DEVELOPING SYSTEMATIC PROCEDURES FOR TRAINING CHILDREN'S LANGUAGE

ASHA MONOGRAPHS

NUMBER 18 A PUBLICATION OF THE AMERICAN SPEECH AND HEARING ASSOCIATION

DEVELOPING SYSTEMATIC PROCEDURES FOR TRAINING CHILDREN'S LANGUAGE

Developing Systematic Procedures for Training Children's Language

Edited by

LEIJA V. MCREYNOLDS

University of Kansas Medical Center

Kansas City, Kansas

ASHA Monographs Number 18

AMERICAN SPEECH AND HEARING ASSOCIATION

Washington, D.C.

August 1974

ASHA MONOGRAPHS NUMBER 18

Contents

Chapter I

INTRODUCTION TO DEVELOPING SYSTEMATIC PROCEDURES

LEIJA V. McREYNOLDS

Speech pathology has traditionally been interested in the language disorders of children, and recent developments have encouraged speech pathologists to expand their knowledge and skills in the treatment of language problems. Psycholinguistic research and theory have helped specify the linguistic units acquired by children and the sequence in which they are acquired (Berko and Brown, 1960; Bloom, 1970, 1973; Carroll, 1971; Cazden, 1972; Ferguson and Slobin, 1973; Greenberg, 1966; Menyuk, 1969, 1971; Slobin, 1971). Furthermore, research has helped identify some of the environmental events that facilitate language acquisition and generalization. Also contributing to the increased need for greater knowledge and skill in treatment is a growing demand for accountability (Caccamo, 1973; Mowrer, 1972). Parents are requesting more information concerning their children's language evaluations and subsequent progress in training programs. Administrators and legislators, likewise, are asking for objective reports of the effectiveness and efficiency of our treatment programs.

One purpose of this monograph is to present basic information about the linguistic features children learn when they learn language. Perhaps the primary purpose, however, is to describe procedures that will help clinicians enhance their skills for developing efficient language training programs.

Speech pathologists are aware that descriptions of their services and accomplishments require objective data. The need for stronger evidence has motivated speech pathologists to turn more frequently to science for guidelines to help them describe and evaluate treatment programs in an objective manner. Clinicians find that research methods yield empirical data that they can fruitfully apply to evaluate treatment programs (Bachrach, 1965; Bijou, Peterson, and Ault, 1968; Gilbert, 1958; Mussen, 1960).

The scientific method defines characteristics necessary to the development of an effective training program. A treatment program must be relevant to the behavior that is to be trained. Therefore, careful definitions, descriptions, and specifications of the components comprising the program are necessary. A

data-based evaluation of a language training program requires that (1) a sufficiently large sample of the child's language is obtained initially to state with confidence that the child has a specific language problem and requires training, (2) the language behavior to be treated is carefully defined and specified, (3) procedures for treatment are described in sufficient detail to enable determination that they are directly related to the language behavior selected for training, (4) a measure of the training is used that yields objective data directly related to the behavior being trained, (5) these data can be quantified to show how the behavior is changing during treatment, and (6) changes in behavior can be shown to be a function of the procedures, rather than variables in the environment unrelated to the procedures of the treatment program. Some of these characteristics may be found in the studies reported in this monograph. They are discussed in greater detail and applied to a language problem in the final chapter.

Psycholinguistics and the experimental analysis of behavior have contributed a great deal to the development of treatment programs that include the attributes listed. Clinicians are using information obtained from research in these areas as a means of selecting and modifying the language behaviors to be trained. Procedures used in these investigative areas can be transferred readily to a clinical situation. Furthermore, procedures used by investigators in the experimental analysis of behavior are particularly useful for evaluating the effectiveness of treatment programs (Baer, Wolf, and Risley, 1968; Lahey, 1973; Skinner, 1966).

An effort has been made in this monograph to include chapters that demonstrate the importance of careful definitions of the language behaviors studied and detailed descriptions of the procedures used for studying them. The studies use different methods of measurement, since each is designed to measure specifically the behavior studied.

Chapter II presents a descriptive study of children's acquisition of a linguistic feature in two populations. The method used in this study to collect language samples may provide speech pathologists with ideas for procedures to be used in evaluating children's language disorders. In Chapter III, the authors have posed an important procedural question concerning the effectiveness of comprehension training for teaching production. Procedures for training and generalization testing are specified in the study of noun phrases in Chapter IV and could be incorporated directly into a treatment program.

Two of the chapters, Chapters V and VI, show how research procedures have been transferred to the training environment. One of the language training programs uses information from experimental analysis of behavior, linguistics, and logic for developing a program. The other language training program is based entirely on psycholinguistic and experimental analysis research findings and procedures. The two programs are different from each other in several ways. Both of them, however, attempt to evaluate the effectiveness of their procedures for the language behaviors being trained. Procedures are tested to determine whether the child generalizes the trained behavior

and if the behavior to be trained in each step is in the child's repertoire before training is initiated.

Two designs used in the experimental analysis of behavior to explore the effect of a variable can be employed to test the effectiveness of a program. One of the designs is referred to as a reversal procedure (ABA) and the other as a multiple baseline procedure. Chapter IV presents an example of an ABA design. An ABA design is not particularly suitable for a clinical setting because it requires that the trained behavior be placed on extinction or reversed (Guess, 1969; Hart and Risley, 1968). That is, the treatment is withdrawn to determine if the behavior extinguishes when treatment is no longer provided. Sometimes the behavior is reversed and the child is trained to emit his former language behavior. This may be considered inappropriate use of clinical time since the reversal is incompatible with general training purposes. A language behavior that has been trained should be maintained, not extinguished or replaced with deficient behavior.

The multiple baseline, however, is appropriate in a clinical setting (Baer and Guess, 1971). A brief description of the design is included here, since an example of it is not available in the studies reported in this monograph. In this design, treatment is provided for more than one language behavior per child. Treatment is not presented simultaneously, but rather successively to each behavior. While the first language behavior is receiving treatment, the second behavior is simply tested to determine if it is changing without treatment. After the child has acquired the first behavior, the treatment is applied to the second behavior to see if the child now acquires the behavior with treatment. If each behavior is acquired only after treatment is provided for it, the treatment is considered successful. Usually, a replication of the treatment with other children and other behaviors is required. The more replications, the greater the confidence that can be placed in the effectiveness of the treatment.

An example of a multiple baseline design was offered in a study of verb inflections by Schumaker and Sherman (1970). They defined four classes of inflections: (1) inflection of verb stems ending in /t/, (2) inflection of verb stems ending in other voiceless consonants; (3) inflection of verb stems ending in /d/, and (4) inflection of verb stems ending in other voiced consonants. Training was initiated on only one class of inflections. When the child had acquired the first class, the second class of inflections was trained. Each time criterion was reached on one class of inflections, the next class was trained. In this manner, the investigators showed that the child did not acquire the inflections until training was provided on each class.

Chapter VII presents suggestions for application of a multiple baseline design in a treatment program and indicates how procedures from the studies in the previous chapters might be incorporated into a language training program. Use of the procedures provides clinicians with a means of securing objective evidence of the effectiveness of their work.

ACKNOWLEDGMENT

Leija V. McReynolds is a professor of speech pathology in the Hearing and Speech Department at the University of Kansas Medical Center and is affiliated with the Ralph L. Smith Mental Retardation Research Center, University of Kansas School of Medicine, Kansas City, Kansas.

REFERENCES

BACHRACH, A., *Psychological Research.* New York: Random House (1965).

BAER, D. M., and GUESS, D., Receptive training of adjectival inflections in mental retardation. *J. appl. behav. Anal.*, **4**, 129-139 (1971).

BAER, D. M., WOLF, M. W., and RISLEY, T. R., Some current dimensions of applied behavior analysis. *J. appl. behav. Anal.*, **1**, 91-97 (1968).

BERKO, J., and BROWN, R., Psycholinguistic research methods. In P. H. Mussen (Ed.), *Handbook of Research Methods in Child Development.* New York: Wiley, 517-557 (1960).

BIJOU, S. W., PETERSON, R. F., and AULT, M. H., A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *J. appl. behav. Anal.*, **1**, 175-191 (1968).

BLOOM, L., *Language Development: Form and Function in Emerging Grammars.* Cambridge, Mass.: MIT Press (1970).

BLOOM, L., *One Word at a Time.* The Hague: Mouton (1973).

CACCAMO, J. M., Accountability—A matter of ethics? *Asha*, **15**, 411-412 (1973).

CARROLL, J. B., Language development. In A. Bar-Adon and W. F. Leopold (Eds.), *Child Language, A Book of Readings.* Englewood Cliffs, N. J.: Prentice-Hall, 200-211 (1971).

CAZDEN, C. B., *Child Language and Education.* New York: Holt, Rinehart and Winston (1972).

FERGUSON, C. A., and SLOBIN, D. I. (Eds.), *Studies of Child Language Development.* New York: Holt, Rinehart and Winston (1973).

GILBERT, T. F., Fundamental dimensional properties of the operant. *Psychol. Rev.*, **5**, 272-282 (1958).

GREENBERG, J. H. (Ed.), *Universals of Language.* Cambridge, Mass.: MIT Press (1966).

GUESS, D., A functional analysis of receptive language and productive speech: Acquisition of the plural morpheme. *J. appl. behav. Anal.*, **2**, 55-64 (1969).

HART, B. M., and RISLEY, T. R., Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *J. appl. behav. Anal.*, **1**, 109-120 (1968).

LAHEY, B. B. (Ed.), *The Modification of Language Behavior.* Springfield, Ill.: Charles C Thomas (1973).

MENYUK, P., *Sentences Children Use.* Cambridge, Mass.: MIT Press (1969).

MENYUK, P., *The Acquisition and Development of Language.* Englewood Cliffs, N. J.: Prentice-Hall (1971).

MOWRER, D., Accountability and speech therapy. *Asha*, **14**, 111-115 (1972).

MUSSEN, P. H. (Ed.), *Handbook of Research Methods in Child Development.* New York: Wiley (1960).

SCHUMAKER, J., and SHERMAN, J. A., Training generative verb usage by imitation and reinforcement procedures. *J. appl. behav. Anal.*, **3**, 273-287 (1970).

SKINNER, B. F., What is the experimental analysis of behavior? *J. exp. Anal. Behav.*, **9**, 213-218 (1966).

SLOBIN, D. I., *Psycholinguistics.* Glenview, Ill.: Scott, Foresman (1971).

Chapter II

THE ACQUISITION OF THE ENGLISH VERBAL AUXILIARY AND COPULA IN NORMAL AND LINGUISTICALLY DEVIANT CHILDREN

DAVID INGRAM

The acquisition of the verb *to be* has had an important place in current research into language disorders. Little is actually known about its development in either normal or linguistically delayed children. In this study, the development of the verb *to be* was observed in 15 normal and 15 deviant children of increasing levels of linguistic sophistication. The comparisons between normal and language-deviant children showed that both groups acquire the forms in the same order and at the same linguistic levels, but that the deviant group supplies the forms less frequently. Both groups acquire the copula function faster than the verbal auxiliary function and also supply the forms more often in uncontractible than in contractible environments.

Some recent investigations into children's acquisition of a first language have emphasized observing specific features of grammar and determining stages of development (compare Cazden [1968] and Brown [1968]). The results of this kind of research contribute to programming language for children with linguistic disorders. The child can be taught a grammatical feature through its various stages until he reaches adult proficiency.

One grammatical feature that has not been studied sufficiently in this regard is the English verbal auxiliary and copula *to be*. Nonetheless, it has appeared in both theoretical and applied discussions of linguistic deviance in children. In a comparative study of a young normal and a young linguistically deviant child, Lee (1966) claimed that the latter showed an exceptional difficulty with *is* specifically and predicative constructions in general. She used this finding to strengthen her conclusion that linguistic deviance may result in a qualitatively different grammar. On the pragmatic side, Fygetakis and Gray (1970) outlined the programmed conditioning approach, in which teaching *is* constitutes a significant part. The authors did not attempt to justify this decision, although they assumed that *is* is an important step in language learning.

Despite a lack of empirical verification for their basic assumptions, both of these studies are correct when they consider *is* an element that has important implications for the study of linguistic deviance. If it can be shown that linguistically deviant children do have exceptional difficulty in learning *is* and the

other forms of the English verbal auxiliary and copula, this would constitute strong evidence for a qualitative difference in their grammatical systems. Likewise, if *is* is an important feature in the child's acquisition of English, we would need an empirically based program strongly emphasizing its teaching.

The English verbal auxiliary and copula (henceforth abbreviated VAC) can be observed in terms of both its forms and its two functions. Besides the commonly cited form *is*, there are seven other full forms and three contractions. Table 1 presents all the conjugational forms of *to be*.

The contractions cannot occur in some environments.[1] Both full and contractible forms can occur in contractible environments, for example, "he's tall" or "he is tall." In uncontractible environments, however, only the full form can occur, for example, "Here I am"; the use of the contraction would result in an ungrammatical sentence, for example, "Here I'm."

The forms of *to be* occur in two different grammatical functions in English. The first is as a copula or linking verb.[2] Constructions that contain the copula are often referred to as predicative, and the copula is followed by a predicate adjective or predicate noun. The forms of *to be* also occur before verbs ending in *-ing*. Here, *to be* has the function of a verbal auxiliary. It occurs next to another verb and supports it. Both the copula and verbal auxiliary may occur in contractible and uncontractible environments, resulting in four linguistic environments in which the forms of *to be* may occur. Examples of each follow:

Copula		*Verbal Auxiliary*	
Contractible	*Uncontractible*	*Contractible*	*Uncontractible*
He's tall.	This is a ball.	He's running.	Is he running?
They're children.	That is.	They're going.	This is moving.
I'm happy.	Here I am.	I'm leaving.	These are flying.

The only study that has observed the VAC in children is that of Brown (1973). Using longitudinal data from three young children, Brown examined two parameters of the child's development of the English VAC. First, he recorded the development of contractible vs uncontractible forms. Second, he separated verbal auxiliary uses of *to be* from the copula uses. The criterion for acquisition was the percentage of obligatory occurrence, that is, the percentage of times a child would supply the VAC when it was required according to adult rules. By this measure he was able to overcome difficulties in sampling and frequency. Brown found two differences: (1) uncontractible forms reached criterion (90% occurrence when required) before contractible forms,

[1]For a discussion of the rules for the contraction of a VAC form, see King (1970).

[2]I will not be concerned here with the derivation of the copula from deep to surface structure. There are at least three alternate proposals: (1) the copula belongs to the same category as all other verbs and occurs in deep structure (Ross, 1969), (2) the copula is a unique verb form and occurs in deep structure (Chomsky, 1965), or (3) the copula does not occur in deep structure but is transformationally derived (Jacobs and Rosenbaum, 1968).

TABLE 1. Forms of *to be* in English.

Verbal Categories	*Full Forms*		*Contractions*	
Present tense	I *am*	we *are*	I'*m*	we'*re*
	you *are*	you *are*	you'*re*	you'*re*
	he *is*	they *are*	he'*s*	they'*re*
Past tense	I *was*	we *were*	–	–
	you *were*	you *were*	–	–
	he *was*	they *were*	–	–
Imperative	*be*	–	–	–
Present participle	*being*	–	–	–
Infinitive	*be*	–	–	–
Past participle	*been*	–	–	–

and (2) the copula function was acquired earlier than the verbal auxiliary.

The following study was undertaken to examine the development in production of the English VAC in a group of children with language dysfunctions and compare these results to a matched group of normal children. Three parameters were chosen: (1) the sequence in which the various forms (Table 1) are acquired, (2) the acquisition of contractible vs uncontractible forms, and (3) the acquisition of the copula vs the verbal auxiliary. The purposes were (1) to determine the developmental patterns of the English VAC for both normal and linguistically deviant children to see whether the differences are qualitative or quantitative and (2) to weigh the importance of the VAC in language acquisition and subsequently in rehabilitation and to provide developmental sequences for its teaching.

METHOD

Subjects

The subjects were 15 normal and 15 linguistically deviant children. The normal children, nine boys and six girls, were selected from the Stanford, California, community and the Bing Nursery School at Stanford University. Their age range was one year and seven months to three years and one month, with a mean of two years and four months. They were selected to represent cross sectionally a period of active syntactic development. On the basis of mean length of utterance (MLU), the normal subjects were divided into five arbitrary levels of increasing MLU and matched with 15 children with language disorders (see Table 2). The latter population, consisting of 11 boys and four girls, was selected from children undergoing therapy at the Institute for Childhood Aphasia, Stanford University School of Medicine. The age range was three years and six months to nine years and six months, with a mean of six years and seven months. The selection was limited to children whose linguistic

difficulty could not be accounted for by intellectual or psychological impairment. The normal group was screened for speech and hearing pathologies.[3]

Language Samples

Language samples were collected and recorded on a high-fidelity tape recorder under three conditions: (1) free play with experimenter or parent, (2) elicitation while the child played with toys, and (3) elicitation through the use of a standard picture book. At each session, the experimenter and an observer made notes on contextual features of the child's speech. The samples

TABLE 2. Mean age (years, months), mean sample size (number of utterances), and mean number of morphemes per utterance (MMU) for 15 normal and 15 deviant children, three at each of five linguistic levels.

Linguistic Level	Normal			Deviant		
	MMU	*Age*	*Sample Size*	*MMU*	*Age*	*Sample Size*
I (2.0 to 2.5)	2.23	1, 8	76.7	2.33	5, 5	79.9
II (2.5 to 3.0)	2.72	1, 9	100.7	2.83	5, 11	155.3
III (3.0 to 4.0)	3.70	2, 9	223.3	3.80	5, 10	161.0
IV (4.0 to 5.0)	4.67	2, 10	242.7	4.53	7, 4	200.0
V (5.0 to 6.0)	5.61	2, 10	234.0	5.83	8, 9	147.7

were transcribed and included any adult's comments to the child, the child's own utterance, and an expansion of the child's utterance into an appropriate adult version according to the experimenter's and observer's decision concerning what the child was attempting to say.[4] In this way, the child's underlying meaning was approximated. Items were excluded when no agreement could be reached.

Procedure

Each of the 30 language samples was examined for those sentences the child used that should have contained a VAC according to the adult rule system. The utterances were separated into those that required a copula and those that required a verbal auxiliary. Both were likewise subdivided into contractible and uncontractible environments. Thus, there were the categories of contractible copula, uncontractible copula, contractible verbal auxiliary, and uncontractible verbal auxiliary. The measure used to determine the degree of acquisition was Brown's percentage of obligatory occurrence, that is, how frequently the child supplied a form of *to be* when one was required. In addi-

[3]See Morehead and Ingram (1973) for a discussion of the more general grammatical characteristics of the two groups.

[4]See Tyack (1973) for an extensive discussion of the sampling procedures and their usefulness in language rehabilitation.

tion, the forms that were supplied were examined to see if there was a developmental sequence. Lastly, frequency was observed, both in terms of forms and the above categories, so that the significance of the VAC in the developmental process could be evaluated.

RESULTS

Both normal and linguistically deviant children used VAC contexts, that is, sentences that required a form of *to be* by adult standards (Table 3, Row A).

TABLE 3. Mean percentages for normal (N) and linguistically deviant (D) children on a variety of parameters at five linguistic levels.

Parameters	*Groups*	*I*	*II*	*III*	*IV*	*V*	*Total*
A. VAC sentences in	N	21	15	26	35	37	27
total sample	D	18	13	29	26	40	25
B. Occurrences of forms	N	3	7	75	80	91	51
of *to be* in VAC contexts	D	5	20	45	47	77	39
C. Occurrences of forms of	N	3	10	74	78	89	51
to be in contractible VACs	D	6	20	44	41	74	37
D. Occurrences of forms of	N	0	7	77	85	95	53
to be in uncontractible VACs	D	0	11	51	51	81	39
E. Occurrences of forms	N	3	14	77	82	94	54
of *to be* in copula	D	5	29	61	62	79	47
F. Occurrences of forms	N	–	0	48	72	82	41
of *to be* in verbal auxiliary	D	0	6	30	32	76	29
G. Occurrences of forms of	N	3	13	78	81	92	57
to be in contractible copula	D	6	32	59	52	79	45
H. Occurrences of forms of	N	0	17	58	85	96	51
to be in uncontractible copula	D	0	11	72	85	81	50
I. Occurrences of forms of *to be*	N	–	0	42	67	85	39
in contractible verbal auxiliary	D	0	6	28	31	69	27
J. Occurrences of forms of *to be* in	N	–	0	67	89	91	49
uncontractible verbal auxiliary	D	–	–	0	33	77	21

An example is the utterance "Teri sad," which, by adult rules would have a copula, that is, "Teri *is* sad." Overall, 27% of the normal children's sentences and 25% of the linguistically deviant children's sentences required *to be*. In this regard there were no substantial differences between the groups. The similarity was independent of whether or not a child supplied a form of *to be*. For example, two of the normal subjects at Level I supplied no forms of *to be*, whereas one used VAC contexts 36% of the time and the other did so only 2% of the time. The use of the VAC sentences did not depend on whether or not the child had forms of *to be* to use in them.

The calculation of the percentage of obligatory occurrence for both groups showed a crossover effect (Table 3, Row B). The deviant group supplied forms of *to be* more frequently at Levels I and II, whereas the normal group did so much more at Levels III, IV, and V. Although both groups had a similar

number of VAC contexts, the normal children at the higher levels supplied forms of *to be* more consistently than did the matched deviants. The same trend between groups occurred on contractible vs uncontractible occurrences (Table 3, Rows C and D), copula vs verbal auxiliary (Rows E and F), and contractible copula (Row G) vs uncontractible copula (Row H) vs contractible verbal auxiliary (Row I) vs uncontractible verbal auxiliary (Row J). In each case, the normal children supplied forms of *to be* when required more frequently than did the deviant children.

Concerning contractible vs uncontractible VACs, for example, "John*'s* tall" vs "This *is* tall," both groups showed at the three highest levels a higher percentage of occurrence for the uncontractible VACs (Rows C and D). That is, they were more likely to supply a form of *to be* when the sentence required only a full form and not a contraction. This is in keeping with Brown's (1973) findings. Likewise, both groups supplied forms of *to be* for the copula at a higher percentage than for the verbal auxiliary, that is, "He *is* tall" vs "He *is* running." This is particularly true for the deviant group, which showed a marked preference for the copula usage (Rows E and F). In Categories G to J, the deviant group had much lower overall percentages for the verbal auxiliary (uncontractible 21%, contractible 27%) than for the copula (uncontractible 50%, contractible 45%). The contractibility vs VAC parameters were more even for the normal group. Their best performance was on the contractible copula (57%), and the worst performance was on the contractible verbal auxiliary (39%). They did about as well on the uncontractible copula (51%) as on the uncontractible verbal auxiliary (49%).

A comparison of the forms of *to be* used at each level showed a similar sequence of development for both groups. Through the first two levels, the only form that occurs with any frequency is the contraction *'s*, although one deviant child used *'m* on three occasions. At Level III, *'s* is still the most frequent form (as it is at every subsequent level), *is* is the next most frequent, and *'m* and *are* follow. At Level IV, the forms *be, was, am,* and *been* are added to the list of forms shared by both groups. In addition, the normal group used the form *'re*. One new shared form, the past tense *were,* is found at Level V.

Regarding substitutions, the children tended not to use a form they didn't have rather than replace it with a familiar one. This was particularly true of *'m,* which was either used correctly or omitted. Occasionally, *is* was substituted for *are,* and *was* for *were.*

The results showed the interaction between the appearance of a form and its eventual use in all cases where it was required. It was not the case that a form appeared and was used all the time. VAC forms showed a steady increase in usage from Level I to V. The use of a form depended on factors such as whether or not it had appeared yet, and, if so, whether or not it was used in a contractible environment, as a copula, or both. The contraction *'s* appeared early and showed a gradual increase in usage through the five stages. Meanwhile, the form *were* appeared late and, consequently, quickly reached a high percentage of usage.

TABLE 4. Forms of *to be* and their frequencies (in parentheses) for normal and deviant subjects at five linguistic levels.

	Levels				
Group	*I*	*II*	*III*	*IV*	*V*
Normal	's (2)	's (3)	's (84)	's (95)	's (109)
		*be (1)	is (32)	is (56)	is (68)
			'm (5)	are (14)	was (25)
			are (3)	'm (12)	'm (22)
				*'re (10)	are (16)
				be (8)	be (5)
				was (3)	're (2)
				am (1)	*am (1)
				been (1)	were (1)
Deviant	's (4)	's (6)	's (41)	's (25)	's (119)
		'm (3)	is (17)	is (24)	is (24)
		is (2)	'm (3)	are (8)	are (14)
		*yes (1)	are (3)	'm (8)	was (13)
		*being(1)	*'re (1)	was (6)	be (5)
			*be	be (5)	're (2)
				been (2)	were (2)
				*a (2)	'm (2)
				am (1)	*a (2)
				*'ll (1)	

*Indicates forms that one group has at a level and the other does not.

The acquisition sequence of forms in Table 4 is reflected in the appearance of VACs that could potentially contain them. That is, it was not the case that there were sentences at Level I and onward that could contain a *were*. Rather, sentences of this sort did not even appear until the last level. Table 5 shows the breakdown of VAC sentences at each level into those forms that would have been required by correct adult usage.

Lastly, the four possible VAC categories (contractible copula, uncontractible copula, contractible verbal auxiliary, and uncontractible verbal auxiliary) did not occur with equal frequency. Table 6 shows the percentages

TABLE 5. Mean percentages at five linguistic levels of the forms required by adult rules for VAC sentences in samples of normal (N) and linguistically deviant (D) children.

		Adult Forms						
Level	*Group*	*is*	*are*	*am*	*was*	*be*	*were*	*been*
I	N	99	1	–	–	–	–	–
	D	89	11	–	–	–	–	–
II	N	85	13	–	–	2	–	–
	D	81	17	2	–	–	–	–
III	N	85	8	7	–	–	–	–
	D	77	17	4	1	1	–	–
IV	N	74	14	7	2	3	–	–
	D	67	18	7	5	3	–	–
V	N	68	8	11	10	2	1	–
	D	61	15	2	18	1	3	–

of each of these categories in regard to the total number of VACs. For both the normal (N) and deviant (D) populations, the contractible copula was the most frequent (N = 63%, D = 41%). The uncontractible verbal auxiliary was infrequent for both (N = 5%, D= 6%). The greatest disparity between groups was on the contractible verbal auxiliary, which was infrequent for the normal children (13%) but frequent for the deviant children (39%).

TABLE 6. Mean percentages at five linguistic levels of the occurrence of four categories of VAC for the samples of VAC sentences from normal (N) and linguistically deviant (D) children.

Category	*Group*	*I*	*II*	*III*	*IV*	*V*	*Total*
Contractible copula	N	99	65	48	50	63	63
	D	68	42	40	32	41	41
Uncontractible copula	N	1	20	20	24	19	19
	D	14	8	14	17	14	14
Contractible verbal auxiliary	N	–	8	26	21	13	13
	D	18	51	42	39	39	39
Uncontractible verbal auxiliary	N	–	8	6	5	5	5
	D	–	–	4	12	6	6

DISCUSSION

The results indicate that the difference between normal and deviant development of the forms of *to be* is one of quantity rather than quality. This was found on a number of parameters. Even though the deviant group had the same percentage of adult VAC contexts, they consistently supplied a form less frequently than did the matched normal group throughout Levels III to V, the period during which the forms of the VAC are acquired. In addition, both groups showed remarkable similarities in terms of the levels at which forms appeared (Table 4) and the ranking of these forms in terms of frequency. Lastly, both groups showed the preferences noted by Brown (1973), that is, a greater tendency to supply a form in uncontractible rather than contractible environments and in copula rather than verbal auxiliary environments.

These findings suggest that linguistic deviance results from a disorder in linguistic performance rather than linguistic competence. The deviant children seem to follow the same developmental stages as the normal children, but more slowly. Also, when matched with normal children on the basis of MLU, the deviant children typically will have the same forms as the normal children, but will use them less frequently. Consequently, the deviant child appears to have difficulty in both acquiring a form and supplying it when required.

In terms of rehabilitation, the results present some important considerations that must be taken into account. Morehead and Ingram (1973) have observed in a comparative study that linguistically deviant children follow the same stages of acquisition as do normal children. The present study supports

this finding on a particular linguistic feature. Also, the data reflect the fact that the deviant children showed this strategy despite what they were taught. At the time of the study, teaching the contracted *'s* was not part of the teaching procedures used at the Institute for Childhood Aphasia. Rather, in those cases where VACs were part of the therapy program, the full form *is* was used. Despite this, the deviant children often showed *-s* in their productive uses of these constructions.

In recent years data such as these have suggested a need to teach deviant children by stages, based on those found in normal children. General programs along these lines include those of Ingram and Eisenson (1972) and Miller and Yoder (in press). The theoretical issues involved in such a decision are discussed in depth in Ruder and Smith (in press). It is still an empirical issue whether or not children learn more effectively and rapidly when taught in stages. However, early results, for example, those of Fygetakis and Ingram (1973), suggest that it is advantageous to teach by stages.

The results of the current study provide a further consideration for rehabilitation. If linguistic deviance reflects a difficulty in linguistic performance, then it will not suffice simply to teach a form in its correct developmental sequence. The results show that the deviant children have additional problems using forms, even after they are acquired. Consequently, constant and repeated work will be required to teach the child to use forms, once he has them.

Combining the above theoretical considerations with the specific findings on the acquisition of *to be*, the following guidelines are suggested:

1. The forms of *to be* do not begin to appear until after the two-word utterance stage (that is, Level II) and consequently should not be taught until after that time.
2. Since only one out of every four sentences the child uses potentially can contain a form of *to be*, teaching these forms should be one of several aspects of training, the others including the teaching of grammatical relations, pronouns, and other function words.
3. The forms of *to be* can be taught in their sequence of appearance as suggested in Table 4 and weighed in terms of their frequency as presented in Table 5.
4. The kinds of constructions in which the forms are taught can be determined from the performance of the children on Categories G to J (Table 3) and the frequency of these categories (Table 6). The contractible copula appears to be the best construction with which to start in light of the fact of its high frequency and high percentage of obligatory morphemes supplied. The least likely category to teach is the uncontractible verbal auxiliary, due to its low frequency of appearance. In between are the uncontractible copula and the contractible verbal auxiliary.

ACKNOWLEDGMENT

This work was supported by National Institute for Neurological Diseases and Stroke Grant 5 P15 NS07514-05. David Ingram is an assistant professor in the Department of Linguistics, University of British Columbia, Vancouver, British Columbia.

REFERENCES

BROWN, R., The development of Wh questions in child speech. *J. verb. Learn. verb. Behav.*, 7, 279-290 (1968).

BROWN, R., *A First Language.* Cambridge, Mass.: Harvard Univ. Press (1973).

CAZDEN, C., The acquisition of noun and verb inflections. *Child Develpm.*, **39**, 433-448 (1968).

CHOMSKY, N., *Aspects of the Theory of Syntax.* Cambridge, Mass.: MIT Press (1965).

FYGETAKIS, L., and GRAY, B., Programmed conditioning of linguistic competence. *Behav. Res. Ther.*, **8**, 153-163 (1970).

FYGETAKIS, L., and INGRAM, D., Language rehabilitation and programmed conditioning: A case study. *J. learn. Dis.*, **6**, 60-64 (1973).

INGRAM, D., and EISENSON, J., Establishing and developing language in congenitally aphasic children. In J. Eisenson, *Aphasia in Children.* New York: Harper and Row, 148-188 (1972).

JACOBS, R., and ROSENBAUM, P., *English Transformational Grammar.* Waltham, Mass.: Ginn (1968).

KING, H., On blocking the rules for contraction in English. *Linguistic Inquiry*, **1**, 134-136 (1970).

LEE, L., Developmental sentence types: A method for comparing normal and deviant syntactic development. *J. Speech Hearing Dis.*, **31**, 311-330 (1966).

MILLER, J., and YODER, D., On ontogenetic language teaching strategy for retarded children. In R. Schiefelbusch and L. Lloyd (Eds.), *Language Perspectives—Acquisition, Retardation, and Intervention.* Baltimore, Md.: University Park Press (in press).

MOREHEAD, D., and INGRAM, D., The development of base syntax in normal and linguistically deviant children. *J. Speech Hearing Res.*, **16**, 330-352 (1973).

ROSS, J. R., Adjectives as noun phrases. In D. Reibel and S. Schane (Eds.), *Modern Studies in English.* Englewood Cliffs, N.J.: Prentice-Hall, 352-360 (1969).

RUDER, K., and SMITH, M. D., Issues in language training. In R. Schiefelbusch and L. Lloyd (Eds.), *Language Perspectives—Acquisition, Retardation, and Intervention.* Baltimore, Md.: University Park Press (in press).

TYACK, D., The use of language samples in clinical setting. *J. learn. Dis.*, **6**, 213-216 (1973).

Chapter III

EFFECT OF VERBAL IMITATION AND COMPREHENSION ON VERBAL PRODUCTION OF LEXICAL ITEMS

KENNETH F. RUDER, MICHAEL D. SMITH, *and* PATRICIA HERMANN

This study investigated the effect of nonreferential imitation and comprehension training on production of lexical items. Each subject was trained to imitate words for which he had no referents. Additional words were trained in a comprehension task where overt verbal responses were prohibited. Results of both the imitation and comprehension training indicated that neither form of training alone was sufficient to bring about production. Reversal of the training procedures on each set of words (words originally trained on comprehension were trained on imitation and vice versa) did result in production. Furthermore, previous training in one mode (imitation or comprehension) was found to facilitate subsequent training in the other mode. A replication confirmed the original results, indicating that a combination of imitation and comprehension training is necessary to achieve production.

The past decade has witnessed a renewed and invigorating interest in normal language development and its implications for language intervention techniques (Lynch and Bricker, 1972; Malouf and Dodd, 1972). However, in spite of the research undertaken by language interventionists and developmental psycholinguists, many if not all of the basic issues stand unresolved (Lynch and Bricker, 1972; Guess and Baer, 1973; Ruder and Smith, 1974; Bowerman, 1973). For example, controversy continues to exist over the role of imitation (I), comprehension (C), and production (P), and consequently over Fraser, Bellugi, and Brown's (1963) hypothesis that in developmental terms imitation of a particular linguistic behavior precedes comprehension, which in turn precedes production of that behavior (I > C > P) (Fernald, 1972; Baird, 1972; Bloom, 1973; Chapman and Miller, 1973; Ruder and Smith, 1974).

The controversy concerning the roles of imitation, comprehension, and production in the language intervention process is just as acute. Language training procedures based on principles of behavior modification frequently stress the use of imitation-based training; more psycholinguistically based second-language training procedures (Asher, 1972; Winitz and Reeds, 1972) play down the role of imitation and focus on comprehension training. In a more eclectic approach, Stremel and Waryas, in the language training pro-

gram described in Chapter VI of this monograph, use both comprehension and verbal imitation as their basic training procedures.

Much of the disagreement concerning the role of imitation in language intervention procedures stems from definitional considerations as well as the ambiguous role attributed to imitation in the normal language acquisition process. Until just recently, where language intervention is concerned, imitation has been viewed too often as a process involving "exact copying" of the topography or items of an immediately preceding model. Aware of the limitations of such an interpretation, Bandura (1969, 1970), Sherman (1971), and Whitehurst (in press) agree that researchers have been overly concerned with conditions that use imitation to train selected linguistic behaviors rather than with the nature of the processes involved in the imitation task. As a consequence, according to Bandura (1970), the research on the role of imitation has dealt with the question of language development and training in a cursory manner, hence obscuring the function of imitation in the acquisition and training of language.

The role of imitation has also been obscured in the psycholinguistic literature. A much-cited case in point is the research of Ervin (1964). Judging from a comparison of her subjects' spontaneous imitations vs their free speech patterns, Ervin concluded that ". . . there is not a shred of evidence supporting a view that progress toward adult norms of grammar arises merely from practice in overt imitation of adult sentences" (1964, p. 172). Many mistakingly took Ervin's conclusion to mean that imitation plays no role in the acquisition process, rather than that imitation is not the sole means of acquiring knowledge of language structure.

Skeptical of the claim that imitation does not play a significant role in the acquisition process, Slobin (1968), Kemp (1972), and Kemp and Dale (1973) argue that a child will imitate utterances more complex than those he produces on his own. But, if imitation is "progressive" (that is, provides a means of introducing new features), we still have the difficult task of specifying the precise role played by imitation. As Kemp and Dale (1973) point out, complicating the task are situations where (1) features are not imitated even though they occur in free speech and (2) features are imitated that do not occur in free speech. Undoubtedly, future success will depend on how imitation is defined. The "exact copy" interpretation is plainly inadequate, especially when one considers that children tend to simplify adult models when imitating. A plausible alternative is proposed by Whitehurst (in press). In Whitehurst's terms, imitation need not be an exact copy; that is, not every feature in the model needs to be mirrored in the output. Imitation, in this sense, can refer to a response that contains any specifiable subset or dimension of the model's behavior such that the occurrence of the imitative behavior can be shown to be a function of the occurrence of that dimension or characteristic in the model's behavior. The only requirement within this definition of imitation is that a specifiable subset of the total stimulus array modeled be separated out by the imitator by way of abstraction and mirrored

in the output. The result is that imitation is seen as a process where the response is brought under the control of a particular subset of a stimulus array.

Implicit in Whitehurst's definition of imitation is a comprehension component or at least attempts at comprehension. The act of imitation, as we have defined it, implies that the child must attend to, separate out by way of abstraction, and assimilate regularities embedded in the models that are imitated. Such a view of the role of imitation in language intervention has, for the most part, been obscured by the assumption that intervention programs based on imitation and differential reinforcement will provide a sufficient basis for the emergence (comprehension and production) of selected linguistic behaviors (for example, Lynch and Bricker, 1972; Guess and Baer, 1973). The role of comprehension in such training procedures is largely unspecified. However, this also raises the question of whether intervention programs based on comprehension training and differential reinforcement may facilitate subsequent imitation training and, in turn, result in the occurrence of nontrained production.

The potential of comprehension-based training procedures has received attention in Mann and Baer (1971), Asher (1972), and Winitz and Reeds (1972). The results of the Asher and the Winitz and Reeds studies imply that training based solely on comprehension may prove to be more successful than training based on imitation alone or some combination of comprehension and imitation. More specifically, Winitz and Reeds and Asher have demonstrated that training on comprehension alone results in nontrained production, supposedly ruling out imitation as a functional component in a language training program. It is very possible, however, that the results obtained are ambiguous in that there was no control for the occurrence of rehearsal or covert imitation. The Mann and Baer study addressed itself to the questions of (1) whether or not antecedent as opposed to consequent events (comprehension vs production) facilitate the occurrence of production, and (2) whether or not the development of receptive language is related functionally to productive speech. While training on comprehension, Mann and Baer were successful in demonstrating that antecedent events (defined as comprehension) facilitated the occurrence of production. The results also serve as evidence that receptive and productive repertoires are related functionally, thus opening to question the previous claim that receptive and productive repertoires may be functionally independent (Guess, 1969). A serious problem with this study, however, is that their production task appears equivalent to an elicited imitation task. Witness the instructions given to the subjects for the production task: "I am going to say some words one at a time and I want you to say the same word after me." All that can be said, then, is that training based on comprehension facilitates subsequent imitation of trained vs nontrained items.

In view of the implications of the Winitz and Reeds (1972), Asher (1972), and Mann and Baer (1971) studies concerning the relationship between comprehension and production, the present study was designed as an initial

attempt to examine more closely the claim that comprehension training alone is sufficient to achieve untrained verbal production and that this procedure is more facilitative than a procedure that includes an imitation component.

METHOD

Subjects

Two normal three-year-old children (MR and TM) and one five-year-old language-delayed child (KE) served as subjects for the study. All three children were acquiring English as a native language and were at approximately the same level of linguistic development (comprehension of syntactic forms and receptive vocabulary at about the 3.5-year age level as assessed by the Northwestern Syntax Screening Test and the Peabody Picture Vocabulary Test, respectively). Audiometric screening revealed normal hearing for speech for all three subjects (screened at 15 dB ISO at 500, 1000, 2000, and 4000 Hz). Articulation of MR and TM was considered to be normal; KE had a severe articulation disorder compounding the language delay problem.

Stimuli

Stimuli for this initial study consisted of 16 lexical items. The discussion section deals with the question of whether results obtained by the use of isolated lexical items can be generalized to situations involving structured strings. Lexical rather than sentential stimuli were selected as the focus of this initial study because many language training programs (such as that described by Stremel and Waryas in Chapter VI of this monograph) view the acquisition of lexical items as an elementary, discrete step that is prerequisite to the training of syntax. Subsequent studies in this series systematically explore the roles of imitation and comprehension training on production of sentential components of language training programs as well.

To control for the effects of previous exposure, all nouns selected for training were from the Spanish language. All noun stimuli were easily depictable and did not sound like or resemble in any way the English translations of the Spanish nouns, and subjects were able to identify and name the items in English. The 16 stimulus items selected for use in the study follow:

1. cup–taza
2. dog–perro
3. banana–platano
4. tree–arbol
5. apple–manzana
6. bird–pajaro
7. rabbit–conejo
8. cone–helado
9. house–casa
10. truck–camion
11. ball–pelota
12. duck–pato
13. squirrel–ardilla
14. fish–pescado
15. horse–caballo
16. crib–cuna

Procedure—Pretraining

All subjects underwent a series of pretraining sessions (two trials on each stimulus item) consisting of imitation and comprehension training of Spanish nouns that sounded similar to their English counterparts (for example, *radio* and *baby*). These items were used to acquaint the subjects with the experimental tasks. Two words each were trained on imitation and comprehension to a criterion of 100% performance for three successive sessions. In the imitation task, criterion performance consisted of correctly imitating both stimulus words for three consecutive sessions (a total of six trials for each word since two trials were given in each session during pretraining). Criterion performance on the comprehension training consisted of correctly pointing to the picture (from a choice of three) named by the stimulus word spoken by the experimenter. Reaching criterion on the pretraining task constituted the entry behavior for the experimental training sessions. Production probes were conducted in the pretraining sessions to acquaint the subjects with the procedure; no feedback, however, was given nor was correct performance on the production probes a prerequisite to entry into the experimental phase of the study. The experimental phase consisted of an initial training study that used eight of the stimulus words (four for imitation and four for comprehension) and a replication of the initial training study that used the remaining eight stimulus words.

Condition I: Imitation Training

Four words from the pool of 16 were chosen for the initial imitation training; another four were reserved for use in the replication phase of the study. A native speaker of Spanish delivered the verbal models to be imitated. Imitation training for the three subjects was conducted in a group situation (as was the comprehension training) in the context of a word game. The subjects were told they were going to play a word game and were expected to say some Spanish words just as the Spanish teacher said them. No referents accompanied these items at any time. From the child's point of view, these words could be considered nonreferential nonsense words spoken with Spanish pronunciation. Tokens (exchanged later for edibles and toys) and verbal praise accompanied what the native Spanish speaker considered an acceptable Spanish pronunciation of the word; incorrect or unacceptable pronunciations were followed by the experimenter's verbal responses such as "No," "That's not right," and so on. Initially a CRF schedule was used; a variable reinforcement schedule (for example, every third item or so was not reinforced) was used as soon as the subject demonstrated that he would continue to respond even though no reinforcement followed a particular response. Occasionally, the pretraining stimuli were used as a check on the response veracity on the unreinforced trials. Order of presentation of the verbal stimuli and the order in which subjects were to respond were completely randomized for each session. A session was defined as one trial for each of the stimulus

items for each of the three subjects. Each stimulus word was thus imitated once by each child during a session. The same four words were used for each child in imitation training.

Condition II: Comprehension Training

Eight words, different from those being trained on imitation, comprised the verbal stimuli for this portion of the study, four words in the initial training study and four for the replication study. Comprehension training sessions were carried on concurrently with the imitation training sessions. Approximately one hour separated the imitation and comprehension training sessions. As in imitation training, a comprehension training session consisted of one trial for each stimulus word for each child. Comprehension training consisted of arranging four pictures in front of the subject, one depicting the verbal stimulus, the other three being foils. In addition to pictures representing four stimulus words, six other pictures were also used as foils. For any one trial, then, there was a pool of nine possible pictures from which the foils could be selected. Selection of the foils from this pool, as well as their sequential arrangement on the match-to-sample format board, was randomly determined. The verbal stimulus was presented to the subject in the carrier phrase "Show me ———" (for example, "Show me *gato*"). The subject responded by picking up one of the four pictures and placing it on the response square of a match-to-sample format board. Subjects were instructed not to rehearse the verbal stimuli during comprehension training. In both the imitation and comprehension training, incorrect responses were also followed by corrective feedback in the form of the appropriate response being modeled by the experimenter. In the case of an incorrect imitative response, corrective feedback consisted of the experimenter again producing the correct verbal model before going on to the next stimulus item. In the comprehension task, the corrective feedback consisted of saying "No" or "That's not right, I said show me ———," after which the experimenter picked up the correct picture and placed it in the response square.

Production Probes

Production probes were conducted before training to determine if the subjects could label the 16 stimulus pictures with the appropriate Spanish names. Failure to produce any resemblance to the correct Spanish labels on three consecutive probes (each probe being administered on a separate day) was taken as evidence that the subject's initial verbal production baseline was at zero. None of the three subjects produced anything resembling the correct Spanish label for any of the 16 stimulus items. Once a subject reached criterion (defined as 100% performance on the imitation or comprehension task for three successive sessions), daily probes were conducted when possible. Probes were conducted separately from training (that is, always following the imitation and comprehension training sessions) and were conducted

individually rather than in a group. Probes consisted of showing the subject a picture of the stimulus items being trained in the imitation and comprehension sessions and asking, "What is the Spanish name for this?" An appropriate response to a probe was a verbal response that was judged by the experimenter and a reliability observer as being an acceptable and identifiable approximation to the Spanish label for that picture.

Reversal Training

A reversal of training procedures was used to train those stimulus items for which all three subjects had achieved criterion performance (100% correct responding for three successive sessions) in initial training but for which production had not been achieved. Since all training was conducted in a group, this switch from imitation to comprehension training or comprehension to imitation training was not performed until all subjects reached criterion performance. This resulted in continuing the initial training for some subjects long beyond their reaching criterion performance. To control for the possibility that it was not the reversal training but simply continued training that resulted in verbal production performance, if achieved, only half of the words for which no production resulted from initial training were used in the reversal training. The other half was continued in the initial training condition. For instance, if none of the four words trained to criterion in imitation training resulted in verbal production, two of these words would be selected randomly to be continued for further practice in imitation while the other two words would be switched to comprehension training. Production probes would then be conducted as in the initial training. If the reversal procedure resulted in production whereas the continued training did not (or vice versa), then the training mode (imitation or comprehension) was reversed for these "continued" items as well. In any event, training continued until all subjects produced the Spanish names for all eight stimulus items used in this phase of the study.

Replication

Following the completion of the first phase of the study (where all subjects could verbally produce the Spanish names of the eight stimulus items on unreinforced probes), a systematic replication was undertaken to see if the results were replicable or whether, having gone through the study once, the subjects now knew what was wanted of them and employed different strategies and behaviors as a result of the initial training experience (perhaps a result of learning to learn). Procedures for the replication were the same as those for the initial study, the only difference being that eight new stimulus items were employed (Items 9 to 16 in the list of stimuli). The criterion for switching from one training mode to the other (I to C or C to I) was raised from three to four successive 100% performances within a block of five sessions (to insure stability of performance further). Upon reaching initial training

criterion, all words were switched to the other mode of training. The continuation of the comprehension training condition was dropped, since the mere addition of more training trials did not have a significant effect on verbal production in the original study.

Reliability

Reliability of the experimenter's judgments regarding the acceptability of the subjects' verbal responses during imitation training was assessed periodically by using several independent observers (one a native speaker of Spanish and the other a native speaker of English trained in Spanish). Approximately one fifth of the sessions were monitored "live" without the experimenter's knowledge, while another one fifth were monitored using a videotape recording that was subsequently analyzed as an additional reliability check. The percentage of agreement with the experimenter on acceptability of verbal responses ranged from 90% to 100%, with an average agreement of nearly 96%. Reliability judgments for verbal production during the probes were near 100%.

RESULTS AND DISCUSSION

The results of imitation training on production for the three subjects are summarized in Table 1, Condition I. Since the imitation training consisted of echoic imitations of nonreferential Spanish words, one would not expect the production probes to show any systematic increase in correct responding as imitation ability increased. Table 1 shows this to be the case. Subject MR,

TABLE 1. Initial imitation and comprehension training results. Data are presented as correct responses in total number of trials in blocks of sessions.

	Condition I			*Condition II*		
Subject	*Sessions*	*Imitation Training*	*Production Probes*	*Sessions*	*Comprehension Training*	*Production Probes*
MR	1-5	4/20	0/4	1-5	5/20	0/4
	6-10	8/20	0/4	6-10	4/20	0/4
	11-15	13/20	0/4	11-15	17/20	0/4
	16-20	20/20*	0/4	16-20	17/20	0/4
	21-25	20/20	0/4	21-25	20/20*	0/4
	26-28	12/12	0/8	26-28	20/20	0/8
TM	1-5	6/20	0/4	1-5	4/20	0/4
	6-10	8/20	0/4	6-10	8/20	0/4
	11-15	11/20	0/4	11-15	4/20	0/4
	16-20	20/20*	0/4	16-20	10/20	0/4
	21-25	18/20	0/4	21-25	18/20*	0/4
	26-29	16/6	0/8	26-30	18/20	0/8
KE	1-5	3/20	0/4	1-5	4/20	0/4
	6-10	5/20	0/4	6-10	3/20	0/4
	11-15	9/20	0/4	11-15	2/20	0/4
	16-20	16/20	0/4	16-20	9/20	0/4
	21-25	15/20	0/4	21-25	17/20*	0/4
	26-29	16/16*	0/4	26-30	20/20	0/4

*Reached criterion in training three successive 100% sessions during this block of trials.

for example, initially performed between 25% and 50% in the first two blocks of five sessions. By the fifteenth training session, MR achieved 100% performance on imitation of the four Spanish words and remained at this level for an additional 13 sessions. Production probes, as expected, remained at zero even though additional training was given (10 additional sessions beyond the criterion level of three consecutive 100% performances). Similar results held for subjects TM and KE.

The data concerning the effect of comprehension training on production depicted in Table 1, Condition II, were unexpected. According to Winitz and Reeds (1972) and Asher (1972), one would have expected the comprehension training to result in improved production, although one might expect production to lag somewhat behind comprehension performance in light of the data showing that comprehension precedes productions in the normal language acquisition process. Such was not the case in the present study. Initial comprehension scores for the four Spanish words ranged from zero to 25% for the first five sessions (essentially a chance performance) for the three subjects and increased to 100% performance by the twelfth session for subject MR, by the twenty-first session for subject KE, and by the twenty-third session for subject TM. Although there were as many as nine to 14 consecutive 100% performances by KE and MR, respectively, there was no correct production on any of the probes. Probe responses consisted of (1) no response or "I don't know" (80% of probe responses), (2) unidentifiable verbal responses (15% of probe responses), or (3) incorrect Spanish labels (5% of probe responses). As far as acquisition of lexical items is concerned, the data indicate that contrary to suggestions by Winitz and Reeds (1972) and Asher (1972), simple comprehension training is not sufficient to result in improved production.

To determine if continued training on comprehension might result eventually in production, two of the original four words for all subjects were continued in comprehension training. In addition, two words previously used in imitation training were included for comprehension training to see if the verbal practice in the imitation task plus comprehension training had any effect on production. Conversely, the remaining two words previously trained on comprehension were then trained on imitation primarily to see if order of training (imitation followed by comprehension or comprehension followed by imitation) had an effect on the acquisition of production. All imitation and comprehension training in this phase of the study ran concurrently.

Table 2 shows the results of training in the reversal phase of the study. For subject MR, despite continued comprehension training for 23 additional sessions, production probes continued at zero level throughout. During comprehension training of the two words previously trained on imitation, subject MR remained at 100% performance level for 11 sessions with production probes continuing to zero. On the twelfth session, however, the first verbal production was observed, and by the nineteenth session both words were produced correctly during the production probe. In contrast, the results of imitation training

TABLE 2. Reversal training results. Data are presented as correct responses in total number of trials for blocks of sessions. A total of two words per condition was trained in any one session.

	Condition I—Continuation of Previous Comprehension Training			Condition II—Comprehension Training on Items Previously Learned in Imitation			Condition III—Imitation Training on Items Previously Learned in Comprehension		
Subject	Session	Comprehension Training	Production Probes	Session	Comprehension Training	Production Probes	Session	Imitation Training	Production Probes
MR	1-5	9/10	0/2	1-5	8/10	0/2	1-5	10/10	0/2
	6-10	8/10	0/2	6-10	10/10	0/4	6-10	10/10	3/4
	11-15	10/10	0/2	11-15	10/10	2/6	11-12	4/4	4/4*
	16-20	10/10	0/6	16-19	8/8	4/6*			
	21-23	6/6	0/6						
TM	1-5	7/10	0/2	1-5	4/10	0/2	1-5	10/10	4/4
	6-10	8/10	0/2	6-10	5/10	0/2	6-10	10/10	6/6*
	11-15	7/10	0/4	11-15	8/10	1/6			
	16-20	9/10	0/6	16-2	10/10	4/6*			
	21-24	7/8	2/4						
KE	1-5	10/10	0/2	1-5	4/10	0/2	1-5	9/10	1/2
	6-10	10/10	0/2	6-10	9/10	0/2	6-10	10/10	5/6
	11-15	10/10	0/2	11-15	7/10	0/4	11-15	10/10	6/6*
	16-20	10/10	1/6	16-20	9/10	0/6			
	21-25	10/10	0/6	21-25	10/10	1/6			
	26-30	10/10	0/6	26-30	10/10	5/6*			

*Training terminated at this point since 100% verbal production had been achieved on at least one set of probes during this block of sessions.

on words previously learned in comprehension training show that 100% production was achieved by the eleventh session for subject MR, several sessions before acquisition of production in the imitation-comprehension training sequence. Table 2 shows similar trends for subjects TM and KE. The results are particularly striking in the case of KE, where 25 additional sessions of comprehension training (on words initially trained on comprehension) failed to yield consistently correct productions. Twenty additional sessions of comprehension training on words originally trained to criterion in imitation likewise failed to yield any productions during the probes. Contrast this with the imitation training of items previously learned in comprehension where production was obtained by the third session and stabilized at 100% production by the eleventh session. The only subject to benefit by the additional comprehension training was TM, who achieved a 50% level (two of four probe words correct) in production probes after an additional 24 sessions of training. This is difficult to interpret, however, in light of the sporadic performance in comprehension training on items supposedly learned on previous training. (There was a time lapse of approximately four weeks between the completion of the first phase of training and the resumption of this training in the reversal phase of the study. This same time lapse, however, did not seem to affect the performance of subjects MR or KE to the same extent). Mode of training on these items was reversed at this point and consistent verbal production was obtained with 15 additional training sessions on all words.

A replication of the study was then undertaken using the second set of

TABLE 3. Replication study results. Data are presented as correct responses in total number of trials for blocks of sessions.

	Condition I—Imitation Training Followed by Comprehension Training (I + C)					*Condition II—Comprehension Training Followed by Imitation Training (C + I)*				
Subject	*Session*	*Imitation Training*	*Production Probe*	*Comprehension Training*	*Production Probe*	*Session*	*Comprehension Training*	*Production Probe*	*Imitation Training*	*Production Probe*
MR	1-5	16/20	0/4			1-5	11/20	0/4		
	6-10	20/20*	0/4			6-10	18/20	0/4		
	11-15			15/20	0/12	11-15	20/20*	0/8		
	16-20			17/20	3/16	16-20			20/20	14/20†
	21-24			15/16	12/12†					
TM	1-5	17/20	0/4			1-5	4/20	0/4		
	6-10	20/20*	0/4			6-10	11/20	0/4		
	11-15			14/20	0/16	11-15	15/20	0/8		
	16-20			19/20	7/20	16-20	20/20*	0/16		
	21-25			20/20	16/20†	21-25			19/20	15/20
						26-27			8/8	8/8†
KE	1-5	2/20	0/4			1-5	6/20	0/4		
	6-10	14/20	0/4			6-10	12/20	0/4		
	11-15	16/20	0/4			11-15	19/20*	0/8		
	16-20	20/20*	0/4			16-20			4/20	0/8
	21-25			10/20	7/20	21-25			10/20	1/20
	26-30			16/20	10/20	26-30			10/20	4/20
	31-35			20/20	17/20†	31-35			16/20	5/20

*Reached criteria in training.
†Training terminated at this point since verbal production had reached 100% on at least one set of probes during this block of sessions.

eight Spanish nouns. The replication data are presented in Table 3. As can be seen, production was not achieved on either the initial imitation or comprehension training phase of this study, thus replicating the previous findings for all three subjects. Subjects MR and TM show similar trends on the reversal phase of the training. That is, when production was not achieved through either imitation or comprehension training and the training procedure was reversed so that items trained initially on imitation were then trained in comprehension and vice versa, both subjects achieved some verbal production following first imitation training of items previously learned on comprehension. Fewer trials were needed to achieve the same level of verbal production in the C + I training sequence than in the I + C training sequence for both these subjects. However, in switching from comprehension to imitation training, both subjects performed at or near a 100% correct criterion level from the beginning. Comprehension training on items previously learned in imitation took longer to achieve a similar level of proficiency, thus accounting, in part, for the increased number of trials necessary to achieve production on the I + C training sequence.

Subject KE's performance in the replication presents an interesting reversal of her performance on initial training in that the replication data show the I + C training sequence as being more effective than the C + I sequence. The superiority of the I + C sequence in the replication study can be partially accounted for by the subject's articulation problem. It simply took longer for

her to master the pronunciation of the words than it did to comprehend them (a nonverbal task). It is difficult to explain why the superiority of the I + C sequence did not manifest itself initially. This issue requires further study.

For both MR and TM there apparently is a facilitating effect of previous imitation training on comprehension training of those same items. Since initial comprehension training in the C + I training sequence took considerably longer than the initial imitation training of the I + C sequence, the apparent superiority of the C + I sequence (in terms of almost immediate transfer to verbal production during the imitation phase) is obscured by the difference in trials to criterion of the initial comprehension training in the C + I sequence and initial imitation training of the I + C sequence. That is, the subjects simply received more exposure to words in the C + I sequence in the initial training phase than they did in the I + C sequence. As a result, for subjects MR and TM, production is achieved in about the same block of five sessions for the I + C and C + I sequences. These data can be interpreted to mean that one training sequence is apparently not superior to the other.

Comparison of the data to comprehension training alone or imitation training alone does highlight one important fact. Some combination of both verbal (imitation) and comprehension training seems to be a necessary prerequisite to achieving verbal production. Such an interpretation contradicts Asher (1972) and Winitz and Reeds (1972) where it is claimed that comprehension training alone is sufficient to bring about production. It should be mentioned that the present study differs in several important respects from the Asher and Winitz and Reeds studies. For example, the present study dealt with children whereas the other two studies dealt with college students, and the present study was interested in the acquisition of lexical items whereas the other studies were primarily interested in syntax. It may well be that once the lexical item is mastered, further imitation training would not be essential to the establishment of productive use of syntax. A study to test this particular hypothesis is currently underway. One might tentatively infer, however, that while comprehension training alone might be sufficient to bring about production, it is likely that it is not the most facilitative procedure to achieve the goal of verbal production. Witness in this regard that the training procedures in the Stremel and Waryas language training program in Chapter VI of this monograph consist of a comprehension-followed-by-imitation sequence similar to the C + I sequence of the present study. One should note as well that in the study in this monograph by McReynolds and Engmann, they too resorted to procedures involving both comprehension and imitation to achieve their goal of verbal production. While not answering the question as to whether comprehension training alone is sufficient (and more facilitative than other procedures) in achieving verbal production of sentential stimuli, these two articles at least illustrate the potential of training programs based on components of both imitation and comprehension of sentential stimuli and indicate that the results of the present study on training of lexical items might hold for the training of more structured strings as well.

An alternative explanation of the discrepancy between the present study's findings and those claiming that comprehension training alone is sufficient to achieve production lies in the possible occurrence of overt or covert verbal rehearsal on the part of the subjects in the latter studies. In the present study, subjects were specifically instructed not to say anything during comprehension training. However, covert rehearsal was not controlled for and may well account for the fact that the subjects required considerably less training on imitation to achieve satisfactory production following comprehension training than when the imitation training was the subject's first exposure to the word. Moreover, when the subject was shifted from imitation to comprehension training, one could expect some covert rehearsal as a function of previous training. Also, when shifting from comprehension to imitation training, non-referential imitation is ruled out since the subjects have already associated the words with pictures and referents. It is plausible to consider the control of overt rehearsal as possibly contributing to the finding that production was not achieved by means of comprehension training alone as had been expected. Currently, a study is underway to assess the role of directed rehearsal during comprehension training.

CONCLUSIONS

The results of the present study do not support the claim that comprehension training alone is sufficient to bring about verbal production of lexical items. Rather, the results can be interpreted as demonstrating that both imitation training and comprehension training are necessary components of a program designed to achieve production of lexical items. Furthermore, the data do not show a clear trend for the most efficient direction of training. It is not clear from the data whether it is better to begin with imitation training and follow it with comprehension training or vice versa. The data do seem to indicate that the initial training, whether it be based on imitation or comprehension training, does facilitate later training. In the case of initial comprehension training, the facilitating effect on later imitation training is particularly striking, perhaps indicating that covert rehearsal had taken place. The data from the replication study, in particular, clearly show that exposure to the verbal stimuli in imitation training led to more rapid comprehension of the lexical items such that verbal production was achieved in the same number of sessions regardless of the training sequence. Whether such generalizations hold for more than the limited sample studied here and whether these same generalizations apply to language training of syntactic rules as well as training on lexical items is the subject of a follow-up study arising from this initial investigation. The data argue in favor of a training program for lexical items that contains both imitation and comprehension training, thus supporting the implications of Mann and Baer (1971).

ACKNOWLEDGMENT

This study was supported by Grants HD 00870 and 00183 from the National Institute of Child Health and Human Development and Grant NS 10468 from the National Institute of Neurological Diseases and Stroke awarded to the Bureau of Child Research, University of Kansas, Lawrence, Kansas. Kenneth F. Ruder, Michael D. Smith, and Patricia Hermann are affiliated with the Bureau of Child Research and the Department of Linguistics, University of Kansas, Lawrence, Kansas.

REFERENCES

ASHER, J., Children's first language as a model for second language learning. *Mod. Lang. J.*, **56**, 133-138 (1972).

BAIRD, R., On the role of chance in imitation-comprehension-production test results. *J. verb. Learn. verb. Behav.*, **11**, 474-477 (1972).

BANDURA, A., *Principles of Behavior Modification*. New York: Holt, Rinehart and Winston (1969).

BANDURA, A., Modeling theory. In W. S. Sahakian (Ed.), *Psychology of Learning: Systems, Models, and Theories*. Chicago: Markham, 350-368 (1970).

BLOOM, L., *One Word at a Time: The Use of Single Word Utterances before Syntax*. The Hague: Mouton (1973).

BOWERMAN, M. F., *Learning to Talk: A Cross-Linguistic Comparison of Early Syntactic Development, with Special Reference to Finnish*. London: Cambridge Univ. Press (1973).

CHAPMAN, R., and MILLER, J., Early two- and three-word utterances: Does production precede comprehension? Paper presented at the Fifth Annual Child Language Research Forum, Stanford Univ. (April 1973).

ERVIN, S., Imitation and structural change in children's language. In E. H. Lenneberg (Ed.), *New Directions in the Study of Language*. Cambridge, Mass.: MIT Press, 163-189 (1964).

FERNALD, C., Control of grammar in imitation, comprehension and production: Problems of replication. *J. verb. Learn. verb. Behav.*, **11**, 606-613 (1972).

FRASER, C., BELLUGI, U., and BROWN, R., Control of grammar in imitation, comprehension, and production. *J. verb. Learn. verb. Behav.*, **2**, 121-135 (1963).

GUESS, D., A functional analysis of receptive language and productive speech: Acquisition of the plural morpheme. *J. appl. behav. Anal.*, **2**, 55-64 (1969).

GUESS, D., and BAER, D., Some experimental analyses of linguistic development in institutionalized retarded children. In B. B. Lahey (Ed.), *The Modification of Language Behavior*. Springfield, Ill.: Charles C Thomas, 3-60 (1973).

KEMP, J., A study of young children's spontaneous verbal imitations. Doctoral dissertation, Univ. of Washington (1972).

KEMP, J., and DALE, P., Spontaneous imitations and free speech: A developmental comparison. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Philadelphia (1973).

LYNCH, J., and BRICKER, W., Linguistic theory and operant procedures: Toward an integrated approach to language training for the mentally retarded. *Ment. Retard.*, **10**, 12-17 (1972).

MALOUF, R., and DODD, D., Role of exposure, imitation and expansion in the acquisition of an artificial grammatical rule. *Develpm. Psychol.*, **7** 195-203 (1972).

MANN, R., and BAER, D., The effects of receptive language training on articulation. *J. appl. behav. Anal.*, **4**, 291-298 (1971).

RUDER, K., and SMITH, M., Issues in language training. In R. Schiefelbusch and L. Lloyd (Eds.), *Language Perspectives—Acquisition, Retardation and Intervention*. Baltimore: University Park Press, 564-605 (1974).

SHERMAN, J., Imitation and language development. In H. W. Reese and L. P. Lipsitt (Eds.), *Advances in Child Development and Behavior*. New York: Academic, 239-272 (1971).

SLOBIN, D. I., Early grammatical development in several languages, with special attention to Soviet research. Working Paper No. 11. Berkeley, Calif.: Language Behavior Research Laboratory (1968).

WHITEHURST, G., Imitation, response novelty, and language acquisition. *J. exp. child Psychol.* (in press).
WINITZ, H., and REEDS, J., The OHR method of language training. Kansas City Working Papers in Speech Science and Linguistics, #3. Kansas City, Mo.: Univ. of Missouri in Kansas City (1972).

Chapter IV

AN EXPERIMENTAL ANALYSIS OF THE RELATIONSHIP OF SUBJECT AND OBJECT NOUN PHRASES

LEIJA V. McREYNOLDS *and* DEEDRA L. ENGMANN

An experimental analysis study was designed to determine whether two linguistic constructions consisted of two separate response classes, or if they were functionally related as members of one response class. The grammatical constructions investigated were the subject and object noun phrases and the verb phrase. Results showed a probable functional relationship occurring between the two noun phrases. The subject and object noun phrases appeared to be functioning as members of one response class. In both noun phrase and verb phrase training, generalization occurred after only a few items had been trained.

The language program described by Stremel and Waryas in Chapter VI is based on findings from psycholinguistic and experimental analysis research. Carrier's training program in Chapter V is based on information from several disciplines. The authors of both chapters recognize that further experimental work is necessary to help determine if the research findings are appropriate for the development of clinical training programs. As data are collected from experimental studies, the information can be used to change existing programs. New research findings may be incorporated into language training programs.

The experimental study reported in this chapter was designed to obtain additional information about training a child to produce and use noun phrases. We investigated variables that may influence the child's acquisition of noun phrases and his use of them in contexts other than the trained one. A child with an adequate vocabulary, who occasionally used three words in a sentence sequence, but not noun phrases, was selected for the study. An experimental analysis explored whether two noun phrases consisted of two separate response classes, or if they were related as members of one response class. Although the grammatical construction of main concern was the noun phrase, the verb phrase was also explored.

The noun phrases were explored in the context of a declarative sentence. A declarative sentence may consist of a subject, predicate, and object. The subject is the noun phrase of the sentence, the predicate is the verb phrase, and the object is the noun phrase of the verb phrase. The verb phrase may

consist of an auxiliary + verb. The two noun phrases are topographically similar in that they consist of a modifier + noun. Syntactically the two noun phrases follow a prescribed order. They function in different ways within the sentence in that one is the actor and the other is acted upon. Because of these differences a child may not acquire them simultaneously. They may have to be learned as separate linguistic classes. For example, if a child learns the noun phrase "the dog" as a subject phrase, what is the probability that it will influence his learning other noun phrases in the object position in a declarative sentence with little additional help? Linguistically, the two noun phrases differ from each other in syntactic and semantic parameters. On the other hand, if a functional relationship exists between the two topographically similar phrases, then training the child to use either one should increase the probability of his acquiring the other without specific training.

A few studies using an experimental analysis approach for exploring generative language have been completed. The studies, demonstrating the development of functional response classes in language, or generative language, have been largely restricted to morphological development (Guess et al., 1968; Schumaker and Sherman, 1970). Only one study has experimentally analyzed the development of articles and verbs (Wheeler and Sulzer, 1970).

Wheeler and Sulzer's study was an attempt to demonstrate generalization of a sentence form that included articles and verbs to pictures that were never trained, and the development of a functional response class, or generative language. A child who spoke "telegraphic" English, leaving out most articles and auxiliary verbs, was the subject in the study. The study used an ABA design to establish response classes.

A baseline of telegraphic speech in response to pictures was established. On the baseline measure the child demonstrated use of articles and auxiliary verbs, but these were somewhat inconsistent. In Condition 1 the child was trained to respond to a picture with three complete components consisting of (1) noun phrase, article + noun subject; (2) verb phrase, auxiliary verb *is* + verb; and (3) noun phrase, article + noun object. Generalization of the entire sentence was tested by presenting the subject with pictures on which he had received no training. After criterion had been reached and generalization of the complete sentence form had been tested, reversal training was provided. The subject was trained to respond to the pictures with his former telegraphic speech, leaving out the articles and auxiliary verb. At the end of Training Condition 2, generalization of the telegraphic sentence form was tested to determine whether the subject would use incomplete sentences to respond to untrained pictures. In both conditions of training, the subject learned to use the trained sentence form and generalized the trained form to untrained items. In the final training condition the subject was taught once more to use the complete sentence form in response to pictures.

Since generalization of the trained complex verbal response occurred to untrained stimuli, it was concluded that the procedures and the forms used in training were important factors in the development of the response. The

study added further evidence that a functional response class or generative language had developed. In Wheeler and Sulzer's (1970) study the entire sentence was trained simultaneously (subject noun phrase + verb phrase + object noun phrase). Generalization of the complete sentence form was tested.

A somewhat different question was investigated in the study to be reported. We attempted to determine whether two noun phrases were members of the same response class. We were concerned also with investigating verb phrase generalization.

Several specific questions were posed in the investigation: (1) How many subject noun phrases need to be trained before generalization to untrained subject noun phrases occurs? (2) When no training is presented in object noun phrases, will generalization from subject noun phrase training occur to object noun phrases? and (3) In how many noun phrase contexts do verb phrases need to be trained before generalization to untrained verb phrases occurs?

METHOD

The study was designed as an ABA (reversal) procedure to explore the relationship between two noun phrases in a sentence. Principles of operant conditioning were employed in the procedure.

Subject

The subject was an eight-year-old male, diagnosed by the psychologist in his school as a high-level trainable retarded child. He had been referred to the laboratory because he lacked many syntactic classes. When the study was initiated, his language consisted of single nouns and simple verbs. No articles or verb inflections were present in his speech. Although his articulation was not entirely correct, vocabulary items he named were differentiated consistently from one another in expressive language. He had no obvious vision or motor problems, and his hearing was below 20 dB ISO for all speech frequences.

Before the study began, the child was shown approximately 50 Peabody Picture Cards from the Peabody Language Development Kit, Level 1, to establish a nucleus of known vocabulary words. From those that were named correctly, 15 were chosen as subject nouns and 15 as object nouns to be used in the study.

Experimental Setting

Experimental sessions were held four days a week for approximately 30 minutes per session. The experimental sessions were conducted in a $10' \times 8'$ training room containing one table with a chair on each side so the experimenter and subject sat facing each other. An observer, a speech pathologist, sat in one corner of the room facing the subject and phonetically recorded her

judgments of the subject's responses. Periodically, a second observer was introduced to check on reliability.

A marble was dropped into a one-inch plexiglas cylinder on the table each time the subject responded correctly. During the session, marbles were exchanged for tokens, which could be exchanged for inexpensive toys or candy at the end of each session.

Materials

Colored stimulus cards, 7″ × 9½″, were drawn to picture the 15 sentences used in this study. The subject noun phrase was represented by 15 cards, 15 cards represented the verb phrases and were appropriate to the subject of the first card, and 15 cards represented the object phrases. For example, in the sentence "The boy—is eating—the apple," the first card for the sentence showed a boy, the second card showed the same boy at a dining table with a fork in his hand, and the third card showed a picture of an apple. In the sentence "The dog—is eating—the potato," the first picture showed a dog, the second card showed the same dog bending over a plate on the floor, and the third pictured a potato. Therefore, each sentence was represented by three individual stimulus cards. The object phrase cards were randomly paired with the subject phrase cards during presentation for probes.

Baseline

Baseline measurement consisted of seven presentations of each of the 15 pictures that could be described expressively by a noun phrase + a verb phrase + a noun phrase, that is, "the boy" + "is eating" + "the apple." The experimenter placed the three cards corresponding to one sentence on the table in front of the child. The cards were placed in an order corresponding to a sentence sequence (subject noun phrase + verb phrase + object noun phrase). The subject noun phrase card was on the child's left, the verb phrase card in the middle, and the object noun phrase card on the right. All 15 sentences were presented in this manner.

The seven presentations of the 15 sentences occurred over six different sessions. The only difference between presentations was the stimulus used by the experimenter to evoke baseline responses by the child. The stimuli were presented in a sequence from minimum to maximum cues in order to give the child an opportunity to respond with the appropriate response, if it was within his linguistic repertoire. Stimuli used for each presentation were as follows:

1. The experimenter pointed to the three pictures and said, "Tell me about these." The stimulus was presented only once and encompassed all three pictures.
2. Pointing consecutively to each of the three pictures on the table, the experimenter said, "What's this?"

3. The experimenter pointed to each picture and asked, "What?" for each individual picture. The experimenter waited for a response to each picture before moving to the next in the sequence and asking, "What?" again.
4. The experimenter used the stimulus "What?" for the subject noun phrase and object noun phrase, and "What's he doing?" for the verb phrase, pointing to the appropriate picture each time the stimulus was presented.

No feedback was given to the child during baseline as to the correctness of his responses.

Training Procedures

Procedures for training the noun phrase consisted of training only the subject noun phrase, never the object noun phrase. The subject noun phrase training was labeled Procedure 1. Each subject noun phrase was trained to criterion. At completion of Training Item 1, the child was presented with probes to test generalization of the appropriate response to the remaining 14 untrained subject noun phrases and the 15 object noun phrases. If generalization had not occurred to the subject noun phrases, the child was provided training on the second subject noun phrase. With the addition of the second subject noun phrase a discrimination procedure was instituted; the first trained item was interspersed randomly with the new item during training. At completion of training each new item to criterion, generalization was again tested. Additional phrases were trained until the child had generalized to 80% of the untrained subject noun phrases. When noun phrase training in the subject position had been completed, training on verb phrases was initiated. The procedures for verb phrase training were similar to those for noun phrase training. Verb phrase training was labeled Procedure 2.

Procedure 1: Subject Noun Phrase Training. The first phase of the procedure consisted of training the article *the* by imitation. The experimenter, seated across the table from the child, presented the picture of the boy and the verbal model "the." Correct imitative responses were reinforced with a verbal "good" or "that's right," and a marble dropped into a container. Six sets of 20 trials each were presented for a total of 120 trials per session. Training continued until the child responded correctly on an FR (fixed ratio) 1 schedule of reinforcement at a 90% level of correctness on three consecutive sets of 20 trials each.

On reaching criterion for "the," the subject was trained to imitate the complete noun phrase "the boy." Both the picture of the boy and the verbal model "the boy" were presented. If the child initially had difficulty imitating both words in succession, single-word imitation training was provided in the early stages of training. The experimenter said, "Say *the*," followed by the subject's response and a marble if the response was correct. The experimenter then said, "Say *boy*," after which the subject was presented a marble if he imitated correctly. After imitative responding on the individual words presented in sequence was completed, training shifted to imitation of the complete re-

sponse, "the boy." Criterion for this phase was 90% correct, unaided imitation on an FR 1 schedule for three consecutive sets.

The second phase of Procedure 1 consisted of spontaneous production of "the boy." The experimenter continued to present the picture of the boy, but the verbal stimulus was changed to "What's this?" The child had to produce both the article and noun spontaneously without a preceding model. Training on an FR 1 schedule was continued until a 90% correct level of responding for three consecutive sets of 20 trials was reached. The schedule was then shifted to an FR 3 schedule of reinforcement so that probes could be inserted within training trials. Criterion was 90% correct for six consecutive sets of trials. When criterion had been reached, probes were presented.

Procedure 2: Verb Phrase Training. Procedures for verb phrase training were similar to those for noun phrase training. They involved training the verb phrase "is eating" with an already-learned subject noun phrase. For example, the correct response was "The boy is eating." As in Procedure 1, verb phrase training consisted of an imitation phase and a spontaneous production phase. Criteria for each phase were identical to those in Procedure 1. The only difference was that the verb phrase "is eating" first received FR 1 imitation training to 90% correct responding on three consecutive sets, and then the complete subject noun phrase + verb phrase training was initiated.

When criterion was reached in the first verb phrase training, generalization was probed. The probes were similar to those used in noun phrase training. If the child had not generalized at the end of the first verb phrase training, the second verb phrase was trained to criterion in a discrimination procedure identical to the one described in noun phrase training. At the completion of training for each additional verb phrase, generalization was probed. When the child had generalized to 80% of the untrained verb phrases, training in verb phrases was terminated.

Generalization Testing

Two kinds of probes were administered to the child. One of the probes was inserted within the training sessions when the child was on an FR 3 schedule of reinforcement. In this kind of probe an untrained item was inserted periodically during regular training on a specific item. The probe items were inserted on trials in which no reinforcement was available. On an FR 3 schedule three consecutive correct responses are required before the child is reinforced. The probe items, for example, could be presented either in Trial 1 or 2, thus replacing a training item that normally would not have been reinforced on an FR 3 schedule.

The second kind of probe was administered after the child had reached criterion in training on each item. Training items and reinforcers were removed and the entire session was devoted to testing generalization. The probe was identical to baseline measurement. The 15 pictured sentences (noun phrase + verb phrase + noun phrase) were presented twice to the subject.

Responses were evoked with the verbal stimulus "What?" to both the subject and the object noun phrases, and "What's he doing?" to the verb phrase. The number of probe items available for generalization testing was dependent on the number of items on which the child had been trained.

Reversal Training

The final phase of the experiment consisted of reversed subject noun phrase training. The article (*the*) was omitted from the phrase. The child was trained to emit only the noun, not the article + noun response, when presented with a subject noun phrase stimulus card. As in Procedure 1 and Procedure 2, training consisted of an imitation phase and a spontaneous phase. When the first subject noun was trained to criterion, the child was tested for generalization of the noun-only response to the remaining untrained subject and object noun phrase stimuli. The child was first tested on the untrained subject nouns and then on the 15 complete sentences to determine if he would respond with incomplete subject and object phrases. If the child had not generalized the noun-only response to 80% of the untrained subject nouns, a second noun was trained to criterion in the already-described discrimination procedure. Generalization was probed at the completion of training for each additional noun. Noun training terminated when 80% generalization occurred to the remaining untrained subject nouns.

Reliability

The percentage of agreement between the experimenter and the two observers was obtained by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. Agreement was computed for all probe measures. Between the experimenter and the first observer, agreement ranged from 93% to 100%. Agreement between the experimenter and the second observer was 100%.

RESULTS AND DISCUSSION

The study explored whether a functional relationship could be demonstrated between subject noun phrases and object noun phrases when a child was trained only to use the correct form of the subject noun phrase. Before training, a baseline of correct use of subject noun, object noun, and verb phrases was obtained. The boy's performance on baseline and results for subject noun phrase generalization during training are presented in Figure 1.

Baseline performance by the child on all seven presentations of the 15 sentences demonstrated correct identification on the noun vocabulary in all subject nouns and object nouns, and an occasional use of the verb *eat* in the verb phrase. At no time during baseline did the child use the articles *the* or *a* or any other modifier, nor did he use *is* or *eating*, or the appropriate combina-

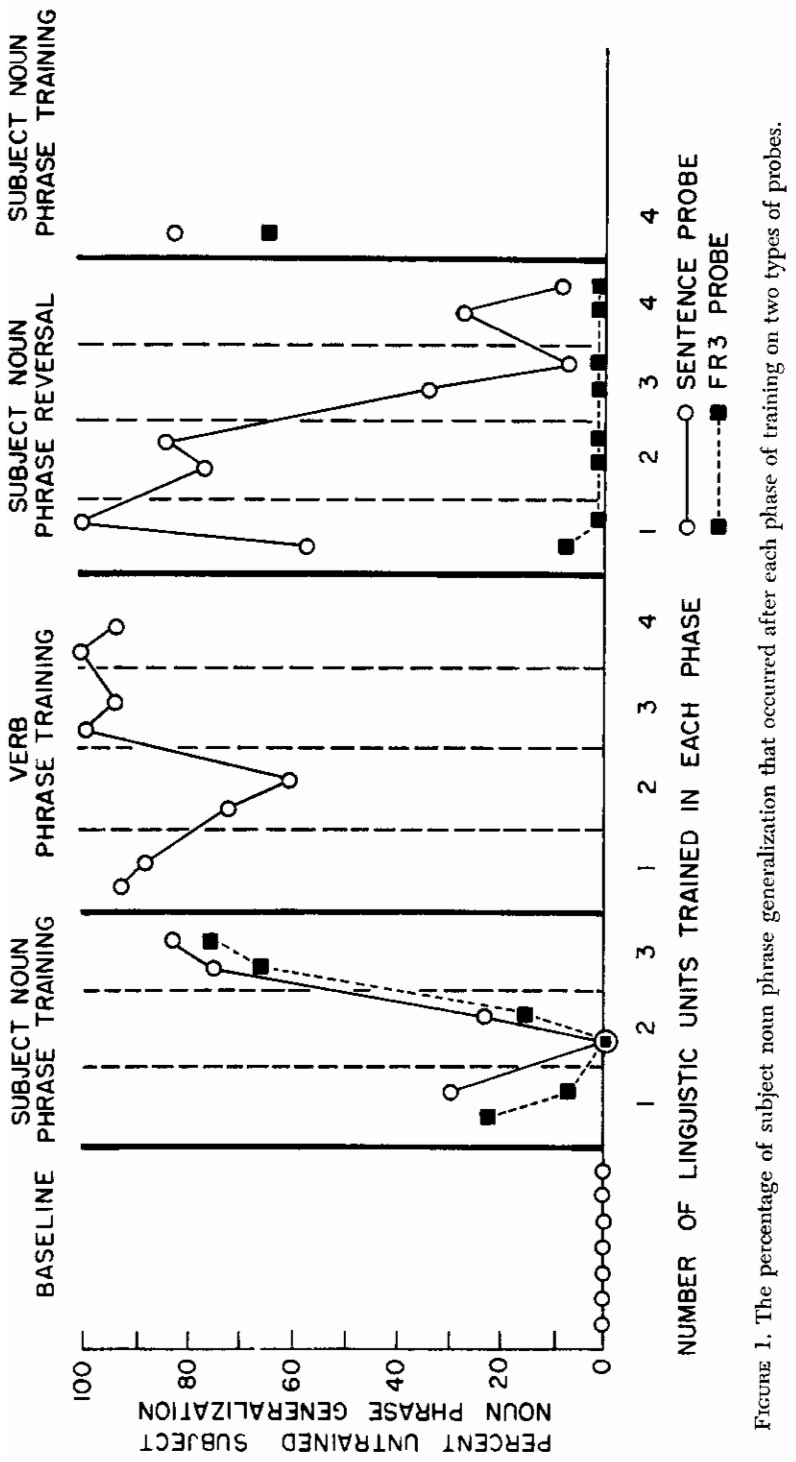


FIGURE 1. The percentage of subject noun phrase generalization that occurred after each phase of training on two types of probes.

tion "is eating." In other words, no appropriate responses of "the + (noun)" or "is + eating" were obtained during baseline measures. His responses consisted of words such as "boy–eat–apple." He had a 0% correct baseline for use of correct subject noun phrases, verb phrases, and object noun phrases.

To test generalization of subject noun phrases to untrained subject noun phrases, two kinds of probe tests were used. One probe consisted of presenting all untrained subject noun phrases within training sessions when the child was on an FR 3 schedule of reinforcement. This was referred to as the FR 3 probe. The second kind of probe was identical to baseline measurement in which all 15 pictured sentences (noun phrase + verb phrase + noun phrase) were presented twice to the subject. This was referred to as the sentence probe.

As shown in Figure 1, the child's responses on both types of probes were similar. Difference as a function of the context in which the noun phrase was tested was one of degree. Generalization was slightly greater on the sentence probes, but the pattern of generalization was the same for both.

Generalization occurred after only one subject noun phrase was trained, but it was somewhat minimal. The child generalized to 21% of the untrained subject noun phrases on the first trial of the FR 3 probe, but dropped to 7% on the second trial. On the sentence probe, the child generalized to 28% of the untrained subject noun phrases. In other words, after reaching criterion on "the boy," the child used a complete noun phrase in four untrained subject noun phrases. Generalization, however, was not stable over probes in the first subject noun phrase training.

Training a second subject noun phrase resulted in little change in the number of items to which generalization occurred. After one phrase had been trained, a new noun phrase was introduced and interspersed with the previously trained phrase. When the discrimination training was initiated a decrease in generalization occurred. On the first FR 3 probe the subject used no correct untrained noun phrases. On the second FR 3 probe, however, he generalized to 15% of the untrained subject noun phrases. Likewise, on the first sentence probe the child made no correct responses although he previously had used four correct untrained phrases after training on one subject noun phrase. He recovered correct use, however, on the second sentence probe and emitted 23% of the untrained subject noun phrases correctly.

The addition of a third subject noun phrase resulted in a considerable increase in generalization. When the boy had completed training on three noun phrases, he correctly used 83% of the untrained subject noun phrases in the complete sentence probe, a 60% increase in generalization from the previous probe during two-item training. Criterion of 80% generalization occurred after the child had been trained in a discrimination procedure on "the boy," "the pig," and "the rabbit." Training in three subject noun phrases, therefore, appeared to provide a sufficient number of contexts for almost total subject noun phrase generalization. The extent of the generalization suggests the formation of a rule concerning subject noun phrase structure.

Correct subject noun phrase responses remained stable during the remainder

of the training program except on one occasion. In the sentence probes after second verb phrase training, correct use of subject noun phrases decreased. The child quickly recovered use of subject noun phrases on all probe items, and stability was maintained throughout training. After this decrease the eight remaining probe tests showed 93% to 100% correct responses on subject noun phrases during the remainder of the training program. Before reversal training, therefore, the subject noun phrase was well established in the boy's linguistic repertoire.

In reversal training the child learned to respond to the subject noun picture with his former one-word response, leaving out the article *the*. After training on the first item the child responded on the FR 3 probe to only 10% of the pictures with the complete noun phrase "the + (noun)." To the rest of the pictures he emitted the noun alone. On the remaining FR 3 probes in reversal training his responses consisted of single nouns. Complete noun phrase responses in the sentence probe also showed a slight decrease in the first probe, but the decrease was not maintained in the second sentence probe. Thereafter, a consistent decline in "the + (noun)" responses was obtained in the sentence probe as training on new items was presented. The most extensive decrease occurred when the third noun was added to the training items. Complete noun phrase responses were used in less than 10% of the sentences in the probe. Criterion of 80% generalization of single-word responses in sentence probes was achieved after the child had been trained on four nouns: *boy, pig, rabbit,* and *cow*. In reversal training, therefore, generalization of the trained response was obtained and the pattern of generalization was similar to that obtained in the noun phrase generalization. Single-word responses in reversal training began to occur after one noun had been trained. Criterion of 80% generalization required training on four nouns, however, instead of three, as in the complete phrase training. In the original training, generalization had been slightly greater in the sentence probes. In reversal training, complete noun phrase responses were extinguished rapidly in the FR 3 probes, but were maintained in more sentences over a longer period of training. Perhaps additional cues are present in sentences, or dimension of change is difficult to isolate in a complex structure, such as a sentence.

In the final phase of training the complete noun phrase was retrained so that the child would leave training with the appropriate response in his repertoire. As shown in Figure 1, generalization of the complete phrase occurred, and the child was using "the + (noun)" in 82% of the sentences at the termination of the study.

Another purpose of the study was to investigate if individual training on subject and object noun phrases was necessary before the child began to produce both. In order to explore this possibility, training was provided only on subject noun phrases while probes were presented on subject and object noun phrases. Since object noun phrases were never trained, they were probed only in sentences. Results on object noun phrase generalization during the training program are presented in Figure 2.

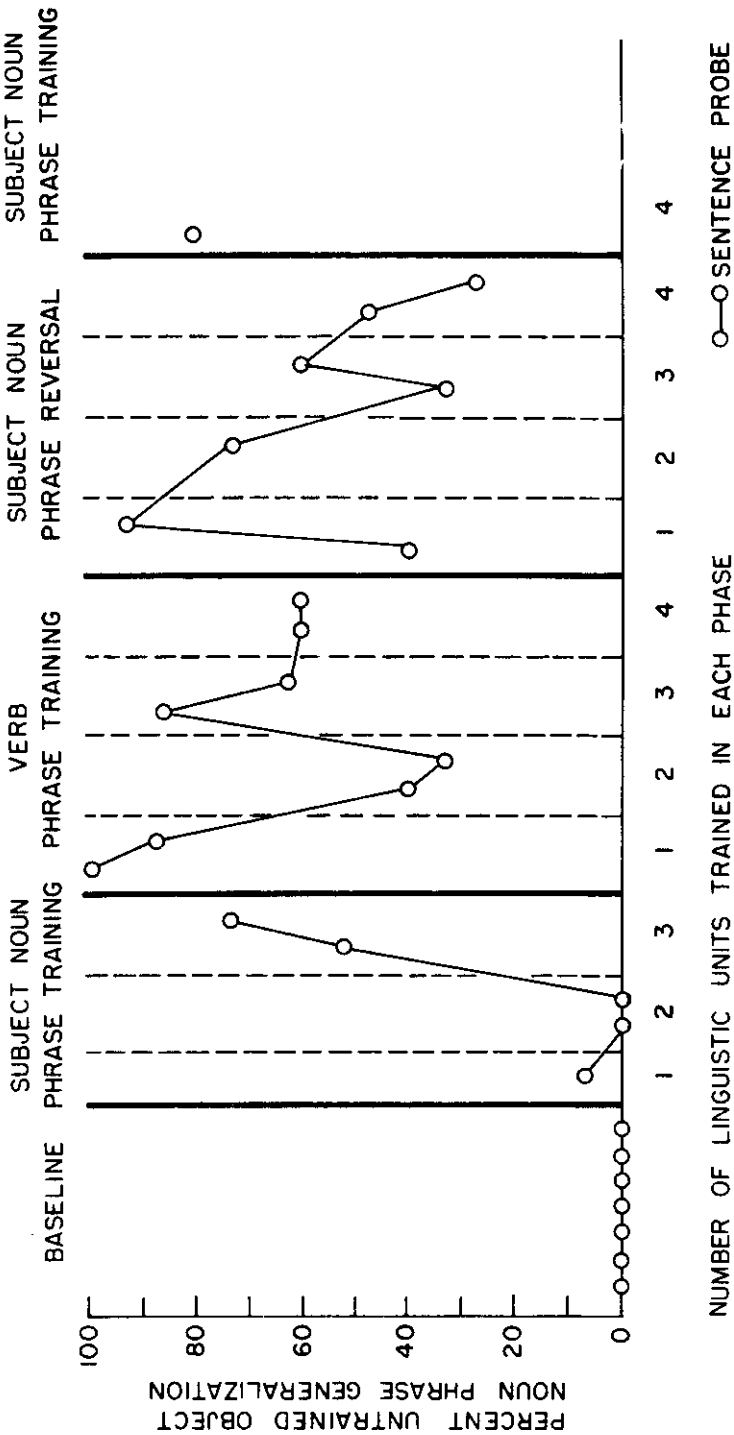


FIGURE 2. The percentage of object noun phrase generalization that occurred after each training phase on the sentence probe.

Generalization to object noun phrases was demonstrated. Several aspects of the generalization data may be considered to provide evidence that a functional relationship between the two phrases was demonstrated.

A decided increase in correct use of complete object noun phrases occurred after three subject noun phrases had been trained. An increase from zero in the two-item training to 73% correct use in the three-item training provided the strongest evidence that the two phrases could be members of one response class. Earlier it was suggested that several differences between the noun phrases might operate against the possibility that generalization would occur. For example, the subject phrase was always in the initial position in a sentence and the object in the final. The subject was the actor, whereas the object phrase was that which was acted upon, and, finally, in the present sentences, the subject phrase always consisted of an animate noun while the object phrases consisted of inanimate nouns. The only similarity between the two phrases was one of topography and number of linguistic units, that is, "the + (noun)." Because generalization occurred, these two parameters appear to have been sufficient. It appeared that the child learned a rule for noun phrase structure, that is, a noun phrase, regardless of other factors, is generative in nature.

Additional support for a relationship between the two phrases can be found in similarities between the two noun phrases in their overall pattern of generalization. When subject phrase generalization decreased, so did object phrase generalization. A substantial increase in the number of items to which the child generalized in subject noun phrase probes was reflected in a concommitant increase in the number of object noun phrases. For example, during the two-item discrimination training, a decrease in subject noun generalization was reflected in object noun phrase generalization. When the third item was added to training, both noun phrases showed a simultaneous increase in correct use on the sentence probes. Again, correct responses on the two noun phrases decreased in the same probes during verb phrase training. These similar patterns regarding generalization of both noun phrases suggest that they functioned as members of one response class.

Results from the reversal training also suggested that a relationship between the noun phrases was probable. As the child learned to respond to the subject noun phrase picture with singular nouns, his use of *the* in the object noun phrase decreased from a high of 95% to a low of 25% use in the sentence probes. Generalization of the object noun followed generalization of the subject noun.

As in the original training, single-word utterances in subject and object noun probes evidenced similar trends. The largest single drop in the use of *the* in the object phrase occurred when the third noun training had been completed. A similar decrease of *the* occurred in the subject noun probe after the third item had been trained. However, a more rapid decrease occurred in the subject noun phrase utterances. Whereas the subject noun phrase utterances decreased to a low of 10%, object noun phrases never reached that low a percentage.

During reversal training in subject nouns the object nouns were changing in the appropriate direction. That similar changes in both noun phrases occurred when only one was trained may be considered evidence that subject and object noun phrases are related functionally. However, it is possible that the child was not making the subject-object noun phrase distinction since his responses consisted of three specific phrases, each associated with individual pictures. That is, he may have been responding to noun phrases in general, rather than noun phrases as subject and object phrases, because the pictures were always presented individually and in the same order. The child, however, had a stable history of producing both noun phrases in the appropriate and distinguishing locations in a sentence context so that the differences could have been discriminated. With a history of exposure to the respective roles, functions, and locations of subject and object noun phrases within a sentence context, the subject continued to respond to both after training on only one.

In the terminal phase, retraining a complete subject noun phrase, generalization of "the + (noun)" in object phrases was tested once more. As the data show, appropriate responses were occurring to 80% of the sentences when the program was terminated.

Verb phrase training and generalization was not the primary area of investigation in the present study. The verb phrase was trained to provide a framework for looking at subject and object noun phrases in the context of the three necessary components of a complete sentence. However, the verb phrase training served other important functions. It served to demonstrate that the child was not acquiring the verb phrase until specific training for the phrase was administered. The verb phrase provided comparative information on the number of training contexts required for noun phrase generalization, as opposed to verb phrase generalization. Furthermore, it indicated whether the two kinds of phrases influenced each other as training was shifted from subject nouns to verbs and back again. Finally, it provided information as to the pattern of verb phrase generalization in comparison to subject noun phrase generalization. Results on verb phrase generalization in all phases of training are presented in Figure 3.

In the first training condition, which consisted of training the child to respond with "the + (noun)," verb phrases were probed in the complete sentence probe. As the data show, no change occurred in the child's emission of "is + eating." Without specific training in the response, the child continued to emit *eat* during training on all three subject noun phrases.

After the boy had reached criterion of 80% generalization to the subject noun phrases in the sentence probes, verb phrase training was initiated. The child was trained to respond with "is eating" to the second picture in the sequence in which the noun (person or animal) from the subject phrase was pictured in a position appropriate for eating. Verb phrase generalization was tested in three contexts: (1) verb phrase only to all untrained verb phrase pictures; (2) verb phrase in the context of the first two pictures representing

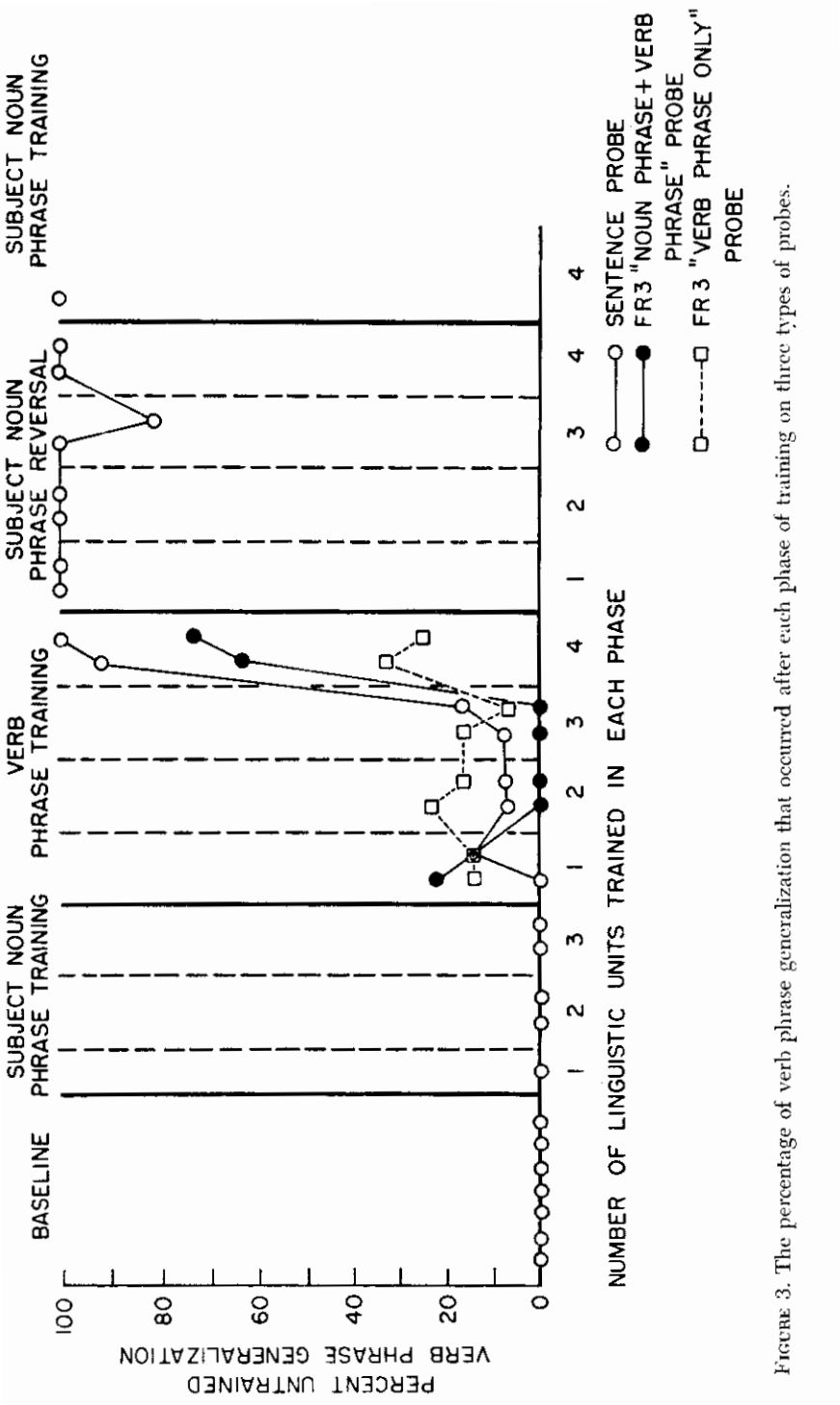


FIGURE 3. The percentage of verb phrase generalization that occurred after each phase of training on three types of probes.

the subject noun phrase and verb phrase, for example, "the boy + is eating"; and (3) all three pictures representing complete sentences, for example, "the boy + is eating + the pie." The first two contexts were probed within training sessions when the child was on an FR 3 schedule of reinforcement.

Some generalization in all three contexts was obtained after the first verb phrase had been trained. When the second and third verb phrases were added, generalization again occurred but did not increase over that which had been obtained after the first item training. When the fourth phrase was trained, correct verb phrase responses increased to 90% in the complete sentence probe, and the child reached criterion for verb phrase generalization.

The amount of generalization obtained in the three kinds of probes differed considerably. The greatest degree of generalization occurred to the sentence probes. Contexts in which the subject noun phrase was included were next, reaching a high of 70% correct verb phrase use. Discrepancies in generalization across contexts suggest that the cues present in the complete sentences and subject noun phrase contexts functioned to enhance generalization. It seems possible that syntax, for example, was an important dimension for cueing the appropriate verb phrase response in the more complex probe contexts. The verb phrase–only context provided minimal linguistic cues to the child.

Several similarities in generalization of noun phrases and verb phrases were observed. Generalization of verb phrases started immediately after one phrase had been trained, but criterion was reached only after the fourth phrase had been trained. This was also the case in subject noun phrase training. Three items were required in the original training and four in the reversal training. Once verb phrase generalization had reached criterion, it was maintained in the reverse subject noun training, except on one occasion.

CONCLUSIONS AND IMPLICATIONS

The pattern of generalization in the different kinds of probes suggested that syntactic cues have some influence on the degree of generalization. When testing involved the construction alone, so that contextual cues were absent, the child generalized, but to a lesser degree than in the complete sentence probes. Throughout the training program, sentence probes resulted in a higher percentage of correct responses. During reversal training, subject and object noun phrases showed a rapid extinction in the isolated construction probes, but were maintained longer in the sentence probes.

The study also indicated that a child may acquire a grammatical rule after training on a somewhat limited number of items. After only three subject noun phrases had been trained, generalization to both noun phrases occurred at a high level. Only four training items in the verb phrase training were required before the child used the appropriate phrase to 90% of the untrained stimuli. Furthermore, once the response had generalized to most of the items, it remained stable over later sessions of training.

The results have several implications for training. The data suggest that linguistic cues present in a complete sentence may function to increase the amount of generalization. Apparently the child is able to use the syntactic information present in more complex linguistic sequences after he has acquired a construction. Training in grammatical constructions may be facilitated if the child is provided with such cues soon after a construction has been acquired in isolation.

Training involved 15 items, but only three had to be taught for the child to acquire the rule and stabilize the response in his repertoire. Results indicated that generalization may begin after training on just a few items, and only a little additional training is required to assure the child's using the response in the presence of new stimuli. Speech pathologists would do well to test generalization at frequent intervals to determine whether additional training is required. Results of this study suggest that testing may function to increase the efficiency of training. Stremel and Waryas, in their program in Chapter VI, test generalization not only to untrained items but also to each phase of their program. They indicate that time allotted to generalization testing is usefully employed. Their program offers procedures other than those used in the present study for testing generalization.

If subject noun phrases and object noun phrases are members of the same response class, speech pathologists may not need to train both noun phrases specifically. If training on subject noun phrases is sufficient for a child to acquire a noun phrase rule, the efficiency of training would be increased. A speech pathologist interested in using the procedures could, at termination of training, present the child with one composite picture representing each sentence. For example, for the sentence "The dog is eating the meat," the child could be presented with one picture, instead of three, in which the dog is eating meat. If the child produces the declarative sentence with the subject noun phrase and object noun phrase in correct order, he has learned the distinction but has produced the noun phrases as members of one response class. Reversing the order of the two pictures representing subject and object noun phrases also would demonstrate acquisition of the distinction if the child produced them in appropriate order in a declarative sentence.

ACKNOWLEDGMENT

This research was supported by Research Grant HD 00870 from the National Institute of Child Health and Human Development and Grant NS 010468 from the National Institute of Neurological Diseases and Stroke to the Bureau of Child Research at the University of Kansas. Leija V. McReynolds and Deedra Engmann are affiliated with the Ralph L. Smith Mental Retardation Research Center, University of Kansas School of Medicine, Kansas City, Kansas.

REFERENCES

GUESS, D., SAILOR, W., RUTHERFORD, G., and BAER, D., An experimental analysis of linguistic development: The productive use of the plural morpheme. *J. appl. behav. Anal.*, 1, 297-306 (1968).

SCHUMAKER, J., and SHERMAN, J., Training generative verb usage by imitation and reinforcement procedures. *J. appl. behav. Anal.*, 3, 273-287 (1970).

WHEELER, A., and SULZER, B., Operant training and generalization of a verbal response form in a speech deficient child. *J. appl. behav. Anal.*, 3, 139-147 (1970).

APPENDIX

Sentence Stimuli

Subject Noun Phrase	*Verb Phrase*	*Object Noun Phrase*
1. The boy	is eating	the hot dog
2. The pig	is eating	the grapes
3. The rabbit	is eating	the orange
4. The cow	is eating	the tomato
5. The doctor	is eating	the pie
6. The dentist	is eating	the egg
7. The tiger	is eating	the bread
8. The mouse	is eating	the pear
9. The horse	is eating	the meat
10. The bear	is eating	the corn
11. The sheep	is eating	the cookies
12. The bird	is eating	the toast
13. The monkey	is eating	the banana
14. The dog	is eating	the potato
15. The turtle	is eating	the apple

Chapter V

APPLICATION OF FUNCTIONAL ANALYSIS AND A NONSPEECH RESPONSE MODE TO TEACHING LANGUAGE

JOSEPH K. CARRIER, JR.

The work presented here is research in the development of tactics for language training with children with severe communication handicaps. These tactics are characterized by (1) evoking symbolic language in response modes other than oral speech, (2) establishing complex overt rote responses (with certain linguistic properties) before teaching meaning, and (3) programming sequences derived from functional analysis and logic systems rather than from developmental data.

This work began as a simple attempt to replicate, with severely retarded children, the language training procedures Premack (1970) used to teach language functions to a chimpanzee. Later, when data became available from a similar application of Premack's procedures (Schmidt, Carrier, and Parsons, 1971), revisions were made in this programming to make the procedures more directly applicable to teaching language to humans. The disciplines of linguistics, programming, and logic have all made significant contributions to this endeavor.

The critical need for the development of language training tactics for severely impaired children is obvious to individuals familiar with institutions for retarded children. Although there are some excellent teachers and well-constructed programs, the fact remains that many institutionalized children do not acquire speech and language. For them, something more than a simple language training program is needed.

As a child learns language, he begins to conceptualize his environment in a manner that relates to the way other persons conceptualize theirs. He learns the critical parameters for making discriminations among environmental events, and he learns to respond differentially to symbolic stimuli and with symbolic responses. As he learns the nonlanguage skills that are appropriate to adaptation into society, he is often required to make discriminations between environmental events, to respond to symbolic stimuli (verbal instruction), and to make use of other sorts of linguistic skills. The interaction between language and nonlanguage learning is so strong that it is doubtful that

a child can make much progress in learning one without acquiring skills in the other.

Response Mode in Language Training

One way of training severely impaired children in language was suggested by Premack (1970). His use of a nonspeech symbol system and his treatment of language from the perspective of its function rather than its structure greatly simplify the language training process.

If language is defined as a set of rules and principles by which meanings and symbolic representations are correlated, it becomes immediately apparent that language is not overt behavior per se, but that language skills can be demonstrated only by overt responses–symbolic representations in which symbols are selected and arranged in linguistically determined fashions. The response mode most commonly associated with language is oral speech, which can be defined as various phonemic responses arranged to create morphemes, which, in turn, may be arranged to create grammatical utterances. The symbols to be selected and arranged are various combinations of phonemic responses (morphemes), and the response topography is quite complex. Similar conclusions can be made about the complexity of written language and manual communication systems used by the deaf. All these communication systems require a response topography in which the user must, in addition to selecting and arranging symbols, actually produce each individual symbol. This is a complex behavior in any response mode.

Premack's response mode eliminated the need for a complex response topography and, therefore, suggested a fresh approach to teaching language. He used plastic shapes as symbols and required nothing more than the simple placement of the shapes on a response board for responses. In such a system the student is not required to go through the complex response sequences involved in actually producing symbols (articulating, writing, or signing). However, in order to respond appropriately he must still recognize the rules and principles for correlating meanings and symbolic representations; he must still know semantic and syntactic aspects of language. It seems reasonable that a response mode similar to that used by Premack would have the effect of greatly simplifying the language learning process by eliminating the requirement of symbol production and thus facilitating language acquisition in children who could not succeed if speech were required.

Premack's work led to a functional analysis of language–a perspective that eliminates the need to explain the cognitive parameters of language. His work suggested that to learn language a child has only to learn discriminations among different symbols, environmental events, and different sequential arrangements of symbols. When the child appropriately matches specific arrangements of symbols to environmental events, he is in fact demonstrating language.

Finally, it is worth noting that such a symbol system eliminates the transient

qualities of speech responses. The shapes remaining in front of the child make it easier for him to monitor himself and correct his sequences.

Defining What to Teach

It is important for a programmer to define operationally what is to be taught. Program goals such as teaching language or teaching linguistic rules and principles are too vague. It is necessary to specify rules and principles as well as the behaviors that will demonstrate their mastery.

Premack (1970) specified functions of linguistic behavior (that is, identification and interrogation) and then designed response classes to demonstrate these functions. He was interested in demonstrating linguistic functions in a chimpanzee rather than in teaching communication skills to a child and thus had considerable latitude in his selection of specific semantic and syntactic elements to be taught. He chose semantic elements and designed syntactic structures that would permit maximum efficiency in training strategies, but that were not necessarily identical to those used by communicating humans.

The task of teaching children to communicate, of course, does not permit such latitude. The language system of a child's environment is a fact of life, and, however inefficient it may be, is the one the child must learn. Thus, the process of determining program goals for children requires not only a consideration of language functions, but also a consideration of semantics and syntax as they actually exist. In other words, the programmer must select linguistic responses that will serve the communication needs of the child. In the work reported here, it was assumed that it was not necessary to teach language functions separate from environmental language systems, and that the simultaneous teaching of the two would prove more efficient. To this end, an attempt was made to define those operations that an individual might go through to generate grammatical strings that would adhere to the rules and principles and serve the functions of language.

The model generated by this work was in no way intended to simulate any actual processes in which humans engage. For example, no attempt was made to accommodate data describing the normal acquisition of language; the normal development process does not appear to be efficient logically, and, indeed, some language-deficient children may fail to learn language because of the inefficiency of that process. The model used in this work is intended only as a definition of operations that can efficiently generate responses that incorporate linguistic principles–processes that can function in helping to determine sequences, specific steps, and behavior goals for programs.

A MODEL FOR LANGUAGE

Our current language model is quite large and complex, and no attempt will be made to present it in its entirety. Rather, representative portions of the model will be isolated to help the reader understand some of the program rationale.

The first step in the development of this model was an attempt to define operationally two sets of rules and principles, each of which is an integral part of language. Semantic rules consist of those used for the selection of symbols to represent meanings. In writing, the symbol *boy* may be used to represent a young male human. Syntactic rules determine the sequential arrangement of symbols in a standard grammatical response. For example, in an active declarative sentence, the subject noun precedes the verb, and articles precede nouns. In the current analysis, semantic and syntactic systems are treated separately, although each is certainly dependent on the other for ultimate linguistic performance. It should be further noted that this means of operationally defining syntactic and semantic systems was strictly for the purpose of generating a workable model and was not intended, in any way, as an argument relating to their treatment in linguistic literature.

Syntactic Model

The purpose of the syntax parameter of the model was to define operations that would result in correctly arranged sequences of symbols. This is a complex task if one attempts to consider all the transformations suggested in linguistic literature. But, if the problem is approached from a functional perspective, it is somewhat simpler.

Skinner (1957) provided a reasonable and simple means of defining function when he presented the basis for distinguishing between tacts and mands. For the purpose of this analysis these terms were interpreted as meaning that a response might be directed more strongly toward either an antecedent or a consequent event. Operationally, those responses designed to bring about specific consequences are directed toward consequent events and are called *mands*. All others, more strongly directed toward antecedent events, are called *tacts*. The grammatical class called declarative sentences consists of tacts, and the classes called interrogative and imperative sentences are mands. Interrogative and imperative sentences are interchangeable at this level; they can serve the same function. Thus, development of a functional syntax model becomes a matter of describing operations necessary to generate two types of syntactic strings—declarative and either interrogative or imperative sentences. Of the latter two, interrogative forms were chosen because these appeared to have more general applicability.

Interrogative and declarative sentence types have certain properties in common. Both consist of one or more noun phrases and one or more verb phrases with similar constituents. However, the interrogative sentence type is usually marked by a question indicator (*do* and *wh-* words) or a change in the sequential arrangement of constituents; the declarative "The boy is going" has the same constituents as the interrogative "Is the boy going?" but an obvious word-order difference. The model can, in many respects, treat these sentence types similarly, but is also equipped to handle their differences.

The current model consists of several components defining a series of opera-

tions to generate grammatical strings (Figure 1). The first component is designed to construct subject-noun phrases. The second component directs the construction of the verb, and the third component consists of those operations necessary to sequence the constituents of the noun phrase and the verb. Additional operations, such as the inclusion of *wh-* words for interrogatives, prepositional phrases, direct objects, and adverbs, are then included in the model, and operations are delineated for forming compound or complex sentences. Figure 1 is only an outline of the actual model and does not detail the numerous discrete operations within each component. The actual model, at this stage, does not permit many of the transformations referred to in psycholinguistic literature, but it does appear to be adequate for grammatically arranging symbols to represent any meaning.

Semantic Model

As mentioned earlier, the function of the semantic model is to delineate

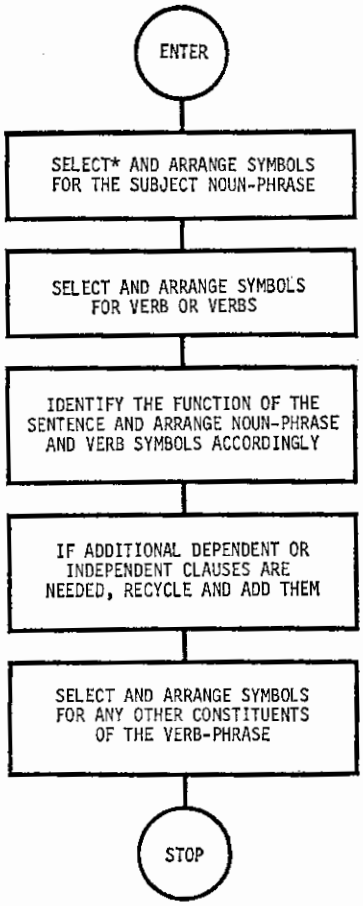


FIGURE 1. Schematic of major modules of syntax. The asterisk indicates the point at which symbols must be selected. The operations for selection are defined in the semantic charts (for example, Figure 2).

operations necessary to select symbols. The semantic model, because there are many functionally determined classes of symbols, consists of several different parts. Each part defines the operations necessary for selecting a specific member from that class. The operations are nothing more than a series of binary discriminations, performed in specific sequences. The critical discriminations and their sequences were logically derived using decision logic tables (McDaniel, 1968) and schematized in flow-chart form. An example for such an analysis appears in Figure 2, where the operations necessary for proper selec-

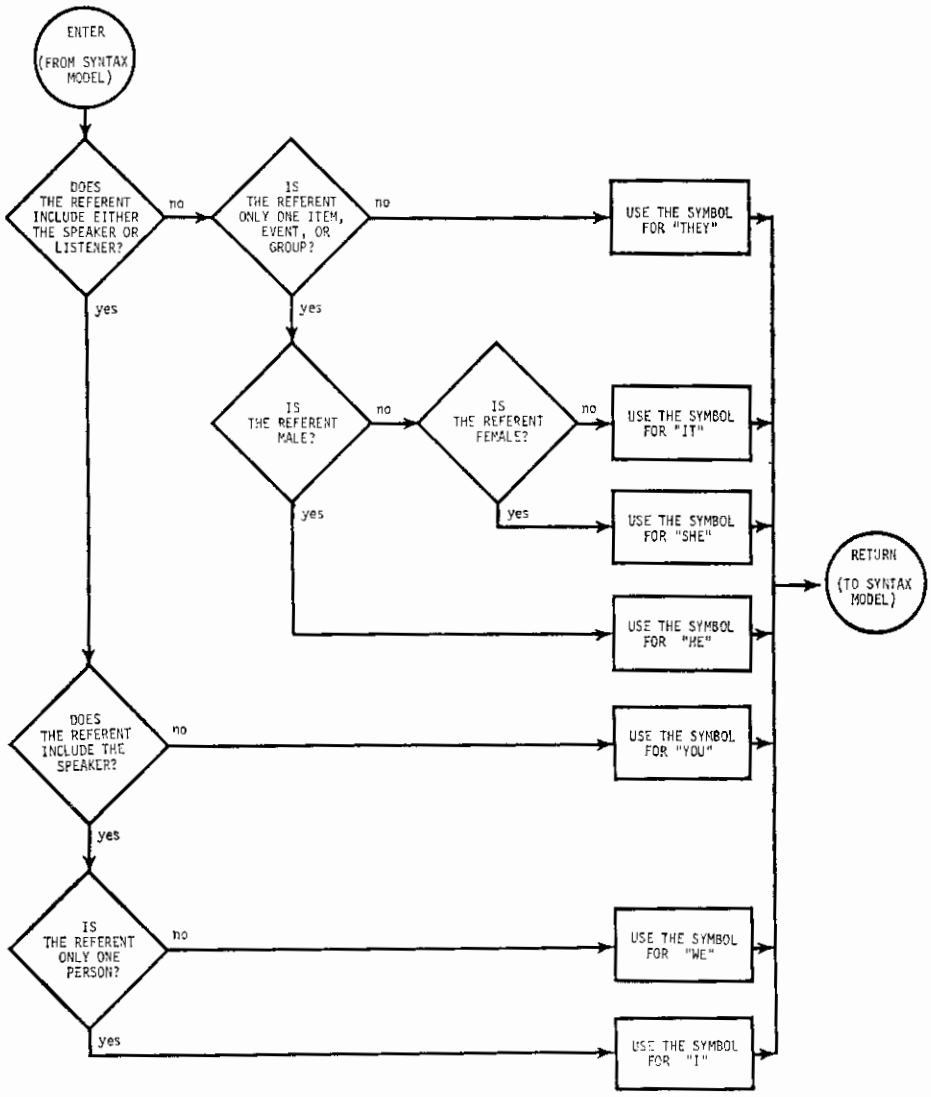


FIGURE 2. Flow chart of subject pronoun selection operations.

tion of subject pronouns are presented. The user, with a specific referent in mind, enters the model and must answer the question "Is the referent either the speaker or listener?" If the answer is no, the user exits that box from the right side. If the answer is yes, the user continues vertically to the next box. He continues to make similar decisions until he has eliminated all but one option and is instructed to use a particular symbol. This schematic permits the user to perform one semantic operation called for in the syntax schematic. The child who learns those operations will be able to make such selections.

Obviously, similar schematics are required for the other classes within the semantic system. Flow charts have been designed for the selection of members of easily quantifiable classes such as articles and conjunctions. Other classes with more members, such as prepositions, nouns, and verbs, are currently being treated in part. That is, systems are being designed to handle only a limited number of entries—vocabulary items chosen as those to be taught earliest in the program sequences.

Application of a Language Model to Programming

With such a model, the matter of determining tactics for language training becomes no more complex than the process of programming any other carefully defined behavior. The model defines those binary discriminations, semantic and syntactic, and a set of operations that will result in appropriate linguistic responses. The program sequences can thus begin with responses already in the child's repertoire and then establish behaviors that indicate mastery of each of the operations specified in the model.

For example, if we set out to teach sentences of the form article + noun + verb, we might begin by teaching the child to sequence properly any set of three items cued in a particular way. We might color cue symbols: all article symbols cued red, all noun symbols yellow, and all verb symbols blue. The child's task, when presented with any combination of three of these symbols, would simply be to arrange them, left to right, in the proper sequence—red, yellow, blue. When he had learned this discrimination, he would be emitting behavior with certain properties of syntactically determined sequences. The sequence would be by color cue rather than symbol function. Nevertheless, it would be identical to the correct syntactic arrangement. A schematic for this behavior (Figure 3A) shows that the behavior represents only a very small portion of the total model, but that it is an approximation of what is desired.

A next step would be to teach the child, through the semantic model, to select appropriate nouns. Successful acquisition of such behavior would add another box to the child's performance schematic (Figure 3B) and make it more closely approximate the final model. Figures 3C and D show the inclusion of additional steps in which the child is taught to select verbs and articles. In each step of the program, the index of language acquisition would increase, and the schematic of the child's performance would expand to more closely approximate ultimate goals. The model, therefore, in addition to suggesting

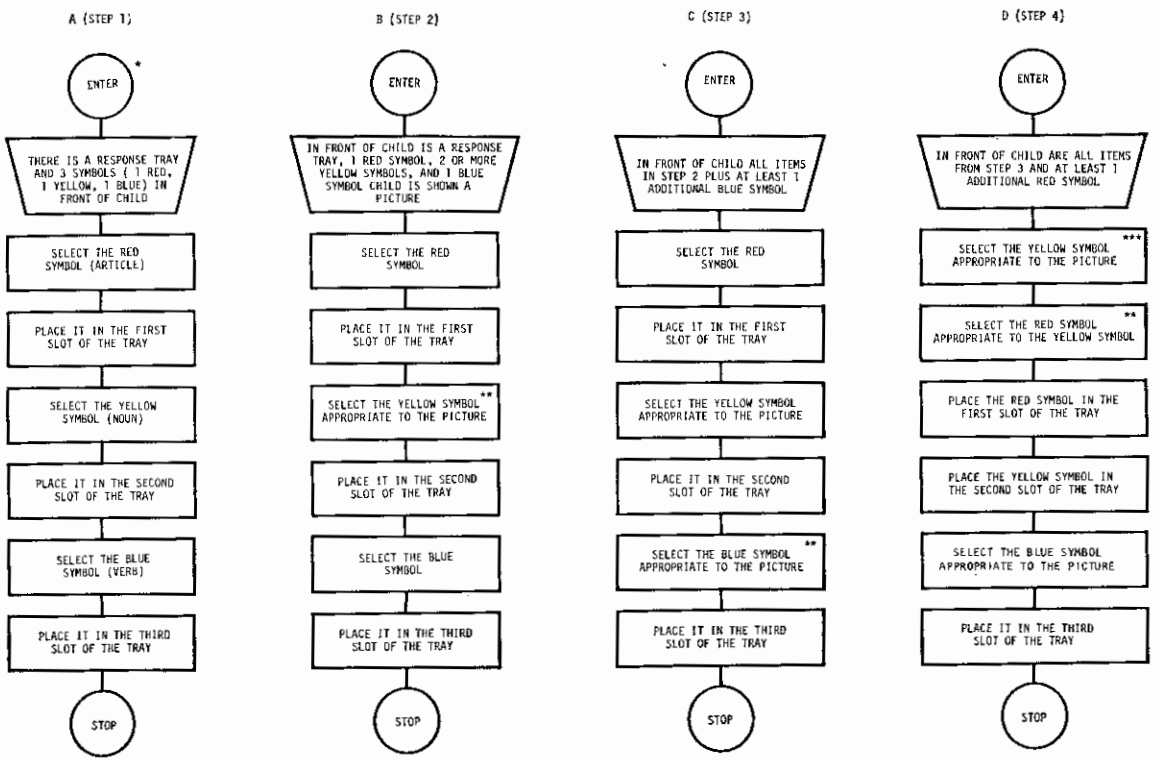


FIGURE 3. Sequence of operations for teaching sentences by using the forms. *This series of operations is carefully shaped (see Rate Sequencing Program for details). **These operations represent gradual approximations of terminal performance. ***The noun must be selected before the article, since article selection depends on noun properties. This phase in the sequence of operations might require an additional step between Steps 3 and 4.

programming sequences, permits continual comparison of the child's performance, via his performance schematic, to the terminal goals of the programs.

There is another very reasonable application of the language model. The child is exposed to a communication environment outside of any therapy room, and he usually has opportunities to learn linguistic rules and principles there. This generalization of the language acquisition process is probably critical to successful language training, and its measurement could, therefore, provide useful information to the programmer. With a master model and the child's performance model, the programmer can observe samples of the child's linguistic performance and precisely identify those operations acquired outside of therapy. Such information might then be used to develop program sequences further and to provide a rationale for deleting steps designed to teach behaviors most children can learn outside therapy.

LANGUAGE PROGRAMS

Although the programs to be presented here do appear to have certain implications for the clinical requirements of language training, they are not intended for direct clinical application in their present form. Rather, they represent on-going research. Their purposes, to date, have been to test the feasibility of the language model and to begin to develop a program model that might later be applied to the actual process of teaching functional language to severely impaired children. Consequently, it has been necessary to impose certain restrictions that would not be necessary, or even efficient, in actual clinical application. The purpose of presenting information here is not to delineate clinical procedures but to report preliminary research and suggest directions for additional research and eventual clinical application.

The nature of the children for whom such programs are being designed is an important consideration. All children for whom data are available have been residents of institutions for retarded children. All were at least eight years of age when the data were collected, and none had been observed using speech for communication. Similarly, none had been able to imitate speech responses of more than one intelligible word. Some were enrolled previously in language therapy in which they were asked to use a speech-response mode and failed to make progress.

In addition, many of these children, when initially seen for therapy, would not follow simple directions or show changes in frequency of responses that the clinician provided consequences for in traditional ways.

The language programs to be presented here all have the following features in common:

1. The symbols for various morphemes to be taught are geometric forms cut from three-inch squares of masonite. Each form is marked on its face with colored tape to indicate the grammatical class of the linguistic constituent it is to represent (noun, verb, article, plural marker, and so on) along with

the written representation (the latter primarily for the clinician's use) of the actual constituent.

2. The response board is a simple plywood tray similar to the tray of a chalkboard. It is 24 inches long and divided into eight three-inch sections by lines drawn on its face. Figure 4 shows the tray and a sample set of forms to represent the sentence "The boy is sitting on the floor."

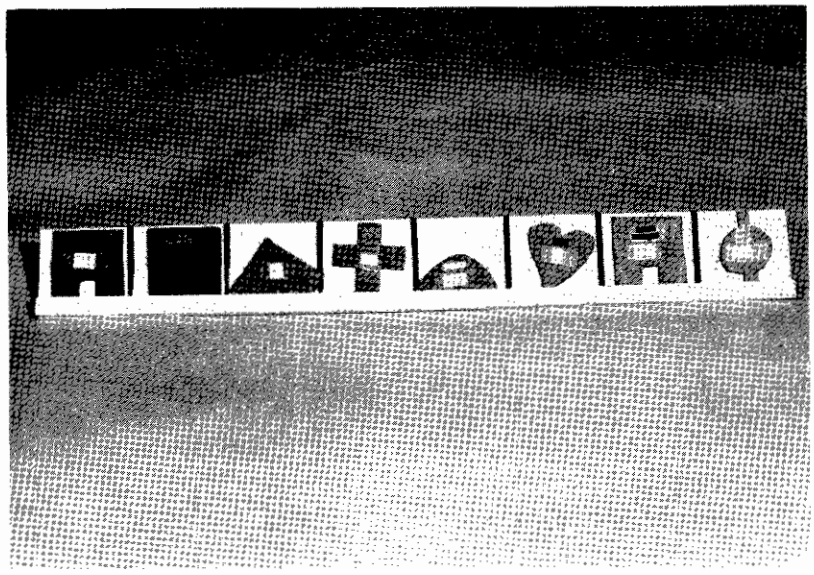


FIGURE 4. Symbolic representation of "The boy is sitting on the floor" (written with geometric forms).

3. The child's response topography is essentially the same as that used by Premack (1970) except that ordering of the forms is done horizontally rather than vertically. It was felt that this might facilitate eventual transfer to conventional reading and writing tasks if such a transfer was later indicated.
4. In all program steps, the child is seated at a table with the response tray directly in front of him. Before the child responds, the clinician places, between the child and the tray, those geometric forms designated by the appropriate step of the program.
5. In all programs, the children are on a continuous schedule of reinforcement for correct responses. Reinforcers are selected on the basis of child preference before each session. The most common reinforcers have been pieces of candy, cereal, or a few drops of soda pop or water. No attempt is made to provide consequences for incorrect responses.
6. The data recorded include pretest and posttest responses (correct and incorrect), records of every correct and incorrect response in each step of the program, and, where appropriate, probe-test performance indicating

stimulus or response generalization. Records also include precise identifying information about stimuli (geometric forms and, where appropriate, pictures) and reinforcers. These data are kept with a cumulative recorder. The cumulative record introduces two new parameters to the data: the child's rate of responding (responses/unit of time) and a measure of the time required for the clinician to perform various operations.

The reliability of the records of correct and incorrect responses, stimuli presented, and reinforcers used has been predictably high. All discriminations required of the record keeper are simple and clear, and the occasional scoring of sessions by an independent observer has indicated 100% agreement. The reliability of the temporal measures provided by the cumulative recorder may, however, be another matter. With the clinician activating the time markers on the recorder when stimuli are presented and when the child responds, the validity of these measures may be in question. Until validity is established, the matter of reliability is a moot question.

Labeling Program

The first program in the series was designed to teach a child to use 10 symbols to represent 10 environmental events that might, ordinarily, evoke noun responses. This program uses procedures similar to those often used to teach single nouns to children. Picture stimuli represent each of the 10 objects, and 10 different geometric forms are used as the symbols. The pretests and posttests and procedures for administering this program are presented in Appendix A.

After the child has been pretested and program sequences to meet his individual needs have been planned (completion of the stimulus key), he is taught that, when one form is between him and the tray and he is shown a picture, he is to place the form in the tray. In the next step, he is presented a choice of two forms, for example, a square for *boy* and a circle for *girl*, and, from one trial to the next, he is shown a randomly selected picture of either a boy or a girl. When he has responded correctly 10 consecutive times, another form is added, for example, a square for *boy*, a circle for *girl*, and a triangle for *man*, and pictures of the three nouns are presented randomly until 10 consecutive correct responses have been emitted. The randomization procedure, at this and all future steps, is designed to insure that about 50% of all pictures presented will be of the noun being learned at this step (for example, *man*) and that the other 50% will be randomly selected from the nouns already learned in previous steps. This progression is continued until the child has met criterion (10 consecutive correct responses) at a step on which all 10 forms are in front of him and all 10 pictures have equal probability of being presented. He is then posttested. If he scores 100% correct, he is moved to the next program. If he scores less than 100%, he is continued in this program, learning the items failed in the posttest. The program is reviewed, the teach-

ing of appropriate items continued, and the posttest repeated until criterion is met.

This program has been quite successful with children for whom clinician control and attending behavior were not serious problems. Such children have progressed very rapidly (see Table 1 for a summary of the data), usually completing the program in about two hours of training time. Error rates have usually been below 10%, and most children have shown total retention when retested one to two weeks after completing the program.

TABLE 1. Summary of data for 60 subjects completing the Labeling Program.

	Total Responses	*Total Errors*	*Training Times (minutes)*
Mean	695.86	86.98	125.38
Standard deviation	671.32	124.04	111.86
Range	58–3469	0–728	8.18–512.2

Unfortunately, the program has not been so successful with some children who do not attend or who do not show responsiveness to clinician control when first entered in the program. They show no apparent progress even after several sessions in which they are required to do nothing more than place a form on the tray. Such children have been removed from the program, run through procedures for establishing clinician control, and then placed back in the program. Under these circumstances some progress has been observed, but it has been extremely slow compared to that of the other children.

It seems unlikely that the children who fail simply cannot learn the appropriate discriminations, although such a possibility may exist for some. The response topography (placing a form on the tray) is not a problem in itself, although, just as speech responding may interfere with language acquisition, this response class may be interfering with discrimination learning. For some children, it may be necessary to program more carefully the stimuli that are to be presented, as Sidman and Stoddard (1966) did, or begin with responses of even less complex topography similar to procedures suggested by Carrow (1971) for testing. In addition to being a successful means of establishing some basic language behavior in some children, the labeling program seems to be a means for probe testing to determine which children may require even more basic types of programs before acquiring labeling behavior.

Rote Sequencing Program

The second program of this series is designed to teach a child to arrange sequentially from left to right, by color and number cues, eight geometric forms in the response tray. The forms that are to be placed in the slot at the left of the tray are always marked with one red stripe, which, in subsequent programs, will indicate that that form is the symbol for an article. The form for the second slot of the tray has one red marker to designate a noun. The

form for the third slot has a green marker to designate a verbal auxiliary. For the fourth slot a dark blue marker is used to designate a verb. The fifth slot has a light blue marker to designate a verb ending (*-ing* or *-ed*), and the sixth slot has a black marker indicating a preposition. The form for the seventh slot has two red markers, and the form for the eighth slot has two orange markers, indicating by color that they are articles and nouns, but by number of markers that they do not go in the subject portion of the sentence sequence. If the child were to know the meaning of the sequences being constructed in this program, all sequences would take the form article + noun + verbal auxiliary + verb + verb ending + preposition + article + noun. This response sequence, when established, is intended to serve as a rote-response skeleton that will function as the vehicle for teaching the child the operations suggested by the semantic and the syntactic models. At this level it does not function communicatively, and, in that sense, is not syntactic performance. However, it is precisely the same behavior that, emitted in a communicative context, will serve as evidence of syntax acquisition. Figure 5, in which this behavior is schematically represented, shows the child's first actual approximation of the syntax model.

Procedures in this program include pretests and posttests in addition to program steps in which the terminal response topography is gradually shaped. The child is pretested and, if he makes no correct responses, is first taught to place a form with two orange markers in the last slot of the tray. This task is learned easily because a wooden covering is placed across the tray, concealing all but the last slot, and only one form is presented to the child. In the next step, however, the last two slots are uncovered and the child is presented two forms, one with two orange markers (noun) and one with two red markers (article). His task is to place the red-marked form in the first open slot of the tray, then to place the orange-marked form in the last slot. When he performs this task successfully without assistance, new geometric forms with the same color markers are presented to him. To complete this step of the program he must demonstrate generalization to the new forms, that is, demonstrate that he is responding to the color markers. The teaching is continued until such generalization is observed, and then a black marked form is added and the next slot in the tray is made available. This process of adding forms, training and probing for generalization, is continued until the child can take any set of eight appropriately colored and numbered forms and place them, from left to right, in the tray in their correct slots. He is then posttested to ensure his generalization of color cues and the acquisition of the behavior.

The data for 60 subjects who have completed this program are presented in Table 2. Most children show a pattern in which criterion is reached quickly in the first lesson, attained more slowly in Lesson 2, and reached more slowly still in Lesson 3. Most children seem to acquire the concepts of sequencing and placing the new form in the slot farthest to the left, and the remaining tasks are learned very quickly. Some do, however, have unusual difficulty with the last two steps. The children who have been given this program have

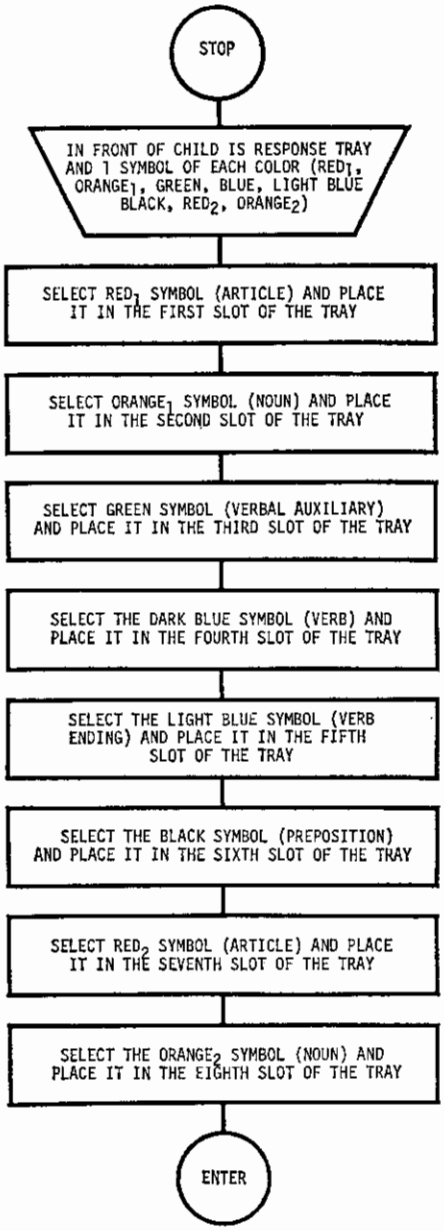


FIGURE 5. Operations performed by child completing the Rote Sequencing Program. Red1 and Orange1 are symbols for articles and nouns that go in the subject noun phrase (they have one color marker). Red2 and Orange2 are symbols for articles and nouns that go in the prepositional phrase (they have two color markers).

TABLE 2. Summary of data for 60 subjects completing the Rote Sequencing Program.

	Total Responses	*Total Errors*	*Training Times (minutes)*
Mean	1761.28	136.86	199.35
Standard deviation	1886.60	177.52	217.20
Range	179–9125	5–1119	16.68–908.7

learned the rote sequencing performance in a mean time of about three and one-half hours and maintained the behavior in subsequent programs.

Subject Selection Program

When a child enters this program, he has learned to select symbols (subject nouns) out of context, and he has learned to sequence, by rote, the eight constituents of one sentence type. This program was designed to combine these two behaviors, that is, to teach the child to select and sequence in one series of operations. The flow chart for these operations (Figure 6) is a step closer to that of the master language model discussed earlier in this writing.

Before entering the Subject Selection Program, the child is again posttested on the 10 nouns learned earlier in the Labeling Program, since the retention of that behavior is necessary for performance on this program. If he makes errors in that test, the Labeling Program is repeated until posttest criterion is met.

The child is then pretested for behavior in the Subject Selection Program. In this pretest, only five of the nouns taught in the Labeling Program are used. The child has in front of him the geometric form symbols to produce a complete sentence appropriate to a picture to be presented, just as he did in the Rote Sequencing Program. But, mixed in with these are four additional symbols representing inappropriate subject nouns. When the child is shown a picture, he is to select the correct article and place it in the first slot of the tray, select the correct subject noun and place it in the second slot, and then place properly, by color and number cues, the other constituents of the sentence. This procedure is used for five different sentences, each with a different subject noun.

If the child does not successfully complete the pretest scoring 100% correct, he begins the program in which only the other five nouns from the Labeling Program are used. Since he has already learned the behaviors required in the program, but has learned them in response to different types of environmental events, the responses required throughout this program have the same basic topography (described in the preceding paragraph); but the events used to evoke the responses are varied to approximate gradually the final desired conditions. Two parameters of these evoking events are varied systematically. The child begins with only two subject-noun options. Then, as he progresses, he is presented three, then four, and finally five possibilities. Similarly, at any level where the number of options is being held constant (two, three, four, or five), the sequence and manner in which the geometric forms are presented are changed gradually (Figure 7). That is, in the first step the child is presented only one form, the article from the first slot of the tray, and then, after correctly placing that form, he is presented the forms for the appropriate number of noun options. Finally, after selecting and placing the noun, he is presented the forms for the rest of the sentence. In the second step the article and noun forms are first presented simultaneously, the responses with these

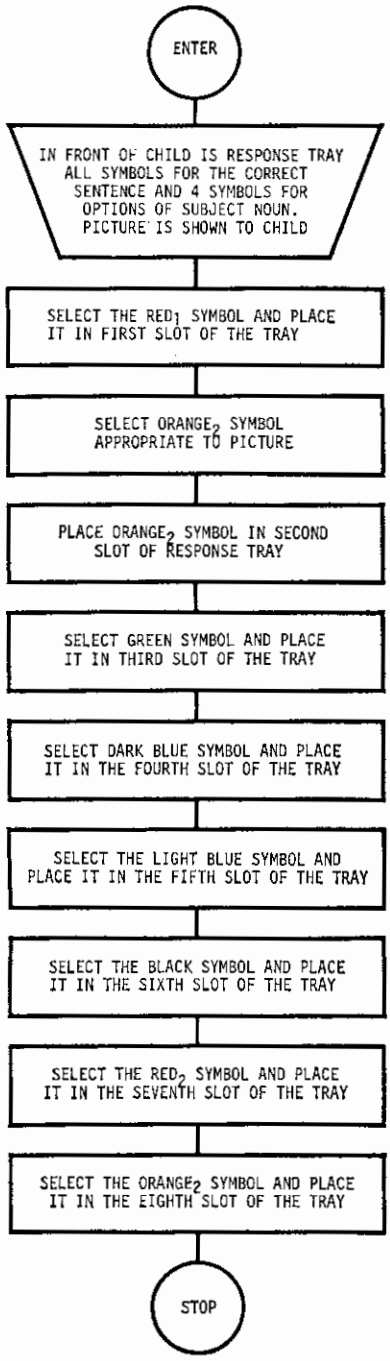


FIGURE 6. Operations performed by child completing the Subject Selection Program.

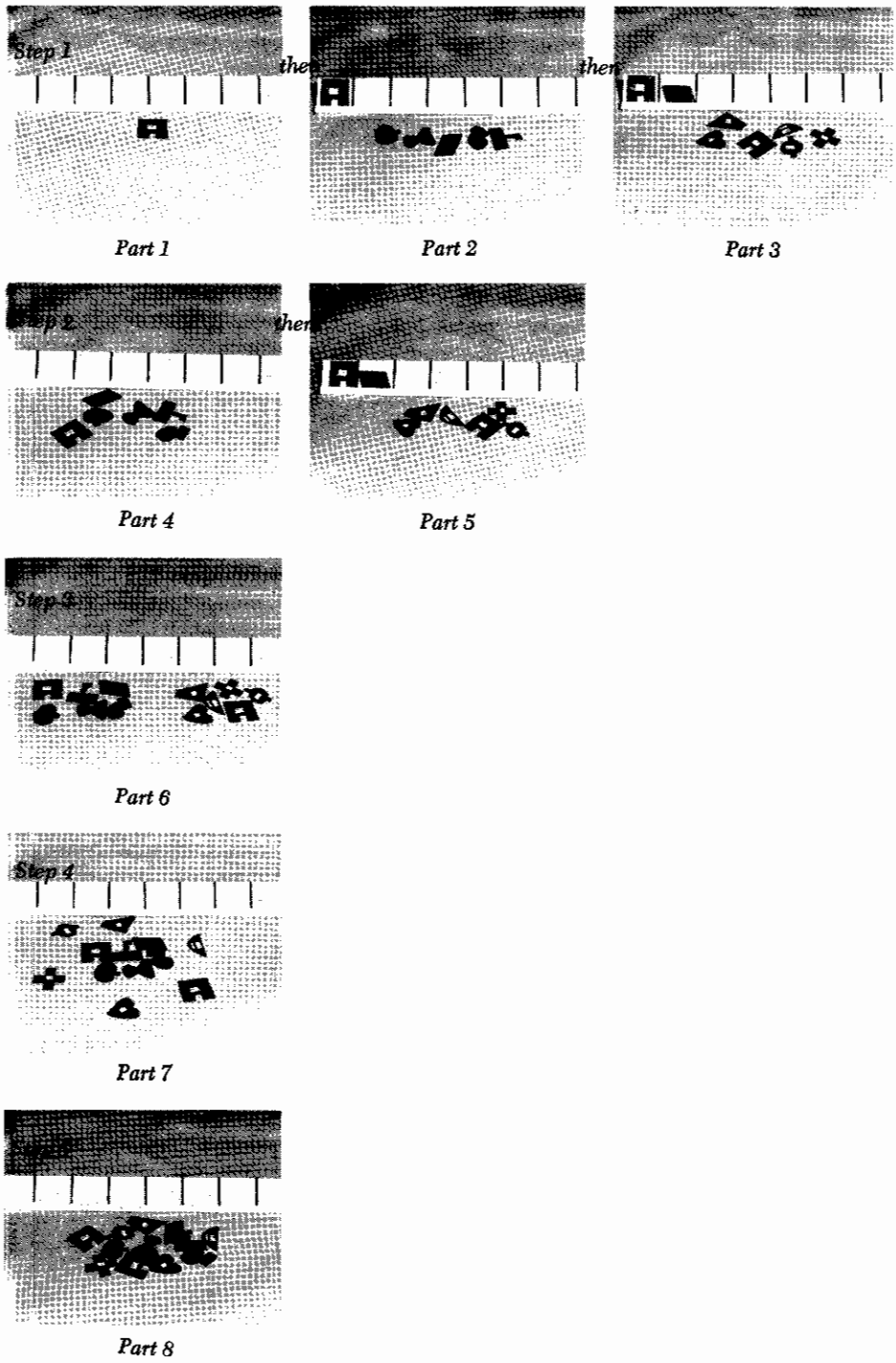


FIGURE 7. Manner of presenting forms for Subject Selection Program (in five steps).

forms completed, and the forms for the rest of the sentence presented. In the third step, forms for the sentence are presented at the same time but placed in two separate groups on the table—article and subject noun options in one group and the rest of the sentence in the other group. In the fourth step, the article and noun groups are placed together and the other forms are placed randomly around that group. In the final step all forms are mixed on the table in front of the child.

Criterion for completing this program is successful generalization from the behavior specific in the pretest. Probes for testing this behavior are made periodically throughout the program and continued until criterion is met, demonstrating that the child has learned the operation of noun selection in conjunction with the sequencing behavior.

The program for teaching this behavior, presented in Appendix C, is lengthy, primarily because of its experimental nature. The gradual changing of the evoking events adds many steps to the program, and the frequent probe tests and procedures for going back to the Labeling Program to teach new nouns make the program, when visually inspected, appear to be extremely long. Although this kind of care is necessary to answer research questions, the data indicate that, for many children, several of the steps that add to the program's length probably will be unnecessary for clinical application.

The children for whom data are available in this program (see Table 3) typically show some of the target performance during the pretest. Some (as in the Labeling Program) select the proper subject nouns and place them in the tray, but ignore the rest of the forms. Others, as in the Rote Sequencing Program, place forms with the correct color and number markers in the appropriate slots, but do not properly select correct subject nouns. Many children actually begin combining the two behaviors and respond correctly in several of the pretest items.

TABLE 3. Summary of data for 50 subjects completing the Subject Selection Program.

	Total Responses	*Total Errors*	*Training Times (minutes)*
Mean	75.52	11.16	75.83
Standard deviation	75.51	30.66	74.24
Range	8–388	0–214	9.7–328.63

Typically, program time for these children has been very short. In fact, most children have met target criterion in the probe test following the first step of the program in which only two choices for subject nouns were available. The mean training time for the program has been about 1.25 hours.

Verb Selection Program

This program is similar in structure to the Subject Selection Program, but there may be a subtle difference in the nature of the learning process required

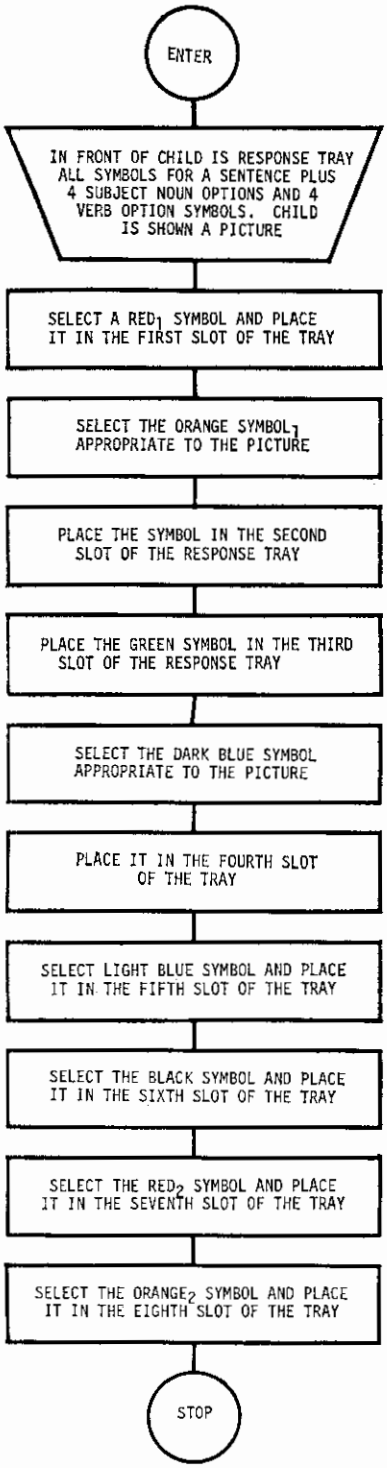


FIGURE 8. Operations performed by child completing the Verb Selection Program.

of the child. Before beginning the Noun Program, the selection process had already been taught in the Labeling Program. In the Verb Selection Program, the selection process is taught at the same time all previously learned behaviors are being required, that is, in context. The schematic of the terminal behavior, again a step closer to that of the master language model, is presented in Figure 8. This program is not presented in the appendixes because of its similarity to the Subject Selection Program.

The Verb Selection Program is very similar in basic structure to the Subject Selection Program in that the general response topography is held constant throughout and only the evoking events are varied. In Step 1 the child is presented forms for the appropriate article, for all nouns previously taught, and for the appropriate verbal auxiliary. He is shown a picture, and, after completing this first part of the sentence, the verb option forms are presented. Finally, the forms for the rest of the sentence are presented. In the next step, the forms (including noun and verb options) through the sentence verb are presented, that part of the response completed, and the rest of the forms presented. The same basic five steps used in the Subject Selection Program are used. Then another verb is added and the procedures for Steps 1 through 5 repeated. In this work only five verbs have been taught to each child, but it is reasonable to conclude from the children's performance that the procedures could be used to teach a greater number of verbs if this were desired.

The data for this program (Table 4) show rapid acquisition of verb selection, with a mean training time of under two hours. However, it should be noted that some children have unusual difficulty with the first two verbs and thus require much longer training times.

TABLE 4. Summary of data for 30 subjects completing the Verb Selection Program.

	Total Responses	*Total Errors*	*Training Times (minutes)*
Mean	412.13	108.63	363.42
Standard deviation	421.93	137.70	453.12
Range	57–1660	3–552	59.15–2240

DEVELOPMENT OF ADDITIONAL PROGRAMS

The Verb Selection Program essentially completes the program model required for teaching a sentence of a specific structure, in this case, article + noun + verbal auxiliary + verb + verb ending + preposition + article + noun. In other words, children should learn to use the additional constituents to pluralize and select verb tense following the same basic procedures employed in the Verb Selection Program. Rather than verbs being varied, as in the Verb Selection Program, options for other constituents, such as articles or prepositions, might be presented. Some data are available regarding such an application of the program model to nouns in prepositional phrases. These

data show patterns and rates of acquisition that are very similar to those observed in Verb Selection Program data. Figure 9 illustrates the general nature of the child's task after completing this program.

When children have learned to select various symbols and arrange them appropriately for this type of declarative sentence, a reasonable progression in the programming might be to begin to teach the child, using symbols already learned, to produce other declarative sentences with different syntactic structures. For example, the child might be taught that certain situations do not call for responses with prepositional phrases, but, rather, call for responses with direct objects or adverbs following the verb. Such training has not yet been undertaken, but it is hypothesized that the program model for such training will include steps similar to those of the Rote Sequencing Program, except that the child will be permitted options in sequences. The choice of options will be determined by characteristics of the evoking events. For example, a picture of a boy sitting on the floor might call for production of the prepositional phrase sequence, while a picture of a boy eating candy might call for a direct object construction. It seems reasonable that a child could learn such discriminations if he could learn some of the others in previously completed programs.

It is anticipated that procedures similar to those used to teach declarative sentence discriminations will also be used to teach interrogative and perhaps imperative sentences. During this process, vocabulary could also be easily expanded.

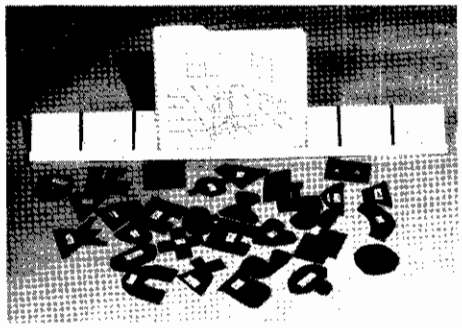
APPLICATION OF PROGRAMS

As previously mentioned, these programs currently are being used on an experimental basis, and they are far from ready for effective clinical application. However, there are certain implications of this preliminary work that may have direct application to clinical procedures.

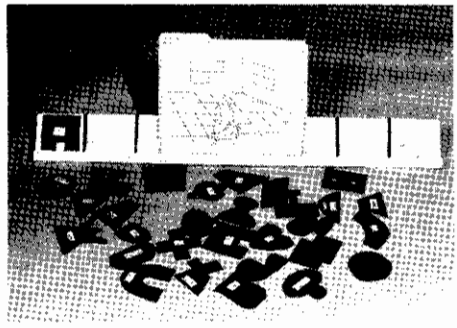
Effectiveness of Nonspeech Symbols in Language Training

First, as suggested by Premack (1970), it seems clear that the process of language acquisition can be separated from complex response topographies such as speech, writing, and manual signing. Further, this work suggests that many children who typically learn very slowly when speech responses are required can learn language (rules and principles) when the symbols are provided for them. This does not mean that all language-handicapped children should learn language in a nonspeech response mode, but it does indicate that such an approach might be effective and efficient for many who have particular difficulty with more traditional approaches.

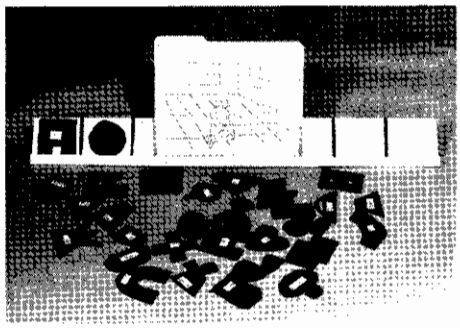
Indications are, however, that even this type of approach to language training may be too complex for some children. The programs using the nonspeech symbols, reported in this work, appear to be effective with some of the children



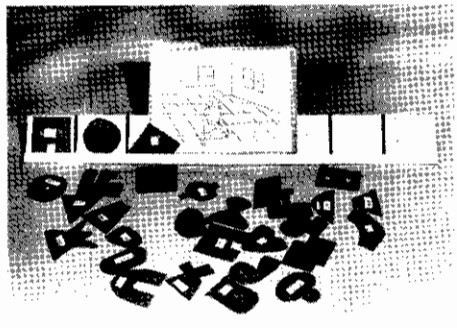
1. Stimuli presented.



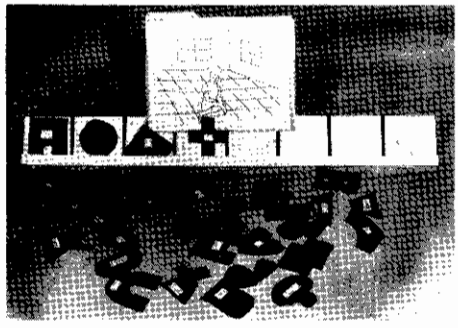
2. Places first article forms.



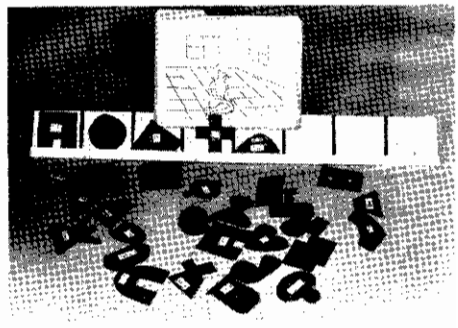
3. Selects and places subject noun.



4. Places verbal auxiliary form.

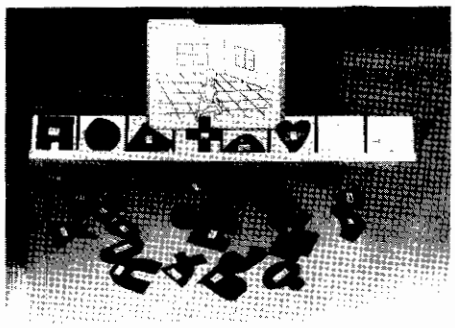


5. Selects and places verb.

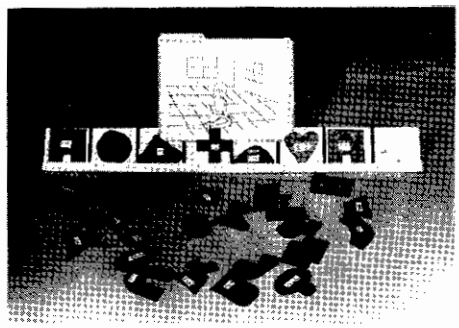


6. Places verb ending form.

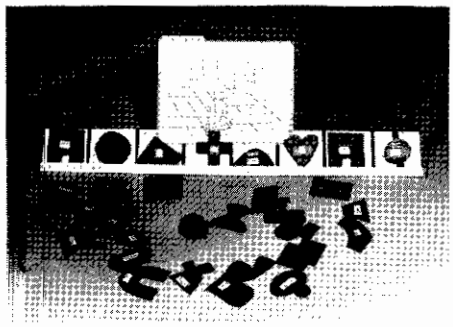
FIGURE 9. Sequential performance of child completing the Object of Preposition Program.



7. Places preposition form.



8. Places second article.



9. Selects and places object of preposition.

for whom they are intended. Still, more basic programming is indicated for others.

Transfer to a More Functional Response Mode

A major problem with a response mode such as the one being used here is the obvious fact that the specific communication system being taught to the child is not likely to be functional in an environment where other symbol sets such as speech are used. There seem to be several ways of approaching the problem of making language functional outside the therapy setting. One such approach was used in some of the earlier pilot work with these procedures. As children "wrote" responses with the forms, the clinician spoke the words being represented. Many children began imitating these words and soon the clinician's utterance was faded and the child continued emitting the speech responses. Reports on one such child, after less than a year of therapy, indicate that he is beginning to speak in other environments and is using some of the complex grammar taught in therapy. This approach is not yet built into the program and cannot be carefully evaluated at this time, but clinical experience does suggest it may be very effective for some children. Eventually, variations of the nonspeech program, designed specifically for clinical application, will probably include such procedures.

A second obvious approach has not been investigated at this time but will quite probably be necessary for some children. This approach would involve carefully programmed transfer of the application of linguistic rules and principles to another, more functional response topography (that is, speech, writing, or manual signing). The nature of such programming would likely be shaping functional responses and gradually substituting them for the geometric forms.

Finally, it might be reasonable, in certain very structured activities, to use the geometric forms for actual communication. The children who are candidates for nonspeech programs presented here are typically children who are also engaged in learning certain basic nonlanguage skills, such as putting on clothes. In those cases where communication between teacher and child might facilitate learning, it would be possible to teach the child language responses appropriate to a specific nonlanguage behavior and introduce a set of forms and a response tray into the other learning situation. The teacher using the written words on the forms as cues would arrange the forms to represent instructions, and the child could ask questions and provide other types of appropriate feedback. Such procedures could be initiated easily where sequences for teaching nonlanguage behaviors were specified carefully and when teachers of those skills were willing to cooperate. This type of functional usage of the geometric forms is certainly not the ideal, but it might be extremely useful for making all of the child's learning experiences more efficient and for demonstrating the power of communication to him.

Initiating Training in Another Response Mode

It should be mentioned that neither the language model nor the program model discussed in this work need be restricted in application to training procedures using the geometric form symbols. Although there is no evidence in this work to validate the application of the models to language training using other response modes, it does seem logical to make such a generalization. The application of such models to language therapy to teach speech or manual signing might greatly simplify the programming task of the clinician and result in very specific program strategies that might enable some clinicians to be very precise in describing their therapy and its relation to the total process of language training. Such a switch in the response mode would involve no program changes except slight variations in specific evoking events and criteria for calling responses correct.

Nonessential Parameters of the Program Model

Although lack of substantive data makes positive conclusions impossible at this time, the data from performance on the Verb Selection Program strongly suggest that the Labeling Program is probably not essential to the language intervention process for many children. If children learn verbs in context as they do in the Verb Selection Program, it would seem reasonable that they

might learn various other constituents in context. If such is the case, the Labeling Program is not necessary for teaching nouns per se. It might, however, as suggested earlier, serve either as a convenient means of beginning discrimination training at a simple level or as a source for certain kinds of prognostic or diagnostic information.

Use of More Functional Evoking Events

All the work presented here has used pictures as events to evoke responses; however, although pictures were the most convenient stimuli for this kind of experimental work, their use in clinical application is certainly questionable. A child in his out-of-therapy environment is seldom asked to respond to pictures. Rather, he is faced with environmental events, such as questions, bladder pains, sensations of hunger, and the like. It would seem much more functional to teach responses to such situations to a child so that responses learned in therapy could be easily used to generate consequences in his everyday environment. Descriptive information about the environment and activities of children could be inspected to deduce specific linguistic responses that might have high probabilities of being used. These responses could be taught using the same language and program models.

CONCLUSIONS

The purpose of the work reported here has been to begin to develop two models—one for operationally defining goals for language intervention and the other for specifying actual program sequences. This research appears to have clinical implications but has not yet advanced to the point where the programs presented should be recommended for actual clinical application.

In operationally defining language program goals, the unmanageable number of correct linguistic responses was viewed in terms of two of its components—an operationally defined semantic system and an operationally defined syntactic system. Each of these, excluding dialectical variance and temporal change, can be treated as a finite set and, if defined separately, should permit a quantifiable, all-inclusive description of language. Tactics for developing a language model were derived from functional analysis as suggested by Premack (1970), linguistic literature, and logic systems. The results of such analysis have been used as rationale for programming tactics.

The language programs presented in this paper are unlike traditional language programs in a number of ways. It was assumed that the complex nature of the speech response system often interferes with language acquisition when speech-response-system responses are required in language remediation. Therefore, a nonspeech response mode, similar to that used by Premack (1970), was substituted for speech. In this mode, geometric forms function as linguistic constituents and the child has only to select and correctly arrange forms appropriate to the meaning to be conveyed.

A second feature of these programs is derived from the results of the linguistic analysis. The child is taught, very early in the programming sequence, to produce grammatically correct sentences by rote. These sentences are not necessarily meaningful to the child but are grammatical responses to the stimuli presented. The effect is that the child always uses complete responses and is never reinforced for a partial response as he is in the response-shaping strategies more commonly used in language therapy. Complete responses are established by rote and, as they are repeatedly evoked, the child is taught the differential functions (meaning) of each of the constituents of his response.

A third feature of these programs is that they follow logical rather than developmental sequences. In most instances the two models suggest similar sequences but, where they do differ, the directions indicated by the logic model appear to have higher probability of improving overall language functions.

The specific programs presented in this paper include (1) a program to teach a child to label, (2) a program to teach a child to arrange geometric forms of varying grammatical classes into their correct syntactic order, (3) a program to teach a child to select correct subject nouns and use them in sentences, and (4) a program to teach a child to select correct verbs and use them in sentences.

These programs are still in need of at least two kinds of refinement. First, there remains a need for effective procedures for children who do not progress significantly in these programs. Second, there is a need for considerable work in preparing the programs for clinical application. If these needs can be met, this approach to language intervention may become useful in the process of teaching severely impaired individuals.

ACKNOWLEDGMENT

Some of the work reported and discussed herein should be credited to the following federally funded projects: NICHHD 00870, NICHHD 05088, and OEG-0-71-0449(607).
Joseph K. Carrier, Jr., is a research associate with the Bureau of Child Research, University of Kansas, Lawrence, Kansas, and Parsons Research Center, Parsons State Hospital and Training Center, Parsons, Kansas.

REFERENCES

CARROW, E., Assessment of speech and language in children. In J. E. McLean, D. E. Yoder, and R. L. Schiefelbusch (Eds.), *Language Intervention with the Retarded: Developing Strategies.* Baltimore: University Park Press (1971).

MCDANIEL, H., *An Introduction to Decision Logic Tables.* New York: Wiley (1968).

PREMACK, D., A functional analysis of language. *J. exp. Anal. Behav.*, **14**, 107-125 (1970).

SCHMIDT, M. J., CARRIER, J., and PARSONS, S., Use of a non-speech mode for teaching language. Paper presented at the Annual Convention of the American Speech and Hearing Association, Chicago (1971).

SIDMAN, M., and STODDARD, L., Programing perception and learning for retarded children. In N. Ellis (Ed.), *International Review of Research in Mental Retardation.* New York: Academic (1966).

SKINNER, B. F., *Verbal Behavior.* New York: Appleton-Century-Crofts (1957).

APPENDIX A

Labeling Program

This program is designed to teach a child to label, that is, to use symbols to represent stimuli from the environment.

In this program the stimuli to be used are pictures (of a man or a dog, for example) and the symbol for each picture is a different geometric form cut from masonite (triangle = man, circle = dog). To label, the child must select (from a group of forms in front of him) the one representing the stimulus presented and place that form on a response tray similar to the tray on a chalkboard.

Entry Behavior. Before entering the program, the child should be attentive (look at pictures shown by the teacher) and responsive to some external control (interact with the teacher in a play situation and show consistent increase(s) in frequency of responses that are responded to contingently by teacher-administered events).

Terminal Behavior. Upon completion of the program, the child will be able to label, in the described fashion, 10 objects represented in pictures.

Contingencies. Specific reinforcers are not designated in the program because of the tremendous variance from child to child. A reinforcer is anything presented after the response that results in an increased frequency of the response. For most children pieces of candy, cereal, a few drops of soda pop, or a similar edible item will be effective. For others, verbal praise or a pat on the arm may be adequate. The teacher should begin by hypothesizing a reinforcer and viewing its effect (on a record sheet). If the child is not learning and has met entry criteria, a new reinforcer should be tried.

Administrative Sequences. The program should be preceded by a pretest (Labeling Program Test). After completion of this test, a guide to program sequences, tailored to the needs of the individual child, should be prepared (Stimulus Key Construction). All lessons of the program are then administered (Labeling Program), and upon their completion the Labeling Program Test is repeated as a posttest. If the child does not complete this test with 100% accuracy, a new stimulus key is constructed and he repeats those parts of the program with which he is having difficulty. He continues to recycle through the entire sequence until he scores 100% correct on the posttest. He then goes to the next program.

Labeling Program Test Record Sheet

Name _____ ✓ = correct

Date _____ X = incorrect

Pretest

Form No.	*Response*	*Form No.*	*Response*
1		5	
2		4	
3		3	
4		2	
5		1	
6		10	
7		9	
8		8	
9		7	
10		6	

Posttest 1

Form No.	*Response*	*Form No.*	*Response*
1		5	
2		4	
3		3	
4		2	
5		1	
6		10	
7		9	
8		8	
9		7	
10		6	

Labeling Program Test

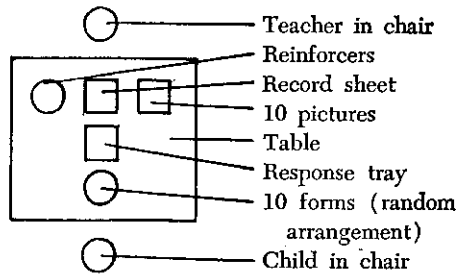
Materials

1. Labeling Program Test Record Sheet and pencil
2. Reinforcers
3. 10 forms
4. 10 pictures

boy	*dog*
girl	*cat*
man	*bird*
lady	*horse*
baby	*cow*

Arrangement of Materials

5. Response tray



Before Administering Program

1. Record identifying information (name, date, and so on) on record sheet.
2. Arrange materials as indicated above.
3. Shuffle pictures.

Administering Labeling Program Test

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1	Show top picture to child.	*Correct:* Child places matching form on tray. *Incorrect:* Child does not place matching form on tray or places more than one form on tray.	If *correct:* Reinforce. If *incorrect:* Do nothing.	If *correct:* Record ✓ and form number on first unused blank on record sheet. If *incorrect:* Record X and form number on first unused blank on record sheet.	After each stimulus presentation, place the picture just used in another pile. AND Repeat Step 1 showing one picture at a time until all pictures are used. THEN

Labeling Program Test (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
					If child did not have 10 correct, go to Stimulus Key Construction. If child had 10 correct, shuffle pictures and repeat Step 1 for 10 more responses. THEN If child did not have 10 more correct, go to Stimulus Key Construction. OR If child had 10 more correct, go to the Rote Sequencing Program Test.

Stimulus Key Construction

Materials

1. Stimulus Key blank and pencil
2. Labeling Program Test Record Sheet

Procedures

1. Identify the numbers of all items missed on the Labeling Program Test.
2. Enter each of these numbers, one item per row, in the blanks in Column A of the Stimulus Key. Stop when each error number has been entered once.
3. Identify the numbers of all items with correct responses on the Labeling Program Test.
4. Enter all these numbers on the Lesson 1 row of Column B of the Stimulus Key. If there were no correct responses, enter 0.
5. In the next row of Column B, enter all items from Columns A and B of the preceding row.
6. Continue Step 5 until Column B has an entry in every row for which there is an entry in Column A.
7. Go to the Labeling Program.

Stimulus Key

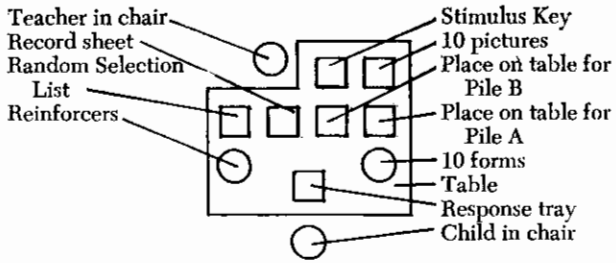
Lesson No.	*Box A*	*Box B*	*Completed*
1			
2			
3			
•			
•			
•			
20			

Labeling Program

Materials

1. Stimulus Key (completed)
2. Reinforcers
3. Labeling Program Record Sheet and pencil
4. Tray
5. Random selection list*
6. 10 pictures — *boy, girl, man, lady, baby*
7. 10 masonite forms — *dog, cat, bird, horse, cow*

(Items 1–5: Arrangement of Materials)



Before Administering Program

1. Record identifying information (name, date, and so on) on record sheet and number the first trial *1*.
2. Arrange materials as indicated above.
3. Select the first uncompleted lesson from the Stimulus Key.
4. Place picture in Column A of Stimulus Key in Pile A on table.
5. Place picture(s) (if any) in Column B of Stimulus Key in Pile B on table.
6. Place one form for each of the pictures in Piles A and B on table between child and tray.

Administering the Program

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1	Show child the picture from Pile A.	*Correct:* Child places matching form on tray. *Incorrect:* Child does not place matching form on tray or places more than one form on tray.	If *correct:* Reinforce. If *incorrect:* Do nothing.	If *correct:* Record a ✓ and the picture number on the first unused blank of the record sheet for this trial. If *incorrect:* Record an X and the picture number on the first unused blank of the record sheet for this trial.	If *correct:* Go to Step 2. If *incorrect:* Go to Step 3.

*The Random Selection List (not presented here) is simply a series of columns containing randomly selected *A*s and *B*s.

Labeling Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
2	Arrange all materials as they were before administering program. Select the first unused letter from the random selection list. Draw a line through that letter to indicate you have used it. Show child a picture from that pile (A or B).	Same as Step 1.	Same as Step 1.	Same as Step 1.	If *correct:* Continue Step 2 until child makes an error or completes 10 consecutive correct responses. Mark that lesson "completed" on Stimulus Key. If this was the last lesson on the Stimulus Key go to the Labeling Program Test. If not, repeat procedures from "Before Administering Program" (above) and begin the next lesson at Step 1 ("Administering the Program"). If *incorrect:* Go to Step 3.
3	Arrange all materials as they were before administering the program. Show child the same picture used for the last response. Point to the correct form.	Same as Step 1.	Same as Step 1.	If *correct:* Record a ✓ beside the mark for the last response. If *incorrect:* Record an X beside the mark for the last response.	If *correct:* Begin a new trial on the record sheet, number it, go back to Step 1, and use, for the first response, the same picture just used. If *incorrect:* Go to Step 4.

Labeling Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
4	Arrange all materials as they were before administering the program. Show child the picture on which he was just incorrect. Point to the correct form and then to the tray.	Same as Step 1.	Same as Step 1.	If *correct:* Record a ✓ beside the mark for the last response. If *incorrect:* Record an X beside the mark for the last response.	If *correct:* Go back to Step 3. If *incorrect:* Go to the Hand-Shaping Program†

†The Hand-Shaping Program is not presented here. It is a carefully sequenced branch program in which the child is first physically "put through" the correct response and then the assistance involved in "putting-through" is gradually faded.

Labeling Program Record Sheet

Name _____

Date _____

Lesson No. ____		Lesson No. ____	
Trial No. ____		Trial No. ____	
Form No.	*Response*	*Form No.*	*Response*
1 ____	_____	1 ____	_____
2 ____	_____	2 ____	_____
3 ____	_____	3 ____	_____
4 ____	_____	4 ____	_____
5 ____	_____	5 ____	_____
6 ____	_____	6 ____	_____
7 ____	_____	7 ____	_____
8 ____	_____	8 ____	_____
9 ____	_____	9 ____	_____
10 ____	_____	10 ____	_____
Total		Total	

APPENDIX B

Rote Sequencing Program

This program is designed to teach a child to arrange sequentially eight geometric forms in a tray in response to color and number cues.

Entry Behavior. Completion of the Labeling Program.

Terminal Behavior. Upon completion of this program the child will be able to sequence properly any set of appropriately color/number cued geometric forms.

Contingencies. Same as in Labeling Program.

Administration Sequences. The program should be preceded with the pretest. The beginning lesson is then selected (Rote Sequencing Lesson Selection) and the program administered. After completing the program for all lessons, the posttest is administered (same as pretest) and the child either recycled through parts of the program or moved on to the Subject Selection Program.

Rote Sequencing Program Test (RSPT)

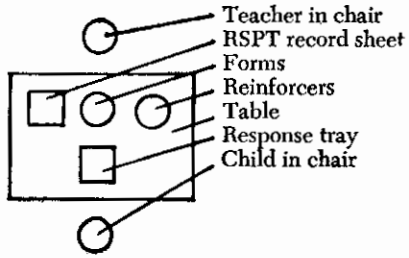
Materials

1. Rote Sequencing Program Test Record Sheet and pencil
2. Forms for

$$\left[\begin{Bmatrix}\textit{The}\\ \textit{A}\end{Bmatrix}\begin{Bmatrix}\textit{boy}\\ \textit{girl}\\ \textit{man}\\ \textit{lady}\\ \textit{baby}\end{Bmatrix}\textit{is}\begin{Bmatrix}\textit{sit}\\ \textit{walk}\\ \textit{stand}\\ \textit{play}\end{Bmatrix}\textit{ing on}\begin{Bmatrix}\textit{the}\\ \textit{a}\end{Bmatrix}\begin{Bmatrix}\textit{floor}\\ \textit{bed}\\ \textit{chair}\\ \textit{sidewalk}\\ \textit{grass}\end{Bmatrix}\right]$$

3. Response tray
4. Reinforcers

Arrangement of Materials



Before Administering Program

1. Record identifying information (name, date, and so on) on record sheet.
2. Arrange materials as indicated above.

Administering the Program

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1	Place forms in front of child for "The boy is sit ing on the floor."	*Correct:* Child places all forms on tray in their proper order.	If *correct:* Reinforce. If *incorrect:* Do nothing.	If *correct:* Place a ✓ on record sheet under each word placed correctly. If *incorrect:* Place ✓s on record sheet for any forms correctly placed and Xs for incorrectly placed forms.	Go to Step 2.
2	Place forms in front of child for "A girl is walk ing on the bed."	Same as Step 1.	Same as Step 1.	Same as Step 1.	Go to Step 3.
3	Place forms in front of child for "The lady is stand ing on a chair."	Same as Step 1.	Same as Step 1.	Same as Step 1.	Go to Step 4.

Rote Sequencing Program Test (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
4	Place forms in front of child for "A man is play ing on the sidewalk."	Same as Step 1.	Same as Step 1.	Same as Step 1.	Go to Step 5.
5	Place forms in front of child for "A baby is sit ing on the grass."	Same as Step 1.	Same as Step 1.	Same as Step 1.	Total ✓s for all five steps. If child has 40 ✓s go to Subject Selection Program Test. If child has fewer than 40 ✓s and has been on Rote Sequencing Program go to Rote Sequencing Lesson Selection; otherwise, go to Rote Sequencing Program and repeat Lesson 8.

Rote Sequencing Program Test Record Sheet

Name _____

Pretest:
Date:

1.	The	boy	is	sit	ing	on	the	floor.
	—	—	—	—	—	—	—	—
2.	A	girl	is	walk	ing	on	the	bed.
	—	—	—	—	—	—	—	—
3.	The	lady	is	stand	ing	on	a	chair.
	—	—	—	—	—	—	—	—
4.	A	man	is	play	ing	on	the	sidewalk.
	—	—	—	—	—	—	—	—
5.	A	baby	is	sit	ing	on	the	grass.
	—	—	—	—	—	—	—	—

Posttest:
Date:

1.	The	boy	is	sit	ing	on	the	floor.
	—	—	—	—	—	—	—	—
2.	A	girl	is	walk	ing	on	the	bed.
	—	—	—	—	—	—	—	—
3.	The	lady	is	stand	ing	on	a	chair.
	—	—	—	—	—	—	—	—
4.	A	man	is	play	ing	on	the	sidewalk.
	—	—	—	—	—	—	—	—
5.	A	baby	is	sit	ing	on	the	grass.
	—	—	—	—	—	—	—	—

Rote Sequencing Program Lesson Selection

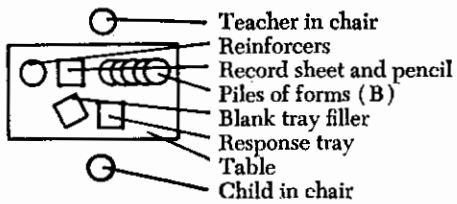
1. If the child has not completed Lesson 1, he is on Lesson 1.
   Construct a pile containing the forms for *floor, chair, bed, grass,* and *sidewalk.*
2. If the child has completed Lesson 1 but not Lesson 2, he is on Lesson 2.
   Construct the pile for Lesson 1 and a pile containing the forms for *the* and *a,* with two red markers.
3. If the child has completed Lesson 2 but not Lesson 3, he is on Lesson 3.
   Construct a pile for Lesson 2 and a pile containing the form for *on.*
4. If the child has completed Lesson 3 but not Lesson 4, he is on Lesson 4.
   Construct a pile from Lesson 3 and a pile containing the form for *ing.*
5. If the child has completed Lesson 4 but not Lesson 5, he is on Lesson 5.
   Construct a pile for Lesson 4 and a pile containing the forms for *sit, stand, walk, lazy,* and *play.*
6. If the child has completed Lesson 5 but not Lesson 6, he is on Lesson 6.
   Construct a pile for Lesson 5 and a pile containing the form for *is.*
7. If the child has completed Lesson 6 but not Lesson 7, he is on Lesson 7.
   Construct a pile for Lesson 6 and a pile containing the forms for *boy, girl, man, lady,* and *baby.*
8. If the child has completed Lesson 7 but not Lesson 8, he is on Lesson 8.
   Construct a pile for Lesson 7 and a pile containing the forms for *the* and *a,* with one red marker.

Rote Sequencing Program

Materials

1. Rote Sequencing Program Record Sheet and pencil
2. Forms in piles designated on Rote Sequencing Lesson Selection
3. Tray
4. Blank tray filler
5. Reinforcers

Arrangement of Materials



Before Administering Program

1. Fill in identifying information (name and date) on record sheet.
2. Arrange materials as indicated above.
3. For all but Lesson 8, count the number of spaces on the tray, from left to right (right to left for the child) to equal the lesson number (that is, if on Lesson 5, count the last five spaces on the tray).
4. Place the blank tray filler so that it covers all but the spaces you have counted.

Administering the Program

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1	Part 1: Place 1 form from each of the piles for this lesson between child and tray.	Part 1: *Correct:* Child selects the first form in the sequence and places it in correct slot.	Part 1: If *correct:* Provide verbal praise. If *incorrect:* Provide verbal "no."	Part 1: If *correct:* Record lesson number and a ✓ in appropriate column on record sheet. If *incorrect:* Record lesson number and an X in appropriate columns on record sheet.	Part 1: If *correct:* Go to Part 2 of Step 1 in column "Evaluate the Response." If *incorrect:* Go to Step 3.
	Part 2: Already presented in Part 1, Step 1.	Part 2: If response is more than one form. *Correct:* Child places each of the rest of the forms in their correct	Part 2: If *correct:* Reinforce. If *incorrect:* Provide verbal "no."	Part 2: If *correct:* Record ✓s in column of record sheet for all elements of response.	Part 2: If *correct:* Go to Step 2. If *incorrect:* Go to Step 3.

Rote Sequencing Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
		slots in left-to-right sequence. If *incorrect:* Child makes an error in selecting or placing one of the forms. STOP CHILD IMMEDIATELY WHEN ANY ERROR OCCURS.		If *incorrect:* Record X in column of record sheet for this element of the response.	
2	Part 1: Same as Part 1, Step 1, but use new forms from same pile where possible.	Part 1: Same as Part 1, Step 1.	Same as Part 1, Step 1.	Same as Part 1, Step 1.	Part 1: If *correct:* Go to Part 2, Step 2. If *incorrect:* Go to Step 3.
	Part 2: Already presented in Part 1, Step 2.	Part 2: Same as Part 2, Step 1.	Same as Part 2, Step 1.	Same as Part 2, Step 1.	Part 2: If *correct:* Go to the next lesson of this program. Begin at "Before Administering Program" (above).
3	Put form on which error was made back on table and point to correct form.	Part 1: If *correct:* Child places correct form in correct slot. If *incorrect:* Child selects incorrect form	Part 1: Same as Part 1, Step 1.	If *correct:* Place a ✓ in column for that element on next row of record sheet and indicate one prompt.	If *correct,* but response from Step 1 or 2 is not complete: Go to Part 2, Step 3. If response is completed without error go to Step 1.

Rote Sequencing Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
		or places it in wrong slot.		If *incorrect:* Place X in column for that element in next row of record sheet and indicate one prompt.	If *incorrect:* Go to Step 4.
		Part 2: If more forms must be placed to fill tray. Same as Part 2, Step 1.	Part 2: Same as Part 2, Step 1.	Part 2: If *correct:* Record ✓s for all elements correctly placed. If *incorrect:* Record Xs for the incorrect element.	Part 2: If *correct:* Go back to Step 1. If *incorrect:* Go back to Step 3, Part 1.
4	Put form on which error was made back on table and point to correct form, then to tray.	Part 1: Same as Part 1, Step 3. Part 2: Same as Part 2, Step 1.	Part 1: Same as Part 1, Step 1. Part 2: Same as Part 2, Step 1.	If *correct:* Place ✓ in column for that element in next row on record sheet and indicate two prompts. If *incorrect:* Place X in column for that element on record sheet and indicate two prompts. Part 2: Same as Part 2, Step 3.	If *correct,* but response from Step 1 or 2 is not complete: Go to Part 2, Step 4. If response is completed without error go to Step 3. If *incorrect:* Go to Hand-Shaping Program for this response. Reenter this program at Step 4. If *correct:* Go to Step 3. If *incorrect:* Go back to Step 4, Part 1.

Rote Sequencing Program Record Sheet

Session _____

Name _____ Date _____

Lesson No.	*Step No.*	*Part No.*	*No. of Prompts*	*Art 1*	*N*	*VA*	*V*	*ing*	*Prep*	*Art 2*	*N 2*
1											
2											
3											
•											
•											
•											
50											

APPENDIX C

Subject Selection Program

This program is designed to teach a child to select subject nouns and place them in context. It is essentially a combination of the behaviors taught in the Labeling Program and the Rote Sequencing Program.

Entry Behavior. Completion of Rote Sequencing Program.

Terminal Behavior. Upon completion of this program the child will be able to select from those nouns taught in the Labeling Program subject nouns appropriate to stimulus pictures and use them in sentence sequences.

Contingencies. Same as in Labeling Program.

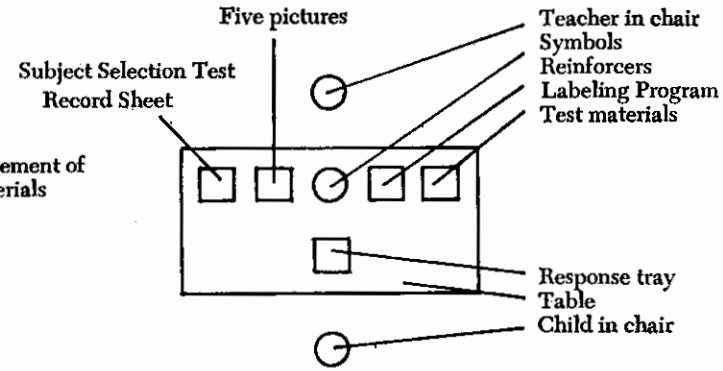
Administration Sequences. The program is preceded by a posttest of behavior taught in the Labeling Program, review of that program if necessary, and a pretest of behavior specific to this program. The beginning lesson for the child is then selected and the five steps of the program begun. Following completion of each step in each lesson, a probe test is administered to examine generalization and the child continued in the program until he has successfully completed the posttest.

Subject Selection Test (SST)

Materials

1. All materials for Labeling Program Test
2. Subject Selection Test Record Sheet and pencil
3. Response tray
4. Symbols for *"The* { *boy, girl, man, lady, baby* } *is stand ing on the floor"*
5. Reinforcers
6. Pictures for *"the boy is standing on the floor"*
   "the girl is standing on the floor"
   "the man is standing on the floor"
   "the lady is standing on the floor"
   "the baby is standing on the floor"

Arrangement of Materials



Before Administering Test

1. Administer Labeling Program Test and reteach any items not remembered.
2. Fill in identifying information (name, date, and so on) on record sheet.
3. Arrange materials as indicated above.

Administering the Test

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1	Place forms for *"the boy / girl / man / lady / baby / stand ing on the floor"* in front of the child and show him the	*Correct:* If symbol appropriate to picture is selected and all forms for that sentence are properly placed on the tray. *Incorrect:* If anything else is done.	If *correct:* Reinforce. If *incorrect:* Do nothing.	If *correct:* Record in all blanks on SST record sheet for that response. If *incorrect:* Record on SST record sheet for any correctly placed and selected symbols and record Xs for all others.	Put the picture just used in a new pile, clear the response tray, and repeat Step 1 until all pictures have been used (five sentences). THEN:

Subject Selection Test (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
	top picture from the pile.				Total the ✓s and if the total is less than 40 go to the Subject Selection Program Lesson Selection. If the total is 40 go to the Verb Selection Program.

Subject Selection Test Record Sheet

Name _____ Date _____

Posttest _____ Pretest _____

Lesson No.	*Part No.*	*No. of Prompts*	*Art 1*	*N 1*	*VA*	*V*	*ing*	*Prep*	*Art 2*	*N 2*
1										
2										
3										
•										
•										
•										
10										

Subject Selection Program (SSP) Lesson Selection

1. If the child has not completed Lesson 1, he is on Lesson 1.
   Use the symbols for "The (cat, dog) is stand ing on the floor."
   Use pictures for "The cat is standing on the floor" and "The dog is standing on the floor."
   Place the dog picture in the A pile and the cat picture in the B pile.
2. If the child has completed Lesson 1 but not Lesson 2, he is on Lesson 2.
   Use all symbols from Lesson 1 plus the symbol for *bird*.
   Use all pictures from Lesson 1 plus a picture of "The bird is standing on the floor."
   Place the dog and cat pictures in Pile A and the bird picture in Pile B.
3. If the child has completed Lesson 2 but not Lesson 3, he is on Lesson 3.
   Use all symbols from Lesson 2 plus the symbol for *horse*.
   Use all pictures from Lesson 2 plus the picture of "The horse is standing on the floor."
   Place the dog, cat, and bird pictures in Pile A and the horse picture in Pile B.
4. If the child has completed Lesson 3 but not Lesson 4, he is on Lesson 4.
   Use all symbols from Lesson 3 plus the symbol for *cow*.
   Use all pictures from Lesson 3 plus the picture of "The cow is standing on the floor."
   Place the dog, cat, bird, and horse pictures in Pile A and the cow picture in Pile B.

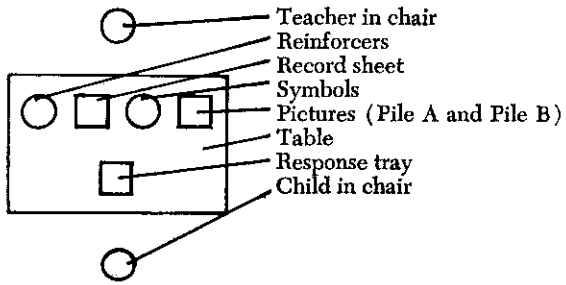
When the lesson is selected and materials arranged, go to the Subject Selection Program (Step 1).

If the child has completed Lesson 4 of the SSP and still fails to meet criterion, teach five new nouns with the labeling program and begin the Subject Selection Program at Lesson 1 for those nouns.

Subject Selection Program

Materials
1. Subject Selection Program Record Sheet and pencil
2. Pictures and forms indicated by lesson selection
3. Reinforcers
4. Response tray

Arrangement of Materials



Before Administering the Program
1. Fill in identifying information on record sheet.
2. Arrange materials as indicated above.
3. Begin Step 1a with the picture in Pile B.

Administering the Program

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1a	Place symbol for *the* (one red marker) in front of child. Show child the picture.	*Correct:* If symbol is placed in first slot of tray.	If *correct:* Provide verbal praise. If *incorrect:* Provide verbal "no."	If *correct:* Record ✓ in appropriate slot of record sheet. If *incorrect:* Record X in appropriate slot of record sheet.	If *correct:* Go to Step 1b. If *incorrect:* Go to Step 6.
1b	Place subject noun symbols for this lesson in front of child. Show child the picture.	*Correct:* If symbol matching picture is placed in second slot of tray.	Same as in 1a.	Same as in 1a.	If *correct:* Go to 1c (remove other noun symbols from table). If *incorrect:* Go to Step 6.

Subject Selection Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
1c	Place symbols for rest of sentence in front of child. Show child the picture.	*Correct:* If all forms are placed in proper slots as in Rote Sequencing Program.	If *correct:* Provide verbal praise for each symbol correctly placed and present reinforcer when sentence is complete. If *incorrect* on any symbol: stop and provide verbal "no."	If *correct:* Record ✓s in appropriate slots of record sheet. If *incorrect:* Record X in slot for symbol not used correctly.	If *correct:* Go to A-B list,* choose a picture from the designated pile, and repeat Steps 1a-1c until five consecutive sentences have been produced without error. Then, repeat SNP Test and if child scores less than 100% go to Step 2a. If *incorrect* on any symbol: Go to Step 6 for that symbol.
2a	Place symbols for *the* (one red marker) and subject nouns for this lesson in front of child. Select a picture from the A-B list and show that picture to the child.	*Correct:* If article and appropriate noun are placed sequentially in correct slots of tray.	If *correct:* Provide verbal praise after placement of each symbol. If *incorrect:* On either symbol stop responding and say "no."	If *correct:* Record ✓s in appropriate slots of record sheet. If *incorrect:* Record X in slot for that symbol not used correctly.	If *correct:* Go to Step 2b. If *incorrect:* Go to Step 6 for that symbol.
2b	Same as 1c.	Same as 1c.	Same as 1c.	Same as 1c.	If *correct:* Repeat Steps 2a and 2b until five consecutive sentences have been produced correctly. Then, repeat SNP Test and if the

*Use the same A-B list (Random Selection List) used in the Labeling Program and use it in the same way.

Subject Selection Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
					child scores less than 100% go to Step 3. If *incorrect:* Go to Step 6 for that symbol.
3	Place all symbols used in Step 2a in one pile and all symbols from 2b in another pile in front of child. Select a picture from A-B list and show it to child.	*Correct:* If all appropriate symbols are placed in proper slots in left-to-right sequence.	Provide verbal praise after correct placement of each symbol and present a reinforcer when sentence is completed. If *incorrect* on any symbol: Stop responding and say "no."	Put ✓s in appropriate slots on record sheet for all properly placed symbols. Put X in slot on record sheet for symbol.	If *correct:* Repeat Step 3 until five consecutive sentences have been produced correctly. Then repeat SNP Test and if child scores less than 100% go to Step 4. If *incorrect:* Go to Step 6 for that symbol.
4	Place symbols from 2a in one group in front of child. Place symbols from 2b in circle around that group. Select a picture from the A-B list and show that picture to the child.	Same as in Step 3.	Same as in Step 3.	Same as in Step 3.	If *correct:* Repeat Step 4 until five consecutive sentences have been produced correctly. Then, repeat SNP Test and if the child scores less than 100% go to Step 5. If *incorrect:* Go to Step 6 for that symbol.
5	Mix all symbols from Step 4 in front of child.	Same as in Step 3.	Same as in Step 3.	Same as in Step 3.	If *correct:* Repeat Step 5 until five consecutive sentences have been

Subject Selection Program (Cont.)

Step	*Evoke the Response*	*Evaluate the Response*	*Provide Consequences*	*Record the Response*	*Select the Next Step*
	Select picture from A-B list and show it to child.				produced correctly. Then, repeat SNP Test and if the child scores less than 100% go to Subject Selection Program (Lesson Selection).
6	Present same symbols presented in previous step. Show child same picture. When child gets to response in which he made the error, point to the correct form.	Same as in Step 5.	Same as in Step 5.	Same as in Step 5.	If *correct:* Go back to previous step. If *incorrect:* Go to Step 7.
7	Same as Step 6 but point to both correct symbol and incorrect slot on tray.	Same as Step 6.	Same as Step 6.	Same as Step 6.	If *correct:* Go back to Step 6. If *incorrect:* Go to Hand-Shaping Program.

Subject Selection Program Record Sheet

Session _____

Name _____ Date _____

Lesson No.	*Part No.*	*No. of Prompts*	*Art 1*	*N 1*	*VA*	*V*	*ing*	*Prep*	*Art 2*	*N 2*
1										
2										
3										
•										
•										
•										
50										

Chapter VI

A BEHAVIORAL-PSYCHOLINGUISTIC APPROACH TO LANGUAGE TRAINING

KATHLEEN STREMEL *and* CAROL WARYAS

This chapter presents a series of sequential language training programs and assessment procedures for the child who displays delayed or deficient language structures. The individual programs are sequenced according to information on normal language development and data collected in the course of developing the program. Behavior modification techniques have been used to train the language content most effectively and efficiently. Data from 30 mentally retarded children and five normal language-delayed children have been collected over the past two-and-one-half years and used to develop and modify the current language program. The program has been divided into three main sections: (1) Early Language Training, (2) Early-Intermediate Language Training, and (3) Late-Intermediate Language Training.

Most children succeed in mastering a majority of exceedingly complex structures of their native language in three to four years. The normal child, at the end of the preschool period, is able to produce and comprehend—on the grammatical level—almost an endless variety of novel sentences (Slobin, 1971). However, the retarded child consistently displays deficient language functions and delayed linguistic structures. These children are often delayed in their receptive language (comprehension) as well as in their expressive language (production).

PSYCHOLINGUISTIC PRINCIPLES

Linguistic analyses of children's language development have revealed that children's early language can be described as a rule-governed system with sequential stages of development toward the adult model. The regularities in development on the semantic, syntactic, and phonological levels suggest that the acquisition of certain aspects of language may depend on, or at least be facilitated by, a given level of prior development. The present language training program incorporates the best information available regarding the details of the normal language development sequence. Although this sequence

may not be the only way language can be acquired, it represents one way in which language may be acquired.

Children's early utterances appear to be "contentive" in nature, consisting initially of concrete nouns and action verbs, followed by certain semantically less complex adjectives, prepositions, and pronouns. Auxiliaries, determiners, and markers are missing from these early utterances, and they are omitted correspondingly from the beginning stages of language training in this program. Brown (1973) reports that the acquisition of functors appears to be related to growth in the length of utterances: "Absence from earlier stages indicates they are acquired later than basic operations of reference and semantic relations as expressed by content words and word order" (Brown, 1973, p. 11). Since children are initially limited in the length of their utterances, we decided to forestall training on the functors until the children were able to express complete relational concepts with contentive words. It was felt that a child at the two-word stage who could say "boy sit" had more functional communication than one who could say "the boy."

Brown (1973) has indicated that children's early sentences are of two types:

1. (agent) (action) (dative) (object) (locative)

boy	push		car	
	put		car	chair

2. (person affected) (state) (object)

I	want	cookie

The parentheses indicate that one or more elements may be missing, and of course are, depending on sentence length.

The difference between these two sentence types lies in the relationship of the subject to the verb. "I go" would be considered an agent + action relationship while "I want" would be considered a person affected + state, since the subject is the person affected by the verb, rather than the initiator. The primary, and almost exclusive, three-word expressions that were found in the speech of the six children about whom Brown (1973) reports were agent + action + object and agent + action + location. Building toward this from the two-word stage, the agent + action and action + (object/location) stages are used in the present program. Preliminary to this stage, nouns (agents, objects, and locatives) and verbs (actions) are taught.

The structure of children's early utterances is simple in syntactic terms and approximates the deep or base structure posited by the theory of transformational grammar. However, within these simple syntactic structures a variety of semantic relationships and semantic intents may be expressed (Bloom, 1970; Schlesinger, 1974; Brown, 1973). The child does not use syntactic structure to indicate negation and question, although there may be other behavioral indicants of these intents.

From these early stages of development, the child progresses to:

1. Extending the length of his utterance,
2. Expanding his classes of content words and introducing function words,
3. Expanding his lexicon (vocabulary) and refining his semantic categorization of lexical items,
4. Refining his classifications within the phonological system,
5. Acquiring phonological rules,
6. Incorporating external markers of questions and negation into his utterances,
7. Acquiring rules for transforming existing structures into others,
8. Acquiring syntactic rules for refining structures, and
9. Acquiring morphological rules.

This list is not intended to indicate a sequential development of these processes, but it is apparent that certain processes require the prior development of others. For example, let us consider the pluralization of nouns. First the child must recognize that events in the world are either in singles or in multiples and that the language requires that he mark the plurality he observes in some referents. Next, he must acquire the specific morphological rule for pluralizing. The use of the morphological rule depends, however, on the child's phonological development and his ability to employ the correct phonological marker.

Psycholinguistic theory specifies the sequence in which structures emerge and rules for operating on them. These insights form the basis of the training program. Specific developmental data will be presented under appropriate training sections, but the general theoretical contributions to this program may be summarized as follows.

In her study of the early language development of three children, Bloom (1970) identified two types of acquisition, which she termed pivotal and categorical. Pivotal patterns are defined by the use of syntactic operators such as *more* and *no* with substantive forms such as nouns and verbs occurring in fixed syntactic frames. Categorical patterns are defined as structures that use the relational aspects of language to express grammatical functions, such as subject + verb and verb + object. Miller and Yoder (1974) have developed a language program that initially uses the earlier relational function forms and noun + noun forms. The present training program is directed toward the development of categorical patterns, since the goal is the acquisition of the rules for forming grammatical structures to express varying semantic relationships, rather than the acquisition of relatively fixed expressions.

Psycholinguistic theory has also contributed certain procedural principles. First, the program uses expansions as a grammatically progressive procedure for the child. This procedure is more specific than the term *expansion* described in psycholinguistic literature. Our use of expansions provides discrete (single-word), developmentally sequenced (preparatory to the next stage of training) expansions of the child's utterances. For example, if the child is

receiving training on subject + verb structures, the expansion, subject + verb + object, is provided immediately after the child is reinforced for his correct subject + verb response (Child: "Girl eat." Clinician: "That's right. 'Girl eat *cookie*.'").

Second, as indicated by the research of Slobin and Welsh (1973), children's spontaneous utterances in the presence of a referent may be far superior to their imitations when no referent is present. In Chapter III, Ruder, Smith, and Hermann found that nonreferential imitation is not sufficient to establish production. The present training program uses imitation only when it is paired with relevant environmental stimuli. Third, the present procedures emphasize the importance of behavioral indicants of semantic intent as some of the prerequisites for training particular structures. For example, a child is not introduced to negation training until he has given some indication of denial or rejection, such as a head shake in response to some event. This principle, like the second, places heavy emphasis on the primary role of the semantic component of language, as does much of the current developmental psycholinguistic literature (Bloom, 1970; Brown, 1973; and Bowerman, 1973).

BEHAVIOR MODIFICATION PRINCIPLES

Programming

The language training program presented in this paper is divided into three major sections with specific programs and stages of programs being trained within each section. Terminal behavioral objectives are specified for each program and intermediate objectives are provided when a program is trained in stages. The program uses both serial and concurrent orders of training. Each program is presented in a systematic manner so that previous program objectives become prerequisite behaviors for the following programs. The language content of each program is arranged in a series of sequential steps in order that each child have an optimal opportunity to complete that program. Various pretests and probes are provided to help the clinician determine whether a child needs branching steps or whether programs or training steps can be deleted.

Stimulus Control

One of the first tasks in training language is to establish the desired response and then to bring the behaviors under the control of a variety of stimuli. Verbal, motor, written, and visual stimulus modes are used in the current training program. Verbal stimuli consist of echoic stimuli; intraverbal stimuli, which include words and phonemes; questions; and directives requiring a response to visual stimuli. Included in the motor stimuli (mode) are body actions, gestures, and some manual signs. Written stimuli include symbols, letters, and written words. Visual stimuli consist of objects, pictures, photographs, slides,

and the clinician's behavior. Transfer of control may be achieved by pairing stimuli so that a response under the control of Stimulus 1 comes under the control of Stimulus 2 after Stimulus 2 has been paired with Stimulus 1. Prompting and cueing are used as fading techniques to withdraw the stimulus support gradually. The stimuli used and the order in which the paired stimuli are presented depend on the specific linguistic elements or structures that are being trained as well as the progress of the individual child. Stimulus control is programmed so that it involves small sequential steps. For instance, stimulus control for a given training task might be initiated with comprehension tasks and then extended to imitation tasks, responses to an intraverbal, responses to a prompt, verbal responses to a directive, and spontaneous responses.

Responses made by the clinician following the child's response may function as reinforcers and as additional stimuli. This stimulus + response + reinforcement/stimulus system provides the child with a communication system that increases in semantic complexity as language itself begins to reinforce the child.

Responses

The Early Language Training Program specifies that one prerequisite behavior is the child's approximate verbal imitation of a set of 10 consonants and five vowels at 80% criterion. This provides the clinician with a behavior that is under some degree of stimulus control. As the child progresses in training, the phonemes within specific words are shaped by successive approximation. This is done by initially reinforcing the word the child emits, such as /au/ for "house." Later, reinforcement is provided only for a closer approximation, /hau/ for "house," then /haut/. Then only correct responses are reinforced. The child is given a token for a closer approximation of a word in addition to a token for the correct language response, "Boy walk to house." If a child is highly unintelligible after early language training, he may be placed in articulation training for work on a specific phoneme.

Appropriate spontaneous language responses by the child are reinforced by responding to him in a communicative manner. Prompts and correction procedures are used only if they do not interfere with the communicative process. For example, if a child asks a question in an incomplete form, the clinician expands the question and then provides the answer. Inappropriate responses that interfere with the language responses being trained are decreased by time-out procedures or removal of a token.

Reinforcement

Positive reinforcement is established for each child during the course of pretesting and training. Once several reinforcers have been established for a child, a token system is gradually introduced so that the child has a variety of reinforcers available to him. The time taken to establish a token system often depends on the individual child. Some children are initially reinforced

only by receiving an edible for each correct response. Since this type of reinforcer reduces the number of responses that can be emitted during a session, the child is gradually placed on token reinforcement. The number of tokens that the child needs before he can exchange them is gradually increased until tokens are exchanged only at the end of each session for pennies, toys, or edibles or saved for more expensive items.

Social praise is always paired with the tangible reinforcer. Social praise provides immediate feedback to the child and can be presented more efficiently than tangible reinforcement. The type of social reinforcement should vary in order that the child is not satiated by "very good"s. Differential reinforcement is used to establish and maintain specific linguistic responses. A continuous reinforcement schedule is used when a specific linguistic response is being trained. Immediate feedback of the correct response is given if the child produces an incorrect response. Since the child always hears the next target behavior (the clinician's expansion) after his correct response, it is possible that he may produce the slightly more complex behavior before he is required to produce it. If the child produces the next target response before receiving training on it, he is provided with a magnitude of reinforcement (Ayllon and Azrin, 1968). He receives one token for the required response and an additional token for the additional nontrained response. Reinforcement continues to be important long after the child has acquired the specific behavior. Once a linguistic response has been trained to criterion, it is placed on a fixed ratio 2 (FR 2) schedule in order to maintain it, and the next element or structure to be trained is introduced on a continuous reinforcement (CRF) schedule.

Criteria

The criterion levels for the different program steps were established initially by giving various probes to a group of children to determine approximately the number of correct responses the child needed to produce in order to come under the stimulus control of the next step. Adjustment of criterion levels within specific programs was made when some children demonstrated that additional training or branching steps were needed. If a branching step could not be provided, the criterion level on the preceding step was changed so that the child had to produce more correct responses within a fixed number of trials (100% on two consecutive blocks) or produce the fixed number of correct responses within an increased number of trials (90% on four consecutive training blocks).

In most of the programs, the data are recorded in blocks of 10. A 90% criterion level on any training step would mean that the child had to make 18 out of 20 correct responses on two consecutive training blocks.

TRAINING PROGRAMS

The language training program has been divided into three main sections:

I, Early Language Training; II, Early-Intermediate Language Training; and III, Late-Intermediate Language Training. The Early Language Program is crucial for the later programs and is discussed in the greatest detail. The same general procedures for testing and training apply throughout the training programs.

Early Language Training

Before a child is placed in the Early Language Training Program, he is given a pretest to determine if he can produce the required entry behaviors. If he cannot, he may be placed within a training program that emphasizes teaching early developing language skills, such as the program developed by Bricker and Bricker (1974) or a nonoral program such as the one described by Carrier in Chapter V. The following sequence lists the entry behaviors and training tasks within the program.

I. Early Language Training Program

A. Minimal entry behaviors.
   1. Gross attending (stays in chair and demonstrates eye contact).
   2. Following simple directives such as "Look," "Sit down," and "Put coat on."
   3. Comprehension of at least 10 functional nouns.

B. Preferred entry behaviors (in addition to the above).
   1. Attending to stimulus materials and clinician.
   2. Imitation of a sequence of finer motor actions (for manipulation of objects).
   3. Following directives such as "Show me," "Point to," and "Match."
   4. Comprehension of 25 functional nouns.
   5. Consistent (eight out of 10 trials) approximate imitation of a set of phonemes.
   6. Verbal labeling (of pictures or objects) of at least 10 nouns.

C. Early Language Training Sequence.
   The child is placed in the Early Language Training Program if he is able to emit the behaviors listed under A and B. The content of the training program includes the following training items. All of the items are first presented in receptive training if the child does not demonstrate comprehension of the item being trained.
   1. Receptive and expressive training of an expanded noun vocabulary (may run concurrently with verb training).
   2. Verb training (at least 15 verbs are trained before the next training items are presented).
   3. Noun + verb and verb + noun (subject + verb and verb + object) structures. The object constituent may include a locative, "Sit chair"; a direct object, "Eat cookie"; or an adverb, "Run fast." Verb + object structures initially function as requests, for example, "Want drink."

4. Noun + verb + noun (agent + action + object and person affected + state + object), for example, "Girl eat cookie" or "I want ball."
   Once the child has a limited number of noun + verb + noun constituents, these constituents can be combined into additional structures. Additional lexical items can be placed within the constituent structures as the child learns more nouns and verbs.
5. Noun + verb(*-ing*) + noun.
   This training task may be trained later depending on the child's articulatory skill.
6. Pronouns.
   a. First-person singular.
      Possessive case—"*my* coat."
      Objective case—"give *me*."
      Subjective case—"*I* want that."
   b. Second-person singular.
      Objective case—"I give *you*."
      Subjective case—"*you* have candy."
7. Adjectives.
   a. Size.
   b. Color.
   c. Number (if a token exchange is used, a few numbers can be presented between Items C3 and 4).
8. Adjective + noun, for example, "blue ball" or "big car."
9. Prepositions (*in, on, to,* and *with*).
   The prepositions are trained after the noun + verb + noun structure is trained. If the child generally (50%) omits the verb in the noun + verb + preposition + noun structure, noun + preposition + noun training then will precede noun + verb + preposition + noun training.
   Noun + verb + preposition + object training.
   a. Preposition + noun, for example, "on bed" or "to house."
   b. Noun + preposition + noun, for example, "Girl on chair."
   c. Noun + verb(*-ing*) + preposition + noun, for example, "Girl sit on chair."
10. Particles (verb + noun + particle), for example, "put coat on" or "put on coat."
11. Single-word responses to *wh-* questions at appropriate levels.
    a. What (is that)—"Ball."
    b. Who (is that)—"Boy."
    c. What N doing (is N doing?)—"running."
    d. Where (is boy)—(on) "chair."
12. Question inflections paired with a single-word response should be in the child's repertoire at this time. The child's response should be expanded to a two-, then three-word response during Early-Intermediate Training.

a. "What that?" "What doing?"
b. "What that?" "What noun doing?"—"What boy doing?"

13. Simple form of negation markers on trained structures (may be a gesture or "No" response external to the structure), for example, "No —I want car" or "I want car—No."

The Early Language Training Program is designed to train the comprehension and production of (1) the individual constituents of the basic grammatical relations—nouns and verbs; (2) the verbal and gestural stimuli that control the specific constituent responses, such as the *wh-* questions; (3) the basic grammatical structure (subject + verb + object responses); (4) a limited set of pronouns; (5) a limited number of adjectives; (6) a limited number of prepositions and particles; and (7) inclusion of 4, 5, and 6 in the basic grammatical structure.

The clinician may train additional nouns concurrently with initial verb training; however, the description of the procedures of the program will begin with verb training. A sample of the outlined verb training procedures is provided in Table 1. The Early Language Program has been programmed for

TABLE 1. Sample of verb training procedures.

Condition	*Step*	*Stimulus*	*Response*	*Stimulus Mode*	*Response Mode*
Vocal/speech responses to verbal imitative stimuli. Alternate nonvocal discriminations and imitative vocal responses to verbal stimuli.	1a	verbal mand	body action	verbal	motor
	1b	echoic verbal	imitative (verb)	imitative verbal/visual	verbal
	2a	objects/verbal mand	manipulating objects	verbal/visual	motor
	2b	objects/echoic verbal	imitative (verb)	imitative verbal/visual	verbal
	3a	pictures/verbal mand	pointing to pictures	verbal/visual	motor
	3b	pictures/echoic verbal	imitative (verb)	imitative verbal/visual	verbal

paraprofessionals (Stremel, 1971). An example of the programming for one of the verb training steps is presented in Appendix A.

Verb Training. The 10 action verbs that represent the actions of the noun + verb + noun structures to be trained later are selected for training. Initially, two action verbs are selected for training if the child's pretest indicates that he does not comprehend action verbs. These verbs are functional and easily demonstrated by action, pictures, and object manipulation. The types of stimuli are paired and sequentially ordered to allow for the extension of response variation and stimulus control. The training conditions and steps for

verb training will be briefly described. The content for training is given in Appendix B.

Condition I. Imitation of motor responses to motor stimuli. The child is required to make three types of imitative responses: (1) imitation of the clinician's body action (the clinician demonstrates eating and says, "Do this, 'eat'"), (2) imitation of object manipulation (the child is presented only the objects needed to perform the manipulation and a step-by-step model is provided as the clinician says, "Do this, make 'Boy sleep'"), and (3) imitation of pointing to the pictures (two foil pictures are randomly presented with the stimulus picture). The stimulus items that represent the two training verbs are presented in blocks of 10 trials, with five trials randomly presented for each of the two verbs. The child must reach criterion on one step before progressing to the next step. The child is required to imitate nine out of 10 stimulus presentations before advancing to Condition II. Condition I allows the clinician to shape a response by hand if necessary and thus reinforce that response.

Condition II. Matching responses to identical stimuli. The child is required to (1) match pictures to identical pictures (two foil pictures are randomly presented with the stimulus picture) and (2) match object manipulations to previously manipulated models when several objects that could represent an action are available to the child. The criterion of nine out of 10 correct responses in one training block for each step is required before moving to the next training step. The child advances to the following condition after reaching criterion on the final step of each condition.

Condition III. Matching responses to a nonidentical stimulus. The child is required to (1) select one of three pictures in response to an object manipulation (which represents the stimulus verb) paired with the verbal stimulus "Show me, 'Boy eat'" and (2) manipulate the objects in response to the stimulus picture paired with the verbal stimulus "Show me, 'Girl sleep'."

Condition IV. Motor responses to verbal stimuli. The child is required to (1) perform a motor response of body action when a verbal stimulus is provided; (2) manipulate the objects placed in front of him to represent a verbal stimulus "Show me, 'Boy sleep'"; and (3) identify one of three pictures when the clinician gives the verbal stimulus "Give me, 'Girl eat'."

Condition V. Alternate motor responses to verbal stimuli and verbal imitative responses to verbal stimuli. The child is required to (1) respond to the verbal stimulus "Mike, you sleep" (an echoic stimulus, "Say 'sleep'," is presented after each of the child's correct motor responses); (2) manipulate objects to represent the verbal stimulus (an echoic stimulus, "Say 'eat'," is presented after each of the child's correct object manipulations); and (3) identify one of three pictures when a verbal stimulus is presented (an echoic stimulus, "Say 'sleep'," is given after each of the child's correct responses).

Condition VI. Imitative responses to an echoic stimulus paired with an intraverbal (subject) prompt. The child is required to (1) imitate the clinician's verb stimulus after she demonstrates and says, "Stremel 'sleep'"; (2)

imitate the clinician's verb stimulus after she manipulates the objects and says, "Boy 'eat' "; and (3) imitate the clinician's verb stimulus after she presents the picture and says, "Girl 'eat'." After the child meets the set criterion for each step in Condition VI, he advances to Condition VIII.

Condition VII. Imitative responses to questions paired with echoic stimuli. Condition VII is included as a branching condition if the child fails to make 50% correct responses on the first training block under Condition VIII. The child is required to make an imitative response when the question stimulus "What girl doing?" is paired with an echoic stimulus under each of the three stimulus steps involving body action, object manipulation, and picture selection.

Condition VIII. Verbal responses to question stimuli. The child is required to make a verb response when the clinician asks, "What noun doing?" under each training step. The clinician (1) performs a body action and asks, "What Stremel doing?"—"*eat*"; (2) manipulates the objects to represent the stimulus verb and asks, "What boy doing?"—"*sleep*"; and (3) presents a picture and asks, "What girl doing?"—"*eat.*" If the child makes 50% or more incorrect responses on the first training block in Step I, Condition VII is trained to criterion and the child continues training under Condition VIII.

Condition IX. Verbal responses to questions paired with an intraverbal subject prompt. Condition IX is included also as a branching step. It is to be used if the child repeats the "doing" of the clinician's question before producing the correct verb response to the question under Condition VIII.

When the subject meets the criterion of nine correct responses out of 10 attempts on each of the training conditions for the first set of verbs (five correct responses for each verb), the additional eight training verbs are probed under Conditions VIII and V. If the subject meets the criterion of two correct responses out of two attempts for each verb under both Conditions VIII and V, he advances to the noun + verb training. If the subject does not give two correct responses out of two attempts for any one of the eight verbs under either Condition VIII or Condition V, the error verb(s) are trained in two additional sets.

The second set of verbs for training may consist of *sit, stand, look, play,* or only the error verbs in Probe B. The child is given training on the second set of verbs under Conditions IV, V, VI, and VIII, with only pictures being used as visual stimuli. When the child meets the criterion of 90% on two consecutive training blocks (five trials for each verb) under Conditions IV, V, VI, and VIII, he is given a probe on Conditions VIII and V for any additional error verbs. If the child does not give two correct responses out of two attempts on any of the training verbs in the third probe set of training verbs under either Condition VIII or V, those error verbs are trained.

The third set of training verbs is *jump, run, walk,* and *ride.* The child is given training on the third set of verbs under Conditions IV, V, VI, and VIII, with only pictures being used as visual stimuli. When the child meets the criterion of 18 correct responses out of 20 attempts for two consecutive train-

ing blocks under Conditions IV, V, VI, and VIII, he advances to noun + verb training.

Noun + Verb (Agent + Action) Training. The four nouns that represent the agent in the training pictures are paired with the action through the basic strategies of (1) nonvocal discrimination, (2) verbal imitation, and (3) production. Criterion is 90% correct responding on two consecutive training blocks (20 trials) for all training conditions.

Condition I. The child is required to match pictures representing the agent and to manipulate objects to represent agent + action for the verbal stimulus presented.

Condition II. The child is required to make a verbal response of agent + action when a question stimulus paired with the echoic agent stimulus is presented.

Condition III. The child is required to make a verbal response of agent + action when a question stimulus is paired with a picture.

Noun + Verb + Noun (Agent + Action + Object) Training. The major objective of training agent + action + object is to teach the child to give an agent + action + object response to a picture or *wh-* + *do* question stimulus. After the subject gives 90% correct noun + verb + noun responses on two consecutive training blocks, he is asked specific questions about noun + verb + noun constructions, for example, "Who is running?" and "Where is boy running?"

Condition I. The child is required to make a verbal agent + action response to a question stimulus. If the child does not make an agent + action + object response, he is given an echoic object stimulus immediately after he emits the agent + action response.

Condition II. The child is required to make a verbal response to questions paired with only picture stimuli. If the child does not respond with an agent + action + object response to a "what + do" question stimulus, he is given a second trial stimulus of "Who" or "What" and is required to give an appropriate response. Pre- and postgeneralization items include trained constructions to different pictures, pictures that represent trained constituents but untrained constructions, and pictures that represent constructions in which one constituent is untrained.

Person Affected + State + Object Training. Additional types of training procedures and strategies are employed to establish and maintain person affected + state + object responses. The token exchange period is structured to increase the probability that the child has to make a request and gradually make a more complete grammatical response. The procedure used for this type of response employs reverse chaining of the person affected + state + object structure. Gestures are employed for the state verbs and pronouns (first and second singular personal pronouns.) These gestures are paired with verbal responses and then faded.

Pronoun Training. Pronoun usage is then extended to the singular form of the first- and second-person pronouns in the possessive case and objective case,

such as "my coat," "you picture," "give me," "I go bathroom," and "You take paper." These pronouns are the only obligatory pronouns and develop early in normal language development. The child is not required to say "your" because of the difficult-to-articulate *r* phoneme. The plural form of the first-person pronoun (*we*) is trained in the initial phase of the Early-Intermediate Program. A prerequisite behavior for training the first-person pronouns is the child's concept of himself and what he possesses. Even though a child has no label or lexical item for these concepts, he indicates them by gestures or actions directed toward himself. Since the child must initiate these gestures or actions, the possessive and subjective case pronouns are trained in a setting not tightly controlled by the clinician. When the child emits a response indicating himself or his possessions, the clinician provides an echoic stimulus to be paired with the child's gestures. The clinician also points to the child while giving the echoic stimulus "Say 'me'" or "Say 'my coat'." The clinician directs gestures toward herself as she provides the echoic stimulus "Say 'you'" or "Say 'you purse'." These gestures provide the clinician with a tool to reduce the *I-you, me-you* confusion, and they provide the clinician with a form of stimulus control once the echoic stimulus is omitted. The echoic stimulus for each of the pronouns is omitted after the child imitates the clinician's gestures and verbal stimuli for five consecutive trials. The clinician omits the gesture prompt after the child has said the correct pronoun for five consecutive trials. The possessive case pronoun, "*my* coat," and the objective case pronoun, "give *me*," are trained before the subjective case pronoun. *Mine* is trained to function as an individual word, whereas the other pronouns are trained within the context of the verb + pronoun, pronoun + noun, pronoun + verb structure.

Noun + Verb(-ing) + Noun Training. The present progressive *-ing* verb form may be trained after the child has completed noun + verb + noun training. If the child's articulatory skills are poor, the clinician may wait until later to include the *-ing* form within the noun + verb + noun structure.

Preposition Training. Brown (1973) reports that the prepositions *in* and *on* are not only the earliest emerging prepositions, but also some of the first functors in the children's speech. The first prepositions to be trained in the present program are *in, on, with,* and *to.* These prepositions are trained as a part of the verbal structure, that is, "play with car" or "go to cottage." The child is exposed to the prepositions during noun + verb + noun training. The noun + verb + noun structure is expanded to noun + verb + preposition + noun, where the clinician's verbal production of the four prepositions is paired with manual signs.

Once the child meets criterion on noun + verb + noun training, the echoic stimulus for the preposition is paired with the child's gesture after the child has produced the subject and verb of the structure. After the child imitates the verbal preposition stimulus, he is required to say the object and, thus, complete the structure.

If the child omits the verb on at least 50% of the trials on each of two consecutive training blocks, he is placed in noun + preposition + noun training

until he meets criterion on each training step of that program. He is then placed in the final step of training, although some children require a token card that indicates that a four-word response is required. The child is not required to fade his own signing gestures as a prompt. However, verbal responses paired with signing responses are recorded in order to see when the child no longer uses the gestures.

Adjective Training. The adjective + noun structure was chosen for training rather than the noun + adjective structure, since the former form occurs more frequently in children's speech (Brown, 1973). Moreover, it was intended that the adjective + noun construction would be directed toward the elaboration of the noun phrase (NP). The adjective pretest is a brief assessment of size, number, and color attributes. Comprehension and production pretests may include (1) size–big and little; (2) numbers–one, two, five, and ten; and (3) colors–red, blue, green, yellow, orange, black, and white.

Initial adjective training occurs during the token exchange period and the controlled play period. A limited number of functional adjectives are used during the two periods–"(I have) five," "(I want) red," "(I want) blue car," and "(Give) big ball me." Additional colors and numbers are added as training continues–"(I) have two penny–(I) want gum." The child learns that adjectives are functional for specifying his preferences. For instance, if the child points to the big ball and says "Ball," the clinician would first say "Big ball" and let the child play with the ball. After the child has heard the adjective + noun combination several times, the clinician gives the child his nonpreferred item–a little ball. The clinician requires the child to imitate *big* when she gets a negative response from the child for the little ball. After the child imitates the adjective and says "big ball" or "blue car" on five consecutive trials, he is required to say the adjective + noun before he can play with the object. It is necessary for the clinician to have a small array of items that contains pairs of items that differ on one dimension, such as (1) a big white ball and a little white ball, (2) a big blue car and a big red car, and (3) a green block and an orange block. The items can represent a variety of attributes. If the child has difficulty specifying certain colors after he has met criterion on the verbal imitation training, he is placed in training steps involving matching and discrimination procedures (only two colors at a time are presented for training.) Adjective + noun training may run concurrently with the noun + verb and noun + verb + noun training.

Horizontal and Vertical Training Sequence. Although the training programs are presented in a vertical sequence, some of the programs are trained concurrently with other programs. That is, two or three programs may be presented during the same session(s). Appendix C represents a sample of a program sequence for the Early and Early-Intermediate Training Programs. The progression of one program is independent of the other programs. Once criterion has been met for a training element or structure, that training item is reviewed once or twice a week (one or two blocks a session) while a new training item is introduced. If the child's correct responding falls below 80%

on a review item, more review blocks are given. If the child's correct responding falls below 70% on a review item, that item is replaced in the final step of training. A training element or structure is reviewed only it if is not incorporated into the next training element or structure. Current research programs are being conducted to determine how many review trials a child requires to maintain a learned element or structure.

Early-Intermediate Language Training

After individual children have met criteria on the Early Language Training Program, they have the prerequisite behaviors necessary to enter the Early-Intermediate Language Training Program. If possible, the children are placed in group training at this level. The size of the group may vary from three to six children depending on the number of children that are ready for the program. Specific training programs in the Early-Intermediate Program are trained concurrently. The child has recently completed the noun + verb + preposition + noun program and this structure is presented to the child for review. One noun + verb + preposition + noun training block (10 trials) is presented in each training session or every other session depending on the size of the group. Each child is reinforced on an FR 2 reinforcement schedule (every two correct responses are reinforced). The noun + verb + preposition + noun structures are reviewed with pictures and also with the children's and clinician's actions; for example, the child may perform an action himself and say, "I stand on chair," another child may perform an action and the child will say, "Roy sit on table," or the clinician may perform an action and the child will say, "You play with ball." The children are also trained on the initial stages of the *wh-* question program and on the article and pronoun programs. Approximately 15 minutes are spent on each of the three programs. An outline of the training content for the Early-Intermediate Program follows:

II. Early-Intermediate Language Training Program
A. Entry behaviors.
   The behaviors listed under the sequence for the Early Language Training Program are considered prerequisite behaviors for the Intermediate Language Training Programs.
B. Training sequence.
   1. Receptive or expressive expansion of noun, verb, adjective, and preposition repertoire. (Many novel words can be introduced into the child's vocabulary as language training continues.)
   2. Pronouns.
      a. Comprehension of the pronouns is trained first by presenting the gender, human, and number features of the pronoun. Objective case pronouns are trained before subjective pronouns.
         1. *Her, him, it, them.*
         2. *She, he, it, they.*

b. Production (gradually incorporated into trained structures).
   1. Objective case–*her, him, it, them.*
   2. Possessive case–*her, his, their.*
   3. Subjective case–*she, he, they.*

3. Articles.
   a. Definite and indefinite singular.
   b. Plural (*the* or *some*). The articles are gradually incorporated into trained structures.
4. Negatives–contractions.
   a. Pronoun + *don't* + verb + noun, for example, "I don't have candy."
   b. Pronoun + *don't* + verb + indefinite pronoun, for example, "I don't want that."
   c. (Pronoun or noun) + *can't* + verb + noun, for example, "I can't touch ceiling."
5. Copula */is-are/*.
   a. Noun + *is* + adjective, for example, "Ball is blue."
   b. Adjective + noun + *is* + adjective, for example, "Big ball is blue."
   c. Possessive pronoun + noun + *is* + adjective, for example, "My dress is red."
   d. "What is that?"
6. Auxiliary */is-are/*.
   a. Noun + *is* + verb-ing + noun, for example, "Girl is drinking pop."
   b. Noun + *is* + verb-ing + preposition + noun, for example, "Boy is sitting on bed."
   c. What + *is* + noun + *doing*?, for example, "What is man doing?"
   d. Where + *is* + noun + verb-ing?
   e. Noun + *is* + verb-ing + preposition + noun.
7. Negatives–*is* + *not.*
   a. Indefinite pronoun + *is* + *not* + noun, for example, "That is not horse."
   b. Noun + *is* + *not* + adjective, for example, "Ball is not red."
8. Replacement and expansion of noun phrase within trained structures.
   a. Noun + is + verb-ing + pronoun (direct object), for example, "Girl is chasing *him.*"
   b. Noun + is + verb-ing + (possessive pronoun or article) + noun, for example, "Girl is brushing *her* teeth" or "Lady is stirring *the* soup."
   c. Pronoun + (is or are) + verb-ing + pronoun (direct object), for example, "*She* is chasing him."
      Pronoun + is + verb-ing + preposition + noun, for example, "*He* is sitting on bed."
   d. Pronoun + (is or are) + verb-ing + (possessive pronoun or article) + noun, for example, "He is washing *his* face" or "*She* is reading *a* book."
   e. Pronoun + (is or are) + verb-ing + preposition + (possessive pro-

noun or article) + noun, for example, "He is getting on *his* bed" or "*She* is getting on the bus."

f. (Pronoun or article + noun) + (is or are) + verb-ing + (possessive pronoun or article) + noun + particle, for example, "*They* are putting *their* clothes on" or "*She* is turning *the* light on."

g. (Pronoun or article) + noun + (is or are) + verb-ing + noun (direct object) + preposition + pronoun (indirect object), for example, "*She* is giving pop to *him.*"

h. (Pronoun or article) + noun + (is or are) + verb-ing + possessive pronoun or article) + noun (direct object) + preposition + (possessive pronoun or article) + (noun or pronoun [indirect object]), for example, "*He* is riding *his* bike to the cottage" or "*They* are taking the books to *their* room."

i. (Possessive pronoun or article) + noun + (is or are) + not + preposition + (possessive pronoun or article) + noun, for example, "*My* coat isn't in *my* room" or "The candy is not in *your* desk."

Pronoun Training. The second set of pronouns to be trained at this point includes the third-person pronouns. Pronoun comprehension is trained before production training. Waryas (1972, 1973) developed a pronoun comprehension program that presented the gender, human, and number contrast features of the pronouns. Each pronoun representing a specific feature is presented with a foil representing another feature. A total of 30 stimulus plates is used for training. Objective case pronouns, *him, her, it,* and *them,* are trained before the subjective case pronouns, *he, she, it,* and *they.* The same plates are used for training both cases, but the verbal stimulus varies according to the case: objective case, "Show me him," and subjective case, "Show me, he is on the table." Many of the children demonstrated production rehearsing during comprehension training. That is, they would say, "him" while pointing to the singular, male stimulus.

The specific pronouns are trained productively in isolation unless the child demonstrates rehearsing at a 50% criterion level on the last two sets of comprehension training. However, if the clinician cannot discriminate two (or more) of the child's pronoun responses, they are trained in isolation with an emphasis on the articulatory placement. Written word cards may be used for supporting stimuli. The objective and subjective case distinction is trained as the pronouns included in both cases are gradually incorporated into the trained structures. The structures become increasingly longer and more complex, that is, the first structure used in production training is subject + verb-ing + direct object (pronoun), that is, "Girl chasing *him.*" The clinician expands to the next training structure: subject (pronoun) + verb-ing + direct object (pronoun). If the child makes more than 50% errors on the first training block on the subject (pronoun) + verb-ing + direct object (pronoun) structure, the subject (pronoun) + verb-ing + direct object structure is used as a branching step.

The training steps for establishing the objective case pronouns in the first training structure are (1) echoic stimulus for isolated word (only if necessary); (2) intraverbal stimulus, such as "Boy chasing ———," followed by an echoic stimulus only if the child makes five or more incorrect responses on the first training block (10 trials); and (3) directive requesting response, such as "Tell me about the picture." The training steps for establishing the subjective case pronouns are (1) directive requesting a response followed by the echoic stimulus for the subject (pronoun); (2) *wh-* question containing a pronoun element, "What he doing?" (branching to a question stimulus followed by an echoic stimulus if necessary); and (3) directive requesting a structure response.

The articles and possessive pronouns are trained concurrently with the objective and subjective case pronouns. The articles and possessive pronouns are trained in structures that contain a modifier noun in the verb phrase, such as "Boy wearing *his* coat" and "Girl eating *a* cookie." The clinician also expands the child's response to include the subjective case pronoun, as in "She eating a cookie." The length and complexity of the structures involving subjective, objective, and possessive case pronouns and articles are gradually increased.

Article and Possessive Pronoun Training. The articles in the present language program are trained at approximately the same time as the third-person possessive pronouns. The singular form of the definite and indefinite articles (*the* and *a*) is trained before the plural form (*the* and *some*). Objects that are functional in the child's environment are used as stimuli to train the definite and indefinite features of the articles. The stimuli are arranged to present the following features of the definite article *the* that make the indefinite article definite: (1) one object placed within a set of unlike objects, (2) one object placed in a specific location, (3) previous knowledge between speaker and listener, and (4) action upon an indefinite object once it has been recognized or mentioned. The stimuli used to train the indefinite article are arranged to present the following features: (1) two or more like objects placed in a set of objects including or excluding unlike objects and (2) a specific item from an array of nonspecific possibilities, such as "I want *a* cookie." The child learns to use articles in functional responses, such as "I want *a* candy bar," "I take *the* rubber band off," "I want *some* candy," and "I getting *the* picture(s)."

The articles and possessive pronouns are expanded within a structure when the child makes a subject + verb-ing + (preposition or particle) + direct object response. The child is trained to use the articles or possessive pronouns within the subject + verb-ing + (preposition or particle) + (possessive pronoun or article) + direct object structure in the following training steps: (1) intraverbal stimulus–subject + verb-ing + preposition +, followed by the echoic stimulus *his;* (2) intraverbal stimulus–subject + verb-ing + preposition +, and (3) directive requesting a structure response–"Tell me about the picture." The specific modifier to be used depends on the noun category to be modified. For instance, nouns referring to body parts and relatives require an obligatory possessive pronoun modifier. Nouns referring to clothes or toys are

usually modified by a possessive pronoun, but they can be modified by an article. Nonspecific items, such as food, are modified by an article, and idioms may require specific articles, such as "taking *a* bath." The structures in which the articles and possessive pronouns occur are trained in blocks of 10. The sentences containing either the article(s) or specific pronouns (*his, her,* or *their*) are randomized within the block of 10 sentences.

Copula and Auxiliary Training. Brown (1973) presents evidence that the verb *be* emerges differently as a copula and as an auxiliary. In general the copula emerges before the auxiliary. Both the copula and auxiliary tend to be produced inconsistently in the normal child's language development. In Chapter II, Ingram presents definitions of the copula and auxiliary and provides data from normal and linguistically deviant children.

The singular copula program is trained after the child is producing basic affirmative sentence questions and negation structures. The copula is trained within the noun + (*is* or *are*) + adjective structure. The training steps used for training the copula are (1) intraverbal noun prompt followed by the echoic *is* stimulus paired with an equation symbol, for example, "Ball, say (*is* or *are*)"; (2) intraverbal noun prompt, followed by pointing to the symbol; (3) directive for a verbal response and pointing to the symbol after the child's noun response; (4) directive for a self-response and symbol (no pairing); and (5) directive for a self response, "Tell me about the ball"—"Ball is big!" The child is required to give a noun response at Step 3. If the child produces the noun during Step 1, Step 2 may be omitted. The child must meet the criterion of 18 correct responses on two consecutive training blocks (10 trials per block) on each training step before advancing to the next step. After the child meets criterion on Step 5, the training structure is extended to (1) introduce new adjectives, such as *dirty, broke, happy,* and *sad*; (2) include the possessive pronoun + noun + (*is* or *are*) + adjective, and (3) include the adjective + noun + (*is* or *are*) + adjective structure.

Auxiliary Training. The same equation symbol used in copula training is used in auxiliary training. Since the child has learned to produce the basic noun + verb + preposition + noun and *wh-* question structure and has received echoic training on *is* and *are,* the child has to be trained on simply the placement of *is* (refer to Step 3 of copula training) within those structures. Pictures representing subject + verb-ing + object structures should be used before those representing verb-ing + preposition + object structures. The majority of the children in our program omitted the preposition in the initial steps of including the auxiliary within the required noun + *is* + verb-ing + preposition + noun structure if the noun + *is* + verb-ing + noun structures were not presented first. Noun + *is* + verb-ing + preposition + noun structures are required in the final blocks on Step 5. The copulas *am* and *are* are added to the noun + verb-ing + preposition + noun structures in which the child, the clinician, or other children are the subjects (agents), for example, "I'm sitting on the chair" or "You are writing with a pencil."

Wh- Question Training. The child must have the following prerequisite be-

haviors before the *wh-* questions are trained: (1) noun + verb + noun structures, (2) exposure to the *wh-* questions (*what, who,* and *where*) and (3) final, rising intonations paired with nouns, verbs, or indefinite pronouns. The child's typical question response when entering the program consists of *that* ("What/who is that?"), *doing* ("What is she doing?"), and *pencil* ("Where is pencil?"). During the *wh-* question program the child is given the stimulus cards (or objects) that represent people, places, inanimate objects, or actions.

"What Doing" Training. The clinician gives the child 10 pictures and provides the directive "Ask me, 'What doing?'" After the child learns the protocol (after two to five examples), the clinician says to ask "What doing?" for each of the 10 pictures. Correct responses are reinforced by social praise, token reinforcement, and answering the question—"Good question—What boy doing? Boy is sitting on chair." The clinician is expanding during the question (noun) and the answer (auxiliary *is*). If the child does not make a correct response, the clinician gives the correct response, but does not answer the question. After the child meets the criterion of 18 correct responses on two consecutive training blocks (10 trials per block) the echoic stimulus noun paired with pointing to the noun is given after the child asks, "What . . ." The echoic stimulus is omitted after the child makes 18 correct responses, so the child is asking, "What noun doing?" to each of the 10 pictures. If the child makes five incorrect responses on the first "What noun doing?" training block, the pointing stimulus is used in a branching step. The child has been receiving concurrent training on the copula *is* program while he is being trained or reviewed on the specific stages of the *wh-* questions. When the child has met the criterion of 18 correct responses on two consecutive training blocks on both the noun + *is* + adjective stage of copula *is* training and the "What noun doing?" stage, he is trained on the "What is noun doing?" stage. An equation symbol (=) for *is* is used for training the auxiliary *is*. Since the child has learned the label for *is,* he usually doesn't require training on the echoic training step. The clinician points to the symbol for *is* after the child has asked, "What . . . ," and the child is required to label the symbol *is* and complete the question ". . . girl doing (what is girl doing)?"

"Who/What Is That/This?" Training. The child is trained to discriminate *who* and *what* on the basis of pairing *who* with humans and *what* with nonhumans. Pictures of humans do not serve as good stimulus items during comprehension training. However, pictures can be used later during production training, which consists of an echoic step and a directive for verbal responses for each training stage. The training stages are "What (who) that?" and "What (who) is that?"

"Where Is Noun Verbing?" Training. The training steps for each stage under the *where* question are similar to the "What is noun doing?" question. The training stages are (1) "Where verbing?," (2) "Where noun verbing?," (3) "Where is noun?," and (4) "Where is noun verbing?" The criterion level for each program step (for each stage) is 18 correct responses on two consecutive training blocks (10 trials within each block).

The child may generalize specific trained question elements to other questions. Therefore, some specific stages of training may be omitted. For instance, if the child receives training on "What is noun doing?" before Stage 2 or 3 of the other *wh-* questions, he may produce "What *is* that?" or "Where *noun* verbing?" before being trained on the specific italicized elements within those questions. Later the child is trained to produce other questions, such as "Who is verbing + preposition + noun?," "What are pronoun doing?," and "Why (noun or pronoun) verb (noun or indefinite pronoun)?"

Not all children require all the stages in the *wh-* question training. A child may have a more developed question structure than a child with only the prerequisite behaviors. If the child asks an incorrect question (for his stage of training), such as "What time it is?" in spontaneous speech, the clinician repeats the question, emphasizing the correct production, and then answers the question: "What time *is it*—three o'clock."

Negation Training. Klima and Bellugi (1966) have outlined three stages in the child's development of negation. At the earliest stage, *no* or *not* precedes (or follows) the rest of the sentence, as in these examples: "no singing song," "not sit there," and "not fit." At the second stage, the negative element, now also including *can't* and *don't,* is inserted between the noun phrase and the verb phrase, giving rise to examples such as "He no bit you," "I can't see it," and "Don't touch fish." In the third stage, the child combines negation with *do, can, be,* and *will,* and the auxiliaries are used independently of the negative element.

The child must indicate some form of negation before he begins training on the negatives. Most of the children in the program began expressing negation by pairing the verb in an affirmative structure with a negative, such as "I (gesture 'no') want it." The clinician repeats their positive structure as a question (without the negative gesture), that is, "You want it?" The child would reply, "No, I (gesture 'no') want it." The child is placed in negation training after he is using or trained to use *no* or *not* preceding or following the rest of his structure. Various stimulus items are arranged to initially train *don't, can't,* and *is not.*

"Don't" Training. Two different objects or pictures are placed in front of the child. He is required to choose one of the pictures (or objects) by saying, for example, "I want car," and discard the other picture by saying, "I don't want *ball.*" Ten presentations are given in each training block. The training steps are the same as those for the *is not* negative. However, if the child gives the *no* or *not* negative element in his structure, for example, "I no want ball," during the echoic step, this form of negation is reinforced during the first two blocks of training. The stimulus question in each step is "Do you want . . . ?"

"Can't" Training. The stimulus items for *can't* training include activities that involve the child's senses, for example, "I touch wall" and "I can't touch wall"; "I eat apple" and I can't eat paper"; "I hear radio" and "I can't hear radio"; and "I see ball" and "I can't see car." The stimulus question in each step is

"Can you . . . ?" The training procedures are the same as those used for the *is not* training.

"Is Not" Training. Several similar objects, pictures, or colors and one dissimilar item are placed before the child. The child is required to label similar stimulus items with an affirmative structure, "This is cow, this is cow," and the dissimilar stimulus item with a negative structure, "This is not cow." Ten such presentations of similar structures, such as "Boat is blue, boat is blue, boat is not blue," are presented in one training block. The training steps include a question ("Is this a ———?") paired with (1) an intraverbal stimulus ("This is . . .") and an echoic stimulus ("Say, *not*"), (2) an intraverbal stimulus, and (3) a directive requesting a self-response.

Late-Intermediate Language Training.

The programs in the Late-Intermediate Language Training Program are currently being developed. Specific research projects are being conducted to determine the most effective and efficient procedures for training plurality and past and future verb tenses. The various procedures used for training plurality and the verb tenses will not be discussed in this chapter, because too little representative data have been collected at the present time.

III. Late-Intermediate Language Training Program
A. Entry behaviors.
B. Training sequence.
1. Interrogative reversals.
   a. Copula reversal—"Is it here?"
   b. Auxiliary reversal—"Is he playing?"
   c. Obligatory *do, does, did*—"Do you like me?"
2. Conjunctions.
   a. Noun and noun (may be included earlier in the program).
   b. Expand noun and noun in simple structures.
3. Plurality.
   Comprehension and production of noun + morphological marker; first paired with plurality markers in child's repertoire, such as:
   a. Number + nouns (z, s, or əz).
   b. Demonstrative + noun (z, s, əz).
   c. Determiner + noun (z, s, əz).
   d. Verb + noun (z, s, əz).
4. Noun/verb—singular plural agreement.
5. Verb tense marks.
   a. Present.
   b. Past.
   c. Future.
6. Relative clauses.
7. Embedded sentences.

Pretests. When a child is referred for language training, a sample of his spontaneous speech is taken to determine the general area for specific testing. The speech sample is analyzed according to the child's mean length of utterance (MLU) (Brown, 1973) and the specific linguistic elements and structures that the child displays. Since the obtained speech sample may not be representative of the child's spontaneous speech, the clinician has only an unprecise measure of the child's language.

If the child's MLU is between 1.0 and 3.0 words, he is placed in the Early Language Training Program for specific testing on the prerequisite entry behaviors. This initial test includes comprehension, production, and verbal imitation measures of the child's noun vocabulary. At least five functional nouns are assessed under each category of (1) people, (2) animals, (3) places, (4) clothes, (5) toys, (6) foods, and (7) furniture. The pretest criterion includes (1) comprehension of at least 25 functional nouns, (2) approximate production (verbal labeling) of at least 10 nouns, and (3) 80% criterion on approximate imitation of a set of 10 consonants and five vowels. Pictures or objects may be used as the visual stimuli. The child is placed in the Early Language Training Program for additional testing only if he meets the criterion of the specified entry behaviors. The pretesting within each section is programmed from behaviors intermediate in complexity to more simple or complex behaviors until the child's level is reached.

If the child's MLU is above 3.0 words, he is given pretests on the noun + verb + noun structure; noun + verb + preposition + noun structure; articles; possessive, objective, and subjective pronouns; copula; auxiliary; *wh-* questions; and negative structures. The order of pretests for the Early-Intermediate Training Program depends on the spontaneous speech analysis. Some of the programs in the Early and Late Intermediate Training Programs are not prerequisite programs for other programs. Therefore, it is not crucial to administer one pretest before another if the second program is not an extension of the first program.

Pretests on the Late-Intermediate Training Program are administered if the child is able to produce complete simple active declarative sentences, complete *wh-* questions, and complete negation structures. These structures would include articles, pronouns, and copula and auxiliary forms. Comprehension and production pretests are given for conjunctions, plurality, and tense.

Noun + Verb + Noun Comprehension and Production Pretests. This pretest initially assesses the child's comprehension and production of nonreversible noun + verb + noun structures when pictures are used as the visual stimuli (see Figure 1). Four pictures are placed before the child and he is requested to give the clinician the picture that represents a specific noun + verb + noun structure, such as "Give me, 'girl eat cookie'." The three foil pictures represent noun + verb + noun structures that vary from the stimulus picture in one element only, for example, (1) "Boy eat cookie," (2) "Girl hold cookie," and (3) "Girl eat soup." The child is given 10 trials on the noun + verb + noun comprehension pretest. The stimulus picture for each trial represents a dif-

ferent verb. Some of the noun + verb + noun structures include locative structures as well as the basic noun + verb + noun structure. If the child makes errors on more than 20% (at least three out of 10) of the noun + verb + noun structures, he is later given the complete noun + verb and verb comprehension pretest. If the child correctly identifies at least 80% of the noun + verb + noun structures, he is pretested for the noun + verb + preposition + noun structure. Figure 1 presents a diagram of the pretesting procedure.

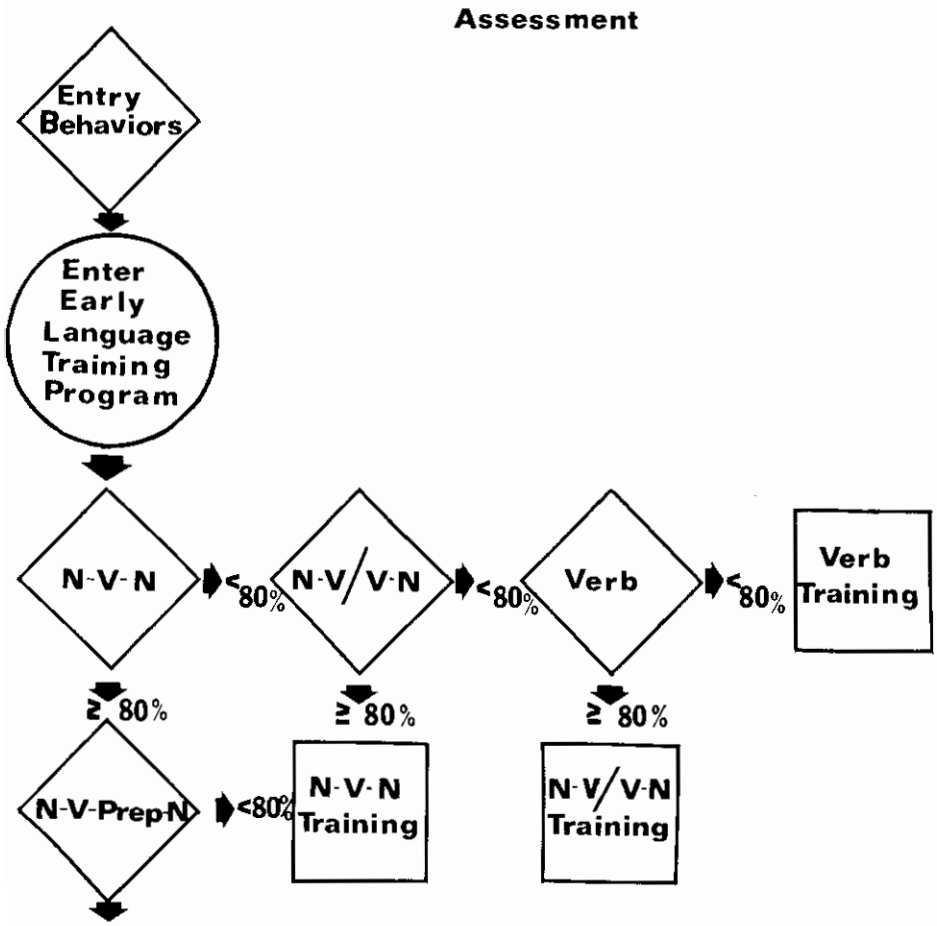


FIGURE 1. Comprehension and production assessment of the early language behaviors.

The noun + verb + noun production pretest is given after the noun + verb + noun comprehension pretest even if the child could not identify noun + verb + noun structures. The same stimulus pictures used in the comprehension test are used for production. The clinician initially demonstrates the task by producing noun + verb + noun structures as she shows the child the picture. Three examples are given to the child before the child is requested to tell the

clinician about the 10 stimulus pictures. Exact errors are recorded and compared to the scores on the comprehension pretest. For instance, did the child incorrectly produce the same stimulus that he incorrectly identified? What element(s) in the structure were incorrectly produced or omitted? Were the majority of the child's responses one-word element responses, such as subject, object, or verb, or were they noun + noun, noun + verb, or verb + noun responses? If the child incorrectly produces more than 20% of the noun + verb + noun structures, he is later given the complete noun + verb production test. If the child correctly produces at least 80% of the noun + verb + noun structures, he is presented the noun + verb + preposition + noun pretest. If the child correctly produces at least 80% of the noun + verb + noun structures, the clinician asks specific *wh-* questions that request specific information about the pictures: "Who is running?—*boy,*" What is boy doing?—*running,*" and "Where is boy running?—*to house.*" Since the child can produce noun + verb + noun structures, the clinician assesses the child's production of prepositions in the noun + verb + noun locative structures and in the child's responses to the *where* questions. The clinician also assesses the child's comprehension and production of reversible noun + verb + noun structures, such as "Boy push girl."

Noun + Verb Comprehension and Production Pretests. The noun + verb comprehension pretest is presented in the same way as the noun + verb + noun comprehension pretest. The specific noun + verb structures represented by the 10 pictures do not necessarily have to require objects. If the child incorrectly identifies more than 20% of the noun + verb structures, he is later given the complete verb and noun comprehension pretest. If the child correctly identifies at least 80% of the noun + verb structures, he is placed in noun + verb + noun training.

The noun + verb production pretest is given after the noun + verb comprehension pretest. It is presented in the same way as the noun + verb + noun production pretest. If the child misses more than 20% of the noun + verb structures, he is later given the complete verb and noun production pretest. If the child correctly produces 80% of the noun + verb structures, he is placed in noun + verb + noun training.

Verb Comprehension and Production Pretests. Only the stimulus items in the verb comprehension pretest differ from the presentation of the previous comprehension tests. The subjects in the stimulus and foil pictures in one trial represent the same agent. Therefore, even though the clinician asks the child to indicate "Boy sit," the child identifies the picture by comprehending the verb, since the foils represent "Boy stand," "Boy eat," and "Boy sleep." Since an action cannot be performed without an agent, the agent should also be given in the clinician's verbal stimulus. If the child incorrectly identifies any of the 10 verbs presented, the child is placed in verb training and trained on his error verbs. If the child makes errors on all the verbs and demonstrates that he cannot perform actions when the verbal stimulus such as "Mike, you stand" is given, the 10 training verbs are divided into sets and initially only two verbs

are selected for training. The child then enters the verb training program on Condition I, which consists of a point-to-point matching procedure of body actions, object manipulation, and picture selection. If the child correctly identifies all the verbs, he is placed in either verb training of Condition V (comprehension/imitation) or in noun + verb training, depending on the correct production of the verbs.

The verb production pretest is given after the verb comprehension pretest. Each of 10 pictures (same pictures as used in the noun + verb + noun test) are presented to the child with the "What noun doing?" question. If the child incorrectly produces any of the 10 verbs, he is placed in verb training. A verb-imitation pretest is presented to assess the child's intelligibility in order to select or reject specific training verbs. If the child correctly comprehends and produces all of the verbs presented on the pretest, he is placed in noun + verb training. Additional verbs may be assessed and trained concurrently with noun + verb training. Based on the results of the pretests, the child is placed in either verb, noun + verb, or noun + verb + noun training.

Probes. Several types of probes are taken throughout the course of the program. Probes are administered during a specific program to determine if a training step can be deleted for a child. Several probes on advanced structures are taken during the earlier training program. For instance, during noun + verb + preposition + noun training, the clinician also keeps data on untrained elements that the child may produce: noun + verb(*-ing*) + preposition + noun or noun (pronoun) + verb + preposition + noun. If the child is not producing noun + verb + preposition + noun structure during training, the clinician has probe information that demonstrates that the child is not producing noun (pronoun) + is + verb-ing + direct object + preposition + indirect object structures. If specific elements or structures cannot be probed during the training of other structures, probes are taken at various points before that structure is trained. Probes are taken after comprehension training to determine if production training is necessary for that program.

Once a structure is trained and is not to be incorporated into a later training structure, it is usually reviewed twice a week. If a previously trained structure is not reviewed, probes are taken to see if the child has maintained the specific element or structure response. Probes are also taken on trained structures after the child has been absent for more than five training sessions.

Generalization. Several types of generalization measures are taken on each specific training program. Generalization measures are taken only after the child has met criterion on the final training step of a specific program. Ten to 20 pictures that are not used in training are presented in the pretest and again after the child has met criterion on the pictures that were used for training. If the child does not meet an 80% criterion on 10 of the generalization pictures (or novel stimuli), those pictures are used for additional training on the last training step until the child reaches a 90% training criterion. The other 10 generalization pictures are then used as generalization items. Measures for

overgeneralization are taken when it is applicable, that is, on the pronoun, plurality, and tense programs.

Specific structures are sometimes used for training a specific element. For instance, the noun + *is* + adjective structure is used for training the copula *is*. After the child has reached training criterion, other structures that contain the copula are presented to see if the trained element has generalized to the structures that were not used in training, that is, "What is that?" and possessive pronoun + noun + *is* + adjective. If the element does not generalize to other structures, the element is then trained within those structures.

Spontaneous speech samples are taken at least once a week to see if the trained element or structure has generalized to the child's spontaneous speech. Since the trained item may not generalize to the child's spontaneous speech immediately after it is trained, the clinician can determine (by weekly checks) when the child does begin to use a specific element or structure and how consistently the child uses it. The spontaneous speech samples are taken randomly in environments outside the therapy room. Home and cottage programs designed to maintain more efficiently a trained response are currently being developed.

DISCUSSION

The purpose of this chapter is to present a sequence of language behaviors and detailed procedures for training those behaviors. Data from 30 mentally retarded children and five normal language-delayed children have been collected over the past two and one-half years. In the development and modification of the total language program, a number of specific studies have been conducted to determine the most effective and efficient procedures and sequence.

Studies involving multiple baselines and group designs were used in order to determine (1) whether certain programs should be trained concurrently with other programs, (2) whether group therapy is more efficient than individual therapy, (3) whether gestures facilitate the teaching of certain linguistic units, and (4) what probes should be introduced to determine branching steps or step deletions for individual children. Detailed data were recorded throughout the program to assess the procedures, sequence of training, and progress of the individual child. However, the number of specific programs and the number of children completing each program preclude the presentation of specific results.

Data indicated that concurrent training of noun + verb + noun structures, questions, and negation is more effective and efficient than serial training, but there are specific prerequisite phases within each of the individual programs. Group therapy is conducted after the child has completed Early Language Training because specific language elements can be presented more efficiently when three or four children are receiving group training. The children involved in group therapy produce more spontaneous speech within the therapy

setting. The stimuli do not always have to be arranged or presented by the clinician because other children are providing adequate stimuli. However, inferential learning can interfere with a child's progress if he is placed in a group that is significantly more advanced in the program. The use of gestures eliminates the *I-you* confusion and facilitates the production of the early developing prepositions. Inter- and intraprogram probes provide information for individual branching steps, step deletions, and criterion levels. Although the children showed individual differences, the majority of children also showed that some programs were more difficult to train than other programs.

A progress record for one of the children is presented in Figure 2. This

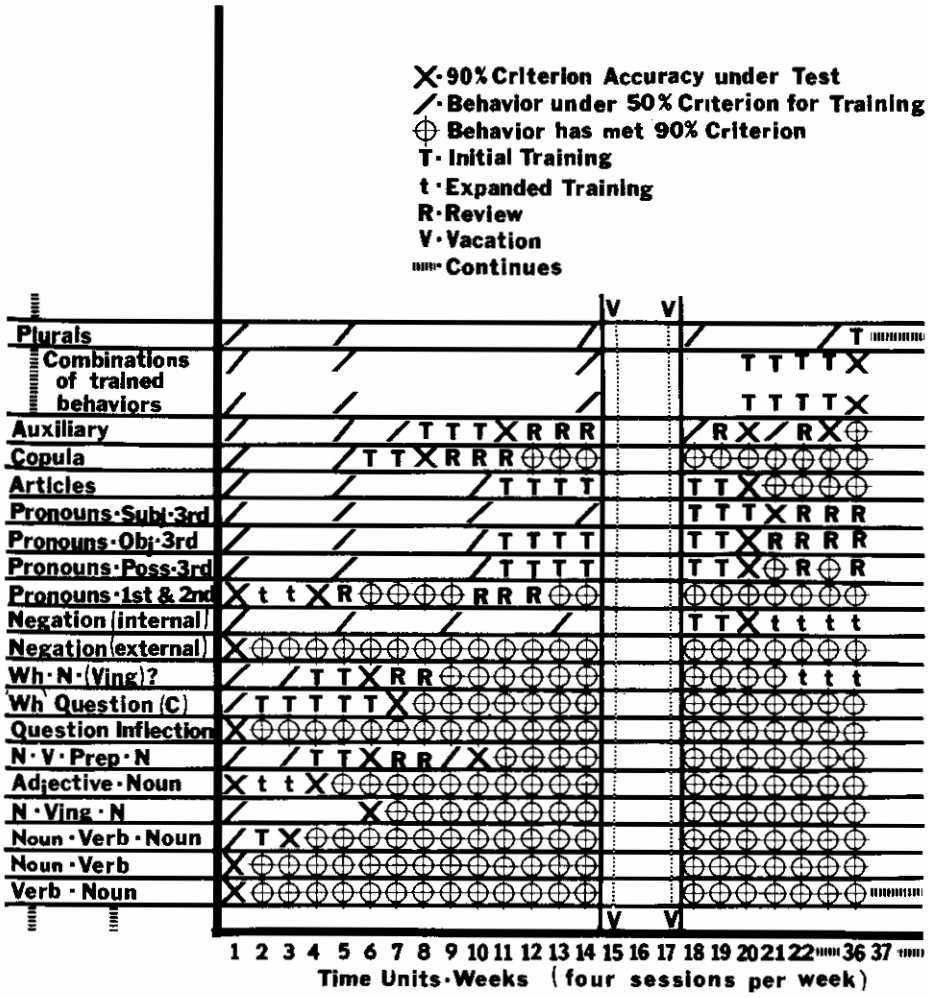


FIGURE 2. Progressive record chart.

method of representing a long-term program has been presented by Spradlin.[1] It represents 36 weeks of therapy for one child. Behaviors for the specific training programs that met pretraining or posttraining criterion are recorded by an "X." The slash marks indicate that pretest or probe criteria were not met. "T" shows the programs being trained, "t" represents expanded training, and "R" shows the programs that are being reviewed. The progress record also presents the number of specific programs that are being trained concurrently and reviewed during one week of training.

Research projects currently are being conducted to develop programs in the Late-Intermediate Language Program. Specific research projects are in progress to determine the number and frequency of review sessions that are needed to maintain a child's criterion performance on the specific structure. Maintenance programs need to be developed to insure more efficient generalization of trained structures to situations outside of therapy. Spontaneous speech samples taken outside of therapy indicated that most of the children did not begin spontaneously producing the elements or structures immediately after they were trained. Some children did not spontaneously use the trained element or structure above 80% of the time until two months after it was trained. Examples of pretraining and current training responses for three children are listed in Appendix D.

ACKNOWLEDGMENT

This work was supported by Grants HD-05088 and HD-00870 from the National Institute of Child Health and Human Development and Grant NS-10468 from the National Institute of Neurological Diseases and Stroke to the Bureau of Child Research, University of Kansas. Recognition is given to Kim Miller, Sherry Howard, Shari Bosler, and Norie Haines, who acted as clinicians during the administration of the training programs. A 16-mm color movie entitled "Perspectives on Language" (Ruder and Stremel), which demonstrates many of the procedures and techniques described in this chapter, currently is being prepared under the auspices of the Bureau of Child Research, University of Kansas (supported by Grants HD-00870 and HD-02528 from the National Institute of Child Health and Development and Grant HD-10468 from the National Institute of Neurological Diseases and Stroke). Kathleen Stremel and Carol Waryas are affiliated with the Bureau of Child Research, University of Kansas, Lawrence, Kansas.

REFERENCES

AYLLON, T., and AZRIN, N., *The token economy: A motivational system for therapy and rehabilitation.* New York: Appleton-Century-Crofts (1968).

BLOOM, L., *Language development: Form and function in emerging grammars.* Cambridge, Mass.: MIT Press (1970).

BOWERMAN, M., *Early syntactic development.* Cambridge, Mass.: Cambridge Univ. Press (1973).

BRICKER, W., and BRICKER, D., An early language training strategy. In R. Schiefelbusch and L. Lloyd (Eds.), *Language Perspectives—Acquisition, Retardation and Intervention.* Baltimore: University Park Press, 430-468 (1974).

BROWN, R., *A First Language: The Early Stages.* Cambridge, Mass.: Harvard Univ. Press (1973).

[1]Joseph Spradlin, personal communication (1973).

BROWN, R., and BELLUGI, U., Three processes in the child's acquisition of syntax. *Harvard ed. Rev.*, 34, 133-151 (1964).

KLIMA, E., and BELLUGI, U., Syntactic regularities in the speech of children. In J. Lyons and R. J. Wales (Eds.), *Psycholinguistic Papers, The Proceedings of the 1966 Edinburgh Conference.* Edinburgh, Scotland: Edinburgh Univ. Press, 183-208 (1966).

MILLER, J., and YODER, D., An ontogenetic language teaching strategy for retarded children. In R. Schiefelbusch and L. Lloyd (Eds.), *Language Perspectives—Acquisition, Retardation and Intervention.* Baltimore: University Park Press, 504-528 (1974).

SCHLESINGER, I., Learning grammar: From pivot to realization rule. In R. Huxley and E. Ingram (Eds.), *Studies in Language Acquisition: Models and Methods.* New York: Academic, 79-89 (1974).

SLOBIN, D., *The Ontogenesis of Grammar.* New York: Academic (1971).

SLOBIN, D., and WELSH, C., Elicited imitation as a research tool in developmental psycholinguistics. In C. Ferguson and D. Slobin (Eds.), *Studies of Child Language Development.* New York: Holt, 485-497 (1973).

STREMEL, K., A systematic language training program for the acquisition of basic grammatical relations. Master's thesis, Kansas State Univ., Manhattan (1971).

WARYAS, C., An investigation of children's development of the semantic features of the pronoun system. Parsons Research Center Working Paper #275. Parsons, Kans.: Parsons Research Center (1972).

WARYAS, C., Psycholinguistic research in language intervention programming: The pronoun system. *J. psycholing. Res.*, 2, 221-237 (1973).

APPENDIX A

Example of a Training Step

Condition V, Step 3--Alternate--Manipulating objects to verbal mand and echoic response to verbal stimuli.

Objective

The subject will manipulate the objects into the appropriate positions (sitting or standing), to the experimenter's verbal mand, "Ron, show me 'girl sit (stand)'." The subject will then give an echoic response when the experimenter gives the echoic model, "Show me 'girl sit (stand)'." The subject will perform a block of 10 correct alternate object manipulations followed by the echoic response, "sit (stand)," when the experimenter gives a verbal mand followed by the echoic model, "sit (stand)," before advancing to the next step in the program.

Materials

One flexible, rubber girl doll (4½" tall).
One doll chair.

Training Procedure

The subject is seated at a table across from the experimenter. The objects are placed in front of the subject. The alternate mand-echoic stimuli for *sit* and *stand* are presented in recurring blocks of 10. Within each of the blocks, each mand-echoic stimulus for *sit* and *stand* is presented five times in a scrambled order.

Training: Verbs	*Discriminative Stimuli*	*Correct Responses*	*Reinforcement*	*Incorrect Responses*	*Criteria*	*Expansion*
sit	The experimenter says, "Ron, show me 'girl sit'."	The subject manipulates objects to "sit" within five seconds after mand is presented.	Echoic model is presented. No token is presented.	If the subject fails to respond correctly within five seconds after verbal mand is presented, no echoic model is presented. The experimenter manipulates objects to "girl sit."	The subject advances to the next step in the program when he correctly responds to nine out of 10 stimulus presentations (90% correct responding). Verbal mand and echoic model are considered as one stimulus presentation in a block of 10.	No response is expanded.
	When the subject manipulates objects to show "girl sit," the experimenter, while pointing to the manipulation, says, "You say 'sit'."	The subject says, "Sit," within five seconds after echoic model is presented.	The subject is reinforced with a token paired with social praise for each correct response.	If the subject fails to respond correctly within five seconds after echoic model is presented, the experimenter says, "Sit," then presents the next action-mand stimulus.		After reinforcement is given, the experimenter says, "Ron, sit."

Appendix A (Cont.)

Training: Verbs	*Discriminative Stimuli*	*Correct Responses*	*Reinforcement*	*Incorrect Responses*	*Criteria*	*Expansion*
stand	The experimenter says, "Ron, show me 'girl stand'."	The subject manipulates objects to stand within five seconds after mand is presented.	Echoic model is presented. No token is presented.	If the subject fails to respond correctly within five seconds after echoic model is presented, the experimenter says, "Stand," then presents the next action-mand stimulus.	The subject advances to the next step in the program when he correctly responds to nine out of 10 stimulus presentations (90% correct responding). Verbal mand and echoic model are considered as one stimulus presentation in a block of 10.	No response is expanded.
	When the subject manipulates the objects to show "girl stand," the experimenter, while pointing to the manipulation, says, "You say 'stand'."	The subject says, "Stand," within five seconds after echoic model is presented.	The subject is reinforced with a token paired with social praise for each correct response.	If the subject fails to respond correctly within five seconds after echoic model is presented, the experimenter says, "Stand," then presents the next action-mand stimulus.		After reinforcement is given, the experimenter says, "Ron, stand."

APPENDIX B

Specific Language Content and Control Sequence for Early Language Training

A. Verbs (action):

Training Verbs	*First Set*	*Second Set*	*Third Set*	*Replacements*
walk	sit	jump	eat	drink
sleep	stand	ride	run	run
eat		look	read	throw
read		play	sleep	drive
look				push
sit				
ride				
stand				
jump				
play				

Verbs that are placed in the training sets depend on the subject's pretraining test responses and probe responses.

Additional verbs used to indicate request:

want	take	get
have	tie	show
go	make	put

B. Subject + verb (agent + action) constructions:

girl sleep	lady (mama) read
girl eat	boy look
boy stand	boy play
man (daddy) walk	girl jump
boy sit	girl ride

Additional subject + verb (agent + action)/verb + object (action + object) constructions used in a functional therapy setting:

Subject + Verb	*Verb + Object*	
Ron go	have token	make picture
boy fall	want penny (candy)	go bathroom
girl cry	take cottage?	get drink
mama come	tie shoe	put 'way?
girl go	go home	show lady?

C. Subject + verb + object (direct object, object of preposition, or adverb) (agent + action + object) constructions:

girl sleep bed	lady (mama) read book
girl eat soup	boy look ball
boy stand floor	boy play ball
man (daddy) walk home	girl jump rope
boy sit chair	girl ride horse

Appendix B (Cont.)

Additional subject + verb + object (agent + action + object) constructions used in a functional therapy setting:

I go bathroom	you tie shoe	I take it back
I go cottage	you make picture	I make that
I go school	I put 'way	I get that
I go home	I show lady	girl come speech
I get drink	you have dress–pretty	
I have candy		
I have token		
I have penny		
I have dress–new		

Noun phrases and question indicators used in a functional therapy setting:

big ball	two penny	more candy
blue car	new boy	that? what's that
little box	pretty dress	who's that
new shoe	dirty shirt	doing? what doing
five token	red book	

The additional constructions are trained by setting up high-probability response situations and waiting for the child to initiate a request or naming response (gesture or label). When the child makes a type of gesture or labeling response, the clinician names or primes the indicated referent.

D. Prepositions used in response priming during subject + verb + object training and later trained within the subject + verb + object structure (each verbal label is paired with a gesture):

on
to
in
with

APPENDIX C

Horizontal and Vertical Training Sequence

Concurrent Training		
verb (action) noun + verb noun + verb + noun	adjective verb (state) + adjective or noun pronoun (subject–first and second) pronoun(s) + verb + noun	noun (expansion) adjective + noun pronoun + (objective–1,2) + verb + pronoun pronoun (possessive–1,2) + noun
Review or Placed within Next Training		
noun + preposition + noun noun + verb(*-ing*) + preposition + noun noun + verb + noun + particle	negation (gesture) (no) noun + verb + noun (no)	*wh-* question (inflection) *wh-* verb(*-ing*)? *wh* + noun + verb(*-ing*)

Appendix C (Cont.)

Review (FR 2)		
articles possessive pronouns	objective pronouns subjective pronouns	expand-nouns, verbs, adjectives, and prepositions
Review and Combinations of Trained Items		
		copula auxiliary

APPENDIX D

Pretraining and Current Responses of Three Children

Child	*Pretraining Responses*	*Time in Training*	*Current Responses*
RW	Doing? (echoic) Have? (echoic) Me go? Shoe. Take that? Come here.	(2½ years)	We went roller skating last Thursday. I got some new shoes at home. My mommy and daddy buy them for me. Can I take the rubber band off the cards? Stremel–What are you doing? I watched TV and ride my bike. They are giving the books to them. The kids are riding their bikes to Pine Cottage.
ML	That? Hit–Boy. Name? Soap 'huh.' Roy–sister.	(2½ years)	Where you live now? We went to a party last night. Have fun. Stremel–Can I sit by you? They are making their beds. She isn't coming to speech anymore. The man is taking a picture of him.
RT	You coming? Him take it. Me (gesture, no) that. That girl. No. See that. You make it?	(1½ years)	Can I get some more candy? I take my pennies back to the cottage. She is turning the light off. The boys are playing basketball/At the gym. She isn't coming today. She sick. She is putting a Band-Aid on his knee. What you making on that paper?

Chapter VII

APPLICATION OF SYSTEMATIC PROCEDURES IN CLINICAL ENVIRONMENTS

LEIJA V. McREYNOLDS

Speech pathologists are confronted with children with language disorders in need of immediate training. Clinicians need to know what to train and how to train it, directly after evaluation of a child's language. Like researchers, however, they are also interested in developing the most effective and efficient procedures for modifying language behavior. Once principles and procedures have been discovered, they recognize the need for replication over a variety of language behaviors and children.

Work reported in the previous chapters included some of the features suggested in the introduction as beneficial to the development of scientifically based language programs. This final chapter discusses how they might contribute to the development of data-oriented training procedures by presenting a hypothetical language problem and suggesting a treatment program with the characteristics listed in the introduction.

The characteristics may be summarized briefly. First, the program is based on training a behavior that has been isolated from a broad sample and thoroughly evaluated. Second, all stimuli, responses, and procedures are described well enough to allow replication. Third, appropriate measures are used to provide empirical evidence of behavioral change. Finally, effectiveness of the program is evaluated.

The presence of the first feature is apparent if a sufficiently large sample of language is obtained to make evident that the child has a problem and requires training. A large sample also enables determination of linguistic units consistently present in the child's language repertoire. This information aids in designing training procedures if they need to be based on language behaviors already in the child's system. Procedures used by Ingram, for example, to collect language samples, give the child opportunity to produce the linguistic units already present in his repertoire. In Ingram's study the child's language was sampled in unstructured and semistructured environments in three situations. As Stremel and Waryas suggested in Chapter VI, a sample of spontane-

ous speech can be used to select the area of specific testing and indicate if prerequisite language behaviors are present.

From the general language sample, then, a particular linguistic construction in error is identified. Before designing the specific program, the speech pathologist forms some general ideas concerning the child's problem and the approach to be used in training. These impressions, derived from developmental and experimental research in language, offer some general directions, but the construction in error has to be carefully specified and the child's problem with the construction clearly defined before procedures can be developed.

It is not sufficient, for example, to decide that a child needs to learn to produce complete sentences. Such a behavior may indeed be the terminal goal, but designing procedures for training such a broadly defined behavior initially may not be possible. A complete sentence has many components. It would probably include a subject + verb + object sequence. It might also include articles, prepositions, adjectives, adverbs, and other linguistic units. Unless the definition of a complete sentence includes all the components composing it, and the error components are specified, designing efficient training procedures may be precluded.

Another essential characteristic of a scientifically based program is the requirement for careful descriptions of the behavior to be trained and the purpose for training it. Stating the purpose assumes that the level at which the specific construction in error is occurring in the child's repertoire over time and variety of contexts or situations has been established. That is, an adequate baseline has been obtained.

If a clinician, for instance, wishes to train a child to produce complete sentences, it is first necessary to determine which component in the sentence should be trained. For example, a spontaneous sample of the child's language may reveal that he does not use prepositional phrases. Therefore, prepositional phrases are selected for training. Next, the component to be trained in the prepositional phrase needs to be isolated. A prepositional phrase consists of a preposition labeling a spatial relationship, an article, and a noun. To specify the component in error, it is necessary to discover why the child does not use prepositional phrases. Is it because he doesn't have the concept of the spatial arrangement? Does he have the concept but not the verbal label for it? If he has the concept, but not the expressive phrase, is it because he lacks articles and nouns? In other words, do all components of a prepositional phrase need to be trained, or only a part of them?

If a large enough corpus is obtained in the initial language sample, it is possible to determine if articles and nouns are present in the child's repertoire. For example, 50 utterances would indicate how frequently the child uses noun phrases. If noun phrases are used consistently, articles and nouns can be eliminated as problems; that is, preposition errors are not related to an inability to produce articles and nouns. Some other component of prepositional phrases

constitutes the problem and needs to be identified. To do this, the child's comprehension and production of prepositions are tested.

Before testing prepositions, the child's ability to name 20 objects is explored. Nouns the child knows are used in the preposition test. Once the child's knowledge of the nouns in comprehension (pointing to the object named) and production (naming the objects) has been confirmed, the preposition test may be administered, but it must first be designed.

Two tests might be designed to test the child's comprehension and production of prepositions. For each test the 20 objects named by the child can be used. Before testing, data sheets are prepared on which the prepositions, the objects, and the stimuli to be presented are noted. A space for recording the child's exact response on each trial during the test is included on the data sheet. Each preposition is tested in several contexts to allow the child an opportunity to respond appropriately, if he is able to do so. Each context is tested more than once to explore whether a consistent response pattern on each preposition is present. Thus, each preposition might be tested 12 times in at least three different contexts. Chapter IV reported in-depth testing procedures for exploring noun phrases. The number of sentence contexts, the times that each was tested, and the manner of recording responses in that study might provide some guidelines.

The production test is administered before the comprehension test to determine if the child produces the preposition before hearing it during comprehension testing. Procedures for the production test consist of the clinician's performing the arrangement and asking the child to label it verbally. For example, the clinician might put a cat in a box and ask the child, "Tell me, where is the cat?" For the comprehension test, presented after the production test, the child may be presented verbal directions for arranging two objects. For example, he may be directed to "Put the book on the table." Another procedure might consist of presenting more than one pair of objects. Each pair would represent a different spatial arrangement, and the child would be asked to point to the arrangement described by the speech pathologist, for example, "Point to the book on the table."

Counting the exact number of times the behaviors were tested, the contexts in which they were tested, and the number of times correct responses occurred in each yields objective data. When the test results are tabulated, the data allow careful specification of the linguistic unit to be trained and a general idea of procedures appropriate for this training. The specification is possible because quantifiable data have been collected, and they show that the behavior is lacking or occurring only occasionally. Procedures for defining an adequate baseline are found in Chapters IV and VI. In the present test, for instance, the clinician may learn that performance on the comprehension test was at approximately a chance level. He also may learn that no correct labels were produced on the production test. The test has helped to define one of the child's language problems in more direct terms; he has neither the con-

cept of spatial relationships nor the prepositions for labeling them. Because of the thoroughness of the sample, confidence can be placed in the statement that the child lacks prepositions. Therefore, a basis for designing training procedures has been provided. Consequently, the definition of the behavior to be trained has changed from a broad statement concerning complete sentences to a more specific statement concerning the production of prepositional phrases when spatial arrangements are presented.

Thus far, two of the requirements for the development of a scientifically based training program have been met in assessing the child with a preposition deficit. Fulfillment of these requirements facilitates meeting the remaining ones. It is easier to design training procedures and measures for a behavior that has been clearly identified. Likewise, if the procedures are described carefully, evaluation of the program's effectiveness and efficiency is possible.

A few introductory comments will be made about procedures before continuing with a discussion of the child's preposition problem and before presenting suggestions for development of training procedures with the characteristics listed in Chapter I. The remaining characteristics will be discussed together, rather than individually, as procedures for preposition training are designed in the following pages.

The chapters in this monograph may be studied to learn the degree of specificity included in their descriptions of procedures. One way to determine if procedures are described adequately is to attempt to replicate them. If a clinician, after reading the description, is able to apply the procedures, then they are defined and described adequately. To determine if the procedures are related directly to the behavior to be trained, the measures used to obtain data may be examined. Data should be pertinent to the purpose of the training; that is, it is the behavior being trained that should be measured, not other behaviors that may be occurring. Occurrence of the trained behavior to untrained stimuli and situations may also be measured, as it is in some of the studies in this monograph. Data from training show that the procedures effectively modified the behavior, while data on the behavior outside of training show that it transfers to untrained contexts. Chapters III, IV, V, and VI described tests and measures of generalization and transfer.

Characteristics listed in Chapter I have been taken into consideration in developing the preposition training procedures presented in this chapter. The first step is selection of the prepositions to be trained. Clinicians, of course, are aware that training all possible occurrences of a specific linguistic unit is not possible or desirable. It is not possible, for example, to train all possible occurrences of *in* or any preposition. Instead, a preposition must be trained in a restricted number of contexts. It can, however, be tested in untrained contexts to determine if additional items need to be trained before the preposition is stable in the child's repertoire, that is, if he uses it spontaneously in new, untrained contexts.

Results from the preposition test provide the basis for selecting the prepositions to be trained. If several, or all, were in error, the specific prepositions

are chosen on the basis of information from developmental and experimental studies in language. For example, two sources the speech pathologist might refer to are Brown (1970) and Brown (1973). Perhaps, on the basis of this information, the prepositions *in, on, behind,* and *beside* are selected to be trained. After specification of the four prepositions, the speech pathologist defines the purpose of the training. Is it sufficient to demonstrate that the child acquires the four prepositions in the training situation? Should training be administered on all of the objects tested on baseline? Should just two of the objects be used? If objects are used in training, should testing be administered to determine if the child can respond to the same spatial arrangements in pictures or to untrained objects? These are some of the questions that need to be asked before designing procedures. Procedures used are dependent on what the speech pathologist considers essential to train and the extent to which he wishes to train them.

Perhaps in the case of the prepositions, the clinician decides he would like to use just two objects for training and test transfer to the other objects. For example, the prepositions will be trained using a ball and box. In order to test if the procedures have taught the preposition, regardless of the number of objects used, a test is devised. The child will be presented the other objects on which baseline was obtained, but on which no training will be presented.

The specific purpose of the procedures has now been detailed a little more carefully. Four prepositions, using two objects, will be trained. Other objects, not used in training, will be arranged to represent the trained spatial relationship. They will be presented to test whether the child responds with the appropriate preposition to the new objects. Testing generalization will provide useful information. It might demonstrate that a preposition can be trained with only a few objects. On the other hand, it may disclose that the child does not acquire the preposition until presented with several objects demonstrating the same spatial arrangement. Fortunately, generalization can be measured rather precisely. Presenting the same items in baseline and generalization testing allows comparison of the child's responses to identical stimuli pre- and posttraining.

Once the speech pathologist has defined exactly what will be trained and tested, he is ready to design specific procedures for training. In the present case, several options are available. For example, the prepositions could be trained in comprehension only, or they could be trained in production and comprehension simultaneously.

Results from the study by Ruder, Smith, and Hermann (Chapter III) indicated that it might be more efficient to train comprehension and production simultaneously, if the terminal response is production. McReynolds and Engmann (Chapter IV), basing their procedures on prior research in experimental analysis (Sloane and MacAulay, 1968; Garcia, Baer, and Firestone, 1971; Brigham and Sherman, 1968; Girardeau and Spradlin, 1970), administered only production training in requiring production as the terminal behavior.

Perhaps, on the basis of these and other studies that have shown that imitation is an effective procedure in language training, imitation is chosen as the procedure for establishing the prepositions in the child's repertoire. The procedure may be somewhat similar to the imitation used in the Ruder et al. study or the McReynolds and Engmann study. Stremel and Waryas also used imitation in their language program. A second phase may be initiated when criterion in imitation is reached. Training can be shifted to spontaneous emission with the expectation that comprehension occurs as the child acquires production. (Research exploring the nature of the relationship between comprehension and production is somewhat inconclusive. Yet, it is important to the development of effective procedures. An experimentally oriented speech pathologist, training prepositions, might decide to explore the effectiveness of separate comprehension and production training. Designing a multiple baseline to investigate the two procedures is possible in a clinical environment.)

Evaluation, the sixth feature of a scientifically based program, is possible if the program meets several criteria. Briefly summarized, they are as follows: (1) stimuli presented to the child are defined carefully, (2) the response the child is to produce is specified, (3) the consequent event for correct and incorrect responses is described, and (4) the exact manner in which the stimulus-response-consequence sequence will occur is explained. In addition, (5) a training session is defined, perhaps in terms of trials; (6) criterion levels are set to provide evidence that the child has acquired the behavior on which he receives training; (7) the manner in which data are recorded is described; and (8) testing items and administration are specified. If these events are defined, confidence can be placed in the data, provided the measure is appropriate to the behavior receiving treatment.

In the preposition training, for example, imitation has been designated as the procedure to be used. For some, this might be sufficient specification to initiate training. For the speech pathologist with an experimental attitude, it is totally inadequate. Another speech pathologist, attempting to replicate the procedures, or a clinician attempting to replicate his own procedures with other children, would need clarification on several points: (1) Will the clinician demonstrate the spatial arrangements as he presents the verbal stimulus? (2) Will the verbal model be presented before, during, or after the objects have been arranged? (3) What is included in the verbal model presented by the clinician—the complete sentence? the prepositional phrase? the preposition only? (4) What constitutes a correct response? If the child imitates only the preposition, is the response correct? If the child deletes the article in the prepositional phrase, is the response correct? If the child imitates only a part of the sentence but imitates the preposition, is his response correct? Does the child imitate the spatial arrangement as well as the verbal statement? (5) When the child imitates correctly, what does the clinician do? What does he do when the child makes an incorrect response? (6) Are all four prepositions trained simultaneously? Are they all presented in each session? (7) Are the prepositions presented randomly? (8) How many trials are administered on

each preposition? (9) How is acquisition defined? What is the criterion level?

These are only a few of the many questions that can be asked if procedures are not clearly defined and described. If answers are not possible, the treatment cannot be evaluated. Therefore, the speech pathologist will not be able to determine if his purpose has been met by the training program.

Specification of the preposition training procedure would, in all probability, include at least two phases: imitation training and spontaneous training. Specifications, definitions, and descriptions of procedures would differ for the two. Under each phase the various steps in training would be defined.

Initially, the overall plan or procedure for each phase would be described. In each phase a session might consist of 80 trials. One preposition would be trained to criterion in the imitation and spontaneous phases. When criterion was reached in the spontaneous phase for the first preposition, transfer of that preposition (to the remaining 18 objects) would be tested. Presentation of pairs of objects would be the same as in baseline. No consequent event would follow the child's responses during testing.

After testing generalization of the first preposition, training on the second preposition would be initiated. Procedures would be similar to the procedures for training the first preposition with one exception. Each 80-trial session would consist of 50 trials on the new preposition and 30 trials on the first preposition to ensure that the first preposition is maintained in the child's repertoire.

When criterion on the second preposition is reached in spontaneous training, both prepositions would be tested on the remaining 18 objects. After completion of generalization testing, the third preposition would be trained. Training trials on the first two prepositions would be interspersed with trials on the third preposition. Similar procedures might be applied until all four prepositions had been trained and tested. The criterion level set by the clinician might be 90% correct in one session on the 50 trials of the preposition receiving training.

After the general procedures are described, the stimuli, responses, consequent events, and procedures prevailing in each step and phase of the program would be defined. The training environment would be described to show that extraneous variables that might influence the child's behavior are not present.

The stimulus in the imitation phase might consist of a particular spatial arrangement of the ball and box. Upon completion of the arrangement, the speech pathologist would verbally describe it. For example, "The ball is *in* the box." Then he would say to the child, "Say 'the ball is *in* the box.' "

A correct response would be defined as imitation of the complete sentence by the child within five seconds after the model is presented by the clinician. All words in the sentence would be required to be produced intelligibly, as judged by the clinician. Any other response would be incorrect.

The consequent event, the event following the child's correct response, would be a plus mark on a piece of paper placed on a table close to the child.

A total of 20 marks would be exchangeable for a token, which could be used to purchase candy. The consequent event for an incorrect response might be, "No, that's wrong," said by the clinician, after which he would repeat the model. If the child responded correctly to the second model, the clinician might say, "Yes, that's right." He would not, however, make a plus mark on the paper. If the child responded incorrectly again, the clinician would say, "No, that's wrong," pause for two seconds, then remove the objects from the table. Five seconds later another trial would be initiated.

For each step in treatment, procedures would be specified in as much detail as in the example above, and perhaps more. Additionally, procedures for testing generalization to the other objects would be specified. That is, the description would include the number of times each pair of objects should be presented, the spatial arrangement to be tested on each trial, the number of times each preposition would be tested, and the objects used on each trial. Data sheets for training and testing would be designed before obtaining baseline and initiating training. Careful consideration would be given to designing data sheets on which relevant information from each session could be recorded. Many researchers and clinicians develop codes to simplify recording. In the case of the preposition training, for example, the child's entire response could be transcribed. This might give the clinician clues to use for modifying procedures if the child failed to acquire prepositions.

A clinician following the suggestions for designing training programs proposed thus far in this chapter could feel somewhat comfortable that what he is doing has value. Unfortunately, it would not be sufficient to provide evidence that his treatment was efficient, or that it was related to the generalization obtained on untrained objects. To provide that evidence, two other procedures would be incorporated into treatment.

One procedure concerns reliability (Noll, 1970; Winitz, 1969). Clinicians, as well as researchers, understand the necessity for obtaining independent judgments of the child's responses. An observer, using data sheets used by the clinician, listens to the child's productions. He judges the correctness of the productions on the basis of the clinician's original definition of a correct response. It is important that the speech pathologist's judgments be corroborated by another not directly involved in the program. Several options are available to the speech pathologist. He might, for instance, record the training sessions on audio or video tape and later present the tape to a colleague for judgments. If the situation allows, he might introduce a live observer into the sessions at crucial periods. Independent judgments should be obtained especially during baseline measurement, again when the child reaches criterion in training, and, finally, during generalization testing. A comparison of the observer's and clinician's judgments of the number of correct responses made by the child would indicate if they agree on the child's productions. If they agree consistently, then the clinician can place confidence in his own observations of the child's behavior in training. By presenting an independent observer's judgments in addition to his own and showing the two agree, the

speech pathologist increases the probability that he is reporting more than his subjective impressions.

In addition to reliability, if the program is to be evaluated, some means must be found to show that the treatment was responsible for the child's acquiring the prepositions and generalizing them to other objects. Unless that is done, the clinician has no way of knowing whether the child would have acquired the prepositions as a function of other events in the environment. The child's parents, for example, might have decided to teach prepositions at the same time. Peers or a classroom teacher might have placed emphasis on prepositions during the training period. These and other events in the child's environment have to be ruled out before confidence can be placed in the treatment. In order to show that the treatment was responsible for the change in the child's language, the clinician presents strong evidence that other variables have been eliminated. As a result, others will be more willing to use a similar procedure and the clinician himself will use it again with greater confidence. Each replication with appropriate controls, as suggested in the introduction, will add evidence that the treatment was responsible. With additional evidence, greater confidence can be placed in the results obtained.

It was suggested in Chapter I that two procedures, either an ABA or multiple baseline, could be used to evaluate a program. It was further explained that the ABA, or reversal, was not considered entirely suitable for application in clinical programs. The multiple baseline, however, offers some possibilities (Hall et al., 1970; Barton et al., 1970).

The prepositional phrase training would be particularly amenable to a multiple baseline design. The clinician would have four prepositions to train for this purpose. He might, after obtaining baselines on all four, decide to train only two of them initially. The other two prepositions would be sampled continually, as in baseline, but would not be administered training. That is, they would be tested every session or every other session, but only the first two prepositions would be trained. When the first pair of prepositions had been trained and tested, a final baseline on the two remaining prepositions would be obtained. If the treatment program was responsible for the child's acquiring the first prepositions, no change on the other pair should be observed. Without training, the child should not have acquired the second pair of prepositions. The clinician would then be able to initiate training for the second pair. The procedures applied to the second pair would be identical to the procedures applied to the first pair. With training the child should acquire the second pair. If so, the effectiveness of the procedure would have been demonstrated. Upon conclusion of the prepositional phrase training, it was concluded that the child did not acquire the four prepositions until each one was trained with procedures designed by the clinician.

COMMENTS

A clinician's primary responsibility is to provide services to his clients. These services should be as effective and efficient as possible. Because of their close association with individuals in need of training, clinicians are in a position to observe variables that have potential for contributing considerably to improving present treatment procedures. They are also in an advantageous position for exploring these variables beyond anecdotal observations. If training programs encompassed the characteristics described in this monograph, clinicians would be adopting procedures that would allow exploration of relevant variables beyond the level of subjective observations. They could offer empirical evidence of their work. The procedures would not interfere with the services that clinicians extend. Rather, they might facilitate and enhance them. Many clinicians provide excellent services and make efficient use of their time. They are in a position to contribute valuable information to our profession. Others are not operating at their optimum level, but would like to do so. For both groups of clinicians, we hope that reading this monograph will encourage them to apply some of the procedures in their own settings.

ACKNOWLEDGMENT

This work was supported by Research Grants HD 00870-10 from the National Institute of Child Health and Human Development and NS 010468-01 from the National Institute of Neurological Diseases and Stroke. Leija V. McReynolds is a professor of speech pathology in the Hearing and Speech Department at the University of Kansas Medical Center and is affiliated with the Ralph L. Smith Mental Retardation Research Center, University of Kansas School of Medicine, Kansas City, Kansas.

REFERENCES

BARTON, E. S., GUESS, D., GARCIA, E., and BAER, D., Improvement of retardates' mealtime behavior by timeout procedures using multiple baseline techniques. *J. appl. behav. Anal.*, 3, 77-84 (1970).

BRIGHAM, T. A., and SHERMAN, J. A., An experimental analysis of verbal imitation in preschool children. *J. appl. behav. Anal.*, 1, 151-160 (1968).

BROWN, R., *Psycholinguistics: Selected Papers*. New York: Free Press (1970).

BROWN, R., *A First Language*. Cambridge, Mass.: Harvard Univ. Press (1973).

GARCIA, E., BAER, D., and FIRESTONE, I., The development of generalized imitation within topographically determined boundaries. *J. appl. behav. Anal.*, 4, 101-112 (1971).

GIRARDEAU, F., and SPRADLIN, J. (Eds.), *A Functional Analysis Approach to Speech and Language: ASHA Monogr. Number 14*. Washington, D.C.: American Speech and Hearing Association (January 1970).

HALL, R., CRISTLER, C., CRANSTON, S., and TUCKER, B., Teachers and parents as researchers using multiple baseline designs. *J. appl. behav. Anal.*, 3, 247-260 (1970).

NOLL, J., Articulatory assessment. In *Speech and the Dentofacial Complex: The State of the Art. Proceedings of the Workshop: ASHA Reports 5*. Washington, D.C.: American Speech and Hearing Association, 283-298 (1970).

SLOANE, H., and MACAULAY, B. (Eds.), *Operant Procedures in Remedial Speech and Language Training*. Boston: Houghton Mifflin (1968).

WINITZ, H., *Articulatory Acquisition and Behavior*. New York: Appleton (1969).