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ABSTRACT

A study was conducted (1) to examine the development of comprehension and production in written language of two aspects of linguistic knowledge, knowledge of ambiguity and paraphrase; and (2) to examine the influences of reading ability as measured by currently used standardized reading tests and of sex on the development of this knowledge of ambiguity and paraphrase. Sixty-two fourth grade students were given eight sentences containing ambiguity and asked to provide two or more interpretations of each sentence. A second study was carried out with 24 good and poor readers from fourth, seventh, and tenth grades, and 16 good and poor adult readers. Results of the two studies showed that poorer readers made more than twice the number of errors than did better readers in each domain of the task--syntax, morphology, semantics, and transcription. The findings also revealed that in the sentence task, the order of difficulty of the varying metalinguistic tasks was the same across modes of processing, but that there were sharper differences between good and poor fourth grade readers and in good and poor adult readers in certain tasks. (HOD)

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FINAL REPORT

Detection of Ambiguity and Production of Paraphrase in Written Language

National Institute of Education

Grant # NIE G-78-0176

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Review of the Literature

I. Introduction

Recent research in reading has begun to explicate the complex relation between oral language development and processing and written language acquisition and processing. The relation between morpho-phonological awareness and reading has been established in a number of studies (Liberman, 1980). The ability to map letter sequences into sound sequences at the morpheme level (the decoding process) is considered to be the important step in beginning reading. A summary review of this literature includes findings about the importance of awareness of the word in print and speech and awareness of word-segmentation skills to beginning reading facility (Calfee, Venezky, and Chapman (1969), Calfee, Lindamood and Lindamood (1969), Fhri (1975), Holden and MacGinitie (1972), Liberman et al (1977), Liberman (1980), Massaro (1973), Sulzby (1979, 1980, 1980), Venezky (1970, 1979). What has not been generally discussed is the relation between structural-relational (semantic-syntactic) linguistic knowledge and reading development. If it is the case that the reading process requires bringing to conscious awareness the categories and relations in language (metalinguistic abilities), then structural-relational knowledge must also play a role in reading development. Indeed, this latter type of knowledge may be a prerequisite to morpho-phonological awareness and may, in some instances, compensate for morpho-phonological mapping difficulties. The over-all purpose of the research conducted in this project was to examine the relation between metalinguistic structural-relational knowledge and reading/writing abilities of fourth grade students, from 9 to 11 years of age.

II. Significance of the Project

It has been suggested by a number of researchers that metalinguistic awareness of categories and relations is critical to successful reading. Mattingly (1972) states that bringing phonological categories and relations to conscious awareness was crucial to the initial stages of reading acquisition. Others have suggested that a general knowledge of linguistic structures is necessary for successful reading (Gibson and Levin, 1975; Goodman, 1973; Marshall and Glock, 1977; Oppenheim, 1981). Several studies have reported positive correlations between general oral language skills and reading achievement (Bougere, 1969; Dixon, 1979; Fea, 1953; Martin, 1955; Ruddell, 1965 , Strickland, 1962; Weintraub, 1968). These low positive correlations become highly significant with language disordered (Jansky and deHirsh, 1972) and dyslexic (Vogel, 1975) populations.

Although a number of researchers have, for a long time, suggested that oral language knowledge in general and metalinguistic abilities in particular are crucial to the reading acquisition process, the relations between these processes have not been clearly defined. That is, we do not know what aspects of metalinguistic awareness, in which forms, during which age periods are crucial to the process. It is also not clear what relations exist between writing and reading processes, although, logically some kinds of relations should exist among all these processes.

This research was an attempt to explicate some of these proposed relations by examining the development of metalinguistic awareness in oral language processing and reading and in writing in the same populations and using the same types of linguistic materials across the three modes of processing. The crucial question is one of development. It can be assumed that all three processes change in time. What is not known is how the interactions among these processes change in time and how patterns of interactions

may vary in different populations of readers; good, poor and deficited. As shall be seen in the brief review below, we have a comparatively rich body of knowledge on the development of oral language metalinguistic awareness, a very meager body of knowledge on the relation of this development to reading development and little on the relation of these developments to the development of writing.

The Development of Metalinguistic Awareness in Oral Language

The linguistic competence of adults has been described as the ability to make judgments about utterances; whether or not they are paraphrases of each other, are ambiguous, anomalous or nongrammatical on the basis of the structure of the utterances, the contexts in which they are produced or both (Fromkin and Rodman, 1979). Some examples of these intuitions are the following:

John loves Mary. Mary is loved by John. (paraphrase)
The turkey is ready to eat. (ambiguous)
The apple ate the boy. (anomalous)
Billed called up here. (nongrammatical)

Such metalinguistic abilities are evident during the early periods of language development; although they do not take the form of talking about language structures. Rather, one observes overt practice with language structures in imitations, monologues and invented words (Menyuk, 1976). These abilities are shown in all linguistic domains; i.e., phonology, syntax, semantics and pragmatics. However, metalinguistic knowledge continues to mature into middle childhood and adulthood. Developmental studies indicate that the ability to make the above-listed judgments develops in time, that a linguistic knowledge matures, that some types of intuitions develop before others, and that the contexts in which these intuitions can be formed also change with maturation (Menyuk, 1977).

As an example of the first type of finding, it has been observed that at two years a sentence such as "The dog pats the mother." is acceptable but becomes unacceptable at three years as linguistic knowledge of the constraints of the language increase (Bever, 1970). As an example of the second finding, it has been observed that children can more easily determine that a sentence is anomalous than they can determine that a sentence is nongrammatical (Menyuk, 1963), and they can more easily determine paraphrase than they can ambiguity (Flood and Menyuk, 1979). Thus it appears that the order of development of intuitions about linguistic structures is: anomaly, nongrammaticality, paraphrase and ambiguity. However, these findings concerning the order in which types of intuitions develop does not provide a complete picture of the development of linguistic intuitions or metalinguistic knowledge. It is also the case that within each category of intuition developmental changes occur. For example, anomaly can be detected early in utterances which violate the expected subject-object relations but only much later in sentences which violate the dependent relations between two propositions (for example, "She is pretty but nice."). Nongrammaticality can be detected early in utterances which violate the rule of adjective clustering ("gray old mare") (Menyuk, 1971). However, both with anomaly and nongrammaticality, the range of contexts in which these deviations can be detected, during what age periods has not been examined. The developmental trends with paraphrase and ambiguity are clearer. The domains in which para-

phrase can be generated (Hoar, 1977) and ambiguity detected (Schultz and Pilon, 1973) in oral language also change in time, and have been delineated. Finally, what may be the case but has not been experimentally tested, is that intuitions about isolated utterances are more easily formed than intuitions about utterances embedded in passages. There are, therefore, several questions about metalinguistic knowledge in oral language processing which need to be resolved. However, it is clear that developmental changes in this knowledge occur well into the middle childhood years.

Relations between Metalinguistic Awareness and Reading

There are three ways that the relation between oral language processing and development and written language processing has been viewed. These are: 1) that written language processing is dependent on oral language development or 2) that both types of processing and development are dependent on the same super-ordinate cognitive abilities or 3) that processing of written material is initially dependent on oral language knowledge and then becomes independent in developmental stages that reflect changes in the level of acquisition of oral language knowledge. It has been argued that this last position is the most explanatory (Menyuk, 1980). The gist of the argument is that, at least at the beginning of the reading process, what is required is transformation of written material into oral language categories and relations. As structural oral language knowledge is established, this process becomes automatic or so rapid that it appears to be automatic. Such a possibility of automatic processing has also been suggested by LaBerge and Samuels (1974). Then, "Gradually this intermediate link, spoken language, disappears and written language is converted into a system of signs that directly symbolize the entities and relations between them." (Vygotsky, 1978, p. 106).

The above view is supported by some research findings (Ryan, 1979) that level of knowledge of particular linguistic structures affects the ease with which these structures are read. Bowey (1980) found that sentences containing structures that are known to be early acquisitions were read more quickly and with fewer errors by 3rd, 4th, and 5th grade children than were sentences containing structures that are known to be later acquisitions. Variations in the structural complexity of well-learned structures did not affect oral reading performance to a significant extent whereas the relative complexity of less well-learned structures had a marked effect. Goldsmith (1977) found near perfect performance by 9 to 11 year-old children in listening and reading simple types of relative clauses (an early acquisition), whereas they experienced difficulty in understanding and reading more complex types of such clauses (a late acquisition). As was noted previously, oral language knowledge is a much better predictor of beginning reading performance in populations with language disorders than in populations without such deficits. One might assume that in the latter populations some level of automaticity of processing has been achieved with the structures they are required to read whereas the children with language disorders are probably in the process of acquiring these structures. Flood and Menyuk (1979) found a significant correlation between level of reading and success in metalinguistic processing. More importantly, they found that good readers had developed more sophisticated metalinguistic processes than average readers.

These findings, taken together, seem to indicate that children have great difficulty in reading sentences which contain structures they have not

acquired, some difficulty in reading sentences containing structures they are in the process of acquiring and read automatically those structures that are well-learned. This hypothesis has not been directly tested by an examination of level of oral language knowledge of structures by individuals and their their reading of these structures in either sentences or passages.

Relations between Metalinguistic Awareness and Writing

Much current research on writing has focussed on the writing process. Scardamalia, Bereiter and other OISE researchers, for example, have studied the writing development of elementary school students, examining the cognitive and communicative demands made on early writers (Scardamalia, 1981; Bereiter, 1980; Bereiter and Scardamalia, in press; Bracewell, 1980; Hidi and Hilyard, 1980). Flowers and Hayes, using protocol analysis of college and professional writers, have explored writing as a problem-solving activity, with writers having to access and control their meanings through specific plans and strategies (Flowers and Hayes, 1977 and 1979). Graves and his colleagues at the University of New Hampshire have observed and recorded in great detail what elementary school children readily do as they begin to write and revise, (Graves, 1975 and 1979; Calkins, 1980; Sowers, 1979).

This research into the writing process, as well as other recent research (see Perl, 1979; Stallard, 1974; Britten et al, 1975), has revealed the complexity of the composing process. Writing is no longer seen as an isomorphic, linear, sequential act proceeding through discrete stages of prewriting, writing and revising. Instead, writing is beginning to be recognized as a recursive, often idiosyncratic process which draws on a writer's full communicative, cognitive and linguistic competence. The current research further suggests that because writing an informative and cohesive text is such a complex task, writers-- as they develop and become more proficient-- have to learn how to control their substantive, rhetorical and linguistic knolwedge, that is, they learn to use their metacognitive and metalinguistic awareness. In sum, current research into writing, and the models generated from this research, have begun to name the components of composing, indicating the cognitive and linguistic processes subsumed within writing, and suggesting how a writer moves from fuzzy thought to correct prose, from idea to text.

Most of the current research, however, has focussed on the ideational and rhetorical components of the process, on the constructive side of the composing process: how meaning is composed and revised relative to constraints of audience, information, rhetorical mode and syntax. Very little research has been done at the other end of the composing process: how a writer learns, accesses and applies his knowledge of written English while composing and revising; how knowledge of standard written English develops and is used in writing. There has been little examination of how a writer's attention can turn from faithfully mapping and transcribing his thoughts onto paper to higher level concerns such as substance, rhetoric, text cohesion, audience and style.

As many researchers have pointed out, writing can be seen as a formal operation wherein a writer has to manipulate words in the absence of an immediate context; the act of writing is conscious symbol manipulation

which must be learned at school: the spoken word must be turned into letters; these letters will represent sound and meaning of a word; and these words must be conjoined in sentences to be understood by a reader, (Vygotsky, 1962; Olsen, 1977; Bereiter and Scardamalia, in press). Meaning must be exchanged in silence, and this process is far different from the noise, gesture and insistence of speaking. Moreover, the process can misfire at several junctures-- retrieving, composing, mapping, revising, or transcribing words. Therefore, if a researcher is interested primarily in the mapping and transcribing of meaning and not in retrieving, composing or revising, the researcher must provide the content to be written so that the writer's attention is not focussed on retrieving, composing or revising information. Because the content has been supplied, the writer can attend to form, as in a typing task wherein a typist seeks the replication of the meaning through replication of the form-- the words, spelling and punctuation. By providing the information to be written, the researcher can investigate the metalinguistic skills of mapping and transcribing sentences, (See Bracewell, 1980, for an example of research that focuses on form).

PURPOSE OF RESEARCH

The first purpose of the current research was to examine the development of comprehension and production in written language of two aspects of linguistic knowledge-- knowledge of ambiguity and paraphrase-- which are known to develop in oral language over the middle and later childhood years and on into adulthood. As will be shown, preliminary findings indicate that there may be a substantial amount of individual variation in this process; the extent and nature of this variation warrants and needs further investigation.

Another element of this first purpose of examining written response was to characterize variations on both mechanics and expression. Mechanics is taken here to include variations in capitalization, punctuation, spelling, inflectional morphology and verb tense and aspect. The expected areas of variation in expression were syntactic (use of pronomial, passive/active, dative movement, fronting, and deletion) and lexical. In light of the current concern among educators that students are not performing up to expected writing competence levels, this examination of variation in expression and mechanics may have theoretical and educational applications. Our investigation up to this time has dealt only with the factor of expression and only with children aged nine to eleven years. In progress is an examination of the factor of mechanics in the data obtained and we are unable to report upon it at this time.

The secondary purpose of the research was to examine the influences of reading ability as measured by currently used standardized reading tests (Reading Comprehension section of the Stanford Achievement Test) and sex on the development of this knowledge of ambiguity and paraphrase. Gibson and Levin (1975) maintain that "the recognition of a paraphrase seems, intuitively, to be the essence of comprehension..." In fact, able readers are able to paraphrase-- to remember the gist of what they read regardless of the production task constraints, whether the task is free recall (Gomulicki, 1965; Fillenbaum, 1966; Drum, 1974; Kintsch, 1974) or recognition of isolated components abstracted from the text (Bransford, Barclay, and Franks, 1972). Memory for prose is not necessarily a verbatim rendition or an iconic representation. Rather, it is the selection and rearrangement of elements of the text into a reasonable, efficient paraphrase.

PREPARATION OF SENTENCES AND PASSAGES

A list of sentences and passages containing the target structures was constructed for this phase of our research. Eight sentences contained ambiguity and students were asked to provide two or more interpretations of each sentence. Eight other sentences required one of four types of paraphrase only (lexical, fronting, dative movement, active/passive).

STUDY 1

Four passages at each age level containing ambiguities were constructed. Each passage contained a different type of ambiguity (lexical, pronominal, sentence phrasing, deep structure). Passages for each age group were commensurate with assumed level of language abilities, i.e., length and complexity of structures and subject matter interests. Examples of these stimulus items are presented below:

AMBIGUITIES

1. Nan is standing by the teacher talking to the little boy.
2. The coach asked me how many times Jack beat Stuart.
3. John played with the dog while he was eating.
4. Mary wanted to work with Sue, but I chose her.
5. Thomas walked home, his bookbag held over his shoulder and rubbing his elbow.
6. Do you want a tiger to chase you or a lion?
7. Bob's speech made the teacher angry.
8. The fat farmer's wife cooks all day long.

PARAPHRASE SENTENCES

1. The big boy sat in the baby's chair and broke it.
2. His mother was waiting when he arrived home.
3. The money for the trip was raised by the fourth grade class.
4. The teacher sent the report card to his parents.
5. John sent every girl a valentine.
6. The black and white puppy was bought by Jimmy's older sister.
7. After school, Joanne stopped at the store.
8. The teacher told us to stop talking.

Passages

Bill was angry at John. He took his baseball bat. Sally ran to tell the principal. The principal promised to do something about it right away.

Mary, Peter and Joe became friends last summer They saw each other every day at camp. Mary likes Peter better than Joe. Camp won't be the same next year.

Everyone knows Farmer Brown is clumsy. Yesterday, he hurt his calf while he was mending the fence around the cow pasture. The day before, a goose bit his hand at feeding time.

Coming down the stairs, I saw the young boy fall. They took him to the nurse's office to bandage his leg. I hope he'll be better tomorrow.

PROCEDURES

TASKS AT THE SENTENCE LEVEL

We have looked at the skills of paraphrase by examining each student's ability to detect ambiguity and to generate unambiguous paraphrase at the sentence level.

Subjects were asked to read sixteen sentences: eight contained ambiguity, and eight did not contain ambiguity. Students were asked to generate the two (or more) underlying sentences for ambiguity and, in this way, were required to generate paraphrase at the sentence level. With unambiguous sentences, they were asked to rephrase the sentence but keep the meaning the same. This procedure also allows for the possibility of detecting ambiguity in what we might consider non-ambiguous sentences, but, in any case, requires paraphrasing.

SUBJECTS

Subjects were sixty-two native English-speaking fourth grade students, ages nine to eleven, selected from public schools in a lower to middle-income suburb of Boston. Stanford Reading Achievement scores for the children ranged from a low of 42nd percentile ranking to a high of 99th percentile; one quarter (¼) of the sample fell between the 42nd and 62nd percentile; one quarter (¼) fell between the 79th and 99th percentile; and one half (½) of our sample fell between these points.

Students with known reading/writing pathology were not included in the sample.

READING RESULTS

PARAPHRASE

We have chosen here to illustrate response to four representative paraphrase items. Below are listed the items with their expected paraphrase mechanism:

The teacher told us to stop talking. (lexical substitution)
The money for the trip was raised by the fourth grade class. (de-passivization)
John sent every girl a valentine. (dative movement)
His mother was waiting when he arrived home. (re-arrangement of clauses fronting)

The resulting distribution of responses was obtained from our sixty-two fourth graders on these items:

Figure 1

Distribution of Responses for Paraphrase Sentences

	Lexical Substitution: "Stop talking"	de-passivize: "class trip"	dative: "John's Valentine"	Fronting: "Mother waiting"
Expected strategy:	16	29	6	39
Other strategy:	14 quote "stop talking"	1 dative movement	1 lexical change (i.e., gave, wrote, female, heart, card)	10 lexical change
	21 attempted to quote without appropriate punctuation	9 lexical change	28 passive	
Inaccurate paraphrase (slight change in meaning):	9 (changes implied threat or causality)	10 (omission of content items)	4 — 4	8 meaning D's 3 deletions of content items
Anomalous response:	2	12	3	3

Exemplars of the behaviors noted here are provided in Figure 2.

Figure 2

Stimuli: Paraphrase Sentences

Stimulus Sentence: The teacher told us to stop talking.
Category: Lexical

Expected Strategy
1. The teacher told us to stop yapping.
2. The teacher told us to be quiet.

Other Strategy
1. "Stop talking," said the teacher.
2. Stop talking the teacher told us.

Inaccurate Paraphrase (slight change in meaning)
1. We stopped talking because the teacher said no.
2. The talking stopped after the teacher warned us.

Anomalous
1. "stop talking the," teacher told us.
2. "stop talking the," the teacher told us.

Stimulus Sentence: The money for the trip was raised by the fourth grade class.
Category: Passive/active

Expected Strategy
1. The fourth grade raised the money for the trip.
2. The fourth grade earned the money for the trip.

Other Strategy (Category: Lexical)
1. The money for the voyage was raised by the fourth grade.
2. The money for the trip was collected by the fourth grade.

Inaccurate Paraphrase (slight change in meaning)
1. The money was raised from the fourth grade.
2. The money for the trip came from the fourth grade.

Anomalous
1. The trip for the money was raised by the fourth grade class.
2. The money for the trip wa raised by the fourht grade stunts.
3. The money for the vacaiton was loned by the forth grade.

Stimulus Sentence: John sent every girl a valentine.
Category: Dative

Expected Strategy
1. John sent a valentine to every girl.
2. John gave valentines to every girl.

Other Strategy (Category: Lexical)
1. John sent every girl a hart (sic).
2. John wrote every girl a valentine.

Other Strategy (Category: Passive)
1. Every girl got a valentine from John.

Inaccurate Paraphrase (slight change in meaning)
1. Every girl had a valentine from John.
2. Johns mother told John to send a valentine card to every girl in the class.

Anomalous Response
1. A girl got a valentine by John.
2. "every girl got a valentine" from John (sic).

Stimulus Sentence: His mother was waiting when he arrived home.
Category: Fronting

Expected Strategy
1. When he arrived home his mother was waiting.
2. When he arrived home his mother was waiting for him.

Other Strategy (Category: Lexical)
1. His mother was waiting when he got there.
2. His mother was waiting when he came home.

Inaccurate Paraphrase (slight change in meaning)
1. His mother was waiting for his father when he arrived home.
2. Jimmy's mother waited, waited and waited till Jimmy cam home (sic).

Anomalous
1. Home arrived him while his mother was waiting.
2. "when he arrived," home his mother was waiting.

As may be seen, students were most successful in paraphrasing sentences with optionally positioned phrases, and least successful in forming the dative. Because the dative may also be successfully passivized, and these children were quite successful on passive sentences, it is not surprising that many of them chose this option instead of the dative. The passive, however, appears to stymie some children, as may be seen by the large number of anomalous responses. The last category, lexical substitution, engendered an unusual strategy, probably because of its verb of communication and because of the mode of the paraphrase task, i.e., writing. The most common response of students to this sentence was to attempt to punctuate it as a direct quotation. However, many children did attempt to change vocabulary.

AMBIGUITY

The following figure indicates the rough distribution of responses to four representative ambiguous sentences by sixty-two fourth grade children. Sentences:

John played with the dog while he was eating. (ambiguous promonimal reference)

The coach asked me how many times Jack beat Stuart. (ambiguous lexical item)

Would you rather have a tiger chase you or a lion? (deep structure ambiguity)

The fat farmer's wife cooks all day long. (surface structure or bracketed ambiguity)

Figure 3

Distribution of Responses for Ambiguous Sentences

	Pronominal: John/Dog	Lexical: ...Beat Stuart	Deep Structure Tiger/Lion	Surface Structure Farmer's Wife
Totally correct (both readings)	12	11	2	1
One reading only	29	9	27	18
Paraphrase retaining ambiguity	14	31	19	27
Anomalous response	6	10	15	16

Representative responses for each of these categories are provided in Figure 4.

Figure 4

Stimuli: Ambiguous Sentences

Stimulus Sentence: The coach asked me how many times Jack beat Stuart.

Category: Lexical Ambiguity

Totally Correct Response

1. The coach asked Jack how many times he beat Stuart in a fight.
   Jack beat Stuart in the baseball game.
   How many times did Jack beat up Stuart asked the coach.
2. The coach asked how many times Jack beat Stuart in the 600.

Paraphrase Ask But Retains Ambiguity Response

1. The coach wondered how many times Jack beat Stuart.
2. The coach wanted me to answer the gustion (sic) did Jack beat Stuart.

Single Reading Response

1. The coach asked me how many times Jack won.
   The coach asked me how many times I won Stuart.
2. Coach asked me how many time Stuart beaten up by Jack (sic).
   How many times had Jack beaten up Stuart asked the coach.

Anomalous Response

1. The coach was talking to me about Jack and Stuart.
2. Beat him in racing and stuff.

Stimulus Sentence: John played with the dog while he was eating.

Category: Pronominal Ambiguity

Totally Correct Response

1. John played with the dog while the dog was eating.
   John played with the dog while John was eating.
2. John played with the eating dog.
   John was eating when he played with the dog.

Single Reading Response

1. John was playing with the dog and eating at the same time.
   As he was eating he fooled with the dog.
2. The dog didn't mind John playing with him while the dog eat.
   The dog was being play with while he was eating.

Retain Ambiguity

1. While John played with dog he was eating.
2. John was playing with the dog and he was eating.

Anomalous Response

1. John played with is (sic) dog in the backyard.
2. He pet the dog. He played catch.

Stimulus Sentence: The fat farmer's wife cooks all day long.
Category: Bracketing Ambiguity

Totally Correct Response
1. The farmer's fat wife cooks all day long.
2. The wife of the fat farmer cooks all day long.

Single Reading Response

Fat Farmer
1. The fat farmer has a wife that cooks all day long.
2. The wife of the fat farmer cooks all day long.

Fat Wife
1. The fat lady cooks all day long.
2. The chubby lady cooks all day long.

Retain Ambiguity
1. all day the Fat Farmers wife cooks (sic).
2. The Fat Farmer's wife is a all day long cooker (sic).

Anomalous Response
1. She is being cook all day.
2. cooks at the stove all day (sic).

Stimulus Sentence: Do you want a tiger to chase you or a lion?
Category: Deep Structure Ambiguity

Totally Correct Response
1. What do you want to chase you a tiger or a lion.
   Should a tiger chase a lion or you.
2. Do you want a tiger to chase you or do you want the tiger to chase the lion (sic).

Single Reading Response
1. I want the tiger to chase the lion.
   I wan't (sic) the tiger to get the lion.
2. A tiger or a lion will chase you.
   Which one will you chose (sic).
   Do you want to be chased by a tiger or a lion?

Retain Ambiguity
1. Do you want a tiger to chase you or else a lion?
2. Do you want a lion to chase you or a tiger.

Anomalous Response
1. Would you like a big striped cat to chase you or a big yellow one?
2. Do you want to be chased by the ball team.

As may be readily observed, pronominal reference was easiest for the fourth graders to disambiguate, both in terms of number of correct responses and minimal number of anomalous responses, while surface structure ambiguity was most difficult for this group on the basis of these criteria. These results are somewhat in variance with the results of Shultz & Pilon's (1973) finding that lexical and surface structure ambiguity were those first resolved by young children. It is also interesting to note that children found lexical ambiguity difficult to perceive and to resolve, i.e., they did not find it ambiguous. Werner and Kaplan (1972) found developmental changes in finding the meaning of a nonsense word that reflected an increasing ability to disassociate a word from a particular sentential context. In summary, our choice of items may have prejudiced the results to some extent.

EXAMINATION OF SCORES BY SEX

READING SCORES (STANFORD ACHIEVEMENT)

Reading scores were analyzed to check for homogeneity of reading ability of male and female fourth grade readers. No significant difference in overall reading ability was found for the two groups ($t=1.02$, n.s.).

While performance on the paraphrase portion of our battery was consistent with these findings, showing no significant difference by sex ($t=.315$), boys performed significantly more poorly on the ambiguities sub-test than did the girls ($t=2.14$, $p < .05$, 2-tail); this difficulty cannot be explained by particularly poor reading abilities of our boys, as their reading achievement scores do not differ significantly from our girls.

CORRELATION OF SUB-TEST SCORES WITH READING ABILITY

We have examined the correspondence between fourth graders' performance on our ambiguities and paraphrase tasks and their reading achievement scores.

Ability to paraphrase appears to be highly correlated with reading ability in our sample ($r=.43$, $p < .001$, 2-tail).

That many of our ambiguity and paraphrase items appear to tap the same underlying skills or processes may be seen from our analysis of these items against each other, showing that performance on paraphrase and ambiguity items is significantly correlated ($r=.277$, $p < .05$, 2-tail).

DISCUSSION

This study of knowledge of paraphrase and ambiguity and the translation of this knowledge into reading and writing performance, indicates the necessity of taking into account this knowledge in both the construction of appropriate reading and writing materials and in reading and writing instruction for students of varying ages. Insight into strategies used in the gradual acquisition of full competence in these areas and other areas of meta-linguistic abilities will give further evidence of the strategies used in the exercise of reading and writing and their development. This information may be applied to program development.

In Study Two (p. 26, below) we have extended this investigation to other age groups: seventh graders, tenth graders and college freshmen. A comparison of the performance of high and low ability groupings of students at the various grade levels on our tasks also help

establish the importance of these two skills for reading and writing achievement in general. We will also be dealing with the mechanics factor and developmental changes in this factor. The most obvious area of application would seem to be curricula for the development of basic skills of functioning with written language within the language arts. Skill in paraphrase and disambiguation will be important for students in dealing successfully with readings in all content areas, especially math, science, and the social studies. A finding of relatively late acquisition of certain specific sub-abilities may well provide the basis for careful scrutiny of materials and expectations for reading and writing during the school years. Further, our data indicate that development of curricula which engage the meta-linguistic abilities of students may have general consequences in their overall reading and writing competence.

WRITING RESULTS

Variation in Mapping and Transcribing

To demonstrate paraphrase and disambiguation competency, the fourth graders had to write sentences. We see this language processing/production task as having three routines: 1) the writer has to silently generate grammatically correct sentences that either paraphrase or disambiguate a target sentence: this is a language-processing task; 2) the writer has to map, copy from his mind onto paper, this paraphrase or disambiguation, holding this sentence in mind as he faithfully represents it on the paper: this is a language-mapping task; and 3) the writer has to produce a transcription of his paraphrase or disambiguation in the correct written form: this is a language-transcribing task. The sentences written by the fourth graders, therefore, are the result of this threefold process in which silent paraphrase or disambiguation may influence or interfere with faithful mapping which may interfere with standard English transcription. Due to this confluence of tasks -- processing, mapping and transcribing-- the sentences written by the subjects embody a mixture of the options and constraints inherent in the three processing/production tasks, and variations in written response, i.e., students having different and/or more errors, cannot readily be explained by a student's lack of a specific metalinguistic routine. In sum, we cannot be certain what routine in the overall process of writing paraphrases and disambiguations presents the necessary and sufficient problem which will manifest itself in an incorrect response. For example, when a subject writes "The money for the trip wa raised the fourht grade stunts" (sic) as a paraphrase for "The money for the trip was raised by the fourth grade class", we have no way of knowing where and why the language breakdown has occurred. Did the writer really have the correct lexical paraphrase in mind ("The money was raised by the fourth grade students.") but could not map it correctly? Or did the constraints of writing the sentence correctly (spelling, punctuation, penmanship) result in failure to realize the correct paraphrase he had in mind.

Analyzing the Writing

Even though we cannot be sure of the reasons for errors, nonetheless, by characterizing and counting the mistakes, we can see whether students designated as "Better Readers" or "Poorer Readers" made more mistakes in writing paraphrases and disambiguations, and we can examine the type of errors made by each group. Such an examination may suggest that the metalinguistic knowledge that results in being able to correctly paraphrase

and disambiguate, also results in these paraphrases and disambiguations being better written, that is, containing fewer errors in grammaticality and mechanics than the students who had trouble with the metalinguistic processing/production tasks of paraphrasing and disambiguating target sentences.

Constraints of Writing

Errors occur because subjects violated the constraints of written sentence production. Some of these constraints govern both spoken and written language (syntax, semantics and morphology), while other constraints are peculiar to the written language (punctuation, spelling and capitalization). A list of the constraints which could be violated are as follows:

1. Syntax -- Ungrammatical or nonstandard sentences resulting from a) words missing; b) inverted word order; and c) errors in verb tense or usage.

2. Morphology -- Errors in verb and noun inflections.

3. Semantics -- Anomalous sentences or anomalous words within sentence (sentence frame dissonance).

4. Transcription or Mechanics -- Errors in punctuation (end or internal), spelling (copied or new words) and capitalization.

Options of Writing

Since the written responses of the students were circumscribed by the sentences to be paraphrased and disambiguated, errors in responses might also be correlated to the options available to complete the task. Writers may vary in the number of words and/or sentences needed to correctly complete the task; and writers may also vary in the number of new words introduced. The number and type of error might, in fact, be a reflection of the syntactic and semantic options the subject employed, i.e., "Better Readers" may use fewer or more words to complete the task; or "Poorer Readers" may introduce more new words and therefore make more mistakes because they are also poorer writers.

The following options were available for paraphrasing and disambiguating. (Notice that a writer has no transcription options and morphological options that are constrained by syntax.)

1. Syntax -- Word order and verb aspect can be altered to complete task.

2. Semantics -- New words and/or phrases can be added to complete task. Options are particularly interesting because they lie at the heart of metalinguistic awareness: who has the most facility with and knowledge about language.

METHOD OF DATA COLLECTION

To analyze and characterize the errors we divided the students into two groups: 1) the "Better Readers" who scored 80 and above on the Reading Comprehension section of the Stanford Achievement Test: and 2) the

"Poorer Readers" who scored below 80 on the same test.

Items Analyzed

Data for the following items were collected:

1) Number of words written
2) Number of sentences written
3) Number of errors (see #6)
4) New words introduced
5) Spelling errors of words introduced
6) Syntactic Errors

   a) ungrammatical sentences, including sentence fragment
   b) articles missing
   c) verb missing
   d) noun missing
   e) particle
   f) infinitive
   g) preposition ungrammatical
   i) run-together sentence

7) Morphological Errors

   a) verb inflections
      i. past
      ii. progressive
      iii. present (subject-verb agreement)
   b) noun inflections
      i. plurals
      ii. possessive

8) Semantic Errors

   a) nonsensical sentence
   b) anomalous words

9) Transcription Errors

   a) end marks of punctuation
      i. period
      ii. question mark
   b) internal punctuation
      i. apostrophe
      ii. quotation marks
      iii. commas
   c) spelling/copying words in target sentence
   d) capitalization and lower case letters

RESULTS

The performance of better and poorer readers is reported in Table 1 below. The data were collected individually for paraphrase and ambiguity tasks, and totals for type and token compiled; most of the results which follow are from the combined totals.

1. Number of Words

Both groups -- the Better and Poorer Readers -- generated approximately the same number of words to complete the tasks.

Table 1
ANALYSIS OF THE TOTAL WRITING ERRORS OF GOOD AND AVERAGE READERS

	Good Readers	Average Readers
Syntax	25 errors	53 errors
Morphology	17	57
Semantics	7	25
Transcription	154	332
	203errors	467 errors
Total Errors / Total Words =	6.3%	13.4%
Total Errors / Total Sentences =	54%	119%

2. Total Number of Sentences

The Better Readers generated more sentences to complete the tasks. The average length of sentence was longer for the Poorer Reader; this average sentence was significantly larger for the Poorer Reader's paraphrase task.

3. Total and Type of Errors

The Poorer Readers made more than twice the number of errors -- syntax, morphology, semantics and transcription -- than the Better Readers. The Better Readers had on the average one error for every two sentences completed, whereas the Poorer Reader made approximately one error per sentence.

4. New Words Introduced

Poorer Readers introduced on the average more new words than Better Readers; on the paraphrase task, the Poorer Readers introduced almost twice the number of new words than the Better Readers. Poorer Readers also had a higher percentage of new words to total words than Better Readers.

5. Spelling Errors of Words Introduced

Poorer Readers misspelled the words they introduced six times more frequently than the Better Readers.

6. Syntactic Errors

Poorer Readers had twice as many syntactic errors as Better Readers.

7. Morphological Errors

Poorer Readers made approximately three times as many inflection errors as Better Readers.

8. Semantic Errors

Poorer Readers had three times as many semantic errors as Better Readers.

9. Transcription Errors

Poorer Readers made almost twice the number of transcription errors as Better Readers. In end marks of punctuation the Poorer Readers had 2½ times the number of errors; in spelling/copying the Poorer Readers had 3 times as many mistakes; and in using the apostrophe Poorer Readers had three times as many mistakes.

DISCUSSION

Poorer Readers made more than twice the number of errors than Better Readers in each domain of the task -- syntax, morphology, semantics and transcription. Errors in transcription (spelling, punctuation and capital letters), however, did not affect the researchers' ability to determine the subjects' success on the metalinguistic tasks of paraphrase and disambiguation. The problem with transcribing can be parcelled out: it seems plausible that

errors in transcription -- the final routine or component of the task -- reflect the subject's lack of familiarity with written English. That Better Readers are also better in English mechanics might be explained in two ways: 1) Better Readers have had more exposure to written language and are modeling the form they have read; and/or 2) Better Readers have had more practice and/or drill in writing and therefore they know more and are more careful about their writing. Regardless of the explanation, Better Readers can be considered to have enhanced metalinguistic awareness in that they are more aware of the constraints of the written language and therefore seek to produce a text which imitates the correct form of writing. Poorer Readers, on the other hand, may be poor transcribers because one part of being a poor reader is having problems paying attention to both surface structure and meaning (LaBerge and Samuels, 1974). For the Better Reader, however, surface structure decoding becomes automatic and attention can be given to the deeper meaning aspects of the text, those very meaning aspects that are tapped by the paraphrase and disambiguation tasks. Lending support to the notion that the Poorer Readers have more difficulty with surfaces is that the Poorer Readers made nearly three times as many copying errors (the word was already present in the supplied text) as the Better Readers, and the Poorer Readers misspelled new words they introduced into the text six times more frequently than the Better Readers.

Poorer Readers made end punctuation errors (period or question mark) more than twice as frequently as the Better Readers (PR-128 errors: BR-50 errors). This problem with sentence ending might have been more glaring had the subjects had to paraphrase or disambiguate a passage of successive sentences, for then sentence boundaries would have been crucial for completing the task. Nevertheless, the failure of the Poorer Readers to mark sentence boundaries begins to suggest a lack of sentence closure, namely, that the Poorer Readers might not be attending to sentence endings marked in the written language by end punctuation. But since the task required only a single sentence, the lack of end punctuation appears careless and not a miscue which can be ascribed to some underlying linguistic problem.

In sum, errors in transcription are errors in surface realizations and cannot readily be interpreted as miscues stemming from an underlying linguistic confusion. If we were to examine the mechanics of each student and find intra-student patterns of error, we might conclude that the student might have a particular problem, perhaps rule confusion or some interference from another language or dialect. But we did not analyze papers for miscues. More importantly, we cannot ascribe errors in the transcribing process to problems in language processing. Although students with enhanced metalinguistic awareness as judged by their success on the paraphrase and disambiguation tasks definitely wrote more correctly, we have no way of attributing this ability to metalinguistic awareness, the metalinguistic awareness which resulted in the Better Readers being better able to paraphrase and disambiguate. What the pronounced differences in transcription do suggest, however, is that Better Readers have enhanced facility with producing language which matches the form desired by the adult reader. Perhaps it is just such an awareness of fitting one's language to the demands of the task and the audience which might be considered an important aspect of metalinguistic awareness.

Errors in Syntax, Morphology and Semantics

The problems that the Poorer Readers had in producing sentences that were grammatical and coherent (not anomalous) is a problem different than transcription. In this case, errors in production can be seen as errors in either generating an appropriate paraphrase/disambiguation -- a processing problem -- or a failure to map the appropriate answer onto paper -- a mapping problem. One possible explanation of mapping errors might

be that the subject, by paying attention to producing an appropriate paraphrase or disambiguation may be unable to control other syntactic or semantic factors needed to generate a grammatical sentence. These other syntactic factors include attention to verbs (tense, inflection, agreement with subject, use of all-purpose "got"), noun inflections (plural and possessive), articles (deletions and substitutions) and word order (positioning of modifiers). Poorer Readers had more than twice the number of verb problems as Better Readers; three times the number of noun problems; twice the number of article problems and three times the number of word order problems.

Semantic factors are also present when producing a meaningful sentence: the introduction of an anomalous word will subvert the intended meaning of the sentence. The Poorer Readers introduced anomaly more than three times as frequently as the Better Readers. This also suggests attentional problems: having to generate an appropriate target sentence while attending to other sentence constraints may put a strain on the Poorer Readers linguistic capacities resulting in more errors. But since we did not correlate the errors of a particular subject with the same subject's errors in paraphrase and disambiguation, we cannot suggest that because paraphrase and disambiguation seem to call on identical processing capacities as generating a grammatical, coherent sentence, a subject who had trouble performing the paraphrase and disambiguation, tasks also had other problems in syntax and semantics. We can state, however, that Better Readers, in general, make far fewer errors in syntax, morphology and semantics than Poorer Readers; and it seems reasonable to conclude that this competence with syntax, morphology and semantics is a result of the Better Readers" enhanced metalinguistic awareness.

If subjects had been given an oral task wherein each subject had to paraphrase and disambiguate orally, we could state that faulty paraphrase and disambiguation is clearly a processing, not a mapping problem. One interesting aspect of this question is the words deleted by the subjects to complete the paraphrase task. Both Better Readers and Poorer Readers deleted comparable numbers of words to finish the task (BR-20 words, PR-26 words), yet the Better Readers could delete non-essential words and still paraphrase correctly. The Better Readers' ability to retain the gist and generate a correct paraphrase may be a further indication of their metalinguistic ability: Better readers knew what and how to paraphrase, whereas the Poorer Readers deleted words needed to demonstrate correct paraphrase. The other side of this question is the number of words added: Poorer Readers added more words than Better Readers, more words than needed to complete the task, once again suggesting that Better Readers have more control and facility with their language.

Implications

Research into composing has concentrated primarily on the ideational, functional and rhetorical side of writing: how writers access, compose and revise ideas and language. Little research has been done on the form of writing -- the mapping and transcribing of meaning. Yet, the finished product of writing must be a mirror of the thoughts of the writer and be consonant with standard written English. Successful writers produce sentences that correctly map their meaning: they write what they intended to mean; they have sufficient control over both their thought and the written language that they can match their mind to paper without introducing extraneous or anomalous words or generating ungrammatical sentences. Successful writers can also transcribe their meanings in standard written English, replicating the forms of the written language they have read: good writers spell reasonably well and control their punctuation to be certain their writing communicates their meaning (Calkins, 1980).

This study concentrated on the developing writer's awareness of form and suggests that better readers have a metalinguistic repertoire that enables them to complete a language processing/production task with fewer errors than poorer readers. The better reader seems to attend more closely to forms -- linguistic forms (paraphrase and ambiguity) and written forms (mapping and mechanics) -- and by so attending, is a better writer. This study further suggests that poorer readers, students who could not paraphrase or disambiguate well, lacked other metalinguistic skills evidenced in their written responses. Although much more research is needed, it seems that reading is one skill that relies on metalinguistic awareness sufficient to decode and understand a text. The reading capacity indicates facility with language which reflects the reader's sensitivity to and knowledge of a highly constrained symbol system. It does not seem surprising, therefore, that the better readers were the better writers (see Evanechko, Ollila and Armstrong, 1974, for the converse, namely better writers are better readers).

Elementary school students are more successful in school when they can read and write well. These two silent skills seem to depend on a consciousness of the written language as both a code and conveyor of meaning. This study suggests that being able to manipulate the form of the language means success in the tasks; and the better readers could manipulate the written language much better than the poorer readers. What is needed now is an investigation of the kinds of manipulative linguistic activities that seem to enhance metalinguistic awareness. Also interesting would be an examination of the kinds of writing activities that encourage the student to match form and meaning, i.e. are skill workbooks or personal writing better in improving awareness of mechanics (see Calkins, 1980). Behind these concerns are three overriding issues: 1) Does success in formal operations-- the ability to manipulate symbols-- correlate with metalinguistic ability; 2) Are there domains and structures within metalinguistic knowledge, or do speaking, listening, reading and writing all tap a general consciousness of the options and constraints of language; and 3) How does attention to form develop: is there a sequence in the growth of mapping and transcribing.

STUDY TWO

A second study was carried out with a small number of high (above the 90th percentile) and low (20th to 40th percentile) fourth, seventh, tenth graders and normal and deficited adult readers. Materials developed for each of the metalinguistic tasks (detection and correction of anomaly and nongrammaticality, judgment and generation of paraphrase, and judgment and clarification of ambiguity) were presented in three modes: reading, writing and listening/speaking. The trends observed in the data appear to provide some preliminary answers to several of the questions posed in the introduction of this report.

Research Plan

A. Subjects

Criteria for subject selection were the following: age, socioeconomic status, and reading and writing achievement.

Age

Eight subjects were chosen in each of three age groups:

Group I (9-11 years of age)
Group II (12-14 years of age)
Group III (15-17 years of age)

In addition, 16 adults (over 30 years of age) were selected.

Socioeconomic Status

All participants in the study are of lower-middle socioeconomic status.

Reading Achievement

Subjects in each age group were evenly divided into good readers and deficited readers. Reading performance was identified by using two criteria:

1. Teacher evaluations of subjects' reading performance as good, average or deficited.

2. Reading achievement test scores. The following tests were used:

9-11 years	-Gates-MacGinite Reading Test with Subtests
12-14 years	-Gates-MacGinite Reading Test with Subtests
15-17 years	-Gates-MacGinite Reading Test with Subtests
Adults	-Stanford Diagnostic Reading Test with Subtests

Reading performance was defined in the following manner:

Good - 90th percentile and above
Deficited - below 30th percentile

Procedure

There were four areas of meta-linguistic awareness in four modes of processing that were assessed in the context of single sentences and passages. Following is a list of the areas and modes that were assessed:

Metalinguistic Tasks	Modes of Processing			
	Oral		Written	
	Listening	Speaking	Reading	Writing
Anomaly 1. Disjunction 2. Causal 3. Conditional 4. Temporal				
Nongrammaticality 1. Morphological 2. Adjective Clustering 3. Adverbial Use 4. Preposition				
Paraphrase 1. Lexical Substitution 2. Passive 3. Dative Movement 4. Fronting				
Ambiguity 1. Pronominal Referent 2. Lexical 3. Deep Structures 4. Bracketing				

Practice Period

Before each presentation of stimulus sentences or passages, subjects were given two examples to ensure that they understood the nature of the task. Practice items were not those used in the assessment procedure.

1. Application of metalinguistic awareness in processing sentences

Sentence Stimuli

Below are samples of sentences for each stimulus type.

Type	Example
Anomaly	
Disjunction	Sally likes apples, but she likes bananas.
Causal	He broke his leg because he went to the hospital.
Conditional	If he puts his boots on, it will rain.
Temporal	While he stood on the shore, he waded in the water.
Nongrammaticality	
Morphological	The Martian ship unintergrated when it hit the atmosphere.
Adjective Clustering	The plastic big round ball fell off the table.
Adverbial Use	He wanted to play much.
Preposition	He broke the window by a hammer.
Paraphrase	
Lexical Substitution	The teacher told us to stop talking.
Passive	The money for the trip was raised by the fourth grade.
Dative Movement	John sent every girl a valentine.
Fronting	His mother was waiting when he arrived home.
Ambiguity	
Pronomial Referent	John played with the dog while he was eating
Lexical	The coach asked me how many times Jack beat Stuart.
Deep Structure	Do you want a tiger to chase you or a lion?
Surface Structure/ Bracketing	The fat farmer's wife cooks all day long.

Sentence Tasks

A. Judgment Tasks

Listening

1. Paraphrase: listen to two sentences and decide whether they have the same meaning.
2. Ambiguity: listen to sentences and decide whether they imply more than one meaning.
3. Nongrammaticality: listen to sentences and decide whether they are correct.
4. Anomaly: listen to sentences and decide whether they are correct.

Reading

1. Paraphrase: read two sentences and decide whether they have the same meaning.
2. Ambiguity: read sentences and decide whether they imply more than one meaning.

3. Nongrammaticality: read sentences and decide whether they are correct.
4. Anomaly: read sentences and decide whether they are correct

B. Production Tasks

Listening-Speaking

1. Paraphrase: orally rephrase sentences without changing the meaning.
2. Ambiguity: orally explain two or more meanings for ambiguous sentences.
3. Nongrammaticality: orally correct errors in sentences.
4. Anomaly: orally correct errors in sentences.

Reading-Writing

1. Paraphrase: rewrite sentences without changing the meaning.
2. Ambiguity: write two or more meanings for ambiguous sentences.
3. Nongrammaticality: write corrections to sentences.
4. Anomaly: write corrections to sentences.

2. Application of Metalinguistic Awareness in Processing Passages

The role of context was examined in the processing of passages. As stated previously, distinctions between good and deficited readers may be found in how each group uses context in varying metalinguistic tasks. There is evidence which indicates that good readers ignore nongrammaticality in passages (Gibson and Levin, 1975). However, it is possible that good readers, using context information, will be better able to detect anomaly, paraphrase and ambiguity in a passage than in a sentence, whereas processing a passage may place more strain on the capacities of deficited readers. Therefore, detection and correction of anomaly, detection of paraphrase and detection and disambiguation of ambiguities will be assessed with passages. Nongrammaticality was included to assess the hypothesis that good readers ignore them.

Passage Stimuli

Below are examples of the types of passages used.

Paraphrase

1. Lexical substitution

Dan's family went on a trip to a zoo. They walked for hours looking into different cages. Dan liked the gorilla best of all. It stood up in its cage and pounded its chest.

2. Fronting

A person has to do a lot of work before he can become a teacher. First, there's four years of college. Then, you have to practice as a student teacher. It may be a lot of work, but most teachers feel it's worth the effort.

3. Passive

When Randy was twelve years old. he went with his parents to hear a speech. The speech was given by a man named Martin Luther King. He spoke about a dream he had dreamed. When Mr. King finished speaking, Randy saw tears in his parents' eyes.

4. Dative Movement

Alan was very excited when he went to the first baseball practice. The coach told Alan to play third base. Next, the coach hit all the fielders a ground ball. Alan missed his ground ball but the coach wasn't mad.

Ambiguity

1. Lexical

Sally and Joe went our on dates every Tuesday and Saturday night. They liked each other a lot. John decided one day to give Sally a ring. He hoped she would be home.

2. Pronominal Referent

Three brothers went to school on a yellow school bus. The boys were in kindergarten, first grade, and fourth grade. In the afternoon the bus brought him back home. The driver was a friendly man.

3. Deep Structure

The woman robbed the bank and ran out the door. The policeman heard the alarm and chased her down the street. The policeman arrested the woman with a gun. The thief dropped the money.

4. Surface Structure/ Bracketing

What is your favorite dessert? My favorite aunt's daughter bakes the best chocolate chip cookies. She learned how in a cooking class. Some day she will give me the recipe.

Nongrammaticality

1. Morphological

Gail wanted to learn how to play the piano. She took lessons and practicing every day. Soon she was able to play songs from movies and from records. Everyone thought Gail was very talented.

2. Adjective Clustering

Earthworms live in the ground. They do not have lungs but breathe through their skins. An earthworm has stiff, many, short bristles on the front and sides of its body. Johnny dug up earthworms for fishing bait.

3. Adverbial Use

Joe knew that something nice was going to happen. After school he ran home quick. When he got there he found a big surprise. It was a 10 speed bicycle.

4. Prepositions

Frogs and toads are hard to tell apart. Frogs are smooth and slender. Toads have thicker bodies which are covered in bumps. Both frogs and toads lay their eggs in water. Frogs live in or near water while toads are land dwellers.

Anomaly

1. Disjunction

It had started to rain very hard. Sally had neither a raincoat and an umbrella. She started to run toward the building entrance and kept on running. Just as she got there, she realized it had stopped raining two minutes ago.

2. Causal

Carol's father bought her a puppy for her tenth birthday. The dog was very small, and Carol kept it in the house. The puppy didn't bark because it chewed up Carol's father's slippers. The next day, Carol's father started building a dog house in the backyard.

3. Conditional

Bill and Joe went to the lake to fish. When they got to the lake, the sun was shining. If Bill puts his boots on, it will rain. In that kind of weather the fishing is good.

4. Temporal

When the rain started, the snow began to fall. All the trees along the street had lost their leaves. It seemed too early for this to happen. Winter was coming early this year.

Passage Tasks

a. Judgment Tasks

Listening
1. Paraphrase: listen to two passages and decide whether they have the same meaning.
2. Ambiguity: listen to a passage and decide whether it contains an ambiguity.
3. Nongrammaticality: listen to a passage and decide whether it contains an error.
4. Anomaly: listen to a passage and decide whether it contains an error.

Reading
1. Paraphrase: read two passages and decide whether they have the same meaning.
2. Ambiguity: read a passage and decide whether it contains an ambiguity.
3. Nongrammaticality: read a passage and decide whether it contains an error.
4. Anomaly: read a passage and decide whether it contains an error.

b. Production Tasks

Listening-Speaking
1. Paraphrase: listen to a passage and orally rephrase a sentence stressed by the examiner without changing the meaning.
2. Ambiguity: listen to a passage and orally explain two or more meanings for a sentence stressed by the examiner.
3. Nongrammaticality: listen to a passage and correct errors produced by the examiner.
4. Anomaly: listen to a passage and correct errors produced by the examiner.

Reading-Writing
1. Paraphrase: read a passage and rewrite an underlined sentence without changing the meaning.
2. Ambiguity: read a passage and write two or more meanings for an underlined sentence.
3. Nongrammaticality: read a passage and correct the errors.
4. Anomaly: read a passage and correct the errors.

Results

First, in the sentence task, the order of difficulty of the varying metalinguistic tasks was, on the whole, the same across modes of processing. The paraphrase task was the easiest, anomaly and nongrammaticality followed and the ambiguity task was the most difficult. This was true for all populations (see Table 2). Thus, tasks are related to each other across modes. Second, there were sharp differences between high and low fourth grade readers and in normal and deficited adult readers in certain tasks. Indeed, there were a number of tasks in which adult deficited readers did worse than fourth grade low readers, and they did worse on practically all tasks as compared to high fourth grade readers (see Figure 5). These data indicate that a possible leveling off of linguistic processing, in certain areas, has occurred with these readers. Third, there were some tasks in which reading was somewhat better than listening performance, primarily with paraphrase. This also lends some support to the notion that well learned structures are handled automatically

Table 2

Percentage of Correct Responses Across Modes by Subject Group and Metalinguistic Task for Sentences: Pilot Study

	Paraphrase	Anomaly	Non-Grammaticality	Ambiguity
Adult High	94	94	97	71
10 High	84	87	82	70
7 High	87	80	72	58
4 High	85	79	69	53
Mean High	87	85	80	63
Adult Low	78	70	60	40
10 Low	66	68	69	44
7 Low	55	50	56	34
4 Low	78	64	50	40
Mean Low	69	63	59	40
Grand Mean	78	74	69	51

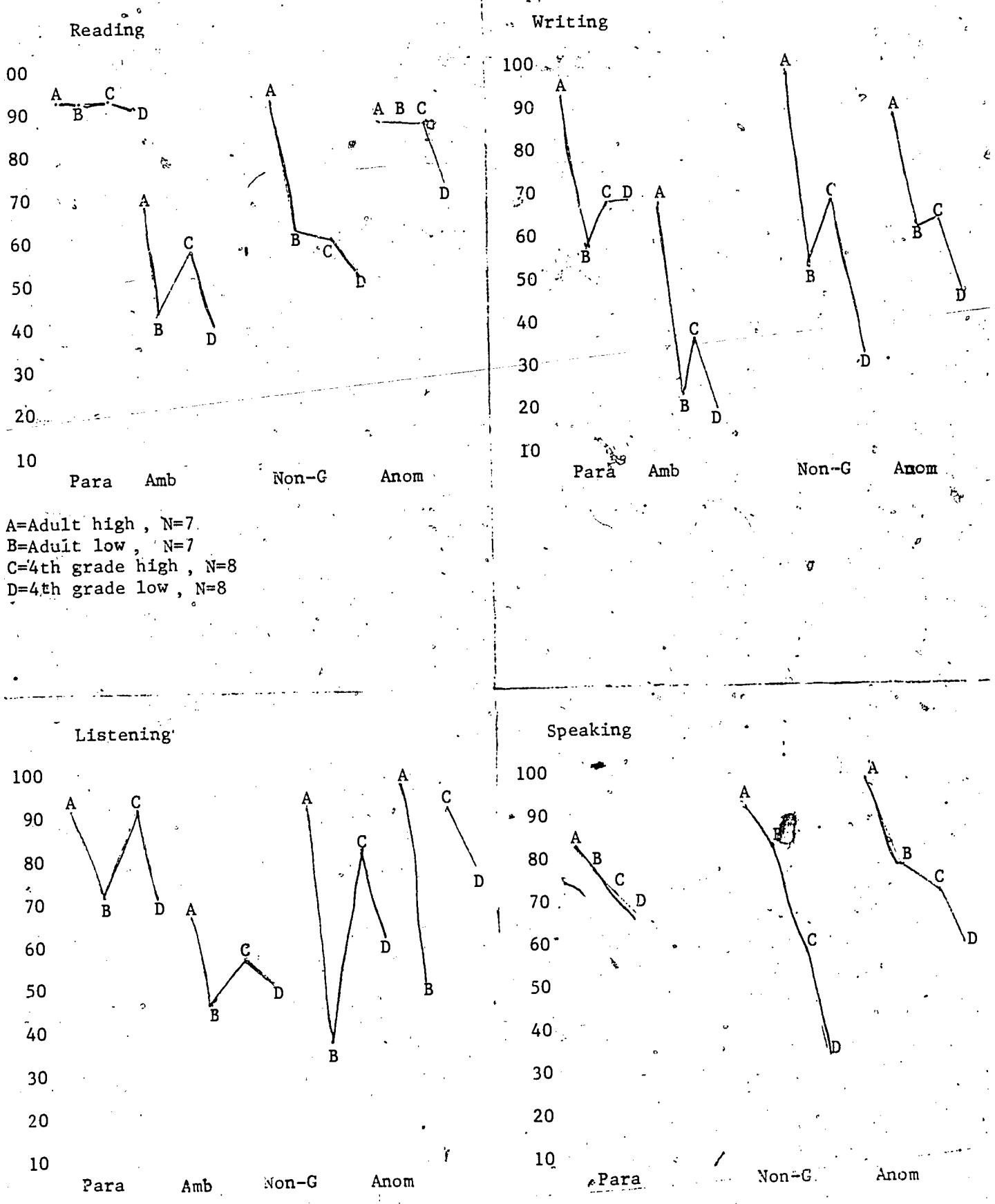

Figure 5. Pilot study results for high and low adult and fourth grade readers.

and with greater efficiency in the reading process, possibly because the information remains continuously available.

Data on processing of passages was obtained only with adult readers. However, the results indicate that it is important to examine processing of passages as well as sentences. The normal adults did better with passages in some instances than they did with single sentences and in some instances did worse. The deficited adult readers, on the whole did worse. The data lend some support to the notion that, developmentally, comprehending sentences precedes comprehending of passages and that passages provide differing kinds of information and pose differing kinds of problems for good and poor readers.

Our data and observations from these pilot studies have led us to modify our experimental design in several ways: 1) alteration of some stimulus items; 2) some changes in task requirements, particularly for paraphrase and ambiguity; 3) pulling apart of the listening and speaking tasks, and of the reading and writing tasks; and 4) a decision to measure the time subjects take to complete each task. There were, as might have been predicted, significant differences between populations on this last measure.

As was indicated in the discussion of the preliminary study, it is also clear that the strategies used by the different populations to complete the tasks can be significantly different. The scoring of strategy use (for example, structural vs. lexical, number of words and sentences used to carry out the task) by each population is therefore to be an important part of the data analysis.

Implications

If the above hypotheses are correct then metalinguistic awareness of categories and relations in certain oral language structures should be achieved before this awareness can be applied to reading/writing since some translation processes are required in reading. The latter should be achieved before this awareness can be applied in writing since writing requires orthographic realization rules. There should, in addition, be developmental changes that occur in the structures with which metalinguistic awareness has been achieved in oral language processing. The research proposed is designed to test these hypotheses and to formulate a developmental model of the relation between the three processes.

We explicitly wish to disavow any inference that we are espousing either (a) formal instruction in metalinguistics or (b) special oral language instruction as prerequisites to efficient reading or writing development. We do hope, however, that such relationships as we may find between language development and metalinguistic awareness will inform and thereby improve pedagogical practice.

The research proposed has pedagogical implications as well. Our own findings (Flood and Menyuk, 1979) suggest that a relation exists between metalinguistic knowledge and later reading achievement. However, these findings and those of others may simply indicate that the processes of metalinguistic awareness and reading are similar in some way and require similar cognitive strategies, but not that acquisition of metalinguistic awareness of particular structures are precursors to adequate processing of these structures in reading and writing. For pedagogical reasons it is important to determine whether the former or the latter explanation of the postulated relation is correct. Further, the relation between processing these structures in reading and generating these structures in writing has never been systematically examined. Although one might logically assume that a precursor to writing structures is comprehension of structures in reading materials, the act of writing, like the act of speaking, requires skills beyond those required for comprehension of written or spoken structures. Again, our preliminary study indicated that in

some instances children had the knowledge of the structure being examined but difficulty in generating this knowledge in written form whereas others simply did not have the structure. This difference in behavior was evident in their productions and could be parcelled out. Nevertheless, again for pedagogical reasons, it is important to examine these abilities separately.

Finally, the important question of whether or not the problems of children and adult semi-literates are related in any way to the nonacquisition or early leveling off of metalinguistic knowledge has never been explored. By logical argument, if it is the case that metalinguistic knowledge is related in some crucial way to reading and writing then one might assume that the basis for semi-literacy might lie in an inability to bring to conscious awareness tacit knowledge of linguistic structures or the unavailability of particular structures. Several studies have indicated that adult speaker-listeners have difficulty in processing particular linguistic structures. Kramer, Koff and Luria (1972) found that some adults have difficulty in processing certain complement structures. Geer, Gleitman and Gleitman (1972) found that some adults have difficulty in paraphrasing nominal compounds. Myerson (1977) found that teenagers had difficulty in generating the rules required for complex derivational words. The relation between these difficulties and reading was only examined in the Myerson study where a significant correlation was found between reading level and success in the linguistic task. These findings point up the necessity of exploring the relation between metalinguistic knowledge and reading in a systematic way with an adult as well as child population. Again, it is not clear whether metalinguistic abilities are related in general to reading or in specific ways and whether or not the abilities of the adult semi-literate resemble those of younger people still in the process of acquiring metalinguistic knowledge.

To obtain answers to the questions posed initially, it is necessary to assess metalinguistic knowledge over the full range of described metalinguistic abilities (anomaly, nongrammaticality, paraphrase, and ambiguity) over the age range during which metalinguistic knowledge in particular domains continues to develop and during which demands on reading and writing performance become more stringent (4th grade to adulthood). It is also necessary to assess the development of this knowledge in oral language as well as in written language comprehension and in writing. We can then determine whether metalinguistic knowledge of oral language is generally related to reading performance or specifically related, whether metalinguistic knowledge of written materials is generally related to writing performance or specifically related during different periods of development over the age range. Finally, we can determine whether or not the difficulties of semi-literate adults is related to an early leveling off of metalinguistic knowledge.

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APPENDIX A

Test Booklet for Fourth Grade Study

On the next few pages you will find some sentences. All of these sentences can be written in another way and still mean the same thing.

For example:

My neighbor thinks she is fat.

can also be written as:

My neighbor thinks she is chubby.

or as:

My neighbor thinks she is overweight.

All three sentences express the same idea, but the words are different.

Another example is:

The book is written by Dr. Seuss.

Another way to write this is:

Dr. Seuss wrote the book.

The meaning doesn't change.

Try rewriting those next sentences without changing the meaning. Write your changes under each typed sentence so they look like this:

The cookies were gone when he arrived home.

When he arrived home, the cookies were gone.

Remember not to change the meaning of the sentence when you change the words. Use the back if you need more space.

Do you have any questions?

1. The big boy sat in the baby's chair and broke it.

2. His mother was waiting when he arrived home.

3. The money for the trip was raised by the fourth grade class.

4. The teacher sent the report card to his parents.

5. John sent every girl a valentine.

6. The black and white puppy was bought by Jimmy's older sister.

7. After school, Joanne stopped at the store.

8. The teacher told us to stop talking.

On the next pages you will find more sentences. This time all of the sentences have two or more meanings.

For example:

The duck is ready to eat.

can mean either

The duck is hungry.

or

The duck is cooked.

Try to find the meanings for the sentences on the next pages. Write your own sentences under each typed sentence so they look like this:

Visiting relatives can be a nuisance.

We don't like it when our relatives visit.

We don't like to visit our relatives.

Remember to look for two or more meanings for each sentence. Use the back if you need more space.

Do you have any questions?

1. ...s standing by the teacher talking to the little boy.

2. John played with the dog while he was eating.

3. Thomas walked home, his bookbag held over his shoulder and rubbing his elbow.

4. Bob's speech made the teacher angry.

5. Do you want a tiger to chase you or a lion?

6. The coach asked me how many times Jack beat Stuart.

7. Mary wanted to work with Sue, but I chose her.

8. The fat farmer's wife cooks all day long.

Stories

Read the following story and tell it in your own words. Keep the meaning the same, but change words and sentences if you like.

If you think the story has two meanings, write them both in your own words.

Bill was angry at John. He took his baseball bat. Sally ran to tell the principal. The principal promised to do something about it right away.

Stories

Read the following story and tell it in your own words. Keep the meaning the same, but change words and sentences if you like.

If you think the story has two meanings, write them both in your own words.

Mary, Peter and Joe became friends last summer. They saw each other everyday at camp. Mary likes Peter better than Joe. Camp won't be the same next year.

Stories

Read the following story and tell it in your own words. Keep the meaning the same, but change words and sentences if you like.

If you think the story has two meanings, write them both in your own words.

Everyone knows Farmer Brown is clumsy. Yesterday, he hurt his calf while he was mending the fence around the cow pasture. The day before, a goose bit his hand at feeding time.

Stories

Read the following story and tell it in your own words. Keep the meaning the same, but change words and sentences if you like.

If you think the story has two meanings, write them both in your own words.

Coming down the stairs, I saw the young boy fall. They took him to the nurse's office to bandage his leg. I hope he'll be better tomorrow.

APPENDIX B

Papers prepared from Grant #NIE-G-78-0176

Syntactic Competence and Reading*

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*Paper presented at the conference "Language, Learning and Reading Disabilities: A New Decade," Graduate Center, C.U.N.Y., May 22-23, 1980.

Writing some fifty years ago, Vygotsky stated: "A feature of this system (written language) is that it is a second order symbolism, which gradually becomes direct symbolism. This means that written language consists of a system of signs that designate the sounds and words of spoken language, which in turn are signs for real entities and relations. Gradually this intermediate link, spoken language, disappears and written language is inverted into a system of signs that directly symbolize the entities and relations between them. It seems clear that mastery of such a complex sign system cannot be accomplished in a purely mechanical and external manner, rather it is the culmination of a long process of development of complex behavioral functions in the child." (Vygotsky, 1978, p.106)

What Vygotsky wrote in the late 1920's appears not to have seriously affected written language acquisition research until the 50's and 60's. Over the past few decades there has been an increasing amount of attention paid to the relation between oral language and written language development. For a long time before this, the relation between morphophonological knowledge and reading acquisition was accepted. The ability to map letter sequences into sound sequences, at the morpheme level, was considered to be the important step in beginning reading. What was not generally discussed was the relation between language knowledge as a whole (semantic, syntactic and pragmatic as well as morphophonological) and reading behavior.

In this paper I shall try to present a logical argument for being particularly concerned with structural-relational linguistic development and reading acquisition, especially in the case of those children who appear to have marked difficulties with this aspect of oral language. To support this argument, I will first discuss some proposed models of the relation between oral and written language processing and development. I shall then present

some data obtained in a study of oral reading and a study of children's ability to carry out a syntactic processing task in reading and writing and their measured reading ability. Finally, I shall make some suggestions concerning the implications of these models and this research for studying written language acquisition in children with marked structural difficulties.

Some Models of the Relation Between Oral and Written Language

I will begin by stating that the term "oral language" is meant, here, to refer to language that is acquired naturally, "through the air." Therefore, I am including both oral and sign language in this term and am using it to distinguish between through the air language and written language. Although I am not specifically addressing the relation between sign language knowledge and reading in this paper, I believe that many of the comments I shall make are germane to that topic.

There are three ways that the relation between oral language processing and development and written language processing have been viewed. These are: 1) that written language processing is dependent on oral language development; 2) that both types of processing and development are dependent on the same superordinate abilities; or 3) that processing of written material is initially dependent on oral language knowledge and then becomes independent in developmental steps that reflect changes in level of acquisition of oral language knowledge. It is this last position that is being espoused in this paper and is, largely, in agreement with Vygotsky's statement. Some of the research carried out in support of each of these positions will be reviewed to indicate why the third view appears, at this stage, to be the most explanatory.

The first view suggests that there is a continuous relation between oral language development and written language development. As oral language knowledge increases so does reading performance. Therefore, those children who are most

advanced in their oral language knowledge would be those children who are the "best" readers at any given age period and, inversely, those children who are most retarded in their oral language development would be the "poorest" readers at any given age period. Figure 1 presents a graphic representation of this notion. As is shown in Fig. 1, oral language production is dependent on oral language comprehension, comprehension of written material is dependent on oral language production rules, and writing is dependent on comprehension of written materials. It is suggested that reading is dependent on oral language production, not comprehension, because the reading process requires bringing to conscious awareness (realizing) oral language categories and relations (Mattingly, 1972). Vocal or subvocal realization appears to be necessary for bringing these categories and relations to conscious awareness. The term used for this process is "meta-linguistic" awareness.

Insert Fig. 1 about here

There have been a number of studies that have attempted to relate sophistication in oral language development to reading achievement. Martin (1955) examined the relation between two gross measures of lexical development (total number of words used and number of different words used) and a similarly gross measure of structural development (sentence length in a language sample) and reading achievement at the end of first grade. She found a low positive relation between number of different words used and reading achievement. In a follow-up study (in fact a replication of the former study with first and second grades) similar results were obtained (Winter, 1957). Bougere (1968) in a somewhat more sophisticated analysis of structural development found a low

positive relation between T-unit measures of sentence complexity and children's performance on standardized reading tests at the end of grade one.

The results of similar types of studies with children who exhibit marked reading difficulties have been more positive concerning the relation between oral language development and reading. Jansky and de Hirsch (1972) found that oral language development, as measured by picture naming, general oral language levels, categories, sentence memory, auditory discrimination and letter naming, was most predictive of silent reading and spelling achievement in second grade. Vogel (1975) found that dyslexic children who exhibited reading comprehension difficulties were also deficient in oral syntax when compared to normally reading children. Badian (as reported in Menyuk, 1976a) found that middle-aged children with severe reading difficulties also exhibited difficulty in processing relativized sentences.

In summary, the results of studies that have examined the relation of level of oral language development to reading achievement in "normal" populations have come up with findings that render the first view (written language development dependent on oral language development) questionable. Conversely, studies of children with marked reading difficulties have come up with findings that, in some sense, support the dependency view. I say "in some sense" because a careful examination of the measures of language used in these studies reveals that language development per se was not being measured in these latter studies except for the general oral language level measure used in the Jansky and de Hirsch (1972) study. What appears to have been measured in these studies is oral language processing rather than level of oral language development. Clearly the two are related. That is, level of oral language development may be a function of the child's ability to process language and any marked differences in this ability may lead to delays or

differences in oral language development. Thus, difficulties in oral language development would be a second-order manifestation of a problem in oral language processing and, in like fasion, it might be the case that this same problem is the cause of difficulties in written language processing. This is the second view of the relation between oral and written language development (that both are dependent on the same types of processing ability) to be discussed here.

The question concerning this view is: what are these processing abilities? There have been a number of studies which have found correlations between beginning reading achievement and conservation, seriation, and classification (for example, Briggs and Elkind, 1973; Lunzer, Dolan and Wilkinson, 1976). Somewhat similar types of studies (that is, correlational) have been carried out to examine the relation between operational thought and aspects of oral language development (for example, Beilin, 1975; deZwart, 1969). These studies have found either that aspects of operational thought precede aspects of oral language comprehension or production or that developments in the two domains occur simultaneously. Given the results of these studies of correlations between reading performance and cognitive abilities or between oral language abilities and cognitive abilities, it does not seem to be the case that oral language and written language performance are dependent on operational thought. Rather, all three performances, oral language, written language and operational thought, may be dependent on some superordinate abilities that develop in time (Menyuk, in press). Possible candidates for these so-called superordinate abilities are perceptual strategies which, in turn, seem to be dependent on both short-term memory strategies and the structures in long-term memory (Mehler, 1971).

This notion of application of similar strategies in processing oral and

written examples of relative clause sentences that varied in complexity. Complexity was defined in terns of the findings of previous studies in oral language development of these structures.. The results of the study indicated that 1) normal subjects performed better than dyslexic subjects; 2) linguistic complexity affected performance across groups and across tasks (reading and auditory comprehension) and 3) that mode of presentation was "slightly" significan for the dyslexic children (the reading task was more difficult). In addition, although the strategies used by both groups were similar, one strategy (order of mention equals order of meaning) was used only by the dyslexic group and strategies used in the listening task by individual children were also used by these children in the reading task.

Several aspects of this study are important in terms of developing a model of the relation between oral and written language development. The first is the finding that similar strategies are employed in written and oral language processing by both normal and disabled readers. The second is that the strategies used by the disabled readers do not lead to correct comprehension as frequently as those used by normal readers. The third is that linguistic complexity has the most marked effect on the performance of both groups. Normal subjects performed almost perfectly with subject relative clause sentences with subject focus, presumably the least complex form. This was not the case with disabled readers. Taken together, these findings might suggest that both oral and written language processing are dependent on the development of certain types of processing abilities and that written language processing is not directly dependent on oral language processing. Figures 2 and 3 present two alternative models of this notion that oral and written language development are dependent on some superordiante abilities. Model 2 (Figure 2) suggests that language development, be it oral or written, is dependent on operational thinkin

Model 3 (Figure 3) suggests that language development and the development of operational thinking are dependent onthe development of perceptual strategies.

Insert Figs. 2 and 3 about here

Neither Models 2 nor 3 indicate a developmental link between oral and written language development. The findings of a number of the studies cited might be much better explained by the third position concerning the relation between oral language and written language processing than by either version of the second model. This third model suggests that oral language knowledge is used to process written language material. Further, as oral language knowledge develops some structures that are well learned are processed automatically both aurally and visually. Structures that are in the process of being acquired in oral language required more conscious processing and require conscious application to the written domain. Those that have not been acquired as yet cannot be used in processing oral or written language. This position seems to provide an explanation of the near-perfect performance of normal readers in listening to and reading subject relative clauses and their poorer performance with more complicated relations in the Goldsmith (1977) study. It might also explain the over-all poorer performance of dyslexics in oral language processing tasks and, also, why oral language knowledge is a much poorer predictor of beginning reading performance in populations without such deficit. One might assume that in the latter population some level of automaticity of processing has been achieved with a large body of structures at the age of six years and that oral language development continues steadily over the

school years and, therefore, automaticity of processing achieved with more and more complex structures over this time.

A conjunction of the second and third position was set forth by Gibson(1972) in her discussion of parallels between oral language and learning to read. Both types of learning require discrimination and categorization abilities. The categorization process also requires feedback. This seems to be a very reasonable statement. Logically, both types of learning, to listen and comprehend and to read and comprehend, do require discrimination and categorization. The differences lie in the bases for discrimination and categorization in the two learning tasks. For example, children do not ordinarily segment the morpheme into speech sounds, discriminate between and categorize them and then synthesize these segments into a morpheme to get at its meaning when listening. Words are treated as wholes at the beginning of lexical acquisition both in comprehension and production and segmental differences are not brought to conscious awareness in oral language processing even at three years of age unless the children are required to do so in particular tasks (Menyuk and Menn, 1979). Such conscious processing of segments appears to be required in many teaching of reading situations and is then spontaneously used in so-called "word attack" approaches in reading.

Even more important than the differences in the bases for discrimination and categorization may be the basis for feedback in the categorization process. The steps in categorization and what takes place at each step in both listening and reading are indicated in Figure 4. The process of categorization with any type of stimulus input has been described at length by Bruner (1957). As can be seen in Figure 4, the process of categorization involves chunking and labelling of input stimuli, checking the validity of the chunk and label in terms of information stored in memory and confirming the chunk and label. That such

processing is required in both listening and reading seems clear. However, it is also clear that, at least at the beginning of the reading process, what is required is transformation of written material into oral language categories and relations. This involves two additional steps in reading for meaning. The first is translation of written material into oral language categories and the second is realization of these categories.

Insert Fig. 4 about here

As structural oral language knowledge is established, this process becomes automatic or, at least, so rapid that it appears to be automatic. Then, to again quote Vygotsky, "Gradually this intermediate link, spoken language, disappears and written language is converted into a system of signs that directly symbolize the entities and relations between them." If this is the case, then children's ease in reading particular written material should be a direct function of their level of oral language knowledge of the structures represented in the written material. That is, whether the structures have been well learned, are in the process of being acquired or not learned as yet should be reflected in the reading of these structures.

Studies of the Relation Between Level of Oral Language Knowledge and Reading

None of the studies cited previously directly examined the relation between state of oral language knowledge of a range of structures and reading these structures. This would be required to test the hypothesis that level of

automaticity in reading structures is a reflection of degree of establishment of knowledge of these structures. The two studies to be discussed here also are not direct examinations of the question, but do represent approximations.

Bowey (1980), as part of her study, examined the oral reading of different sentence types by third, fourth and fifth grade normal readers. Among the sentence types examined were simple declaratives, WH questions, prepositional phrase pre-posing, truncated passives, conjunctions, true passives, dative movements and center-embedded relatives. Both reading time and error rate were used as measures of the difficulty of reading these varying sentence types. The hypothesis being tested by Bowey was that linguistic complexity as measured by the derivational complexity of sentences or as measured by contextual probability should have an effect on rate of reading and errors in reading. Derivational complexity and contextual probability (i.e., what one expects to hear next in a sentence) are often inter-related. For example, the sentence "The boy was hit by the ball." is derivationally more complex than the active version of the relation expressed and the expectation would be that the "boy" is the actor in the sentence. Some truncated passives, such as "The book was finished." are, in fact, pseudo passives (Bever, 1970) and are treated as predicate adjective sentences. Therefore, although traditionally all passives are considered to be derivationally more complex than actives, such pseudo passives may be both contextually more probable and derivationally less complex than real passives.

The findings of the study were that derivational complexity and contextual probability only partially accounted for differences in rate and errors in oral reading of these sentence types. What does more adequately account for the results is a developmental hypothesis. Sentences containing structures that are known to be early acquisitions (simple declaratives, Wh questions,

prepositional phrase pre-posing, truncated passives and conjunctions) were read more quickly and with fewer errors than sentences containing structures that are known to be later acquisitions (true passives, dative movement and center-embedded relative clauses). Thus, variations in the structural complexity of well learned structured did not affect oral reading performance to a significant extent, whereas the complexity of less well learned structures had a marked effect.

An additional and interesting finding was that children's oral imitation of varying sentence types did not completely match their oral reading of these sentence types. Different and more frequent errors were made in the imitation of well learned structures than in the reading of these structures. It is possible that reading well learned structures is "easier" than imitating them because the material is always present in the reading task and disappears in the oral task, a difference in memory support in the two situations. The findings of the Bowey study provide some initial support for the third model of the relation between oral and written language processing; that is, the hypothesis that state of knowledge of linguistic structures has an effect on the reading of these structures and that well learned structures are read automatically.

Flood and Menyak (1979)* examined the ability of fourth graders to read and paraphrase in writing lexical items and structures and to detect ambiguity in lexical items and structures and, again in written form, to paraphrase these ambiguities. The ability to paraphrase and to detect ambiguity were selected for study for two reasons; one development and the other practical. These abilities are late acquitions in the development of oral language which evolve in different structural domains over time and

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and they are often called upon in order to correctly or even adequately interpret written material.

By the time the normally developing child enters school many of the basic categories and relations in oral language are understood and the child is able to use many of the para-linguistic and extra-linguistic cues needed to engage in discourse. Each child's level of development, however, may be a reflection of previous experiences with the language and the development of meta-linguistic abilities (Menyuk, 1976b). For example, it has been suggested that some children are unable to consciously relate words phonologically on entrance to school, whereas other children are able to do so (Savin, 1972). Similar differences between children have been found at all levels (morphophonological, syntactic and semantic) of anlaysis of the language. That is, rates of acquisition of metalinguistic processing of aspects of language will vary among normally developing children.

In addition to differences in the rate at which acquisition of various aspects of linguistic knowledge occurs in the pre-school years, structural knowledge of the language continues to develop over the school years (Menyuk, 1977). It has been found, for example, that understanding of the morphophonological rules used to derive "complex" words (Myerson, 1976) and nominal compounds (Atkinson-King, 1973) and of the subject-object relations in sentences with particular complement verbs (Kramer, Koff and Luria, 1972) develops during the middle to later childhood years (approximately 7 to 17 years). Further, just as the ability to relate words phonologically varies among children of the same age, there are individual differences in the rate at which the above described knowledges are acquired. In some instances there is some question as to whether or not such knowledge is achieved by all speaker-listeners of the language since some adults do not evidence the ability to process all the types of structures.

Two aspects of language processing which seem particularly important in oral and written language processing are knowledge of paraphrase and resolution of ambiguity. Knowledge of paraphrase enables the listener or reader to determine whether new information is being presented which is crucial to the interpretation of the conversation or written passage or if the information is old and simply a reaffirmation of previously presented material. This ability allows for efficient processing. Similarly, the ability to resolve the ambiguity of a particular sentence in a conversation or in a passage by using previously presented material. This ability allows for efficient processing. Similarly, the ability to resolve the ambiguity of a particular sentence in a conversation or in a passage by using previously given information or world knowledge is vital to the comprehension of the conversation or passage. The inability to do so might result in an entire passage being misunderstood.

Research results in the studies of the development of knowledge of paraphrase and resolution of ambiguity in oral language indicate that this knowledge is acquired in a sequence over different linguistic structural domains. In a study of the detection of ambiguity by children ranging in age from 6 to 15 years (Schultz and Pilon, 1973) the following sequence of development was observed: lexical ambiguity (multiple meanings of words such as "bank", "bill", etc.) was detected by the youngest children, surface structure bracketing ambiguity (for example, "He sent her kids story books.") only by the middle-aged and oldest children in the population and subject-object ambiguity (for example, "The duck is ready to eat.") only by the oldest children. In a study of comprehension and production

of paraphrase by children aged 5 to 12 years (Hoar, 1977) it was found that successful lexical paraphrase developmentally preceded syntactic paraphrase and that certain types of syntactic paraphrase preceded others.

The two abilities, resolution of ambiguity and paraphrase, are related to each other. Both require the processes of decomposing sentences into one or more basic relations and observing that different surface structures can have the same relations (paraphrase) and same surface structures can have different basic relations (ambiguity). The ability to decompose sentences into basic relations is a requirement for sentence comprehension whether it is an oral or written sentence.

The subjects in the Flood and Menyuk study were 62 native English-speaking fourth grade children aged 9 to 11 years. Stanford reading achievement scores for the children ranged from a low of 42nd percentile ranking to a high of 99th percentile ranking. One quarter of the children's scores were between the 42nd and 62nd percentile, one quarter between the 79th and 99th percentile and one half between these two points. Subjects were asked to read and re-write sentences containing ambiguities and to generate two (or more)underlying sentences and to read unambiguous sentences designed to elicit paraphrase and to rephrase these sentences. Table I presents examples of sentence types used to tap these skills.

Insert Table I about here

There were two principal findings of the study that are germane to the issue of whether or not oral language competences play a direct role in reading. The first finding was that both paraphrase ability and the ability to reduce ambiguity were significantly correlated with reading ability. In addition, there was a significant difference between the percentage of highest readers (80th to 99th percentile) and the lowest (46th to 62nd percentile) readers in their abilities to carry out the reduction of ambiguity task, but only a tendency for highest readers to do better than lowest readers in the paraphrase task. Since a high proportion of low readers in the study were performing as average or above average readers for their grade, it is not surprising that the difference between them and the high readers was smaller in the "easier" reading task. This result fits in well with the notion that status of knowledge of particular structures should affect the ease with which they are processed in reading. A further finding of the study also fits in well with the hypothesis. The options employed to paraphrase or to reduce ambiguity tended to be somewhat different for the highest and lowest readers. The highest readers tended to introduce structural change rather than lexical (or one word) change to a much greater degree than did the lowest readers. This indicates that the highest readers' state of knowledge of paraphrase was more advanced than that of the lowest readers. The percentages of items that were correctly paraphrased with both unambiguous and ambiguous sentences by both groups of children and the percentages of instances of structural and lexical change in both groups are presented in Figures 5 and 6.

Insert Figs. 5, 6 about here

The findings of the above study indirectly suggest that the degree of oral language knowledge of structures affects how well these structures will be processed in reading. The study was not a direct test of the hypothesis, since particular children's oral language knowledge of these structures and then their reading of these structures were not assessed. Such a direct test is now being undertaken with an even wider range of structures that encompass knowledge that is presumably available to children younger than nine years of age. This study should provide information about the automaticity of reading structures that are well learned rather than in the process of being learned.

One can and should raise the question of whether reading sentences is a good test of reading ability. We are all well aware that the reading of passages (or stories) involves not only understanding each sentence in the text, but, also, being able to relate sentences in the text and being able to bring to bear on the whole text world knowledge. The term that has been applied to these latter abilities is inferential processing (Frederickson, 1976). Despite the logic of suggesting that reading does not simply involve sentence comprehension, it also seems logical to suggest that unless each sentence of the text is comprehended to some degree, the inferencing processes required for comprehension cannot be initiated. Further, it is not the case in reading, as it is in oral discourse, that paralinguistic cues (gesture, facial expression and prosody) and extra-linguistic cues (the situational parameters) outside of those given in the text can be used to fill in the comprehension gaps. Bowey (1980) very aptly distinguishes between comprehending

and comprehension. Comprehending is on-line processing of written material. Comprehension is integration and recall of what has been comprehended. Thus, comprehending is required for comprehension. It is in comprehending written material that oral language structural knowledge is crucial.

Implications for the Language Disordered Child

Several years ago it was suggested that the phonological problems of language disordered children varied in direct relation to their syntactic disability (Menyuk and Looney, 1972). That is, children with more severe syntactic problems also appeared to have more severe phonological problems. This position was somewhat altered by later findings that indicated that the problems might be discrete. Within the so-called "specifically language disordered" population there appeared to be different groups of children with different types of problems (Menyuk, 1975). Further study of the phonological processing per se of a population of language disordered children indicated that there were at least three groups: 1) those with severe articulation problems but with no apparent speech discrimination problems, 2) those with severe discrimination as well as articulation problems and 3) those whose problems were less severe, who were apparently following the normal course of development, but who were delayed in development by approximately 3 to 4 years. The second group of children was also markedly delayed in syntactic development whereas the third group, again, was delayed but apparently following the same course of development as that of normally developing children. The children in the first group were said to display normal

syntactic comprehension but no measu[illegible] of their syntactic comprehension had been taken. A fourth gro[illegible]f children was observed but not tested. One sub-population of t[illegible]tter group displayed language production difficulties (phon[illegible]gically and syntactically similar to those of children in the second group discussed. In addition, they had great difficulty in word retrieval in a naming task. The other sub-group in this group appeared to have difficulty in retrieving words, periodically, but they exhibited no overt delay in syntactic development and, in general, spoke fluently.

In a discussion of phonological development and reading (Menyuk, 1976a) it was suggested that the particular language problems of children within this "specifically language disordered" population would cause different types of initial reading problems. Group One might exhibit no problems at all if phonological realization rules were not required and if their syntactic development was, indeed, normal. Group Two might exhibit severe reading problems initially and subsequently and Group Three a delay in reading acquisition. No specific studies have been carried out to test these predictions. However, the reading abilities of at least one of the above populations (a sub-group of Group Four--word retrieval problems) has been assessed in, at least, some studies and probably one other population (Group Three -- delayed language development) has been assessed in many studies.

Wolf (in press) examined average and poor readers' word retrieval abilities in a number of tasks. Both the rate of processing and errors in processing in the two reading groups were assessed in each task. The children in the study were aged 6 to 11

years and were in grades two through five. The over-all findings of the study were that there was a significant relation between reading and word retrieval processes, that there were qualitative differences in the lexical retrieval process of average and poor readers and that naming difficulties might be a good predictor of reading difficulty.

Although the findings of the above study are highly persuasive, questions still remain, as Wolf indicates, as to the nature of the word retrieval problem (i.e. Is it phonological, semantic or both? Is it accessing or generating or both?) in particular children. Given the results of studies that have examined the interaction of structural complexity of written material and difficulty in reading by good, average and poor readers, a further question might be: is word retrieval a problem for all children with reading difficulties or only some? The studies cited previously in this paper indicate that structural knowledge plays a role in reading. The source of difficulty for some children with reading problems may not be lexical accessing or generation per se but, rather, delays in development of oral language structural knowledge or, as in the case of word retrieval, difficulties may lie not in state of knowledge of structures but accessing and/or generating the knowledge available or both.

Still another question that has not been addressed in studies of the relation between oral language knowledge and reading is the question of comprehension versus comprehending. It might be the case, and such cases have been observed, that reading of sentences creates no difficulties for some children. The appropriate linguistic structures

appear to be available and are employed when reading sentences. What does appear to be a problem is that information in passages cannot be integrated and recalled. It is interesting to note that in the Wolf study, although the differences were slight, at ages 6 to 7 years the poor readers did better at the oral reading task than in the silent comprehension task, whereas the inverse was true of the older children in the group; and this difference between the two types of reading became more marked with age. Average readers either scored better on the silent reading task or similarly (at ages 8 to 9 years) on both tasks. The developmental progression appears to be from comprehending to comprehension with the inadequate readers lagging behind the adequate.

Most of the children who have been examined in studies of the relation between oral language processing deficits and reading have not exhibited gross language deficits. There are other populations of children who do exhibit these gross deficits. These children not only have severe language development but, also, severe non-linguistic problems. As Vygotsky stated, written language is a system of signs which designates the system of signs in oral language which, in turn, represents real entities and relations. If some children are unable to categorize the real entities and relations and/or relate them to the oral language system of signs then, without a doubt, they will have enormous difficulty in acquiring written language. Puzzling exceptions to these logical systemic relations exist. A group of presumably autistic children, who do not produce spontaneous speech, have been observed to read words and sentences silently with comprehension. On closer examination of this small group it was found that the children could only comprehend aurally. Despite this latter finding, these children's reading behavior indicates how complex the relations between the process-

ing systems are, and that an inability to overtly produce language need not represent an inability to comprehend spoken or written language.

In summary, the possible nature of the difficulty in oral language development will affect the nature of the reading problem in particular children. Some children may be delayed in the development of semantic-syntactic structures or morpho-phonological structures or both. They will, therefore, have difficulty in reading structures that are unavailable to them, but will be successful in reading those that are available to them. Other children have difficulty in accessing or realizing semantic-syntactic structures or morpho-phonological structures or both, although these structures are available to them. They, therefore, will consistently have difficulty in reading. Still other children have difficulty in integrating and recalling relations over conversations or stories. These children may have no difficulty in comprehending but great difficulty in comprehension. The above are only some of the possible relations that may exist between oral language development and processing and reading in language handicapped children.

Conclusion

Recent research in reading has begun to explicate the complex relation between oral language knowledge and processing. Reading and oral language processing are not mirror images of each other. The information available and the constraints of oral language processing and written language processing differ from each other in several important ways. The two differences touched upon in this paper are 1) in oral language processing contextual information is much richer and 2) memory constraints are more acute in oral language processing. Despite these differences, written language acquisition and processing

are based, but not wholly dependent, on oral language knowledge and processing. Given this fact, children with problems in oral language development will have problems in written language development. The particular nature of their oral language problem will cause different types of written language processing difficulties. Our task is to first determine the nature of the oral language problems of these childrn and then to examine the relation of these problems to written language development and processing in particular cases. Remediation programs based on an understanding of this relation may achieve better results with particular children than any program based on the notion that this is the way that children learn how to read.

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4

PROSE COMPREHENSION: A SELECTED REVIEW OF LITERATURE ON INFERENCE-GENERATION AS A REQUISITE FOR UNDERSTANDING TEXT *

James Flood

Davis (1968) concluded that the following elements affect the comprehension of written discourse: word meaning; inferring from content; following the structure of a passage; recognizing a writer's purpose, attitude, and mood.

In her chapter, B. J. F. Meyer (this volume) presented a list of nine factors drawn from several research studies, including Davis's study, that have been shown to be related to prose comprehension. Since she has presented a rather clear and comprehensive review of the current research related to these factors, this review will be limited to inferencing as it stands apart from the others as a potentially useful measure of prose comprehension.

In recent years several theorists and researchers have begun to define inference in such a way that it may be virtually synonomous with reading comprehension. Some investigators have suggested that the study of inference provides the researcher with a potentially fruitful methodology for examining the intricate and interactive processes of comprehension that B. J. F. Meyer discusses in her chapter. It is argued that inference, like comprehension, occurs in the mind of the reader. Both are human acts of cognition and cannot occur without the interaction of a stimulant (the text) and a human being (the reader). Inference, like comprehension, cannot exist solely within a text, but must involve active processing.

Meyer explains in her categorization scheme that there are author-related and reader-related variables that must be investigated if we are to understand the process of comprehension. This categorization scheme is extremely useful in understanding inference-generation because the source of inferences can be explained in terms of a continuum that parallels Meyer's system. This continuum is based on the premise that inference-generation, like comprehension,

*This paper appears in D. Fisher and C. Peters (eds.) Comprehension and the Competent Reader: Inter-Specialty Perspectives. New York: Holt Rinehart and Winston, Praeger Special Studies, 1981.

is more or less text-related. At one end of the continuum it is more text-related when the reader possesses explicit grammatical structures in an effort to acquire meaning, for example, the resolution of anaphoric elements: "While Sharon was reaching for the salt, she spilled her milk." The reader has to infer that she = Sharon. Although this is a rather low-level inference, it is clear that the reader —not the text—must make the decision. At the other end of the continuum, inference-generation is far less text-related when the reader is required to draw upon previously acquired knowledge structures that are not explicitly stated in the text, for example, "It was a typical January day in Stockholm." In order to acquire the meaning of this sentence, the reader has to have previously known that Stockholm is typically cold in January.

The study of inference—the text conditions that stimulate it and the cognitive structures that make it possible—may serve as an extremely effective tool for understanding the nature of reading comprehension. In fact, it has been argued by many researchers that the ability to generate inferences while processing written discourse is a vital and necessary component in the comprehension of written materials (Bridge, 1977; Bridge, Tierney, & Cera, 1977; Charniak, 1972; H. H. Clark, 1975; Frederiksen, 1977a; McLeod, 1977; Paris, 1975; Reder, 1980; Reiger, 1975; Schank & Abelson, 1975; Trabasso & Nicholas, 1977; Wilson, 1979). In fact, Frederiksen's (1977a) work on inference has emanated from his belief that comprehension (reading) must be considered intrinsically inferential; and Carroll (1972), in attempting to describe "pure" comprehension, noted two closely related processes (perhaps two components of the same process) that are the essence of comprehension: memory and inference.

A series of research studies conducted at the University of Chicago in the 1950s demonstrated the importance of inference-generation for comprehending several different types of texts: expository, poetic, and narrative (Jenkinson, 1957; Letton, 1958; Piekarz, 1954; Swain, 1953). Although these early studies did not directly examine the nature of inference during reading, they provided the evidence for the necessity of inferring to acquire meaning and the impetus for more recent efforts on inference-generation (Bridge, 1977; Flood, 1978; Flood & Lapp, 1977; Frederiksen, 1975a, 1977b; Lapp & Flood, 1978; McLeod, 1977; Schank, 1975).

In an effort to understand inference-generation, it may prove helpful to briefly examine the ways inference has been defined and research has been focused.

DEFINING INFERENCE

Before discussing the parameters of research on inference from the perspectives of human development, semantics, artificial intel-

ligence, and language and cognition, it is important to examine several definitions of inference, analyzing selected research in each discipline.

INFERENCE RESEARCH

Much of the research on inference generation in the field of developmental psychology has focused on the relationships between comprehension and temporal, spatial, logical, and causal relations. Much attention is paid to the prediction of Piaget (1969) that preoperational children are incapable of transitive reasoning because they are unable to isolate and perceive logical relations. However, Bryant and Trabasso (1971) found that children four years old were capable of understanding transitive inferences about quantity when memory limitations were controlled. Further, Brown and Murphy (1975) and Brown (1975a) demonstrated that preoperational children were capable of reordering logical sequences in memory tasks.

In the field of semantics, the study of inference-generation has been a central focus because standard predicate logic cannot explain the complex syntax of language (Grice, 1971; Lakoff, 1971). In the past, semantic theorists have been unable to describe a set of underlying inference rules that were capable of explaining sentence entailments (Fodor, Bever, & Garrett, 1974), and this limitation made it difficult to assign semantic representations to sentences that accurately characterized language users' inference-generation abilities.

Jackendoff (1975) has proposed a more inclusive semantic theory that contends that certain semantic generalizations can be made. In his system, there are organizational principles available to the language user and these principles are related to "one's ability to handle abstraction . . . in understanding new modes of location and being able to generalize the rules of inference to a new system of relations" (Jackendoff, 1975, p. 29).

Although most of the work in semantic theory has been conducted at the sentence level, several researchers have investigated inference across sentence boundaries. H. H. Clark (1975), for example, has postulated a contract between speakers and listeners that assumes that authorized inference can be achieved through a series of describable steps; this assumption is based on the premise that the speaker and listener share common knowledge about the physical world (cf. B. J. F. Meyer, this volume, regarding conversations between writer and reader).

Semanticists have also investigated inference from the framework of speech act theory, classifying inferences as the speaker/listener's conformity/nonconformity to Grice's (1971) Cooperative

Principle and/or in terms of natural logic and transderivational rules (Gordon & Lakoff, 1971). Including inference as part of speech act theory is extremely useful for reading educators because such an extension of generative semantics may bind syntactic and speech act phenomena within a natural logic system, thereby providing a clearer framework in which inference-generation/comprehension can be analyzed and understood.

Artificial intelligence researchers now show concern with building models of the processes involved in comprehending connected discourse and inference-generation. To date, computer models for understanding inferences based on limited world knowledge have been generated (Collins, Warnock, Aiello, & Miller, 1975; B. J. F. Meyer, 1975b), inference recognition in question/answer formats has been created, and strategies for comprehending inference have been designed (Schand & Abelson, 1975). Charniak (1975) and others have been able to program highly applied situations like shopping in a supermarket, thereby demonstrating that context is generated by listeners while they process information. Artificial intelligence theorists hold the position that inference-generation is a phenomenon that occurs simultaneously and sequentially during the processing of texts.

At the present time, several artificial intelligence models dealing with inference are being tested. Schank's (1975) script approach assumes that the world can be divided into a set of goals with a subset of action plans to achieve these goals; Reiger's (1975) algorithm (CSA) approach is based on five event types with links that forward events toward a goal; Reiter's (1975) deductive system of predicate logic includes a natural language component; and Joshi and Rosenschein's (1975) presupposition system of words is embedded in a semantic network.

Cognitive linguists have taken one of two positions regarding comprehension of sentences. The first group, called the linguistic object theorists by Barclay (1973), espouse a deep structure (meaning) in which listeners retrieve and store deep structure relations; all sentences are stored as separate entities. H. H. Clark's (1969) semantic feature theory lends support to this position; he suggests that listeners extract deep structure relations from sentence input and store them in memory by means of binary features. The second group of researchers, called the assimilation theorists, suggest that listeners actively construct an internal representation for sentences. Several researchers have provided support for this position by demonstrating that inference is an aspect of visual and verbal processing in nonverbal research (Baggett, 1975; Horowitz, 1969) and verbal recall (Brown, 1975b, 1976; Loftus & Palmer, 1974). Paris and Mahoney (1974) have extended the assimilation theory in their memory tasks by asking subjects to remember sentences and pictures.

As early as 1932, Bartlett explained discourse understanding in the framework of constructive schema theory. More recently, similar notions have been expressed that schema operate at the word/concept level, the propositional level, and the passage level (Pearson & Johnson, 1978) and that readers construct meaning from texts.

Kintsch's (1974) constructivist position on discourse comprehension suggests that inference serves the function of a complex processor of texts. He explained that readers may not be fully aware of the inferences that they are generating as they read and interpret written material because these inferences are often generated within milliseconds. Many types of inferences from microstructural—for example, assigning intrasentential pronomial referents for anaphora (Larry ate constantly while he read Tom Jones)—to macrostructural —for example, generating episodic sequences—are formulated. Bridge (1977) further details the phenomenon of unconscious inference-generation by explaining that they originate with the schema or schemata that readers bring to the task.

Hayakawa's (1939) often quoted definition that inference is "a statement about the unknown made on the basis of the known" (p. 41), in its brevity, seems to aptly, if humorously, summarize the current definitions of inference. McLeod's (1977) definition of inference advances and specifies Hayakawa's definition; he describes inference as "cognitively generated information based on explicit linguistic and nonlinguistic information provided in the context of continuous written discourse, and which was previously unstated" (p. 6). Neilsen (1977) reflects Hayakawa's and McLeod's definitions when he describes the act of making inferences as "assigning values to missing elements on the basis of what is already known" (p. 12). Bridge (1977) links her definition to text processing when she defines inference as "semantic information not explicitly stated in the text but generated by the reader during inferential processing of the stated propositions" (p. 11). Frederiksen (1977a) combines many of the elements of each of these researchers' definitions: "Inference occurs whenever a person operates on semantic information, i.e., on concepts, propositional structures, or components of propositions, to generate new semantic information, i.e., new concepts of propositional structures. Any semantic knowledge which is so generated is inferred" (p. 7).

Each of these definitions stresses the point that inference takes place in the mind of the reader. In other words, the text exists; the reader infers. Inference, according to these definitions, does not reside in the text; it is the operation that readers perform while they are reading the text or after they have completed reading the text. The text itself serves as a stimulant for inference-generation (McLeod, 1977; Schank, 1975); it can stimulate the reader's previously acquired cognitive structures, background knowledge, and experience (J. R. Anderson, 1976).

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Although inference types have been classified in several different ways in the past, there seems to be a commonality among classifications according to Rubin, Bruce, and Brown (1976) and Frederiksen (1977a). Essentially, the two major classes of inferences are text-specific inferences and text-external inferences that are generated from one's previous world knowledge. Schank (1975) has attended to this dichotomous classification scheme by labeling inferences as forward-looking; such inferences are inferable from input conceptualizations. Kintsch (1974) describes the dichotomy in terms of structures that readers use to generate cohesiveness in texts: macrostructures, elements of passage outline, or the representation of the overall organization of the passage, including superordinate ideas that subsume the information in the microstructures; and microstructures, the passage content, including surface and embedded propositions that reflect logical relationships among propositions.

RESEARCHING INFERENCE

Several researchers have adequately demonstrated that readers infer both during and after reading (Bridge, 1977; Flood & Lapp, 1977; Frederiksen, 1977a; Kintsch, 1974; Schank, 1975). These data raise several researchable questions on the nature of inference and about the methodology for eliciting inference-generation.

Is there evidence that readers infer in a variety of tasks? Flood and Lapp (1977) focused on the question by examining the number of inferences that readers generate when they read separate versions that contain complementary propositions (i.e., a unified, sequentially ordered text), or contradictory propositions (i.e., sequentially and semantically inappropriate). Above-average readers in the ninth and tenth grades read the two texts and immediately recalled as much information as they could. More inferences were generated (2:1) when subjects read texts containing complementary propositions than when reading texts containing contradictory propositions.

Spiro (1977, 1978) and J. P. Anderson (1976) investigated task demands and the effect of those demands on the scope of readers' recall. They found that immediate recall did not always yield inferences presumably because readers were attempting to follow task demands quite explicitly. Instead, it appeared as though subjects were differentiating between new information and inferred (constructively processed) information in order to do what the researcher required. On delayed recall, subjects remembered far more inferred (constructed) information than they had on the immediate recall test.

What are the types of inferences that competent readers might generate from a single text? Can a model of inference-generation in a specific context be considered a first step in designing the inference

research? Several researchers have taken this approach in order to classify inference types that are generated by competent adult readers (e.g., Flood, 1978; Frederiksen, 1977a; Trabasso & Nicholas, 1977). Flood's (1978) study conducted with college freshmen produced the following inferences from a single text:

I. Generating macro-/microstructures

Creating larger or smaller units to accommodate text information

A. Synonymy—narrowly defined category; traditionally acceptable synonyms. This category assumes a high degree of rater reliability. Synonyms can be conventionally acceptable like couch/sofa or text specific
B. Colloquial (figurative) synonymy—acceptable synonym within a specific context
C. Superordinate—recall of the larger unit to which text element belongs
D. Subordinate—recall of small unit of which text element is a part
E. Categorization—generation of larger concept that encompasses several text elements

II. Generating cause

Establishing preceding or succeeding information that can place an event within a framework that can be tolerated by the reader

A. Text proactive—extracting previous information from text that explains events as effects of causes
B. Text retroactive
C. Experience proactive—presumptions about events that preceded and caused the existing event
D. Experience retroactive—assumptions about events that succeeded the existing event

III. Generating dimension

Creating a spatial, temporal manner framework that can be tolerated by the reader

A. Space—placing an event in space (metric or nonmetric)
B. Time—placing an event in time (metric or nonmetric)
C. Motion—recalling movement
D. Manner—recalling specifiable characteristics

IV. Accommodating referents

Establishing appropriate referents for ambiguous text elements

A. Conjunctive—joining two elements
B. Syncretic—merging diverse elements into a single element

C. Disjunctive—recall of one selected element
D. Episodic—sequencing events in a temporally fixed, irreversible order
E. Additive—creating two sources to accommodate diverse information
F. Anaphoric—establishing a pronomial referent "him"

V. Generating case frames

Creating case frameworks for text elements.

VI. Generating attributes

Creating modification for actors, events, places, or dimensions

A. Actors
B. Events—attributing qualifications to events
C. Places—adding specificity to places
D. Dimension—attributing characteristics to dimension

One study with one text is not sufficient to complete a model inference typing, but many studies, conducted with several age groups of readers and with many different texts, will certainly more closely approximate a workable model of inference-generation.

METHODOLOGY FOR ELICITING INFERENCE-GENERATION

What is the effect of context on inference-generation? Several studies have been undertaken to analyze the effect of context on inference-generation. Researchers generally choose to examine a particular facet of inference-generation in many different contextual situations because of the large number of inference variations. Two immediate problems arise from this approach. First, inference-generation is a process that occurs within the reader; text merely serves as a source for inference-generation. Therefore, the mere existence of a particular structure within a specific text (e.g., pronomial anaphora) does not guarantee inferencing on the part of the reader in all contexts. In order to protect against this confounding, researchers should construct texts that contain the entire anaphoric element verbatim. Second, contexts are typically poorly defined, and stories contain so many different elements that it is extremely difficult to specify all the variables that distinguish contexts and produce or inhibit inference-generation.

These two problem areas pose a restriction on research efforts in that they demand the isolation of minute grammatical elements and the creation of highly structured passages that are plausible and interesting to the reader.

Kubilius (1979) isolated certain elements of anaphoric ellipsis (deletion) in written discourse and investigated the ability of three groups of readers (fourth, seventh, and tenth graders) to comprehend and resolve three types of intrasentential ellipses (nominal, verbal, and phrasal) within three categories (single, compound, and selected) in two separate contexts. An example of each ellipsis type is presented below:

Ellipsis	Nominal	Verbal	Phrasal
Single	Robin was running and stopped.	Sharon cried at home and Diane in school.	Allicia took singing lessons on Wednesday and Jake on Friday.
Compound	JoAnn and Sylvia were pushing too hard.	Karen sang and danced in the church and Scott in the rehearsal hall.	Regan hit the ball and struck out in the third inning and Edward in the fifth inning.
Selected	Jerome can handle a dog sled and he can travel for hundreds of miles, and Camille can too.	Priscilla wants to go to Boston and Candy wants to go to New York, but in neither case do I know why.	Emma and Adam wanted to dance together but her father said she could not.

Kubilius found that ellipsis comprehension is related to reading ability and development. However, in her analysis by context, she found that ellipsis comprehension fluctuates according to the category and type of ellipsis antecedent. Efforts such as these seem to have great potential to aid in constructing a useful theory of inference-generation contributions to comprehension.

How can a researcher objectively evaluate inference-generation? Some researchers have used evaluation methods similar to those assessing recognition in the Bransford and Johnson (1972, 1973) studies where readers were asked to read two sentences (e.g., [1] The bird is in the cage, and [2] The cage is under the table). After an interval, readers were shown a third sentence and asked to judge whether the sentence contained a true or false inference (e.g., [3] The bird is under the table).

Several other methods like yes/no responses, true/false responses, probe questions, and visual displays have been used to elicit information about inferencing. While all of these methods provide

some information about the grammaticality of inference and about the developmental trends in inference recognition, they do not provide information about the spontaneous, systematic generation of inferences. In order to elicit this information, more loosely structured methodologies should be employed. However, there are at least two major problems with using freer methodologies. If the situation is completely unstructured, the subject may not infer; and priming (i.e., being asked to infer) reduces the likelihood of spontaneous inferencing.

With these two caveats in mind, several researchers have devised a methodology that yields useful information about the nature of spontaneous inferencing in a recognition format. The methodology consists of three parts: subjects are asked to read texts; subjects are asked to freely recall these texts in an oral or written form; and subjects' recall data are scored by matching the recall with the underlying propositional structure of the text. Unfortunately, these systems are not yet capable of dealing with all of the inferences that readers generate while they are processing texts.

PROPOSITIONAL ANALYSIS SYSTEMS

Turner and Greene (1977), van Dijk (1977a), Frederiksen (1975b), B. J. F. Meyer (1975b), and Kintsch (1974) have designed systems for representing the underlying propositional structure of expository texts. B. J. F. Meyer's (1975b) system is hierarchical, uses case grammar notions similar to Fillmore's (1968) system, and emphasizes case terms to represent the relationship between the predicate and its arguments in propositions. In addition to lexical predicates (Fillmore, 1968), Meyer uses rhetorical predicates (Grimes, 1975) to explain organization and coherence in texts. In B. J. F Meyer's system, text representation resembles a detailed outline that includes every idea, the paratactic relations, hypotactic relations, and neutral relations between ideas. Although her system is capable of accounting for anomalous recall, it is incapable of dealing directly with readers' inferences, but here research has demonstrated the importance of hierarchical ordering of information in texts (staging). Her system also attempts to explain a writer's organization, which then can be used to further elucidate a reader's processing of a text. Her system contributes enormously to our understanding of texts because it is among the first systems to deal directly with passage level information rather than sentential level information.

Frederiksen's (1975b) representation of the underlying structure of texts can be used as a scoring system for analyzing the match between reader's recall and the writer's structure of texts. His system deals directly with categories of inference. Kintsch (1974) and Turner

TABLE 3

Average Number of Propositions Recalled from Two Versions of a Text by Fourth-Grade Students and Their Teachers

Version of Text	Fourth-Grade Dyad		Seventh-Grade Dyad	
	Student	Teacher	Student	Teacher
Third-Grade	11.6	4.3	10.7	9.3
Sixth-Grade	9.5	9.4	16.4	13.9

and Greene (1977) choose not to deal directly with inferences and spatial locations, instantiation of physical details, and causative events, whereas van Dijk (1977a) includes both macrostructural rules (generalization, deletion, and construction) and microstructural rules without dealing directly with inference at either the passage level or the sentence level.

Flood (1978) addresses the concern that researchers have expressed about using propositional analysis scoring systems for examining inference-generation in readers' recall data. They had eight dyads of the best fourth-grade readers and their teachers and ten dyads of the best seventh-grade readers and their teachers read two texts entitled "Road Runner." The original text was written at a sixty-grade level; it was rewritten at a third-grade level as a second text (Evans, 1977). The Inference-Generation Scoring System (Flood, 1978) was also used to score recall, specifically focusing on readers' generation inferences. The Turner and Greene (1977) system was used to score propositions in the respondents' immediate recall protocols with the results shown in Table 3.

As presented in Table 3, both fourth- and seventh-grade students recalled more propositions than their teachers on the third-grade version of the text. Total propositional recall of the sixth-grade version of the text was not significantly different for students and teachers at either grade level.

The total number of propositions recalled by teachers increased by text version. As expected, the recall of fourth-grade students decreased with the sixth-grade version of the text, whereas the recall of each of the other groups increased with the sixth-grade version of the text.

The conclusion that one may draw is that students recalled the propositional structure of the third-grade version of the text better

than their teachers and probably understood that text more fully. If this is an accurate interpretation of the data, such a finding may be explained in one of several ways.

1. Students attended to the text more closely than teachers because students relied more heavily upon the text for information than teachers.
2. Teachers, having previously acquired the information contained in the text, generated their recall from their extratextual experiences.
3. Although students generated more total propositions, one might speculate that teachers actually recalled more of the important, level one propositions than their students. This hypothesis was not confirmed; students recalled as many or more level one propositions as their teachers.
4. The propositional scoring system used for this data cannot adequately capture the most important elements in the differences between teachers' and students' recall. Therefore, it might be productive to use a second scoring system that examines recall for inferences generated by readers.

Therefore, the Inference-Generation Scoring System (Flood, 1978), used for general recall and focusing specifically on inference-generation, was used for analysis of students' recall. The results of this analysis are presented in Table 4.

The results of this analysis indicate that teachers generated more inferences than their students for both versions of the text. The only category of the seven categories in the Inference-Generation Scoring System in which students generated more inferences than their teachers was generating macro-/microstructures for classifying information. One explanation for this reversal in the data is that teachers used macrostructures of previously acquired knowledge when they were processing the texts, thereby generating more inferences than their students.

This analysis does not suggest that one scoring system should replace another. Although the reversal between fourth-grade students and their teachers on the two measures of recall (propositions: students 93 and teachers 34; inferences: students 10 and teachers 21) is highly significant and the pattern is continued on the sixth-grade version of the text, it does not necessarily mean that inference analysis is a better instrument for measuring comprehension than the propositional analysis. Rather, these data seem to suggest that more variables than are commonly measured by a propositional scoring system need to be taken into consideration when interpreting recall as comprehension. An examination of inferences provides a second set of

TABLE 4

Inference Types Generated by Dyads of Fourth- and Seventh-Grade Students and Their Teachers from Two Texts (third- and sixth-grade levels)

Inference Type	Third-Grade Text				Sixth-Grade Text			
	Fourth-Grade		Seventh-Grade		Fourth-Grade		Seventh-Grade	
	Student	Teacher	Student	Teacher	Student	Teacher	Student	Teacher
Macro-/microstructures	7	1	12	22	6	4	22	33
Cause	3	16	17	29	3	9	28	39
Dimension	0	0	3	7	0	1	2	6
Accommodating referents	0	3	7	16	2	4	18	36
Case frames	0	1	3	8	0	1	5	13
Attributes	0	0	1	7	0	3	5	17
Total	10	21	43	89	11	22	80	144

factors that may eventually help to unravel the complexities of measuring comprehension.

A second important issue suggested by the data is the role of readability formulas in measuring text difficulty. In this set of data the sixth-grade version of the passage induces more responses in inferences for each of the four subject groups than the third-grade rewritten version. One would be inclined to think that the third-grade version would induce more inferences among fourth-grade students than the sixth-grade version that is presumably more difficult. One interpretation of the result is that the third-grade version of the text, although it contains the same conceptual elements as the sixth-grade version, elicits far fewer responses because it contains an incomplete organizational scheme and fewer syntactically and logically cohesive elements.

STORY GRAMMAR

In addition to propositional analysis systems that have been used primarily to analyze expository writing, several researchers have designed systems to examine the underlying structure of stories (narration). The designers of these systems generally ascribe to a schema theory view of comprehension. In early analyses of stories, Sawyer (1941) stressed the importance of form (sequence) as a conducive element for comprehension, and Propp (1958) described the structure of a single type of story, the folktale, as a development that proceeds from villainy to denouement by means of intermediary functions, such as rewards and punishments.

More recently, R. C. Johnson (1970) demonstrated a relationship between the linguistic units contained in a story and recall, suggesting that linguistic units were the basis for coding decisions. Prince (1973) developed a set of rules, based on transformational grammar notions, to explain the essential features of a story. Rumelhart (1975) described one of the first story grammars to contain two sets of rewrite rules: syntactic (decomposition of sentences) and semantic (relations among parts). He suggested that a story consisted of an episode, that is, an event and a reaction. An event was defined as a change of state or action. Although his grammar cannot account for certain types of inferences based on world knowledge, it seems quite useful in coding macrostructural inferences. Rumelhart's grammar influenced Thorndyke (1977a) and Mandler and Johnson (1977) in the design of their grammars. Thorndyke's (1977a) grammar differed from Rumelhart's in its focus on goal structure; his research showed that stories with the clearest goal structure were the stories that were most easily and fully understood by readers.

In their grammar, Mandler and Johnson (1977) deleted semantic rewrite rules and added an analysis of the moral in the story. They focused on the aspects of an episode that most affect readers; for example, they found, while attempting to account for background knowledge as well as story grammar rules, that causal episodes are better remembered than temporal episodes.

Stein and Glenn's (1977) approach, in many ways, is similar to Mandler and Johnson's approach. Their grammar consists of rules that define the units in a story and the relationships among the units; it is capable of explaining actions and states in stories. Glenn (1978) found that event and consequence are the most important components of the story structure, and Stein and Nezworski (1978) found that story memory is directly related to the match between story structure and ideal structure.

A brief analysis of three applications of story grammar in school settings demonstrates the potential usefulness of this research. Three recent efforts point out the importance of experience and its relationship to pedagogical applications. Bruce (1978) reported that children who had limited experience listening to well-formed stories, like those appearing in basal reading programs, found these stories extremely difficult to understand. Stein and Baker (1978) reported that children's ability to interpret well-formed stories and inability to interpret poorly formed stories was related to their familiarity with story structures. Kintsch and Greene (1978) found that story schemas were culture bound. Some students in their study omitted whole sections of unfamiliar, culturally-different stories during recall.

Do readers bring certain orientations/schema to their reading that affect inference-generation? Several studies investigated the use of graphic and/or verbal context (labeling, titles) prior to testing to study the effects of prior orientation on recall (Dooling & Lachman, 1971; Frederiksen, 1975a; Schallert, 1976; Sherman, 1976). These studies used ambiguous texts (sentences and passages) to investigate the effects of orientation on inference and provided evidence in favor of the constructivist notion that readers use macrostructural schema to generate inference about text.

Recently, Flood and Menyuk (1979) investigated fourth-grade students' ability to paraphrase and disambiguate sentences and short passages without the benefit of content orientation. In addition to investigating the issues of reading (processing) and writing (production) abilities, the researchers were investigating whether or not fourth-grade children had acquired a schema for ambiguity (riddles). It was argued that the ability to paraphrase and disambiguate are essentially inferential abilities. One must infer to acquire the gist of the sentence or passage, and reworking the gist is precisely what paraphrasing is.

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Research has indicated that knowledge [illegible]y and paraphrase in oral language are acquired develo[illegible]n a study of detection of ambiguity by children ranging in [illegible] 15 years, Schultz and Pilon (1973) found that lexical ambig[illegible]equired firs (e.g., homophonous words like pear and pair or m[illegible]neaning words such as bank, bill), then segmentation of syn[illegible]nits ("He sent her kids story books"), and finally, relational (dee[illegible]tructure) ambiguity ("The duck is ready to eat"). Regarding comprehension and production of paraphrase by children aged 5 to 12 years, Hoar (1977) found that lexical paraphrase preceded syntactic paraphrase. She demonstrated that some children as old as 12 we[illegible] unable to generate syntactic paraphrases with all types of syntac[illegible]tructures. Thus children at the earlier ages were able to substi[illegible] lexical items with synonomous terms (thin/skinny), but even the oldest children were not all able to understand the relation between active and passive sentences ("The dog was chased by the cat" or "The cat chased the dog"), dative-movement sentences ("John gave Mary the book" or "John gave the book to Mary"), and sentences with fronting ("I left the house yesterday" or "Yesterday, I left the house").

Clearly the two abilities, resolution of ambiguity and paraphrase are related. Both require the decomposing of sentences into one or more basic relations and observing that different surface structures can have the same basic relations (paraphrase) and same surface structures can have different basic relations (ambiguity). The ability to decompose sentences into basic relations is a requirement for sentence comprehension whether oral or written.

Four types of ambiguous sentences have typically been examined as shown below. The four stimulus types of ambiguous sentences were

Type	Stimulus
Surface structure ambiguity (bracketing)	The fat farmer's wife cooks all day long.
Lexical ambiguity	Bob's speech made the teacher angry.
Pronominal ambiguity	John played with the dog while he was eating.
Deep structure ambiguity	Thomas walked home, his bookbag held over his shoulder and rubbing his elbow.

In general, Flood and Menyuk (1979) showed that fourth graders found pronominal ambiguity easier to disambiguate and surface struc-

ture most difficult, while Schultz and Pilon (1973) found that both lexical and surface structure ambiguities were the first and most easily resolved by the younger children. The apparent conflict may be accounted for in terms of children's growing understanding of word meaning. When confronted with paragraphs, Flood and Menyuk found that fourth graders most easily disambiguated deep structure and lexical ambiguities.

These studies detail some of the patterns in the acquisition of grammatical structure that may be necessary for the development of a macrostructure for dealing with textual ambiguities, but many fourth grade children apparently did not have a schema for disambiguating unclear elements in some sentences and most passages.

SUMMARY

This chapter has focused on the phenomenon of inference-generation during the processing of written discourse. Inferencing was described by Davis (1968) as an important part of reading comprehension and others in this review claim that inference-generation is critical for comprehension and may be considered comprehension in certain contexts.

This brief and selected review of current studies on inference-generation abilities presented perspectives from developmental psychology, semantics, artificial intelligence, linguistics, and cognition that hopefully provide a framework for understanding the current concerns about inference among reading educators. While it may not be necessary or desirable to have a standard definition of inference in the domain of reading education, it is argued that any reading comprehension study focusing on inference-generation should contain a clear description of the parameters of inference being examined.

The understanding of inference-generation—the stimulants that affect it and the cognitive structure that promotes it—will hopefully lead to a more thorough understanding of the way in which readers comprehend written materials. The examination of inference will provide researchers with an effective methodology for examining several important factors in the interactive processing of texts. By focusing on inference as a mirror of comprehension, researchers will be able to examine several variables: text-elements that stimulate inference-generation; reader's cognitive structures that operate on explicitly stated information to produce inferences; and background knowledge and experiences that readers bring to the task of reading. An appreciation of the fact that all good readers use previously acquired knowledge and experiences to infer meaning from texts enables us to more accurately assess the factors that interact in a reading

episode to produce meaning. This interaction is very closely related to inference-generation.

Five questions about the nature of inference-generation and the precision of studying inference-generation were raised. Researchers have found evidence for the following assumptions: readers infer in many task situations; readers construct (infer) meaning from oblique texts; and context and orientation play an important role in the types of inferences that readers generate. Because an overall model of inference-ability is not yet available, additional developmental research on aspects of inference-generation, including the role of changing contexts on inference-generation, would be useful. Answers to the questions of how to elicit spontaneous inferences and how to measure inference-generation continue to be forthcoming making viable models imminent.

That inference is a function of one's ability to paraphrase, to acquire the gist of a sentence or text, seems intuitively reasonable. However, a comprehensive model of paraphrasing ability, like comprehension ability, has yet to be designed. Future inference-generation research will be most productive when it focuses on the generation of structure that is capable of explaining how texts are processed and stored in memory and how and why inference, as vehicles of this process, are made.

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Language Development and Reading*

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Outline

I Introduction

II Oral Language Development

III Possible Relations to Reading

IV Some Preliminary Data

V Conclusions

Introduction

In a paper concerning the use of language to control and plan motor behaviors Wozniak (1972) presents the following paradox: how can we tell ourselves something we don't already know? In this statement Wozniak is presenting the dilemma of researchers who attempt to explore the relation between "cognition" and "language." Although, in general (there are exceptions), the child doesn't talk about things she doesn't know about, it is clear that talking about what one knows about, either to oneself or aloud, modifies what is known. It has become evident to researchers in this area that simple-minded notions about dependency relations between non-linguistic cognitive development and linguistic cognitive development do not provide adequate explanations of development in either domain or developments that depend on interaction of the two domains. (Menyuk, 1980)

How can one read what one does not know in oral language? would be the statement of a paradox similar to the one cited above concerning the relation between cognition and language. Researchers who are concerned with the relation between oral and written language development have become increasingly uncomfortable with the simplistic notion that written language processing is wholly dependent on oral language knowledge. The reading researcher is interested in obtaining a detailed description of the relations between oral and written language development just as the developmental researcher is interested in determining, in detail, the relations between the non-linguistic and linguistic domains of development.

In this paper I will present some notions about possible relations between developments in the two domains of oral and written language. I will do this by first discussing the findings of studies of oral language development that seem germane to the issue. Some hypotheses concerning the relation between the two domains of development and some data directly assessing the proposed relation will then be reviewed. Finally, some conclusions will be

drawn about possible relations. These will, of necessity, be highly tentative conclusions since detailed exploration of relations between the domains of development are still in their infancy stage.

Oral Language Development

The latest (over the past ten years) studies of oral language development have seriously challenged the notion that the child knows most of what she has to learn about the structure and use of oral language by the age of five to six years. Before that time it was thought that "almost" adult competence in, at least, phonological and syntactic knowledge was achieved by that age (McNeill, 1970). More recent studies indicate that developmental changes in knowledge of syntactic and morpho-phonological rules continue to occur after age five and, indeed, throughout the school years. Therefore, it is not the case that the child on entrance to school "has" a fully mature grammar of the language which might then be available for processing all types of written material presented. There are areas of structural knowledge which remain to be acquired.

Despite the above statements, the normally developing child does know a great deal about the language on entrance to school and has been communicating effectively with others in her environment for a number of years. This substantial knowledge exists in all aspects of language: pragmatics, semantics, syntax and morpho-phonology (Menyuk, 1977). Further, and importantly, this competence in communication has been achieved by all normally developing children in their native language regardless of socio-economic status (Ervin-Tripp, 1971). Emphasis has been placed on the term "in their native language" since varying degrees of competence are to be expected in use of a second language.

The questions that arise, then are: what do most children know about language at age five and what are they yet to learn over the school years? and what differences in language knowledge exist among normally developing

children that may affect acquisition of written language? The remainder of this section will attempt to deal with these questions.

It was stated above that normally developing children at age five have acquired substantial knowledge of all aspects of language. What children appear to know in each of these aspects will be discussed separately since, it will be argued, each aspect of oral language knowledge plays a differing role in the acquisition of written language knowledge.

The pragmatic rules of a language are concerned with how to convey the purpose of the utterance; that is, to assert, command, request, question, negate, etc. These purposes have been termed "speech acts" (Clark and Clark, 1977). Another aspect of pragmatic competence is knowledge of how to engage in conversation: how to take a turn, how to initiate and respond appropriately in a conversation. This latter requires the ability to keep track of what is being said and has been said in the conversation as well as physical parameters that are crucial to clarity of communication. Cultural rules of how to say what to whom under what circumstances (for example, rules of politeness) must also be learned.

Pragmatic competence, then, involves both knowledge of structural rules and rules of use of language that require both on-going memorial abilities (keeping track in conversation) and, in some instances, retrieval from memory of past exchanges. In addition, particular cultural rules for exchange must be kept in mind and these require both situational and addressee appraisal for appropriate communication. A great deal of what makes for pragmatic competence depends on inferencing abilities (for example, interpretation of paralinguistic cues of intonation, stress and gesture and keeping in mind referents or deducing referents from situational cues) rather than merely understanding the utterances produced.

Although the child at age five communicates very effectively with members of her own linguistic community and knows how to generate the speech acts

listed above there are any number of communicative situations the child has yet to learn about (for example, how to converse with a teacher), a number of domains of discourse that the child has relative unfamiliarity with (for example, formal mathematical and scientific notions) and a number of speech acts that the child has yet to engage in (for example, commissives or argumentation based on causal, conditional or hypothetical physical conditions). Development of these abilities will continue over the school years. Development of these abilities is highly dependent on further experience. The domains of discourse in the home and classroom and the written materials children are exposed to are the experiences which will broaden pragmatic competence. Domains of discourse are also a cricial source for acquisition of word knowledge.

Semantic and syntactic knowledge is knowledge of word meanings in the context of varying structures. For example, comprehension of the sentence "The boy kissed the girl." requires knowledge of the meaning of each morpheme in the sentence (boy, kiss, ed, girl) and the relation between morphemes (the modifies boy and girl; the boy is the actor and the girl the object; ed modifies kiss).

By the time the child enters school she has acquired a vocabulary of some two to three thousand words and is using these words in structurally complete utterances. The child's acquisition of word knowledge is derived initially from physical contextual information and then from the linguistic contexts in which words are used. An unfamiliar word such as "avocado" might be, at least, partially identified in a context such as "He likes avocadoes in his salad." The two areas of development, semantic and syntactic, are mutually interdependent. In addition to the child having acquired a sizable lexicon by the time she enters school she is also able to understand a number of structurally different types of utterances which allows further interpretation of old lexical items and interpretation of new lexical items.

These new lexical items allow, in turn, acquisition of knowledge of still other syntactic structures. It should be stressed that comprehension of the meaning of utterances is dependent on both lexical and syntactic knowledge.

The further developments of word knowledge that occur after entering school are, obviously, an increase in the size of the available lexicon and, less obviously, changes in the meaning of the words in the lexicon. This developmental change takes place in two ways. One way is an increased hierarchical organization of words which provides connections between words. For example, red, white, blue, etc. are organized into the category of color and have the same privileges of occurrence in sentences; man, woman, boy, girl, etc. are humans; plants, animals, humans are living things; run and jump are action verbs; believe, think, know are stative verbs. A second direction in which word knowledge grows is the understanding that words can have more than one meaning and play different roles in sentences.

Knowledge of the syntactic possibilities in the language also grows. Knowledge of types of structures such as double function relative clauses ("The cat that the dog chased ran into the bushes."), complement ("Joe promised Bill that he would go.") are acquired over the school years and beyond. Further, just as in semantic development, not only is further knowledge acquired but the depth of knowledge changes as well. The child becomes aware of structural paraphrase possibilities in the language (there is more than one way to say the same thing) and, therefore, connections between structures. The child, also, becomes aware of ambiguities (there is more than one meaning that a sentence can have). Again, these developments continue over the school years and beyond.

By the time the child enters school she is able to discriminate between all the phonological segments in the language that are crucial for word identification and can accurately generate most of these segments with the

possible exception of strident clusters (/str/, /spr/, etc.). In addition the child is able to apply plural and tense markers appropriately, although she may still be having some difficulty with strong nouns ("feet") and, more frequently, strong verbs ("brought"). Despite this clear ability to accurately perceive and produce phonological distinctions in the language, many children are unable to segment words into phonological components at this age. Others have difficulty in rhyming words ("cat", "hat", "bat") or generating words that have the same initial sounds ("bat", "ball", "boat"). These abilities develop over the early school years and, as with other areas of development, are probably enhanced by engaging in the reading acquisition process. Thus, although children tend to group words on the basis of their surface structure (phonology) rather than meaning at four years of age (in the series "cap", "can", "hat"; "cap" and "can" are grouped and not "cap" and "hat") and to provide "clang" responses to unknown words on a word association task, there does not appear to be a conscious awareness of phonological segments as belonging to a category among all children on entrance to school.

A further development that takes place over the school years in the morpho-phonological aspect of language is acquisition of knowledge of 1)rules of stress to create different syntactic categories (pérmit, permít) and to create nominal compounds (bírdhouse) and 2) rules of phonological change to create different syntactic categories ("sane - sanity", "discuss - discussion") These phonological developments are like developments in other aspects of language. Some of these developments require acquisition of new knowledge (derivational rules for complex words such as "indisputable") and other developments require reorganization of old knowledge; observation of similarities in sets of categories (segmental and syllabic "paraphrases"). Unlike category developments in other aspects of language many of the segmental and syllabic categorizations the child must make are unrelated to meaning. The categories /b/ or /t/, /ub/ or /ut/ carry no meaning.

The above findings indicate that, although the child at age five or six appears to be a highly competent speaker-listener of the language, further developments occur in all aspects of language over the school years and many of these developments, as we shall argue, seem particularly important for the reading acquisition process. Figure 1 presents a summary of these further developments in each aspect of language. In all aspects of language new categories of language knowledge are acquired and this knowledge is applied in new contextual and linguistic domains. For example, pragmatic discourse knowledge is applied to an increasing number of differing situations, lexical knowledge is used in an increasing number of areas of inquiry, semantax knowledge is applied in increasingly different and abstract contexts, phonological knowledge is applied over increasingly longer and more complex words. In three aspects of language (lexicon, semantax and phonology) relations between a paraphrase of categories is observed. In two (lexicon and semantax) multiple meanings are acquired.

Insert Figure 1 about here

The above data address the first questions posed: what do children know about language on entrance to school and what are they yet to learn? The second question (what differences in language knowledge are there among normally developing children which may affect reading acquisition?) is a more difficult question to answer since it is not entirely clear exactly what children have to know about language to acquire reading. There are, however, some obvious differences in language knowledge which affect the reading acquisition process. Clearly, different children develop at different rates. Theoretically, then, different children aged five or six years, will bring to the reading acquisition process different sets of knowledge about the varying aspects of language. As we will argue below, these differences in sheer language knowledge might certainly affect what

material can be read and understood but it is not clear that such differences should affect the reading acquisition process per se when the material to be read is very simple structurally and lexically.

Another source of difference which might seriously affect the acquisition process itself are differences in the content and organization of a child's language knowledge. It has been argued that the orthography is indifferent to dialectal or native language variation (Menyuk, 1976). All readers are required to translate the orthography into their lexical-phonological representations to access word meaning. However, if a "double" translation is required (that is, from orthography to a second language and then to the native language) then the task may not only be more difficult but also depend on the accessibility of such translations to the reader (Chu-Chang, 1979). The ease with which these latter children engage in the acquisition process may, therefore, be very dependent on the degree of familiarity these children have with the lexicon of the second language. The organization and content of their knowledge of other aspects of language will affect how they continue to read.

Possible Relations to Reading

It was stated above that sheer amount of knowledge about language as indicated in spontaneous language production does not appear to be the factor that crucially distinguishes between good, average and poor readers who do not have a marked difficulty in oral language. Weak, although significant, correlations have been found between such measures as vocabulary and sentence length and reading performance at grades one and two (Bougere, 1969). It is, of course, during the early years of school (grades one through three) that reading materials are carefully controlled and do not seriously challenge the language knowledge acquired by most children at ages five through seven or eight. As discussed below, this does not continue to be the case throughout the school years. It was also stated that speakers

of another native language might have difficulty in acquiring reading because of, possibly, being confronted with a double translation task.

The statements above are meant to suggest that the relation between oral language knowledge and reading differs depending on the nature of the reading task and over time. They are further meant to suggest that oral language knowledge differences between good, average and poor readers may vary and that particular differences will affect the reading behavior of the individual child initially and over time.

What will be argued throughout this section is that different aspects of oral language knowledge and state of knowledge of these aspects are required in the processing of written material over time. It will also be argued that with time or maturation these relations undergo a change. That is, it will be suggested that Vygotsky was partially correct when he stated, " . . . written language consists of a system of signs that designate the sounds and words of spoken language, which in turn are signs for real entities and relations. Gradually this intermediate link, spoken language, disappears and written language is converted into a system of signs that directly symbolize the entities and relations between them." (Vygotsky, 1978, p. 106). Vygotsky's statement implies that at the beginning of the reading acquisition process reference is always made to a linguistic representation of an orthographic category (letter, word, sentence). This requires bringing to conscious awareness these linguistic representations. But, as the process becomes mature it no longer requires bringing to conscious awareness these linguistic representations. The process becomes automatic. My first statement implies, however, that if the orthography represents linguistic entities and relations that are not easily accessible to the reader then the process does require bringing these entities and relations to conscious awareness. Therefore, orthographic representations of well learned structures will be read automatically, representations of less well learned

structures will require conscious awareness of their oral language representations and representations of structures that have not yet been acquired will be incorrectly read because of approximations made to the text based on structures that are available (Menyuk, 1980, in press, a).

The three categories of reading task to be considered in this discussion are: acquisition, comprehending and comprehension. The first and initial task, acquisition, has been viewed in two ways; as a decoding or word attack task or as a procedure to discover how language is represented in orthography. There is a vast array of data collected by Goodman (1976) supporting the fact that children during the earliest and later stages of reading make guesses about the words they read based on the linguistic context of what they are reading and extra-linguistic knowledge. There is an equally impressive array of data which indicates that the first step in accessing the lexicon in reading is via translation of the orthography of the word into the phonological representation of that word. These latter data also suggest that the process of translating the orthography into a phonological representation requires bringing to conscious awareness this phonological representation by relating the letters of the words to sound segments and reconstituting them (Liberman, Liberman, Mattingly and Shankweiler, 1978). These researchers find, for example, that there is a significant correlation between the ability of young children to count the number of segments in CVC (consonant - vowel - consonant) words and reading achievement during the early grades.

It is not clear that these two positions are mutually exclusive even at the beginning stages of reading except when words are presented in isolation. Then accessing must be through phonological representation. But when the child is reading a sentence the sentential context in conjunction with minimal orthographic-phonological cues may elicit guesses that are correct in terms of semantic field (for example "toy" for "train") or

partially correct phonologically but incorrect semantically (for example "fort" for "fortune"). (These examples are taken from Goodman's article). These so-called mis-cues may be corrected by reference to phonological representations of orthography or by reference to both phonology and semantics. Since it seems to be the case that being taught to read helps to develop awareness of phonological segments and that, in fact, illiterate adults have difficulty in segmenting words (Liberman, et. al., 1978), it may be the case, then, that semantic representations may interact with phonological representations to store in memory relations between orthographic representations, phonological representations and meanings during the beginning of the reading process. When this does occur for a particular word then the reading of the word becomes automatic and no longer requires bringing to conscious awareness either the phonological or semantic representation of that word. A parallel processing procedure would be required initially in which both phonological and semantic representations must be brought to conscious awareness. At the beginning stages of reading a word, or in the process of reading acquisition, then, phonological segments and semantic features must be brought to conscious awareness. If the child has yet to achieve the ability of phonological segmentation and reference to orthography, then learning to read will be a difficult process. However, if the child is able to relate orthography and phonology but has no semantic representation for the product or has difficulty in accessing this representation, there would be equal difficulty in reading. There are two populations in whom this latter difficulty can be observed; children with so-called word retrieval problems (Wolf, in press) and children required to read a language which they have little familiarity with. Gleitman and Gleitman (1979) note that the difficulty in word segmentation and reconstruction continues to distinguish successful from unsuccessful readers through twelfth grade. They suggest that poor readers have acquired a logography; a set of memorized words,

and that, therefore, as the list of words to be read rapidly exceeds this finite list the reader who is unable to apply word attack skills will flounder. It might be the case, however, that word attack skills, alone, are not the only requirement in comprehending written sentences. Further knowledge of other aspects of the language are required when the materials to be read are sentences and not simply words.

Listening to and comprehending sentences clearly requires not only phonological accessing but, also, lexical, syntactic and pragmatic knowledge. For example, the listener when attempting to understand a double function relative clause such as "The horse raced past the barn fell." needs to have knowledge of the syntactic possiblities of the language, the meaning of words, a strategy for determining clause boundaries (Bever, 1970) and the ability to keep in mind the whole sentence in order to comprehend it. One would assume that reading and comprehending sentences also calls upon each and every one of these aspects of linguistic knowledge and not simply translation of orthography into phonology. One can also assume that the child's knowledge of all these aspects of language change with maturation.

At the beginning stages of reading acquisition the materials that children are required to read are usually simple sentences that are well within their level of syntactic and lexical knowledge. Additionally, the subject matter is usually within the child's experience. The beginning reader reads about topics and relations that she is familiar with and which, usually, meet her pragmatic expectations. Some examples, again taken from Goodman (1976), make the point clear. For the beginning reader the following is provided:

> "Jimmy said, "Come here, Sue,
> look at my toy train.
> See it go."

For the older reader the following passage was read:

> "So education it was! I opened the dictionary and picked out a word that sounded good."

The relative lexical and syntactic complexity of the two passages is evident. Further, in the first passage how Jimmy is talking to Sue and what he is talking about seems reasonable if not an exact representation of what might be said. The assumption being made is that it is "easier" for the beginning reader to read language that is composed of linguistic categories and relations that the young child can easily process. Thus, at the beginning stages of reading the principal requirement is translation of word orthography into phonological and semantic representations. However, after this task has been achieved (it is clearly not a minimal one for some beginning readers) the reference to lexical entries and sentence relations in the material are probably automatic since the words are well known and are in sentence structures that are well learned. Comprehending written sentences of these simple forms becomes an automatic process and does not require bringing to conscious awareness the relations being expressed.

Some children who learn how to read the materials presented to them in the first through third grade encounter difficulty in the fourth grade. This difficulty has been attributed to the sudden requirement to read materials that are no longer carefully controlled for vocabulary and structure. It is probable that the problem lies not in the nature of the reading material but, rather, in the reader since a large number of children do not find this change in the structure of material a source of difficulty. The problem may lie in the fact that while the child is learning more about the structure of language (and as we have indicated previously, the child learns a great deal more about language over the school years than she knew before) she is, simultaneously, being confronted with more complex written material. This material is more complex in all structural aspects of language (lexicon, syntax and morpho-phonology) and is also less familiar in terms of topic.

A possible source of difficulty for some readers might then be in comprehending sentences that contain structures that are relatively unfamiliar.

What appears to be universal in the reading process is that the process initially requires the ability to bring to conscious awareness the structural categories and relations in language and that with time the process becomes automatic. But automaticity requires easy availability of the structures being read. If these categories and relations are not easily accessible to the reader (be they morpho-phonological, lexical or syntactic) the reader encounters difficulty in comprehending the sentences read.

Reading a passage or story requires still other linguistic skills. These latter skills are needed in comprehension of the content and interpretation of connected sentences. The ability to integrate information across sentences and retain (remember) crucial information is required. The task is somewhat similar to listening to and comprehending a story or oral lecture. In this latter task verbatim recall of sentences becomes impossible and listeners, rather, attempt to select, integrate and organize linguistic information across sentences (Clark and Clark, 1977). The reader also must select, integrate and organize linguistic information. Varying descriptions of these abilities have been used. For example, some researchers have described organizational ability as employment of a story grammar (Stein and Glenn, 1979) when the context is a story. Other researchers have described selection and integration of materials as inferencing abilities (Frederickson, 1976).

In summary, the processes employed by the reader depend on the structure of the material to be read. Reading of words engages different aspects of language knowledge from that of reading of sentences which, in turn, engages different aspects from that of reading of passages. The different types of knowledge required in reading are presented in Figure 2.

Insert Figure 2 about here

The highest level of processing (passage) requires some processing at other

levels. The processing is parallel and, therefore, requires some information from all levels simultaneously but just as in oral language processing, does not require complete information from all levels.

Further, the linguistic knowledge of the reader changes with development as does the material she is required to read. As the child's linguistic knowledge increases and as her linguistic processing abilities mature the complexity of the materials to be read increases. In many instances these two developments are congruous but in some instances they are not. Still further, a reciprocal arrangement appears to exist between having linguistic knowledge available, bringing it to conscious awareness and reading. That is, the process of reading requires the intuitive language user to initially bring to conscious awareness the categories and relations in language and, therefore, learning how to read and reading provide new insights into the structure of language to the language user. However, and importantly, if the reader does not have oral language knowledge of certain categories and relations available they obviously cannot be brought to conscious awareness for the reading task. The most obvious level at which awareness is required is the morpho-phonological and lexical level. Indeed, it has been suggested that difficulty at this level alone can account for most of the difficulty of poor readers from childhood to adulthood (Gleitman and Gleitman, 1979). It has been suggested here that availability of categories and relations in all aspects of language contribute to comprehending and comprehension of written material.

The above statements are hypothetical. There is very little evidence available to support the above position. There is a wealth of direct evidence concerning the importance of phonological awareness in acquisition of reading. There is, however, also a wealth of evidence, based on miscues in reading, to support the notion that other aspects of language are actively used in the reading process. In the next section some additional evidence will be

presented to support the notion that awareness of structural relations in sentences play a role in the reading process.

Some Preliminary Data

There have been two studies which have, in differing ways, examined the relation between syntactic development and reading. Bowey (1980) found upon examining the ability of third, fourth and fifth grade readers to read differently structured sentences aloud, that significantly more errors occurred with complex sentences as compared to simple. For example, children had more difficulty with passive and relative clause sentences than they did with active and question sentences. Goldsmith (1980) found that children aged 9 to 11 years had greater difficulty in comprehending orally and in written form relative clause sentences as compared to conjoined sentences. The dyslexic children in this population had more difficulty with relative clause sentences than did the non-dyslexic children but both groups of children had increasing difficulty with more complex types of relative clause sentences than with simpler types. For example, the children found sentences such as "The boy who kissed the girl ran away." easier to understand than sentences such as "The cat that the dog chased ran into the house."

These data indicate that relative unfamiliarity with structures leads to greater difficulty in reading them aloud and greater difficulty in comprehending these sentences in either oral or written form. It seems reasonable to suggest that the further syntactic developments that occur over the school years in oral language development can account for the differences found in reading performance with different structures. These further developments are either more delayed in a dyslexic population (i.e. the more complex structures are simply not available at the same age) or the processing skills required for comprehending these more complex structures are not available to the dyslexic children. In either case, and with both normal and dyslexic readers, there seems to be a relation between syntactic oral language knowledge and reading

performance.

Oppenheim (1981) examined the oral linguistic processing skills of average kindergarten children and their later reading performance. Two aspects of language processing were examined; phonological and syntactic. She found that the ability to segment words and the ability to comprehend sentences with embedded structures was significantly predictive of later reading performance. The two linguistic processing behaviors appeared to be related in that those children with better segmenting abilities were also those children who were better able to comprehend sentences with embedded structures. These latter findings may indicate that some of the processing abilities required at, at least, the word and sentence level are the same and that these same processing skills are required in reading as well as listening.

Two studies have examined the morpho-phonological processing of complex derived words. Myerson (1976) examined the ability of children aged eight to seventeen years to derive words from nonsense stems by the application of appropriate phonological rules (for example, "glanity" from "glane" using the model of "sane" - "sanity"). Myerson found that there were developmental changes in the ability of children over this age range to apply the appropriate rules and that some children, at age seventeen, could not apply all the rules required in the task. Myerson also found that there were significant differences between poor, average and good readers in their ability to apply these rules.

Loritz (1981) studied third and fifth grade children's ability to read aloud real and nonse polysyllabic words. The question being examined was the possible relation between the ability to decode polysyllabic words by application of appropriate stress rules and reading and spelling abilities. Loritz found developmental differences between the grades in application of simple (left-right) versus more advanced (right-left) application of rules. Among the fifth graders, also, there were differences in application of rules.

Age alone did not determine ability to apply appropriate rules. Acquisition of advanced rules was found to be significantly correlated with standardized measures of vocabulary, spelling and reading.

Just as syntactic knowledge increases over the school years so does morpho-phonological knowledge. The decoding or word attack skills required with polysyllabic words which have undergone derivational changes from base stems demand more than the ability to segment base words and relate them to phonological representations. Both of the above studies provide evidence that those children who have acquired more advanced knowledge of morpho-phonological rules are also the more advanced readers for their age and/or grade.

Most of the studies discussed thus far indicate that level of phonological and syntactic knowledge affects how written linguistic structures are processed. However, it was previously suggested that it is not simply how much one intuitively knows about the differing aspects of language which predicts reading performance but, rather, that the degree of knowledge of any particular structure, as indicated by being able to bring it to conscious awareness, predicts how well that category or relation will be read. What has been found, developmentally, is that children appear to intuitively comprehend and produce linguistic structures before they achieve the ability to judge whether a sentence is correct or incorrect and they achieve this latter ability before they are able to correct incorrect forms. It has also been found that the most sophisticated behaviors (judgment and correction) occur with differing structures as the child matures. Intuitive knowledge of varying structures precedes conscious knowledge of these structures. The most sophisticated form of knowledge of structures is being able to bring this knowledge to conscious awareness. However, this ability does not appear for all structures at a particular period of development. The ability to bring differing structures to conscious awareness depends on how well the child has learned particular structures. For example, at the time when a child can

bring to conscious awareness tense and plural markers she may still be unable to bring to conscious awareness the relations expressed in center-embedded relative clauses (Menyuk, 1977). As indicated previously, reading aids in bringing structures to conscious awareness but the structures must be there for reading to aid in awareness.

All of the oral language tasks and, by definition, the reading tasks described above required bringing to conscious awareness knowledge of varying syntactic and morpho-phonological structures. However, none of the above studies explicitly examined meta-linguistic awarenss of particular structures and the ability to read these same structures. A study undertaken by Flood and Menyuk (1979) indicated that ability to read structures might be dependent on awareness of structures. Developmental data from studies of oral language processing abilities had indicated that the ability to paraphrase occurs during the middle childhood years and that, further, the ability to paraphrase lexically occurs before the ability to paraphrase structurally. The same sequence of abilities appears when the task is one of detecting ambiguity but the ability to paraphrase precedes the ability to detect ambiguity in the lexical domain and the same sequence is observed in the structural domain. Using these data as a basis, Menyuk and Flood examined the ability of fourth grade average and above average readers to read and paraphrase lexically and structurally, to read and detect lexical and structural ambiguities and to paraphrase the two (or more) underlying meanings of the ambiguous sentences. It was found that the ability to carry out the two types of tasks was significantly correlated with reading ability. It was further found that there were differences between average and above average readers in terms of the complexity of the structures they could paraphrase and the options for paraphrase they selected. The above average readers could more easily deal with structural paraphrase and more frequently selected to paraphrase by structural

rather than lexical means than did the average readers. The data indicated developmental differences between average and good readers in meta-linguistic awareness of the same structures.

To more directly test the hypothesis, rather than relying on the findings of other studies, a pilot study has been carried out to examine meta-linguistic awareness of varying structures in oral language processing and written language processing (Menyuk and Flood, in preparation). Fourth, 7th, 10th grade and adult good and poor readers were asked to judge and correct non-grammatical and anomalous sentences and to paraphrase sentences and detect ambiguities in sentences in both the oral and written mode. The preliminary findings, in comparing good and poor readers, indicate that poor readers perform more poorly than good readers at all age/grade levels in both modes of processing. In fact, adult poor readers do worse than 4th grade good readers. There are developmental changes which occur in both modes of processing for all the aspects of meta-linguistic awareness assessed in good readers but much less marked developmental changes in the poor reading population. The order of difficulty of processing the varying structures is similar throughout the age range for both good and poor readers and across listening and reading tasks. The ability to paraphrase and to judge anomaly and non-grammaticality is consistently better than detection of ambiguity when the sentence is presented either orally or in written form. This is quite consistent with other developmental findings. The reading and listening behavior of good readers is quite similar but there is a tendency for poor readers to do somewhat better in detection of ambiguity in the listening mode and somewhat better with paraphrase in the reading mode. This makes sense if the assumption is correct that well-learned structures (i.e., those easily available) can be processed more easily in the written than in the oral mode because the former mode places less constraints on memory (Menyuk, 1980, in press, b).

These preliminary findings that varying aspects of meta-linguistic abilities continue to develop over the school years in good readers and that these abilities are related in listening to and reading sentences lend some support to the notion that oral language meta-knowledge is related to reading throughout the school years. However, these preliminary studies still leave many questions about the details of the relation over time and, importantly, about what differences exist between good, average and poor readers in meta-linguistic abilities.

The issue of application of language knowledge to the reading of passages has not yet been addressed. Although it may be the case that comprehending written sentences is a prerequisite to comprehension of passages, such comprehension clearly demands more and something different than the comprehending of sentences. It was previously stated that selection, integration, organization and recall are required in this task. There has been a great deal of research on children's early development of the ability to recall stories in terms of story grammar (Stein and Glenn, 1979), use of topical information to make inferences about references in stories (Brown, et. al., 1977) and to infer, in general, from spoken language (Barclay and Reid, 1974). There has, however, not been a systematic examination of the developing child's ability to select, integrate, organize and recall the same material when presented orally and in written form. Until such comparisons take place we can simply point to some data which indicate that there is likely to be a relation between the two when recall constraints are similar in oral and written comprehension (i.e., when the written passage is not present for recall).

Two studies have been carried out with "special" populations that have some bearing on the issue. Wilson (1979) compared deaf and hearing children's ability to answer verbatim and inferential questions about short (4 sentences)

stories presented through the air (orally and signed) and in written form. The children were reading at 2nd, 3rd, 4th and 5th grade levels. In this study the children's ability to comprehend the sentences containing various structures was pre-tested. The deaf children showed a significant developmental trend in the acquisition of linguistic inference abilities whereas no such trend was observed with hearing children; hearing children reading at 2nd grade level were able to answer inferential questions almost as well as those reading at higher levels. There were remarkable differences between the two groups in their ability to accurately answer inferential questions but not in their ability to answer literal questions. Very importantly, hearing subjects performed significantly better with spoken than with written presentation whereas the inverse occurred with the deaf children. These data indicate the very early ability of hearing children to draw inferences from heard stories. These abilities are then applied to written stories. This ability, as was stated previously, is an important one in the comprehension and recall of passages.

Another study provides some evidence concerning the importance of inferential abilities in comprehension and recall of spoken stories. In this study (Graybeal, 1981), the ability of language disordered and normally developing children to recall orally presented stories was examined. In this study, sentence comprehending was also pre-tested. The principal difference between the groups was in amount of information recalled. There was no difference beween groups in the components of story grammar recalled or in the order in which they were recalled. It was also found that after two types of treatment conditions (one in which verbatim questions were asked and one in which inferential questions were asked) that the amount of information recalled by the language disordered children was markedly improved after inferential questions were asked but not after verbatim questions were asked.

No such effect was observed with normally developing children. They were performing very well to begin with. Although the written language processing of these children was not assessed, the findings of this and the previous study described lend some support to the notion that inferential abilities are important in passage comprehension and recall be the passage written or oral and that these abilities develop early and first in the domain of oral language processing and then are applied to the written language domain.

Conclusions

The argument has been presented that oral language development has an important and continuing effect on written language development. It has also been argued that oral language development cannot be simply viewed as an increasing amount of intuitive knowledge acquired but, also, as changing state of knowledge and developmental changes in how language is processed. If this argument has validity then one should be able to observe developmental changes in what is known intuitively about language, what is consciously known and in how oral language is processed. The interaction of these factors would predict what is comprehended and recalled in written language. There are also clear indications of a reverse effect; that is, the reading task per se changes the state of knowledge of oral language. Some examples of each of these arguments are presented below.

An obvious example of the effect of what is known about language on reading is lexical knowledge. If a lexical item is not in the vocabulary of a child then it cannot be comprehended in reading unless the context provides this information. A less obvious example would be the child's lack of comprehension of a syntactic structure as in "The boy who kissed the girl ran away." If the child doesn't understand this sentence orally she will not comprehend it in written form. Something further, however, is required when reading the word or sentence. In the first instance the phonological

representation of the word must be brought to conscious awareness; in the second instance the semantic/syntactic relations in the sentence must be brought to conscious awareness. How available (that is, how well learned a structure is) will affect how easily it is brought to conscious awareness. This is what is meant by state of knowledge of a structure. Thus, there are some structures that will be very well learned when the reading process begins (simple morpheme structure rules and certain semantic/syntactic structures in sentences) and others that will be less available and still others that remain to be acquired. Those that are very well learned will be processed automatically without the requirement of their being brought to conscious awareness.

How oral language is processed will have an effect on what is known about oral language. If, for example, oral language is processed by a surface-structure strategy with heavy reliance on contextual information for comprehension then the child will not be ready to understand sentences in which this strategy does not lead to correct interpretation (as in the example sentence above). How the child represents information about linguistic categories and relations in memory will have an effect on what the child knows about language. For example, if the child relies on imaginal representations rather than linguistic representations for storage and recall of lexical meanings, a behavior that is observed during the early years of life (Conrad, 1972) and continues to store imaginally syntactic-semantic relations in the early stages of acquisition of new structures (Kosslyn and Bower, 1974), then, linguistic representations will not be available and, therefore, cannot be brought to conscious awareness in the reading process. A shift from imaginal to linguistic representations has, in general, been observed at about 5 to 7 years. But any particular child might yet be in the process of development of this shift during the early stages of reading acquisition.

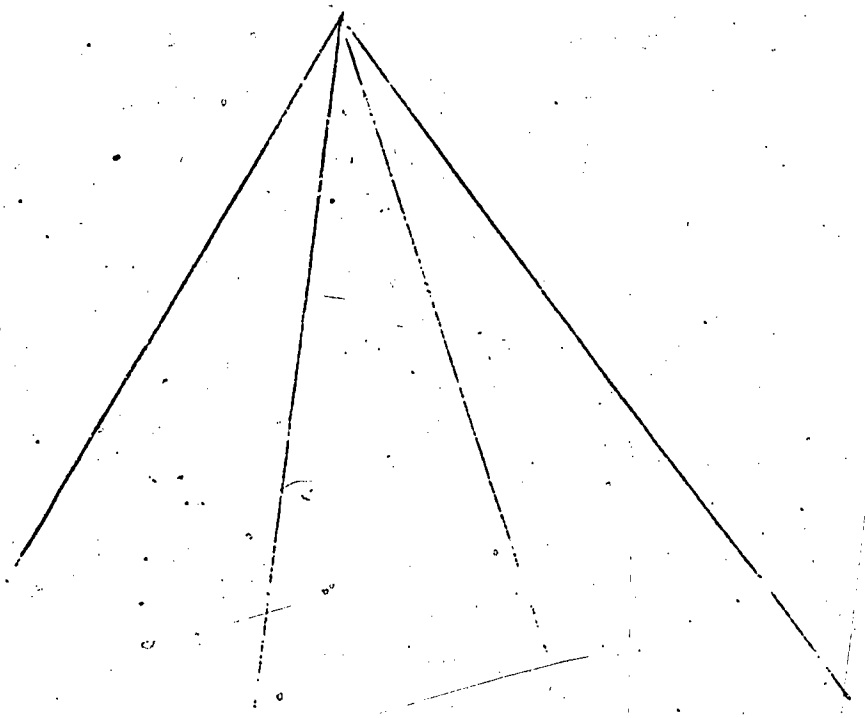
The ability to draw inferences from the linguistic context and world knowledge appears to be crucial in the comprehension and recall of connected discourse. This ability is first exercised in the oral language domain and then applied to the written language domain. This seems to be a very early ability in the normally developing child but somewhat delayed in children with developmental problems. However, again, there may be developmental differences among children in the age at which this processing strategy is available and is used plus differences in experiences which will affect the presence of or nature of the inferences that can be made.

Figure 3 is a graphic presentation of the notions expressed above. It suggests that as the child matures changes take place in the strategies used to process language, the set of linguistic rules the child has intuitive knowledge of, the set of rules the child is able to bring to conscious awareness if required to do so and the set of categories and relations which are automatically processed in reading.

Insert Figure 3 here

Particular linguistic experiences, particular social experiences, and possibly, biological capacities can account for individual differences in the development of meta-awareness (conscious knowledge) of language categories and relations. These differences can account for individual differences in the development or rate of development of processing strategies and, therefore, in the development or rate of development of intuitive knowledge of categories and relations in the language as well as conscious knowledge of these categories and relations. Since conscious knowledge is dependent on intuitive knowledge then differing children will achieve differing sets of conscious knowledge and, as we have argued, this will affect what is comprehended in reading.

Aspects of Language



Pragmatics	Lexicon	Semantax	Phonology
New categories New domain application	New categories New domain application Relations between categories Multiple meanings	New categories New domain application Relations between categories Multiple meanings	New categories New domain application Relations between categories

Figure 1. Summary of developments in each aspect of language over the school years.

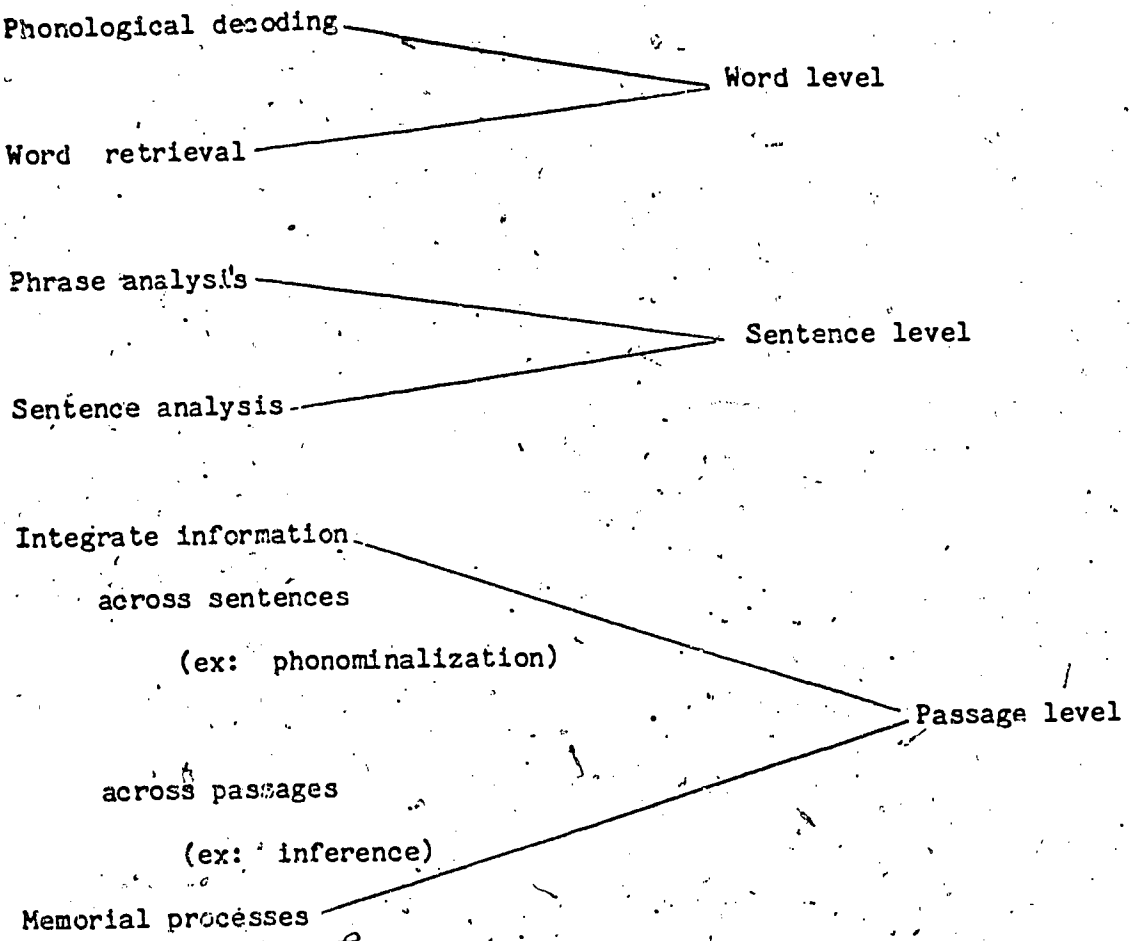


Figure 2. Levels of language required depending on reading task

Time 1	Time 2	Time 3
Processing strategies Set 1	Processing Strategies Set 2	Processing Strategies Set 3
Intuitive knowledge of Rules Set 1	Intuitive knowledge of Rules Set 2	Intuitive knowledge of Rules Set 3
	Conscious knowledge of rules Set 1	Conscious knowledge of rules Set 2
		Automatic processing of rules Set 1 in reading

Figure 3. Developmental changes in processing strategies and state of knowledge of linguistic rules

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APPENDIX C

Consent Forms

Boston University

School of Education
Institute for Literacy and Language
232 Bay State Road
Boston, Massachusetts 02215

Center for Applied
Research in Language
Co-Directors:
Paula Menyuk, Ed.D.
James Flood, Ph.D.

Center for the
Assessment and
Design of Learning
Director:
Roselmina Indrisano, Ed.D.

Center for the Study
of Communication
and Deafness
Director:
Robert Hoffmeister, Ph.D.

Parental Consent Form

Dear Parent,

This letter is to request permission for your child_____ to participate in a research study which examines the relationship between certain language abilities and reading and writing skills.

In particular, this research studies how well children can detect and correct errors in sentences and paragraphs which they hear or read. Their ability to perform these tasks may be correlated with how well they read and write.

The experimenter agrees to answer participants' questions regarding procedures or other aspects of the project. Participants are free to withdraw consent and to discontinue participation. Strict confidentiality regarding identification of subjects will be assured by coding data by number and not by name. At the conclusion of the research study, a written summary report will be made available to all subjects who have participated in the project, if they so request.

Many thanks for your cooperation.

Sincerely,

Paula Menyuk
Professor
Boston University
School of Education

James Flood,
Associate Profess
Boston University
School of Educati

I have read the above and consent to have my child, _____, participate in this research study.

Date:_____
Parent Signature:_____

I _____ like a summary report at the conclusion of the
(would, would not)
research study. If yes, give mailing address on back of this page.

Boston University

School of Education
Institute for Literacy and Language
232 Bay State Road
Boston, Massachusetts 02215

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James Flood, Ph.D.

Center for the
Assessment and
Design of Learning
Director:
Roselmina Indrisano, Ed.D.

Center for the Study
of Communication
and Deafness
Director:
Robert Hoffmeister, Ph.D.

Subject Consent Form

Dear

This letter is to request your permission to participate in a research study which examines the relationship between certain language abilities and reading and writing skills.

In particular, this research studies how well people can detect and correct errors in sentences and paragraphs which they hear or read. The ability to perform these tasks may be correlated with how well they read and write.

The experimenter agrees to answer participants' questions regarding procedures or other aspects of the project. Participants are free to withdraw consent and to discontinue participation. Strict confidentiality regarding identification of subjects will be assured by coding data by number and not by name. At the conclusion of the research study, a written summary report will be made available to all subjects who have participated in the project if they so request.

Many thanks for your cooperation.

Sincerely,

Paula Menyuk	James Flood
Professor	Associate Professor
Boston University	Boston University
School of Education	School of Education

I have read the above and consent to participate in this research study.

Date:_____

Signature:_____

I_____ like a summary report at the conclusion of
(would, would not)
the research study. If yes, give mailing address on back of this sheet.