DOCUMENT RESUME

ED 115 585 SP 009 639

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TITLE Verbal Correlates of Instructional Effectiveness with Kindergarten Children.
PUB DATE Apr 75
NOTE 61p.; Paper presented at the Annual Meeting of the American Educational Research Association (Washington, D.C., April 1975)

EDRS PRICE MF-$0.76 HC-$3.32 Plus Postage
DESCRIPTORS Child Language; Children; Communication Skills; Kindergarten Children; *Language Styles; Language Usage; Listening; *Preschool Teachers; *Primary Education; *Verbal Communication; *Verbal Tests

ABSTRACT

This was an attempt to conduct a micro-investigation of teachers' verbal instruction. It was based on the assumption that there must be, within broad categories such as "explaining," both better and worse ways of using language to represent reality and/or to direct student behaviors. The subjects in the study were 20 experienced kindergarten teachers, 20 elementary student teachers, 20 secondary student teachers, and 120 children aged four and one-half to six. The teachers made tapes telling children how to do eight tasks ranging from drawing and tracing figures to moving furniture around the room. Characteristics of each message were counted regarding number of words used, number of utterances, number of communication units, and time in seconds from first to last word. Two children attempted the task for each recorded message. They were scored as either accomplishing the task correctly, partially correctly, or not at all. It was found that in instructing young children one must include instructions that show exactly what the limits are for the response (what should not be done, as well as what should be done), one must use unambiguous, specific words wherever possible, and one should clearly separate each idea into a separate thought. (CD)

ED115585

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WITH KINDERGARTEN CHILDREN

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INTRODUCTION

The Paradigm and the Problem

Rosenshine and Furst (1973) have proposed a "Descriptive-Correlational Experimental Loop (DCEL)" three-stage paradigm for substantive research on teaching:

> Stage 1: Development of procedures for describing teaching in a quantitative manner;
>
> Stage 2: Research on the correlation between the descriptive variables of Stage 1 and variables of student growth or performance;
>
> Stage 3: Controlled experimental research in which the significantly descriptive variables are manipulated to test the findings of Stage 2 and, if verified, to yield instructional presecriptions.
>
> (Adapted from Rosenshine and Furst, 1973, p. 122)

To a certain extent, Rosenshine and Furst's suggestion is a delineation of N.L. Gage's (1963) proposal ten years earlier:

> One solution within the 'criterion-of-effectiveness' approach may be the development of the notion of 'micro-effectiveness'. Rather than seek criteria for the over-all effectiveness of teachers in the many, varied facets of their roles, we may have better success with criteria of effectiveness in small, specifically defined aspects of the role (p. 120).

The present study is an attempt to conduct, in Gage's terms, a micro-investigation of teachers' verbal instruction. It is based upon the assumption that there must be, within broad categories such as 'explaining', both better and worse ways of using language to represent reality and/or to direct student behaviours. In terms of the DCEL paradigm, the general objective of present investigation was to complete the first two stages with a set of micro-predictors that can be incorporated meaningfully into the third stage.

The search for micro-predictors of the effectiveness of verbal instruction is particularly appropriate when the learners are young children, whose language skills are only incompletely developed in terms of vocabulary, syntax (Chomsky, 1969), and role-taking in communication situations (Flavell 1968). Given that at any specific point in time children's incomplete verbal development is a relatively fixed effect, the responsibility for effective instructional communication in the early childhood classroom rests largely with the teacher. Therefore, the logical level at which to begin an investigation of the correlates of verbal effectiveness is within broader categories of language use, with variables in teachers' language that correspond systematically to instructional success with young learners.

General Characteristics of the Present Design

The instructional setting. The search for verbal micro-predictors of instructional effectiveness is nearly impossible in speech data gathered from natural classroom settings, particularly early childhood settings. Two aspects of the role of verbal language in early childhood instruction suggest that the gathering of instructional data for Stage 1 of the DCEL paradigm be conducted outside the classroom: (1) Language is seldom used as the exclusive mode of instructional communication: it is typically supplemented with nonverbal communication aids (e.g., demonstration, manipulation,); (2) Language, even when used exclusively, is seldom used in monologue form; it typically takes the form of close-order teacher-student exchanges.

The research problem to be solved is one of specifying the input to the student. Simply stated, when the contribution of teacher language to student achievement is obscured by factors such as non-exclusive and interactive use, the the identification and operation of micro-variables within language is similarly, and probably critically, obscured. The constraint on the solution of this problem is one of controlling the conditions under which speech data is gathered from teachers while maintaining the relevance of the study to real-world, everyday teaching in natural classroom settings.

In the present study, the input to the student was controlled by restricting the mode of instruction to verbal language and the style of instruction to monological delivery without feedback from the student. Two additional desirable features of the speech data were produced by these restrictions. The speech was relatively disciplined, with fewer verbal mazes (see Loban, 1963) and fewer incomplete utterances than conversational speech. In addition, the language was relatively self-contained with respect to proform referents (e.g., this, that, the other, it). Both of these features were expected to be useful in the isolation of micro-variables and their relationships to decoder performance.

METHOD

Subjects

Encoders: Three groups of twenty female teachers were selected: (a) experienced, practicing kindergarten teachers (PKT), (b) elementary student teachers (EST), and (c) secondary student teachers (SST).

Decoders: A sample of 120 children of roughly equal numbers of each sex was selected from the junior and senior kindergartens of six schools in an inner-ring suburb of Toronto. Decoders ranged from four-and-a-half to six years of age. All decoders were from English-speaking homes.

Materials

The design of instructional tasks. The present study was largely exploratory, as little was known about the kinds of instructional tasks that would produce rich speech data and clearly defined relationships between the variables chosen for study and the measures of student performance. The design of the experimental materials was based on educated guesses about points of difficulty in adult-to-child communication and on the need to maintain relevance to real classroom instruction. Accordingly, four contraints were imposed on the design of the tasks:

1. The conceptual content had to parallel closely that of standard kindergarten activities.
2. The skill requirements for decoders had to be within the normal range of performance abilities for kindergarten children.
3. The tasks had to be capable of successful completion by exclusively verbal instructions
4. The operant probability of the goal behaviours for the decoders had to be low.

Thus, the tasks did not involve 'teaching' in the sense of promoting new learning. Rather they were exercises in the manipulation and control of already-learned concepts and behaviours.

Eight communication problems (see Appendix A) were developed to represent a variety of commonplace classroom communication situations. The specific tasks were adapted from ordinary worksheets, standard curriculum guides, and common child-management situations. The performance requirements of the tasks, such as knowledge of basic shapes, paper folding, and line tracing were selected because virtually all kindergarten children have acquired such skills by the end of a year at school.

The tasks were designed so that their laboratory presentation to the encoders could be non-verbal. The reason for this contraint was to ensure that no suggestions of specific verbal language originated in the language used by the experimenter in the course of presenting the tasks. Each task, therefore, was presented to the encoder as a "before" and an "after" discrimination. For example, in a pencil-paper task, the "before" picture was a copy of the unmarked worksheet that would be placed in front of the decoder at the beginning of each presentation of the taped message. The "after" picture was an identical worksheet correctly completed with a blue wax crayon (e.g., certain items circled, traced, drawn). The explicitly stated instruction to the encoder was to provide the listener with as much information as she judged was necessary for the listener to be able to complete the task correctly, i.e., to make the unmarked worksheet look like the "after" picture. The actual instructions to encoders are presented in Appendix B, and the "before" and "after" pictures for each task are presented in Appendix A.

Procedures

Encoding. The central objective in the design of encoding procedures was to collect instructional messages that were as fluent and as faithful as possible to natural speech styles, in spite of the laboratory conditions. Virtually all the encoders were unaccustomed to working with children without face-to-face contact, so every effort was made to develop a cordial, unthreatening situation.

The following procedures were used with all encoders, with slight modifications for practising teachers who were taped in their schools:

1. The encoder was shown into the listening room and introduced to the (stooge) decoder and the laboratory assistant. The encoder was also shown the table and chair to be used by the decoder and cautioned against the use of the decoder's name and against the use of specific physical details of the listening room in her messages. The encoder was told that the (stooge) decoder would be completing her instructions as she gave them and that the tape recording would be used to instruct

other children at another time and place.

2. The encoder was taken to the adjacent, encoding room, seated at her table, assigned a subject number and asked to complete a brief background information form and an address label for the final report.
3. The instructions to the encoder were administered from pre-recorded tape while the subject read along from a typewritten text (Appendix B). Subjects were allowed to ask procedural questions following the instructions and between experimental tasks. The latter provision was not anticipated or encouraged, but it proved to be necessary for some encoders. At all times, questions concerning other than procedural matters were answered by suggesting that the matter be discussed after the experimental session.
4. The tasks were administered in a different randomized sequence for each encoder. The administration of each task was conducted as follows:
   a. The cassette tape for the task was selected (a separate cassette was used for each task) and placed in the recorder.
   b. The message was identified by the experimenter's reading-in the encoder's subject number and the task number.
   c. The materials for the task were placed before the encoder, the "before" picture on the left and the "after" picture on the right.
   d. The encoder was given a signal to begin (a nod from the experimenter).
   e. The encoder signalled her completion of the task with a nod to the experimenter, who then confirmed the end of the message by registering "Okay" on the tape recording.
   f. The next task was begun, repeating a - e above.

Altogether, twenty-four cassettes were used in the experiment, one for each task, and a separate set of eight for each group. This provision made it practical to randomize task order for both encoders and decoders by rearranging the cassettes.

Decoding. The total group of 120 decoders was divided randomly into two groups of 60 subjects each, with decoder identification numbers of 1-60 and 61-120, respectively. The decoding procedure was organized for the first group and replicated with the second.

Task and message assignment were organized so that the eight messages from a given encoder were decoded by eight different decoders from each of the two decoder groups. Similarly, each of the eight messages received by a given decoder was from a different encoder, three from each of two of the encoder groups and two from the third.

The procedure for each task was as follows:

1. The decoder was seated at a table and told that he would hear a tape recording of a teacher who was going to tell him to do some things. He was told that some of the things were very hard to do and that he would have to work very hard.
2. A warm-up task was played to accustom the subject to taking instructions from a taped message. If the subject could not complete the warm-up task nearly perfectly, he was dropped from the experiment and replaced. No effort was made to "teach" decoding.
3. The materials for the first task were placed before the subject (identical to the "before" picture), and the tape was played.
4. When a subject hesitated in his performance of instructions, he was told to "Do what she says." If he looked puzzled or asked questions, he was told, "Do what you *think* she means." No effort was made to directly reinforce the decoder for the performance of just-completed tasks, since the performance was quite often not correct. Instead, children were

encouraged to "Keep on working very hard" throughout the administration of the tasks.

The task-assignment system was designed so that, at the conclusion of a given decoder's experimental session, the cassette tape for each of the eight tasks was at the correct point for the next decoder. Before each task administration, the appropriate randomization of task-presentation sequence was accomplished by rearranging the cassettes.

Scoring - Decoder Performance

The development of a reliable scoring system for decoder performances was particularly important because funding constraints limited the number of decoders for each message to only two children. The contribution of decoder variance to the data was, therefore, expected to be rather high. The problem became, then, to organize the data in such a way that the research instrument was less sensitive to decoder variance and more sensitive to encoder variance. Criterion scoring, with its attention to relatively fine details of decoder performance, seemed to highlight rather than to ignore variance that resided in the decoder (e.g., visual-motor ability), independently of the information contained in the item of communication.

Categorical Scoring. The type of scoring system that was applied to the data was a categorical system. Although the category into which a given decoder performance was placed depended upon specific criteria being met, the system was at root an ordinally scaled system, inasmuch as decoder performances were grouped into categories on the basis of their closeness to the task objective(s), with numerical score assigned accordingly. In general, decoder performances were categorized and scored as follows: (1) "correct" -- two points; (2) "minimally discriminative" in the direction of the task objectives -- one point; and (3) "non-discriminative" with respect to the task objective -- zero points. The criteria defining the boundaries of each category are provided in detail for each task in Appendix C.

On certain tasks, the classification of performance as "correct" was broadened somewhat because of extreme task difficulty. In Task I, for example, only one strictly correct performance occurred out of the 120 decoders. In order to achieve a reasonable distributions of decoders across the three categories (irrespective of encoder groups), the upper two categories were broadened. Similarly, Task 6 category boundaries were stretched slightly to admit as "correct" decoder performances in which the straight lines did not converge.

The criterion of "minimally discriminative" performance was, in a sense, the core of the scoring system used with the data. Even casual inspection of the decoders' performance reveals that one of the most difficult instructional achievements with young children is to prompt both the initiation and the termination of a behaviour that could be either serially or symmetrically iterated. Thus, "minimal discrimination" included two dimensions of decoder performance: at least some acknowledgement of the task objective and the avoidance of indiscriminate patterned or serial behaviour.

Scoring Procedures--Message Content

Surface structure variables. Most of the prior studies involving the extensive analysis of speech have been concerned with conversational or narrative speech (e.g., Loban, 1963; Rosenshine, 1968; Olim, 1969; Snow, 1972). Olson's communication study (1972) is a singular exception inasmuch as it was concerned with short, unrehearsed oral instructions (although with all decoders above the age of twelve). Olson did not find crude counting analysis useful in accounting for the difference between successful and unsuccessful messages on his geometric task, the only one that is similar to the tasks reported here. Since the decoders in this study, however, were young children with verbal skills below adult levels, there was some reason to believe that variables such as message length, speed of speech, and structuring would be important.

Accordingly, four basic counts were taken from each encoded message: (1) the number of words, (2) the number of utterances, (3) the number of communication units, and (4) the time in seconds from the first to the last word. Five additional variables were derived from the original four: (1) the number of words per second, (2) the number of communication units per utterance, (3) the number of words per utterance, (4) the number of words per communication unite, and (5) the number of seconds per communication unit.

Segmentation of encoders' speech required the unexpected modification of methods devised by other researchers for conversational speech (e.g., Loban, 1963). Normal conversational patterns of stress, inflection, and pause were frequently violated by the teachers in this study. Imperative sentences dominated the speech. In addition, many teachers used a kind of 'teacher talk', a rather forceful style without normal variations in pitch and inflection. Frequently, there were no pauses at the ends of utterances, such as when a teacher suddenly remembered something she forgot to say or suddenly modified a previous instruction. Thus, where Loban defined phonological units on the basis of inflection, stress, and pause, the comparable unit of speech in this research--the utterance--was defined on the basis of inflection, stress, pause, <u>and/or</u> the experimenter's judgment that a new "complete thought" (in the sense of traditional grammatical analysis) was beginning. If no identifiable pause occurred, then intonational and inflectional information was used. If no standard pattern occurred but a clearly "new" idea was invoked without any conjunction (e.g. and, or, but), then an utterance was marked.

Much of the time, of course, utterances corresponded closely to one's idea of normal English sentences. Nonetheless, the analytical system had to be designed to cope with the not-infrequent occurrence of clear non-sentences, such as the repetition of a prepositional phrase with complete initial and terminal pitch changes and too distant in time to be termed merely a parenthetical addition to an utterance. Occasionally, and especially in the case of "O.K." or "Good", single words were marked as utterances on the basis of long pauses before and after the word.

For this research, the communication unit was defined to be a unit of speech containing a single, independent idea. Syntactically, a communication unit corresponded closely to the traditional notion of an independent clause. Semantically, it could stand alone as a unit of instructional information, although it could also be linked to another such unit within a single utterance by a coordinating conjunction. Thus, for example, "Put a circle around the top letter", was marked as a single utterance with a single communication unit, while, "Put a circle around the top letter, and then trace the square", was marked as a single utterance but two communication units. The communication unit is a much more reliable unit than the utterance for the speech in this research, simply because its marking was not affected significantly by phonological inconsistencies.

Textual variables. The search for instructional correlates of decoder performance was conducted in a part-to-whole fashion, beginning with individual tasks with the objective of generalizing across tasks where possible. In order to illuminate the differences between generally good and generally bad messages, trancriptions were separated into three groups: 'high' messages, or those with at least one perfect decoder performance; 'low' messages, or those with both decoder performance scores of zero; and a residual group of messages with one or two partially correct performances.

The two extreme groups of messages (high and low) were searched for textual features that occurred frequently in one or both groups. Given the detection of a promising feature, all sixty messages for that task were searched and the feature counted. Two kinds of frequency counts were made, depending upon the feature in question. In the case of organizational features (e.g., advance organizers), messages were scored dichotomously (zero to one). In the case of features for which repetition could influence comprehension, a raw frequency count was taken for each message. In some cases both counts were taken, usually when common sense failed to suggest which would be more appropriate.

RESULTS

Analysis of Tasks

Encoder task score distribution. Each of the eight messages for a given encoder was decoded by two different decoders, each decoder performance having a maximum possible score of two points. The maximum possible encoder task score, therefore, was four points. The means and standard deviations for the task data are shown in Table 1 below.

Insert Table 1 about here

In all but Task 8, the distributions of encoder task scores were highly skewed with low mean scores and relatively high standard deviations. A high level of task score variance was expected because of the small number of decoders for each message.

The maximum possible total score for each encoder was 32, the sum of the maximum possible scores from the 16 different decoder performances. The distribution of encoder total scores is shown in Figure 1. The mean total score for all encoders was 8.867 with a standard deviation of 4.086. Thirty-four of the 60 encoders (57%) scored below the mean and 26 above (43%).

Insert Figure 1 about here

Each message was decoded by two children. The correlation between the pairs of decoder scores for each task, adjusted for a test of double length, provides an index of the reliability of the encoder task scores. The results of this analysis are shown in Table 2.

Insert Table 2 about here

Because of the generally low task reliability, two separate coefficients were computed for encoder total score reliability in order to determine the adequacy of the measure as a criterion of encoding effectiveness. Coefficient α provides a conservative lower bound on reliability when the items in an instrument are heterogeneous and few in number. For the present purposes, the obtained α of 0.46 was judged low but acceptable. The second measure was expected to yield a conservative upper bound on total score reliability. The tasks were divided into split-halves roughly parallel in terms of content and a correlation coefficient computed. The raw correlation of 0.48 adjusted for a test of double length, yielded an upper bound for the reliability of the eight tasks of 0.65.

Analysis of Messages--Surface Structure Variables

The mean and standard deviation for each of the nine surface structure variables (SSVs) are given in Table 3. In each of the nine cases, the differences between the eight task means (encoder groups pooled) were significantly different (univariate $p \doteq 0.001$), indicating that the tasks were generally diverse in terms of the surface characteristics of the language they prompted.

Insert Table 3 about here

In order to avoid 'overfitting' later analyses of the relationship between content variables generally and encoder total score (Tatsuoka, 1973), it was necessary to isolate those SSVs that were likely to be significantly related to encoder total score. The values of the SSVs were correlated with encoder task score for each task to provide a basis for a selection of those tasks in which SSVs may be related to encoder total score. Table 4 shows these correlations.

Insert Table 4 about here

In order to refine futher the selection of surface structure variables for later analysis, stepwise multiple regression analyses were performed on the SSV data for Tasks 3, 4, and 6, in which correlations between the SSVs and task score were relatively high. The F-to-delete and F-to-enter thresholds were set at 0.05 in order to guard against the accidental non-entry or removal of an important predictor. An SSV was retained for analysis as a predictor of encoder total scores if it accounted for at least 2% of the task score variance when stepped into the regression analysis for a given task. The five SSVs that emerged as significant predictors of their respective task scores are presented with selected summary data in Table 5.

Insert Table 5 about here

A discriminant analysis was conducted to determine the predictability of encoder group membership from the five surface structure variables. Encoders were only moderately consistent within groups, with only 35 of the 60 encoders (53.3%) assigned by the analysis to their original groups.

Analysis of Messages--Textual Variables

The identification of textual features for systematic coding and counting was a post hoc operation. Features that were suggested by significant results in related prior studies were included only if consistent coding for them was possible in the present data. The manual scanning procedure used to identify textual variables for the principal analysis was as follows:

1. High- and low-scoring messages were read until a commonly or differentially occurring feature was noted.
2. A definition of the feature was developed to permit systematic identification of its occurence. If the speech data did not support a workable definition, or if development work beyond the resources of the present study was required, then the feature was excluded from futher consideration.
3. The feature was counted for only the high and low messages. If the mean frequencies were obviously not different, then the feature was excluded from further consideration.
4. If the feature occurred with detectable difference frequencies, or if the n of either group was too small to permit relatively reliable judgement, then the feature was counted for all 60 messages for that task. A correlation coefficient between the frequency of occurrence and task score was computed.
5. A correlation of 0.20 was considered to be high enough to merit futher investigation and inclusion of the feature as a variable in the principal analyses of the study.

Although the search for textual features was not conducted in order of task number, the results of the search have been organized in that manner to facilitate reference to other sections of the report, most notably to Appendix A, where the tasks are presented. The features described below represent only a small portion of the hunches and informal hypotheses that came to mind as the messages were read and re-read for salient characteristics that could possible relate to effectiveness.

1. Sequence references (SEQU-1). Relative to other tasks, Task 1 seemed to prompt more language designed to pace decoders through their performances. Such language included "After you've done that....." "Now....," and "Now listen carefully....," The correlation between the frequency of such references in each message and task score was 0.06. Because sequence cues would not be likely to occur more than once in a communication unit, a derived variable was computed: sequence references per communication unit. Its correlation with task score was 0.31 (N = 30).
2. Caution references (CAUTION-2, CAUTION-5). Both Task 2 and Task 5 decoder performances included many instances in which decoders were not selective in their execution of the general instruction of draw-a-circle and trace, respectively. This observation prompted a search for words in the high-scoring messages that would tend to engender care and selectivity in a listener. The words counted were those that signalled points in the instructions at which the listener was to "be especially careful," and included only and just in Task 5 and only, just, particular, instead and but in Task 2. The correlations between frequency and task score were 0.33 and 0.35 (N = 60) for Tasks 2 and 5, respectively.
3. Ambiguous/unambiguous reference (AMBIG-3, UNAMBIG-3). Task 3 involved thepplacement of actual pieces of paper on a larger page, including the location of one square horizontally above a larger square. Based on the investigator's linguistic intuition with respect to ambiguity, two types of reference to the location of that square occurred in encoder's messages: over and on-top-of (the large square), and at-the-top-of, above, and on-top-of-but-next-to (the large square). The former characterizations are ambiguous with respect to the placement of the smaller square physically on the larger square and horizontally above

the large square. The correlations between the frequency of occurence of the ambiguous and unambiguous references and task score were -0.35 and 0.49 (N = 60), respectively.

4. Explicit count instruction (COUNT-4). The explicit count instruction was readily identified, since its occurrence caused a break in the natural flow of speech (i.e., "Let's count # one, two three #") and since seven of the eleven high scoring and few of the low scoring messages included it. Its correlation with task score was 0.56 (N = 60).

5. Explicit negative references (EXNEG-5, EGNEG-6). Explicit negative instructions occurred most obviously in Tasks 5 and 6, in which the task goals required the partial execution of an otherwise general instruction. For example, Task 5 required that the decoder trace portions of the geometric form: Task 6 required the copying of only a portion of the form. Explicit negatives are illustrated by expressions such as "don't trace the circle," and "don't let the two lines touch." The correlations between the frequency of occurrence of this feature and task score were 0.26 and 0.36 (N = 60) for Task 5 and 6, respectively.

6. Vagueness words (VAGUE-5). The defining characteristics of this feature was that the 'vague' word or expression could have been replaced by a more explicit one. The list of vagueness words from Hiller, et al. (1969) was used as a guide, with additional instances included on the basis of the definition. Task 5 was chosen for this count because of the opportunities it presented for both vague and precise language. Vagueness words included "the little part of the circle," "some shapes," and "O.K.". The correlation between frequency and task score was 0.05. Vagueness was retained as a variable because of the findings of Hiller, et al. (1969).

7. Upside-down (UPSIDE-8). The frequent occurrence in decoder performances of the chair overturned on the table with both the top of the back and the front of the seat resting on the surface of the table suggested that the characterization of the 'upside-down-ness' of the chair may have been important. Thus, the occurrence of upside down itself (as opposed to "turn the chair over") was counted. The correlation with task score was 0.37 (N = 60).

Table 6 provides a summary of the preliminary data on the ten textual features designated as variables.

Insert Table 6 about here

Correlated Effects--Content Variables and Encoder Total Score

The final objective of the present study was to discover what have been termed 'micro-variables' that may predict the effectiveness of teachers' verbal instruction of young children in simple, one-way verbal communciation tasks. On the basis of the foregoing analyses of surface structure and textual variables, 15 'content variables' were isolated within their respective tasks as having significantly accounted for task-score variance. The final analysis of the content variables, therefore, was designed to test their value, collectively and individually, as predictors of encoder total score.

The raw values of the 15 content predictors yielded what may be termed a content variable (CV) vector score. The procedures for the selection of the content variables resulted in the production of three vector-scores for each encoder: (1) an SSV score, the raw values of the five surface structure variables; (2) a TV score, composed of the raw frequencies of the textual variables for that encoder; (3) a CV score, made up of all 15 content variables.

The correlation matrix for the CV scores and encoder total score is presented in Table 7, with the sub-matrices for SSV and TV scores isolated by double-line dividers. Inspection of the matrix generally reveals relatively mixed levels of intercorrelation for the variable pairs. The clusters of very high correlations were generally expected, such as those for matrix items 12, 13, and 14, all of which are measures of message length.

Insert Table 7 about here

The multiple correlation coefficients for the three groupings of variables and total encoder score indicate the amount of encoder total score variance accounted for. The multiple R values and their shrunken values (to adjust for over-estimation of the population multiple R) are provided in Table 8.

Insert Table 8 about here

Combined into a single multiple correlation analysis, after adjustment for shrinkage, the 15 variables account for 37% of the total score variance. An analysis of commonality developed by Mood (1971) was performed to determine the degree of predictive overlap in the two sets of variables. This analysis separates the amount of the variance associated with each set of predictors and, by simple subtraction, the amount common to both. In the present case, two sets of predictors, SSVs and TVs, were used to predict encoder total score (TS). Hence, the amount of the variance uniquely associated with each is given by:

$$U(SSV) = R^2_{TS(CV)} - R^2_{TS(TV)}\text{, or}$$
$$= 0.531 - 0.349$$
$$= 0.182$$
$$U(TV) = R^2_{TS(CV)} - R^2_{TS(SSV)}\text{, or}$$
$$= 0.531 - 0.205$$
$$= 0.326$$

The amount of shared accountability, therefore, is the amount by which the sum of U(SSV) and U(TV) falls short of the variance accounted for by the two sets of predictors together. Thus, the amount of shared variance is 0.023, suggesting that the two sets of predictors operate relatively independently of one another.

Cooley and Lohnes (1971) suggest that the beta weights not be relied upon too heavily in the interpretation of multiple linear regression analyses with only moderate sample sizes, since beta weights are known to fluctuate considerably from sample to sample. Marks (1966) found that 'normed sample predictor-criterion correlations' were generally more reliable than beta weights upon relication. Cooley and Lohnes, therefore, suggest their 'regression factor structure coefficient' (RFS coefficient) as an alternative to beta weights as the basis for the interpretation of multiple regression analyses (Cooley and Lohnes, 1971, p. 55). The RFS coefficient for a given variable is the correlation between encoder total score as predicted by that variable and total score as actually obtained. It is computed by multiplying the predictor-criterion correlation by the inverse of the multiple R for the inter-correlation matrix as a whole, thus reducing the influence of the beta weights in their respective contributions to the computation of the multiple partial regression coefficient $R_{c.1,2,3,...p}$.

Table 9 provides the RFS coefficients for the two sets of variables, computed using the multiple R values from their respective regression functions.

Insert Table 9 about here

The obvious breaks at 0.40 for the SSVs and at 0.27 for the TVs served to demark the 'significant' variables, since no standard means of testing significance was available. By this procedure, four SSVs and seven TVs were considered to be related enough to total score to merit experimental testing.

DISCUSSION

Interpretative limitations and requirements. In its principal objective, the present study was genuinely exploratory. Thus, in two important aspects, the development of a criterion of instructional effectiveness and the selection of predictor variables, its findings were arrived at by means of a post hoc analysis of the data. There are three aspects of the present study which prescribe limitations on the interpretation of its correlational findings. First, the criterion of effectiveness, encoder total score, and the significant predictor variables have common roots in the 960 decoder performance sheets. The scoring sytem used was developed by sorting decoder performances on the basis of their closeness to the task objectives. The preliminary identification of potential predictor variables was accomplished by the same investigator selectively scanning the messages and basing decisions on subjective correspondence between the verbal language in the messages and his inevitable knowledge of common errors in decoder performance. Second, the statistical screening procedure, of successively eliminating from a large number of measures those that did not correlate signficantly with task score and of retaining those that did, guaranteed the final significance of at least some of the correlations. Finally, the corpus of encoder speech data collected for this study is sizable, consisting of nearly 5,000 communication units and almost 50,000 words. The number of potential variables that could be identified and counted is very large. Eleven variables emerged from the present analysis significantly correlated with the regression function. Another post hoc investigation of the same data could produce an entirely different collection of equally significant predictors.

The presumed summary effect of these factors was to bias the results in favour of the statistical significance of selected variables. Thus, even the significant variables must be discussed with caution. Accordingly, nonsignificant variables are best ignored, for their number is large, and discussion of them is unwarranted in the absence of hypotheses advanced prior to the collection and analysis of data.

Task-specific variable origins and generalized significance. Each of the significant predictor variables was identified and measured in a single task. Further, its correlation with task score was the basis for the screening procedure which selected variables for inclusion in the final multiple correlation with total score. Given the low reliability of task scores generally, the effect of this initially was to load the case somewhat against the selection of variables, so that only the strongest ones emerged. The entry of these variables into a multiple correlation analysis with encoder total score was based on an important post hoc speculation, that an encoder's tendency to employ an appropriately powerful verbal communication device in a specific task situation would correlate with her communication ability generally. The significance of the multiple R's indicates the degree to which that assumption was valid generally, while the significant RFS coefficients for each type of variable suggest the degree to which it was true for specific communication devices.

The finding that the surface structure and textual variable sets are relatively independent of one another is important to subsequent discussion and to the construction of experimental suggestions for future research. It suggests that at least two factors were accounting for total score variance, since the sum of their unique contributions is nearly equal to the variance accounted for when they are treated as elements of a common factor. For the immediate interpretative purposes, the independence of the two types of variables permits the discussion to consider the possibility of their interaction as factors without great risk of that being confounded by overlapped or common effects.

Message surface structure. The communication unit has emerged as the most useful surface structure predictor of encoder total score, occurring in three of the four significant SSVs (CU-3, CU-4, CU/UTT-6). The fourth significant SSV, WORDS-4, originiates in the same data as CU-4, and is not particularly useful in this discussion since it correlates highly with the latter variable but has a much lower RFS coefficient (cf. Cooley and Lohnes, 1971, p. 71). Superficially, the positive RFS coefficients of the communication unit variables and the negative coefficient of the utterance-size variable (CU/UTT-6) suggest that instructional effectiveness varies directly with the number of communication units and inversely with the number of such units within a given utterance (i.e. phonological unit). By itself, this suggestion is not particularly useful. It is highly unlikely that encoders in this study or that teachers in general would think in terms of message length when making decisions about optimal instructional communication. In order to be useful, further suggestions have to be found concerning the content of the communication units and a more plausible basis for decisions regarding their use..

Three types of communication units can be discerned in the messages generally: (1) core units, (2) supplementary units, and (3) peripheral units. Core units can be defined as those in which key concepts or behaviours, related directly to the task goal, are presented for the first time in a message. Supplementary units can be defined as those which contain a repetition, a paraphrase, and/or some other modification of a prior core unit. Peripheral units are all those which do not contain instruction related to the achievement of the task goal. The three units are defined in such a way that a message could be perfectly decoded from the core units alone, barring such problems as ambiguity and lexical errors. In addition, the definitions suggest that the differences among messages should occur largely as a function of the number of peripheral and supplementary units, since the number of key concepts and/or behaviours in a given task is assumed to be relatively fixed. Insight into the roles played by the three types of communication units can be gained by considering the message of Encoder 52 -- the highest scoring encoder in the present sample -- for Task 5, which earned the maximum task score of four points. Figure 2 shows the same message parsed into its communication units, each one labelled according to the above definitions. An important observation can be made: If one could assume a good decoder, only four of the thirteen communication units would have been necessary.

Insert Figure 2 about here

In the light of the above observation, it is useful to consider the character of Task 4 since CU-4 was the most significant surface structure predictor. The worksheet for Task 4 contained four alpha-numeric-like nonsense figures arranged differently in each of four rows. The task objective was to instruct the decoder in the circling of one specific figure in each row. The message of Encoder 12 would probably be an adequate message for a good, adult decoder:

> I want you to circle one shape in each row # in the first row circle the first shape # in the second row the third shape # and in the third row circle the first shape # and in the fourth row the second shape #

Yet, it and most messages like it produced no discriminative decoder performance on Task 4. The mean number of communication units in the seven Task 4 messages that produced at least one perfect decoder peformance was almost one and a half standard deviations above the mean for all 60 encoders of that task, indicating, in conjunction with the significance of CU-4, that the number of supplementary and/or peripheral units may have been important to decoder performance.

Considered alone, the surface structure predictors fall short of the requirement that substantive theoretical statements be supported by the significant findings. The reason for this is that surface structure findings are empty without information about the content of the units measured. For that information, it is appropriate to integrate further discussion of the surface structure predictors with a consideration of the significant textual variables.

Message textual structure. The instructional problems addressed by this study were not ''teaching' problems in the usual sense of enlarging a listener's repertoire of learned concepts or skills. Rather, the tasks were designed as problems in the initiation and control of already-acquired behaviours around conceptual response parameters. Nearly every encoder was successful in the communication of the basic response modes required by the tasks (e.g., tracing, circling, moving a chair).[1] Virtually all the important breakdowns in instructional communication occurred in the control of these responses.

The tasks were of two general types in terms of the kinds of errors that were made: (1) those in which the goal response was amenable to continous or discrete generalization (e.g., tracing and circling, respectively) and in which the primary instructional problem seemed to be one of eliciting selective responding, and (2) those in which the goal response was singular and mutually exclusive of alternative responses (e.g., a single chair can only be in one place at a time) and in which the primary instructional problem seemed to be one of clear, unambiguous specification of the end-state of the materials to be manipulated. Tasks 1, 2, 4, 5, and 6 were of the former type and produced most of the significant surface structure and textual predictors. Tasks 3, 7, and 8 were of the latter type.

Apparently, the decoders in the present study were strongly inclined to indiscriminantly generalize a response mode. For example, in Task 4, nearly half the decoders circled every figure in a single row or column; in Task 6, nearly a third either traced or copied the entire "ice cream cone." Not surprisingly, therefore, the principal difference between successful and unsuccessful encoders seemed to reside in their relative abilities to communicate to the decoder, with adequate instructional power, the points at which the generalizable response was to be started and stopped, or at least applied with caution. Within the context of this

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1 The only notable exception to this generalization was Task 6, in which the instruction to 'draw' produced both tracing and copying responses.

observation, five of the seven significant textual predictors were measures of 'response-limiting' features: CAUTION-2, CAUTION-5, EXNEG-5, EXNEG-6 and COUNT-4.

Only two of the 60 messages for Task 6 elicited perfect performances from both decoders. One of them, the message of Encoder 13, is presented in parsed form in Figure 3 with the explicit negative and caution references italicized. Both of the explicit negatives and two of the three caution words appear in supplementary communication units (units 4, 7, 9, and 11). In the message of Encoder 52, Task 5, presented in Figure 2, these response-limiting features occur in supplementary units exclusively (units 7, 12, and 13).

The message feature measured by the textual variable for Task 4, COUNT-4, can also be considered a response-limiting feature, inasmuch as the explicit presentation to the decoder of the counting operation ("one, two, three") specifies both starting and stopping points. Figure 4 contains the message of Encoder 46, Task 4, one of the two messages with perfect decoder performances. The explicit counting occurs in units, 6, 13 and 14, all of which are supplementary units.

Insert Figure 3 about here

Insert Figure 4 about here

The messages in Figures 2, 3, and 4 were selected for illustrative purposes because they were among the very few that generated pefect performances from both decoders. To the degree that they are representative of 'optimal' messages, the following observations may be important.

1. Of the 40 communication units of all three types in the three messages, only 16 were core units, or those minimally required for complete communication of the task objectives.
2. Of the 40 communication units of all types, 16 were supplementary units, or those which repeated or paraphrased, or modified prior core units.
3. Of the 16 supplementary units, 10 contained one or more of the response-limiting, significant textual variables.
4. In the three messages, only one occurrence of a textual variable was in a non-supplementary unit.
5. Nine of the response-limiting communication units were complete utterances (CU/UTT = 1.0).

The common errors in decoder performances suggested that Tasks 3, 7, and 8 were qualitatively different from the others in terms of the kind of communication problems they presented. The textual predictors that emerged from Tasks 3 and 8 reflect this difference. Both UNAMIG-3 and UPSIDE-8 are measures of relative non-ambiguity in the specification of an aspect of the end-state if the task materials. (The relatively ambiguous alternatives for each task are discussed in the Results section of this report). In terms of message surface structure, their occurrence was most frequent in core communication units, with occasional occurrence in supplementary units that repeated or paraphrased the information of a core unit and in peripheral units of a summary nature. The messages of Encoder 35, Task 3, and of Encoder 52, Task 8, presented in Figures 5 and 6, respectively, illustrate the general observations.

Insert Figure 5 about here

Insert Figure 6 about here

Summary of correlational findings. In the present study, the definition of verbal instruction was restricted to the use of verbal language to initiate and control familiar response modes within acquired conceptual parameters. The interrelationships observed among the surface structure and textual variables that correlated significantly with encoder total score suggest the following hypotheses about the structure of instructional messages for young children.

1. When the goal response for a task is generalizable beyond the goal parameters, an instructional message will be effective to the degree that the minimal, 'core' specification of response parameters is augmented by (a) the explicit negative specification of undesired or forbidden extensions of the response and/or (b) the cautionary paraphrasing of the desired range of the response, represented in the present analysis as supplementary communication units.
2. When the goal response for a task is singular and non-generalizable, an instructional message will be effective to the degree that the specification of the task objective is unambiguous.
3. An instructional message will be more effective if individual communication units are constructed as single phonological units (i.e. utterances).

The correlational findings of this study suggest that adult standards of minimal instructional adequacy--for a given task represented by the set of core communication units--are not strictly applicable to the verbal instruction of young children. The significance of the variables measuring response-limiting verbal features suggest that the common adult notion of instructional 'explicitness' may have to be modified when applied to communication to young children, that it may have to include the specification of the things that are logically excluded by the positive specification of concepts or behaviours. Virtually all encoders in this study seemed to assume that children would require <u>more</u> than merely 'core' information, but relatively few of them seemed to know what semantic and/or logical form that additional information should take.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF ENCODER TASK SCORES FOR EIGHT TASKS

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8
Mean	0.85	0.80	1.02	0.73	0.95	1.15	1.17	2.20
Standard Deviation	1.16	0.94	1.02	1.07	1.08	1.15	1.20	1.33

TABLE 2

TASK RELIABILITY MEASURED BY PAIRED-DECODER CORRELATIONS

(N = 60)

	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8
Reliability	.33	.11	.11	.54	.15	.06	.08	.23

TABLE 3

COMMON AND GROUP MEANS AND STANDARD DEVIATIONS FOR NINE SURFACE STRUCTURE VARIABLES (N = 60)

Variable	Abbrev./ Acronym*		Common (N=60)
Words	WORDS	M S.D.	99.43 67.99
Time (seconds)	TIME	M S.D.	58.87 40.99
Words/Second	WDSEC	M S.D.	1.80 0.56
Utterances	UTTS	M S.D.	7.99 5.82
Communication Units	CUS	M S.D.	10.54 7.19
CUs/Utt.	CUS/UTT	M S.D.	1.41 0.42
Wds./Utt.	WDS/UTT	M S.D.	13.61 5.23
Wds./CU.	WDS/CU	M S.D.	9.81 3.23
Time/CU.	TIME/CU	M S.D.	5.97 2.56

* To be used hereafter in tables and figures.

TABLE 4

CORRELATIONS OF NINE SURFACE STRUCTURE VARIABLES AND ENCODER TASK SCORES

(N = 60)

Variable	Task Number							
	1	2	3	4	5	6	7	8
WORDS	.07	.06	.26	.28	.05	.08	.05	-.09
TIME	-.00	.04	.31	.40	.05	.09	.06	-.05
WDSEC	.03	.02	-.10	-.17	.08	-.03	-.05	.01
UTTS	.13	.05	.35	.41	.06	.13	.14	.04
CUS	.06	.01	.36	.41	.03	.12	.13	-.03
CUS/UTT	-.14	-.08	-.11	.05	-.11	-.26	.01	-.13
WDS/UTT	-.09	-.07	-.23	-.38	-.08	-.17	-.16	-.18
WDS/CU	.01	-.00	-.24	-.41	-.04	.05	-.20	-.12
TIME/CU	-.05	-.03	-.01	-.21	-.15	.00	-.14	-.13

TABLE 5

SUMMARY OF ANALYSES OF STEPWISE MULTIPLE REGRESSION OF TASK SCORE ON FIVE SSVs FOR TASKS 3, 4, and 6

(N = 60)

	Variable	F-to-Enter	F-Signif. After Entry	Contribution to Mult. R^2	Mult. R After Entry
Task 3 Analysis	CUS	8.41	.01	.13	.36
	WDSEC	3.44	.00	.05	.42
Task 4 Analysis	CUS	12.05	.00	.17	.42
	WORDS	9.37	.00	.08	.50
Task 6 Analysis	CUS/UTT	4.31	.04	.07	.26

TABLE 6

SUMMARY OF PRELIMINARY DATA FOR TEN TEXTUAL VARIABLES[a]

(N = 60)

Variable	Abbrev./ Acronym[b]	Frequency of Occurrence M	Frequency of Occurrence S.D.	Correlation with Task Score
Sequence Cues/CU	SEQU-1	0.14	0.11	.24 (n.s.)
Caution Words	CAUTION-2	0.98	1.14	.33
Unambiguous reference	UNAMBIG-3	0.95	0.95	.49
Ambiguous reference	AMBIG-3	0.47	0.65	-.35
Explicit count instruction	COUNT-4	0.68	1.02	.56
Explicit negatives	EXNEG-5	0.50	0.75	.26
"Only/Just"	CAUTION-5	0.97	1.33	.35
Vagueness words	VAGUE-5	1.02	1.59	-.05 (n.s.)
Explicit negatives	EXNEG-6	1.37	1.35	.36
"Upside down"	UPSIDE-8	0.98	0.91	.37

[a]Except where indicated, all correlations significant ($p < 0.05$).

[b]To be used in all tables and figures hereafter. The arabic numerals refer to the number of the task in which the feature was counted.

TABLE 7

CORRELATION MATRIX FOR CV SCORE AND ENCODER TOTAL SCORE (N = 60)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. SEQU-1	-															
2. CAUTION-2	.12	-														
3. UNAMBIG-3	-.02	.36	-													
4. AMBIG-3	-.09	-.26	-.21	-												
5. COUNT-4	-.02	.02	-.07	.05	-											
6. VAGUE-5	.22	.16	.00	.01	.40	-										
7. EXNEG-5	.25	.23	.08	-.14	.32	.39	-									
8. CAUTION-5	.05	.16	.07	-.02	.17	.40	.38	-								
9. EXNEG-6	-.02	.01	.05	-.04	.36	.12	.12	.20	-							
10. UPSIDE-8	-.06	.13	.04	.01	.16	.01	.26	.31	.27	-						
11. WDS/SEC-3	.24	.18	-.07	.10	-.03	.34	.18	.29	.19	-.02	-					
12. CU-3	.06	.29	.40	.00	.38	.55	.22	.28	.24	.11	.31	-				
13. WORDS-4	.11	.18	.16	.00	.38	.55	.37	.36	.30	.12	.28	.70	-			
14. CU-4	.05	.19	.17	-.06	.52	.58	.40	.33	.30	.17	.12	.71	.93	-		
15. CU/UTT	-.04	-.14	-.01	-.12	-.11	-.08	-.10	.08	-.07	.01	-.08	.05	-.06	-.09	-	
16. Total Score	.01	.27	.31	-.03	.16	-.05	.21	.20	.39	.31	.02	.18	.26	.35	-.27	-

Multiple R = 0.728 Mult. R^2 = 0.531

Shrunken Mult. R = 0.609 Shrunken Mult. R^2 = 0.371

TABLE 8

SAMPLE AND SHRUNKEN MULTIPLE R VALUES FOR THREE GROUPINGS OF PREDICTOR VARIABLES AND ENCODER TOTAL SCORE

	SSV Scores	TV Scores	Combined SSV & TV Scores
Sample Mult. R	0.452	0.591	0.728
Sample Mult. R^2	0.205	0.349	0.531
Shrunken Mult. R	0.362	0.465	0.609
Shrunken Mult. R^2	0.131	0.216	0.371

TABLE 9

RFS CORRELATIONS FOR FIVE SURFACE STRUCTURE VARIABLES AND TEN TEXTUAL VARIABLES*

(N = 60)

SSV	RFSC	TV	RFSC
CU-4	0.77	EXNEG-6	0.65
CU/UTT-6	-0.59	UNAMBIG-3	0.53
WORDS-4	0.57	UPSIDE-8	0.53
CU-3	0.40	CAUTION-2	0.45
WDSEC-3	0.04	EXNEG-5	0.36
		CAUTION-5	0.34
		COUNT-4	0.27
		VAGUE-5	0.08
		AMBIG-3	0.05
		SEQU-1	0.02

*The significant variables (RFS coefficients 0.25) are italicized in their respective transcriptions in Appendix G.

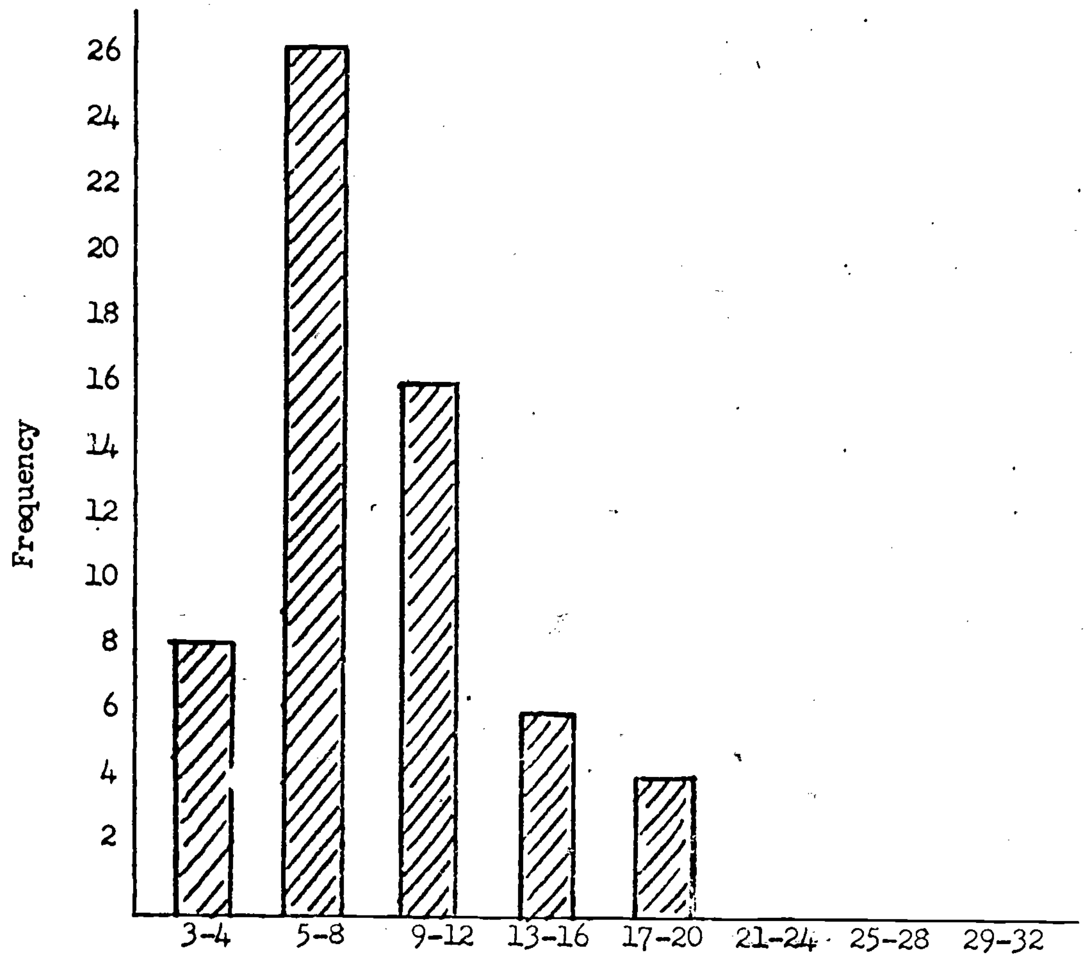
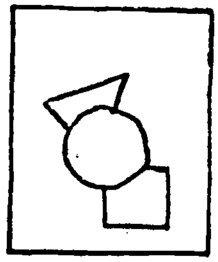
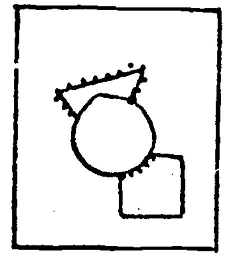


Figure 1. Distribution of Encoder Total Score
(N = 60)



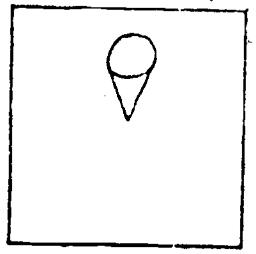
"Before" picture



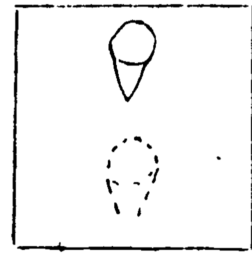
"After" picture

1.	Peripheral	On the worksheet in front of you you have a circle, a triangle with part of it hidden and a square with part of it hidden too #
2.	Peripheral	three shapes #
3.	Core	I'd like you to take your blue crayon //
4.	Core	and let's trace the part of the triangle that's showing #
5.	Supplementary	take your blue crayon //
6.	Supplementary	and we'll go all along the black lines of the triangle that's showing #
7.	Supplementary	not the circle or the square just the triangle #
8.	Core	all right put your crayon down #
9.	Peripheral	on your worksheet there's the circle in the middle //
10.	Peripheral	and it looks like it's sitting over one of the corners of the square #
11.	Core	with your blue crayon, I'd like you to trace over the part of the circle that's sitting on top of the square #
12.	Supplementary	not all around the outside of the circle #
13.	Supplementary	just over the part that is sitting on top of the square.

Figure 2. Encoder Stimulus Pictures for Task 5 with the Message of Encoder 52 parsed into three kinds of communication units.



"Before" picture

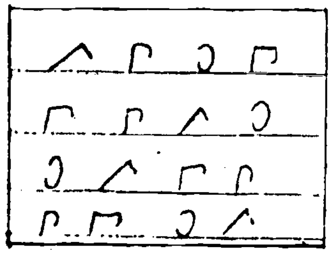


"After" picture

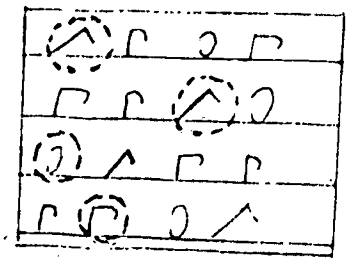
Unit No.	Unit Type	Text
1	Peripheral	The top of your page you'll see a little drawing that looks like an ice cream cone #
2	Core	I want you to take your blue crayon //
3	Core	and at the bottom of your page I want you to draw just the ice cream part #
4	Supplementary	just draw a nice big blue ball #
5	Peripheral	that's for the ice cream #
6	Core	now I want you to give it two legs #
7	Supplementary*	but I don't want you to join the legs #
8	Peripheral	if you look at the picture at the top of the page you'll see that the two legs are joined #
9	Supplementary	but I don't want you to put yours together #
10	Supplementary*	I want you to have a standing ice cream cone #
11	Supplementary	so you just draw two sticks down from your blue ball #

*Using adult verbal conventions as the reference point, both lines 7 and 10 are implied by line 6.

Figure 3 . Encoder Stimulus Pictures for Task 6 with the Message of Encoder 13 parsed into three kinds of communication units.



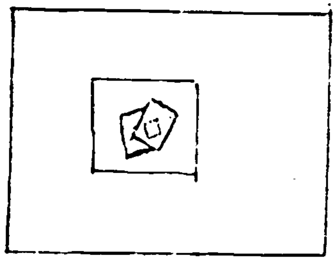
"Before" picture



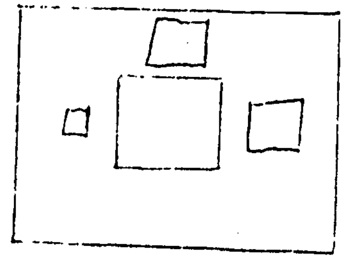
"After" picture

Unit No.	Unit Type	Text
1	Core	Look at the top row of funny little things #
2	Core	put a blue circle around the very first one #
3	Supplementary	the very first one in the row #
4	Core	now look at the next row of funny little things #
5	Core	and you're going to have to count over #
6	Supplementary	you're going to have to count one, two, three #
7	Core	and when you come to three put a circle around that one #
8	Core	now let's look at the next row #
9	Peripheral	I think that first one looks like a letter backwards #
10	Core	put a circle around the first one #
11	Core	now look at the bottom row #
12	Core	can you put a circle around the second one #
13	Supplementary	that's one, two, #
14	Supplementary	you count over one, two //
15	Supplementary	and put a circle around that one where you say two #
16	Supplementary	that's the second one #

Figure 4. Encoder Stimulus Pictures for Task 4 with Message of Encoder 46 parsed into Three Kinds of Communication Units.



"Before" picture



"After" picture

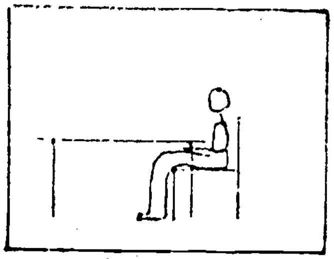
You have four squares that are cut out sitting in front of you # take the biggest square # it's a lot bigger than any of the others // and set it down in the middle of the piece of blank white paper that you have # now that you've done that you'll see that you have three squares of paper left # one is very small // the other two are bigger # and tyey're both the same size

9	Core	take one of the big squares //
10	Core	and place it (on)* above the other one #
11	Supplementary	not on top of it #
12	Supplementary	just towards the top of the paper #
13	Peripheral	so that you have the small square #
14	Peripheral	and underneath that you have a great big square #

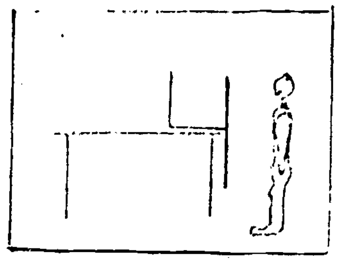
after you've done that take the next square which is the same size as the one I just mentioned to you // and put it down beside the big square on the right hand side towards the door // and put it on the side of the big square that is closest to the door # after you've done that you should have one more square of paper left # and it should be the smallest of all of them # take this little square // and place it on the other side of the big square towards the window # so when you look at your paper you have four squares all different sizes // and none of them touching each other.

*The parentheses indicate that "on" was a 'maze' word, uttered by mistake, indicated on the tape recording by its abrupt termination and the immediate substitution of "above."

Figure 5. Encoder Stimulus Pictures for Task 3 with message of Encoder 35 partially parsed into three kinds of communication units.



"Before" picture



"After" picture

Unit No.	Unit Type	Text
1	Peripheral	Right now you're sitting on a chair facing a table #
2	Peripheral	I'd like you to do something to help me #
3	Core	would you please stand up #
4	Supplementary	get off your chair #
5	Core	stand right up straight #
6	Core	right away from your chair #
7	Core	now I'd like you to pick up your chair with your two hands #
8	Core	turn it <u>upside</u> <u>down</u> //
9	Core	so that the seat of your chair is sitting right up on the table #
10	Peripheral	now your chair is <u>upside</u> <u>down</u>

Figure 6. Encoder stimulus pictures for Task 8 with the message of Encoder 52 parsed into three kinds of communication units.

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APPENDIX A

"Before" and "After" Pictures for Eight Experimental Tasks

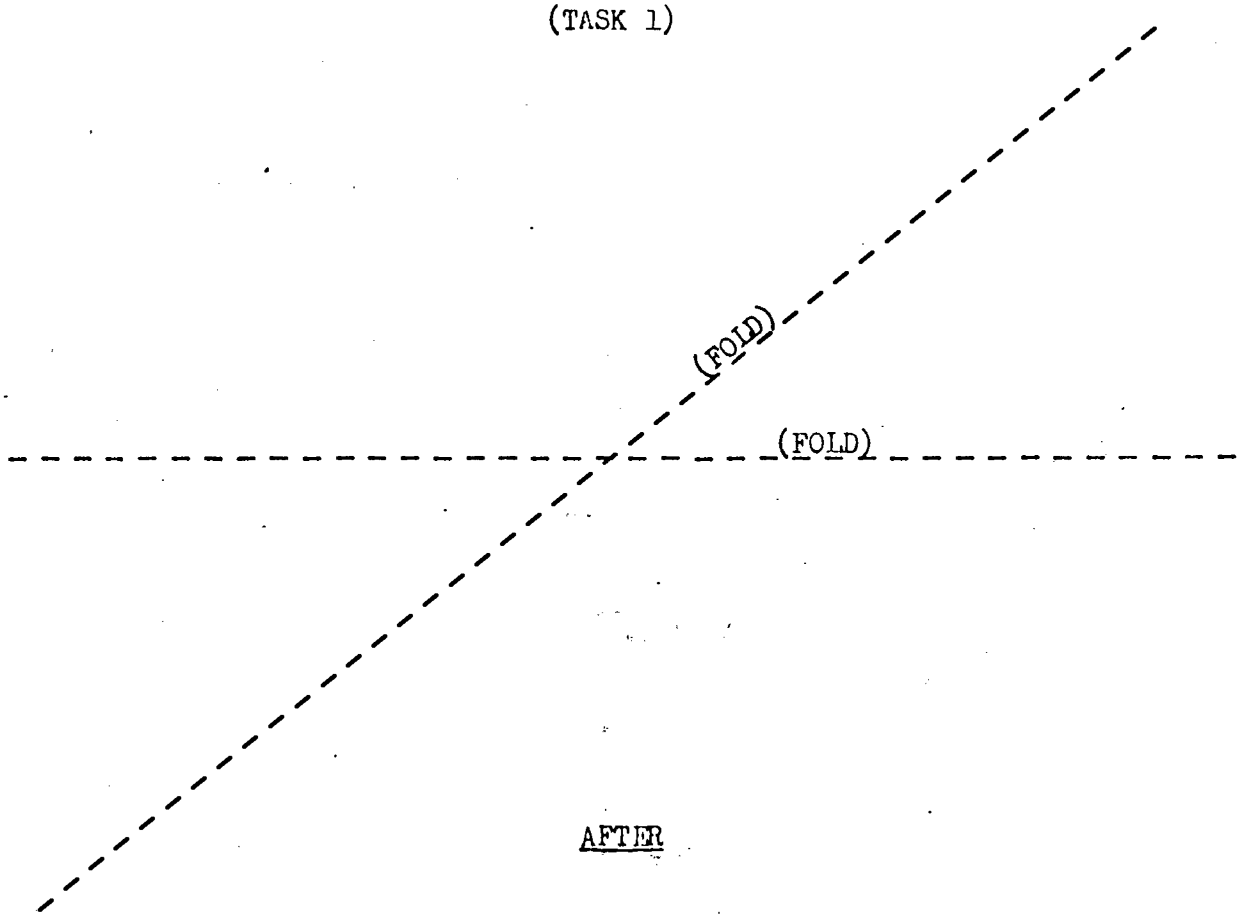
Explanatory note: The "after" pictures for tasks requiring drawing, tracing, circling with the crayon marker, the goal response is indicated by superimposed dotted lines.

(TASK 1)

(plain piece of paper)

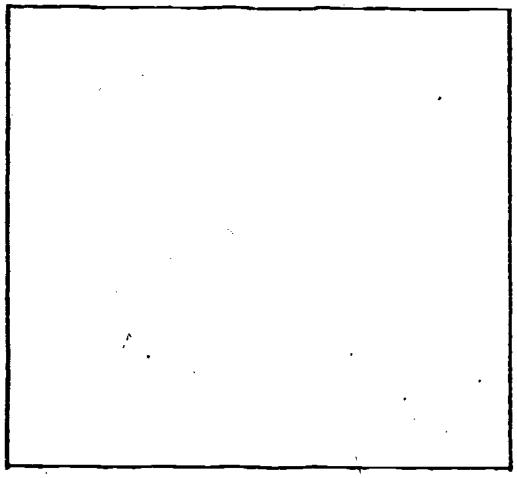
BEFORE

(TASK 1)



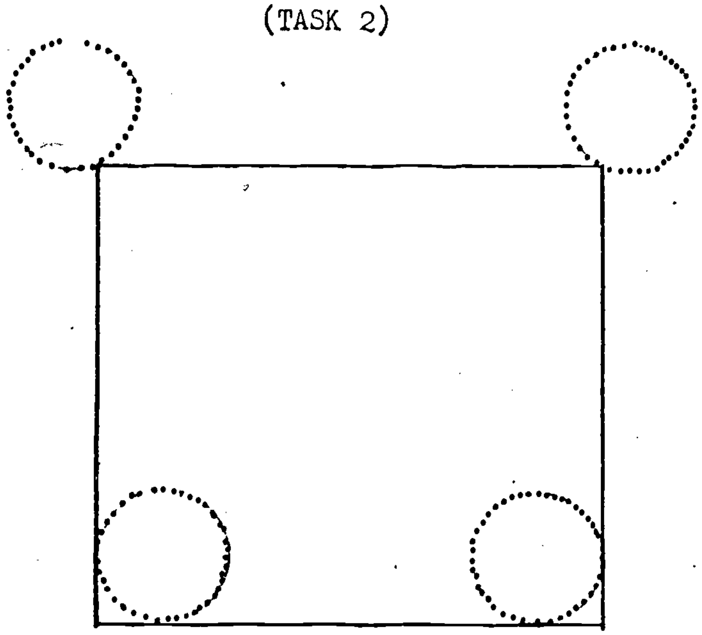
AFTER

(TASK 2)



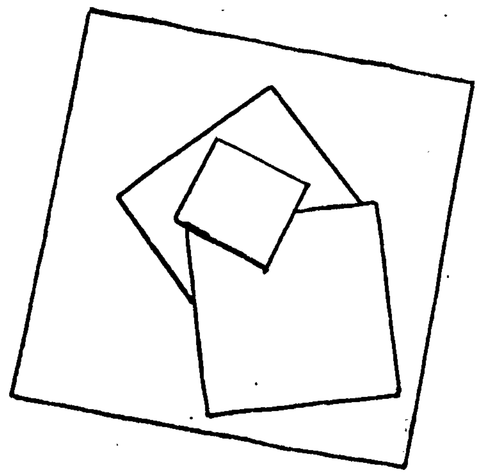
BEFORE

(TASK 2)



AFTER

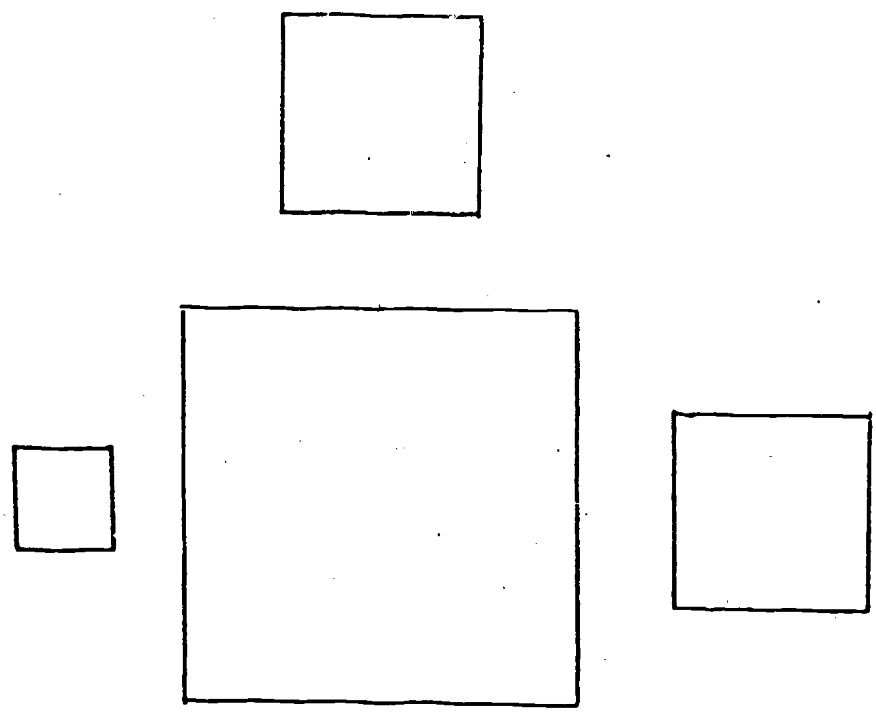
(TASK 3)



(Note: Cut-outs are simply piled loose on listener's worksheet.)

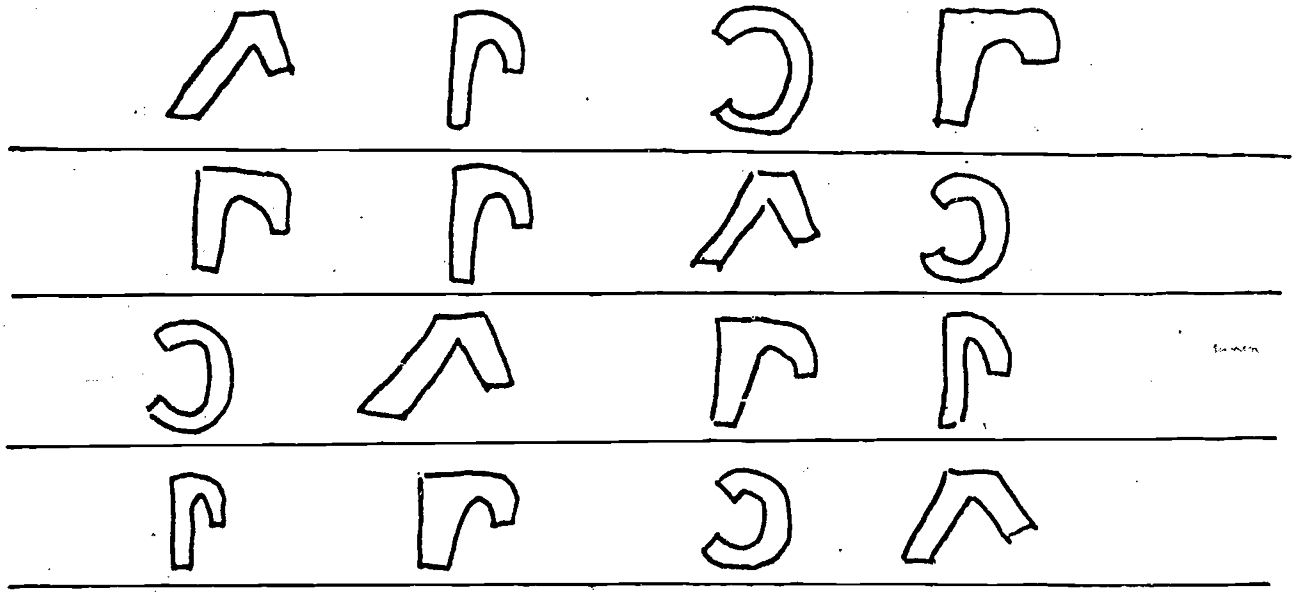
BEFORE

(TASK 3)



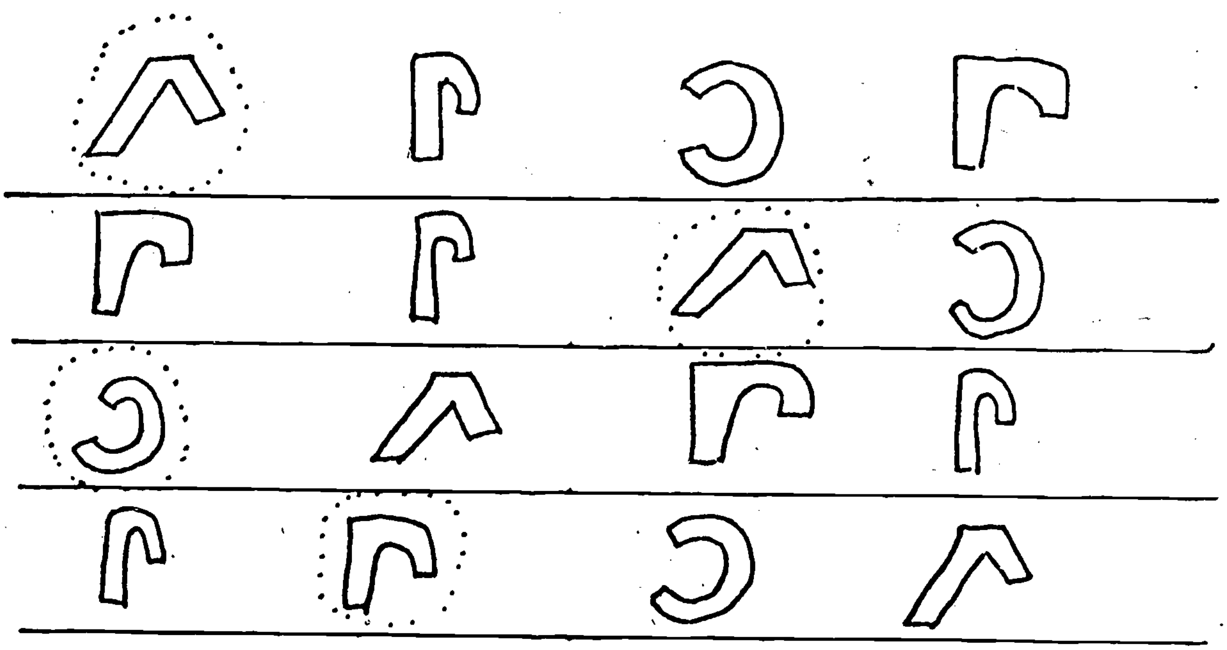
AFTER

(TASK 4)



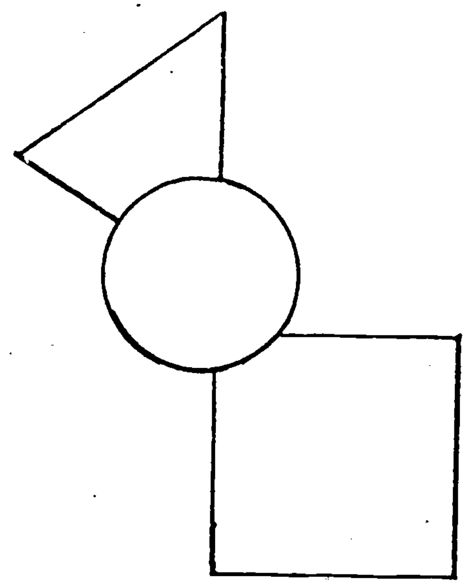
BEFORE

(TASK 4)



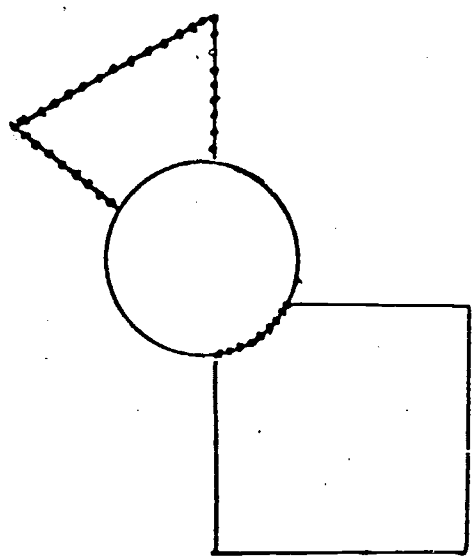
AFTER

(TASK 5)



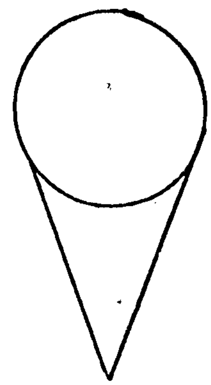
BEFORE

(TASK 5)



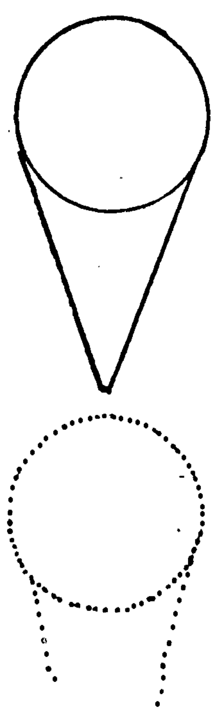
AFTER

(TASK 6)



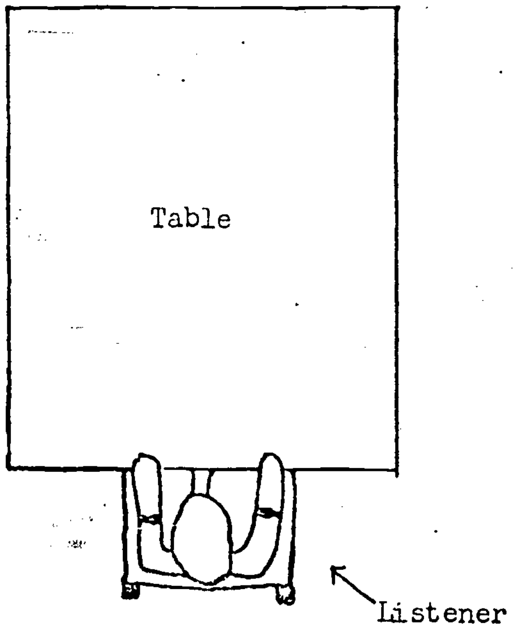
BEFORE

(TASK 6)



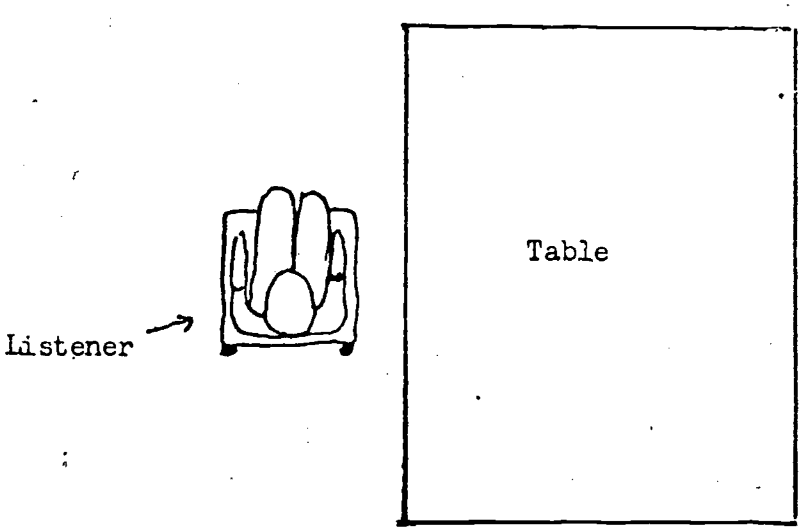
AFTER

(TASK 7)



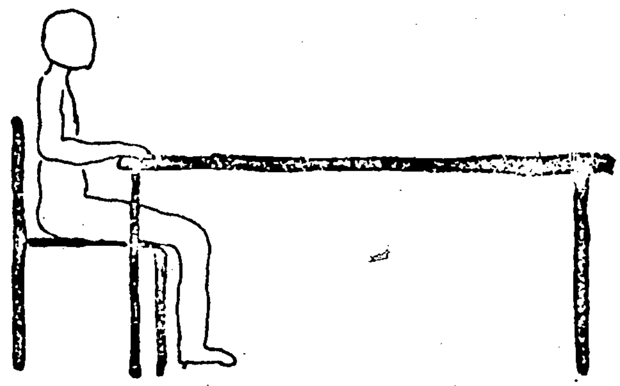
Listening Room BEFORE

(TASK 7)



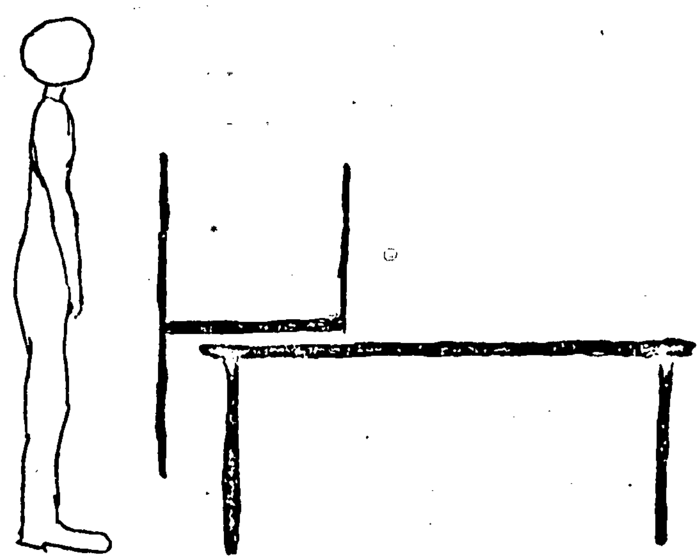
Listening Room AFTER

(TASK 8)



Listening Room BEFORE

(TASK 8)



Listening Room AFTER

APPENDIX B

Instructions to the Encoder

You are about to participate in a study of how adults communicate to kindergarten children.

In all, you will instruct eight exercises. In each, you are to use your own best judgment about the most appropriate language to use, including vocabulary, sentence structure, and so forth. There is no single correct way to do the instructions. Each person has his own style.

Prior to each instruction, you will be presented with two pictures, a BEFORE picture and an AFTER picture.

On six of the tasks, the BEFORE will be an unmarked worksheet, such as might be used in a kindergarten classroom. The AFTER picture will be the same worksheet correctly completed with a wax crayon marker. Your task will be to instruct the listener in the information he needs in order to complete the worksheet correctly with the crayon.

In every case, the listener will be completing the task as you speak, carrying out your instructions as he hears them.

On two of the tasks, the BEFORE picture will be a drawing of the listener's room, with the listener in his normal position, sitting at a table. The AFTER picture will be a drawing of the listening room with various things changed around. Your task will be to instruct the listener in the information he needs in order to change the listening room so that it will be arranged as in the AFTER picture.

Again, the listener will be carrying out your instructions as he hears them.

The tasks are in no particular order. An assistant in the listening room will ensure that all materials are correctly positioned in front of the listener at the beginning of each task. Your instructions for each task should be complete and should not rely on the instructions for prior tasks or on specific details of the listening room, since the listener and the room will not be the same during later administration of your instructions.

In addition to being heard by the child introduced to you before entering the experimental room, your instructions will be tape recorded for use with other listeners. All use of the tape recordings will be anonymous, as you will be identified by a randomly assigned number only.

Following each task, you will be asked to estimate your success at communicating the instructions on a seven-point scale from low to high.

If you have any questions about the procedures, please ask them after this message. Once the experiment begins, there should be no conversation between you and the experimenter, lest your instructions be influenced. If you have no questions, you will be given the materials for the first task and a signal to begin.

Thank you.