three subjects below. The discussion is separated into the following sections:

1) Pretraining;

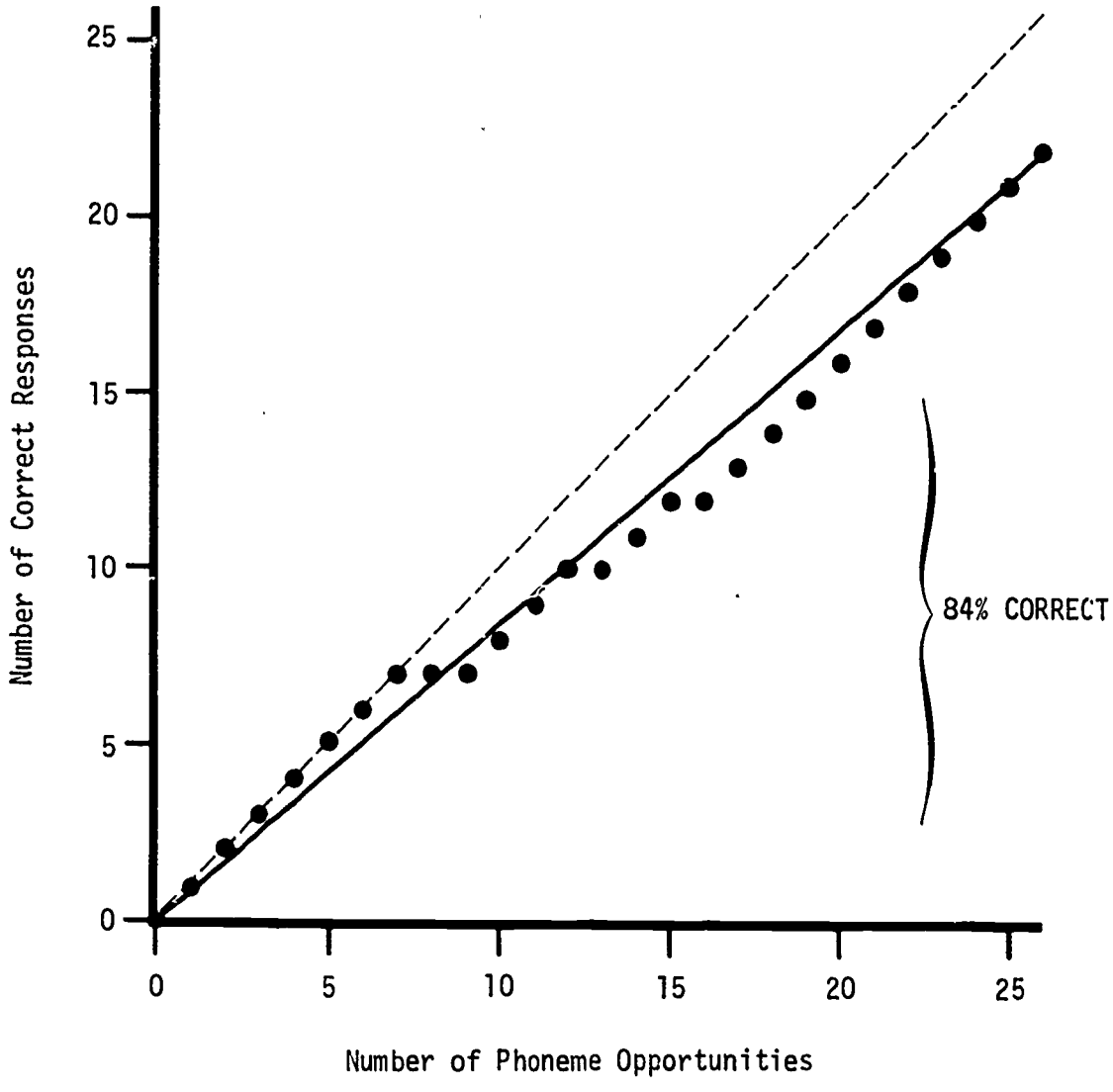
Figure 3

METHOD OF ANALYSIS FOR CONVERSATION PROBE

PARAGRAPH (READING)

Phoneme	13		4		4			L.P. 9/22/71
Phoneme Blend	*-		-		1			
TOTAL CORRECT	13	+	4	+	5	=	22	
TOTAL POSSIBLE	13	+	6	+	7	=	26	or 84% correct

*- = No blends in that word position were produced in this sample



2) Training;

3) Post-training; and

4) Summary.

Pre-Training Probe

Before training was initiated for each subject, baseline data were collected. Table 6 represents the results of the pre-training test.

Table 6
Pre-Training Test (Probe I)
Percentage of Correct Responses Prior to Training to Pictured Stimuli of Training Words, Untrained Words, Untrained Phoneme Boundary Words, Three-Word Sentences, and Conversation

	TRAINING WORDS				UNTRAINED WORDS				UNTRAINED WORDS		CONVERSATION		
Subj.	I	M	F	R	I	M	F	R	PB*	S^2S^7*	PARA*	CB*	CT*
A	70	0	0	30	100	20	0	40	100	38	30	14	22
B	0	0	0	0	0	0	0	0	100	0	20	43	48
C	20	0	0	5	0	0	0	0	100	3	10	16	0

*PB = Phoneme Boundary (untrained words)
S^2S^7 = Three-Word Sentences Presented with Cueing Picture and Echoic Support

Conversation { PARA = Paragraph (reading); CB = Cartoon Board; CT = 3' to 5' Conversation in the Therapy Setting }

Training Words. It can be noted that Subject A was judged to respond correctly to 70 per cent of the initial position words and 30 per cent of the words in the randomized word positions. Two weeks prior to the presentation of Probe I, during the second screening test, the experimenter demonstrated to the parent this subject's ability to imitate the /l/ sound in the initial position in isolation, in one word, and in one sentence. Prior to this short demonstration, no correct /l/ phoneme productions had been observed in conversation. However, after the two-week interim between the screening and Probe I, he had begun to produce the /l/ phoneme in the initial position of some words. It was decided to train him on the entire program since the quality of the phoneme production was not totally acceptable. Even though judged correct by virtue of correct placement in single words--timing features were still inadequate for connected speech even in the initial position.

Subject B demonstrated a zero-level of phoneme production for all training words in the initial position. Subject C also responded at a low level on initial position training words.

Untrained Words. Again, Subject A demonstrated a high percentage of responses judged correct in the initial position by producing correct /l/ phonemes in all five untrained words. He responded correctly to one word in the medial position, no words in the final position and to 6 of the 15 words in the randomized presentation. Both Subjects B and C were unable to correctly produce their training phonemes in initial, medial, final, or randomized positions.

Phoneme Boundary. All three subjects correctly produced the substituted phoneme in words appropriately beginning with that phoneme.

Three-Word Sentences (S^2S^7). Subject A correctly produced the /l/ phoneme in 11 words out of a possible 31. All correct occurrences were in the initial position. Subject B was unable to imitate correct production of the 14 phonemes in any of the three-word sentence stimuli. Subject C used the /l/ phoneme correctly once in the initial position to the S^2S^7 stimuli.

Paragraph. All three subjects were able to read; the data represented on Table 6 are samples obtained from the readings of a sound-loaded paragraph. Subject A again scored relatively high: all correct responses were made in the initial position. Subject B scored 5 correct responses out of a possible 26 on this first probe with the correct responses occurring primarily in the initial word position.

Subject C correctly produced two utterances in a paragraph containing 19 possible correct. Both were in the initial position.

Cartoon Board. Correct responses to items in a heavily sound-loaded picture were made by all three subjects. Subject A correctly produced ten /l/ phonemes out of a possible 71. Eight of those ten were in the initial position. The remaining two were in the medial position but were pronounced in a releasing position (i.e., *smi-ling*).

The relatively high scores on the cartoon board and conversational portions of Probe I for Subject B may be due partially to the fact that these judgments were made from audiotapes. Since the placement feature was an important aspect of her phonological error, some of the auditorially-judged "correct" responses may have sounded correct but, in actuality, were not correct in terms of placement. In order to make the acoustic judgements, the experimenter listened for a slightly guttural presentation. If this was not a feature of the response in question, it was judged correct. According to this criterion, then, this subject correctly produced the /l/ phoneme 15 times in all word positions out of a possible

35 according to the auditory judgements. Subject C produced 5 correct /ʃ/ phonemes out of a possible 31 with 3 correct responses in the initial position and 2, in the medial position.

Conversation in Therapy. Subject A correctly produced 6 out of 27 words containing the /l/ phoneme. All 6 correct responses were made in the initial position. Subject B made 14 correct responses in 29 words containing the /l/ phoneme. Eleven of the 14 correct were in the final position. Judgements were made from a tape recording.

Summary. The data presented in Table 6 indicate the following patterns of baseline or pre-training performance for each Subject:

1) Subject A produced relatively high levels of correct responding in each subtest. Analysis revealed correct production was most often in the initial word position. Phoneme boundary responding was appropriate.

2) Subject B maintained a zero baseline on all subtests where judgements were made by visual as well as auditory observations. However, the data show relatively high correct response levels in all conversation probes due, at least in part, to the method of judgement (auditory, no visual). Phoneme boundary responding was appropriate.

3) Subject C displayed relatively low levels of responding in all subtests (highest correct percentage was 20 per cent in initial position training words). Phoneme boundary responding was appropriate.

Training

Figure 4 demonstrates the acquisition curves for all three subjects during training in the initial position of the selected phoneme. Figure 5 shows final, medial and randomized position training, while Figure 6 illustrates training in each of the sentence stimulus conditions (S^5, S^6, S^7) and reading. Each figure shows a) the percentage of correct responses in each training block, b) the number of training blocks needed to attain criteria, and c) the overall pattern of acquisition for each subject. Data for each acquisition curve were plotted from judgements made during the training session.

Figure 4 begins with the second stimulus condition (echoic stimulus S^1 paired with the picture, S^2) with the selected phoneme response being trained in the initial position for all three subjects. Figure 5 begins with the paired S^1S^2 stimulus condition in the medial position for Subjects A and B and the final position for Subject C. Priority of positions to be trained was determined by the relative difficulty of acquisition of each position for each phoneme.

Figure 6 demonstrates the beginning of training at the sentence configuration for Subjects A and B. Subject C demonstrated complete generalization of training on the probe given immediately after the five-week speech vacation; therefore, he did not receive further training.

The termination of each stimulus condition, or the point at which each stimulus shift occurs, is noted by a single, broken line on each figure. When the criterion is achieved on any one configuration, the termination of the particular treatment is designated by a double, broken line. The end of each training session is shown by a small black triangle (▲).

Due to the somewhat unique characteristics of the acquisition curves for the three representative subjects, the following section will provide a general discussion of the patterns of learning that have occurred during training. Figure 4 demonstrates the patterns of acquisition for all three subjects for training in the initial position.

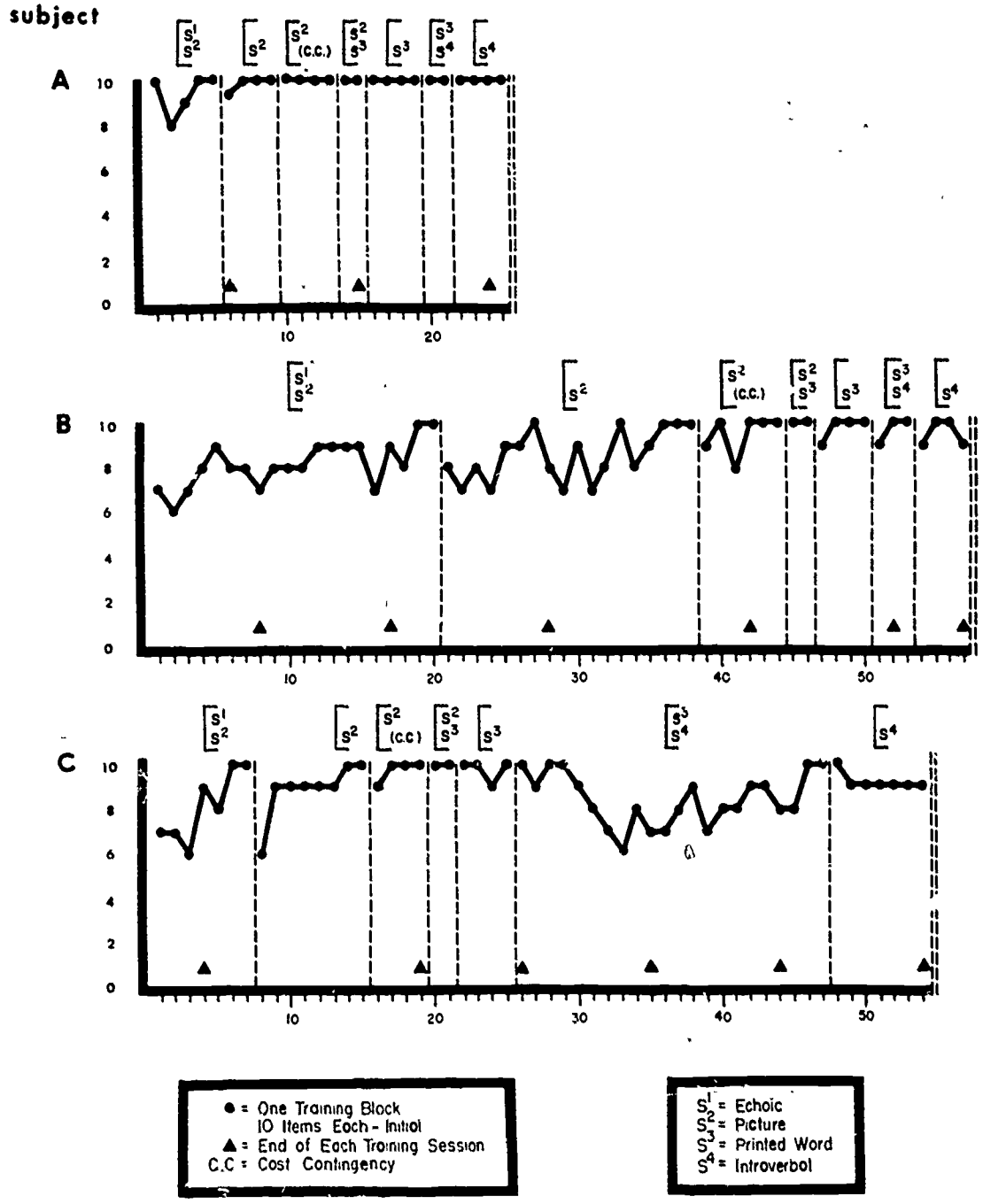
Initial Position Training. Subject A. As expected, this Subject did not appear to experience any difficulty in this treatment. The level of responding did not drop below 80 per cent. Only three more than the absolute minimum number of training blocks were required on the entire treatment. There was no difficulty shifting from a supportive stimulus (echoic) to a non-supportive stimulus (picture). Introduction of the cost contingency form of reinforcement was unremarkable. Training in the initial position was successful and, subsequently, reinforcing for this subject.

Subject B. This subject experienced more difficulty in acquisition of the /l/ phoneme in this phase of training than in any other. Until the criterion was met on the S^2 stimulus condition, the acquisition curve was erratic. Of particular note is the drop in correct responding and the variability in responding when the S^1 condition (echoic) support was withdrawn. Stabilization did not occur until more than 30 blocks of training when the child attained the S^2 criterion. Consistant reporting continued through the introduction of the cost-contingency schedule of reinforcement. After the point, the percentage of correct responding did not fall below 90 per cent and the criteria were met with relative ease.

Subject C. The training curve for this Subject shows some variable responding in the initial stages of the paired echoic (S^1)-picture (S^2) condition until the attainment of the criterion. However, when the echoic stimulus support was withdrawn, the level of reponding dropped on one training block but was recovered at the 90 per cent level and maintained until the criterion was recognized seven training blocks later. Responding in the next three stimulus conditions was essentially unremarkable in that the level of correct responses was high and in each case the criterion was obtained with minimum training. Difficulty was encountered on the paired S^3S^4 stimulus condition. Past experience has dictated a return

FIGURE 4

SHIFT OF STIMULUS CONTROL WITH THREE SUBJECTS
ON WORDS WITH PHONEME IN INITIAL POSITION



to the previous training condition when a subject shows a drop in correct responding on four consecutive training blocks. An exception was made for Subject C. He did not drop below 60 per cent and did show recovery after that point. It appeared that program regression was unnecessary.

Of note also is the procedural error made by the E on the third and fourth training blocks of that paired condition. The level of correct responding indicated the achievement of the criterion (20/20 correct responses). Responding at that high level for two successive blocks did not appear to warrant regression when the decrement in responding began to occur. After the criterion on the paired condition was met again, due to procedural error, the level of responding remained high on the remaining training for the last condition of the initial position treatment.

After each subject completed training in the initial word position, Probe II was given to test the effects of training on untrained words and configurations. Table 7 shows the results of that probe.

Table 7
PROBE II
Percentage of Correct Responses After Initial Position Training to Untrained Stimuli (S^2), Untrained Phoneme Boundary Words, Three-Word Sentences, and Paragraph

Subj.	UNTRAINED WORDS				UNTRAINED WORDS		CONV
	I	M	F	Randomized Positions	PB*	S^2S^7*	PARA*
A	100	20	0	46	100	42	50
B	100	20	0	33	100	13	60
C	100	0	0	33	100	60	0

*PB = Untrained phoneme boundary words (S^2)
S^2S^7 = Three-word sentences Presented with Cueing Picture and Echoic Support
CONV = Conversation
PARA = Paragraph (reading)

Probe II

Untrained Words. The results shown on Probe II indicate 100 per cent acquisition and generalization of the training phoneme for all three subjects in the initial position to untrained words. Subject A did not experience an increase, but rather a maintenance of perfect phoneme production in the initial position. The level of responding did not

change for the medial or final word positions and a slight increase from the baseline data was shown on the randomized words.

Subjects B and C, however, experienced significant gains in correct responding in the initial position. In addition, Subject B showed a trace of across-position generalization to words containing the training phoneme /l/ in the medial position. Both subjects correctly produced all five of the initial position untrained words in the randomized position condition.

Phoneme Boundary. All three subjects continued to respond appropriately to words containing the previously substituted phoneme in the initial position. These data indicated that overgeneralization had not occurred for any of the subjects; therefore, phoneme boundary training would not be necessary.

Three-Word Sentences (S^2S^7). All three subjects improved the level of correct responding in this paired echoic/picture three-word sentence presentation from the levels shown on baseline Probe I. Subject A increased the level of responding from 30 per cent (Probe I) to 42 per cent and Subject B, from 0 per cent (Probe I) to 13 per cent. Subject C experienced an increase from 0 per cent (Probe I) to 60 per cent. These data indicate the development of topographical awareness of the training phoneme for each of the three subjects, e.g., with echoic support on untrained materials, correct phoneme production is more likely to occur.

Paragraph. Two subjects (A and B) substantially increased the levels of correct responding from that shown on the baseline (Probe I): Subject A, from 30 per cent to 50 per cent and Subject B, from 20 to 60 per cent. Subject C, however, showed a decrease in correct responding from 10 per cent correct to 0 per cent correct. For this subject, it appeared that the echoic stimulus condition was particularly influential (compare S^2S^7 score with the paragraph score for Probe II). This observation did not apparently apply to Subjects A and B.

Summary. Probe II showed overall increases in the level of correct responding for all three subjects with the possible exception of Subject C in the paragraph subtest. Generally, however, each subject experienced valuable phoneme acquisition during the initial position training. Overgeneralization had not occurred for any of the three subjects.

After completing Probe II, each subject was exempted from Phoneme Boundary training (on the basis of data collected on that probe) and given training on the phoneme in other word positions. Subjects A and B, both training on the /l/ phoneme, moved to medial position training while Subject C, training on the /ʃ/ phoneme, began the final position training phase.

Position Training

Figure 5 demonstrates the acquisition curves for each subject on the independent position (medial and final) treatments and the randomized word position treatment.

First Position Treatment. Subject A, training on the /l/ phoneme, was given medial position training. While he experienced very little acquisition difficulty in the initial position, the shift to another word position presented some obstacles for him. The level of responding was still high, never falling below 70 per cent. The main problem centered around two training words: *shoulder* and *valentine*. Other subjects were experiencing the same difficulties with the word *shoulder*.

Since the nature of a pilot study calls for a testing of stimulus materials, it was decided by the E that the assimilative features of the word *shoulder* were such that, for a learning task, the word was inappropriate. Since the subjects could have been influenced by the co-articulation interference of the /d/ and the /l/ phonemes, it was decided to change the training word to *wallet*.

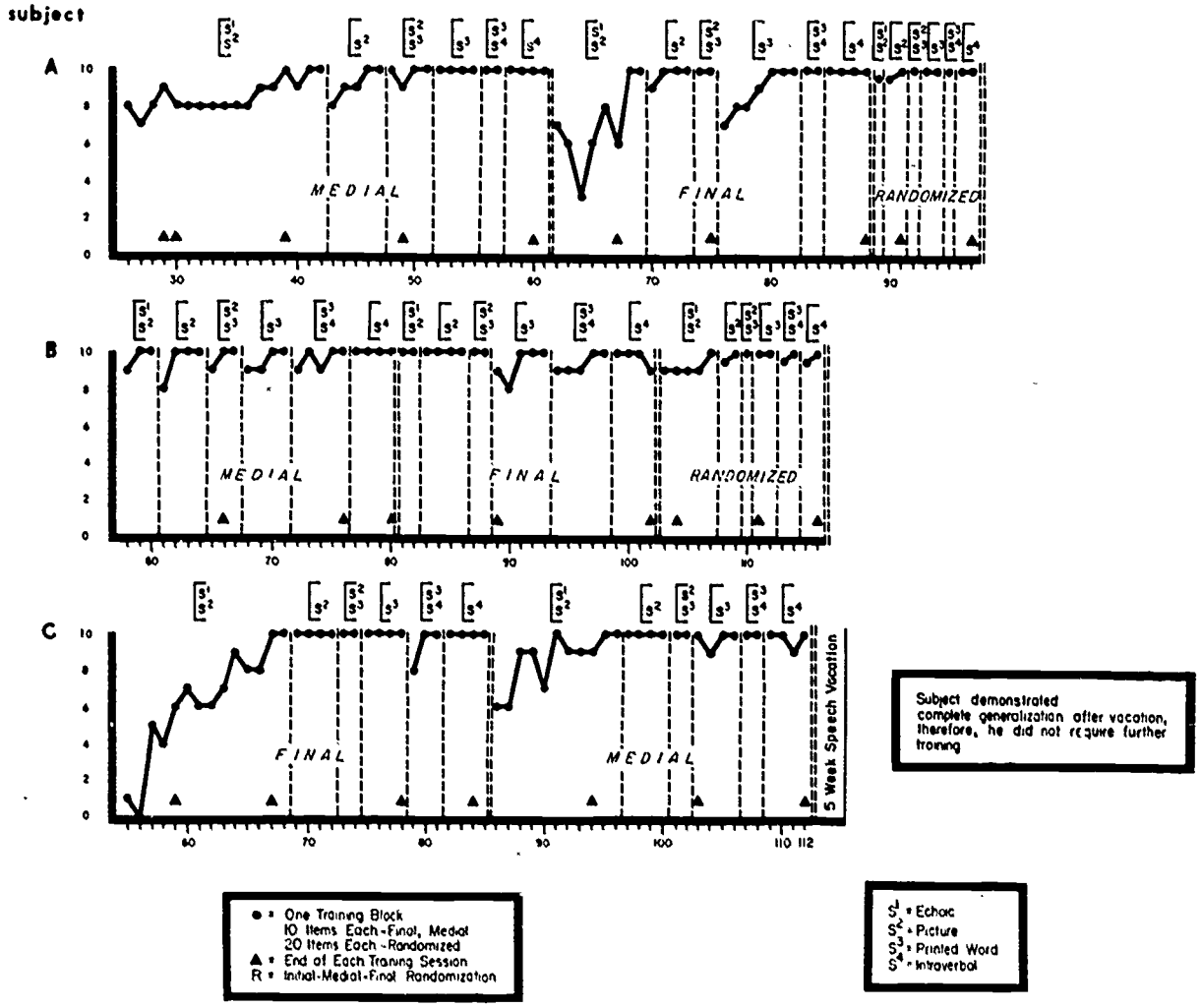
When the new word was introduced into the program, Subject A immediately produced it correctly ruling out the necessity for an echoic model. Three training blocks later, he had correctly produced all words in the training block and subsequent training brought recognition of the criterion. He then experienced a drop to 80 per cent correct when the echoic stimulus was withdrawn, but recovered to meet the criterion in the next four training blocks. The remainder of medial position training was completed with little difficulty.

The acquisition curve for Subject B shows that she evidenced high response levels in phoneme acquisition for the medial position. All but one training block was no lower than 90 per cent correct. The training block in question dropped to 80 per cent when the echoic stimulus was withdrawn. A recovery to 100 per cent was made on the next training block and the criteria for the rest of medial position training was met in the minimum number of training blocks.

Subject C was trained on the final position occurrence for the /ʃ/ phoneme. He experienced low (between 0 and 50 per cent) levels of responding in the paired S^1S^2 stimulus condition. Fourteen training blocks were needed to achieve the criterion for that stimulus condition (20 correct responses out of 20 attempts). Once the response was acquired, however, correct responding remained stable until the criterion S^4 (intraverbal) stimulus condition was met.

FIGURE 5

ACQUISITION OF MEDIAL AND FINAL PHONEME POSITION RESPONSES
AND ESTABLISHMENT OF PHONEME BOUNDRIES WITH THREE SUBJECTS



After the first independent word position treatment, Probe IV was presented to the subjects. Table 8 demonstrates the effects of this training.

Table 8
PROBE IV
Percentage of Correct Responses to all Training and Untrained Stimulus Words After First Position Treatment

Subj.	TRAINING WORDS				UNTRAINED WORDS			
	I	M	F	R	I	M	F	R
A	100	100*	0	75	100	60*	0	53
B	100	100*	100	85	100	80*	60	86
C	100	80	100*	95	100	20	80*	80

*Position most recently trained.

Probe IV

Training Words. Subject A maintained 100 per cent correct responding in the initial position after training in the medial position. He also demonstrated 100 per cent correct production in the most recently-trained medial position. No generalization to the untrained final position occurred for this subject. One-hundred per cent correct responding in the initial and medial word positions was maintained in the randomized treatment.

Subject B demonstrated a maintenance of 100 per cent correct responding in the initial word position, 100 per cent correct acquisition in the recently trained medial position as well as generalization to all training items in the untrained final position. Responding in the randomized treatment was at a slightly lower level with three words of five in the final position being judged as incorrect.

Subject C had just completed final position training when Probe IV was given. He maintained 100 per cent correct responding in the initial position and demonstrated complete acquisition of training words in the newly trained final position. Across-position generalization occurred on four of five training words on the untrained medial word position. Further across-position generalization was shown in the randomization treatment when only one item (the training phoneme in the untrained medial position) was judged as incorrect.

Untrained Words. Subject A maintained 100 per cent correct production in the previously trained initial position and increased the number of medial untrained correct responses from 1 (Probe II) to 3 (Probe IV). No across-position generalization occurred to words in the final position. On the randomized subtest, this Subject correctly produced 8 words; all correct words were the same words correctly produced on the independent position subtests.

Subject B also maintained correct responding in the initial position. Generalization to untrained items in the medial position was not complete in that one of the five untrained items was incorrectly articulated. Across-position generalization occurred to three of the untrained final position items. Correct responses in the randomized treatment indicated a high response level on all word positions on untrained words. A noticeable improvement was evidenced from the responses on all four subtests of Probe II to those of Probe IV.

Subject C was also consistent in the maintenance of correct responses in the initial position. He produced the training phoneme in 80 per cent of the untrained words in final position. Across-position generalization to the untrained medial position was minimal: 1 correct response out of a possible of 5 correct. Increased correct responding in the randomized position was shown with 12 of 15 words being correctly produced. This data showed considerable improvement in all three word positions over that demonstrated on Probe II.

Summary. The data obtained on Probe IV showed significant increases of correct responding on trained and untrained words for each subject when compared to the levels of responding on Probe II. Of particular import were the following results:

1) Across-position generalization occurred for Subjects B and C.

2) The most recent training did not appear to negatively affect the retention of previously learned responses in the initial position, as often occurred with retarded children (Raymore, 1970).

3) Generalization to untrained words occurred for each subject.

Second Position Treatment. After the completion of Probe IV, each Subject began training on the second position treatment. Figure 5 shows the acquisition curves for all three Subjects.

Subject A had shown on Probe IV no across-position generalization to the untrained final word position for either of the trained or untrained words. He demonstrated a need for response development (S^1S^2), then, on words with the training phoneme in the final position. The responding in the paired S^1S^2 stimulus condition was somewhat variable with the percentage of correct responses ranging from 30 per cent to

80 per cent. One training session was needed for the development of correct production. The beginning of the next training session brought the recognition of the criterion for that phase of training. The level of responding remained high when the echoic stimulus was withdrawn. The level of responding on the next two conditions (S^2 and S^2S^3) was high; criteria on each condition were met with no apparent difficulty. Training on the grapheme (S^3) condition showed some response deterioration (from 100 to 60 per cent) but quick recovery and recognition of the criterion. Criteria on the last two stimulus conditions were met with no apparent difficulty.

Subject B revealed across-position generalization to the untrained final position on Probe IV. Therefore, as might be anticipated, she needed training only on the minimum number of training blocks to meet criterion in the final position. The level of responding in each phase was between 80 and 100 per cent correct and when the S^4 (intraverbal) condition was terminated, the final position response appeared stabilized.

On Probe IV, Subject C demonstrated an 80 per cent level of across-position generalization to the untrained medial position in training words and a comparatively low 20 per cent generalization in untrained words in that position. The expected variable, but relatively high, level of responding in the first training condition (paired S^1S^2) was seen over a short period. Once the criterion had been met for the S^1S^2 condition, the high level of responding remained constant for the rest of training in the medial position.

Summary. The following learning trends occurred in the second position treatment:

1) Two subjects (A and C) experienced some difficulty in the transition from the first position treatment to the second position treatment. It is interesting to note that Subject A had not shown across-position generalization to the untrained final position while Subject C had shown variable responding and varied across-position generalization to the untrained medial position.

2) No difficulty was encountered by any of the three subjects when the echoic stimulus was withdrawn.

3) Fewer training blocks were necessary to complete the second position treatment than the first treatment for Subjects A and C. Subject B required the same number of training blocks for both position treatments.

After the termination of the second position treatment, Probe V was given to each subject. The results of this probe are shown in Table 9.

Table 9
PROBE V
Percentage of Correct Responses to All Training and Untrained Stimulus Words After Second Position Treatment

	TRAINING WORDS				UNTRAINED WORDS			
Subj.	I	M	F	R	I	M	F	R
A	100	100	60*	95	100	40	80*	73
B	100	100	100*	90	60	100	100*	93
C	100	100*	100	100	100	60*	100	93

* Position most recently trained

Probe V

Training Words. The level of correct responding made by Subject A to the Training Words subtest of Probe V was increased over the level shown in Probe IV. The 100 per cent correct level of responding was maintained by this subject in the previously trained initial and medial word positions after training in the final position was terminated. However, only three out of five responses were correct in the most recently trained final position on the training words. Responding in the randomized treatment was higher in that only 1 training word out of 20 was incorrect.

A slight improvement on the Training Words subtest was demonstrated by Subject B. Correct responding of 100 per cent was maintained since Probe IV was given in each independent word position treatment after training in the final word position. Responding in the randomized subtest was slightly higher on Probe V than on Probe IV with the correct production of one more word for a 5 per cent increase on that subtest.

Subject C also experienced an increased response level over that shown on Probe IV. The most recently-trained word position for this subject was the medial position. Responses on the Training Word subtest of Probe V showed the maintenance of 100 per cent correct responding in the previously trained initial and final word positions and increased responding (from 80 per cent, Probe IV, to 100 per cent, Probe V) on the medial position. Responding on the randomized portion of the subtest was also increased from 95 to 100 per cent.

Untrained Words. Some rather interesting learning trends were evidenced on the untrained word subtest of Probe V. Subtest A maintained 100 per cent correct responding in the previously trained initial position, but experienced a loss of correct responding in the previously trained medial position (from 60 per cent, Probe IV, to 40 per cent, Probe V). An increase from 0 per cent to 80 per cent correct was shown on the last trained final position. Correct responding was also higher on the randomized portion of the untrained words subtest of this probe as compared to Probe IV: from 53 per cent correct to 73 per cent correct.

Subject B demonstrated a loss of correct responding in the previously trained initial position on untrained words; from 100 per cent, Probe IV, to 60 per cent, Probe V. However, she also increased the level of correct responding on the previously trained medial position from 80 per cent (Probe IV) to 100 per cent (Probe V). The level of responding in the last trained final position also increased from 60 per cent (Probe) IV) to 100 per cent. Likewise, randomized position responding was higher on the probe: from 86 per cent to 93 per cent.

Subject C demonstrated the maintenance of correct phoneme production on the previously trained initial position but a loss of correct responding of words on the position trained in the first position treatment (final position) as demonstrated on Probe IV (80 per cent) and Probe V (60 per cent). Correct responding increased in the recently trained medial position from 20 per cent (Probe IV) to 100 per cent (Probe V). Responding in the randomized treatment also increased from 80 per cent (Probe IV) to 93 per cent (Probe V).

Summary. The learning trends shown in Probe V demonstrate increased levels of correct responding for all three subjects on training words. Trends shown on untrained words demonstrate the following:

1) A maintenance of correct responding in the initial position for Subjects A and C.

2) An increase in correct responding for the following
   a) Subject A: final position,
   b) Subject B: medial and final positions, and
   c) Subject C: medial and final positions.

3) All three subjects demonstrated increased responding in the randomized treatment.

4) Two subjects (A and B) experienced decreased levels of correct responding in one previously trained word position:
   a) Subject A: medial position; and
   b) Subject B: initial position.

5) None of the three subjects achieved 100 per cent correct responding on all probe items.

These data indicated the need for further training at the word configurational level for all three subjects. The program procedures, being applied called for the introduction of a randomized treatment of all words paired previously in the independent word position treatments.

Vacation Probes. Each subject was given a five-week speech vacation. The point at which the vacation was to begin was established before the onset of the pilot program. The appointed date was August 4, 1971, after approximately 6 and ½ weeks of therapy. The vacation was not contingent on the completion of any particular portion of the training program. In each case, a pre-vacation probe was given in the speech clinic prior to the five week absence from speech therapy. At the end of the five-week vacation period, a post-vacation probe was given at the child's school. The content of the probes was the same as that of the baseline Probe I, namely: pictured stimuli of trained words, untrained words, untrained phoneme boundary words, three-word sentences, paragraph reading, cartoon board description, and an experimenter/subject 3-to-5 minute conversation.

Vacation Probes: Subject C. Subject C had just completed training in the final position, the last independent position treatment, when he began his five-week speech vacation. The results of the pre- and post-vacation probes are shown in Table 10. The last portion of the pre-vacation probe shows the absence of data for five subtests. After completion of the first half at the end of the next-to-the-last training session, the parents were unable to bring the subject for completion of the second half. While the data are incomplete, the results of the gathered information is significant.

TABLE 10

Pre-Vacation and Post-Vacation: Subject C
Percentage of Correct Responses to Pictured Stimuli of
Training Words, Untrained Words, Untrained Phoneme Boundary Words,
Three-Word Sentences and Conversation
Before and After Five-Week Speech Vacation After Last Position
Treatment in Words

Time at which Probe Given	TRAINED WORDS				UNTRAINED WORDS				UNTRAINED WORDS		CONVERSATION		
	I	M	F	R	I	M	F	R	PB*	S^2/S^7*	PARA*	CB*	CT*
Pre-Vacation	100	100	100	100	100	60	100	93	--	--	--	--	--
Post-Vacation	100	100	100	100	100	100	100	100	100	100	100	96	100

*PB = Phoneme Boundary (untrained words - initial position)
S^2/S^7 = Three-word sentences Presented with Cueing Picture and Echoic Support

Conversation = PARA = Paragraph reading; CB = Cartoon board; CT = 3' to 5' conversation in therapy setting

The results of Table 10 will be discussed in the following order: 1) Trained Words; 2) Untrained Words; 3) Untrained (Phoneme Boundary and Three-Word Sentences); and 4) Conversation.

Trained Words. Subject C maintained 100 per cent correct responding over the five week period in trained words containing the treatment phoneme in all three independent word positions and in a randomized treatment.

Untrained Words. Subject C maintained 100 per cent correct responding over the five-week period in untrained words in the initial and medial word positions. The level of correct responding for the medial word position increased from 60 to 100 per cent and the randomized treatment, from 93 to 100 per cent.

Untrained and Conversation. While no pre-vacation data is available on these last five subtests, the post-vacation data is conclusive.

Phoneme Boundary. No overgeneralization was shown by Subject C. All words appropriately containing the previously-substituted phoneme /ɵ/ in the initial position were produced correctly.

Three-Word Sentences (S^2S^7). All 30 words containing the training phoneme in all three word positions in 10 sentences were correctly produced.

Paragraph Reading. In a short sound-loaded paragraph read by each subject, all words containing the training phoneme were articulated correctly.

Cartoon Board. One word containing the training phoneme out of 30 was produced incorrectly. The word on which the error was made (*she's*) contained the trained phoneme in the initial position.

Conversation in the Therapy Setting. In a conversation between the subject and the experimenter, 22 occurrences of the selected training phoneme were noted. All occurrences were correctly articulated.

Summary. The results of the pre-vacation and post-vacation probes indicate an average of 99.6 per cent correct usage of the training phoneme at all stimulus and configurational levels. The criterion for dismissal from training calls for 95 per cent correct. Subject C demonstrated that criteria easily. He was dismissed from therapy after 112 training block presentations and is being considered for training on another phoneme. Six weeks of therapy and 13 training sessions were needed for complete phoneme generalization to occur.

Articulation tests have shown that, prior to training, he had the following articulation profile: [θ/tʃ], [θ/s], [θ/z]. It was expected that, from training on the /ʃ/ phoneme with punished tongue protrusion, generalization to the correct production of the /tʃ/, /s/ and /z/ phonemes would occur. However, recent articulation evaluations do not support this expectation. The previous errors still exist, indicating a need for further training. It is anticipated that a shorter acquisition period will be needed in that this subject is now more readily stimulable (imitative) than on earlier evaluations.

While Subject C completed training up to the final position by the August 4 vacation deadline, Subjects A and B were able to progress further into the training program before the occurrence of August 4. Training for Subjects A and B continued as discussed herein. As indicated, the performance of Subjects A and B on Probe V demonstrated the need for randomization training to allow rather discrete differential responding in all three word positions. Figure 5 illustrates the acquisition curves for these two subjects on the randomized treatment.

Randomization Treatment. Subject A met all criteria in this phase of programing without difficulty. The criterion of each stimulus condition was met immediately upon its presentation. All training blocks were 100 per cent correct with the exception of the first block of training after the withdrawal of the echoic stimulus. At that time, the subject dropped to 95 per cent (one error out of 20 words) but quickly recovered with 100 per cent correct on the next training block.

Subject B also demonstrated high levels of correct responding on the randomized treatment. She erred on two words containing the /l/ sound in the initial position on four consecutive training blocks. While the words missed were not necessarily the same time, the guttural-sounding error was made on each initial position word missed. On the fifth training block, the criterion was met. Criteria were met without difficulty during continued training.

At the termination of the randomized treatment, Probe VI was given. Because the randomized treatment was the last training phase at the word configurational level, the Probe was fairly extensive. Table 11 shows the results of Probe VI.

Probe VI

The sixth probe contains all training words, all untrained words, phoneme boundary untrained words, three-word sentences, paragraph (reading), cartoon board, conversation in the therapy setting, and conversation in the home. Each subtest will be discussed in the order listed above.

TABLE 11

PROBE VI

Percentage of Correct Responses to Pictured Stimuli of Training Words, Untrained Phoneme Boundary Words, Three-Word Sentences, and Conversation After Training in Randomized Positions

	TRAINING WORDS				UNTRAINED WORDS				UNTRAINED WORDS		CONVERSATION			
Subj.	I	M	F	R	I	M	F	R	PB*	S^2S^7*	PARA*	CB*	CT*	HP*
A	100	100	100	100	100	80	100	93	100	51	60	30	22	52
B	100	100	100	100	100	100	100	100	100	74	66	64	67.	71

*PB = Phoneme Boundary
S^2S^7 = Three-word sentences Presented with Cueing Picture and Echoic Support

Conversation: PARA = Paragraph (reading); CB = Cartoon Board; CT = 3' to 5' Conversation in Therapy Setting; HP = 10' to 15' Conversation in Home with Parents (Experimenter not present)

Training Words. After training on the randomized treatment, both Subjects A and B responded correctly to all training words in all three word positions and the randomized treatment.

Untrained Words. Subject A had achieved 100 per cent correct responding to untrained words in the initial and final word positions. However, he incorrectly produced one word with the /l/ phoneme in the medial position, *calendar*. The pronunciation was judged as incorrect in the independent medial position treatment and in the randomized treatment. The error was a product of assimilation in that he produced the word as *canendar* bringing the /n/ phoneme, produced in the second syllable of the word, to the first syllable of the word.

Subject B produced all untrained words correctly in all independent and randomized word positions.

Phoneme Boundary. Neither Subject A nor Subject B showed evidence of overgeneralization of the trained phoneme to the previously substituted phoneme. Both produced 100 per cent correct responses to words containing the substituted phoneme in the initial position.

Three-Word Sentences (S^2S^7). When given an echoic model of a sentence consisting of three words containing the training sound in any of the three word positions, Subject A responded correctly to only 51 per cent of the 31 words. The breakdown of errors is as follows:

a) 7 errors, Initial blends (i.e., *play*)

b) 2 errors, Final blends (i.e., *candle*)

c) 3 errors, Medial position (i.e., *sailor*)

d) 3 errors, Final position (i.e., *shell*)

While a 51 per cent score is not a high score, it does demonstrate an improvement over the 42 per cent correct shown on Probe II after initial position responding.

Subject B responded correctly on 74 per cent of the imitated words in sentences. The distribution of missed words was as follows:

a) 1 error, Initial position (i.e., *lightening*)

b) 1 error, Initial blend (i.e., *flash*)

c) 2 errors, Medial position (i.e., *sailor*)

d) 3 errors, Final position (i.e., *sail*)

On Probe II, Subject B correctly responded to 60 per cent of the imitated words. An increase in correct responding to 70 per cent was significant in terms of increased learning. However, both subjects demonstrate a breakdown in correct production in the more complex configurations even under conditions of echoic stimulation.

Paragraph (reading). Both Subjects A and B demonstrated slight gains in correct responding in Probe VI from that shown in Probe II. Subject A increased from 50 per cent (Probe II) to 60 per cent (Probe VI) correct. Incorrect responding occurred on words in the following positions:

a) 5 words, Medial position (i.e., *fellows*)

b) 3 words, Final position blends (i.e., *people*)

c) 3 words, Final position (i.e., *all*)

Subject B demonstrated an increase from 60 per cent (Probe II) to 66 per cent (Probe VI). Errors occurred on words with the following distribution:

a) 5 words, initial position (i.e., *leaping*)

b) 3 words, medial position (i.e., *noisily*)

Again, both subjects demonstrated unstable responses on complex configurational levels. The grapheme (printed) stimulus did not appear to carry sufficient support for correct production at the paragraph reading level.

Cartoon Board. Again, both Subjects A and B demonstrated increased responding. On Probe I given before the commencement of training, Subject A responded correctly on 14 per cent of the words used to describe the sound-loaded picture. Probe VI shows an increased level of responding to 30 per cent. An analysis of the word positions in which words were incorrectly produced reveals that all positions and position-blends, except the initial position, contained errors.

Subject B responded correctly to 43 per cent of the words on the cartoon board in Probe I and 64 per cent on Probe VI. Analysis of words produced incorrectly revealed an even distribution of all word positions and blend-positions, with the exception of the final word position.

Conversation in the Therapy Setting. Conversational samples yielded the following information: Subject A maintained the same level of responding shown in the baseline Probe I. Training in independent and randomized word positions had no effect on his speech in the probe sample. All correct responses were in the initial word position.

Subject B, however, increased the level of correct responding from 48 per cent (Probe I) to 67 per cent (Probe VI). According to auditory judgements, errors occurred in all three word positions with the majority of errors being in the final position.

Home Probe with Parents. In the absence of the experimenter, the parents, using an unobtrusive casette tape recorder, collected 10-to-15 minute sample of their child's speech in a situation which normally yielded spontaneous conversation. The results of this first home probe illustrated the following: Subject A produced the /l/ phoneme correctly on 52 per cent of the words containing that sound. Again, the majority of correct productions occurred in the initial position. It is interesting to note that the words spontaneously emitted in conversation were largely words with the /l/ sound in the initial position.

Subject B responded correctly on 71 per cent of the spontaneously produced words in conversation at home. Analysis of the recorded sample revealed the occurrence of errors most often in the initial position.

Summary. The results of Probe VI indicate the following for Subjects A and B after training on the randomized treatment:

a) Stabilized phoneme production at the word configuration level;

b) No overgeneralized responses; and

c) Increased, but variable, responding at the sentence configurational level. The per cent of correct responding was below that required for dismissal.

Both Subjects A and B indicated on Probe VI a need for training at the sentence level. The first treatment involved sentences containing one word with the training phoneme in varied positions. Figure 6 shows the acquisition curves for Subjects A and B on the ten sentences, each containing one sound-loaded word.

One-Word Sentences

Imitative (S^2S^5). When given an echoic model paired with a cueing picture (S^2), the subject was required to correctly produce the imitative stimulus (S^5), a sentence with the word containing the training phoneme at the end of the sentence. Subject A demonstrated very little difficulty with this phase of training. Ten training blocks were needed to complete the imitative phase. No less than 90 per cent correct was obtained for any one training block.

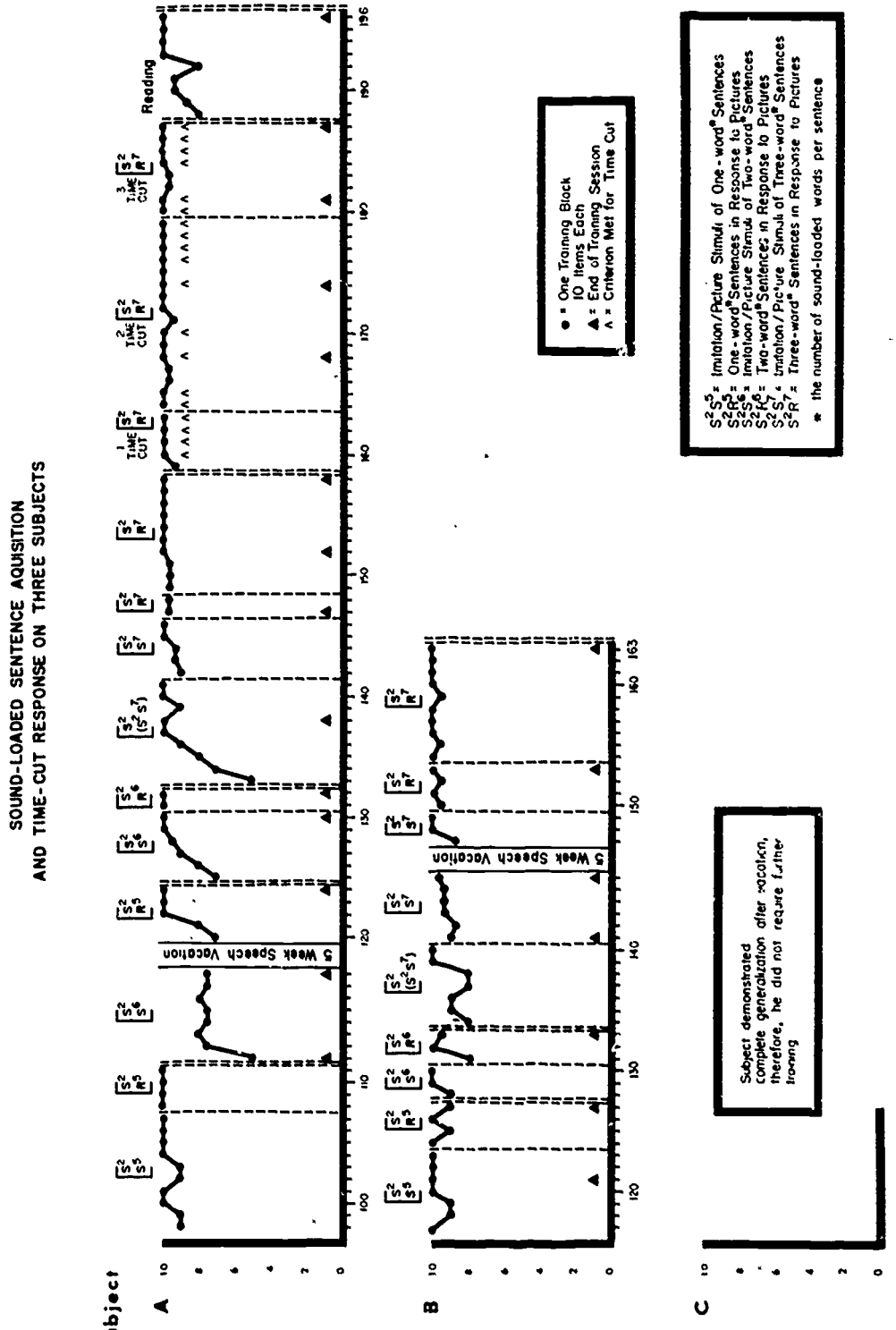
Likewise, Subject B required only seven training blocks to meet the criterion for the imitative phase. She also demonstrated no lower responding than 90 per cent.

Non-imitative (S^2R^5). When given only the picture stimulus (S^2), each subject was required to respond with the appropriate sentence (R^5), and correct production of the training phoneme. Subject A completed training in the non-imitative phase with no apparent difficulty; four consecutive training blocks with 100 per cent correct on each block were produced.

Subject B also met the criterion in the minimum of four training blocks. Her responding varied from 90 to 100 per cent correct on the four blocks.

Summary. The results of training on sentences containing one word with the training phoneme indicate little difficulty in the attainment

FIGURE 6


SOUND-LOADED SENTENCE AQUISITION
AND TIME-CUT RESPONSE ON THREE SUBJECTS
subject
A
B
C
3 Week Speech Vocation
Reading
1 TIME CUT
2 TIME CUT
3 TIME CUT
● = One Training Block
10 Items Each
▲ = End of Training Session
^ = Criterion Met for Time Cut
S^2S^5 = Imitation/Picture Stimuli of One-word* Sentences
S^2R^5 = One-word* Sentences in Response to Pictures
S^2S^6 = Imitation/Picture Stimuli of Two-word* Sentences
S^2R^6 = Two-word* Sentences in Response to Pictures
S^2S^7 = Imitation/Picture Stimuli of Three-word* Sentences
S^2R^7 = Three-word* Sentences in Response to Pictures
* the number of sound-loaded words per sentence
Subject demonstrated complete generalization after vacation, therefore, he did not require further training

of the criteria on both the imitative and non-imitative phases of training for both Subjects A and B.

After the completion of the one-word sentence training, Probe VII was given. The data compiled on this probe represented the unreinforced responses to echoic and picture stimuli of sentences containing two words with the training phoneme in any of the three word positions and in blends. The results of Probe VII are shown below in Table 12.

Table 12
PROBE VII
Percentage of Correct Responses to Echoic and Pictured Stimuli in Sentences Containing Two Words with the Training Phoneme After Completion of One-Word Sentence Training

	PHONEME ONLY			PHONEME BLEND*		
SUBJ.	I	M	F	I	M	F
A	85	40	33	0	--**	0
B	85	80	100	100	--	100

*Phoneme Blend = Training phoneme and another consonant (i.e., *play*)

** (--) = no words in the sentences contained Medial Position Blends

Probe VII

Subject A revealed variable correct imitative responding to two-word sentence stimuli. Initial position responses were correct 6 out of 7 times; 2 out of 5 imitated responses in the medial position and 1 out of 5 imitated responses in the final position were correct. However, no responses were correct in phoneme blends in the initial and final word positions.

Subject B performed on a higher imitative level than Subject A on Probe VII. Initial Position responses were correct 6 out of 7 times; 4 out of 5 were correct in the medial position; 3 out of 3 were correct in the final position; 4 out of 4 were correct on initial-position blends; and 1 out of 1 were correct on a final-position blend.

Summary. The data in Probe VII indicate a higher per cent of correct imitative responses in the initial position than in any other word positions or phoneme blends for Subject A. Subject B demonstrated high levels of imitative responding to words in all positions and blends in the two-word sentences.

After completing Probe VII, each subject began training on the two-word sentences. Figure 6 shows the acquisition trends on the two-word sentence training.

Two-Word Sentence Training

A discussion of the training at the two-word sentence configurational level involves the following:

a) Subject B: Two-Word Sentence Training

b) Subject A: Two-Word Sentence Training
Five Week Speech Vacation
One-Word Sentence Training
Two-Word Sentence Training

Subject B: *Imitative.* When given an echoic model and a picture stimulus, Subject B required only three training-block presentations to demonstrate the criterion. Responding was at a high and consistent level.

Non-Imitative. When the echoic stimulus was withdrawn, Subject B dropped to 80 per cent correct responding but quickly recovered to 100 per cent and 95 per cent correct to meet the established criterion. Training on two-word sentences was terminated at that point. Probe VIII was given before further training. Discussion of the probe follows the narrative on Subject A.

Subject A: *Imitative.* Subject A experienced a drop in correct responding to 50 per cent on the first training-block presentation. Correct responding then rose to 75 per cent on the next block and remained at the 75 to 80 per cent correct level until the termination of the training session. The criterion had not been met when the session ended. Because of the pre-assigned date of the five-week speech vacation, Subject A was given the pre-vacation probe test and released from therapy. After the end of the speech vacation, the post-vacation probe was given.

Subject A: Five-Week Speech Vacation.

The pre- and post-vacation probe results are shown in Table 13.

The results shown in Table 13 will be discussed in terms of the following subtests: a) trained words; b) untrained words; and c) untrained and conversation.

TABLE 13

Pre-Vacation and Post-Vacation: Subject A
Percentage of Correct Responses to Pictured Stimuli of
Training Words, Untrained Words, Untrained Phoneme Boundary Words,
Three-Word Sentences and Conversation
Before and After Five-Week Speech Vacation
Which Followed Imitative Two-Word Sentence Training

Time at Which Probe was Given	TRAINED WORDS				UNTRAINED WORDS				UNTRAINED WORDS		CONVERSATION		
	I	M	F	R	I	M	F	R	PB*	S^2S^7*	PARA*	CB*	CT*
Pre-Vacation	100	100	80	100	100	70	80	90	100	50	60	30	22
Post-Vacation	100	100	100	100	100	100	100	100	100	70	73	60	60

*PB = Phoneme Boundary (untrained words - initial positon
S^2S^7 = Three-word sentences with Cueing Picture and Echoic Support

Conversation = PARA - Paragraph reading
CB - Cartoon Board
CT = 3' to 5' conversation in therapy setting

Trained Words. Subject A maintained 100 per cent correct production in the initial, medial, and randomized word positions and increased correct production from 80 per cent (pre-vacation probe) to 100 per cent.

Untrained Words. Further increments in correct responding were noted on untrained words. One-hundred per cent correct responding was maintained in the initial position. Increased responding to 100 per cent correct occurred on untrained medial, final, and randomized position probe words over the five-week period.

Untrained and Conversation. Probed responses in this section will be described according to the following: a) phoneme boundary; b) three-word sentences; c) paragraph reading; d) cartoon board; and e) conversation in the therapy setting.

Phoneme Boundary. No overgeneralization had occurred as evidenced by 100 per cent correct production of words with the previously substituted phoneme in the initial word position.

Three-Word Sentences. Increased correct imitative responding to 10 untrained sentences, each containing three words with the /l/ phoneme in any word position, was shown after the five-week speech vacation. An increase from 18 correct phoneme productions to 22 correct productions was shown after the vacation period.

Paragraph Reading. Correct responding also increased over the five week interim in a heavily sound-loaded paragraph reading. Sixty per cent of the words were produced correctly prior to the vacation while 73 per cent correct was scored after the vacation.

Cartoon Board. The percentage of correct responses to the heavily sound-loaded picture doubled from 30 per cent to 60 per cent over the five week period.

Conversation in the Therapy Setting. Correct responding almost tripled in conversation after the five week period. The pre-vacation probe indicated 22 per cent correct while the post-vacation probe indicated 60 per cent.

Summary. The five-week speech vacation appeared to benefit Subject A. He not only maintained 100 per cent correct responding in words but also corrected errors made previous to the speech vacation to the 100 per cent correct level in words. All trained and untrained words were produced correctly after the vacation period.

While correct responding in conversation did not reach the 100 per cent level, significant increases were noted on all post-vacation conversation probes. Correct phoneme boundary responding was also maintained.

Subject A: One-Word Sentence Training

Due to experimental error, the non-imitative one-word sentence phase of training was repeated. As Figure 6 indicates, three training blocks were needed to reach the 100 per cent correct level of responding and subsequently, the recognition of criteria after a total of five training blocks.

Subject A: Two-Word Sentence Training

Imitative. When the two-word sentence treatment was re-instituted for Subject A, the level of correct responding, beginning at 70 per cent on the first training block, rose with the presentation of the next block until the criterion was met.

Non-imitative. Withdrawal of the echoic stimulus did not affect the 100 per cent correct responding achieved on the imitative stage. Only two training blocks (100 per cent correct on each) were needed on the final stage of two-word sentence training.

When the subjects had completed training on the two-word sentence treatment, they were given Probe VIII. Only three subtests are included in this probe: 1) paragraph reading; 2) cartoon board; and 3) conversation in the therapy setting. Table 14 shows the results obtained on Probe VIII.

Table 14
Probe VIII
Percentage of Correct Responses to
a Paragraph Reading, Cartoon Board
and Conversation in Therapy Setting
After Two-Word Sentence Training

	CONVERSATION		
SUBJECT	PARA*	CB*	CT*
A	80	64	75
B	80	72	70

*PARA = Paragraph Reading
CB = Cartoon Board
CT = 3' to 5' Conversation in Therapy Setting

Probe VIII

The results in Table 14 indicate overall increased levels of responding for each subject. In order to analyze the probe responses, comparisons between the Post-Vacation Probe and Probe VIII for Subject A and between Probes VI and VIII for Subject B were made. The discussion of the resluts follows this order: a) paragraph reading; b) cartoon board; and c) conversation in the therapy setting.

Paragraph Reading. Subject A responded correctly to 73 per cent of the words in the paragraph reading subtest on the post-vacation probe and to 80 per cen on Probe VIII. Subject B demonstrated 66 per cent correct on the paragraph reading on Probe VI given after the randomized treatment and 90 per cent correct on Probe VIII.

Cartoon Board. Subject A experienced a very slight increase in correct responding on Probe VIII. On the previously presented Post-Vacation Probe, Subject A obtained a 60 per cent correct score on the cartoon board. Probe VIII responding revealed an increase to 64 per cent.

Subject B increased correct responding from 64 per cent (Probe VI) to 72 per cent (Probe VIII) on the cartoon board.

Conversation in the Therapy Setting. On the Post-Vacation Probe, Subject A responded correctly on 60 per cent of the conversational words containing /l/ and on 75 per cent on Probe VIII. Subject B, however, made only a slight gain in responding: from 67 per cent (Probe VI) to 70 per cent (Probe VIII).

Summary. The results of Probe VIII indicate generally increased levels of correct responding in spontaneous conversation for Subject A and only slight increases in correct responding for Subject B.

Three-Word Sentence Training

The completion of Probe VIII signalled the beginning of training on the three-word sentences. Figure 6, previously presented, demonstrates the acquisition curves on this portion of the training. The three-word sentence treatment includes: a) single word responses to pictures only; b) echoic- and picture-cued sentences; c) picture-cued sentences; and d) performance. Also, during this portion of training, Subject B began the five-week speech vacation. The discussion of the pre- and post-vacation probes follows herein after the discussion of the training in which the vacation took place.

Single Word Responses ($S^2[S^2/S^7]$). Subject A experienced a climbing period of acquisition during this phase of training. On the first training block he demonstrated only 50 per cent correct responses on ten words cued by the picture stimulus. Training on the next four blocks of ten words each brought the level of responding up to 100 per cent and subsequent realization of the criterion.

Subject B varied correct responding between 80 and 90 per cent over 5 training blocks, then jumped from 80 per cent to two blocks of 100 per cent correct to meet the criterion.

The acquisition curves of both Subjects A and B appeared to demonstrate the need for training at the single word level, especially prior to training on sentences containing three or more words with the training phoneme in any word position. After each subject met the assigned criterion for single word responding, he was given training using the just-trained words in sentences, each containing a total of three or more words using the selected phoneme.

Echoic and Picture-Cued Sentences. The imitative stage of training was met with a brief training period for Subject A. Only five training blocks were needed to demonstrate the criterion; correct responding did not fall below 90 per cent.

Subject B began training on the imitative sentences just prior to the five-week speech vacation. Six training blocks had been completed, but the criterion had not been reached when the vacation period began. For discussion purposes, it need only be mentioned herein that, after the vacation, only three more training blocks were needed to reach the criterion.

Five-Week Speech Vacation: Subject B. The results of the pre-vacation and post-vacation probes are shown in Table 15.

TABLE 15

Pre-Vacation and Post-Vacation Probes: Subject B
Percentage of Correct Responses to Pictured Stimuli of
Training Words, Untrained Words, Untrained Phoneme Boundary Words,
Three-Word Sentences and Conversation
Before and After Five-Week Speech Vacation
After Beginning Three-Word Sentence Training

Time at Which Probe was Given	TRAINED WORDS				UNTRAINED WORDS				UNTRAINED WORDS		CONVERSATION		
	I	M	F	R	I	M	F	R	PB*	S^2/S^7*	PARA*	CB*	CT*
Pre-Vacation	100	100	100	100	100	100	100	100	100	97	80	74	53
Post-Vacation	100	100	100	100	100	100	100	100	100	90	98	90	77

*PB = Phoneme Boundary (untrained words, initial position)
S^2/S^7 = Three-word sentences Presented with Cueing Picture and Echoic Support

Conversation = PARA = Paragraph reading
CB = Cartoon Board
CT = 3' to 5' conversation in therapy setting

The results of Table 15 will be discussed in the following order: 1) Trained Words; 2) Untrained Words; 3) Sentences; and 4) Conversation.

Trained Words. Subject B responded correctly to all training items before and after the five-week speech vacation.

Untrained Words. Again, correct responding was maintained on all untrained words over the vacation period. In addition, no overgeneralization occurred as shown by 100 per cent correct responding to words beginning with the previously substituted phoneme.

Sentences. Training for Subject B had been interrupted at the S^2S^7 phase of the program. Prior to the program, when given echoic and picture-cued stimuli, she responded at the 97 per cent level of correctness. The five-week vacation affected correct responding by a drop to 90 per cent.

Conversation. Responding in each of the three conversation subtests occurred as follows: *Paragraph reading*. A slight increase in the number of correct responses occurred over the five-week period, from 80 per cent (Pre-Vacation) to 88 per cent (Post-Vacation).

Cartoon Board. In response to a heavily sound-loaded picture stimulus another increase in responding was shown by 74 per cent correct before the vacation and 90 per cent correct after the vacation.

Conversation in the Therapy Setting. Pre-vacation correct responding at the 53 per cent level was raised to 77 per cent after the vacation in a 3-to-5 minute conversation with the experimenter in the therapy setting.

Summary. Stable correct phoneme responding to words, trained and untrained, was evidenced on the vacation probes. A decrease in correct responding was shown in the sentence subtest while increased responding occurred in each conversation subtest. The overall results indicate that the five-week absence of therapy was not harmful to the correct response levels, but was, in fact, beneficial.

Subject B returned to therapy at the imitative S^2S^7 level of training and quickly achieved the criterion. After training on the imitative level, the echoic stimulus was withdrawn.

Picture-Cued Sentences. Subject A met the criterion for picture-cued sentences on the first two training blocks. On both training blocks 97 per cent of the phoneme-contained words were produced correctly.

Through an experimental error, Subject B was given two more training blocks than were necessary to demonstrate the critetion. She met the criterion on the first two training blocks.

Performance. On the same ten sentences, ten additional practice training blocks were completed. The last four training blocks were timed for use in a later training phase. Subject A maintained high (97 to 100 per cent) levels of correct responding through the ten training blocks. The last four timed blocks were completed respectively in: 1) 1 minute, 25 seconds; 2) 1 minute, 18 seconds; 3) 1 minute, 10 seconds; and 4) 1 minute, 40 seconds. Compared to other subjects, the time for each training block for Subject A was relatively slow: other subject's time ranged from 40 seconds to 80 seconds.

Subject B also maintained high levels of correct responding on the practice and production phase of training--from 97 to 100 per cent. The four timed training blocks were completed in 1) 47 seconds; 2) 43 seconds; 3) 47 seconds; and 4) 40.2 seconds respectively. It was the experimenter's judgement that Subject B had met the criteria for the training program and

that she should be dismissed from therapy on the /l/ phoneme. Therapy was terminated after 20 training sessions and 163 training blocks. Plans for this subject included further training on the /f/ phoneme with supplementary training on the /l/ phoneme as probes might indicate the need.

Before the training continued for Subject A, Probe IX was given. The results of the probe are shown in Table 16.

Table 16
PROBE IX
Percentage of Correct Responses to a Paragraph Reading, Cartoon Board, and Conversation in the Therapy Setting After Ten-Block Performance Training

	Conversation		
SUBJ.	PARA*	CB*	CT*
A	88	90	83

*PARA = Paragraph Reading
CB = Cartoon Board
CT = 3' to 5' Conversation in Therapy Setting

Probe IX

The level of responding increased on each conversation subtest from that shown on Probe VIII. Increases were shown in the following:

	Probe VIII	Probe IX
PARA:	80	88
CB:	64	90
CT:	75	83

The majority of errors made were in the final position and in final blends.

Subject A was then given the next treatment which included two 10 per cent time cuts. The first time cut was figured on the average elapsed time of the last four training blocks of the performance phase. The average time for Subject A was 1 minute, 23 seconds. Ten per cent of that time is 1 minute, 15 seconds; thus Subject A was required to maintain 90 per cent or better correct responding on four consecutive training blocks with an imposed time limit on each block of 1 minute, 15 seconds. This subject accomplished the criterion on five training blocks.

The second time cut was figured on 10 per cent of the average elapsed time for the four training blocks on the preceding time cut: 53 seconds; 60 seconds; 55 seconds; 63 seconds. It is interesting to note the substantial drop in time for the first time cut even when the criterion was 1 minute, 15 seconds. Ten per cent of the average elapsed time for the first time cut, then was 53 seconds. The criterion for the second time cut became 90 per cent or better correct responding on four consecutive training blocks in no more than 53 seconds.

Subject A had more difficulty meeting the criterion on the second time cut than on the first. A total of 16 training blocks were needed. The percentage of correct responses remained high, but the timed factor was difficult to achieve. The times of the four training blocks on which the criterion were met were: 45 seconds; 45 seconds; 43 seconds, and 42 seconds.

The purpose of a time cut is twofold:

1) to provide phoneme production practice and

2) to impose conditions which require a reduction in the emphasis of the stressed /l/ phoneme in words to a more conventional form of diction.

Thus, while Subject A met the criterion on both time cuts, a third time cut of 5 per cent was added to obtain a more appropriate conversational rate with the same criterion of 90 per cent on four consecutive training blocks at a figured time of 44 seconds on each block. Eight training blocks were needed to demonstrate the criterion with the following times being recorded for criterion achievement: 41 seconds; 39 seconds; 41½ seconds; and 36 seconds. The time needed per training block was substantially decreased since the first time cut.

At this point, Probe X was given. The results of that probe are shown in Table 17.

Table 17
PROBE X
Percentage of Correct Responses to
a Paragraph Reading, Cartoon Board,
and Conversation in the Therapy Setting
After the Third Time Cut

	CONVERSATION		
SUBJ.	PARA*	CB*	CT*
A	90	70	85

*PARA = Paragraph Reading
CB = Cartoon Board
CT = 3' to 5' Conversation in the Therapy Setting

Probe X

The results of Probe X show only minimal gains in the paragraph reading and conversation in the therapy setting when compared to the results in Probe IX. A significant drop in correct responding was shown on the cartoon board. The compared scores are as follows:

	Probe IX	Probe X
PARA:	88	90
CB:	90	70
CT:	83	85

The results of this probe show evidence of high but variable response levels for Subject A.

Paragraph Training

The next treatment called for a paragraph reading with 90 per cent correct phoneme production or better on four training blocks being established as a criterion. Nine training blocks were needed to demonstrate the criterion for Subject A. The responding in this last phase of training varied between 80 and 100 per cent correct. When the criterion had been met for the paragraph reading treatment, formal therapy was terminated. This subject attended 27 therapy sessions and required 196 training blocks to reach the terminal point.

Post-Training Probe

One week after the conclusion of training, each subject was given a final probe, Probe XI. A conversation probe in the therapy setting and at home were included in this last evaluation measure. The results for each subject are shown in Table 18.

Table 18
PROBE XI
Percentage of Correct Responses in a Conversation
in the Therapy Setting and at Home
for Subjects A, B, and C
After the Completion of Training

	CONVERSATION	
SUBJ.	CT*	HOME*
A	93	85
B	91	100
C	100	100

*CT = 3' to 5' Conversation in the Therapy Setting
Home = 10' to 15' Conversation with Parents at Home without Experimenter

Probe XI

The results demonstrated in the last probe indicate adequate phoneme acquisition for Subjects B and C. Subject A, however, demonstrated as high as 15 per cent error level on the Home Probe. Two options were open to the experimenter: 1) to bring Subject A back into the training program at an appropriate starting point, or 2) to dismiss him from therapy for a short period and check his progress periodically.

The experimenters chose the second alternative. The previous five-week speech vacation had been significantly beneficial for Subject A. The feeling was that a second vacation might provide the same increase. We are awaiting the end of the second vacation at this writing.

Summary

The stimulus shift generalization training program appears to be an effective training program for attaining carry-over of newly-learned phoneme responses. All three subjects made significant improvements in phoneme production in a setting outside the clinical environment. The three subjects used to illustrate the program demonstrated:

1) complete carry-over after training only in the independent word positions (Subject C);

2) complete carry-over after training in sentences (Subject B); and

3) carry-over at home at a high level but continued observation and/or training indicated (Subject A).

The results of the stimulus shift program indicate the following conclusions:

1) Acquisition trends at the word configurational level supported the findings of past research (McLean, 1970; Raymore, 1970; Raymore and McLean, 1972).

2) Correct responding at the 100 per cent level in words did not necessarily indicate complete generalization of correct responses to more complex configurations (sentences, controlled conversation, and spontaneous conversation). Training in all the various levels of configuration (words, sentences, conversation) appeared to be necessary for some children.

3) A five-week speech vacation was found to benefit all three subjects. It was shown that, after at least 19 therapy sessions, each subject made significant gains in correct phoneme production during the five-week therapy vacation regardless of the phase of the program he had attained at the time of the speech vacation.

4) The use of the time cuts, when necessary, provided performance practice which appears to be functional in the generalization of phoneme responses to untrained conversational settings.

5) Slide presentation of the stimulus materials increased the overall efficiency/management of the training program.

Probe results for the subjects not described in narrative detail are illustrated in Appendix C. Blank areas of the tables reporting the Probes in the Appendix indicate that the subject had not completed training at that point.

The results of the study also indicated areas where additional research would be appropriate. These areas include a) phoneme boundary training; b) establishment of termination criteria; c) separate training on the final position /l/; and d) appropriateness of stimulus materials and equipment.

We are presently in the process of establishing the reliability of these results. The stimulus-shift program is being used in three public schools in Parsons, Kansas, with the assistance of three supervised speech-therapy aides.

The use of semi-automated materials and of trained speech-therapy aides would appear to offer alternatives to the functional delivery system for public school articulation therapy; thus, such a system would appear to have the potential to effect change in the philosophy of case selection; the structure of case loads; and the economics of the delivery of such services.

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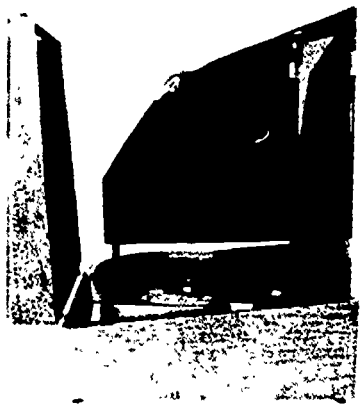
APPENDIX A

Equipment

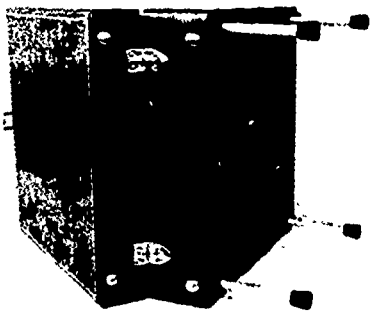
INSTRUCTIONS FOR SHOW AND STOW



STEP 1. Lift the TOP Cover of the Viewer. Lift the TOP FLAP of the Viewer Screen and move the opposite Side Flap so that it sits on the side bracket.

STEP 2. Place Top Flap on top of the Side Flap.

STEP 3. Remove the Kodak Carousel by lifting up straight. Remove the 4 Legs.



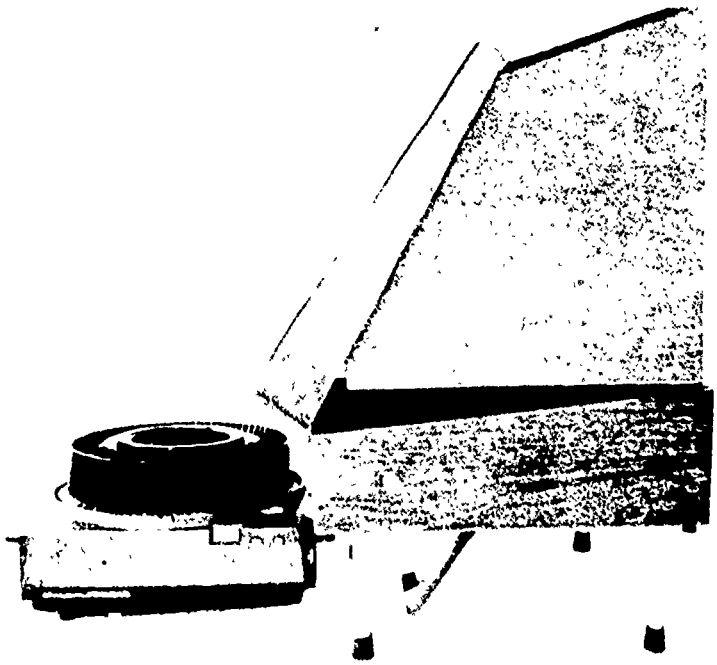
STEP 4. Lay the Case on its side.

(a) Screw the 4 Legs into the 4 holes on the bottom of the case.

(b) Open trap door on the bottom of the case permitting mirror to come out.

(c) Stand Case on its 4 Legs.

(d) Inside the case, lift protective cover of mirror and move toward screen and out of the way.



STEP 5. (a) Lift the Top Flap again and place the second side flap on the side bracket.

(b) Move the Cover of the Case to fit snugly over the two side flaps.

(c) Place the Carousel in back of the Viewer.

STEP 6. Insert one slide or the tray with a slide on the Carousel.

STEP 7. Turn the Carousel to LOW. (TIMER SHOULD BE ON "M")

STEP 8. The slide will shine on the small mirror, then goes to the large mirror on the cover, and then projects on the Screen.

The Carousel should be close to the mirror and the angle of light raised until properly projected on the screen. To raise the picture, roll the Height Adjustment on the front of the Carousel.

If the picture is not complete on the screen, the BACK LEFT LEG of the Carousel can be adjusted. Or by looking from the front the picture can be altered by moving the Carousel one way or the other

IN BREAKING DOWN OF SET-UP, REVERSE PROCEEDURE. Be sure to lower the Height adjustment and the Tilt Leg of the Carousel.

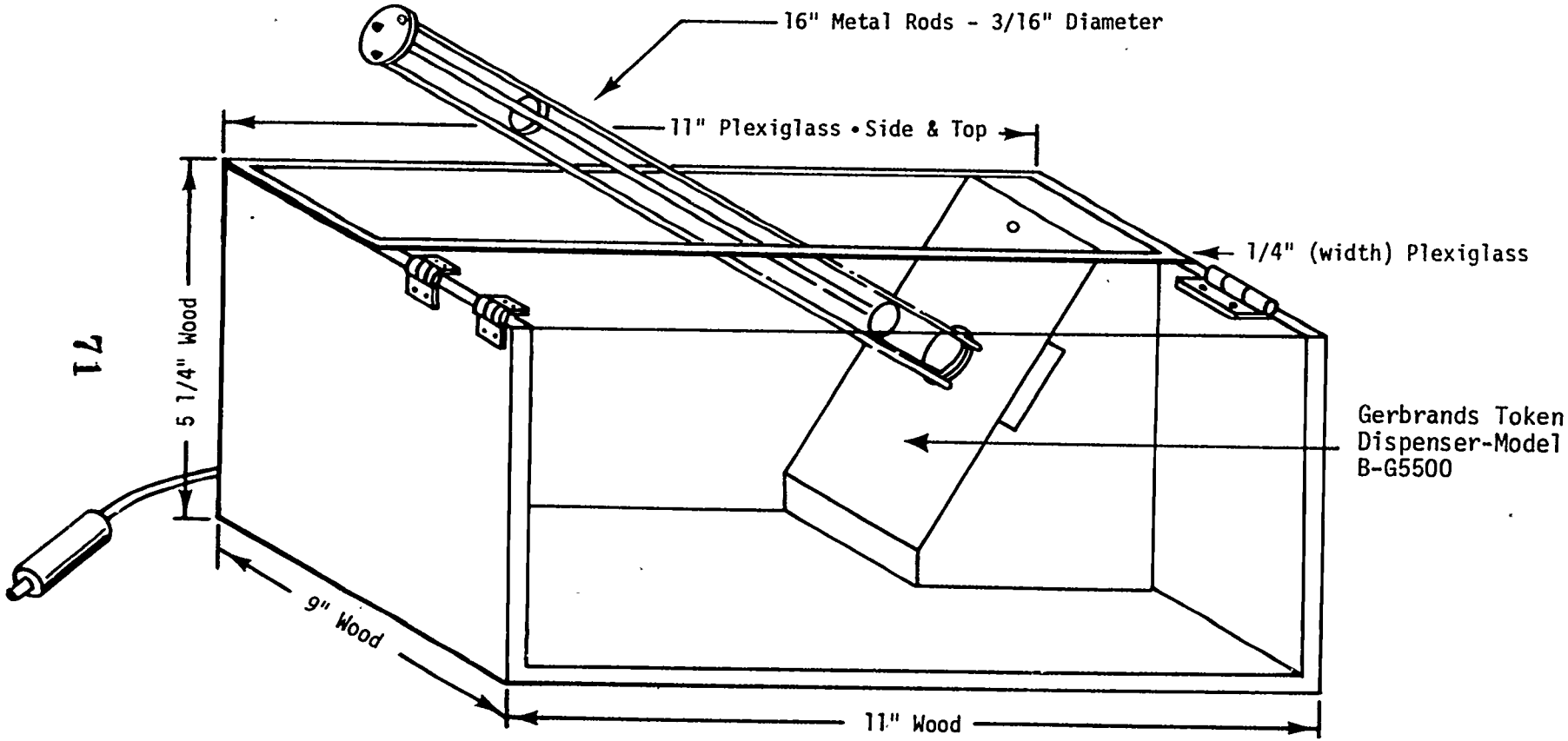
IT IS BEST TO PLACE THE CAROUSEL IN THE CASE WITH THE LENS TO THE FRONT.

To clean the Mirrors use a soft LINT-FREE Cloth. Extra care should be given to bottom mirror as this is a front surface Mirror made of glass.

WHEN SHIPPING, NEVER LEAVE CAROUSEL IN THE CASE. Use two packages.

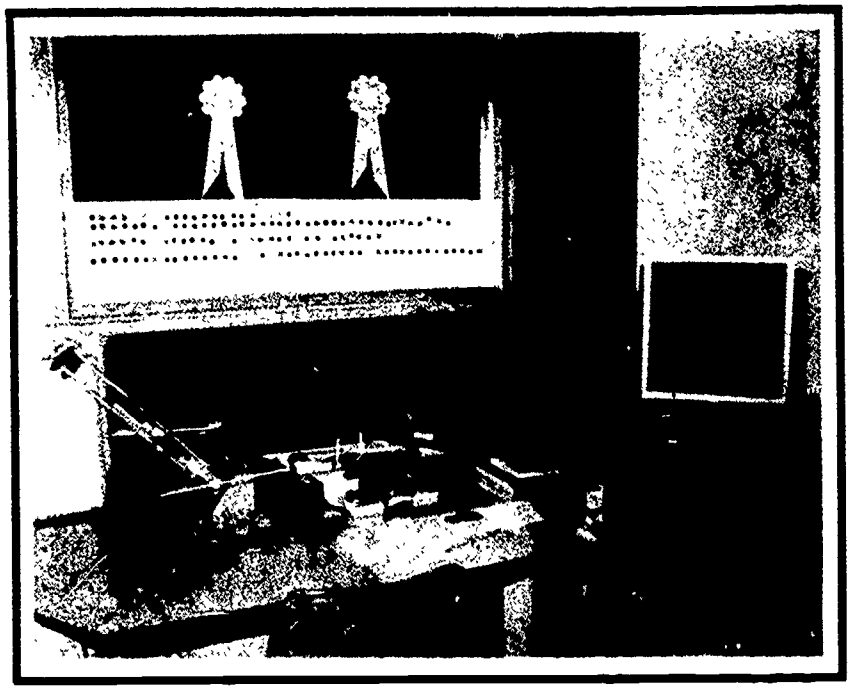
ERIC

TOKEN REINFORCEMENT DISPENSER AND BOX



Speech and Hearing Clinic

Parsons State Hospital and Training Center



THERAPY ROOM SETTING

In the therapy room, the child sat to the immediate right of the experimenter. The Show and Stow screen was slightly to the right of the child. Both the child and the experimenter faced the mirror. The token box was placed to the experimenter's left. The microphone was placed directly in front of the child. The Show and Stow manipulator switch and token box dispenser switch were on the left of the experimenter. The extra poker chips, stop watch, stars and pennies were placed directly in front of the experimenter. (From page 15.)

APPENDIX B

Sample Generalization Training Program
for the /s/ Phoneme

DETAILED PROCEDURE
FOR GENERALIZATION TRAINING PROGRAM ON /S/ PHONEME

I. MULTIPLE STIMULUS CONTROL

INITIAL STIMULUS CONDITIONS AND CRITERION

TRAINING WORDS	S^1	$S^1_{S^2}$	S^2	S^2 only *c c	$S^2_{S^3}$	S^3	$S^3_{S^4}$	S^4
toddle safe sailor seal sign slingshot star ceiling suit sack	20/40 correct	20/20 correct	38/40 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

*Cost contingency schedule introduced

II. CONFIGURATION CONTEXTS

A. Phoneme Boundary Training

	S^1	$S^1_{S^2}$	S^2	$S^2_{S^3}$	S^3
throat sailor thief suit theatre safe thirty saddle thermos ceiling	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

B. Position Training

FINAL

	S^1	$S^1_{S^2}$	S^2	$S^2_{S^3}$	S^3	$S^3_{S^4}$	S^4
chops fox gas ice lace	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

MEDIAL

	S^1	$S^1_{S^2}$	S^2	$S^2_{S^3}$	S^3	$S^3_{S^4}$	S^4
racer faucet pistol policeman basket	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

RANDOMIZED

	S^1	$S^1_{S^2}$	S^2	$S^2_{S^3}$	S^3	$S^3_{S^4}$	S^4
sack basket suit ice policeman ceiling lace star slingshot gas sign pistol fox seal faucet sailor racer safe chops saddle	20/20 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct	20/20 correct	38/40 correct

C. Word-Sentence Transfer Training

* ONE-WORD SENTENCES

	S^1 S^2 S^5 paired	S^2 R^5 only
The cowboy bought a new saddle. My money is in the safe A Navy man is called a sailor. I watched a trained seal A cowboy wears chaps I shot a fox For cold pop, you need ice I saw a racer. Turn on the faucet The cowboy wears a pistol.	40/40 correct	38/40 correct

* TWO-WORD SENTENCES

	S^1 S^2 S^6 paired	S^2 R^6 only
I want some salt Did you see my sandwich ? A saw will cut ice. I'll see you in school She's a nice nurse. We use scissors to make a dress The milk spilled from the glass. Did you swing at the baseball ? The old rooster is sick. You scoop dirt with a dustpan	40/40 correct	38/40 correct

III. PERFORMANCE ACROSS TRAINED AND UNTRAINED STIMULUS AND CONFIGURATION CONSTRAINTS

A. Trained

	S^2 only
soap soup squirrel six cross purse but whistle lipstick pencil	20/20 correct

* THREE-WORD SENTENCES

	S^1 S^2 S^7 paired	S^2 R^7 only	S^2 R^7 only	S^2 R^7 only
Put some soap on the spot I want some stars in my soup The circus squirrel set up I saw six skirts On Sunday, I saw a cross I have cigarettes in my purse The stone stopped the bus A whistle sounds nice She puts lipstick on her lips He saw a pencil on his desk	20/20 correct	18/20 correct	8/10 correct 10 blocks --- Last 4 blocks timed	8/10 correct Two 10% Time Cuts

B. Untrained

	Untrained Reading Material
Three to Five Minutes of Reading	90% ratio between Correct Responses Opportunities on Target Phoneme

	Sound-loaded, Untrained Materials
Three to Five Minutes of Discussion of Picture Stimulus Materials	90% ratio between Correct Responses Opportunities on Target Phoneme

IV. EVALUATION

	Classroom	Home
Three to Five Minute Tape Recorded Samples of Child's Speech (Weekly for 6-8 Weeks)	90% Correct Phoneme Responses After Six Weeks in All Stimulus Conditions	

KEY TO STIMULUS TYPES

S^1 = ECHOIC STIMULUS
S^2 = PICTURE STIMULUS
S^3 = GRAPHEME STIMULUS
S^4 = INTRAVERBAL STIMULUS
S^5 = *ONE-WORD SENTENCES
S^6 = *TWO-WORD SENTENCES
S^7 = *THREE-WORD SENTENCES
CC = COST CONTINGENCY
* = NUMBER OF SOUND-LOADED WORDS PER SENTENCE

STIMULI /s/ & /e/

I. Probe I

(T) = Training Words

(UT) = Untrained (Probe) Words

a. S^2I (T)

1. saddle
2. safe
3. sailor
4. seal
5. sign
6. slingshot
7. star
8. ceiling
9. suit
10. sack

b. S^2F (T)

1. chaps
2. fox
3. gas
4. ice
5. lace

c. S^2M (T)

1. racer
2. faucet
3. pistol
4. policeman
5. basket

d. S^2R (T)

1. sack
2. basket
3. suit
4. ice
5. policeman
6. ceiling
7. lace
8. star
9. slingshot
10. gas
11. sign
12. pistol
13. fox
14. seal
15. faucet
16. sailor
17. racer
18. safe
19. chaps
20. saddle

e. S^2I (UT)

1. scissors
2. sink
3. snake
4. socks
5. sun

I. con't.

f. S^2F (UT)

1. horse
2. lettuce
3. mouse
4. suit case
5. house

g. S^2M (UT)

1. bicycle
2. eraser
3. glasses
4. grasshopper
5. ice cream cone

h. S^2R (UT)

1. house
2. grasshopper
3. sun
4. suit case
5. glasses
6. snake
7. bicycle
8. mouse
9. sink
10. ice cream cone
11. socks
12. lettuce
13. eraser
14. scissors
15. horse

i. PB (UT)

1. thread
2. three
3. thermometer
4. thimble
5. thumb

j. S^2S^7

1. Put some soap on the spot.
2. I want some stars in my soup.
3. The circus squirrel sat up.
4. I saw six skirts.
5. On Sunday, I saw a cross.
6. I have cigarettes in my purse.
7. The stone stopped the bus.
8. A whistle sounds nice.
9. She puts lipstick on her lips.
10. He saw a pencil on his desk.

II. S^1I

1. saddle
2. safe
3. sailor
4. seal
5. sign
6. slingshot
7. star
8. ceiling
9. suit
10. sack

III. S^3S^4

1. The cowboy bought a new saddle.
2. My money is in the safe.
3. A Navy man is called a sailor.
4. I watched a trained seal.
5. We looked for a sign.
6. You can shoot with a slingshot.
7. Twinkle, twinkle little star.
8. The lights are on the ceiling.
9. Father wears a suit.
10. We put groceries in a sack.

IV. S^4I

1. I watched a trained seal.
2. The lights are on the ceiling.
3. The cowboy bought a new saddle.
4. We put groceries in a sack.
5. My money is in the safe.
6. Father wears a suit.
7. You can shoot with a slingshot.
8. Twinkle, twinkle little star.
9. We looked for a sign.
10. A Navy man is called a sailor.

V. Phoneme Boundary - /θ/ - S^1

1. throat
2. sailor
3. thief
4. suit
5. theater
6. safe
7. thirty
8. saddle
9. thermos
10. ceiling

VI. S^3S^4 PB

1. After twenty-nine comes thirty.
2. The lights are on the ceiling.
3. The bank was robbed by a thief.
4. The cowboy bought a new saddle.

5. I have coffee in by thermos.
6. My money is in the safe.
7. Below my chin is my throat.
8. Father wears a suit.
9. We watched a movie at the theater.
10. A Navy man is called a sailor.

VII. S^4PB

1. A Navy man is called a sailor.
2. We watched a movie at the theater.
3. Father wears a suit.
4. Below my chin is my throat.
5. My money is in the safe.
6. I have coffee in my thermos.
7. The cowboy bought a new saddle.
8. The bank was robbed by a thief.
9. After twenty-nine comes thirty.
10. A Navy man is called a sailor.

VIII. S^1F

1. gas
2. ice
3. lace
4. fox
5. chaps

IX. S^3S^4F

1. A cowboy wears chaps.
2. Her hankie was made of lace.
3. For cold pop, you need ice.
4. I shot a fox.
5. To go, the car needs gas.

X. S^4F

1. Her hankie was made of lace.
2. For cold pop, you need ice.
3. To go, the car needs gas.
4. I shot a fox.
5. A cowboy wears chaps.

XI. S^1M

1. pistol
2. policeman
3. faucet
4. basket
5. racer

XII. S^3S^4M

1. We took a picnic basket.
2. I saw a racer.
3. When in trouble, call a policeman.
4. Turn on the faucet.
5. The cowboy wears a pistol.

XIII. S^4M

1. I saw a racer.
2. Turn on the faucet.
3. The cowboy wears a pistol.
4. When in trouble, call a policeman.
5. We took a picnic basket.

XIV. S^1R

1.	racer	6.	suit	11.	lace	16.	seal
2.	sack	7.	ice	12.	policeman	17.	fox
3.	gas	8.	safe	13.	sailor	18.	sign
4.	basket	9.	faucet	14.	star	19.	slingshot
5.	saddle	10.	ceiling	15.	pistol	20.	chaps

XV. S^3S^4R

1. To go, the car needs gas.
2. You can shoot with a slingshot.
3. I saw a racer.
4. We looked for a sign.
5. I watched a trained seal.
6. For cold pop you need ice.
7. We took a picnic basket.
8. Twinkle, twinkle little star.
9. Turn on the faucet.
10. A Navy man is called a sailor.
11. Her hankie was made of lace.
12. When in trouble call a policeman.
13. The lights are on the ceiling.
14. My money is in the safe.
15. I shot a fox.
16. Father wears a suit.
17. The cowboy wears a pistol.
18. A cowboy wears chaps.
19. The cowboy bought a new saddle.
20. We put groceries in a sack.

XVI. S^4R

1. Turn on the faucet.
2. I shot a fox.
3. My money is in the safe.
4. We put groceries in a sack.
5. You can shoot with a slingshot.
6. To go, the car needs gas.
7. We took a picnic basket.
8. The cowboy bought a new saddle.
9. Father wears a suit.
10. A cowboy wears chaps.
11. The lights are on the ceiling.
12. When in trouble call a policeman.
13. Her hankie was made of lace.
14. A Navy man is called a sailor .
15. For cold pop, you need ice.
16. Twinkle, twinkle little star.
17. We looked for a sign.
18. I saw a racer.
19. I watched a trained seal.
20. The cowboy wears a pistol.

XVII. S^2S^5 and S^2S^5

1. The cowboy bought a new saddle.
2. My money is in the safe.
3. A Navy man is called a sailor.
4. I watched a trained seal.
5. A cowboy wears chaps.
6. I shot a fox.
7. For cold pop, you need ice.
8. I saw a racer.
9. Turn on the faucet.
10. The cowboy wears a pistol.

XVIII. S^2S^6 and S^2R^6

1. I want some salt.
2. Did you see my sandwich?
3. A saw will cut ice.
4. I'll see you in school.
5. She's a nice nurse.
6. We use scissors to make a dress.
7. The milk spilled from the glass.
8. Did you swing at the baseball?
9. The old rooster is sick.
10. You scoop dirt with a dustpan.

XIX. S^2 (S^7)

1. soap
2. soup
3. squirrel
4. six
5. cross
6. purse
7. bus
8. whistle
9. lipstick
10. pencil

XX. S^2S^7 and S^2R^7

1. Put some soap on the spot.
2. I want some stars in my soup.
3. The circus squirrel sat up.
4. I saw six skirts.
5. On Sunday, I saw a cross.
6. I have cigarettes in my purse.
7. The stone stopped the bus.
8. A whistle sounds nice.
9. She puts lipstick on her lips.
10. He saw a pencil on his desk.

APPENDIX C

Probe Data on all Subjects

KEY TO PROBE TABLES

S^2 - Pictured Stimulus
I - Initial Word Position
M - Medial Word Position
F - Final Word Position
R - All Word Positions Randomized

T - Trained Words

UT - Untrained Words

PB - Untrained Phoneme Boundary Words

S^2/S^7 - Echoic-Picture Stimuli for Ten Sentences, Each Containing Three Words With the Training Phoneme in Any Position

St
P - Story-Telling or Paragraph-Reading for 3' to 5'

CB - Cartoon Board

CC - Clinic Conversation - 3' to 5' Sample

T* - Total Average Per Cent Correct

Percentage of Correct Responses to Pictured Stimuli of Training Words in Initial, Medial, Final, and Randomized Presentations for All Subjects on All Probes*

SUBJECT	I.				IV.				V.				VI.			
	I	M	F	R	I	M	F	R	I	M	F	R	I	M	F	R
Brad Stout	100	40	40	75	100	100	40	70	100	100	100	100	100	100	100	100
Warren Hillis	0	0	0	5												
Larry Pounds	70	0	0	30	100	100	0	75	100	100	60	95	100	100	80	100
Todd McMillan	0	0	0	0	90	100	0	75	0	40	100	35	100	100	100	100
Sue Duncan	0	0	0	0	90	100	0	75								
Lisa Feagon	0	0	0	0	100	100	20	80								
Maura Steinle	0	0	0	0	100	100	100	85	100	100	100	90	100	100	100	100
Bryan Dawson	20	0	0	5	100	100	80	95	100	100	100	100	PROBE-OUT 5 wk. Vac.			

*See p. xv for Probe Description

Percentage of Correct Responses to Pictures of Untrained Words with the Training Phoneme in Three-Word Positions and Randomized for All Subjects on All Probes*

SUBJECT	I.				II.				III.	IV.				V.				VI.			
	I	M	F	R	I	M	F	R	I	I	M	F	R	I	M	F	R	I	M	F	R
Brad Stout	100	60	60	60	100	0	0	40	---	100	40	80	87	100	20	100	73	100	40	100	80
Warren Hillis	0	20	0	20	100	20	0	33													
Larry Pounds	100	20	0	40	100	20	0	46	---	100	60	0	53	100	40	80	73	100	80	80	87
Todd McMillan	0	0	0	0	80	0	0	33	100	80	40	0	46	0	20	100	13	100	80	100	80
Sue Duncan	0	0	0	0	80	0	0	33	100	100	40	0	46								
Lisa Feagon	0	40	0	40	100	20	0	53	---	100	100	0	60								
Maura Steinle	0	0	0	0	100	20	0	33	---	100	80	60	87	60	100	100	93	100	100	100	100
Bryan Dawson	0	0	0	0	100	0	0	33	---	100	80	20	80	100	100	60	93	PROBE-OUT 5 wk. Vac.			

*See p. xv for Probe Description

Percentage of Correct Responses to
Untrained Pictured Phoneme Boundary
Words on All Probes for All Subjects*

Subject	I	II	III	IV
Brad Stout	100	100	-	100
Warren Hillis	100	100		
Larry Pounds	100	100	-	100
Todd McMillan	100	0	100	100
Sue Duncan	100	60	100	
Lisa Feagon	100	100	-	
Maura Steinle	100	100	-	100
Bryan Dawson	100	100	-	PROBE OUT

*See p. xv for Probe Description

Percentage of Correct Responses to Echoic-Pictured Stimuli in Sentences Containing Three Words With the Training Phoneme for All Probes on All Subjects*

SUBJECT	I				II.				VI.			
	I	M	F	T*	I	M	F	T*	I	M	F	T*
Brad Stout	94	100	63	87	56	20	0	35	100	80	63	87
Warren Hillis	6	0	0	3	17	0	0	10				
Larry Pounds	56	40	0	39	56	40	13	72	33	80	100	72
Todd McMillan	0	0	0	0	11	0	0	6	61	100	38	61
Sue Duncan	0	0	0	0	22	0	0	14				
Lisa Feagon	0	1	0	3	22	40	13	16				
Maura Steinle	0	0	0	0	6	40	13	14	56	100	88	74
Bryan Dawson	6	0	0	3	100	0	13	60	PROBE-OUT 5 week Vac.			

*See p. xv for Probe Description

Percentage of Correct Conversational Responses on a Paragraph Reading or Story Telling, Cartoon Board, Conversation and Home Probe on All Probes for All Subjects*

	I.			II.	VI.				VIII.			IX.			X.			XI.	
SUBJECT	St P	CB	CC	St P	St P	CB	CC	HP	St P	CB	CC	St P	CB	CC	St P	CB	CC	CC	HP
Brad Stout	17	37	62	40	66	33	63	52											
Warren Hillis	0	0	4	6															
Larry Pounds	30	14	23	50	60	30	22	52	80	64	75	88	90	83	90	70	85	93	85
Todd McMillan	0	0	0	0	9	10	11												
Sue Duncan	0	0	0	0															
Lisa Feagon	16	4	0	40															
Maura Steinle	20	43	48	60	66	64	67	71	80	72	70				-	-	-	91	100
Bryan Dawson	10	16	0	0			PROBE OUT -> 5 Week Vacation												

*See p. xv for Probe Description

Percentage of Correct Responses for All Subjects to Pictured Stimuli of Trained and Untrained Words, Phoneme Boundary, Three-Word Sentences and Conversation Before a Five-Week Speech Vacation*

PRE-VACATION	S^2T				S^2UT				UT	UT	CONV.		
SUBJECT	I	M	F	R	I	M	F	R	PB	S^2S^7	P	CB	CC
Brad Stout											66	33	63
Warren Hillis					100	20	0	33	100	9	6		
Larry Pounds	100	100	80	100	100	80	80	90	100	58	60	30	22
Todd McMillan	100	80	100	100	100	40	100	67	80				
Sue Duncan	90	100	0	50	100	40	0	47					
Lisa Feagon	100	100	20	80	100	100	0	60					
Maura Steinle	100	100	100	100	100	100	100	100	100	97	80	74	53
Bryan Dawson	100	100	100	100	100	100	60	93					

*See p. xv for Probe Description

Percentage of Correct Responses for All Subjects to Pictured Stimuli of Trained and Untrained Words, Phoneme Boundary, Three-Word Sentences and Conversation After a Five-Week Speech Vacation*

POST-VACATION	S^2T				S^2UT				UT	UT	CONV.		
SUBJECT	I	M	F	R	I	M	F	R	PB	S^2S^7	P	CB	CC
Brad Stout	100	80	100	95	100	80	100	80	100	83	66	67	80
Warren Hillis	100	0	0	30	20	0	0	0	100	0	22		
Larry Pounds	100	100	100	100	100	100	100	100	100	70	73	60	60
Todd McMillan	100	60	80	80	100	40	0	47	100	6		15	3
Sue Duncan	100	80	0	70	100	40	0	47	100	45	50	36	57
Lisa Feagon	100	0	100	90	100	0	60	60	100	58	50	11	51
Maura Steinle	100	100	100	100	100	100	100	100	100	90	88	90	77
Bryan Dawson	100	100	100	100	100	100	100	100	100	100	100	96	100

*See p. xv for Probe Description