THE EFFECTS OF IMAGERY AND SYNTAX ON ORAL LANGUAGE COMPREHENSION AND PAIRED-ASSOCIATE RECALL

By

DIANE HAMILL BURKE

Bachelor of Science
The University of Tulsa
Tulsa, Oklahoma
1966

Master of Teaching Arts
The University of Tulsa
Tulsa, Oklahoma
1969

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
July, 1974

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Thesis Approved:

Robert E. Mangum
Thesis Adviser

Richard S. Prawat

Paul G. Ward

Bill J Elsom

Philip J Murphy

N N Durham
Dean of the Graduate College

PREFACE

This study evolved out of the writer's continued interest in children and their language. However, it would not have been possible without the assistance of many other persons. Accordingly, the writer wishes to acknowledge her indebtedness to her faculty committee at Oklahoma State University; to the schools, teachers, and students who participated in this research project; and to the family and friends who offered their support and encouragement.

Special appreciation is extended to Dr. Robert Mangum for his direction and guidance, to Dr. Paul Warden for his most helpful comments regarding organization and literary style, and to Dr. Richard Prawat in his continued enthusiasm for the research act. Appreciation is also extended to Dr. Billy Elsom for his assistance with the research design, to Dr. Julia McHale for her constructive criticism, and to Dr. Phil Murphy who most generously agreed to sit in for Dr. McHale in her absence. Each has contributed in a unique manner to make this venture possible.

In addition, the author is most grateful to Mrs. Jeri Brock, the staff, and the students at Town and Country School and to Mr. Gene Harris, Mrs. Rosemarie Taylor, the staff, and the students of Jenks Public Schools who most graciously cooperated in this study. Finally, the author expresses her gratitude to her brother, Jim, who shared his expertise in linguistics and to her brother, Bill, for his advice and

his assistance in the preparation of the manuscript, and to all the members of her family for their patience with an incomprehensible endeavor.

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

The thesis of this study is that both delayed acquisition of oral language and reading disabilities are frequently expressions of a more generalized delay or dysfunction in information processing. Since, developmentally, oral language acquisition precedes learning to read, if this thesis is accurate a high percentage of children with delayed language acquisition may be expected to exhibit reading disabilities.

At the present time children with delayed language are most frequently classified as learning disabled. Students with reading disabilities are classified as either learning disabled or reading disabled. However, both reading specialists and teachers of children with learning disabilities have been slow to recognize subtle problems in language functioning and even slower in considering the possible relationship between oral language deficits and reading disabilities. Moreover, reading specialists have been slow in differentiating between reading disabled children with language deficits and children whose reading disability may best be attributed to other cultural and/or environmental factors. As a consequence, the question of the interaction between oral language processing and reading competence is one which has not been adequately investigated. This is the question to which the present study is addressed.

1. Oral Language Acquisition

Within the past fifteen years research in language acquisition has been characterized by a shift of interest from product to process. Prior to 1960 language acquisition was thought by many to consist of production of intelligible speech units as a result of imitation of the speech of others. Progress was measured in terms of extensiveness of vocabulary, length of utterances, and correctness of syntax. Since 1960, however, the influence of contemporary linguistic theory (Chomsky, 1956, 1965) has prompted a growing awareness that language implies an information-processing activity. With this has come an increased interest in the mechanisms of language acquisition, process, and function as opposed to language as a product to be measured. This shift of interest is reflected in questions of the relationship between language, thought, and speech.

According to current linguistic theory (Chomsky, 1965) language is symbolic representation of thought. Language acquisition is a process of learning to use the grammar of a given language in order to communicate ideas. Thus, Chomsky distinguishes between the deep structures which are syntactical rules that specify the manner in which deep structures are expressed.

Research generated by contemporary linguistic theory has attempted to describe the process of language acquisition and to identify and measure variables which influence it. Research which seeks to describe the process of language acquisition indicates that it is an orderly, predictable process which continues throughout childhood (Ervin, 1964; Menyuk, 1963; Chomsky, 1969). It requires a combination of imitative, associative, and creative processes (Brown and Bellugi, 1964;

Ervin, 1964). Imitation precedes comprehension which, in turn, precedes production (Fraser, Bellugi, and Brown, 1963). While normally developing children master basic syntactic structures prior to school entry (Ervin, 1964; Brown and Fraser, 1963), refinement and elaboration of these basic structures, as well as acquisition of more complex structures, continues through the early school years until at least age ten (Chomsky, 1969; Slobin, 1966; Menyuk, 1963).

Initial language production consists of one word sentences or "holophrases" (McNeill, 1970). These are rapidly replaced by simple sentences constructed from combinations of two form classes (pivot and open). As language acquisition continues, both the number of form classes (Rohwer, 1964) and the complexity of syntactic structures increases (Brown and Berko, 1960). Simple, active, declarative sentences, referred to by Chomsky as "kernel" sentences, are combined and elaborated to form more complex ones by the application of syntactic rules.

Comparison of linguistically normal and deviant children indicates that the developmental patterns of deviant children are not grossly different from those of normal children. Rather, deviant children exhibit a delay in the onset of language, extended language acquisition period, and reduced flexibility and creativity in language production (Menyuk, 1964; Lee, 1966; Morehead and Ingram, 1973).

The influence of contemporary linguistic theory can also be seen in a second body of research, one which seeks to identify and measure the differential effects of learner and task variables on verbal learning. One such task variable is syntactic complexity. By this is meant the number of syntactic rules which has been applied to word

strings to transform them into more complex strings. It is through the application of syntactic rules that kernel sentences are altered or combined to form more complex ones.

In a series of studies Rohwer and his associates attempted to identify syntactic variables which were significant in paired-associate learning of oral language material. Specifically, he attempted to account for his previous finding that verb connectives facilitated the paired-associate learning of noun pairs more than preposition or conjunction connectives. The effects of semantic constraint (Rohwer, 1966), implied activity and meaningfulness (Rohwer and Levin, 1966), and type of word string had a significant effect. Paired-associate learning of nouns embedded in phrase strings was superior to learning of nouns embedded in sentence strings. This finding concurs with other findings (Chomsky, 1969; Slobin, 1966; and Fraser, Bellugi, and Brown, 1963) that syntactic complexity is a significant variable in learning oral language.

Rohwer interpreted his findings to indicate that noun pairs embedded in the same deep structure, but different surface structures are learned more easily than noun pairs which appear in different deep structures, but the same surface string. To date, however, this hypothesis has not been tested.

A second task variable which has been of interest in oral language learning is imagery. By imagery is meant the capacity to create a mental image in response to sensory data. Contemporary research into the mediational value of imagery has been concerned with problems of the image-evoking quality of words; the differential effect of imagery as a stimulus, as compared to a response variable; and the facilitative effect of imagery in information transmission and retrieval.

Studies to determine the effect of imagery on learning indicate that it can be a useful tool in learning and remembering at all ages, but that its effects vary according to the age of the subjects and the nature of the learning task. Research (Paivio, Yuille, and Madigan, 1968) indicates high correlations between imagery and both concreteness and meaningfulness of nouns. High imagery words were found to facilitate verbal learning by mediating between input and output (Paivio, 1963). This effect was greater for imagery as a stimulus variable than as a response variable (Paivio, 1963; Paivio and Yuille, 1966). Furthermore, it was more pronounced with older (grade six) subjects than with younger (grade three) ones (Rohwer, Lynch, Levin, and Suzuki, 1967). Thus, older subjects were thought to be better able to utilize imagery in learning than younger ones.

Pictures facilitate verbal learning to a greater extent than words when used as a stimulus variable, but present decoding problems when used as a response variable (Paivio and Yarmey, 1966; Paivio and Dilley, 1968; Milgram, 1967). Moreover, pictures with words are more effective as stimulus items than are words alone (Rohwer, Lynch, Levin, and Suzuki, 1967).

2. Reading

A second major thrust which has emerged since 1960 is the increased interest of educators in the development of reading competence in students. This interest is evidenced in the proliferation of journals devoted to reading, the initiation of new programs to train reading specialists, and a diversity of remedial reading programs designed to upgrade the skills of retarded readers at all levels in the educational

hierarchy. An inspection of research related to reading instruction, however, reveals no significant shift in orientation. Reading research continues to be preoccupied with definition of reading, identification of types of reading, and evaluation of specific instructional techniques, rather than the development of underlying theory.

Authorities differ in their definition of reading. Some (Staats, 1968) view it as a complex stimulus-response learning task which requires the formation of correct associations between (1) sounds and symbols, and (2) words and the objects they represent. Those who ascribe to this position believe that reading instruction consists of teaching word recognition through the presentation of appropriate stimuli and the reinforcement of appropriate responses. Comprehension is a process of conditioning word responses (auditory stimuli) to their appropriate word stimuli (visual symbols). Thus, reading instruction is a three-stage procedure. In stage one the appropriate sounds are associated with each letter in the visual stimulus. In stage two, the student learns to associate the auditory stimuli with the visual stimuli on a whole word basis. Finally, in stage three the meaning elicited by saying the word is conditioned to the written word stimulus.

A second, and somewhat vague, interpretation of reading defines it as a learning-to-learn skill to be applied in subject matter areas (Carter and McGinnis, 1953). For persons of this orientation reading is "... an activity in which the individual seeks to identify, interpret, and evaluate the ideas and points of view expressed by a writer" (p. 104). Reading involves "... word study, sentence and paragraph comprehension, problem solving, and critical evaluation" (p. 104).

Reading instruction consists of teaching students to apply word analysis skills to subject matter for the purpose of acquiring information from printed materials.

A third group sees reading as a creative activity which is closely related to verbal thought processes. Within this context, reading is an activity in which the meaning the reader brings to the printed page is at least as significant as that expressed by the writer. Bond and Tinker (1967) exemplify this view when they define reading as a skill which:

> ... involves the recognition of printed or written symbols which serve as stimuli for the recall of meaning built up through the reader's past experience. New meanings are derived through manipulation of concepts already in his possession. The organization of these meanings is governed by the clearly defined purposes of the reader. In short, the reading process involves both the acquisition of meaning intended by the writer and the reader's own contributions in the form of interpretation, evaluation, and reflection about these meanings (Bond and Tinker, 1967, p.22).

A fourth definition of reading (Smith, 1971) also stresses meaning as the critical factor in reading. However, this position differs from the previous ones in that it views reading as a process of moving from meaning to words, rather than from words to meaning. Any given word string has multiple meanings. The interpretation of a word string derived by the reader is a result of the meaning which that reader anticipates, rather than the meaning which the initiator of the message intended. This anticipatory process requires that the reader have an implicit, working knowledge of syntactic rules which allows him to construct meaning in response to written statements. Within this context, reading is a process of anticipating meaning as it is transmitted through syntax. The extent to which the meaning anticipated by the reader corresponds to that intended by the writer

depends upon both the reader's ability to effectively utilize syntax and his ability to draw upon experiences which are sufficiently similar to those of the writer. Thus, according to this definition, not only word analysis and word meaning skills, but also socio-cultural factors and information processing, storage, and retrieval skills are significant variables in the reading act.

Traditional definitions of reading (definitions one, two, and three) assume that comprehension is the end product of word analysis. Reading disabilities are attributed to (1) inadequate word analysis skills and/or (2) inadequate knowledge of word meanings. Because these definitions of reading move from words to meaning, they are incompatible with a model of reading as a process in which meaning is constructed and applied to written symbols (definition four). Similarly, the traditional model of a disabled reader is rejected in favor of a model in which a disabled reader is defined as one who fails to apply meaning to written symbols as they are processed. Within the context of this fourth definition of reading, adequate reading comprehension requires not only word analysis skills and adequate knowledge of word meanings, but also efficient information-processing skills and a common fund of information to draw upon in construction of meaning. Assessment of reading comprehension becomes a process of measuring the congruence between the meaning intended by the writer and the meaning constructed by the reader.

3. Learning Disabilities

A third recent development is the emergence of "learning disabilities" as an educational classification and a growing awareness that

the learning disabled child may exhibit atypical development in a number of areas, including both oral language acquisition and mastery of reading skills. Research in learning disabilities has been concerned with identification of underlying perceptual processes which are believed to be prerequisite to all learning. Unfortunately, however, this research suffers from the limitations imposed by the associative, stimulus-response model of learning upon which most of it is based. The most serious of these limitations is its concern for the product of learning to the relative neglect of the learning process. Because of this limitation, research in learning disabilities has been addressed to problems of training learning disabled subjects to perform specific tasks and to identification of effective reinforcers to facilitate this learning. Little attention has been given to questions of differences in learning styles or to identification of mediating processes which intervene between a stimulus and a response. Consequently, to date no adequate model of learning as an information processing function has developed out of this research.

In keeping with the generally accepted definition, a learning disability is considered to be the presence of a specific learning disorder in a child with "normal or potentially normal" intelligence. However, this study is concerned with the concept of learning disabilities only as it applies to dysfunctions in the processing of spoken and written language.

The Problem

The problem of this study is one of the effect of information processing skills on verbal learning. Accordingly, this study is

addressed to the question of whether imagery and syntactic encoding, as oral language processing skills, are significant variables in oral language comprehension and paired-associate recall. This study is further designed to explore the question of whether an interaction exists between oral language processing, as defined in terms of these two variables, and reading comprehension.

The Purpose of the Study

In accordance with the thesis that both delayed language acquisition and reading disabilities are frequently expressions of a more generalized delay and/or dysfunction in formation processing, the purpose of this study is to measure the effects of information processing skills on verbal learning. Thus, this study measures the effects of (1) the image-evoking quality of embedded noun pairs and (2) the syntactic complexity of orally presented sentences on oral language comprehension and paired-associate recall. In addition, this study is designed to measure the interaction of these two oral language processing variables with reading comprehension. If reading is defined as an act which requires information processing skills, and if oral language acquisition and reading comprehension can be assummed to be expressions of a more generalized information processing function, then a demonstrable relationship between oral language acquisition and reading comprehension can be expected to occur.

Research Data

The goal of this study was to measure the effect of imagery and syntactic encoding on the oral language comprehension and paired-

associate learning of (1) adequate readers and (2) disabled readers. A 2 x 2 x 2 split-plot research design (Kirk, 1968) was used. Analysis of variance was selected as the instrument for statistical analysis. A $p < .05$ level of significance was set.

Research Questions

This study was designed to answer the following research questions:

1. Is the imagery value of noun pairs embedded in sentences a significant variable in oral language comprehension and/or paired-associate learning?
2. Is the syntactic complexity of sentences a significant variable in oral language comprehension and/or paired-associate learning?
3. Do imagery and syntactic complexity exert a significant interactive effect on oral language comprehension and/or paired-associate learning?
4. Are the effects of the imagery value of noun pairs on oral language comprehension and/or paired-associate learning significantly different for adequate readers as compared to reading disabled and learning-disabled subjects?
5. Are the effects of syntactic complexity on oral language comprehension and/or paired-associate learning significantly different for adequate readers as compared to reading disabled-learning disabled subjects?
6. Are the interactive effects of imagery value and syntactic complexity on oral language comprehension and/or paired-associate learning significantly different for adequate readers as compared to reading disabled-learning disabled subjects?

Operational Definitions

1. Imagery--the construction of mental images in response to sensory stimuli.

2. Low Imagery Sentences--Sentences rated as low in their capacity to evoke mental images because of the inclusion of noun pairs rated as low in imagery (Paivio, Yuille, and Madigan, 1968).

3. High Imagery Sentences--Sentences rated as high in their capacity to evoke mental images because of the inclusion of noun pairs rated as high in imagery (Paivio, Yuille, and Madigan, 1968).

4. Syntactic Encoding--The application of rules of syntax to word strings, including sentences, in order to derive meaning.

5. Low Syntactic Complexity--A characteristic of a word string which includes a minimum number of transformations. For purposes of this study, a kernel sentence.

6. High Syntactic Complexity--A characteristic of a word string which includes several transformations. For purposes of this study, an embedded sentence.

7. Kernel Sentence--A basic sentence; a simple, active, declarative sentence upon which transformations can be executed.

8. Derived Sentence--A sentence which results from the application of transformational rules.

9. Embedded Sentence--A derived sentence. A sentence in which a previously independent clause has been included as a dependent clause. For example, in the sentence, "The boy who was walking down the street saw the accident" The clause "who was walking down the street" is embedded, that is, included in the simple sentence, "The boy saw the accident."

10. Transformation--The process of converting a syntactic construction into a semantically equivalent construction according to the rules shown to generate the syntax of the language; a construction derived by such transformation.

Limitations of This Study

This study is designed to measure the effect of imagery value and syntactic complexity on the oral language comprehension and paired-associate learning of students who are (1) adequate readers and (2) reading disabled-learning disabled readers. Because subjects were selected in accordance with specific criteria, the results of this study can be generalized to all subjects who meet these criteria.

CHAPTER II

A REVIEW OF RELATED LITERATURE

Introduction

One purpose of Chapter II is to provide the historical perspective and rationale for this study. With this purpose in mind, the chapter will open with a brief summary of the development of linguistics in the United States during the past seventy-five years. A second purpose is that of presenting a view of language and language acquisition as proposed by the most current thought in linguistics. Of special interest are the theories of Noam Chomsky and his associates. Third, this chapter will present a review of research which relates to or represents extensions and applications of these linguistic theories. Included are studies which reflect attempts to apply modern linguistic theory to learning within an educational framework.

With these goals in mind the remainder of Chapter II is divided into the following sections: (1) linguistics, the science of language; (2) a contemporary theory of language acquisition; and (3) extensions and applications of modern linguistic theory.

Linguistics: The Science of Languages

Linguistics, the "science" of languages originated in ancient Greece. Centuries later, during the Renaissance, it reappeared in

Europe as an effort to preserve and interpret ancient Greek writings. Because of this original goal, European linguistics tended to stress written language and to ignore differences between spoken and written communication. It was not until the late nineteenth century that the sounds of language and their relationships attracted the interest of linguists. Out of this interest, phonology emerged as a discipline concerned with analysis and description of speech sounds.

Until the twentieth century the study of languages in the United States followed the same course of development as its European counterpart. However, between 1900 and 1925 American linguists began to turn their attention from historical-comparative studies to description of contemporary American Indian Languages. Franz Boas' Handbook of American Indian Languages (1911) is characteristic of the writings and orientation of this period. Efforts to record and analyze these languages gave American linguistics a practical flavor which was quite foreign to European thought. They also caused American linguistics to focus upon structural differences between languages and to ignore similarities. This, together with a movement within the linguistic community to make descriptive linguistics "scientific," resulted in the emergence of "structural" linguistics. Under the influence of Leonard Bloomfield (1922) American linguistics adopted the behaviorist model of learning espoused by John B. Watson (1919, 1925) as its frameword for linguistic analysis.

With the adoption of this model which relied wholly on directly observable, measurable data, came the shift from word-centered analysis to the structure-centered analysis which was the essence of structural linguistics. Within structure-centered analysis, linguistic items

(sounds, words, word patterns) acquired meaning only as they were contrasted, and thereby used to identify and distinguish meaningful linguistic units. Thus, structural linguistics was concerned with differences within words and word patterns which signaled differences in meaning.

Structuralism remained the accepted approach to linguistic analysis for nearly fifty years. However, the development of the computer and efforts to identify, describe, and program languages so that a computer could perform translating operations stimulated the development of a variety of new approaches to linguistic analysis. Most notable were applications of mathematical-logical set theory initiated by Zelig Harris (1952). Because it rests upon the assumption that all sentences are either "kernel" sentences or "transformations" of kernel sentences Harris' system of linguistic analysis came to be known as "transform" or "transformational" grammar (Fries, 1962).

A linguistic transformation is a process of converting one syntactic construction into a semantically equivalent, but syntactically different construction. It is this process of identifying permitted grammatical transformations which forms the methodological basis of Noam Chomsky's (1965) "transformational-generative" or "generative" grammar. From the standpoint of linguistic analysis, then, transformational-generative grammar is an extension of traditional descriptive linguistics and transform grammar. However, it differs from both structural grammar and from Harris' transform grammar in that it has as its psychological base a rationalistic, cognitive, rather than a behavioristic model of learning. It is the implications of this rational psychology for linguistic theory that makes Chomsky's

transformational-generative grammar revolutionary. Structuralism and transform grammar are built upon a behavioristic model of learning which view man as an organism which reacts to stimuli from its environment. In contrast, rational psychology is based upon the mind-body dualism of the seventeenth century which views man as an organism which interacts with its environment, one which is, therefore, capable of both cognition and creativity.

A Contemporary Theory of Language Acquisition

Noam Chomsky is the acknowledged leader of contemporary linguists. More than any other current authority in his field he has attempted to answer questions of the relationship between language and thought and how language is acquired. In so doing he has ignored accepted theories and methodologies of education, psychology, and linguistics, and has proposed instead radically different systems of analysis and inquiry.

Transformational-generative grammar represents a fusion of transform grammar and rational psychology. In developing this system of linguistic analysis, Chomsky rejected the behaviorism of structural linguistics, together with the associative learning and imitation that behaviorism implies, in favor of a rationalistic model which stresses the innateness of language and the creativity which allows speakers of a language to produce and understand sentences they have neither heard nor used before. While he did not deny that imitation and association are used by the young child as he learns to produce the specific language which happens to be his native tongue, Chomsky maintained that the human child is genetically endowed with certain highly specialized abilities and dispositions which collectively we call "mind."

This position implies a universally human method of organizing and processing information which includes the concept of a sentence and which is a forerunner to language acquisition. The assumption that the concept of a sentence is part of man's innate mental capacity is supported by the observation that "... virtually everything that occurs in language depends on prior knowledge of the basic aspects of sentence structure" (McNeill, 1970, p. 2). It is an assumption that is felt to be essential in explaining facts of language acquisition as they have been observed to occur. Chomsky summarizes his position in this manner:

> In short, language acquisition is a matter of growth and maturation of relatively fixed capacities, under appropriate external conditions. The form of the language that is acquired is largely determined by internal factors; it is because of the fundamental correspondence of all languages ...that a child can learn any language. The functioning of the language capacity is, furthermore, optimal at a certain 'critical period' of intellectual development. (Chomsky, 1966, pp. 64-65).

This position regarding the universality of language is in direct contrast to the emphasis on diversity which is characteristic of structural linguistics. A notable example of this later orientation is found in the Whorfian principle (Whorf, 1956) which states that differences in language produce differences in thought, that is, an individual organizes his world and reacts to it in particular ways because of the linguistic system which he learns.

Chomsky's view of language as a direct expression of thought also differs somewhat from the views of two developmental psychologists, Piaget and Vygotsky. For Piaget, language is a process of symbolization which is critical to the development of conceptual thinking. Thought develops prior to language, but remains autistic, or non-communicable, until the child acquires the language needed for verbali-

zation. The acquisition of language, in turn, permits further refinement of thought processes. Thus, the manner in which language is used reflects the quality of an individual's thought processes, that is, his system of logic.

According to Piaget, all intelligent, communicable thought is social. However, thought does not immediately become communicable with language acquisition. Rather, there are intermediate varieties of thought and language which Piaget labels "egocentric." These egocentric forms of thought arise out of the young child's inability to place himself in the position of another. Egocentric language accompanies the child's actions, but is not intended as communication with others. As the child approaches school age, he gradually conquers egocentrism, his language becomes more social, and egocentric language and thought disappear.

Vygotsky (1962) presents a view of language which is characteristic of contemporary Russian psychology. Like both Chomsky and Piaget, he stresses the interrelationship of thought and language. However, his model differs from both in certain critical ways. Vygotsky sees thought and speech as developing along different paths. Speech appears early in the child's life and serves to express feelings, not to communicate ideas. Similarly, thought appears before language. The presence of pre-linguistic thought is confirmed by the use of tools, a skill which requires thought, but not language. It is the fusion of thought and speech which permits the emergence of language as a mode of communicating thought; thought becomes verbal and speech rational. This fusion normally occurs at about two years of age. It is signaled by the child's realization that things have names and his subsequent

curiosity about what things are called (Stern, 1907). However, this development of language or verbal thought does not eliminate the continued use of both non-verbal thought and speech as separate entities. For Vygotsky, early language is social, that is, it represents attempts to communicate thought to others. Egocentric language develops as a tension release as the child verbalizes problem-solving activities. Egocentric language develops as the child transfers social, communicative language to inner-personal psychic function. Egocentric language which is splintered off in this way makes possible inner language which serves both autistic and logical thought.

From these brief descriptions it can be seen that, although Chomsky, Piaget, and Vygotsky differ with respect to certain aspects of language development, they all share a belief in (1) the social, communicative function of language, (2) the close interrelationship of thought and language, and (3) the presence of a genetic predisposition which permits language acquisition. In so doing, all three reject behaviorism as a model of learning which can adequately account for the complexity of language acquisition and function as they have observed it to occur.

For Chomsky, then, language is a uniquely human capacity to communicate thought through the use of symbols. Defined in this manner language differs from speech in that speech is a process of emitting sounds while language is a process of communicating ideas. This difference becomes clear when one considers the various forms language may take. Ideas may be communicated through written, as well as spoken symbols, or through the use of gestures such as the "sign language" of the deaf. Within this context, the spontaneous emission of sounds

which frequently accompanies the feeling states of infants would not be construed as language in that it does not represent an attempt to communicate thought. Similarly, the production of speech sounds or even word strings by animals would fail to qualify as language; it lacks the spontaneous, creative quality which characterizes the expression of thought.

Speech becomes language when it is used to communicate thought. It is the view of a number of linguists (Stern and Stern, 1907; deLaguna, 1927; McCarthy, 1954), some of whom predate Chomsky, that the single word utterances which young children typically begin using between six and twelve months of age are equivalent to the full sentences of adults. This position implies the belief that the child is capable of thinking sentences before he has acquired the linguistic skills needed for verbal expression.

Closely related to this is the assumption that the child's language is not an impoverished, distorted version of adult language. Rather, it represents a consistent effort on the part of the child to discover the way in which the concept of a sentence is expressed in that particular language which happens to be his native tongue. This assumption is particularly significant in research on language acquisition because it negates the use of devices such as counts of grammatical classes and tabulation of grammatical errors as means of language assessment and focuses instead on the quality and structure of the language the child produces.

Still another and related assumption of current linguistic theory is that, for any given language, there is a natural order, a sequence in which grammatical structures emerge. This sequence depends on the

scope of the rules being learned and proceeds from general to particular. The more comprehensive rules require the least time and experience, and therefore, appear first. After the preliminary analytic phase in which these rules are learned there comes a constructive phase during which specific details are mastered. The first of these phases produces "deep structures," while the second results in "surface structures."

The concept of deep and surface structures reflects the Cartesian dualism of seventeenth century rational psychology. Whether or not one chooses to adopt this dualism as a philosophical position, it represents a revolutionary approach to linguistic analysis. Deep structure is the meaning of an utterance, that is, the thought which is being communicated. It is, therefore, a mental structure. Surface structure is the grammatical form used to convey this meaning. Chomsky discusses the interrelationship of deep and surface structures as follows:

> ... deep structures of the sort postulated in transformational-generative grammar are real mental structures. These deep structures, along with the transformational rules that relate them to surface structures and the rules relating deep and surface structures to representations of sound and meaning, are the rules that have been mastered by the person who has learned a language. They constitute his knowledge of the language, they are put to use when he speaks and understands (Chomsky, 1972, p. 107).

Because surface structure is concerned with the form in which meaning is expressed it is within the domain of syntax. Deep structure, on the other hand, is most closely associated with semantics. Inasmuch as semantics is also influenced to some extent by syntax, however, it cannot be said to be a pure representation of deep structure.

Chomsky quarrels with traditional linguistics in its preoccupation with phonology and syntax to the relative neglect of semantics. He feels that meaning in linguistic utterances should be submitted to

the same precise, formal analysis that is used to study syntax. Through transformational-generative grammar he attempts to analyze linguistic utterances in such a way as to allow consideration of deep as well as surface structures. This analysis is built around the following assumptions concerning the universal character of language:

1. The number of grammatical sentences in a language is infinite.

2. The number of words in the vocabulary of a language is finite.

3. The number of distinct operations involved in the generation of sentences is finite.

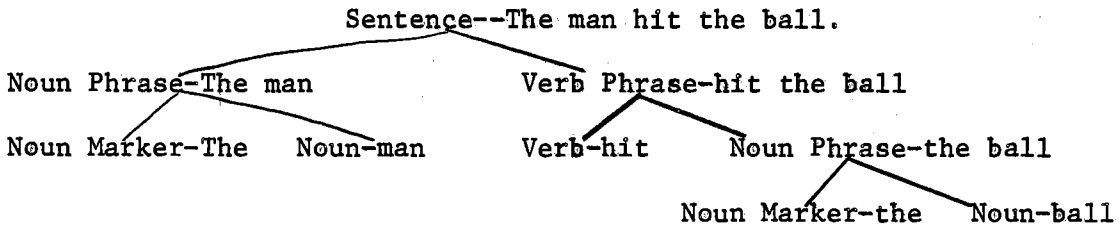
4. It is possible to utilize some of the rules more than once in the generation of the same sentence. (Lyons, 1970, pp. 59-70.

Transformational grammar, as an extension of phrase structure grammar, is concerned with describing the rules used to interpret and produce linguistic utterances. For example, according to phrase structure analysis the sentence, "The man hit the ball," consists of a noun phrase, "The man," which is the subject and a very phrase, "hit the ball," which is the predicate. The noun phrase, in turn, includes a noun marker, "the," and a noun, "man." The verb phrase can be broken down into a verb, "hit" and a noun phrase, "the ball," which also includes a noun marker and a noun.

Phrase structure analysis can be represented by means of bracketing or through the use of a tree diagram. Using brackets, the sentence would appear as follows:

(((The) (man)) ((hit) ((the) (ball)))).

A tree diagram representing the same sentence appears below.



This sentence consists of nine constituents. They are:

1. Sentence--The man hit the ball.
2. Noun Phrase--The man
3. Verb Phrase--hit the ball
4. Noun Marker--The
5. Noun--man
6. Verb--hit
7. Noun Phrase--the ball
8. Noun Marker--the
9. Noun--ball

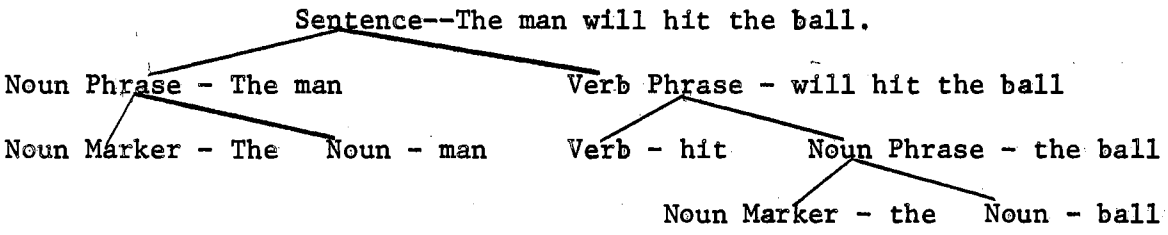
The phrase structure rules utilized in this analysis are:

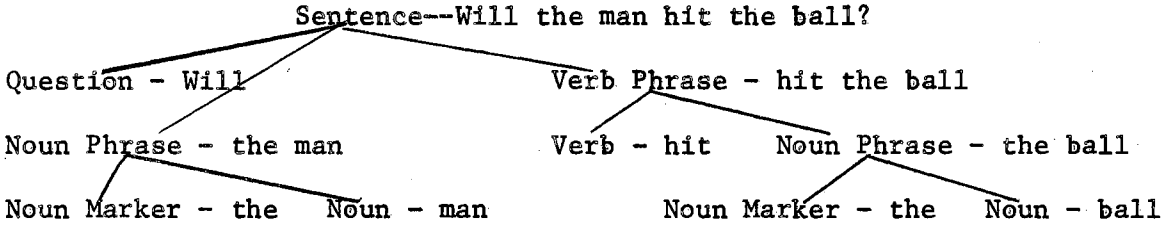
1. Sentence--NP + VP
2. NP--N + NM
3. VP--V + NP
4. NP--N + NM

Transformational grammar differs from phrase structure grammar in two ways. First, it provides fewer, but more complex rules. These more complex rules allow for the choice of both singular and plural noun phrases, and for the selection of numerous verb tenses and moods. Second, transformational grammar allows us to more adequately account for the complexity of semantic relationships that is often found in the utterances of native speakers of a language. For example, the two

sentences, "The man hit the ball," and "The ball was hit by the man," have different surface structures and would, therefore, appear differently on tree diagrams. However, native speakers of English sense that the meaning, or deep structure of these two sentences is similar. Phrase structure grammar provides no way to indicate this similarity in deep structure. However, it can be accounted for with transformational grammar.

Sentences are generated from underlying strings of words by the application of transformational rules. These rules also allow us to develop surface structures which adequately represent deep structures. Consider, for example, the sentence, "The man will hit the ball." Through the application of the "Question" or "Interrogative" transformation is generated the sentence, "Will the man hit the ball?" In this transformation the word, "will" is moved to the front of the sentence. The shift in deep structure is represented by tree diagrams as follows:





Additional transformations which can be used to generate new sentences include:

1. Negative--the introduction of "not" into the sentence

2. Contraction--the changing of "not" to "n't" as in "does not" to "doesn't"

3. Passive--the switching of subject and object phrases within the sentence

More than one transformation can be applied to a single sentence. For example, the application of both the interrogative and the passive transformations to the sentence, "The man hit the ball," would generate the sentence, "Was the ball hit by the man?" However, some transformations must be applied in a particular order. As an example, the negative transformation must precede the contraction transformation.

In generating new sentences, transformational rules are applied to simple, active, declarative sentences which Chomsky calls "kernel" sentences. Both kernel sentences and those which result from the application of transformational rules are derived from common underlying word strings.

Extensions and Applications of Contemporary Linguistic Theory

This section presents a review of that literature which reflects the influence of contemporary linguistic theory on three broad categories of verbal learning: (1) the process of language acquisition, (2) the effect of various learner and/or task variables on verbal learning, and (3) the relationship between oral language and reading.

1. The Process of Language Acquisition

Early research generated by the work of Chomsky and his associates focused upon description of language acquisition and identification of ages at which specific transformations are understood and used by

children. The method of investigation most commonly used was that of observation and description, a method which closely resembled the clinical method of Piaget and the "field study" techniques used to record and analyze American Indian languages.

Investigations of initial language acquisition indicate that most children begin communicating with single words sometime between six and twelve months of age (Leopold, 1949). These words represent objects and actions which are familar to the child. However, linguists are of the opinion that these single word utterances are not mere labels, but serve to express complex ideas (Leopold, 1949b; Greenfield, 1967; McCarthy, 1954). For example, the utterance, "ball" does not simply refer to a spherical object, but also serves to indicate that the child wants the ball, or wants another person to focus his attention on the ball.

These single word sentences are labeled "holophrases" (McNeill, 1970). Their use by the very young child is seen as an indication that the child is capable of conceiving a complete thought unit, even though he is not capable of expressing such a unit. Holophrases tend to be closely linked with the child's actions. Although holophrasic language refers to things, it frequently has an emotional quality. In other words, the child may indicate feelings of approval or disapproval by the tone of his utterance. Thus:

> ...a child's word...signifies loosely and vaguely the object together with its interesting properties and the acts with which it is closely associated in the life of the child. The emphasis may be now on one, now on another of these aspects according to the exigencies of the occasion on which it is used. In order to understand what the baby is saying you must see what the baby is doing (deLaguna, 1927).

During the six to twelve months in which the child's language consists of holophrases there is a continuous emergence of new grammatical relationships. Initially holophrases are used in an expressive, conative, or referential manner. At a second stage they are used to assert properties. For example, the expression, "hot" may be used when refering to any number of objects which possess that property. At a third stage holophrases express the location of objects, as well as their properties. In a final stage, the child begins to use holophrases as the objects of prepositions and verbs as in "door" meaning "close the door," and as the subjects of sentences (Greenfield, 1967). Words used as holophrases are most frequently nouns. Some are adjectives, none are verbs. This is seen as reflecting the fact that only nouns can appear in every grammatical class without endangering communication.

When words are first combined by the child at about eighteen months of age, a number of grammatical relationships are already in existence. Consequently, the appearance of patterned speech represents a new way of expressing grammatical relationships and not the emergence of the relationships themselves. However, with patterned speech comes the emergence of two classes of words. Braine (1963a) refers to these as "pivot" and "open" classes. Samples of pivot and open class words are presented in Table I.

The pivot class contains a small number of frequently used words. These words appear in combination with open class words and are rarely, if ever, used alone or in combination with each other. The open class includes many more, but less frequently used words. Words from this class may appear alone, in combination with pivot class words, or

TABLE I

PIVOT AND OPEN CLASSES
(McNeill, 1966a)

Braine		Brown & Bellugi		Miller & Ervin	
P	O	P	O	P	O
allgone	boy	My	Adam	This	arm
byebye	sock	that	Becky	that	baby
big	boat	two	boot		dolly's
more	fan	a	coat		pretty
pretty	milk	the	coffee		yellow
my	plane	big	knee		come
see	shoe	green	man		doed
night-night	vitamins	poor	Mommy		
hi	hot	wet	nut	The	other
	Mommy	dirty	sock	a	baby
	Daddy	fresh	stool		dolly's
		pretty	Tinker-toy		pretty
					yellow
				here	arm
				there	baby
					dolly's
					pretty
					yellow

in combination with each other. Thus, the possible combinations of pivot and open class words are:

1. Pivot + Open
2. Open + Pivot
3. Open + Open
4. Open

In learning a language the child uses word order to express grammatical relationships. The pivot class includes words for which the child has learned locations in speech patterns. The open class, on the other hand, contains words for which no position has been learned. Open class words are used whenever pivot class words are not. Because the child initially knows the position of only a very few words, the same pivot word appears in many sentences. Because positions are learned more slowly than vocabulary, the pivot class grows slowly. The location of pivot words describes an association between grammatical relations and fixed positions in the surface structure of sentences. As such, it represents a grammatical transformation.

Two word sentences grow into three word sentences only when the child learns the relative position of the words. Increases in sentence length, therefore, involve an increase in the structural complexity as well. Ultimately the learning of word positions leads to the kind of sentence structure which is represented by phrase structure grammar.

By about twenty-eight months of age the child is able to produce sentences comprised of three, four, or even five words. However, auxiliary and copular verbs, articles, and inflections of all kinds are typically missing. Because of these omissions, the language of

children at this stage has been compared to that used by adults in telegrams. This so-called "telegraphic" speech (Brown & Fraser, 1963) is seen as serving the same purpose for the child as it serves for the adult, namely that of conservation. Whereas telegraphic speech is seen as representing a conservation of space for the adult, it has been thought to represent a savings in terms of memory load for the child. However, McNeill (1970) points out that this analogy is limited in its accuracy in that children have been found to drop inflected endings even when these convey critical information. This position ignores the fact that what may be meaningful to the adult may not be meaningful to the child. In any event, telegraphic speech is seen as an outcome of the process of language acquisition rather than a part of the process as such.

Brown and Bellugi (1964) conducted a longitudinal study of the language acquisition of two children. The method used was that of recording and describing the verbal interchanges between each child and his mother. Researchers noted that the mothers' speech differed from that used between two adults in that sentences were short, simple, and perfectly grammatical. It was also noted that the mother-child dialogue involved three distinct processes.

Brown and Bellugi labeled the first of these processes "Imitation and Reduction." It involved the imitation of the mother's speech by the child. This imitation retained the word order used by the mother, but it frequently also involved the omission of elements such as inflections, auxiliary verbs, articles, prepositions, and conjunctions. For example, if the mother said, "He is going out," the child might respond, "He go out." At any given age the child seemed to be limited

in the length of sentence he was able to imitate. For this reason his utterances did not increase in length as the mother's model sentences increased. The child simply adapted by omitting more words or elements from the longer sentences. Brown and Bellugi hypothesized that this "telegraphic" speech may have resulted from the differential stress patterns on the part of the mother, rather than simply from the child's inability to remember the entire passage.

A second process observed by Brown and Bellugi was "Imitation with Expansion." In this process the mother repeated and elaborated on utterances produced by the child. She added the inflections, conjunctions, auxiliary verbs, and other grammatical components which were necessary to make the utterance grammatically complete according to adult criteria. When the child said, "There go one," the mother replied, "Yes, there goes one."

The third process was "Induction of Latent Structure." In this process the mother imitated the child's utterances, but expanded on them in a way which corrected grammatical errors resulting from over-generalization. For example, if the child said, "I digged a hole," the mother responded by substituting "dug" for "digged." This third process involved both semantic and syntactic components in that it retained the meaning of the utterance, but restructured it so as to make it grammatically correct.

In an investigation of the language acquisition process in older children, Carol Chomsky (1969) studied the language of children between ages five and ten. She found that these children gradually acquired the ability to comprehend certain transformations which are found in adult speech, but absent from the language of children under five.

Although the age at which the children in this study acquired the ability to understand these structures varied somewhat, the order in which they were acquired did not vary.

Four grammatical structures which require transformations were studied. The first of these was labeled, "Easy to see." Correct interpretation of this kind of structure required that the child identify the subject of the verb "see" in sentences such as, "John is easy to see." In order to do this the child must have understood that someone other than John was seeing.

A second structure studied was labeled, "Promise." In order to successfully comprehend sentences which contained this transformation, the child was required to identify the subject of the verb, "go" in sentences such as, "John promised Bill to go," which also included the verb "promise." The child must have understood that it was John, not Bill, who made the promise.

Ask/Tell was the third structure studied. It required that the child identify the subject of "do" in sentences such as, "John asked Bill what to do." The child must have been able to identify John as the subject of "do" in contrast to the sentence, "John told Bill what to do," in which Bill was the subject of this same verb, "do."

The fourth structure, Pronominalization, required that the child correctly identify the referent of a pronoun such as "he" in a sentence such as, "He knew that John was going to win the race." The child must have understood that this pronoun refers to someone other than John.

In analyzing the results of her study, Chomsky found that structures one, two, and three were strongly subject to individual rates of development. Structures one and two were acquired by all the children

by age ten. Structure four was acquired by all of the children at approximately age five years, six months. For Chomsky, the significance of these findings was the fact that language acquisition was a process which continued much longer than had generally been acknowledged. These results were seen as casting doubt on the common belief that the child mastered the structure of his native language by the age of six.

Out of early research in language acquisition, a number of propositions can be drawn. First, there are indications that the single word utterances of the young child are communicative in nature. Research further suggests that the process of language acquisition proceeds in an orderly, predictable fashion. This process involves extension of one word utterances, "holophrases," to two and three word sentences which utilize patterned combinations of pivot and open class words. Language acquisition involves imitative and associative processes, but it is also creative in that, from the outset children produce linguistic utterances which they have not heard previously. Attempts to imitate adult language frequently result in "telegraphic" language in which the child omits words and/or parts of words. This compression of language is seen as a simplification which allows the child to process more complex incoming linguistic utterances. At this time, however, there is no agreement as to the specific mechanisms involved. While some (Brown & Fraser, 1963) suggest that telegraphing is a conservation process by which the child adapts utterances to his limited memory span, others (Brown & Bellugi, 1963) propose that telegraphing may be a response to differential stress patterns in the language of the speakers the child hears. Finally, research in language acquisition (Chomsky, 1969) indicates that it is a process which continues until

at least age ten. This finding is in contrast to earlier beliefs that the language process was complete by age six.

2. The Effects of Learner and/or Task Variables on Verbal Learning

A second body of research seeks to identify and measure the effects of various learner and task variables on verbal learning. Studies concerned with learner variables have measured the effects of the age of subjects, their school grade level placement, and/or the quantitative and qualitative differences in the language of linguistically normal and deviant children. Task stimulus variables which have been investigated include length and complexity of utterances, type and number of transformations, and meaningfulness. Task response variables measured include comprehension, recognition, recall, response time, and grammatical correctness.

In one study which measured the interactive effects of imitation and maturation on the language acquisition of two and three year olds, Ervin (1964) theorized that young children make different associative responses to stimulus words than do adults. She investigated two primary sources of change in the language patterns of her subjects, imitation and maturation. Ervin proposed that comprehension of any given language structure precedes production of that structure, In this study Ervin posed two questions:

1. Are imitated utterances grammatically different from free utterances?
2. If they are different, are they more advanced grammatically?

In conducting this study Ervin used five children between two and three years of age as subjects. The spontaneous, as well as

imitated language of these subjects was recorded and described. As a result of her analysis of the language of these subjects Ervin proposed three changes which occur in children's language with maturation:

1. increased sentence length
2. increased use of grammatical markers
3. increases in adult-like sentence structure

On the basis of her observations Ervin concluded that "...clearly we have evidence that children are creative at the very beginning of sentence formation. They are imitative a great deal, but they also produce sentences which have both regularity and systematic difference from adult patterns (Ervin, 1961, pp. 361-372)." Systematic changes are brought about by the presence of both comprehension of adult speech and imitation. The child must build classes and rules which allow him to produce sentences he could not have heard.

> Any system of analysis which omits either the idiosyncratically structured and rule-governed features of children's language or the gradual changes within these rules is contradicted by evidence from all levels of the linguistic behavior of children" (Ervin, 1961).

In a second comparative study, Fraser, Bellugi, and Brown (1963) investigated imitation, comprehension, and production as response variables with ten problems involving optional transformations. Twelve children (six male, six female) ranging in age from thirty-seven (37) to forty-three (43) months served as subjects. Transformations were assumed to be equivalent in difficulty. Consequently, the purpose of this study was to determine the relative difficulty of the three tasks (imitation, comprehension, and production) as utilized with each of the ten transformations. All possible outcomes were hypothesized.

The results of this study indicate that for these subjects imitation was superior to comprehension which, in turn, was superior to production. Results also indicated that the optional transformations presented as stimuli were not equal in difficulty. Passive voice tasks proved to be especially difficult, with only five correct responses. Fraser, Bellugi, and Brown concluded that the "...sense of passive construction cannot be guessed from a knowledge of its constituent elements" (Fraser, Bellugi & Brown, 1963, pp. 121-135). They further concluded that imitation was more accurately seen as a perceptual-motor skill which did not work through the meaning system. Production was seen as occurring when the appropriate linguistic responses began to appear. Reduction of transformations was accomplished by dropping function words, a process which produced telegraphic strings of nouns and verbs.

Paula Menyuk (1963) investigated the ability of nursery school and kindergarten children to repeat sentences containing syntactic structures found in the spontaneous language of four and five year old children. Twenty-seven transformations were tested. On the basis of her study Menyuk concluded that both preschool and kindergarten subjects were still in the process of acquiring many of the transformational processes tested. While all of the transformations were repeated by a sizable number of the subjects in both groups, nursery school subjects repeated significantly fewer items than did kindergarten subjects. In addition, it was found that the length of the sentences was not a critical factor. Rather, differences in the ability to repeat sentences was dependent upon the particular transformational rule used to generate the sentence. Modification of the stimulus sentences was consistently found to involve simplification, that is, the use of a

previously mastered transformation. For example, on one occasion a question was repeated in the form of a declarative sentence. On another, a compound sentence was repeated as two sentences with the conjunction omitted.

Brown and Fraser (1963) used nonsense syllables to elicit relevant information regarding usage of syntactic structures. They observed that children in the first, second, and third grades were all able to make up sentences using the "new" words. However, these children did not always use the words correctly. Performance improved with the age of the subject. More correct responses were given with count nouns, adjectives, and transitive and intransitive verbs than with mass nouns and adverbs. Brown and Fraser concluded that the ability to construct grammatically correct sentences increased with age.

Brown and Berko (1960) studied the effect of syntax on word association. They hypothesized that, as syntax develops in children, syntactic similarity in words becomes an increasingly important determinant of word association. Brown and Berko tested this hypothesis by relating the child's tendency to give homogeneous, same class word associations to his ability to make correct grammatical use of new words after hearing them used in sentences. Forty (40) subjects were selected for the study. Three groups of children were chosen from grades one, two, and three. A fourth group of adults was obtained through advertisement on a college campus. Equal numbers of males and females were selected.

Each subject in this study was administered a word association test which consisted of thirty-six words from each of six parts of speech (count nouns, mass nouns, adjectives, transitive verbs,

intransitive verbs, and adverbs). Words were selected because of their high frequency in the language of American elementary school children. A second word usage test which required that the subject use a nonsense word in a sentence after having been given two examples of its use was also administered to each subject. Responses were scored correct if the subject used the word as the same part of speech implied by the example. Rank order correlations between the means of the free word association test (homogeneous responses) and correct usage scores were tabulated. Correlations for three of the four groups tested were significant. Brown and Berko concluded that free association scores were related to scores for usage.

Slobin (1966) investigated skill in sentence comprehension as indicated by responses to sentences describing pictures in terms of the following five criteria:

1. Truth--whether the sentence was true or false
2. Affirmation--affirmation versus negative
3. Grammar--kernel, passive, negative, passive-negative
4. Reversibility--subject-object reversible versus subject-object nonreversible
5. Normality--Normal (probable subject) versus anomalous (improbable subject)

Sixteen subjects (eight male, eight female) from each of five age groups (6, 8, 10, 12, and 20) served as subjects. Comprehension was operationally defined in terms of response time and number of errors.

Slobin reported that erroneous responses required more time than correct ones. This was thought to be a result of the fact that a greater number of errors occurred on more complex sentences. Contrary to expectations, Passive (P) sentences were found to be easier than

Negative (N) ones. However, when non-reversible P sentences were eliminated the expected sequence of difficulty (K, N, P, NP) occurred. This was thought to indicate that nonreversibility aided comprehension of passive sentences. Both response time and error rate diminished with the age of the subject. Slobin interpreted these findings to indicate that, although the grammatical system was already developed by age six, linguistic learning continued through childhood and involved increasing skill in the manipulation of more subtle and complex aspects of the system.

In one of the few early studies which compared linguistically normal and deviant children, Menyuk (1964) found qualitative differences in the language of these two groups. Deviant children used fewer transformations and a greater number of ungrammatical forms than did normals. In a second study Lee (1966) found that linguistically deviant children omitted grammatical constructions which were not omitted by normally developing children. More recently, Morehead and Ingram (1973) reported no significant differences between normal and deviant children for frequently used transformations. However, significant differences were found to exist between the two groups for infrequently used transformations. The type and number of constructions changed with advancing levels of linguistic development for both groups, but deviant children used fewer linguistic categories and contexts at each level than did normal children.

The effects of syntactic variables in paired-associate learning has been investigated by Rohwer and his associates. Specifically, this research focused upon the learning of noun pairs embedded in grammatical word strings. It was stimulated by Rohwer's finding

that "...the amount of facilitation produced by meaningful, syntactically structured word strings depends upon the form class of the word intermediate between the two members of each pair" (Rohwer, 1964).

Rohwer and Lynch (1966) hypothesized that verb connectives facilitated paired-associate learning of nouns because of the semantic constraint they impose; verbs effect narrower limits on subsequent words in the string than do prepositions or conjunctions. This hypothesis was tested with sixth grade students as subjects, using materials constructed to permit manipulation of both the form class of connectives and the size of the class of response nouns. It was expected that conjunctive connectives would be equally as effective as verb connectives in paired-associate learning when the size of the noun response class was held constant. This control was accomplished through the use of a recognition task rather than a recall task.

Data from a series of three experiments failed to confirm this hypothesis. The results of Experiment I indicate that, while the main effects of verb connectives and the recognition mode of response were significant ($p < .01$), the interactive effect upon which the constraint hypothesis was based, was not significant. In subsequent experiments (II and III) subjects from varying grade levels (five and six) and reading ability levels served as subjects. As in Experiment I, the interactive effect of form class and response mode was not significant. Rohwer and Lynch concluded that semantic constraint was not sufficient to explain the superiority of verb connectives.

The effects of overt activity implied by verb connectives, sentence meaningfulness, and the character of test-trial stimuli on paired-associate learning have also been investigated (Rohwer and

Levin, 1966). The results of this study indicate that neither the activity implied by the verb (action vs. still) nor the meaningfulness of sentences (normal vs. anomalous) produced a significant effect on paired-associate learning. However, the type of test-trial materials used was significant. Stimuli consisting of a "subject noun and a verb" were found to be superior to both "subject noun stimuli" and "verb stimuli" for direct object noun responses. This finding lead Rohwer and Levin to conclude that "...the selection of verbs as functional stimuli during the study trials does not account for the sentential facilitation of noun-pair learning" (Rohwer & Levin, 1968, p. 137).

In a study designed to test the effects of connective form class and type of grammatical unit on paired-associate learning, Suzuki and Rohwer (1968) hypothesized that the type of word string (sentence vs. phrase), not the form class (verb vs. conjunction), was responsible for Rohwer's previous finding that verb connectives facilitate paired-associate learning of nouns. Suzuki and Rohwer predicted that sentence strings would be superior to phrase strings as facilitators of paired-associate learning of nouns regardless of the form class of the connective used. However, the results of their study failed to confirm this hypothesis. Phrase strings (the rock and the bottle) were superior to sentence strings (The rock and the bottle hit him). Verb connectives (The car pulled the wagon.) were superior to conjunctive connectives (The car or the wagon pulled it.). Suzuki and Rohwer concluded that "...the actual linking of the nouns by the verb is crucial in facilitating paired-associate learning" (Suzuki & Rohwer, 1968, p. 586).

In terms of deep and surface structure analysis these results were seen as supporting the premise that learning involves input into the memory system in the form of underlying word strings rather than surface structure units. From this Suzuki and Rohwer predicted that two nouns embedded in the same underlying word string, but different surface strings would be learned faster than two nouns embedded in different underlying strings, but the same surface string. A prediction of surface structure mediation would imply that sentences or phrases with conjunctive connectives would facilitate paired-associate learning to a greater degree than verb connectives. A prediction of underlying string mediation would favor verb connectives. Suzuki and Rohwer's study lends support to a hypothesis of learning in terms of underlying strings rather than surface structures.

One hypothesis of the present study is that complexity of syntactic structure is a significant variable in oral language comprehension. Suzuki and Rohwer's hypothesis, if true, would tend to support this position in that a complex sentence containing an embedded dependent clause implies a greater number of underlying strings than does a kernel sentence.

A second body of contemporary research has been concerned with the mediation value of imagery in paired-associate learning. This research, which considers problems of stimulus meaning, information transmission and retrieval, and distinguishing facilitative characteristics of images, stands in contrast to earlier studies which assummed the value of imagery lay in its capacity to spatially represent two objects as one organized unit.

Paivio's (1963) "conceptual peg" hypothesis is characteristic of this more contemporary viewpoint. According to this hypothesis, high imagery words mediate between verbal input and output by serving as "pegs" from which associates can be hung and retrieved. Implied in this is the assumption that the stimulus effect of words depends on their capacity to arouse sensory images of concreate objects or events (Paivio, 1963).

This conceptual peg hypothesis generated the prediction that the effect of the image-evoking quality of words in paired-associate learning would be greater as a stimulus attribute than a response attribute. Data collected with noun-adjective pairs, using fourth and fifth grade subjects, supported this prediction (Paivio, 1963). Noun concreteness had a more positive effect on learning as a stimulus (N-A) attribute than as a response (A-N) characteristic. A second study (Paivio and Yuille, 1966) with fourth, sixth, and eighth grade subjects also supported this conclusion. Noun-noun, rather than noun-adjective word pairs were used. The concrete-abstract condition was found to be highly superior to the abstract-concrete condition. Paivio and Yuille interpreted this finding to indicate that children experience difficulty when producing responses to abstract items which have only limited meaning for them.

The relationship between imagery (I), concreteness (C), and meaningfulness (m) has also been a topic of research. Paivio, Yuille and Madigan (1968) rated 925 nouns according to these three criteria. Correlations of .83 between imagery and concreteness and .72 between imagery and meaning were obtained. In subsequent investigations, Paivio (1967) and Paivio and Olver (1964) studied the effect of mean-

ingfulness as a stimulus factor. Data from their research indicates that isolating "m" had little effect on the correlation between imagery and learning. With imagery controlled, the effect of "m" was reduced to zero.

Paivio and Madigan (1968) tested the hypothesis that "...the facilitating effect of imagery (I) on the stimulus side of pairs would be greater when the noun member is paired with a high association value rather than a low-association value syllable" (Paivio & Madigan, 1968, pp. 35-39). Nouns rated either high or low in their image-evoking quality (I), but equal in meaningfullness (m) were paired with high and low association value (AV) nonsence syllables. Data from this study indicated that the expected interaction of Order x Imagery x Association Value was not significant. Superior recall occurred for (1) pairs in the syllable-word order, (2) pairs in which nouns were high in imagery (I), and (3) pairs in which syllables were high in association value (AV). Paivio and Madigan concluded that the imagery hypothesis implies a multi-stage coding process in which stimulus and response terms are encoded into nonverbal images during their paired presentation. On recall trials, the stimulus term presumably acts as a cue for the compound image which can be decoded to yield the appropriate verbal response.

Research has compared the stimulus value of pictures to that of words (Paivio and Yarmey, 1966; Dilley and Paivio, 1968; Milgram, 1968). These studies indicate that pictures are superior to words as stimulus items, but present a decoding problem when used as response terms. Dilley and Paivio interpreted their findings to indicate that pictures pose a decoding problem at the mediational level.

"Young children have greater difficulty than adults making symbolic transformation from mediating image to required verbal response" (Dilley and Paivio, 1968, pp. 231-240).

In a study which compared the stimulus value of words in isolation to that of words with pictures; Rohwer, Lynch, Levin, and Suzuki (1967) found that stimulus pictures together with words produced more correct responses than did words alone. Younger children (grade three) benefited more from the picture-word combination than did older (grade six) children. Rohwer concluded that this differential effectiveness indicates that older children, rather than younger ones, make better use of action depiction and, by inference, of the action imagery it provokes. Rohwer attributed this effect to the fact that younger children do not store an appropriate verbal tag along with the action imagery evoked.

Measurement of individual differences in imagery ability (Kuhlman, 1960; Stewart, 1965) indicates that imagery ability measures are predictive of learning performance with pictorial-verbal materials. High-imagery female subjects have been found to be superior to low-imagery females in memory for incidental components of a compound stimulus or response item (Ernest and Paivio, 1969a). However, this trend has not been found to hold for male subjects. Paivio and Csapo (1969) suggest that, while visual imagery is efficient for storage of item data, it is inferior to verbal symbolic representation for storage of sequential information.

Thus, research to identify and measure significant factors in verbal learning indicates that it is the result of a complex process involving both learner and task variables. Maturation, imitation and

and association all play a part, but they are not sufficient to account for the creativity which is found in language production from its inception. While basic language patterns have been mastered by normally developing children prior to school entry, acquisition and refinement of more complex aspects of language continues through the elementary school years until at least age ten. Linguistically deviant children differ from normally developing ones primarily in rate of language acquisition, that is, the language of a linguistically deviant child is typically similar to that of a younger, normally developing child.

Research into paired-associate learning indicates that syntax is one significant variable in verbal learning. The form class of connectives was found to effect paired-associate learning with verb connectives superior to both preposition and conjunction connectives. Noun pairs embedded in phrases were found to be more easily learned than those embedded in sentences. Similarly, research into the effect of the image-evoking quality of nouns indicates that imagery does have a functional effect on learning and memory, an effect which appears to be useful in learning and remembering at all ages. Its effectiveness varies according to the nature of the learning task, the subject's age, and his experience. Paivio (1970) expresses this relationship as follows:

> The developmental changes occurring around 7 to 8 years of age corresponding to the beginning of anticipatory imagery (according to Piaget and Inhelder, 1966) and of verbal symbolic modes of thought (according to Bruner), may be the age at which the capacity for symbolic transformations --from words to images and back to words--makes a quantum leap (Paivio, 1970, pp. 385-392).

4. The Relationship between Oral Language and Reading Achievement

It is only within very recent years that there has developed an awareness that children identified as reading disabled and/or learning disabled frequently exhibit deficits in oral language functioning. Out of this awareness has emerged a number of studies designed to measure the relationship between and/or the effects of various oral language components on reading achievement. Variables which have been studied include comprehension of linguistic and syntactic components of oral language, associative verbal encoding, mode of presentation, type of instructions given, visual memory, paired-associate learning, and reading comprehension. For the most part the results of these studies support the position that a relationship does exist between oral language functioning and reading achievement.

The observation that learning disabled students frequently exhibit immature speech patterns, inadequate comprehension of connected speech, and errors in oral expression prompted Wiig and Semel (1974) to compare the linguistic comprehension abilities of learning disabled and normally achieving students. An experimental test instrument which measured comprehension of linguistic concepts was administered to thirty-two (32) learning disabled and sixteen (16) normally achieving elementary school children. Linguistic concepts measured included passive construction and comparative, sequential, spatial, and familial relationships. Results of this study indicated that learning disabled subjects made a significantly greater number of errors than normally achieving subjects on every construct tested.

This finding lead Wiig and Semel to conclude that oral language functioning was significantly related to learning disabilities.

In a second study, one which investigated the relationship between oral language syntactic skills and reading ability, Vogel (1974) hypothesized that dyslexic students were also deficient in oral language syntax. Vogel compared twenty (20) normal and twenty (20) dyslexic second grade males. Experimental tasks included a series of instruments which measured reading comprehension, word recognition, vocabulary, syntax, grammatic closure, and sentence recall. Results of this study confirmed its hypothesis. Differences between normal and dyslexic subjects were significant at the $p < .001$ level with normal subjects consistently performing more efficiently that dyslexic ones. Vogel concluded that significant differences did exist between the two groups of subjects. She further observed that the nature of these differences was such that identification of "high risk," that is, potentially dyslexic students prior to school entry might be possible.

Samuels and Anderson (1973) studied the relationship between visual perceptual skills and reading achievement. Specifically, they investigated the effects of "visual recognition memory" on paired-associate learning and reading achievement. Samuels and Anderson hypothesized that subjects with high visual recognition memory scores would be superior to those subjects with low visual recognition memory scores on a difficult paired-associate learning task. They further hypothesized that good readers would be superior to poor readers in visual recognition memory and that there would be a difference between good and poor readers in the kinds of errors made on the visual memory task.

Sixty-four (64) second grade children served as subjects. These subjects were divided into groups based upon their reading ability and intelligence. Three experimental tasks were administered to each subject. The first was a visual memory task while the second and third were paired-associate learning tasks. Correlation analysis was used to evaluate data. Results indicated that the relationship between I.Q. and visual recognition memory and the more difficult paired-associate learn task was significant at the $p < .01$ level, the correlation between visual recognition memory and the easier paired associate task was not significant.

Comparison of good and poor readers indicated that good readers were significantly superior ($p < .05$) to poor readers in visual recognition memory, vocabulary, comprehension, I.Q., and the more difficult paired-associate learning task. No significant relationships were found between reading ability and either the easier paired-associate task or the type of visual memory errors. However, good readers made significantly fewer errors than did poor readers. These results lead Samuels and Anderson to conclude that visual recognition memory was related to performance on paired-associate and reading tasks.

In a two-part study Mickelson (1972) investigated the relationship between associative verbal encoding (a/v/e) as a language processing skill and reading achievement. Part I was designed to determine if a significant relationship existed between these two information processing skills. Six hundred and seventy-six (676) nine year old children served as subjects. Significant correlations ($p < .01$) were found to exist between associative verbal learning and reading achievement.

On the basis of this correlation Mickelson hypothesized that: (1) associative verbal encoding will improve with training, and (2) associated with improvement in associative verbal encoding, if it occurs, will be concomitant improvement in reading achievement. Two hundred and nine girls and 214 boys in fourteen randomly selected classes served as subjects for Part II of this study. Classes were randomly assigned to either experimental or control conditions. Training of a/v/e involved encouraging subjects to give as many responses as possible to 96 stimulus words. Two training periods were held daily by classroom teachers during school time. Two stimulus words were presented in each training session. Analysis of results indicated that the main treatment effect was significant at the $p < .001$ level. There were no significant interactive effects. From these results Mickelson concluded that reading performance might well be a cognitive search for meaning in which the verbal repertoire of the learner would be an important component.

Levin (1973) studied the interactive effects of reading ability and mode of presentation. He proposed that reading comprehension consisted of an ongoing search for and processing of information, a search which required complex organizational strategies on the part of the reader. Levin hypothesized that (1) it was possible to demonstrate a reading ability-mode of presentation interaction and (2) this interaction would be produced when an organizational strategy was generated by the student internally as opposed to being provided for the student externally.

Three groups of subjects were identified: adequate readers, deficit poor readers, and difference poor readers. Deficit poor

readers were defined as students who lacked the necessary prerequisite skills for success in reading. Difference poor readers were defined as those who possessed these prerequisite skills but who differed from adequate readers in their reading habits. Stimulus materials consisted of two twelve-sentence stories with two alternative modes of presentation. In the "printed text" format stories were typed on index cards with one sentence per card. For the "pictorial" version the same stories were presented in a series of twelve cartoon-like pictures with one picture representing each sentence and each picture mounted on a separate card. Stories were presented to each subject in one of three experimental conditions: (1) printed text only, (2) printed text with imagery instructions, and (3) pictorial presentation. After a subject completed each story he was asked thirteen questions which measured comprehension and memory. Performance was measured in terms of the number of correct responses to these questions.

Results in terms of the mode of presentation indicated that the imagery instructions produced a significantly superior performance when compared to the printed text only and the pictorial modes. Examination of the effect of reading ability indicated that good readers performed significantly better than poor readers under all experimental conditions. The prediction that poor readers would benefit more from pictorial materials than good readers was not supported. No differences in reading ability were found between deficit and difference readers. However, visual imagery instructions were found to facilitate the learning of difference poor readers more than deficit poor readers. This result was seen as supporting the hypothesis that imagery instructions facilitated the comprehension of difference poor readers by inducing them to attend to the semantic characteristics and relationships in printed materials.

Thus, out of research which measures the relationship between oral language comprehension and reading achievement, the following tentative conclusions can be drawn. First, this research suggests that significant relationships do exist between oral language and number of reading skills including comprehension. Second, students identified as learning disabled and/or dyslexic have been found to be dificient in both comprehension of oral language syntax and in paired-associate learning. Third, this body of research suggests the possibility of significant aptitude-treatment interactions. The implication of this finding, if true, is that no one factor or treatment method can be said to be a blanket solution for any given learning problem. Rather, future research must attend to the task of defining the conditions under and the type of student for which any one treatment is most effective.

CHAPTER III

RESEARCH METHOD AND DESIGN

Selection of Subjects

Subjects (N = 56) for this study were selected from two sources: (1) a private day school for children with learning disabilities and (2) a public school. All prospective subjects were administered the reading comprehension subtest of the Gates-MacGinitie Reading Survey, Level D, (1965) and the Peabody Picture Vocabulary Test (Dunn, 1959). From the results of these two tests reading expectancy scores were computed using the Bond Reading Expectancy Formula (Bond and Tinker, 1967). This formula, which considers both intelligence and educational experience is:

$$\text{Reading Expectancy} = \frac{\text{Years in School} \times \text{I.Q.}}{100} + 1.0$$

Although a definition of educational experience as "years in school" is acknowledged to be inadequate in that it fails to consider quality of instruction, this formula for computing reading expectancy was judged to be superior to those which give no consideration to this factor.

1. Adequate Readers

Two groups of potential subjects were identified through the above process: (1) adequate readers and (2) disabled readers. Adequate

readers were defined as students whose reading comprehension scores were equal to or higher than their expected reading levels. Students so identified were administered the Bender Visual-Motor Gestalt (Bender, 1938) and the Draw-A-Person (Goodenough-Harris, 1963). Teacher interviews and examination of school records were conducted to identify students with a history of learning problems. Drawings were evaluated according to psychometric criteria (Bender, 1938; Koppitz, 1963; Goodenough-Harris, 1963). Students whose drawings and/or school histories suggested the possibility of specific learning deficits were eliminated as possible subjects.

2. Disabled Readers

Students were judged reading disabled if their ability to derive meaning from printed materials was not commensurate with their intelligence and educational experience, that is, their expected reading levels. The amount of discrepancy between the student's actual and expected reading levels which was tolerated varied with level of performance. A lag in actual reading competence of .5 years was considered significant up to a reading grade level of 2.5, while a lag of .75 was permitted between grades 2.5 and 3.9, and a lag of 1.0 was tolerated above grade 4.0 (Ray, 1972). According to Ray's criteria, a fourth grade student with an expected reading level of 4.75, but an actual performance level of 3.75 would be considered a disabled reader. Another student at the same grade level with an expectancy of 4.0 and a performance level of 3.75 would not be so classified.

Students identified as both learning disabled and reading disabled were subjected to a second elimination process to exclude those whose

reading disability might be influenced by other factors such as irregular school attendance or cultural disadvantage. School demographic data were examined and teacher interviews were conducted to identify those students whose membership in an ethnic, cultural, or socio-economic group might serve to classify them as culturally disadvantaged. This decision to eliminate students from these groups stems from the finding that they frequently learn a dialect of English which utilized different syntactic structures than those of Standard English (Cazden, 1972). Similarly, school records were examined for evidence of excessive absenteeism. Students whose attendance at school was irregular were excluded. Finally, quality of instruction was recognized as a third factor which could significantly influence reading achievement. However, because an accurate evaluation of quality of instruction was not possible, and since this factor was judged to be equally variable for both adequate and disabled readers, no attempt was made to control for it.

As additional criteria, only males between the ages of ten years and twelve years, six months were accepted as subjects. This sample was restricted to males because both research and experience have indicated that a disproportionate number of both learning disabled and reading disabled students are male. Imposing this restriction eliminated the need to identify a female sample of RD-LD subjects when it was not available in the populations from which the subjects were drawn. It also eliminated the need to control for sex differences in analyzing data.

The ten year to twelve year, six month age range was selected for a number of reasons. By age ten normally developing children can be expected to have developed the perceptual maturity needed for reading

(Koppitz, 1963; Frostig, 1963) and to have mastered basic word analysis skills (Bond and Tinker, 1967; Smith, 1972). Within Piaget's (1966) model of intellectual development, they should be capable of anticipatory imagery and logical, communicable thought. In addition, they should have acquired the oral language skills needed to correctly respond to the grammatical structures presented in this study.

The above assumptions do not hold for RD-LD students. The failure of students to demonstrate these skills can be interpreted as further indication of delayed and/or atypical development of information-processing skills.

Research Design

This study was designed to test the effects of syntactic complexity of sentences and the image-evoking quality of embedded noun pairs on the oral language comprehension and paired-associate learning of average or above average readers (AR) and reading disabled-learning disabled (RD-LD) subjects. A 2 x 2 x 2 split-plot research design was used. The variables for the study were:

Independent Variables

Stimulus--syntactic complexity of oral language sentences

--imagery value of embedded noun pairs

Organismic Variables--reading ability of subjects; presence or absence of indicators of learning disabilities

Dependent Variables

Response--number of correct responses to oral language comprehension test

--number of embedded noun pairs correctly recalled

Analysis of variance was used as the test of statistical analysis. A $p < .05$ level of probability was selected as the level at which results were considered significant.

Hypotheses

The following hypotheses were tested in this study:

H_1: The effect of the imagery value of embedded noun pairs on oral language comprehension is not significant.

H_2: The effect of the syntactic complexity of sentences on oral language comprehension is not significant.

H_3: The interactive effect of imagery value of embedded noun pairs and syntactic complexity of sentences on oral language comprehension is not significant.

H_4: The interactive effect of reading ability of subjects and imagery value of embedded noun pairs on oral language comprehension is not significant.

H_5: The interactive effect of reading ability of subjects and syntactic complexity of sentences on oral language comprehension is not significant.

H_6: The interactive effect of reading ability of subjects, imagery value of embedded noun pairs, and syntactic complexity of sentences on oral language comprehension is not significant.

H_7: The effect of the imagery value of embedded noun pairs on paired-associate recall is not significant.

H_8: The effect of the syntactic complexity of sentences on paired-associate recall is not significant.

H_9: The interactive effect of the imagery value of embedded noun pairs and syntactic complexity of sentences on paired-associate recall is not significant.

H_{10}: The interactive effect of reading ability of subjects and imagery value of embedded noun pairs on paired-associate recall is not significant.

H_{11}: The interactive effect of reading ability of subjects and syntactic complexity of sentences on paired-associate recall is not significant.

H_{12}: The interactive effect of reading ability of subjects, imagery value of embedded noun pairs, and syntactic complexity of sentences on paired-associate learning is not significant.

The Test Instrument

An experimental test of language acquisition was constructed to measure subject's ability to use imagery and syntax to derive meaning from spoken language. Two levels of imagery were established by the use of either high- or low-imagery noun pairs in sentences. High- and low-imagery noun pairs were selected from a list of 925 nouns rated according to their imagery, concreteness, meaningfulness, and frequency of use (Paivio, Yuille, and Madigan, 1968). High-imagery nouns had a mean imagery scale value of +6.50. The mean imagery scale value of low-imagery nouns was +3.25. All nouns selected were rated as high frequency ratings.

Two levels of syntactic complexity were established. Low syntactic complexity sentences were simple, active, declarative, or kernel sentences. High syntactic complexity sentences were embedded sentences, that is, sentences in which a dependent clause was included in a simple sentence to form a complex one.

Both the imagery value of noun pairs and the level of syntactic complexity was varied in each sentence. Thus, four types of sentences were constructed:

High Imagery--High Syntactic Complexity

High Imagery--Low Syntactic Complexity

Low Imagery--High Syntactic Complexity

Low Imagery--Low Syntactic Complexity

Five sentences of each type were included in the test instrument (Appendix B). Thus, it consisted of twenty sentences.

A sketch depicting each sentence was drawn. This correct sketch, together with a distractor and two other randomly selected filler sketches was presented with each sentence. The order of presentation of sentences within each sentence type was randomly determined. A twenty second maximum response time was enforced. The number of correct responses for each sentence type and the total number of correct responses was recorded for each subject.

After presentation of each sentence type, one noun from each embedded noun pair used in that sentence type was presented orally. The subject was asked to recall the other noun pair member. The number of correctly recalled noun pairs was recorded.

Procedure

Data collection consisted of the administration of an experimental test of language acquisition comprised of twenty sentences which varied in their syntactic complexity and the image-evoking quality of embedded noun pairs. Subjects were randomly assigned to one of the four possible orders of presentation.

The test instrument was individually administered to each subject. The following instructions were given:

> This is to see how well you understand and remember what you see and hear. I am going to say two words, then read a sentence which uses those words. Each time I read a sentence I will show you four pictures. I want you to tell me which picture best describes the sentence. After I have read five sentences, and you have chosen the best picture for each, I want to see how many of the words you can remember. I will tell you one of the words from each sentence and ask you to tell me the other word.
>
> Let's try an example. Listen carefully to these words and sentences, then choose the best picture for each sentence.
>
> Ring--Box "The ring is in the box."
>
> Hand--Lady "The lady held out her hand."

The subject was given twenty seconds to respond. If he did not respond within that time period, or if his response was incorrect, the correct picture was selected by the examiner and the process was explained to the subject. If his response was correct the examiner said, "Good, that is correct."

After both sample sentences had been presented in this manner, the subject was presented with one of the nouns from each sentence and asked to recall the second pair member. These instructions were given:

> "Now tell me, which word goes with box?"
>
> "Which word goes with lady?"

As with the picture identification portion of the test, a twenty second response time was allowed and the correct response was provided if necessary.

After these explanations had been given the test sentences were administered. No additional explanations were given. A twenty second response time was allowed for each response. The number of correct,

that is, the number of correctly identified pictures and the number of nouns recalled, was recorded for each sentence type.

Summary

This chapter has presented a description of the subjects in this study, the criteria for their selection, the research design and procedures, and the test instrument used. An experimental test of language acquisition was administered to fifty-six subjects, half of whom were identified as average or above average readers with no history or indication of learning disabilities and half of whom were identified as reading disabled--learning disabled. A 2 x 2 x 2 split-plot research design was used. Analysis of variance was selected as the test of statistical significance. A $p < .05$ level of probability was set as the acceptable level of significance.

CHAPTER IV

ANALYSIS OF THE DATA

Introduction

Chapter IV presents the results of this study and an analysis of the data. The study was designed to measure the effects of the imagery value of embedded noun pairs and of the syntactic complexity of orally presented sentences on oral language comprehension and paired-associate recall. A 2 x 2 x 2 split plot analysis of variance design was used to measure these effects (Kirk, 1969). A $p < .05$ level of significance was set.

Hypotheses one through six test the effects of imagery and syntax on oral language comprehension. Hypotheses seven through twelve refer to the effects of these same two variables on paired-associate recall. Table II presents data pertaining to hypotheses one through six while Table III contains comparable data for hypotheses seven through twelve.

Hypothesis One

H_1: The effect of the imagery value of embedded noun pairs on oral language comprehension is not significant.

Analysis of variance for Hypothesis One yielded an F value of 108.8 (Table II). This value is significant at the $p < .001$ level. Therefore, Hypothesis One is rejected. These results indicate that the imagery value of embedded noun pairs did significantly effect oral

language comprehension. The mean number of correct responses for the high-imagery condition is 9.59 as compared to 6.84 for the low-imagery condition. These statistics indicate that the high-imagery condition was more facilitative of oral language comprehension than was the low-imagery condition. The standard deviation for the high-imagery condition is .56 as compared to 1.72 for low-imagery. This indicates a greater variability in performance of subjects on the low-imagery task.

Hypothesis Two

H_2: The effect of syntactic complexity of sentences on oral language comprehension is not significant.

Analysis of the data for Hypothesis Two yielded an F value of 4.64. This value is significant at the $p < .05$ level of probability. Therefore, Hypothesis Two is rejected. These data indicate that the syntactic complexity of orally presented sentences is a significant variable in oral language comprehension. The mean number of correct responses for the high-syntactic complexity condition is 8.48 as compared to a mean of 7.95 for the low syntactic complexity task. This indicates that the high syntactic condition facilitated oral language comprehension to a greater degree than the low-syntactic condition. The standard deviation for the high-syntactic complexity condition is 2.71 as compared to 1.10 for the low-syntactic complexity task. This indicates that there was also greater variability in subjects' performance on the high-syntactic complexity task.

TABLE II

ANALYSIS OF VARIANCE SOURCE TABLE FOR
ORAL LANGUAGE COMPREHENSION TASK

Source of Variance	SS	df	ms	F	P
SS Between Subjects	47.93	55	.87		
Reading Ability of Ss	2.16	1	2.16	2.54	NS
Ss within Group	45.77	54	.85		
SS Within Subjects	11254.5	53	212.35		
Imagery	105.87	1	105.87	108.81	.001
Reading Ability x Imagery	2.57	1	2.57	2.64	NS
Imagery x Ss within Groups	52.55	54	0.973		
Syntax	4.01	1	4.01	4.64	.05
Reading Ability x Syntax	.31	1	.31	.36	NS
Syntax x Ss within Groups	46.69	54	.865		
Imagery x Syntax	16.08	1	16.08	.08	NS
Reading Ability x Imagery x Syntax	0.0	1	0.0	.00	NS
Imagery x Syntax x Ss within Groups	11026.43	54	204.19		
SS Total	11302.43				

Hypothesis Three

H_3: The interactive effect of imagery value of embedded noun pairs and syntactic complexity of sentences on oral language comprehension is not significant.

Analysis of variance for Hypothesis Three yielded an F value of .08. Because this value is not significant, the null hypothesis cannot be rejected at the $p < .05$ level. These results indicate that the interactive effect of the imagery value of embedded noun pairs and the syntactic complexity of orally presented sentences was not statistically significant in the oral for the oral language comprehension task.

Hypothesis Four

H_4: The interactive effect of reading ability of subjects and the imagery value of embedded noun pairs on oral language comprehension is not significant.

Analysis of variance for Hypothesis Four yielded an F value of 2.64. This value is not significant at the $p < .05$ level. Therefore, the null hypothesis cannot be rejected. These data indicate that the interaction of reading ability and imagery was not statistically significant in its effect on the oral language comprehension of subjects in this study.

Hypothesis Five

H_5: The interactive effect of reading ability of subjects and syntactic complexity of sentences on oral language comprehension is not significant.

Hypothesis Five, which tested the interactive effects of reading competency and syntactic complexity on oral language comprehension, yielded an F value of .36. This value is not significant at the $p < .05$ level. Accordingly, the null hypothesis cannot be rejected. These results support the conclusion that the interactive effects of reading ability and syntactic complexity were not statistically significant for the oral language comprehension task.

Hypothesis Six

H_6: The interactive effect of reading ability of subjects, imagery value of embedded noun pairs, and syntactic complexity of sentences on oral language comprehension is not significant.

Hypothesis Six measures the interactive effects of reading ability, imagery, and syntactic complexity on oral language comprehension. Statistical analysis yielded an F value of zero. Since this value is not significant at the $p < .05$ level, the null hypothesis cannot be rejected. These results support the position that the interactive effects of reading ability, imagery, and syntactic complexity were not statistically significant on the oral language comprehension task.

Hypothesis Seven

H_7: The effect of the imagery value of embedded noun pairs on paired-associate recall is not significant.

Data derived from statistical analysis to test this hypothesis yielded an F value of 856.94 (Table III). This value is significant at the $p < .001$ level of confidence. Accordingly, Hypothesis Seven is rejected. These results indicate that the imagery value of embedded

TABLE III

ANALYSIS OF VARIANCE SOURCE TABLE FOR PAIRED-ASSOCIATE RECALL TASK

Source of Variance	SS	df	ms	F	P
SS Between Subjects	89.96	55	1.64		
Reading Ability of Ss	18.85	1	18.85	14.28	.001
Ss within Groups	71.11	54	1.32		
SS Within Subjects	4728.75	53	89.22		
Imagery	754.11	1	754.11	856.94	.001
Reading Ability x Imagery	.39	1	.39	.44	NS
Imagery x Ss within Groups	47.75	54	.88		
Syntax	30.75	1	30.75	49.60	.001
Reading Ability x Syntax	.03	1	.03	.05	NS
Syntax x Ss within Groups	33.47	54	.62		
Imagery x Syntax	1.29	1	1.29	.02	NS
Reading Ability x Imagery x Syntax	6.77	1	6.77	.09	NS
Imagery x Syntax x Ss within Groups	3854.19	54	71.37		
SS Total	4818.71				

noun pairs is a significant variable in paired-associate recall. The mean number of correct responses for the high-imagery task is 8.82 as compared to 1.48 for the low-imagery task. This indicates that the high-imagery condition facilitated paired-associate recall to a greater degree than the low-imagery condition. The standard deviation for the high-imagery condition was 1.22 as compared to 1.72 for low-imagery. Thus, there was greater variability in subject performance on the low-imagery task than on the high-imagery task.

Hypothesis Eight

H_8: The effect of the syntactic complexity of sentences on paired-associate recall is not significant.

Data from this study yielded an F value of 49.60 for Hypothesis Eight. This value is significant at the $p < .001$ level of probability. Therefore, Hypothesis Eight is rejected. These data indicate that the syntactic complexity of sentences was a significant variable in paired-associate recall. The mean number of correct responses for the high-syntactic complexity task is 4.41 as compared to 5.89 for the low-syntactic complexity task. These data indicate that the low-syntactic complexity condition facilitated paired-associate recall more effectively than the high-syntactic complexity condition. The standard deviation for the high-syntactic complexity condition is 1.65 compared to a standard deviation of 1.20 for the low-syntactic complexity condition. Thus, subject performance on the high-syntactic complexity task was more variable than subject performance on the low-syntactic complexity task.

Hypothesis Nine

H_9: The interactive effect of the imagery value of embedded noun pairs and syntactic complexity of sentences on paired-associate recall is not significant.

Analysis of variance yielded an F value of .02 for Hypothesis Nine. This value is not significant at the $p < .05$ level. These data support the conclusion that the interactive effects of imagery and syntax were not statistically significant for the paired-associate recall task. Therefore, Hypothesis Nine cannot be rejected.

Hypothesis Ten

H_{10}: The interactive effect of reading ability of subjects and imagery value of embedded noun pairs on paired-associate recall is not significant.

Data derived from statistical analysis of this hypothesis yielded an F value of .44. This value was not significant at the $p < .05$ level of probability. Consequently, Hypothesis Ten cannot be rejected. These results indicate that the interactive effect of reading ability and imagery value of embedded noun pairs was not significant variable in paired-associate recall.

Hypothesis Eleven

H_{11}: The interactive effect of reading ability of subjects and syntactic complexity of sentences on paired-associate recall is not significant.

Analysis of variance to measure the interactive effect of subjects reading ability and syntactic complexity of sentences on paired-

associate recall yielded an F value of .05. Because this value was not significant at the $p < .05$ level, the null hypothesis cannot be rejected. These data indicate that the interactive effect of the subjects' reading ability and syntactic complexity of sentences on paired-associate recall was not significant.

Hypothesis Twelve

H_{12}: The interactive effect of reading ability of subjects, imagery value of embedded noun pairs, and syntactic complexity of sentences on paired-associate recall is not significant.

Data from this study yielded an F value of .09. This value was not significant at the $p < .05$ level. Therefore, Hypothesis Twelve cannot be rejected. These results indicate that the interactive effect of subjects' reading ability, imagery, and syntactic complexity of stimulus sentences was not a statistically significant variable in paired-associate recall.

Summary

Chapter IV presented the results of this study and analysis of the data it generated. These data indicate that the main effects of the imagery value of embedded noun pairs and the syntactic complexity of stimulus sentences were statistically significant in both oral language comprehension and paired-associate recall. High-imagery value of embedded noun pairs facilitated both oral language comprehension and paired-associate recall. High-syntactic complexity of stimulus sentences also aided oral language comprehension, but low-syntactic complexity was more facilitative of paired-associate recall. Data from

this study also indicate that none of the interactive effects predicted were statistically significant. The effects of imagery and syntax were additive rather than interactive for both experimental tasks. Moreover, reading ability of subjects did not interact with imagery or syntax to a statistically significant degree for either oral language comprehension or paired-associate recall.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study was an experimental investigation to test the effects of the image-evoking quality of embedded noun pairs and the syntactic complexity of stimulus sentences on oral language comprehension and paired-associate recall. Fifty-six (56) males ranging in age from ten years to twelve years, six months served as subjects. Half of these were identified as adequate readers with no history of learning disabilities. The remaining half were classified as both reading disabled and learning disabled. This classification was made through administration of a battery of tests to measure reading comprehension and to identify specific learning deficits, through inspection of school records, and through teacher interviews (see Chapter III).

All subjects were administered an experimental test of language acquisition which measured oral language comprehension and paired-associate recall under two levels of syntactic complexity, and two levels of imagery in embedded noun pairs. A split-plot 2 x 2 x 2 analysis of variance research design was used to analyze results (Kirk, 1968). The $p < .05$ level was set as necessary for rejection of null hypotheses.

The purpose of this study was to determine whether the image-evoking quality of embedded noun pairs and/or the syntactic complexity

of stimulus sentences would exert a statistically significant effect on verbal learning in ten to twelve year old male subjects. Verbal learning was operationally defined as oral language comprehension and paired-associate recall as measured by the experimental test instrument. A second purpose of this study was to determine if there were significant interactive effects between these two stimulus variables and subjects' reading comprehension abilities.

A total of twelve hypotheses were constructed to measure the effects of variables in this study. Hypothesis One predicted that the effects of the image-evoking quality of embedded noun pairs, as a stimulus variable, would not be statistically significant when oral language comprehension was the dependent variable. Testing of this hypothesis yielded an F value of 108.81 which was significant beyond the $p < .001$ level. Consequently, Hypothesis One was rejected. This finding indicated that the imagery value of embedded noun pairs was a significant variable in oral language comprehension. Comparison of subjects' performance under the two levels of imagery revealed that the mean number of correct responses for the high-imagery condition was 9.59 as compared to 6.84 for the low-imagery condition. These data indicate that the high-imagery condition facilitated oral language comprehension to a greater extent than the low-imagery condition.

Hypothesis Two was constructed to measure the effects of syntactic complexity as a stimulus variable when oral language comprehension was the dependent variable. This hypothesis stated that the effects of the syntactic complexity of stimulus sentences on oral language comprehension would not be statistically significant. The F value for this hypothesis was 4.64. Because this value was significant at the $p < .05$

level, Hypothesis Two was rejected. This finding indicated that the syntactic complexity of test sentences was also a significant variable in oral language comprehension. Comparison of means for the high and low syntactic complexity conditions indicates that the high-syntax condition produced a greater mean number of correct responses ($M = 8.48$) than did the low-syntax condition ($M = 7.95$).

Hypotheses Three through Six were constructed to measure the interactive effects of stimulus and organismic variables on oral language comprehension. All possible combinations of these variables (image-evoking quality of embedded noun pairs, syntactic complexity of stimulus sentences, and reading comprehension abilities of subjects) were tested. Hypotheses Three through Six predicted that the interactive effects of these stimulus and organismic variables would not be a significant factor in oral language comprehension. Findings of this study indicate that none of the interactive effects of these variables were statistically significant at the $p < .05$ level. Analysis of these data indicates that the effects of the two stimulus variables (imagery and syntax) were additive rather than interactive. These data further indicate that neither of these stimulus variables interacted to a statistically significant degree with the organismic variable, reading ability of subjects. Because of these findings, Hypotheses Three through Six were not rejected.

Hypothesis Seven was constructed to measure the effects of the image-evoking quality of embedded noun pairs as a stimulus variable when paired-associate recall was the dependent variable. This hypothesis predicted that the effect of the image-evoking quality of embedded noun pairs would not be a significant variable in paired-

associate recall. The F statistic computed for this hypothesis was 856.94. Because this value was significant beyond the $p < .001$ level, Hypothesis Seven was rejected. This indicates that the image-evoking quality of embedded noun pairs was a highly significant variable in paired-associate recall. Comparison of the mean number of correct responses for the high- and low-imagery conditions indicates that the high-imagery condition ($M = 8.82$) was more effective in facilitating paired-associate recall than the low-imagery condition ($M = 1.48$).

The effects of the syntactic complexity of stimulus sentences on paired-associate recall was measured by Hypothesis Eight. This hypothesis predicted that these effects would not be statistically significant. The F value computed for this hypothesis was 49.60. Because this value was significant at the $p < .001$ level, Hypothesis Eight was rejected. These findings indicate that syntactic complexity was also a significant variable in paired-associate recall. The mean number of correct responses on the high-syntactic complexity condition was 4.41 as compared to 5.89 for the low-syntactic condition. These statistics indicate that the low-syntactic condition facilitated paired-associate recall to a greater degree than the high-syntactic condition.

Hypotheses Nine through Twelve were constructed to measure the interactive effects of stimulus and organismic variables when paired-associate learning was the dependent variable. All possible combinations of these variables were tested. It was predicted that none of these interactive effects would be statistically significant. Findings supported these predictions. As a result, Hypotheses Nine through Twelve could not be rejected. These findings indicate that the stimulus and organismic variables in this study did not interact to a statistically significant degree in paired-associate learning.

Conclusions

The results of this study indicate that both the image-evoking quality of embedded noun pairs and the syntactic complexity of stimulus sentences were significant variables in verbal learning. The highly significant effect of imagery on both oral language comprehension and paired-associate recall ($p < .001$) is particularly notable. Comparison of the mean number of correct responses under high-imagery and low-imagery conditions (Table IV) reveals that subjects' performance under the high-imagery condition was superior to their performance under the low-imagery condition on both the oral language comprehension task and the paired-associate recall task. On oral language comprehension the high-imagery condition resulted in a mean of 9.58 correct responses as compared to a mean of 6.84 correct responses for the low-imagery condition. Subjects' performance on the paired-associate recall task resulted in a mean of 8.82 correct responses for the high-imagery condition as compared to a mean of 1.48 correct responses for the low-imagery condition. Thus, the high-imagery condition was facilitative of both oral language comprehension and paired-associate recall. These findings with respect to the effect of imagery in paired-associate learning concur with similar previous findings (Paivio, 1973; Paivio and Yuille, 1968; Paivio and Madigan, 1968). They also support findings that differences in imagery ability are predictive of learning performance with pictorial-verbal materials (Kuhlman, 1960; Stewart, 1965).

As with imagery, findings from the present study indicate that the syntactic complexity of stimulus sentences was a significant variable in both oral language comprehension ($p < .05$) and paired-associate recall ($p < .001$). Comparison of means for high-syntactic

complexity and low-syntactic complexity conditions (Table IV) reveals that on the oral language comprehension task the high-syntactic condition produced a mean of 8.48 correct responses as compared to the low-syntactic complexity condition which resulted in a mean of 7.95 correct responses. Thus, the high syntactic complexity condition was more facilitative of oral language comprehension than the low-syntactic complexity condition.

This finding regarding the effects of syntax on oral language comprehension is in contrast to the findings of Slobin (1966) that syntactic simplicity facilitated oral language comprehension. Both Slobin's study and the present study required picture identification as a response task. However, these two studies differed in several respects. First, Slobin's study tested comprehension of different syntactic structures (kernel, negative, passive, and negative-passive) than those tested in the present study (kernel and complex). This difference points to a need to identify ages at which various syntactic transformations are acquired. Second, subjects in Slobin's study differed from those in the present study on several organismic factors. While Slobin used an equal number of male and female subjects, only males participated in the present study. In addition, Slobin's study utilized a greater age range of subjects (6, 8, 10, 12, and 20 years) than those in the present study (10 years to 12 years, 6 months). Finally, Slobin did not differentiate subjects according to reading ability-learning ability criteria. Conflicting findings from these two studies indicate a need to measure the differential effects of these organismic variables.

This facilitative effect of high-syntactic complexity did not hold for the paired-associate recall task. The mean number of correct

responses for the high-syntactic complexity condition was 4.41 as compared to 5.89 for the low-syntactic complexity condition. Inasmuch as the high-syntactic complexity condition produced longer word strings than did the low-syntactic complexity condition, these findings support the finding of Suzuki and Rohwer (1968) that short word strings are more facilitative of paired-associate learning than are longer ones. Findings from the present study also support Suzuki and Rohwer's premise that "...the actual linking of the nouns by the verb is crucial in facilitating paired-associate learning" (Suzuki & Rohwer, 1968, p. 586). Low-syntactic complexity sentences presented in this study consisted of a noun pair with noun markers connected by a verb (Appendix B). In high-syntactic complexity sentences, however, one noun pair member was embedded in the main or independent clause while the second noun pair member was located in the dependent clause. Thus, the low-syntactic complexity sentences followed a noun-verb-noun pattern while the high-syntactic complexity sentences did not. Speculation as to possible reasons for the differential effects of syntactic complexity on oral language comprehension and paired-associate recall suggest the possibility that high syntactic complexity sentences facilitated oral language comprehension because they provided more data than did low-syntactic complexity sentences. On the other hand, low-syntactic complexity sentences might be seen as more facilitative of paired-associate recall because of their shorter length and consequent lower demands in terms of memory load.

None of the interactions predicted in this study proved to be statistically significant. Their nonsignificance indicates that the stimulus variables of this study operated in an additive manner,

independent of each other, and independent of the organismic variable. This finding is similar to Mickelson's (1973) finding that, although training in associative verbal encoding improved the encoding skills of subjects, its interactive effects with reading achievement were not significant.

The finding of the present study that the interaction of stimulus and organismic variables was not statistically significant conflicts with Levin's (1973) finding that imagery instruction facilitates the memory and comprehension of "difference poor readers" to a greater degree than "deficit poor readers." Possible explanations for this discrepancy include differences in stimulus materials and task requirements. Levin's experimental task required subject to construct mental images as mediators between printed text materials and responses while the present study required subjects to select a pictorial representation of a stimulus from an array of four pictures. It might be speculated that, although both tasks involved the use of imagery as a mediator between the stimulus and the response, picture identification constituted a recognition response which was simpler than the recall demanded by Levin's comprehension responses. A second task variable which might account for differences in findings is the length of stimulus units. While the present study required selection of a picture for each single sentence, Levin's study required responses to twelve-sentence units. This greater length might be seen as more demanding in terms of both ideational complexity and memory load.

An additional, and unpredicted result of this study is the differential relationship between subjects' reading ability and their performance on the two response tasks. Results of this study indicate

a significant relationship between subjects' reading ability and their performance on the paired-associate recall task ($F = 14.28$; $p < .001$). However, a similar relationship between subjects' reading ability and oral language comprehension was not indicated. The performance of reading disabled-learning disabled subjects was comparable to that of adequate readers on the oral language comprehension task. The results indicate that the average readers in this study were not superior to the reading disabled-learning disabled subjects in their ability to apply meaning to stimulus sentences varying levels of syntactic complexity. However, average readers were superior to reading disabled-learning disabled subjects in their ability to recall noun pairs embedded in these stimulus sentences.

These findings prompt speculation as to possible explanations and/or implications. One possible explanation might be found in the nature of the response tasks. The oral language comprehension task required a recognition response while the paired-associate learning task required recall. If this explanation were valid, it would imply that reading disabled-learning disabled subjects perceive, encode, and understand as well as adequate readers, but that they do not integrate incoming data into a storage-retrieval system. Within this context, the oral language comprehension task might be viewed as a processing activity in contrast to paired-associate learning which might be considered to be an end product of learning, one which extends beyond the encoding process.

A second possible explanation for these findings might be that the oral language comprehension task was not sufficiently sensitive to discriminate between adequate readers and reading disabled-learning

disabled subjects. This explanation implies a need for further refinement of and research with the test instrument.

The highly significant effect of imagery on both the oral language comprehension and the paired-associate recall tasks supports the thesis that language acquisition requires information processing skills which mediate between input and output. In do doing, these data also concur with Chomsky's position that the stimulus-response model of learning espoused by behaviorism cannot adequately account for the complexity of languages processes. Alternative theories of language acquisition proposed by Chomsky, Piaget, and Vygotsky have all stressed this complexity of language functioning and the close relationship between language and thought. Data from the present study which indicate the significant effect of imagery as a mediating process in language functioning concur with the theories of these men who view language as a process of symbolization which permits expression and/or communication of thought.

Recommendations

The findings of this study demonstrate the need for further research in verbal learning. The following recommendations are based upon these findings.

1. Results of this study indicate the need for further research to determine more precisely the ages at which specific syntactic structures are incorporated into the language system. Further research is also needed to determine more precisely the relationship between language processing variables and subject variables such as age, sex, and reading comprehension ability.

2. The finding of this study that the performance of average readers on the paired-associate recall task was superior to the performance of reading disabled-learning disabled subjects suggests a relationship between paired-associate recall, as an oral language information processing skill, and reading comprehension. A need for further research to define the precise nature of this relationship is indicated.

3. Chomsky has defined deep structures as constructs which represent meaning, in contrast to surface structures which are the grammatical forms used to convey this meaning. Thus, deep structures may be seen as closely related to thought, while surface structures are a function of language. The results of this study suggest that the delineation which is made between receptive and expressive language functioning might be useful in research regarding the acquisition of syntactic structures. Within this context, the oral language comprehension task presented in this study would be most accurately described as a task which measured receptive comprehension of the syntactic structures presented. If, as research has indicated (Lee, 1971), reception precedes expression in language acquisition, then the finding of this study that average readers were not superior to reading disabled-learning disabled subjects on the oral language comprehension task suggests a need for further research to measure the expressive language skills of these two types of subjects, utilizing the same syntactic structures.

4. The finding of this study that high-syntactic complexity facilitated oral language comprehension while low-syntactic complexity aided paired-associate recall suggests a need for further research to determine the effects of syntactic complexity, as a stimulus variable, on other language response variables.

5. Data from this study suggest that reading disabled-learning disabled subjects perceive, encode, and comprehend as well as adequate readers, but that they do not integrate incoming data into a storage-retrieval system as effectively as do average readers. These results indicate a need for further research to identify specific factors which facilitate or impede this integration process.

6. Sentences tend to become longer as syntactic complexity increases. Further research is indicated to measure the differential effects of sentence length and syntactic complexity on a variety of language learning tasks.

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APPENDIX A

TABLES OF RAW SCORES, MEANS, AND STANDARD DEVIATIONS

TABLE IV

MEANS AND STANDARD DEVIATIONS FOR
ORAL LANGUAGE COMPREHENSION AND
PAIRED-ASSOCIATE RECALL TASKS

Oral Language Comprehension Task	M	SD
High Imagery	9.59	.56
Low Imagery	6.84	1.72
High Syntactic Complexity	8.48	2.71
Low Syntactic Complexity	7.95	1.10
Paired-Associate Learning Task		
High Imagery	8.82	1.22
Low Imagery	1.48	1.72
High Syntactic Complexity	4.41	1.65
Low Syntactic Complexity	5.89	1.20

TABLE V

READING COMPREHENSION SCORES FOR
GATES MACGINITIE READING TEST

Average Readers			Reading Disabled-Learning Disabled		
Subject	Grade Level	Expectancy	Subject	Grade Level	Expectancy
1	7.1	5.0	1	4.7	5.7
2	7.6	5.4	2	2.4	4.8
3	11.9	8.2	3	2.6	6.1
4	+11.9	8.4	4	3.0	7.1
5	7.2	6.0	5	3.2	4.8
6	+11.9	7.1	6	2.4	5.5
7	9.3	5.9	7	4.5	7.9
8	+11.9	9.2	8	-2.2	6.8
9	6.1	5.5	9	-2.2	6.2
10	10.9	8.5	10	2.3	7.7
11	9.3	6.7	11	2.3	4.6
12	11.9	6.7	12	4.7	6.4
13	10.9	5.9	13	3.6	5.9
14	+11.9	6.6	14	3.1	6.2
15	10.9	7.4	15	4.5	5.8
16	9.3	7.9	16	3.2	6.9
17	11.9	8.7	17	3.8	7.1
18	8.1	5.8	18	4.1	6.1
19	7.6	5.8	19	4.9	5.1
20	10.9	8.6	20	2.8	5.7
21	10.9	7.5	21	2.2	6.5
22	11.9	9.3	22	3.0	6.0
23	6.5	4.9	23	4.7	5.7
24	6.8	5.6	24	5.6	7.8
25	5.5	5.0	25	4.0	6.1
26	5.5	5.2	26	4.7	6.0
27	6.2	5.2	27	2.3	5.8
28	5.6	5.5	28	2.9	4.8

TABLE VI

RAW SCORES OF READING DISABLED-LEARNING DISABLED SUBJECTS ON THE ORAL LANGUAGE COMPREHENSION TASK

Subject	High Imagery High Syntax	High Imagery Low Syntax	Low Imagery High Syntax	Low Imagery Low Syntax
S-1	4	5	4	3
S-2	5	5	4	3
S-3	5	5	1	2
S-4	5	5	3	3
S-5	4	5	3	1
S-6	5	5	3	3
S-7	5	5	4	4
S-8	4	5	3	2
S-9	5	5	4	3
S-10	5	5	5	5
S-11	5	5	2	2
S-12	4	5	3	3
S-13	4	5	3	3
S-14	5	5	4	1
S-15	5	5	5	4
S-16	5	5	3	3
S-17	5	5	3	4
S-18	5	5	5	3
S-19	4	5	4	3
S-20	5	5	4	3
S-21	4	5	3	3
S-22	5	5	5	3
S-23	4	5	3	3
S-24	4	5	4	2
S-25	5	5	4	3
S-26	4	5	4	4
S-27	5	5	4	4
S-28	5	4	3	0

TABLE VII

RAW SCORES OF AVERAGE READERS ON THE ORAL LANGUAGE COMPREHENSION TASK

Subject	High Imagery High Syntax	High Imagery Low Syntax	Low Imagery High Syntax	Low Imagery Low Syntax
S-1	4	5	4	4
S-2	4	5	4	4
S-3	5	5	5	3
S-4	5	5	5	4
S-5	4	5	3	1
S-6	5	4	5	3
S-7	4	5	4	5
S-8	5	5	5	4
S-9	5	5	3	4
S-10	5	5	5	5
S-11	5	5	3	5
S-12	5	5	4	3
S-13	5	5	4	4
S-14	4	5	4	2
S-15	5	5	4	2
S-16	5	5	5	2
S-17	5	5	5	3
S-18	5	5	5	4
S-19	4	4	4	1
S-20	4	5	5	4
S-21	5	5	3	3
S-22	5	5	4	3
S-23	4	4	4	4
S-24	5	5	3	1
S-25	5	5	3	4
S-26	5	5	3	1
S-27	5	5	4	4
S-28	4	5	4	2

TABLE VIII

RAW SCORES OF READING DISABLED-LEARNING DISABLED SUBJECTS ON THE PAIRED-ASSOCIATE RECALL TASK

Subject	High Imagery High Syntax	High Imagery Low Syntax	Low Imagery High Syntax	Low Imagery Low Syntax
S-1	4	5	0	2
S-2	3	5	2	2
S-3	5	5	3	2
S-4	5	5	0	3
S-5	5	5	0	0
S-6	5	5	1	3
S-7	4	4	0	0
S-8	5	5	4	4
S-9	5	5	2	1
S-10	5	5	0	3
S-11	5	5	0	2
S-12	2	5	0	3
S-13	5	5	0	0
S-14	5	5	0	1
S-15	3	5	1	2
S-16	5	5	0	2
S-17	5	5	0	1
S-18	5	5	0	0
S-19	4	5	0	0
S-20	5	5	2	3
S-21	5	5	0	2
S-22	5	5	1	1
S-23	4	5	1	1
S-24	5	5	0	1
S-25	5	5	0	3
S-26	1	4	0	0
S-27	5	5	0	0
S-28	3	5	0	1

TABLE IX

RAW SCORES OF AVERAGE READERS ON THE PAIRED-ASSOCIATE RECALL TASK

Subject	High Imagery High Syntax	High Imagery Low Syntax	Low Imagery High Syntax	Low Imagery Low Syntax
S-1	5	5	0	0
S-2	4	5	0	1
S-3	3	4	0	0
S-4	5	5	1	0
S-5	3	4	0	0
S-6	5	5	0	1
S-7	5	5	0	2
S-8	3	5	1	1
S-9	2	5	0	1
S-10	1	5	0	0
S-11	1	4	0	0
S-12	5	5	0	1
S-13	4	5	0	0
S-14	4	5	0	0
S-15	4	4	4	0
S-16	3	5	0	1
S-17	4	5	1	2
S-18	2	4	0	0
S-19	4	5	0	0
S-20	3	5	0	0
S-21	3	5	0	0
S-22	4	5	0	1
S-23	1	4	0	0
S-24	4	5	1	3
S-25	5	5	0	0
S-26	4	5	0	0
S-27	4	5	0	1
S-28	4	5	0	0

APPENDIX B

THE EXPERIMENTAL TEST INSTRUMENT

DATA SHEET

NAME:_____

GROUP:_____

SEQUENCE:_____

I. H-H

1. _____(4)	1. _____(church)	Raw Score:	
2. _____(3)	2. _____(camp)	Sentence Comprehension:	
3. _____(3)	3. _____(boy)	Paired-Associate Recall:	
4. _____(3)	4. _____(newspaper)		
5. _____(1)	5. _____(bottle)		

II. H-L

1. _____(4)	1. _____(baby)	Raw Score:	
2. _____(2)	2. _____(hammer)	Sentence Comprehension:	
3. _____(4)	3. _____(car)	Paired-Associate Recall:	
4. _____(1)	4. _____(queen)		
5. _____(4)	5. _____(diamond)		

III. L-H

1. _____(3)	1. _____(fact)	Raw Score:	
2. _____(2)	2. _____(hammer)	Sentence Comprehension:	
3. _____(1)	3. _____(chance)	Paired-Associate Recall:	
4. _____(4)	4. _____(thought)		
5. _____(2)	5. _____(occasion)		

IV. L-L

1. _____(4)	1. _____(opportunity)	Raw Score:	
2. _____(3)	2. _____(moment)	Sentence Comprehension:	
3. _____(1)	3. _____(amount)	Paired-Associate Recall:	
4. _____(4)	4. _____(explanation)		
5. _____(1)	5. _____(answer)		

INSTRUCTIONS TO SUBJECTS

This is to see how well you understand and remember what you see and hear. I am going to say two words, then read a sentence which uses those words. Each time I read a sentence I will show you four pictures. I want you to tell me which picture best describes the sentence. After I have read five sentences, and you have chosen the best picture for each, I want to see how many of the words you can remember. I will tell you one of the words from each sentence and ask you to tell me the other word.

Let's try an example. Listen carefully to these words and sentences, then choose the best picture for each sentence:

Ring--Box The ring is in the box.

Hand--Lady The lady held out her hand.

Now, tell me, which word went with box? Which word went with lady?

STIMULUS SENTENCES

I. H-H

1. The clock* that hung on the church said five.
2. The flag that flew over the camp* was burned.
3. The boy* who was by the table saw what happened.
4. The newspaper that landed on the grass* got wet.
5. The bottle that floated in the ocean* contained a message.

II. H-L

1. The mother* holds the baby.
2. The nail* is lying by the hammer.
3. The car pushes the elephant*.
4. The queen* greets the king.
5. The diamond is lying by the coin*.

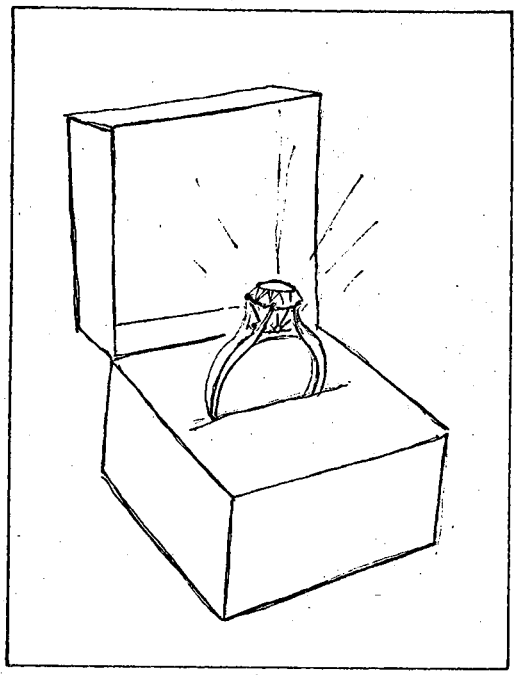
III. L-H

1. The fact* that he might not secure the position worried the man.
2. The situation* that resulted from the event was humorous.
3. The knowledge that there was another chance* inspired hard work.
4. The thought that the method* might work encouraged him to keep trying.
5. The memory* that he had of the occasion frightened him.

IV. L-L

1. The opportunity* requires interest.
2. The moment demands truth*.
3. The amount* is beyond belief.
4. The method defies explanation*.
5. The answer* reflects his attitude.

*First stimulus word



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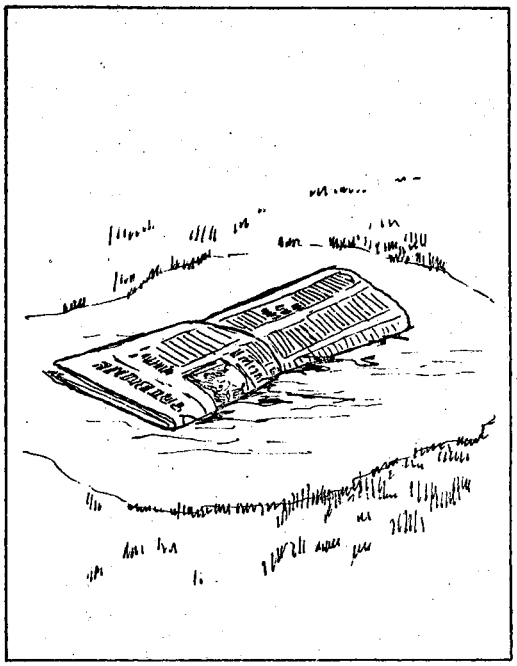

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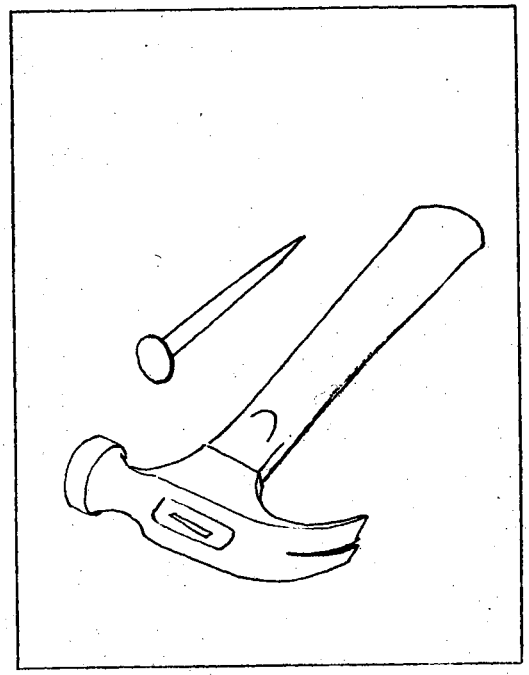

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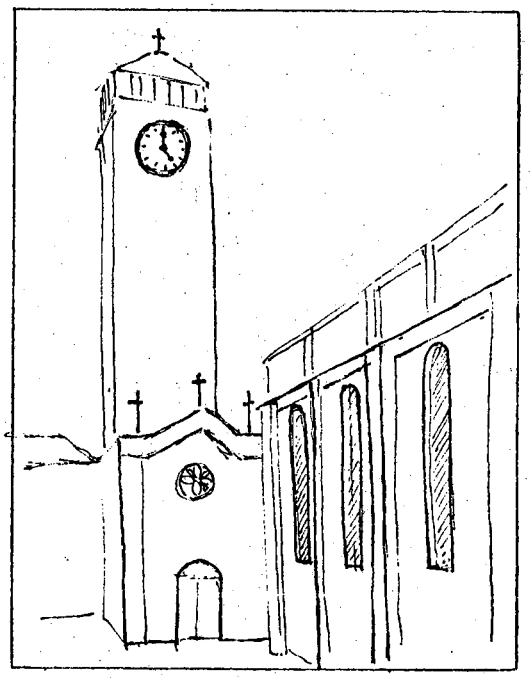

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EXAMPLE ONE

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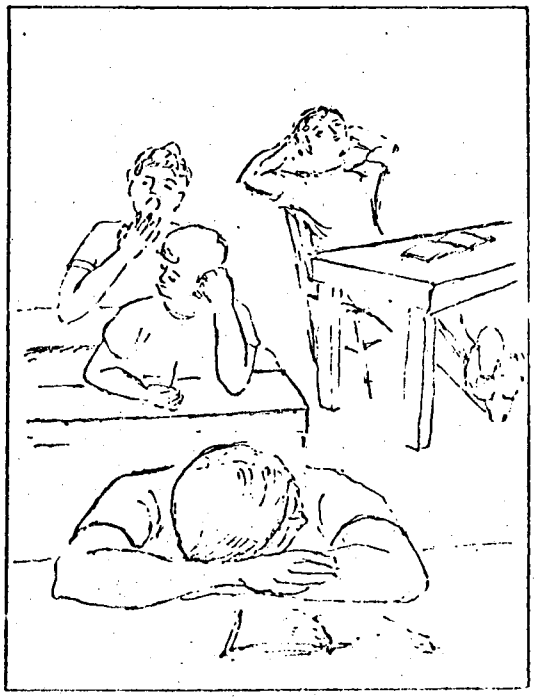
2.

3.



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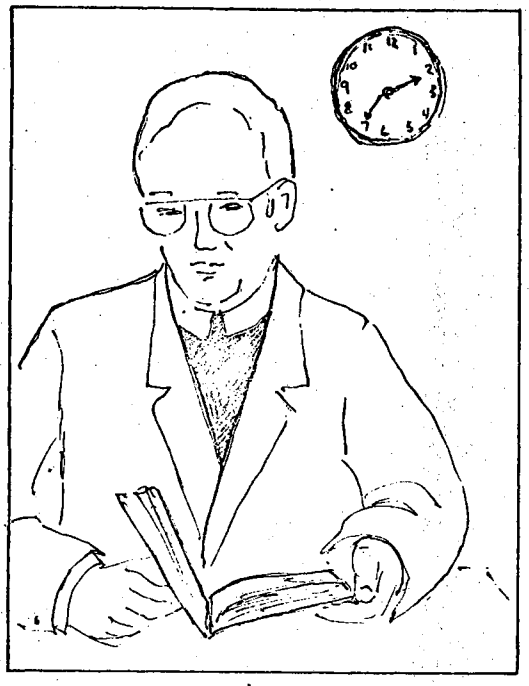

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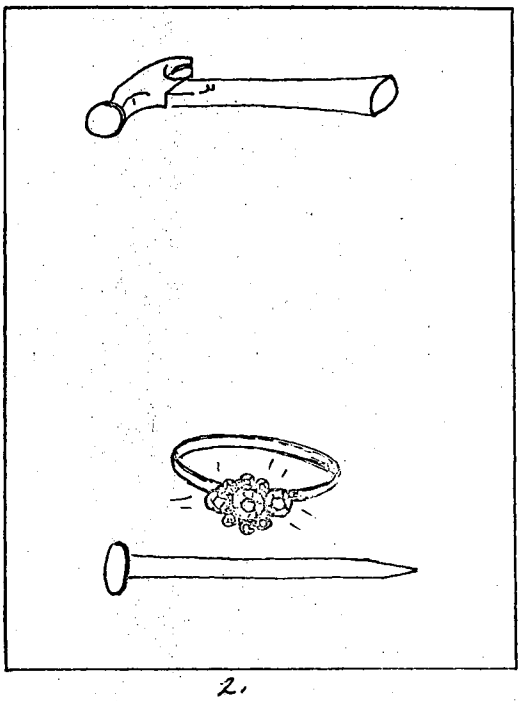

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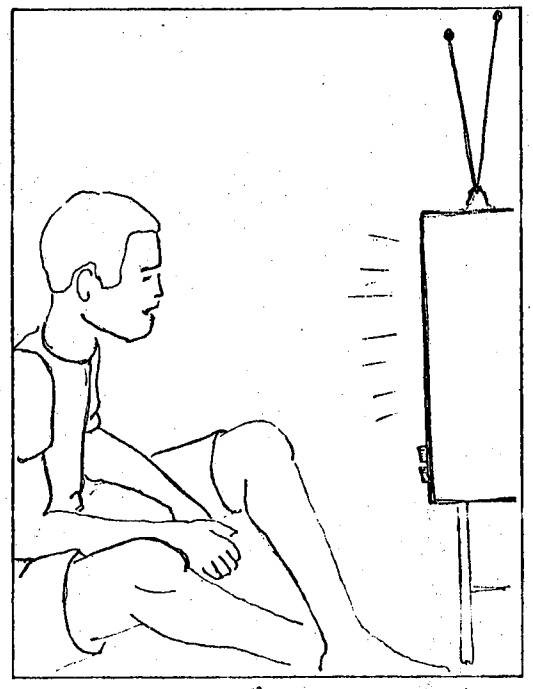

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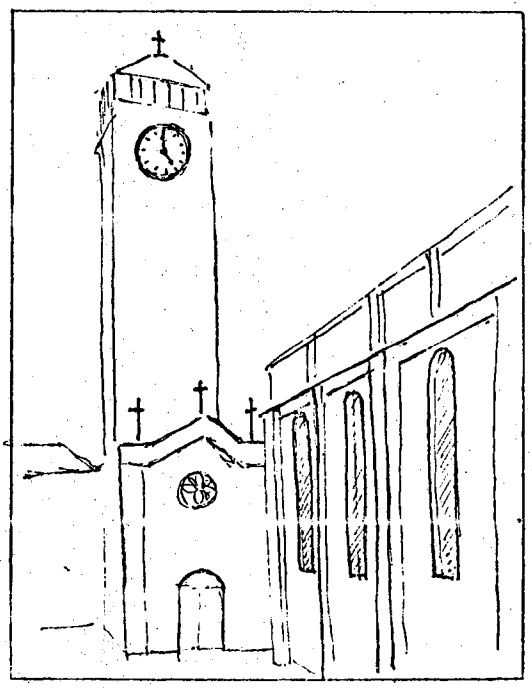

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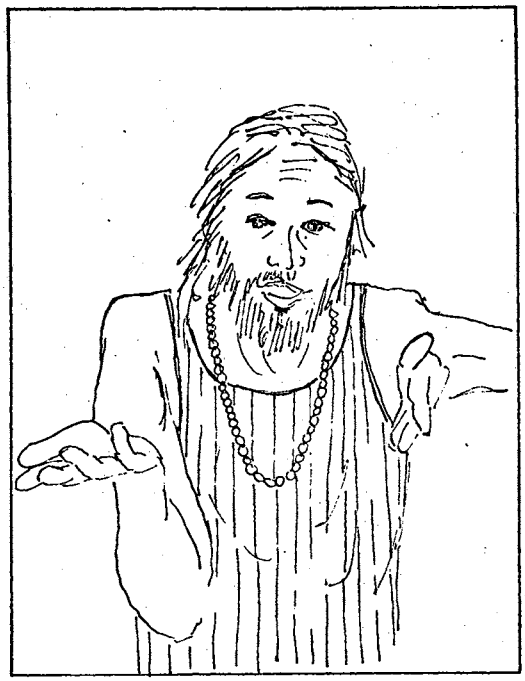

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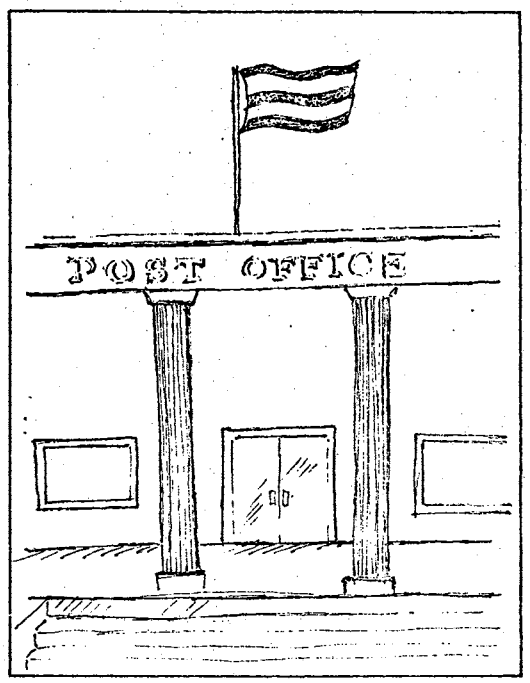

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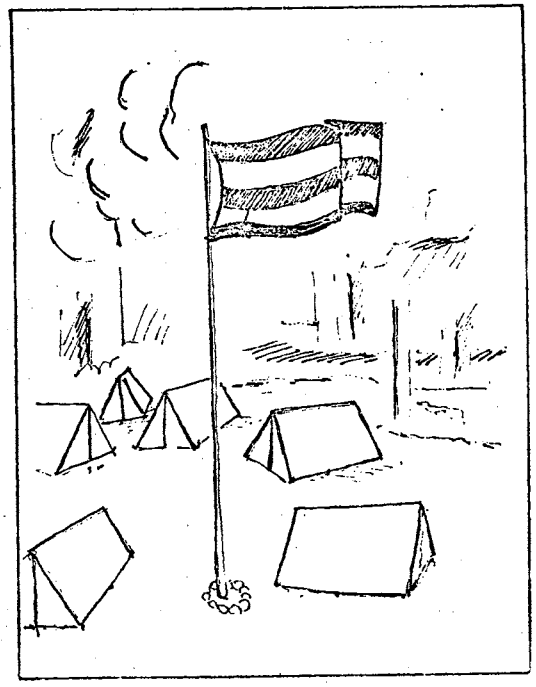

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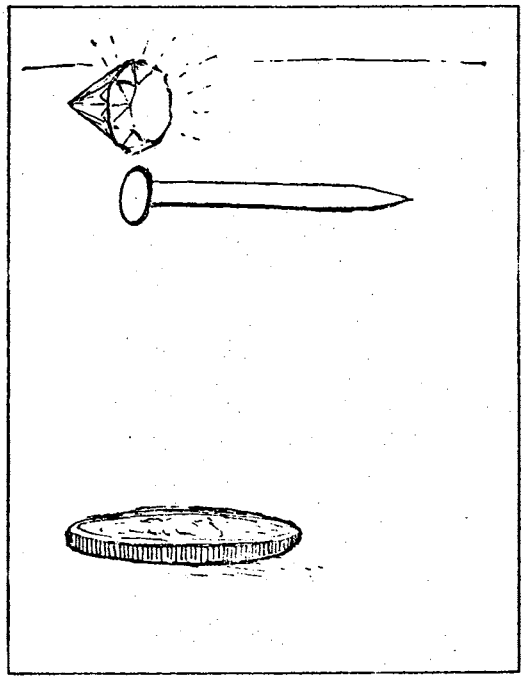

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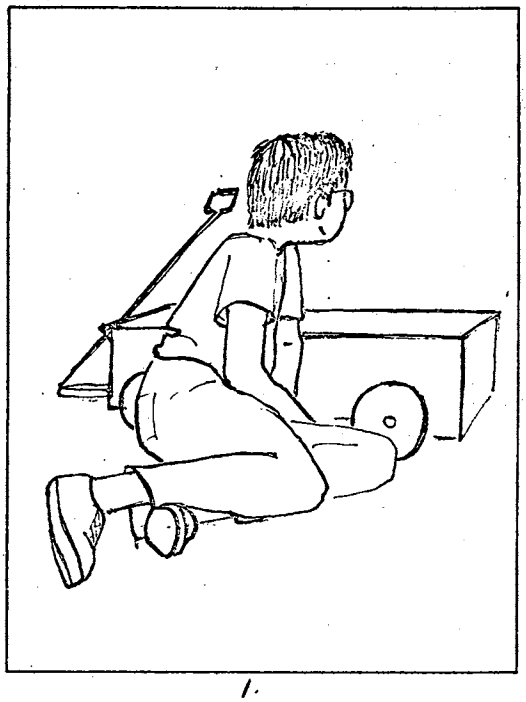

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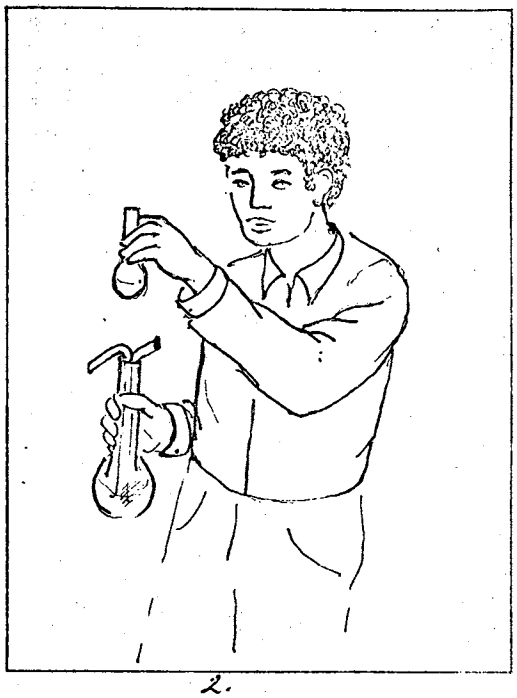

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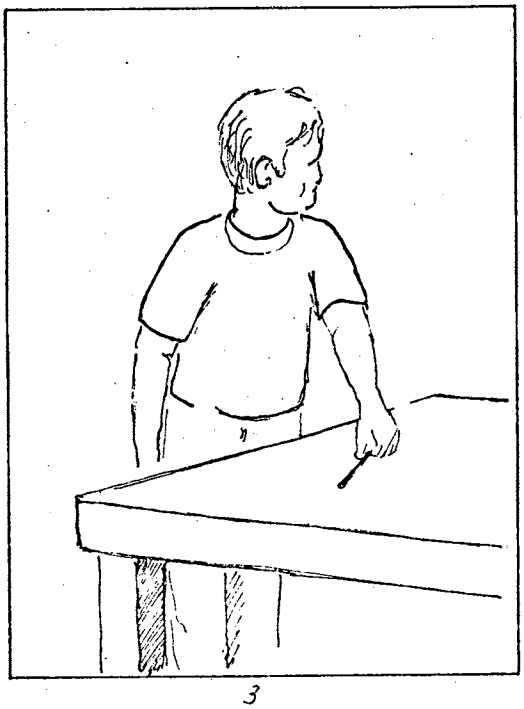

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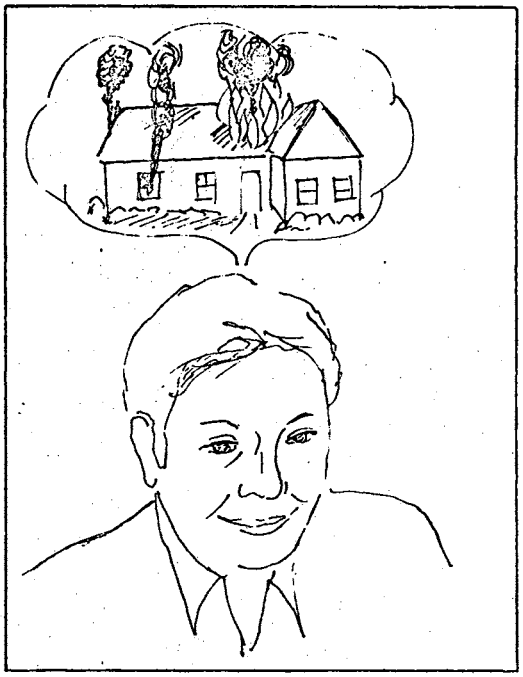

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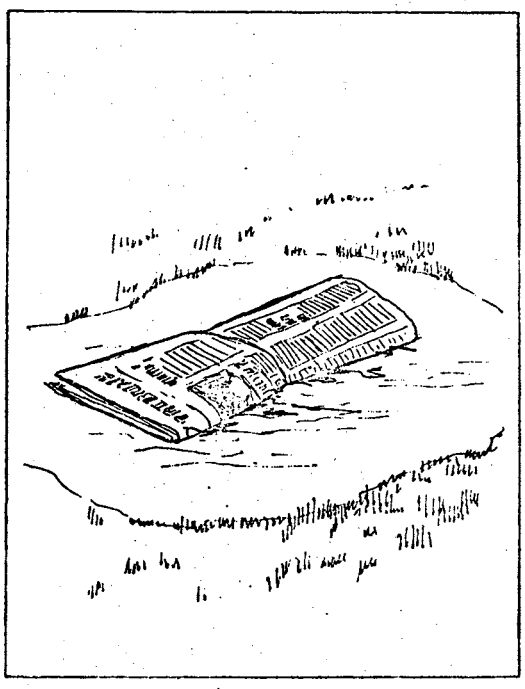

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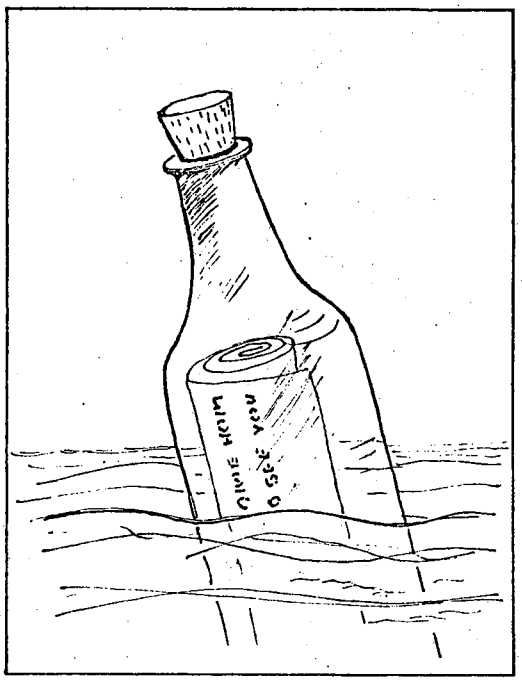
I-4



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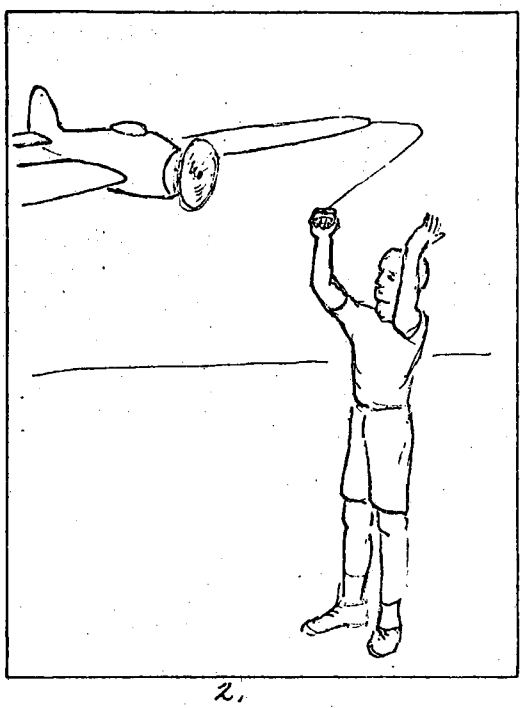

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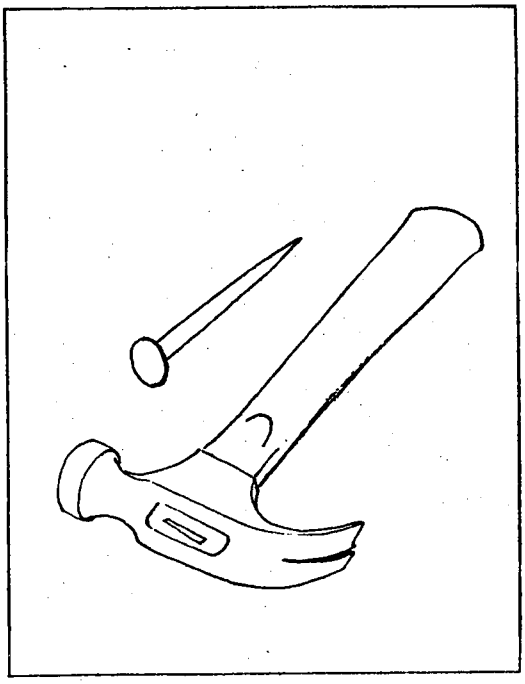

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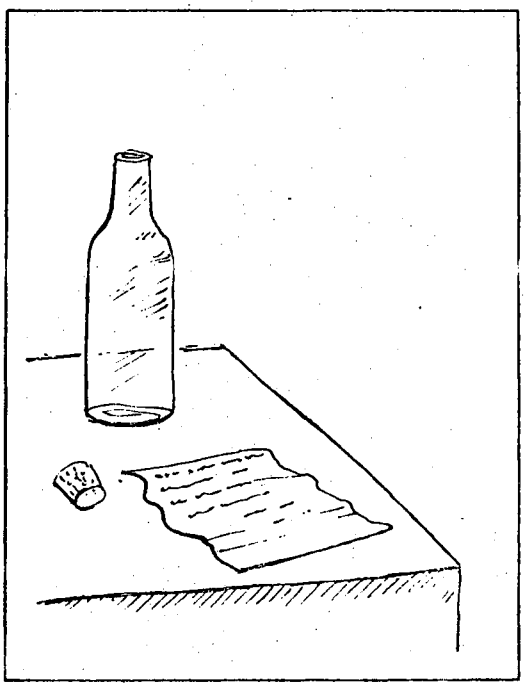

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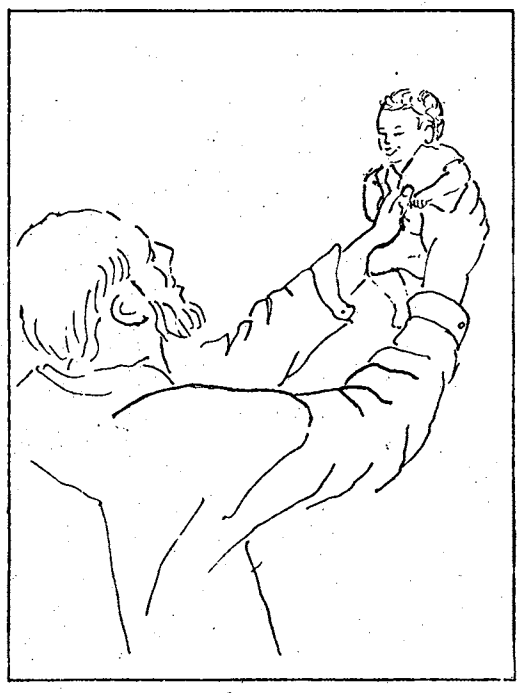

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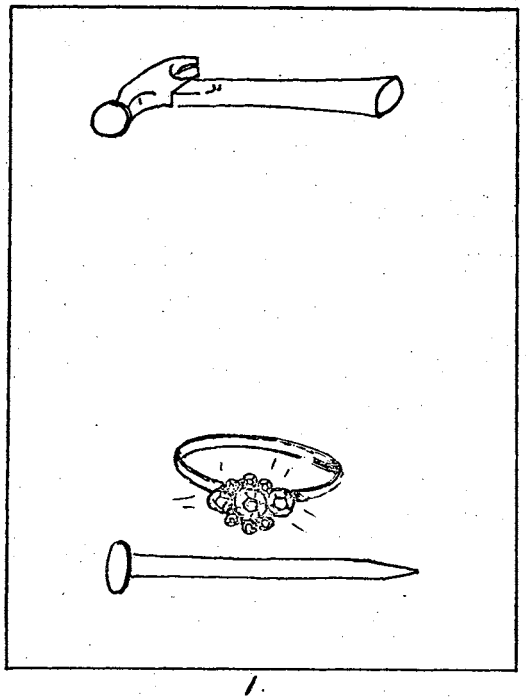

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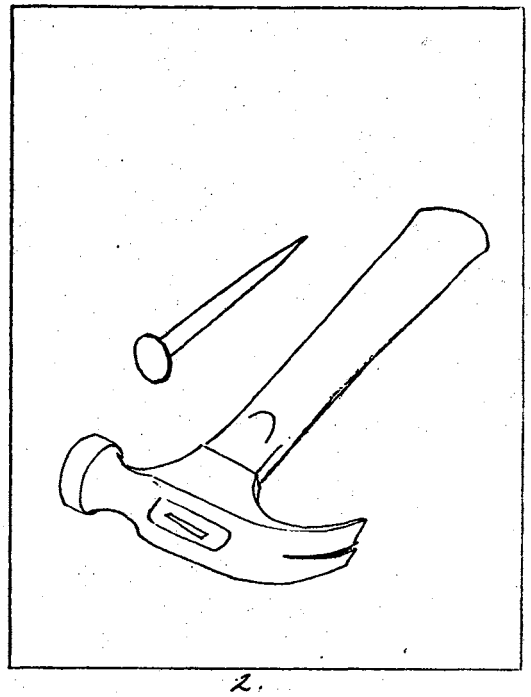

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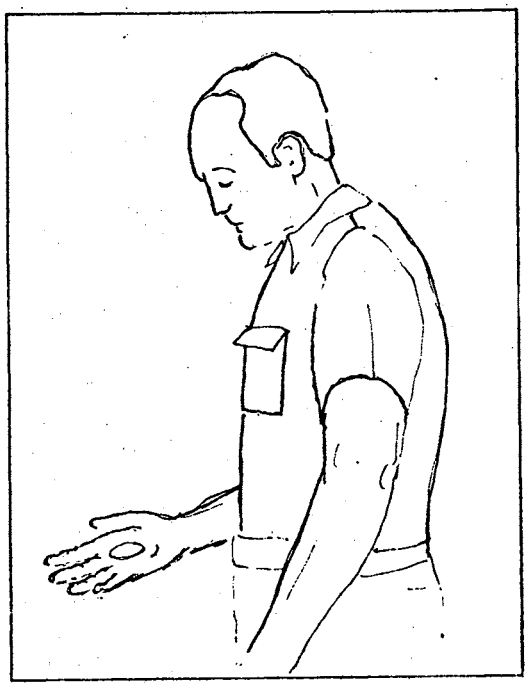

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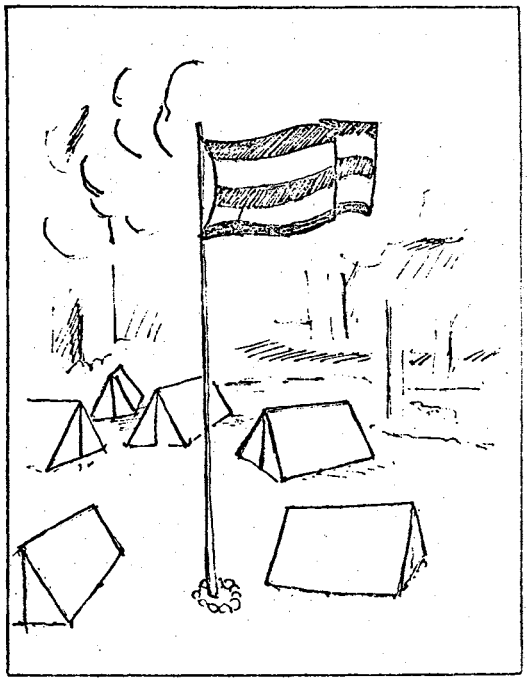

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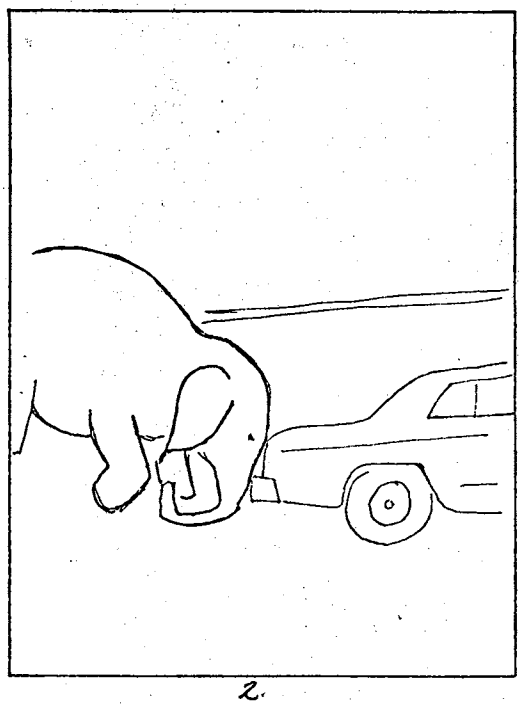

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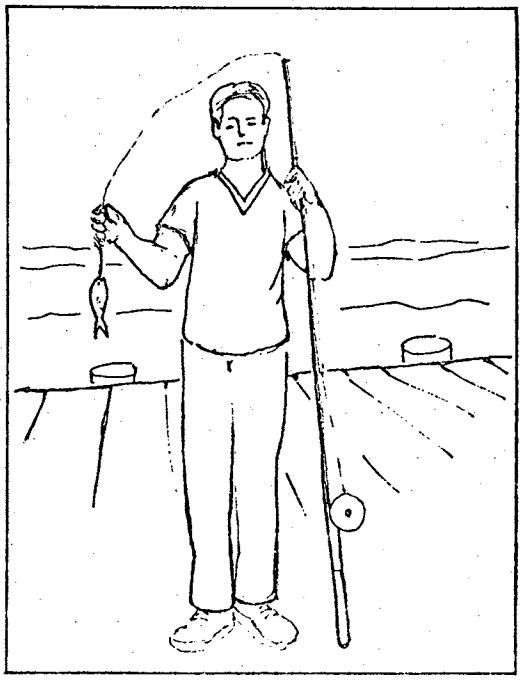

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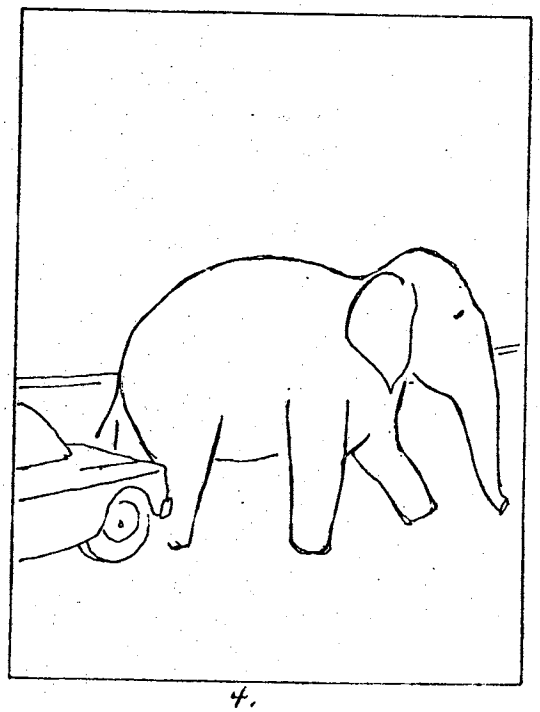

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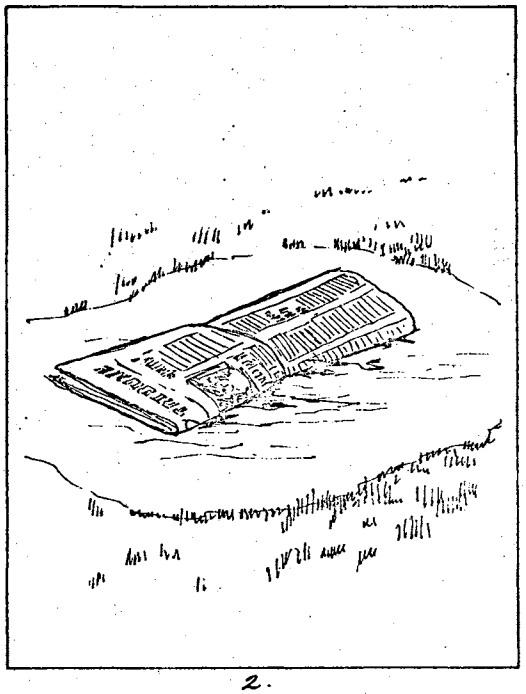

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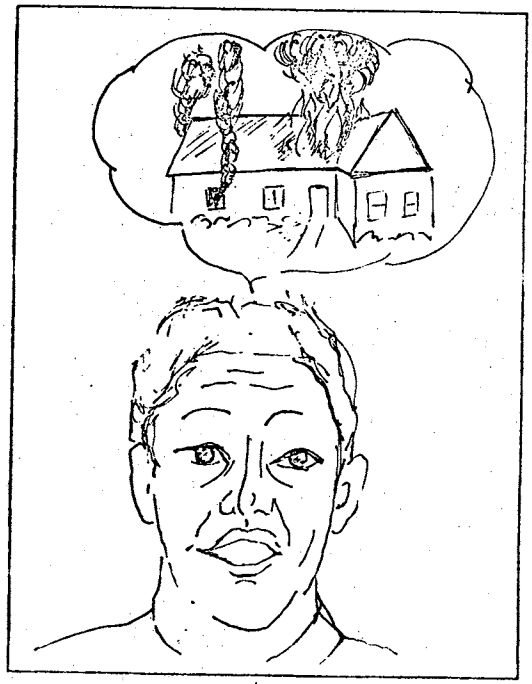

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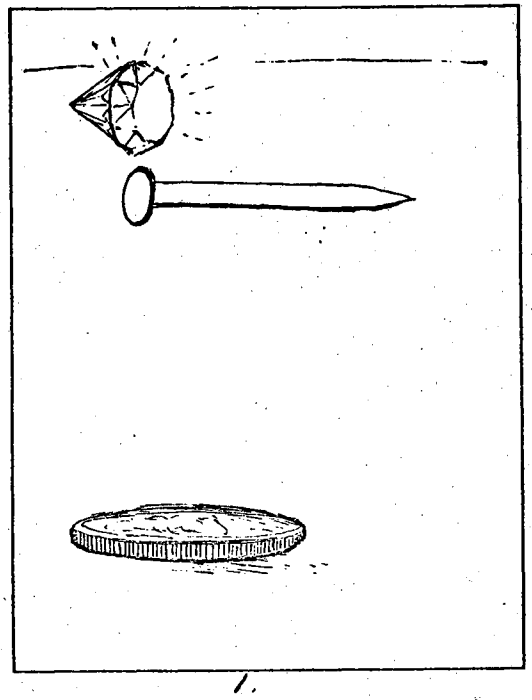

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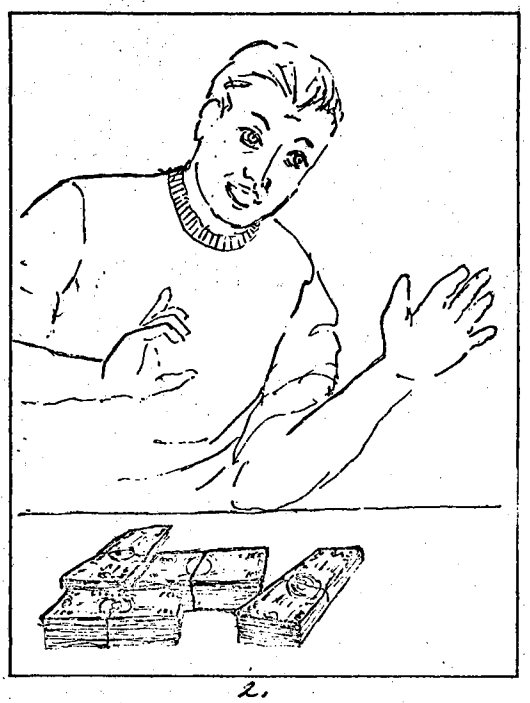

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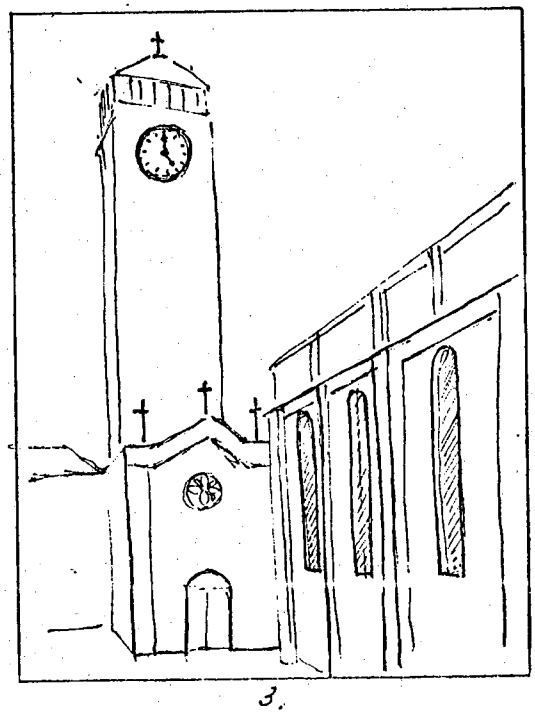

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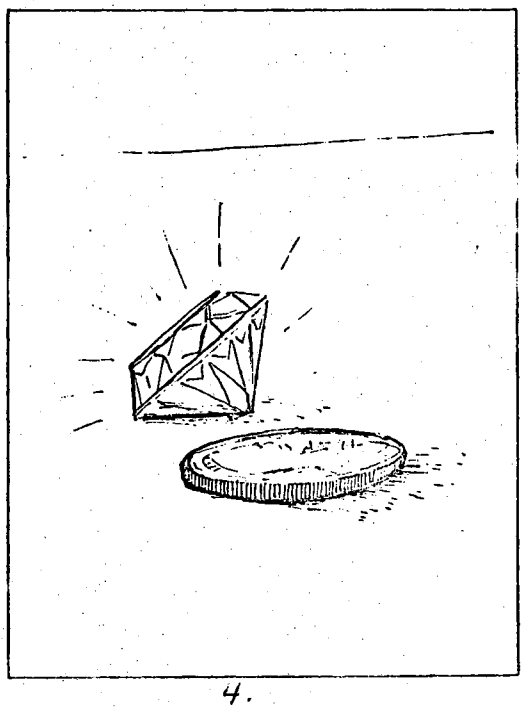

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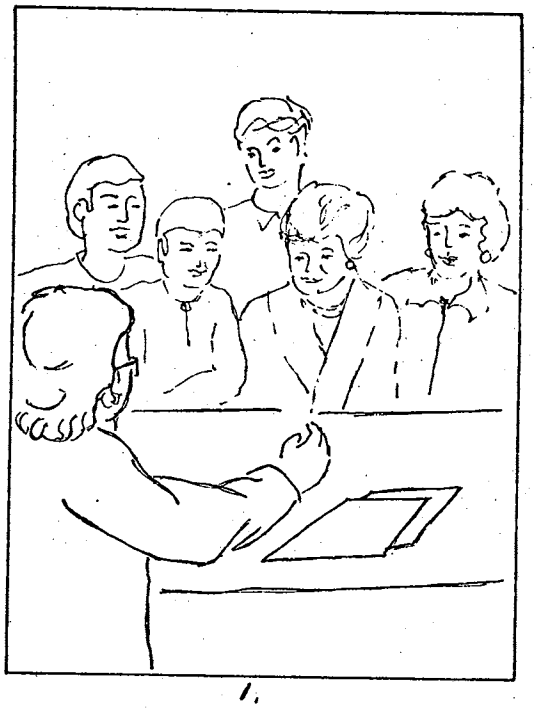

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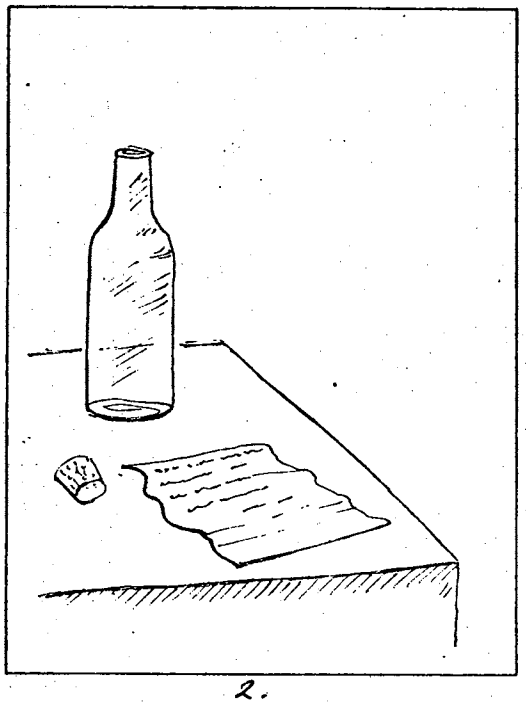

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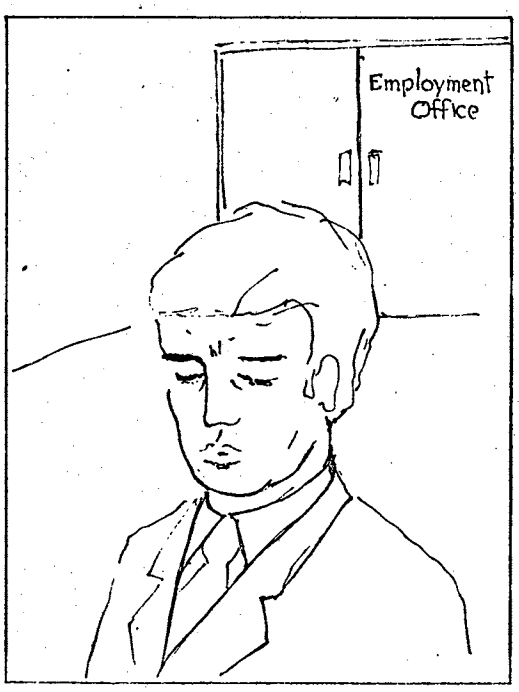

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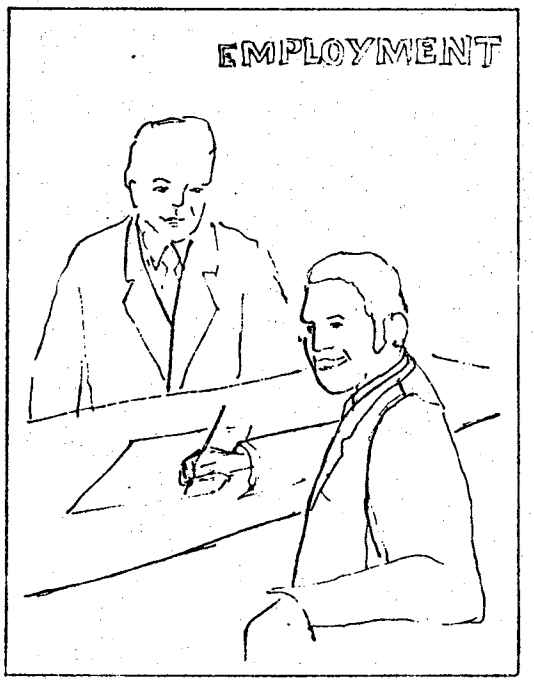

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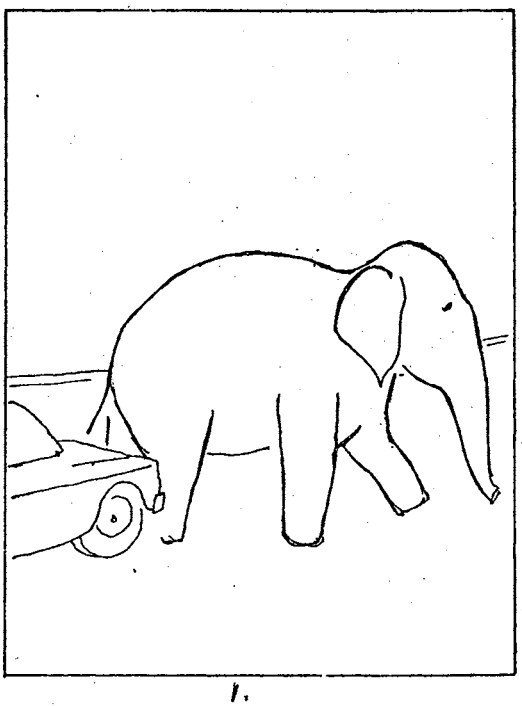

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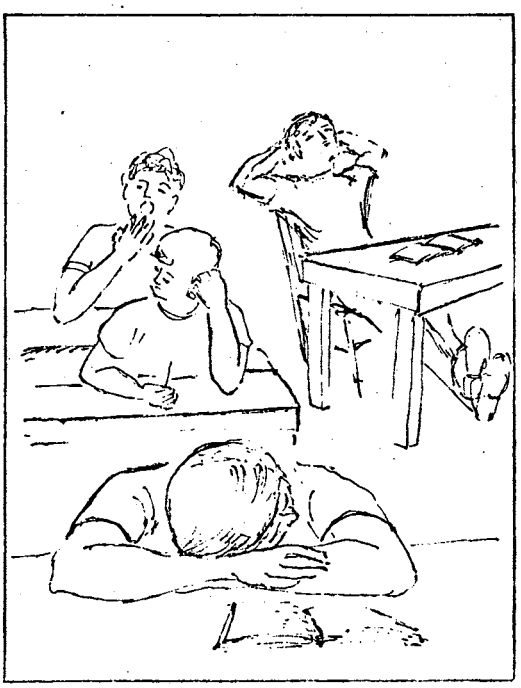

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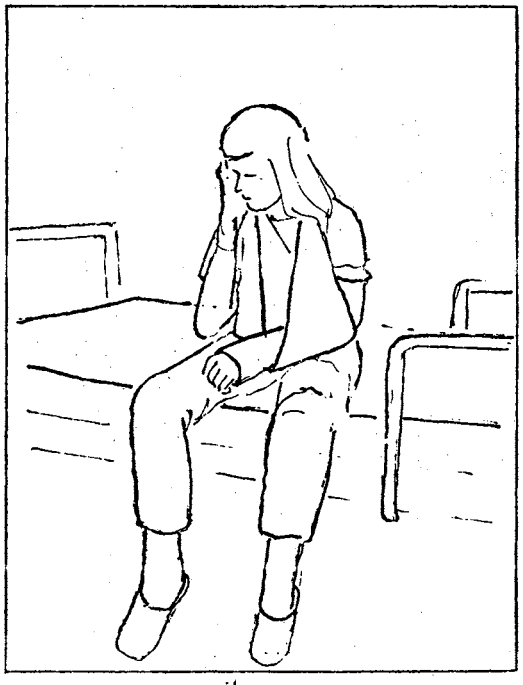

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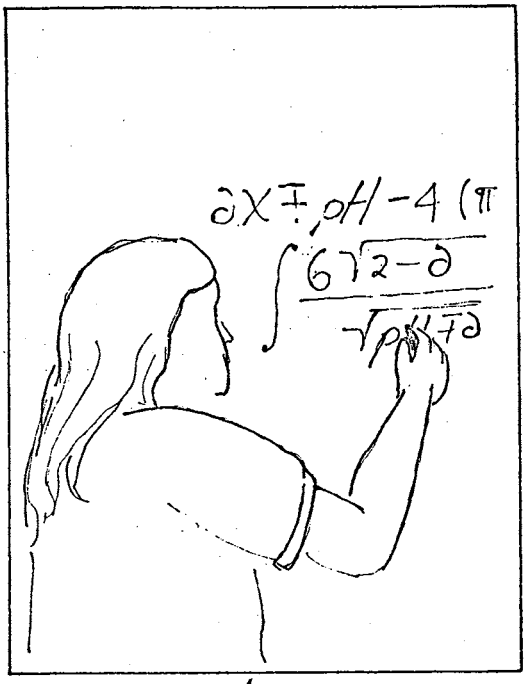

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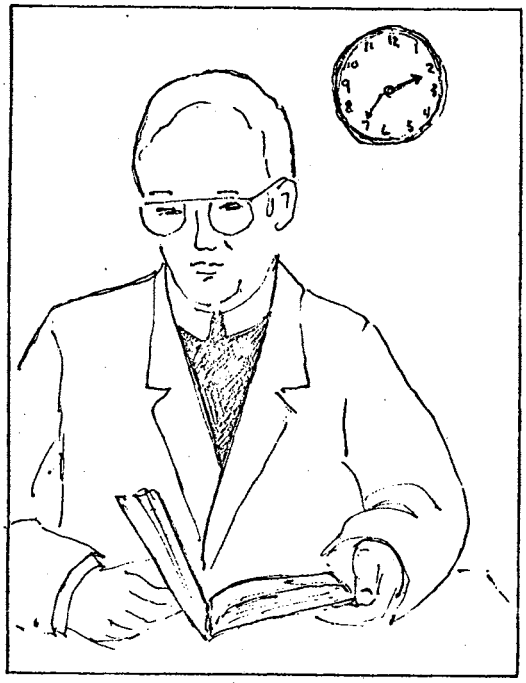

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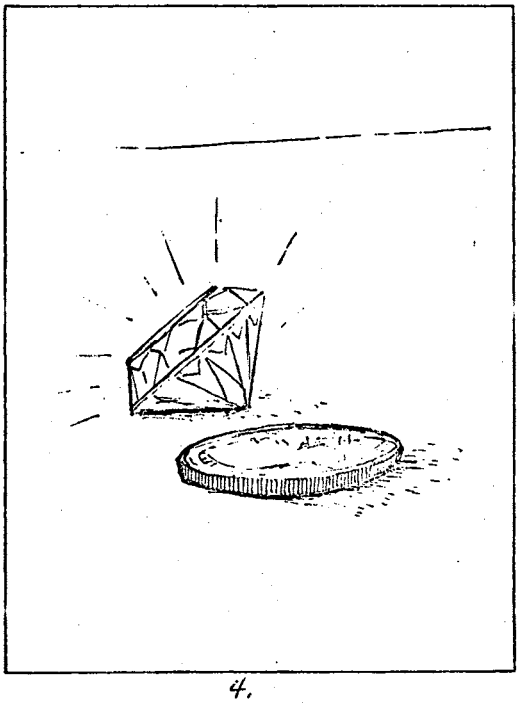

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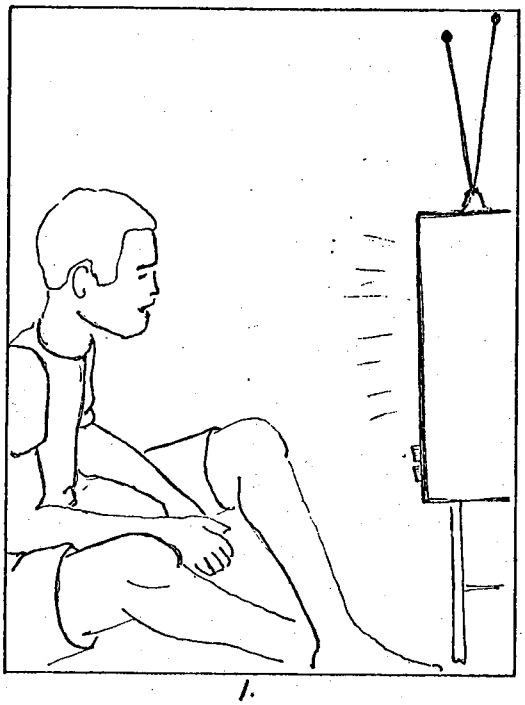

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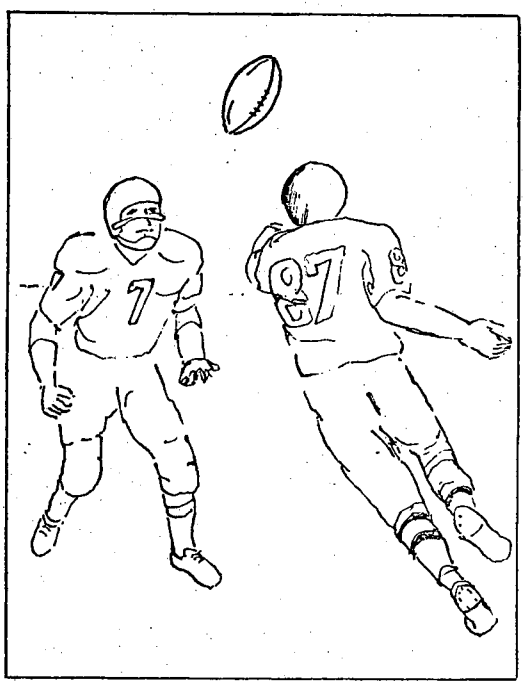

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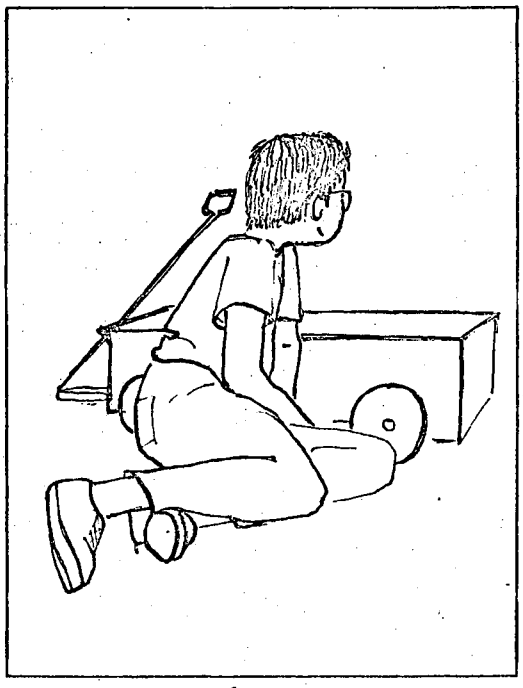

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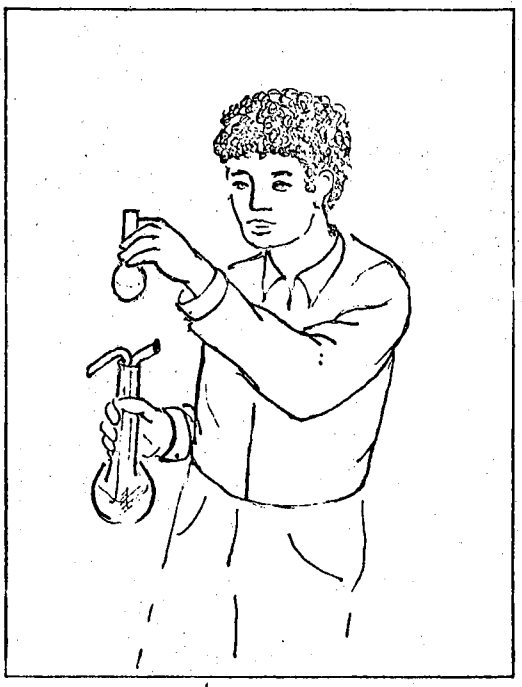

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III-4

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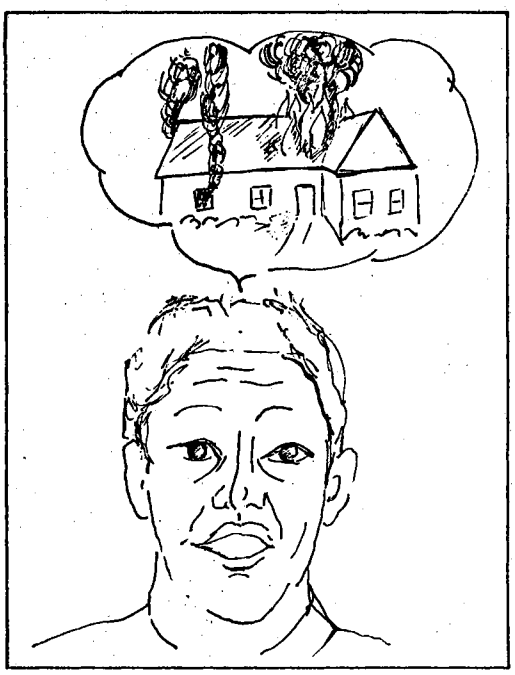

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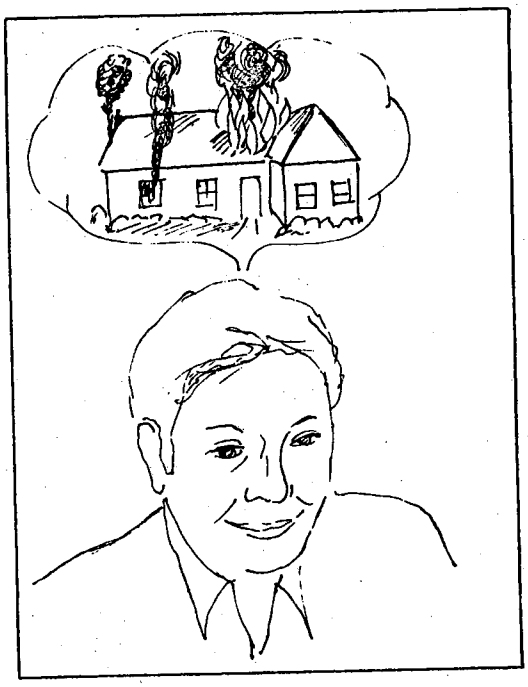

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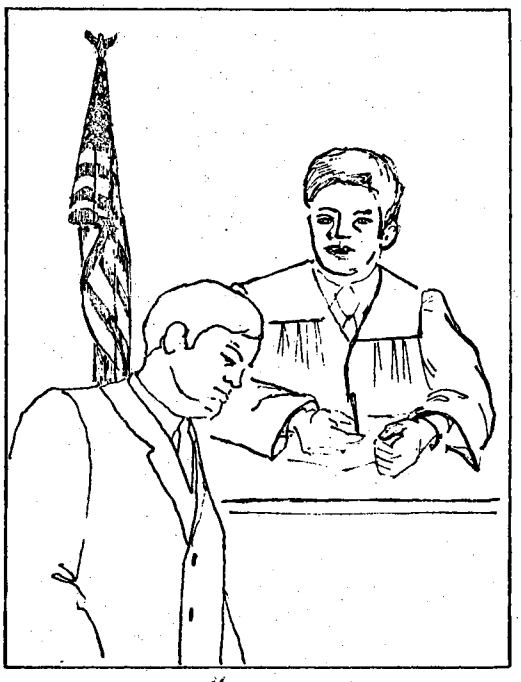

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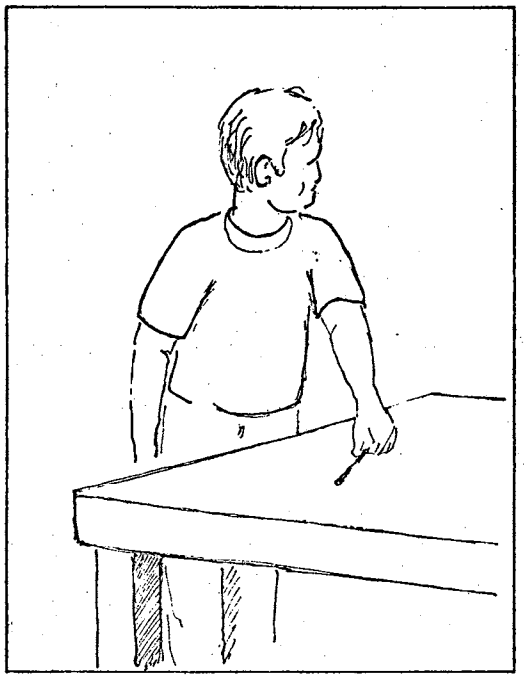

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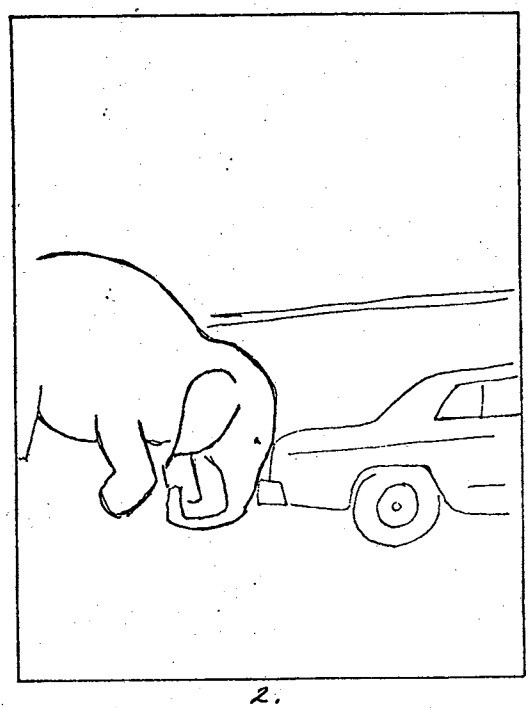

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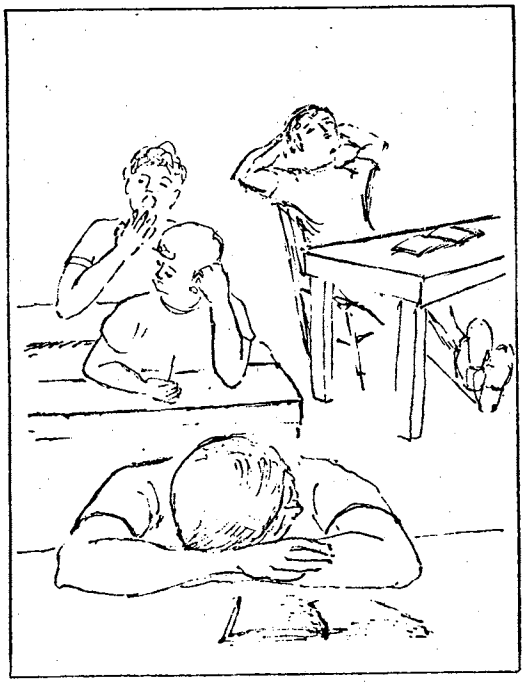

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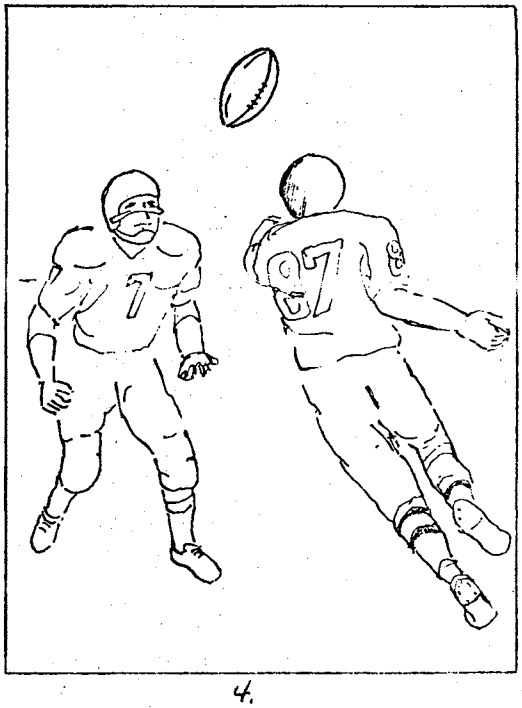

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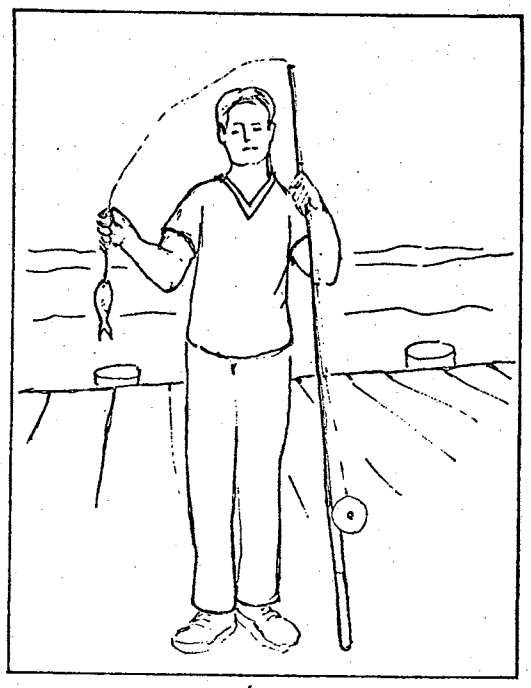
IV-1



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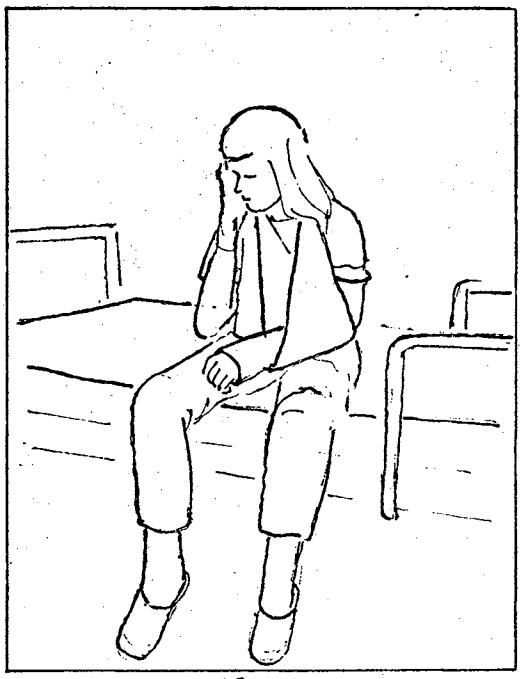

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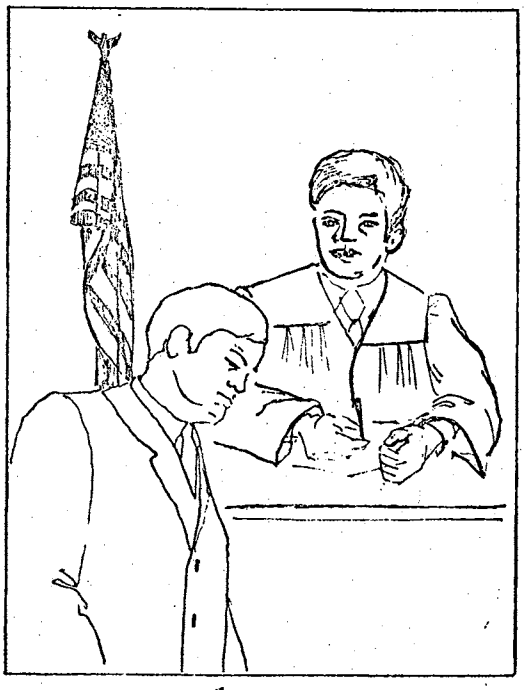

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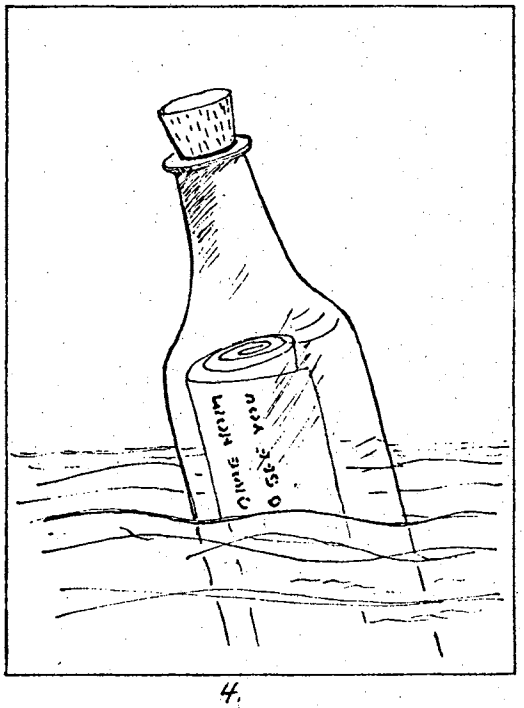

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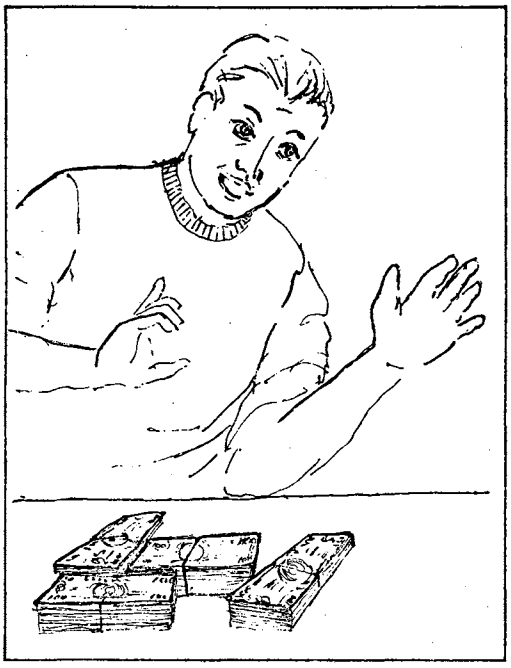

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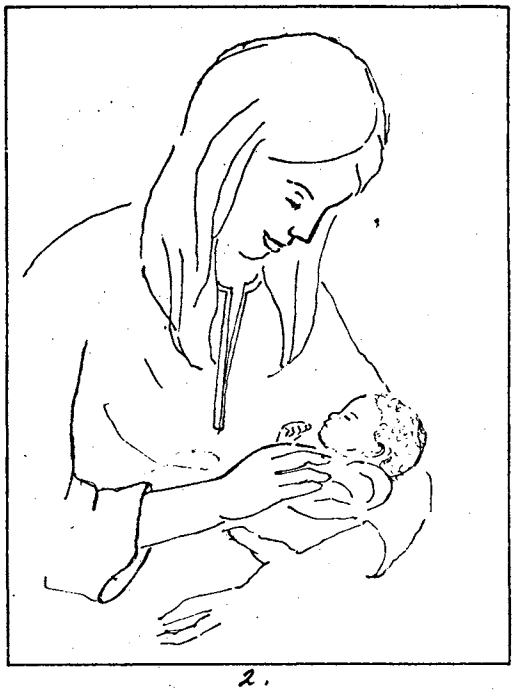

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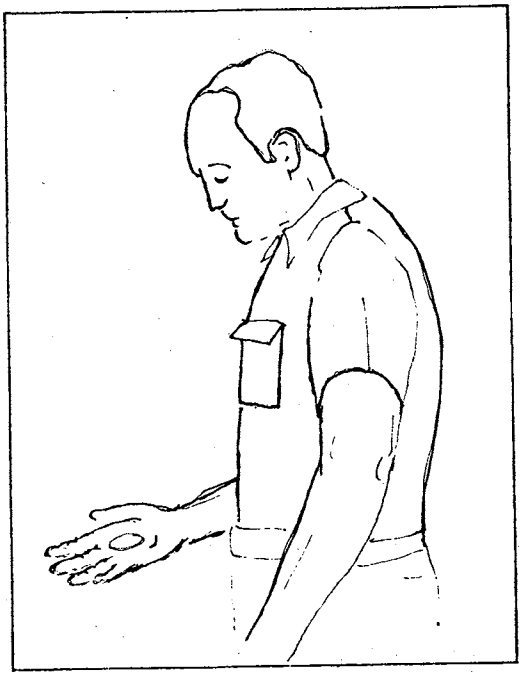

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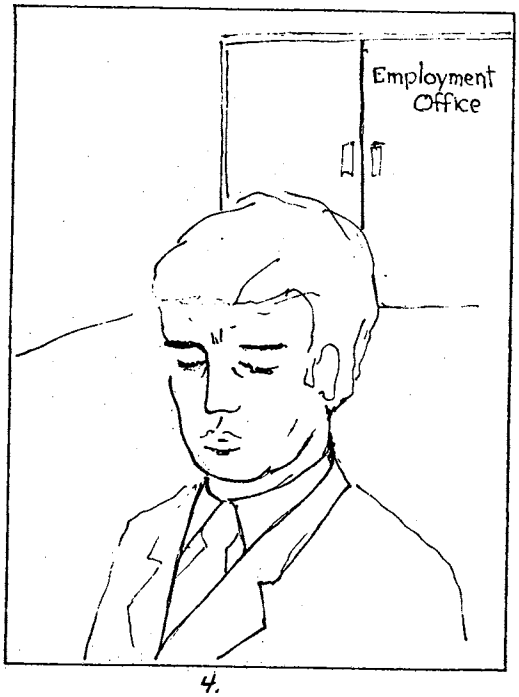

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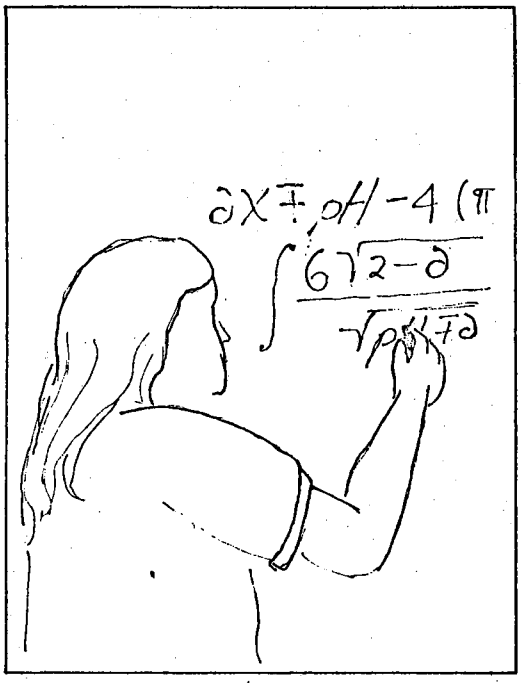

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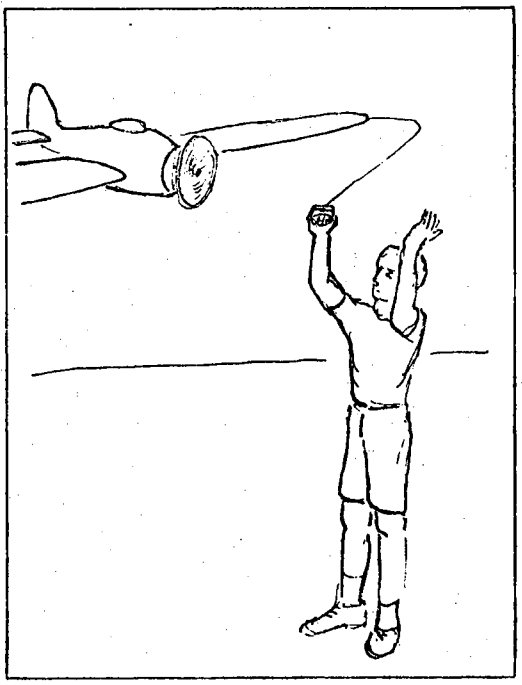

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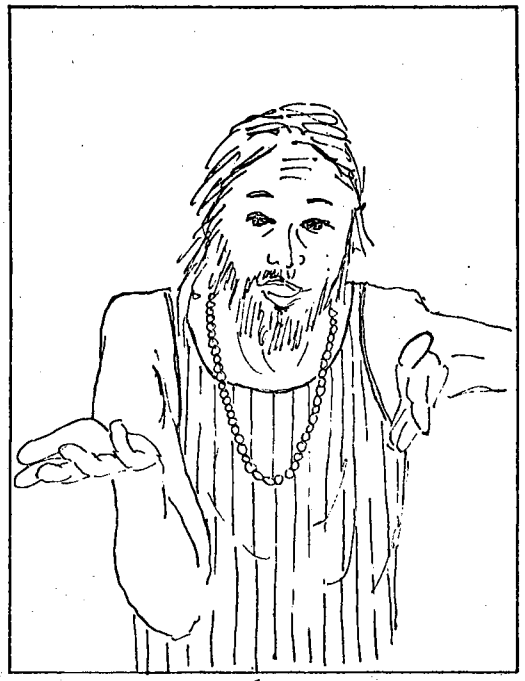

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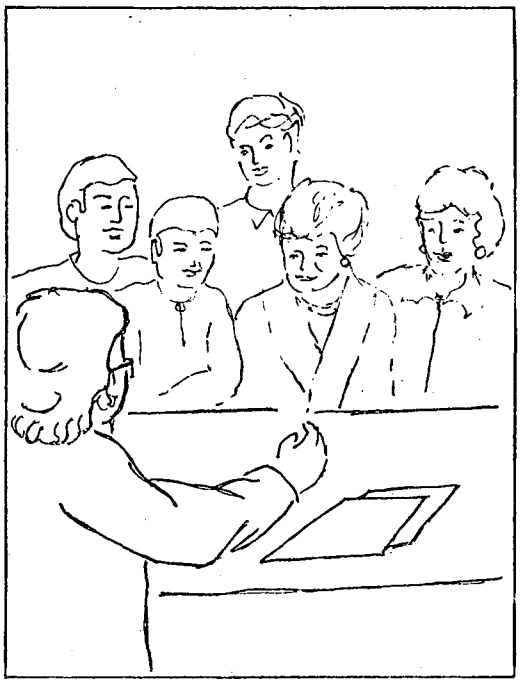

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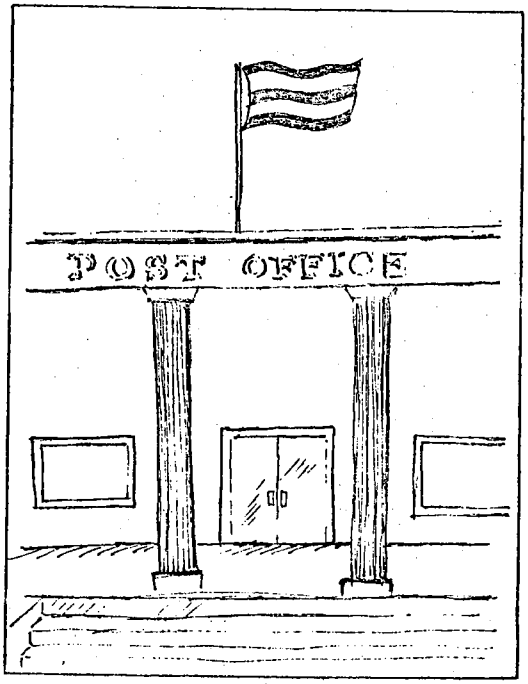

4.

VITA

Diane Hamill Burke

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTS OF IMAGERY AND SYNTAX ON ORAL LANGUAGE COMPREHENSION AND PAIRED-ASSOCIATE RECALL

Major Field: Educational Psychology

Biographical:

Personal Data: Born in Okmulgee, Oklahoma, January 7, 1933, the daughter of Rudolph A. and Mildred D. Hamill

Education: Graduated from Holy Family High School, Tulsa, Oklahoma in May, 1950; received Bachelor of Science degree in Education from the University of Tulsa in 1966; received Master of Teaching Arts degree in Special Education from the University of Tulsa in 1969; enrolled in doctoral program at Oklahoma State University in 1972; completed requirements for Doctor of Education degree at Oklahoma State University in July, 1974.

Professional Experience: Teacher of the Mentally Handicapped, Tulsa, Oklahoma, 1966-1968; Teacher of Children with Learning Disabilities, Tulsa, Oklahoma, 1968-1970; Director of Special Education Instructional Materials Center, Tulsa, Oklahoma, 1970-1973; Intern School Psychologist, Parkwood Clinic, Tulsa, Oklahoma, 1973-1974.