DEVELOPMENTAL AND INDIVIDUAL DIFFERENCES IN CHILDREN'S READING COMPREHENSION

By

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ABSTRACT

This thesis research focused on the contributions of word decoding from print and of reliance on story organization to children's story comprehension. Two experiments were conducted, whose findings contribute to our understanding of developmental and individual differences in reading comprehension. In Experiment 1, children in Grades 3 to 6 read silently, read orally, or listened to well-organized and poorly organized stories. Both amount recalled and reliance on text organization increased with grade. Listening, which required no analysis of print, yielded equivalent comprehension to silent reading, demonstrating that differences in reading comprehension cannot be attributed only to differences in word-decoding skills. Furthermore, oral reading which required the decoding of each word in text, improved the comprehension and recall of good stories, especially for the poorest comprehenders. At each grade level a group of poor readers was identified who showed little sensitivity to story organization, in either silent reading or listening.

In the second experiment, the nature of the oral-reading benefit was examined by having Grade 6 poor readers read well-organized and poorly organized stories silently and aloud. The experiment showed that oral reading

increased recall for well-organized, but not for poorly organized text. This finding suggests that oral reading served to increase text organization, rather than to direct attention to the word level. The poorest comprehenders also gained from an advance organizer that stressed the problem structure of the stories.

The first experiment identified children in each grade, up to Grade 6, who did not spontaneously rely on story organization in reading and remembering stories. The second experiment showed, however, that when story organization was made available and salient, such children were able to use it to help them read and remember stories. Finally, the results of Experiment 2 demonstrated the importance of specific diagnosis prior to developing treatment programs for poor readers.

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INTRODUCTION

Current theories of reading maintain that fluent readers use many sources of information in comprehending text. In addition to the printed words on the page, they use knowledge of language and real world events to help them understand and remember what they read. Reading theories describe the information sources used by fluent readers and the processes or mental operations used to analyze that information. They assume that variations in the efficiency of processing operations affect the level of fluency a reader can achieve. Thus differences in reading skill reflect variations in processing efficiency.

Perfetti (1985) proposed that reading processes can be grouped into two general components. The first involves accessing a word's meaning in memory, when given a particular graphemic display. The operations used in taking the words from the page are referred to in the thesis as word-decoding skills. These are specific to the reading task. Perfetti referred to the second general component as comprehension. Spiro (1980) defined comprehension as a constructive process in which readers relate new information to what they already know. Knowledge of word meanings, sentence and text structure, and knowledge of real world events all contribute to fluent reading comprehension (Carr, 1981). Thus the knowledge the reader brings to the task is also important

to reading comprehension. Because these knowledge sources contribute to both reading and listening comprehension, they are referred to in the thesis as general language comprehension skills. Although both word-decoding skills and more general language comprehension are related to reading comprehension, their relationship to one another is still being investigated. Furthermore the relative importance of these skills to developing readers remains to be established (Carr, 1981). The goal of the thesis research was to examine the contributions of these processing skills to developmental and individual differences in children's story comprehension during the early school years.

Many studies of individual differences have focused on word-decoding skills, because researchers have assumed that decoding from print is a necessary prerequisite for reading comprehension. The literature confirms that individual differences in word-decoding fluency are related to successful reading comprehension. Relative to skilled readers, less skilled readers are slower at naming low-frequency or multisyllabic words and pseudowords (pronounceable nonwords; Hogaboam & Perfetti, 1978; Perfetti & Hogaboam, 1975). These differences in word-naming skills persist through high school (Frederiksen, 1981), and can be seen in university students (Jackson & McClelland, 1979, Mason, 1978; Olds, 1987).

One of the many factors that contributes to general language comprehension is the knowledge the reader or listener brings to the task. There are many demonstrations that a person's knowledge affects both reading and listening comprehension. Individuals who are knowledgeable about a topic recall not only more, but different information from a passage on that topic

than do less knowledgeable subjects (Spilich, Vesonder, Chiesi, & Voss, 1979). Such findings suggest that the well-developed knowledge base of high-knowledge individuals makes story information easier to process and remember (Bisanz & Voss, 1981).

Story comprehension is also facilitated by knowledge of story structure. Simple stories such as folk tales have been passed orally from generation to generation in all cultures. Mandler (1984) argues that because the basic structural elements of such stories are recalled in similar ways by adults, children, and across different cultures, all people possess organized knowledge about the basic structural components of simple stories. The literature confirms that both adults and children rely on text structure to help them to understand and remember stories (Kintsch & Greene, 1978; Poulsen, Kintsch, Kintsch, & Premack, 1979; Stein & Nezworski, 1978). Even 4-year-old children recall more from well-organized than from poorly organized picture stories (Poulsen et al,1979).

In spite of Mandler's (1984) claim that knowledge of simple story structure is found universally, there are very few studies of children with impoverished language backgrounds. If knowledge about story structure develops through many experiences with stories (Mandler, 1977), children who lack those experiences may not develop knowledge about story structure. There is evidence that some young children lack such experiences (Wells, 1985; Young, 1983). Young reported that 4- and 6-year-old children from lower socioeconomic backgrounds were delayed in acquiring knowledge about story structure. She proposed that the delay stemmed from the fact that such

children had few experiences with bedtime stories. Given the reliance on simple stories as vehicles for teaching in the elementary grades, children who lack story awareness may be penalized during both reading and listening. Wells' finding that children who heard many stories as preschoolers learned to read more quickly than those who lacked these experiences provides tentative evidence for this hypothesis. Furthermore, because the studies of story comprehension have used listening tasks, it is not known how variance in use of text structure affects reading fluency. Given that young children rely on story structure to help them understand and remember stories, failure to use text structure may be an important source of difficulty in poor readers' story comprehension.

In summary, fluent word decoding from print and general language comprehension contribute to reading comprehension. This research examined the contributions of these factors to developmental differences in children's story comprehension in Grades 3 to 6. In addition, children who varied in reading comprehension skill (good and poor readers) were studied at each of these grade levels. Simple children's stories were used and two factors were varied. In order to determine whether differences in story comprehension could be attributed to individual differences in word-decoding skill, presentation modality was varied by having children read silently, orally, or listen to stories. Children who had difficulty reading the words should gain from a listening task that required no word decoding. Story organization was varied, by using well-organized and poorly organized stories, to ask whether children who varied in reading skill differed in their reliance on story organization when reading and

recalling stories. Children who relied on story organizaton to aid story comprehension should remember more from well-organized than from poorly organized stories.

The thesis contains seven chapters. The first chapter provides a theoretical orientation to the research, by describing some models of reading employed in individual difference research. Chapter 2 reviews the literature on individual differences in word-decoding skills, and relates the findings to the theories presented in Chapter 1. Knowledge effects on story comprehension are reviewed in Chapter 3. Chapter 4 establishes the rationale for the two experiments to be described in Chapters 5 and 6. The first experiment (Chapter 5) examines the contributions of word decoding and reliance on story structure to comprehension in a large and varied population of children. The study identified a group of children who failed to use text organization to help them read and remember stories. The second experiment (Chapter 6) established two means of increasing story comprehension in the children who did not spontaneously use story organization to direct story processing. The final chapter summarizes the findings and discusses the theoretical and practical implications of the research.

CHAPTER 1

Information Processing Theories of Reading

The study of individual differences in reading comprehension can be traced to the last century, when Romanes (1884, cf. Venezky, 1984) reported a 4:1 difference among subjects in reading rates. He noted that relative to slow readers fast readers remembered more of what they read. An understanding of the reasons for these differences has been slow to emerge. Venezky (1984) argued that psychologists are still asking many of the same questions that were asked at the turn of the century. He described the late 19th century as the "golden years" of reading research, when psychologists were concerned with basic processes in reading. Reading research in the early part of this century was concerned with more practical matters of instruction, and with the development of standardized tests that would differentiate among readers who differed in reading skill (Venezky, 1984).

Interest in basic reading research re-emerged 40 years ago, when advances in communications engineering and computer science suggested ways of asking questions about human behaviour. Analogies were drawn between human processing and communications systems such as telephone lines that transmit information. Two characteristics of such systems interested

psychologists. First, they were limited in how much information could be processed at any one time, by factors such as capacity of transmission lines. Humans also appeared to have limitations in the amount of information that could be processed at any one time, as well as in the speed with which information could be processed. Second, the efficiency of communications systems could be increased by transforming information from one code to another. Psychologists hypothesized that humans also coded and recoded information as they analyzed incoming data. Investigators generated hypotheses about the kinds of information codes that humans might use and the mental operations they might conduct in analyzing the coded information. Among the many contributions from computer science came the idea that human processes could be modelled using flow charts similar to those used in computer programs. Thus flow charts were developed as analogies of how the human information processing system might operate.

Information processing theorists have proposed that complex cognitive activities such as reading can be broken down into a series of component processes, each of which can be studied in isolation to determine its contribution to reading as a whole (e.g., Laberge & Samuels, 1974). These component processes are frequently referred to as component processing skills to indicate that they become more efficient with experience. The component processes operate at different levels of analysis. Lower level processes refer to analyses that are conducted on the printed words or data. In reading, for example, the lowest level of analysis consists of extracting features such as curves, lines, and intersections from the graphemic display (Laberge & Samuels,

1974). Higher level processes produce meaning. In reading, these are the processes involved in comprehension.

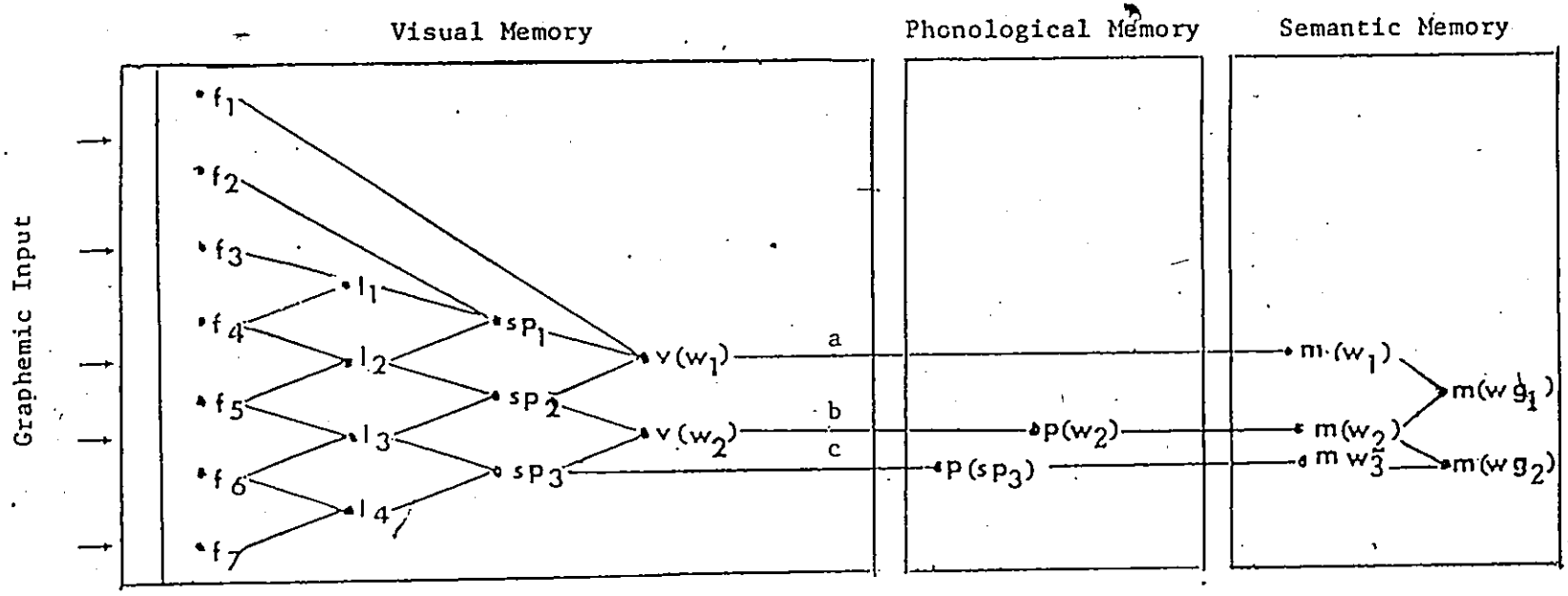
Within the information processing framework, three classes of reading models have been proposed. The first states that information extracted from print is successively analyzed at the feature, letter, word, syntactic and semantic levels until meaning is achieved (e.g. Gough, 1972; Laberge & Samuels, 1974). Because information flows unidirectionally from lower (print) to higher (meaning) levels of analysis, these are referred to as bottom-up or data-driven models. In contrast, K. S. Goodman (1976) and F. Smith (1973) have argued that the reading process begins in the mind of the reader. They proposed that readers use what they already know about a topic, and information derived from previous text, to generate hypotheses about upcoming print. They sample enough print to confirm their predictions. Because the flow of information is directed by higher, conceptual levels, these models are referred to as top-down or conceptually driven. The third type of model is called interactive, because it proposes that both bottom-up and top-down sources of information are used in reading. Readers use all available sources of information simultaneously to generate hypotheses about words in text. The hypothesis that has most support from the combined information sources is adopted (Rumelhart, 1977a). Because the models make different assumptions about fluent reading, they have different implications for individual difference research. The models are described in more detail below.

Data-Driven Models. Data-driven models propose that information extracted from print (data) is sequentially analyzed as it proceeds unidirectionally through a series of stages en route from print to meaning

(Gough, 1972; Laberge & Samuels, 1974). The mental operations required for processing information at each stage are controlled by separate subsystems, each of which has its own coding system. A simplified illustration of the Laberge and Samuels' (1974) model (Figure 1) shows three memory systems, each of which produces its own codes. The visual, phonological, and semantic memory systems produce visual codes, phonological (speech) codes, and meaning codes respectively. The information is recoded as it proceeds from one stage to the next. For example the term phonological recoding refers to the change from a visual code to a phonological or speech code, which occurs when information flows from the visual to the phonological system (Laberge & Samuels, 1974).

The following brief description of Figure 1 begins at the left. From the graphemic input, feature detectors (f), in the visual system, analyze curves, lines, intersections, and the relationships among them. This featural information is then organized into letter codes (l), spelling pattern codes (sp), and visual word codes (vw). Thus information is recoded into successively larger units as it is processed by the visual system. The output of processing at one level becomes the data for the next stage in the sequence. To read the word 'basket', for example, the line and the curve are organized to form 'b', which is subsequently grouped with 'a' and 's' to form the spelling pattern code 'bas'. This is grouped with the spelling pattern 'ket' to form the visual word code 'basket'. All of this processing has taken place in the visual system. Alternatively the reader may recode the spelling pattern codes '/bas//ket/' to phonological or acoustic codes. Once the sounds for '/bas//ket/' have been

Figure 1: A simplified view of the Laberge and Samuels (1974) model of reading.



f = Feature detector

l = Letter code

sp = Spelling pattern code

v(w) = Visual word code

p(w) = Phonological word code

p(sp) = Phonological spelling pattern code

m(w) = Meaning word code

m(wg) = Meaning word group code

coded, they are organized into the phonological or spoken word code 'basket'. The word 'basket' then accesses the semantic system where meaning is achieved. The semantic system also organizes words into phrases and subsequently sentences. Figure 1 shows three of many possible routes from print to meaning proposed by Laberge and Samuels (1974):

a. The visual word code for basket may access semantic memory directly bypassing the phonological system.

b. The visual word code for basket may be recoded to sound prior to accessing semantic memory.

c. The spelling pattern codes /bas/ /ket/ may be recoded to sound, then recoded to a word code, and finally recoded to a meaning code.

Laberge and Samuels maintained that there are two stages of reading acquisition. First the reader achieves accuracy in word identification. The beginning reader learns letters by attending to features such as lines, curves and intersections. Each time the features are organized into a letter, however, a trace is laid down. The repeated, simultaneous activation of these features strengthens connections among them, so that they are organized into letters that can be perceived as whole letter codes without feature by feature analysis. Laberge and Samuels argued that once a letter can be perceived as a whole, processing of that letter is automatic, because it can be read without conscious attention to its constituent features. Similarly, letters are organized into spelling pattern codes (/bas//ket/) or word codes (basket). When a whole word can be read without attention to individual letters, the word is read automatically or without conscious attention. The child reaches the second

stage when words can be read automatically as wholes. Laberge and Samuels defined automaticity as the ability to conduct one set of analyses while simultaneously directing attention elsewhere. The goal in fluent reading is to maximize the number of whole-word codes that can be processed automatically. Automatic processing at lower levels of analysis is important because of the limitations of the human information processing system. Laberge and Samuels (1974) maintained that humans can consciously attend to only one level of processing at a time. Therefore, readers cannot attend simultaneously to the visual analyses of words and to the semantic processing of meaning. The goal in learning to read is to increase the efficiency of lower level processes, so that readers can attend to meaning. A skilled reader can process words automatically, while attending to the higher level processes that produce comprehension.

Three assumptions of the Laberge and Samuels' model have made it influential in the design and interpretation of individual difference studies. First, the flow of information is unidirectional. Output from one coding level becomes the data for the next level of processing. Although some processing levels can be bypassed, there is no mechanism whereby higher level processes can influence lower level analyses. Therefore inaccurate or inefficient processing at a lower level (e.g., at the letter level) means that subsequent levels of analysis must rely on inaccurate or incomplete data. For example, the child who reads 'b' as 'd' will not be able to read the word 'basket'. A child who reads 'cup' as 'cap' will not understand the sentence 'She filled the cup with milk'. Thus lower level deficits cause problems farther up in the system. Second,

because of the attentional limitations of the processing system, slow or inefficient word decoding reduces comprehension. Fluent readers are fast readers. Third, once a phonological code has been formed, it automatically accesses the word's meaning in memory. Laberge and Samuels maintained that through familiarity with spoken language, beginning readers already have automatic associations between spoken words and meaning. Thus they affirm the importance of the speech code in learning to read.

Finally there are many routes from print to meaning. These are illustrated in Figure 1. Words that have been processed automatically by the visual system as whole word units can access meaning directly, bypassing the phonological system (route a). Alternatively, visually coded words may be recoded to sound in order to access semantic memory (routes b and c). Laberge and Samuels (1974) proposed that fluent readers use both routes, and vary their strategies depending on the difficulty of the material and on task demands. The visual word codes for easy words can access semantic memory automatically (without conscious attention), bypassing the phonological system. More difficult materials that include unknown words involve the use of spelling pattern codes to access the word's phonological code, which then accesses the semantic system. There is evidence to support this hypothesis. Meaning can be obtained directly from print by adults (Kleiman, 1975; Levy, 1978), and by skilled Grade 1 readers (Barron & Baron, 1977). There is evidence, however, that young children who become skilled readers rely on the phonological code (Shankweiler & Liberman, 1972), as do adults when faced with difficult materials or memory tasks (Conrad, 1964; Levy, 1975, 1977, 1978; Slowiaczek &

Clifton, 1980). Thus inefficient processing by either the visual or the phonological system is a potential source of difficulty for developing readers.

Conceptually driven Reading Models. Conceptually driven reading models propose that information available at the conceptual level and based on the reader's language experience drives the processing system (K. S. Goodman, 1976). In this respect, reading is like listening. Proponents of conceptually driven models maintain that speech and writing are two surface forms of the same underlying meaning (K. S. Goodman, 1976). They both serve to communicate between the giver and receiver of information. The good reader or listener generates expectations about incoming information based on what he or she already knows and current context, where context refers to the meaning derived from previous text (in reading) or discourse (in listening). He or she samples enough of the print or sound wave to confirm those predictions in what Goodman calls a "psycholinguistic guessing game".

K. S. Goodman (1976) maintained that the beginning reader uses many of the same strategies as the fluent reader. The kinds of oral reading errors or "miscues" made by children reflect the syntactic and semantic constraints of text, suggesting that they use text context to help them "guess" the words. K. S. Goodman and Y. M. Goodman (1977, p. 319) cited the following example from a child's oral reading protocol. Instead of reading "The husband stayed home and began to do his wife's work", the child read "The husband stayed home and began to do his wife's job". The word job was considered a miscue rather than an error because it was correct in terms of completing the sentence syntax and its meaning. Goodman claims that, with experience,

children increase their use of context, make more accurate guesses, and thus reduce their reliance on print. The most fluent reader makes the best predictions using the least graphemic information.

Conceptually driven models assume that children have well-developed language skills by the time they begin to read (K. S. Goodman, 1976). If the reading materials are within children's language experience, they should learn to read as naturally as they learn to speak. This suggests that individual differences among beginning readers may stem from poorly developed oral language, or from a mismatch between what they are given to read and the knowledge they bring to the task. K. S. Goodman maintains that adults may also suffer this problem, when reading in an unfamiliar subject area.

Data-driven and conceptually driven reading models provide different views of the beginning reader. Data-driven models stress the difficulty of learning feature by feature analysis, and of learning to recode from print to sound. In contrast, conceptually driven models regard reading as a natural extension of oral language. The child succeeds by learning to use sentence context efficiently. The models also make different predictions about individual differences in the development of reading fluency. Data-driven models propose that a breakdown in any of the lower level word-decoding processes causes problems further up in the system. Thus fast and accurate word decoding is a necessary prerequisite for fluent reading. Reading difficulties are specific to the reading task, and a poor reader may be a good listener. In contrast, conceptually driven models propose that reading and listening involve similar processes. A child who experiences reading difficulty is also likely to have

problems with a listening task. Proponents of data-driven models propose that recoding from print to sound is important in learning to read, and useful to adults faced with unknown words. Proponents of conceptually driven models argue that recoding to sound is not a natural way to read. They maintain that too great an emphasis on word decoding interferes with reading for meaning, and turns the child into a word by word reader, who can read the words, but not understand the text (F. Smith, 1973).

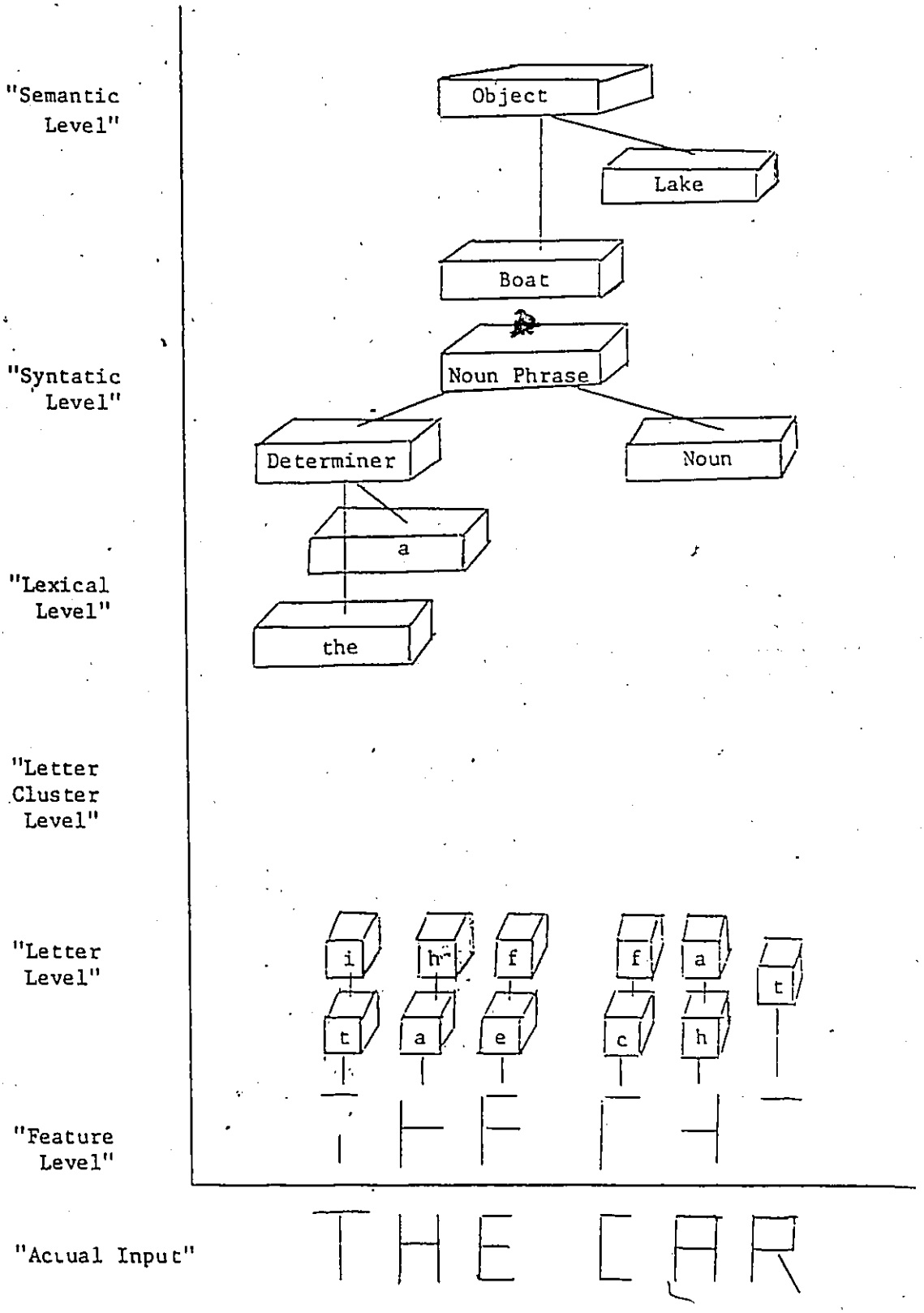
Proponents of both kinds of models propose that data-driven and conceptually driven processes may both be used in reading. Laberge and Samuels (1974) suggest that information from memory may sometimes facilitate word identification, especially in less skilled readers, but do not specify in detail how this occurs. K. S. Goodman (1976) maintains that the reader uses all sources of information, including print, but does not state how print is analyzed, except through the "guessing game".

Interactive Reading Models. Interactive reading models propose that both data-driven and conceptually driven processes contribute to fluent reading. Rumelhart (1977a) proposed a model that allows all sources of information to contribute simultaneously to reading. He argued that many independent sources of knowledge contribute to reading. Figure 2 shows a simplified view of the interactive model. In contrast to conceptually driven models that maintain that hypotheses are generated based on higher level information, interactive models propose that all sources of information are processed in parallel to feed hypotheses into a highly structured central device called a message center. The message centre maintains a running list of current

hypotheses and their relative strengths, as well as an estimation of the probability that each hypothesis is correct. A given hypothesis will be strengthened or weakened by alternate hypotheses from other knowledge sources. Figure 2 shows six knowledge sources, each of which has specialized information from a different processing level, at the feature, letter, letter cluster, lexical (word), syntactic and semantic levels of analysis. For example when the word 'car' is to be identified in the sentence "Near the lake I saw the car", the message centre receives information from the letter level (It starts with "c"), as well as from the syntactic level (It is a noun), and the semantic level (It is an object). Because the processing levels operate in parallel, all sources of information can be evaluated concurrently, as an input string is evaluated. Thus the hypotheses are continuously evaluated by the knowledge sources until the most likely hypothesis is accepted. In the example above, any one of the knowledge sources might accept the hypothesis that the word is "car" and stop the processing.

The following assumptions of the Rumelhart model distinguish it from the earlier unidirectional models. First, all knowledge sources contribute simultaneously to reading. This means that in order to understand the development of reading fluency, it is important to study data-driven and conceptually driven processes as well as the nature of the interactions among them. Although Rumelhart does not specify the nature of these interactions, the model suggests that the child who has insufficient information from any one knowledge source may be at a disadvantage. For example, the child who is inefficient at letter or word analysis has fewer hypotheses to feed into the

Figure 2: The message centre, shortly after processing has begun on "THE CAR", adapted from Rumelhart (1977).



message centre. Stanovich (1980) argued that a reader may use knowledge at one level of processing to compensate for deficiencies at another. A reader with weak word-decoding skills may compensate by relying on syntactic or semantic information to aid word recognition. Stanovich argued that the addition of the compensatory notion to the Rumelhart model makes it useful for the study of individual differences in reading skill acquisition. In contrast to K. S. Goodman (1976) and F. Smith (1973) who argued that skilled readers depend on sentence context to reduce the need for print analysis, Stanovich maintained that the least skilled readers are most dependent on sentence context to help them recognize words, because of their poor word-decoding skills.

A second assumption of Rumelhart's model is that information from all knowledge sources can be processed simultaneously. This assumption has been challenged on the grounds that the human information processing system has limited processing capacity (Lesgold & Perfetti, 1978; Stanovich, 1980). Lesgold and Perfetti have maintained that one type of interaction in an interactive system may be the sharing of attentional resources, and that the comprehension problems of poor readers may be due to "time sharing" in a limited capacity system. They adopted the Laberge and Samuels (1974) assumption that two attention demanding processes cannot be executed at the same time. Lesgold and Perfetti argued that word recognition and sentence comprehension must share processing resources. Beginning readers may switch attention back and forth between word decoding and sentence understanding. If either of these processes is slow, the whole process breaks down, because

memories from either source may be deactivated. For example, a child who struggles with a word may have forgotten what the sentence is about by the time the word is decoded.

Perfetti and Roth (1981) argued that the only way to remedy this problem is to increase the efficiency of the competing processes. They adopted the Laberge and Samuels (1974) assumption that information is processed in a forward feeding manner. Process 2 can be initiated before the completion of Process 1, but cannot begin prior to the beginning of Process 1. For example, phonological recoding can begin before visual analysis is complete, but cannot begin before the reader has begun visual processing of the word. Whereas data-driven processes can be executed without conceptually driven processes, the opposite is not true. Thus the system is interactive but asymmetrical. Because information from lower level processes becomes the data for higher level processing, slow or inaccurate lower level processing limits the efficiency of the whole system. Thus Perfetti and Roth stressed the importance of efficient word-decoding skills, and argued that differences in verbal coding are the critical differences between good and poor readers.

In summary, information processing theory has produced three different approaches to the study of individual differences in the acquisition of reading fluency. Each model suggests different potential sources of reading difficulty. Data-driven models propose that deficits at lower levels of processing have detrimental effects on all subsequent processing levels. This can happen in two ways. Because the output from one level becomes the data for the next level in the sequence, inaccurate analysis at the word level produces poor

quality data for higher levels of processing. In addition, because of attentional limitations, increased attention to the word level reduces the available resources for analysis of meaning. Conceptually driven models suggest that less skilled readers fail to use sentence context to help them to recognize words. Because they fail to engage in the "guessing game", they must read laboriously word by word. K. S. Goodman (1976) maintained that when given meaningful text, at the appropriate level of difficulty, this problem should not occur. Although Rumelhart did not address the question of individual differences, interactive models imply that unavailable or difficult-to-process information, at any knowledge source, reduces the efficiency of the system, because the reader has less information available for generating and confirming hypotheses. Stanovich (1980) maintained that poor readers compensate for their word-decoding deficits by relying on other knowledge sources. Relative to good readers, poor readers are more dependent on sentence context to aid word recognition. Like Laberge and Samuels (1974), and Lesgold and Perfetti (1978), Stanovich (1980) maintained that readers are limited in the amount of information they can consciously attend to at one time. They can allocate attention to the construction of meaning, or to the use of context to recognize words, but not to both at once. Thus reliance on context to aid word recognition reduces the capacity available to construct meaning. Therefore fast and accurate word-decoding is a prerequisite to comprehension. Lesgold and Perfetti argued that all processes must be accurate and fast in order to produce maximum levels of comprehension.

The thesis research was conducted within the interactive processing

framework, thereby assuming that both data-driven and conceptually driven processes contribute to reading fluency. It focused not only on individual differences in decoding words from print, but on general language comprehension factors that contribute to reading comprehension. In terms of the Rumelhart model, it examined the contribution of semantic-level knowledge as well as word-level knowledge to reading comprehension. Rumelhart stated that the semantic level is least understood, because it is most difficult to study. Recent research on memory for stories, however, provides a means of examining the contribution of one semantic knowledge source (knowledge of story organization) to reading comprehension. Although proponents of interactive models acknowledge the importance of studying larger units of text such as stories (Frederiksen, 1981; Jackson & McClelland, 1979; Perfetti & Roth, 1981; Stanovich, 1980), much of the individual difference research conducted within the information processing framework has focused on decoding words from print. This literature will be reviewed and evaluated in the next chapter. The literature on story comprehension has developed within a different theoretical framework, and is reviewed in Chapter 3.

CHAPTER 2

Individual Differences in Word-decoding Skills

Investigators working within an information processing framework agree that efficient word decoding from print is critical to fluent reading. The literature confirms that with increasing skill, word decoding becomes faster and more accurate (K. S. Goodman, 1976; Laberge & Samuels, 1974; Lesgold & Perfetti, 1978; Lovett, 1984a; Stanovich, 1981). Researchers differ, however, in their explanations for the deficits found in children who fail to achieve reading fluency. This chapter examines several hypotheses that have been generated to account for individual skill differences in word decoding from print. It contains four main sections. The first section presents some terminology that is used throughout the thesis to refer to readers who vary in skill. Section 2 examines individual differences in the decoding of individual words and pseudowords. The third section discusses individual differences in reading words in sentence contexts. Section 4 discusses some implications of the research for individual differences in reading comprehension. Although the chapter focuses mainly on research conducted with children, findings from the adult literature are included when they are relevant to particular issues.

Terminology Used to Describe Skill Differences.

In studying the acquisition of reading fluency, researchers are faced with a dual challenge. One goal is to study reading processes in children who are progressing normally in regular classrooms, so that findings can be generalized to a large population and conclusions can be drawn about normal reading skill acquisition. Children whose reading skills are developing normally for their age are referred to in the thesis as average readers. A second goal of reading research is to identify groups of children who vary in skill, within a given grade, in order to examine the nature of skill differences, and further to isolate children with particular deficits who might respond to remediation. Many terms have been devised to describe readers who vary in skill. Carr (1981) proposed that the simple terms good and poor be used to describe skill groups, who represent high and low points on a skill continuum. Whereas some researchers have selected good and poor readers on the basis of their word-decoding skills (e.g., Siegel & Ryan, 1988), others have employed a standard reading comprehension test to select skill groups (e.g., Stanovich, A. E. Cunningham, & Feeman, 1984b). Because the focus of the thesis is on reading comprehension, the terms good and poor are used in the thesis to refer to readers whose reading comprehension skill is advanced or delayed relative to other children of the same age.

Decoding Individual Words from Print.

Rate of word naming. Many individual difference studies have been guided by the Laberge and Samuels (1974) data-driven model of reading. Because of its assumption that all subsequent processing depends on the

efficiency of lower level operations, this model has encouraged researchers to begin by examining lower level processes that relate to word decoding. Laberge and Samuels proposed that readers first extract featural information from print, and organize this featural information into letters, and then words. Some of the earliest individual difference research proposed that skill deficits of very poor readers were at this low level of visual analysis. For example, reading requires the distinction between a letter and its reversal (b, d). In an early individual difference study, Orton (1925, 1966; c.f. Carr, 1981) examined children's oral reading errors and found that poor readers made reversal errors of letters (b, d) and words (was, saw). Orton maintained that children who failed to learn to read had difficulty with visual analysis of order information. His findings influenced educational practice, where teachers watched for such errors and devised exercises to remedy them. More recent research, however, has found that reversal errors are common among young children, and that such errors decrease with age (Gibson, 1965). Furthermore Shankweiler and Liberman (1978) found that reversal errors were not related to reading achievement and concluded that reversal errors alone were not diagnostic of reading failure.

Jackson and McClelland (1979) proposed that skill differences were not at the visual level of analysis, but higher in the processing system. They hypothesized that poor readers were slow to access memory for meaningful visual items, even when these items had been well learned. They cited evidence from an experiment conducted with good and average college readers to support their hypothesis. They asked readers to do a matching task that required them to push a button to indicate whether two items in a pair were the

same or different. They included letter pairs (A a or A b), synonyms (abrupt, sudden) and homonym pairs (bare, bear) that forced subjects to access the item names in memory. Other pairs of items consisted of random dot patterns that could not be named. Jackson and McClelland found that relative to average readers, good readers were faster at letter and word name matching but no faster on the dot matching task. They concluded that average readers were slow to access well-learned codes in memory, and that they were not merely slow processors of visual information. These findings were confirmed by Jackson (1980) who found that relative to poor college readers, good readers were faster at deciding whether or not the names of two objects, represented by line drawings, belonged to the same category. He found no skill differences, however, in matching unfamiliar characters that could not be named. Jackson concluded that speed of memory access to names of any meaningful visual patterns discriminated between readers who varied in skill, and that the problem was not specific to alphabetic materials.

Denckla and Rudel (1976) found similar results with children, using a continuous naming task. Denckla and Rudel asked three groups of 8- to 11-year-old subjects to name 50 item arrays containing either colours, pictures, letters or numbers. Each array contained five different items randomly presented 10 times. One group of children (reading disabled) had a specific reading disability. Their word-naming skills were at least two years behind what would be expected given their other cognitive abilities. Another (learning disabled) group had general learning problems, but were less delayed in their word-decoding skills. The third group consisted of normal readers. Denckla

and Rudel hypothesized that if the disabled readers had difficulty with symbolic materials, they should be especially slow at naming arrays of letters and numbers. If they were slow to name any visual array, naming times should be slow for all of the arrays. They found that, relative to normal or learning-disabled readers, the reading disabled children were slower at naming all of the arrays. Because the disabled readers were slowest at picture naming, and fastest at naming letters and numbers, Denckla and Rudel argued that they had difficulty responding verbally to any multi-stimulus visual array, and that the deficit was not specific to symbols.

Lovett (1984a) reported similar results for a group of disabled readers aged 8 to 13, who were referred to a remedial treatment program. These children comprised a subgroup of her referrals who could read as accurately as normal readers, but who read words significantly more slowly than normals (1.5 years below grade level). Because these children read accurately but slowly, she called them rate disabled. The children were slow at naming any visually presented patterns. They were slower than normal readers at naming visual items presented singly, and were also slower at the Denckla and Rudel continuous naming task. In contrast to their problems with visual materials, these children appeared to have intact oral language skills. They could spell auditorially presented words correctly, but were inaccurate on a spelling recognition test that required them to choose the correct word from among four words presented visually. Because these readers had slow naming times for all visually presented items, and because they could spell words presented auditorially, Lovett argued that their disability was specific to visually presented

language, and that their knowledge of phonology was intact.

The results of other experiments, however, suggest that these problems may be unique to children identified by a word-decoding criterion. For example, Perfetti, Finger, and Hogaboam (1978) asked good and poor Grade 3 readers, selected from regular classrooms on the basis of a standard reading comprehension test, to name colours, pictures, digits or words. The words varied in length (number of letters and syllables). Each item was presented singly, and naming latencies were obtained for each item. In contrast to the Denckla and Rudel (1976), and Lovett (1984a) studies, the Perfetti et al. (1978) study found no skill differences in naming colours, digits or pictures. Skill differences emerged only for words, and the differences increased with word length. Perfetti et al. maintained that poor readers' difficulties were specific to words and stemmed from slow coding of alphabetic materials. Stanovich (1981) also used a reading comprehension test to select good and poor readers, and measured naming latencies for single items. He reported findings similar to those of Perfetti et al. (1978). Stanovich found that good and poor Grade 1 readers were equally fast at naming digits, pictures, colours and letters, but that good readers were faster at naming words. He argued that because the skill groups had equal letter-naming latencies, the poor readers were not merely slow at naming any visually presented information. The deficit involved the translation from letters to sounds in words. In terms of the Laberge and Samuels (1974) model, the deficit was at the stage of recoding from print to sound.

The discrepant results of these studies may stem from differences in

methodology and in subject selection. For example, Jackson and McClelland (1979) concluded that poor readers were slow at accessing the names of any meaningful items in memory. This contrasts with Perfetti et al's. (1978) finding that good and poor readers were equally fast at naming colours, pictures, and digits. The contrasting findings may stem from differences in the experimental tasks. Naming visually presented items is a familiar activity that even poor school age readers engage in daily. The matching task employed by Jackson and McClelland is a novel task for many readers. Poor readers may be differentially penalized not only by less familiar materials, but by novel processing tasks.

The studies also differed in methods of subject selection. For example, the poor readers in the Stanovich study were only three months delayed in reading acquisition on a standard test of reading comprehension. Those in the Denckla and Rudel (1976) and the Lovett (1984a) studies were selected because they were slow word namers. In addition, they were disabled enough to be referred to remedial treatment programs, and were described as severely disabled by the authors. A study by Blachman (1984) confirms that methods of subject selection are important to experimental outcomes in individual difference research. Using the Denckla and Rudel continuous naming paradigm with kindergarten and Grade 1 children in regular classrooms, Blachman (1984) found that rapid naming of colours and pictures predicted year-end achievement on reading-related tasks in kindergarten. Fast colour namers in kindergarten became fast letter namers in Grade 1. By Grade 1 letter naming, but not colour naming was related to year-end reading

achievement. Blachman argued that children who have automated processing of one set of symbols (colours) are fast to automatize naming of new symbols (letters), and that automatic processing of recently learned symbols characterizes children who become fluent readers. Her results support Laberge and Samuels' (1974) emphasis on processing automaticity for fluent reading. Lovett (1984a) maintained that her rate-disabled readers had not achieved a level of automaticity in naming any of the visually presented items. Thus her readers appear to be more disabled than the Grade 1 readers described by Blachman (1984).

In summary the literature confirms the importance of rapid word naming to fluent reading. But it raises interesting questions about the nature of poor readers' deficits. Do they suffer a generalized naming disability, suggesting that they differ quantitatively from good readers? If this were true, the slower the word naming the less efficient reading should be. This interpretation is consistent with data-driven reading models that assume that slow lower level processing reduces the efficiency of the whole system (e.g., Laberge & Samuels, 1974). Alternatively, does slow word naming reflect a variety of processing problems that are simply more numerous in very poor readers? In other words, are there many ways to be a poor reader? Poor readers may differ qualitatively as well as quantitatively from good readers, and from one another. These questions will be addressed later in the chapter.

Linguistic awareness. Some psychologists have hypothesized that because English uses an alphabetic rather than a logographic or pictorial writing system (e.g., Chinese), the child has to become aware of the relationships

between print and sound (Mattingly, 1972). Mattingly proposed that the young reader has to know that speech can be divided into the phonological or sound segments that writing represents. This knowledge is referred to as linguistic or phonemic awareness. A phoneme is the smallest unit of sound that affects a word's meaning. For example the phonemes "b" and "c" differentiate between "bat" and "cat". Sensitivity to the relationships between print and sound has been examined in two ways. Some investigators have employed auditory tasks to determine whether poor readers can hear the sound segments needed for recoding from print to sound in English. Others have examined naming times for words, in order to study children's use of phonological recoding in reading tasks.

Linguistic awareness develops rapidly during the period when children are learning to read (Conrad, 1971; Liberman, Shankweiler, Fischer, & Carter, 1974). Liberman et al. asked 4-, 5- and 6-year olds to indicate the number of syllables in a word, or the number of phonemes in a syllable, by tapping a desk with a wooden dowel. They found that children became increasingly accurate at identifying the number of syllables and phonemes in words between the ages of 4 and 6 years, with the greatest development occurring at age 6 when they were learning to read. Using the Liberman et al. (1974) tapping task, Blachman (1984) showed that skill in counting the phonemes in words was a good predictor of Grade 1 reading achievement. Furthermore, two of the best predictors of success in reading-related skills in kindergarten were syllable tapping and rhyme generation. In the rhyme generation task, Blachman required the child to produce words that rhymed

with a picture. This task also required sensitivity to similarities and differences among word segments. Thus sensitivity to the sound system of English differentiates among children who vary in the acquisition of reading-related skills at an early age.

This difference can also be found in older children (Bradley & Bryant, 1978). Bradley and Bryant compared the linguistic awareness of Grade 5 poor readers with normal readers, three years younger, who were reading at the same level. One task required subjects to identify the "odd" or different word in a series of four words. They were to attend to differences in the initial phoneme (sun, see, sock, rag), in the middle phoneme (nod, red, fed, bed), or in the final phoneme (weed, deed, peel, seed). A second task required subjects to generate a word to rhyme with a word they heard. Bradley and Bryant found that the poor Grade 5 readers had more difficulty with both tasks than did normal younger readers. They argued that because the younger children had had less reading instruction than older children, this difference could not be attributed to greater reading experience. Thus the Grade 5 poor readers had failed to develop the linguistic awareness demonstrated by the normal Grade 2 child.

Blachman's (1984) evidence that both linguistic awareness and rapid naming of visually presented information are predictive of Grade 1 reading achievement indicates that both kinds of processing contribute to reading skill acquisition. Blachman found that while both related to measures of reading fluency, they did not relate to one another. Children who were good at one type of processing were not necessarily good at the other. She concluded that rapid

naming of visual displays and linguistic awareness made independent contributions to reading skill acquisition.

Word naming and the phonological code. Laberge and Samuels (1974) maintained that good readers can read familiar words as whole word codes, without analyzing individual letters or syllables. These whole word codes access their meanings in semantic memory directly, bypassing the phonological system. Unknown words or pseudowords must be decoded either by the visual system, the phonological system or both. These decoding processes may be conducted automatically, or without conscious attention, when familiar spelling patterns are encountered. Alternatively attention may be directed to any stage of processing. Given this scenario, the poor reader may a) have fewer words that can be read automatically as whole word codes, or b) be slower at decoding either visual information, phonological information, or both. In other words, these decoding processes may not be automatic in the poor reader. A large body of literature confirms that, relative to good readers, poor readers are slower at decoding words and pseudowords (Backman, Bruck, Hebert, & Seidenberg, 1984; Hogaboam & Perfetti, 1978; Perfetti et al., 1978; Perfetti & Hogaboam, 1975). The interesting question concerns the nature of these skill differences.

In order to study this question, many studies have obtained naming latencies for single words and varied word characteristics such as length, familiarity with a word's meaning, frequency of usage, and regularity of pronunciation. Frequency refers to the number of times a word appears in print according to established norms. Most studies contrast naming times for words

at the extremes of the frequency distribution. It is assumed that high frequency words are most familiar to the children, and may be read as whole word units. Low frequency words may have to be decoded, and readers may vary in the efficiency of these decoding processes. It is assumed that because pseudowords are not real words, they have zero frequency. They must be decoded by all readers, using knowledge of the relationships between spelling and sound, because they have not been seen before. Regularity refers to the correspondence between spelling and sound in a word. Regular words have predictable spellings that conform to simple spelling-sound rules that describe a large number of English words. Words with similar spellings rhyme (e.g., cat-mat or wave-gave). Pronunciations of irregular words do not conform to spelling-sound correspondence rules, and they have few rhymes. For example the irregular word have looks like the regular word gave but has a unique pronunciation.

The results of such studies demonstrate the importance of word frequency to the naming times of poor readers. Although good and poor readers are equally fast at naming high-frequency familiar words, skill differences emerge in naming latencies for low-frequency words and pseudowords (Hogaboam & Perfetti, 1978; Perfetti & Hogaboam, 1975). Perfetti and Hogaboam (1975) examined naming latencies for high- and low-frequency words and for pseudowords in good and poor third and fifth grade readers. There were only marginal skill differences in naming times for high-frequency words. Perfetti and Hogaboam demonstrated that for overlearned high-frequency words, poor readers had little difficulty. These results support

Laberge and Samuels' (1974) argument that, through many experiences with words, readers learn to read words automatically, and suggest that this holds true for poor as well as for good readers. When words had to be decoded, because they were less frequent words or pseudowords, skill differences emerged. Whereas the good readers in Grade 5 read low frequency words and pseudowords almost as quickly as high frequency words poor readers slowed their naming rates for such words. Perfetti and Hogaboam argued that good readers could decode words and pseudowords automatically using what they knew about the relationships between letters and sounds, but that these processes were not automatic in poor readers. It cannot be determined from this experiment whether the decoding differences occurred in visual or phonological processing, or both.

Other studies have attempted to specify the locus of the decoding differences by using regular and irregular words (Backman et al., 1984; Waters, Seidenberg, & Bruck, 1984). Backman et al. measured naming latencies for one-syllable, high-frequency regular and irregular words in good readers in Grades 2 to 4 and in high school, and in poor Grade 3 and 4 readers. Some of the irregular words had homographic spelling patterns (e.g., ave in gave and have), or ambiguous spellings (e.g., own in clown and blown), so that more than one pronunciation was possible. Backman et al. hypothesized that if subjects could read all words by the direct visual route (i.e., without phonological recoding) that naming times would be equal for all words. Alternatively if subjects recoded from print to sound in order to identify the words, naming times for homographic words should be slower than for regular words, because

homographic words had more than one pronunciation, and readers would have to decide which pronunciation was correct. They found that by Grade 4 the good readers read regular and homographic words equally quickly, and did not differ from high school students. Backman et al. maintained that by Grade 4 good readers could read regular and homographic high frequency words via the visual route, without phonological mediation. Poor readers read regular words as fluently as good readers, suggesting that they too could read high frequency regular words without recoding to sound. Poor readers, however, were slower and less accurate at naming words containing homographic or ambiguous spelling patterns. Their error patterns indicated that they tried to regularize homographic words by applying regular spelling rules to them. Few errors were made that indicated that subjects were pronouncing words by analogy to other exception words they knew. Although nonwords were named more slowly by younger and poor readers than by good readers, they were also pronounced by applying regular spelling-sound correspondence rules. Backman et al. argued that younger readers and poor readers recoded to sound in order to identify the homographic words, and were therefore slower when decoding words with more than one possible pronunciation.

Backman et al. maintained that reliance on spelling-sound correspondence rules changes as a function of developing skill. Knowledge of these rules develops at the same time as the child is learning to read more words as whole-word units. They maintained that both processing skills develop more slowly in poor readers. They can read fewer words as whole-word units, and they are slower to learn spelling-sound correspondence rules. As they learn

spelling-sound correspondences, however, they rely on the rules they know to help them decode new or difficult words. In terms of the Laberge and Samuels (1974) model, these children are slower to attain automaticity in both visual and phonological processing. Backman et al. (1984) argued that poor readers do not use different strategies than good readers in learning to read. Their performance is similar to that of good readers at an earlier stage in development. As they become more efficient at visual analysis they recognize more words visually as whole word units, and are less dependent on spelling-sound correspondences. Waters et al. (1984) have extended these findings to reading homographic words in text. Waters et al. maintained that, relative to poor readers, good readers have a larger "pool" of words that can be rapidly recognized on a visual basis, or without recoding to sound.

In these studies naming speed, or reading rate is an important correlate of reading fluency. The evidence supports two of Laberge and Samuels' (1974) hypotheses. First, with repeated exposure to words, children become faster and more accurate at both visual and phonological analysis. Second, words that are processed automatically by the visual system can access semantic memory directly, bypassing the phonological memory system. Although many of these studies have examined processing of individual letters, words, and pseudowords, a few have extended the findings to reading words in sentences (e.g., Waters et al., 1984). Further studies of word processing in text are presented below.

Processing Words in Text.

Proponents of conceptually driven reading theories claim that the goal of reading is to understand the text, and that words are processed differently in text than in isolation. They maintain that sentences contain enough redundant information that readers can predict what is coming next. Increased fluency stems from increased prediction accuracy and reduced print analysis (K. S. Goodman, 1976; F. Smith, 1973). Poor readers are those who fail to engage in active hypothesis testing, or the "guessing game". There are two possible reasons for this. First, the text may not match the language experience of the child. Therefore he or she does not have the appropriate knowledge base for making predictions. Second, too great an emphasis on word decoding during the teaching of reading produces readers who focus on individual words rather than on meaning (F. Smith, 1973). F. Smith maintained that the teacher's goal should be to help children to use context efficiently so that they can reduce their reliance on print.

Much of the evidence to support these hypotheses comes from the study of oral reading errors. K. S. Goodman and Y. M. Goodman (1977) maintained that oral reading errors reflect the reader's use of the syntactic and semantic context of the sentence in recognizing words. They cite examples from children's oral reading protocols to support their argument. For example the sentence " So the next morning the wife went off to the forest" was read by a child as "So the next day the wife went off to the forest" (K. S. Goodman & Y. M. Goodman, 1977, p. 319). The word day is consistent with the sentence syntax. In terms of the child's understanding of the text, it involves only a minor

change in meaning from the word morning. Therefore it would be considered syntactically and semantically constrained by the text. Even in Grade 1, children's oral reading errors reflect the syntactic and semantic constraints of text (Weber, 1970). Weber reported that both good and poor Grade 1 readers made syntactically constrained errors about 90 % of the time. Furthermore, K. S. Goodman and Y. M. Goodman reported that the proportion of contextually constrained errors increased with grade. Thus children appear to be more sensitive to contextual constraints with increasing age.

Biemiller (1970), however, demonstrated the importance of considering reading skill in drawing conclusions about oral reading errors. He studied the oral reading errors of good and poor Grade 1 readers throughout the school year, and reported that children passed through three stages in learning to read. During the first phase most errors indicated reliance on context to aid word recognition. This was followed by a non-response phase during which children would frequently stop and say nothing when faced with an unknown word. In this phase the number of graphemically constrained errors gradually increased, suggesting that children were trying to use their word-analysis skills to identify words. When their word-decoding skills were inadequate they said nothing. In the final phase, errors were constrained by both graphemic and contextual information. Children who passed through the three stages most quickly were the most fluent readers by the end of the school year. These children showed the greatest number of graphemically constrained errors, suggesting that with increased fluency readers became more rather than less sensitive to the data (print). Biemiller's findings do not support the

hypothesis of conceptually driven models that increased skill means reduced print analysis.

Leu (1982) maintained that there are methodological as well as conceptual problems with many oral reading studies. There is no consensus among studies about how errors should be scored. For example, some studies count self-corrected errors, in which a subject makes an error and corrects it him or herself, as errors and other studies do not. Leu maintained that, because of the diversity of scoring systems, it is difficult to compare one study with another. Leu (1982) and Weber (1968) argued further that even within a study, an error may be classified in two or more overlapping ways. If an error reflects the graphemic as well as the syntactic and semantic constraints of text, it cannot be determined whether the reader used one, two, or all three sources of information in producing the error. Leu (1982, p. 429) gave an example of such an error.

> Before coming back down, Katie reached up and touched the top of the flagpole.
> Before coming back down, Katie reached up and touched the tip of the flagpole.

Leu claimed that tip and top are graphemically similar, as well as syntactically and semantically appropriate to the sentence context. He argued that it is impossible to determine the source of the error. A more serious criticism is that the information source used in reading a correct word may vary with text difficulty and task demands. Leu (1982) maintained that a reader who normally relies on graphemic information in word analysis may use more contextual information when a word is difficult to decipher. Alternatively, a context-reliant reader may use more graphemic information when a word is inconsistent with

the context. Factors such as print clarity, passage difficulty and reader expertise may all affect processing strategies (Leu, 1982).

Graf and Levy (1984) have provided evidence from fluent adults to support Leu's argument. Graf and Levy asked subjects to read passages in which they varied both perceptual and conceptual difficulty. Perceptual difficulty was manipulated by using normal and rotated typescript. Passages were rotated by turning the page upside down. They used easy passages (from elementary school comprehension texts) and difficult passages (from advanced psychology texts) to vary conceptual difficulty. Subjects read the passages aloud and were encouraged to use context to help them identify unknown words. In addition subjects were required to do a proofreading task while reading. They were instructed to mark any words that contained spelling errors. Graf and Levy maintained that because subjects had to identify individual letters in words in order to detect errors, the proofreading task provided a measure of perceptual processing. Three comprehension questions were asked following each story to assess conceptual processing.

Graf and Levy found that rotated passages were read more slowly than normal passages and that, relative to easy passages, difficult passages were slowed differentially by rotation. Subjects located most spelling errors when reading difficult normal passages. Graf and Levy proposed that when less conceptual information was available because of passage difficulty, subjects conducted more perceptual analysis and therefore located more errors. Relative to normal passages, rotated passages produced lower levels of error detection and higher levels of comprehension. Graf and Levy maintained that

when rotated typescript made perceptual processing difficult, subjects relied on conceptual processing to help them read the words. Although this meant that they missed some of the proofreading errors, the increased conceptual processing produced better comprehension. Thus subjects varied processing in response to the demands of the reading task. Such findings cannot be accommodated by either a data-driven or a conceptually-driven reading model. They are consistent with the interactive processing view that many knowledge sources contribute to reading (Rumelhart, 1977). Furthermore they support Stanovich's (1980) notion of an interactive compensatory model of reading. When subjects lack conceptual information, because of passage difficulty or lack of familiarity with the material, they engage in more perceptual level processing. In contrast, when perceptual processing is difficult, readers rely on context to aid in word identification.

Stanovich (1980) claimed that such compensatory processing characterizes the word recognition of poor readers. Three kinds of evidence support his hypothesis. First, in spite of interpretive difficulties with the error classification schemes used in the analysis of oral reading errors (Leu, 1982), investigators agree that the oral reading errors of young and poor readers reflect the syntactic and semantic constraints of text. This indicates that poor readers rely on sentence context in word identification (Biemiller, 1970; Clay, 1968; Weber, 1970). Second, words are read more accurately and quickly in sentences than in random word lists, and this benefit is greatest for the youngest and poorest readers (Allington, 1978; Biemiller, 1977-1978). Furthermore, when levels of word decoding are similar, poor readers gain at least as much as

good readers from reading words in sentences (Stanovich, A. E. Cunningham & Feeman, 1984b). Finally, variations in the quantity and quality of preceding sentence context affect naming times for words in adults and children. Whereas congruous, or predictable sentence contexts, facilitate speed of word naming for all readers, incongruous (unpredictable) contexts slow word naming, especially for young and poor readers (Perfetti, Goldman & Hogaboam, 1979; Stanovich, West & Feeman, 1981).

In a longitudinal study of Grade 2 children, Stanovich et al. (1981) measured naming times for words in congruous, incongruous, and neutral contexts early and late in the school year. A congruous context made the target word (the final word in the sentence) predictable (e.g., "The pilot flew the plane"). In incongruous sentences the target word was not predicted by the sentence (e.g., "The dog ate the plane"). The target in a neutral context was preceded by the word "the" (e.g., "the plane"). Stanovich et al. manipulated target word difficulty and practice. Easy words were shorter and more frequent than difficult words. Prior to the first testing, children practised reading half of the target words in isolation. Stanovich et al. found that sentence congruity had larger effects on naming times for difficult words than for easy words. Relative to the neutral context, predictable sentences facilitated naming times for unpractised difficult words, and unpredictable sentence contexts slowed the naming of such words. Practice in reading words in isolation reduced context effects for all words, but differentially for the difficult words. Thus as the children became faster at decoding individual words they were less vulnerable to context effects. Furthermore, at the end of the year, when the children had

had more experience with the words, they were less affected by context. Thus increased experience with words through concentrated practice, or through reading experience over a school year, reduced context dependence. Finally, relative to good readers, poor readers were more reliant on sentence congruity to help them identify words. They were helped more by predictable sentences and penalized more by unpredictable ones. Stanovich et al. argued that as word analysis skills became more fluent, children were less dependent on context to help them read the words. They maintained that their findings support an interactive compensatory model of reading. Children depend on sentence context to facilitate identification of difficult words, but as word-decoding skills become more fluent, there is less need for compensatory processing.

Although such findings contradict K. S. Goodman's (1976) claim that sensitivity to context increases with skill, Stanovich (1980) argued that readers could be more sensitive to context and yet be less dependent on it. In other words, with increased skill, readers make more accurate predictions about upcoming words in text (the "guessing game"), but because of more fluent word-analysis skills, they are less dependent on context in word identification (Biemiller, 1970; Ehrlich, 1981; Perfetti, Goldman & Hogaboam, 1979; Stanovich, 1980). Perfetti et al. (1979) asked good and poor Grade 5 readers to predict the next word in a sentence prior to naming the word. They found that relative to poor readers, good readers were more accurate at making predictions, but less penalized when they were wrong. Perfetti et al. argued that good readers were so fast at word identification that their inaccurate predictions had little effect.

The finding that increased word-decoding skill reduces vulnerability to context effects supports Perfetti and Roth's (1981) argument that information processing in reading is interactive but asymmetrical. Although Perfetti and Roth argued that processing needs to be efficient at all levels of analyses, they maintained that inefficient lower level processes limit the efficiency of the whole system. Therefore fluent word decoding is critical for fluent reading, and the chief distinguishing characteristic of poor readers is inefficient word decoding. The word-decoding literature reviewed in this chapter confirms the importance of rapid, accurate word decoding to fluent reading. Poor readers in normal classrooms appear to be slow to develop word-decoding skills. Relative to good readers, they can read fewer words automatically, and they are slower to learn spelling-sound correspondence rules (Backman et al., 1984; Waters et al., 1984). They do rely on the spelling-sound rules they know, however, (Backman et al., 1984), as well as on sentence context to help them recognize words (Stanovich, 1980). Such evidence has two implications for the study of individual skill differences in children's reading fluency. First, given that poor readers in normal classrooms read like younger good readers (Backman et al., 1984), they may merely lack experience with reading. Given that practice in reading isolated words increases reading fluency (Stanovich et al., 1981), poor readers should gain from repeated exposure to words. Second, if inefficient word decoding from print precludes reading comprehension, the comprehension of poor readers should benefit from a listening task, that requires no print analysis. These issues are examined in the next section.

Implications of the Research for Poor Readers.

Training in word decoding. Backman et al. (1984) showed that the word-decoding skills of poor readers resembled those of younger readers. If poor readers merely need more reading experience to achieve the level of fluency shown by good readers, they should gain from repeated exposures to words. Hogaboam and Perfetti (1978) provided good and poor readers in Grade 3 with up to 18 exposures to pseudowords in each of two modalities, visual and auditory. They hypothesized that, if skill differences reflected differences in reading experience, both reader groups should benefit from experience with pseudowords, because they were novel to both skill groups. Furthermore, if poor readers just needed more reading experience, they should gain differentially, relative to skilled readers, from multiple exposures to the pseudowords. Their results confirmed both hypotheses. Both skill groups gained from visual and auditory experience with pseudowords. But relative to good readers, poor readers took more exposures (either visual or auditory) to read pseudowords as quickly as they read high frequency real words. Thus good readers learned to decode pseudowords more quickly than poor readers. Relative to good readers, the poor readers showed greater total reductions in reading times from either auditory or visual exposure to pseudowords. Even after 18 exposures, however, the poor readers were still 400 milliseconds slower than good readers at naming pseudowords. This amount of experience was not enough to decrease their latencies to the level the good readers had attained without practice. Olds (1987) reported that poor adult readers also gained from practice in naming pseudowords, but that they too could not attain the rates

achieved by good readers.

Given the strong relationship between word-decoding speed and reading comprehension (Jackson & McClelland, 1979), and given that word-decoding rate increases with practice (Hogaboam & Perfetti, 1978), it is possible that the text comprehension of poor readers can be improved by having them practise reading the words prior to reading the text. In order to examine this issue, Fleisher, Jenkins and Pany (1979) trained a group of poor Grade 4 and 5 readers to read words in lists and in phrases, until they could read them as quickly as good readers. Although training in word decoding increased reading rates and decreased word-decoding errors in reading connected text, the increase in speed and accuracy had no effect on three measures of comprehension. Thus increased word-naming speed was not sufficient to improve reading comprehension. The results confirm Jackson and McClelland's (1979) conclusion that general language comprehension factors also affect reading comprehension.

Modality effects. In contrast to a reading task, which requires the analysis of each word from print, a listening task provides not only individual words, but sentence syntax, and the prosodic rhythm of language. One would therefore expect that, relative to reading, listening should be especially beneficial to poor readers. Sticht (1979) proposed that in the early school years listening comprehension is superior to reading comprehension. He claimed that as word-decoding fluency increases, reading and listening comprehension become more similar, so that by about Grade 7 the two are equivalent. Sticht argued that when decoding processes have been mastered, silent reading and

listening are affected by common factors. He supported this argument with evidence from a Sticht and Beck (1976) study conducted with adults, who represented a wide range of reading fluency. Sticht and Beck compared silent reading comprehension with 'auding', a task in which the subject heard and read the passage simultaneously. They found that readers, whose reading levels were below Grade 7 on the Gates-MacGinitie reading tests, performed better on comprehension tasks following auding, relative to silent reading. At about the Grade 7 level, performance following auding and reading were comparable.

One could argue that Sticht and Beck's 'auding' task is not like a true listening task. Evidence from studies conducted with children, however, confirm the Sticht's argument. Superior comprehension following listening, relative to reading, has been shown in Grade 2 children (Wilkinson, 1980), in Grade 5 children (Berger & Perfetti, 1977), and in Grade 7 children (Smiley, Oakley, Worthen, Campione & Brown, 1977). Berger and Perfetti (1977), and Smiley et al. (1977) found, however, that reading and listening were related. Good readers were also good listeners; poor readers were poor listeners; and differences in word decoding could not explain all of the differences in comprehension. A significant correlation between reading and listening has been shown as early as first grade (Stanovich et al., 1984a), and this correlation increases with reading skill. High correlations are found between reading and listening in adults (Jackson & McClelland, 1979).

Different arguments have been advanced to explain the read-listen relationship. Jackson and McClelland (1979) proposed that reading and listening comprehension may both be affected by a general language

comprehension factor, and suggest that poor readers may have difficulty maintaining attention to continuous discourse in either modality. Perfetti and Lesgold (1977) argued that in either modality, the reader or listener generates a verbal or speech code from the input (print or speech). They proposed that poor readers are inefficient at verbal coding, and that good verbal codes facilitate the retention of information in memory. They argued that the slow coding of poor readers produces a bottleneck in short term memory. They drew an analogy with an assembly line worker who gets out of phase with the production line, and gets less efficient and even slower, so that some items get by without being finished. Similarly the poor reader who gets behind may stop processing entirely, or fail to complete processing of some words. If processing stops, or if verbal codes are not produced for all words, readers or listeners will have difficulty remembering discourse. Perfetti and Lesgold's argument is supported by evidence that good readers rely on a verbal code in memory tasks, but that poor readers are less likely to take advantage of verbal codes to aid memory, even when the verbal codes are provided in a listening task (Shankweiler & Liberman, 1976).

Perfetti and Lesgold (1977) used their verbal coding hypothesis to explain the results of probe memory experiments by Perfetti and Goldman (1976) and by Goldman, Hogaboam, Bell and Perfetti (1980). In a probe memory task, reading is interrupted periodically by a cue word from previous text, and the reader/listener is required to recall the subsequent word or words from the discourse. The distance (number of words back from the point of interruption) is varied, as the position of the word relative to a clause or

sentence boundary. For example, in the Goldman et al. (1980) study cue words were either 3 or 6 words back. In addition the target words were either within the same clause or sentence or in the previous clause or sentence. Whereas Goldman et al. required subjects to read silently or orally, Perfetti and Goldman used a listening task. In both studies readers were less accurate for more distant target cues. Poor readers were differentially penalized relative to good readers when the target was in a previous clause. Given that poor readers were penalized when the cue came from a prior clause, Perfetti and Goldman proposed that their slow verbal coding made clause integration particularly difficult. They argued that poor readers were so slow at verbal coding that they forgot the early part of a sentence before the sentence was finished. This was true in either silent reading or listening. Surprisingly oral reading improved performance for all subjects, but differentially for the poor readers (Goldman et al., 1980). Goldman et al. attributed the oral reading benefit to the need to produce a phonological code when reading aloud, and stated that this acoustic code made words more memorable.

Although the relationship between oral and silent reading has been studied for many years, the nature of the relationship between them remains to be established. As early as 1916 Pintner and Gilliland (c.f. Levin, 1979) showed that silent and oral reading produced similar recall for young children, but that high school and college students recalled more following silent reading. In a review of oral reading studies, Levin (1979) reported that after the early elementary grades, silent reading rates gradually exceeded oral reading rates, and argued that as silent reading rates exceed those of oral reading, silent

reading becomes a more efficient way to read. Levin (1979) reported that good readers perform better following silent reading, but that poor readers gained from reading aloud. He attributed the poor reader gain to the fact that oral reading "focuses attention", and provides input from a second (auditory) modality. Miller and D. E. P. Smith (1985) also used the attention argument to explain an oral reading benefit to poor readers. They found that poor readers in Grade 5 could answer more questions correctly following oral relative to silent reading. Miller and D. E. P. Smith argued that oral reading forced attention to each word in text, but they did not explain how this increased attention changed text processing. In contrast, K. S. Goodman and Y. M. Goodman (1977) claimed that because oral reading focuses attention at the word level and slows reading rate to the rate of spoken language, it interferes with reading for meaning and therefore decreases text comprehension.

In summary, the literature suggests that before word decoding becomes fluent, readers gain from listening (Smiley et al., 1977; Sticht, 1979). Reading and listening are related even in young readers, however, and the degree of the correlation increases with reading skill (Stanovich, 1986). Therefore factors that are common to both modalities must also affect reading comprehension. The effect of oral reading on comprehension is not well established. Although some gain from oral reading has been shown (Goldman et al., 1980; Miller & D. E. P. Smith, 1985), the nature of the benefit remains speculative. It is disputed by K. S. Goodman and Y. M. Goodman (1977) who stated that reading aloud is detrimental to the comprehension of beginning readers.

In the thesis research, the contribution of word-decoding to story comprehension in elementary school children was investigated in two experiments. In the first experiment, children read stories silently and orally, and listened to stories. It was expected that children who had difficulty reading the words would indicate superior story comprehension following a listening task, relative to silent or oral reading, because listening required no analysis of print. If K. S. Goodman and Y. M. Goodman (1977) are correct that oral reading interferes with reading for meaning, then oral reading should produce lowest levels of performance. The second experiment pursued the nature of the relationship between oral and silent reading in poor Grade 6 readers.

The literature reviewed here indicates, however, that word-decoding differences cannot account for all of the variations found in reading comprehension, and suggests that factors related to general language comprehension should also be examined. The thesis research was concerned with one aspect of general language comprehension, the effects of a reader's knowledge on story comprehension. In Rumelhart's (1977a) terminology, it was concerned with the effects of higher "semantic level" effects on comprehension, as well as with lower "word level" effects. The literature on knowledge effects on comprehension is reviewed in the next chapter.

CHAPTER 3

General Language Comprehension

Text comprehension is an active, constructive process that involves an ongoing interaction between incoming data (words in text) and the subject's knowledge regarding that topic (Royer & D. J. Cunningham, 1981; Spiro, 1980). This view of reading suggests that in order to understand individual differences in reading comprehension, we must examine both the knowledge of readers who vary in skill, and their use of that knowledge while reading text.

There are many demonstrations that an individual's knowledge affects comprehension during both reading and listening. One of the first such experiments was conducted by Bartlett (1932). In Bartlett's time many researchers attempted to simplify the material to be learned, in order to minimize the effects of the subject's knowledge on performance. Researchers assumed that recall was an exact replica of experience. In contrast, Bartlett proposed that psychologists should study meaningful materials that were encountered in the real world. He proposed that remembering was a reconstructive task in which subjects related new information to what they already knew about the topic. If this were true, subjects' recall of unfamiliar material should be altered to make it more consistent with the knowledge they

brought to the task. In order to test this hypothesis, Bartlett asked subjects to read and recall unfamiliar folk tales. His most famous story "The War of the Ghosts" was a North American Indian tale. He hypothesized that the story would be difficult to recall, because the subjects lacked knowledge of Indian culture, and because the incidents in the story were only loosely related to one another. If readers used what they knew to help them remember the story, their recalls should include distortions and intrusions from their own culture.

Bartlett found that stories were recalled differently by different subjects. They omitted some details and added others. There were some common substitions of more general, familiar words for Indian words. For example, "canoe" was frequently recalled as "boat". Bartlett contended that as subjects "condensed, elaborated and invented" they were trying to construct a coherent story that was consistent with their cultural expectations. In spite of the recall differences among subjects, however, subjects appeared to adhere to some common principles in remembering stories. The recall protocols were similar in form, suggesting that subjects had a common representation of story organization or structure. Bartlett called the organized knowledge of the subject a schema and speculated that remembering involved the mingling of information from many schemata. He adopted Head's (1920) idea that every new experience was understood in relation to past experiences which were represented in memory as schemata.

Although Bartlett's work was not influential in cognitive psychology for nearly 40 years, it later provided the impetus for the study of stories and real life events. It prompted research in a number of areas in cognitive psychology,

two of which are important here. The first was an empirical study of the effects of world knowledge on people's understanding of stories. The second was an intensive investigation of text structure with an emphasis on the simple folk tale. The remainder of this chapter reviews the literature that is relevant to these two issues, and relates the literature to individual differences in children's story comprehension.

Real World Knowledge and Comprehension. Recent studies have confirmed that fluent adults rely on knowledge to make what they read consistent with their knowledge of the world (Anderson, Reynolds, Schallert & Goetz, 1977, Bower, Black, & Turner,1979; Spilich et al., 1979). Spilich et al. studied the effects of knowledge about baseball on adults' comprehension and recall of a passage about a baseball game. Not only did baseball experts recall more information than did the less knowledgeable subjects, they recalled more information that was important to the game. For example, they recalled scores, the number of outs, and the number of runners on base. In contrast, less knowledgeable subjects recalled irrelevant information such as the weather. Spilich et al. argued that whereas baseball experts constructed an integrated game sequence, nonexperts recalled discrete propositions.

Anderson et al. (1977) asked physical education students and music students to read passages that had two possible interpretations. For example, one of the passages could be interpreted as a card-playing session, or as a rehearsal for a musical performance. Anderson et al. found that performance on a multiple choice test, as well as on a free recall task, reflected the subjects' backgrounds. Whereas physical education students interpreted the passage as a

card game, music students interpreted it as a rehearsal. Subjects reported that they interpreted the passages in one way or the other, without thinking of the alternate perspective. In both of these studies, the authors adopted Bartlett's term schema, and argued that subjects relied on an organized knowledge base, or schema, in interpreting the stories. In spite of such evidence with adults, there are few systematic studies of the relationship between world knowledge and reading comprehension in children. Although young readers also vary in their knowledge about specific subject domains, standard comprehension tests used in reading assessment do not measure the knowledge of those who take the tests (Royer & D. J. Cunningham, 1981). Thus a possible source of individual differences is not taken into account.

Some individual difference studies have adopted Bartlett's technique of using unfamiliar folk tales to control for knowledge effects. They assume that knowledge of the subject matter will be equally low for all subjects. For example, Smiley et al. (1977) presented good and poor Grade 7 readers with Japanese folk tales for reading or listening. Smiley et al. found that relative to good readers, poor readers recalled less story information. In addition, relative to good readers, poor readers recalled fewer story statements that were rated by adults as important to the theme of the passage. This was true in both modalities. Smiley et al. argued that poor readers had difficulty discriminating between thematically important and less important story information. It is possible, however, that good and poor readers did not have equal levels of knowledge relevant to the themes of the stories. Possibly by Grade 7, good readers knew more about folk tales, or more about dragons (the

topic of one of the stories). If this were true, good readers should be better able to construct an integrated story, and to distinguish among important and less important story details. The Spilich et al. (1979) findings for subjects who varied in knowledge about baseball support this hypothesis. Without measuring the children's knowledge prior to story presentation, this possibliity cannot be evaluated.

Another approach to controlling knowledge differences is to provide subjects with the appropriate information prior to story presentation. Many such studies have been conducted with fluent readers. For example, a perspective provided prior to story presentation makes an ambiguous story more comprehensible, and also influences the kinds of inferences drawn by the reader or listener (Bower, 1978; Bransford & Johnson, 1972; Owens, Bower, & Black, 1979; Pichert & Anderson, 1977). Owens et al. presented university students with brief biographical sketches of two characters prior to reading a story describing the events in a day of the protagonists. One protagonist, Nancy, feared she was pregnant; the other, Jack, was trying to make the football team. The story was the same for all subjects except for the protagonists' names (Nancy/ Jack) and the appropriate pronouns. The day's events included making morning coffee, a doctor's visit, going shopping, attending a lecture, and an evening party. The two groups of subjects interpreted the stories in terms of the beliefs, goals and motivations of their respective characters. The authors argued that the "character plus problem" introduction guided story comprehension and text reconstruction at recall. They hypothesized that actions that were consistent with the goal-oriented schemata of the subjects were more

likely to be encoded and remembered.

Bransford and Johnson (1972) reported a study in which they used a picture to provide the necessary information to make an ambiguous story comprehensible. The study included five conditions, three of which provided information to disambiguate the story. In two conditions subjects saw a picture that illustrated the figures and objects in the story, as well as the relationships among them. One group saw the picture prior to reading the story, and the other group saw it after the story. A third group saw the same picture, but with the critical relationships among the objects changed. Two control groups saw no pictures. One of these groups read the story once, and the other read it twice. Bransford and Johnson found that only when subjects saw the picture prior to reading the story, and only when the important relationships among the picture's elements were maintained, did the picture facilitate comprehension. No differences emerged among the other groups. Even reading an ambiguous story twice produced no beneficial effect when the relevant contextual information was not available. Bransford and Johnson stressed the importance of the organized relationships among the elements of the complete picture. Understanding these relationships was necessary for understanding the passage.

Children are also vulnerable to these effects. Arnold and Brooks (1976) used the Bransford and Johnson (1972) picture paradigm with children in Grades 2 to 5. Prior to listening to paragraphs, some children saw pictures containing elements that were organized to illustrate important relationships in the paragraphs. Others saw pictures containing the same elements but without the important relationships shown. Arnold and Brooks found that, relative to

unrelated pictures, meaningfully related pictures increased accurate story recall, and the number of correct inferences made by the children. Correct inferences were propositions that could be made logically on the basis of story information, but were not stated explicitly in the text. Similarly, Brown, Smiley, Day, Townsend, and Lawton (1977) found that children in Grades 2 to 7 recalled more from an ambiguous passage if they were given relevant information about the protagonist, in either pictorial or verbal form, prior to listening to a story. The children showed the same types of intrusions of thematically relevant information as those shown by adults. Such evidence suggests that presentation of appropriate organizing material prior to reading a story should facilitate story comprehension. Many reading series used in elementary grades assume this when they provide pre-lesson activities that provide knowledge about words and concepts in a story.

There has been some controversy, however, over the benefit of pictures to children's story understanding (Beck, Omanson, & McKeown, 1982). The Arnold and Brooks (1976) and the Brown et al. (1977) studies suggest that the usefulness of pictures may depend on their relevance to the story. Peeck (1974) showed that children's comprehension is facilitated by pictures that are congruent with story information, and inhibited by contradictory ones. Beck, McKeown, McCaslin, and Burkes (1979, cf. Beck et al, 1982) studied the teacher manuals from two basal reader series and proposed that they sometimes contained misleading information that might be detrimental to story comprehension. Subsequently, Beck et al. (1982) redesigned two Grade 3 reading lessons to make the accompanying background knowledge relevant to

the stories. They then compared comprehension of the original and the revised lessons as a function of skill. They found that the revised lessons increased comprehension of central story content for both good and poor readers, but that comprehension improved differentially for the poor readers. Beck et al., however, changed three aspects of the lessons. They tried to make story concepts more relevant through discussion. They altered pictures to make them more relevant, and they changed the questions used to guide silent reading. Although it is not possible to determine which of these factors or combination of factors was effective, the evidence suggests that efforts to make accompanying information more relevant to stories are especially beneficial to poor readers.

Ausubel (1960) proposed that presentation of relevant conceptual information (advance organizer) prior to text presentation should improve text comprehension. He was concerned with learning new but meaningful verbal material. Ausubel maintained that prior presentation of organized information provided a framework that would help in organizing more detailed ideas of the passage. For example, prior to presentation of a text on the properties of steel, Ausubel (1960) presented one group of subjects with an advance organizer passage that stressed differences and similarities among metals and alloys. It did not contain any of the details of the test passage. Thus the text was not merely a repetition of the organizer. A control group read an introductory passage that contained historical information about making steel. Ausubel found that relative to the control passage, the organizer passage produced superior performance on a subsequent multiple choice task. He argued that organizers

were most helpful for passages that were not inherently well organized to begin with. Thus the organizer provided subjects with information that was not readily available in the text itself. Studies that have employed advance organizers have had mixed success, however. Although good and average readers gain from advance organizers, poor readers often show no benefit (Cantwell & Kirby, 1983; Langer, 1984). In a literature review, Barnes and Clawson (1975) found no consistent effects of advance organizers for either elementary or high school students.

A study by Tyler, Delaney, and Kinnucan (1983) suggests that reading skill and type of organizer are critical factors in the success of advance organizers. Tyler et al. asked good and poor college readers to sort the sentences from a scientific report into groups of related ideas. They found that poor readers had difficulty grouping sentences into sets that conformed with the structure of a good scientific report, indicating a lack of knowledge about report organization. Tyler et al. then devised four types of advance organizers. The first was a simple summary of the text. The second was similar to the kind of organizer advocated by Ausubel. It included explanations of the main concepts in the passage, as well as definitions of key words used in the text. The third and fourth organizers provided the structural organization needed to understand the text. Although one was prose, and the other diagrammatic, they both showed the main structural components of a scientific report. They included the terms Introduction, Method, Results, and Discussion, and showed how these should be developed. Tyler et al. found that the first two organizers were beneficial only to good readers. Of the four organizers, they gained most

from the second, which presented concepts to be found in the passage. In contrast, poor readers gained no benefit from the first two organizers, but were helped by the third and fourth organizers that emphasized structure. Thus the usefulness of a particular organizer depended on the skill of the subjects. The poor readers who had a specific problem with organization gained only from structural organizers. The good readers who were already sensitive to structure gained from learning about the concepts in the passage. The Tyler et al. study demonstrates the importance of text structure to comprehension of a science report. Recent evidence suggests that subjects also rely on text structure to help them remember stories.

Effects of Story Structure on Story Comprehension. In the late 1970's researchers began an intensive investigation of simple folk tales. Folk tales, found in every culture, have traditionally been passed orally from generation to generation. Investigators have been interested in the characteristics of folk tales that made them so memorable. Many attempts to describe the characteristics of such stories emerged at about the same time (Johnson & Mandler, 1980; Mandler & Johnson, 1977; Stein & Glenn, 1979; Stein & Nezworski, 1978; Rumelhart, 1975; 1977b; Thorndyke, 1977). The results of this research suggested that structural similarities existed among folk tales around the world. Rumelhart (1977b) described this structure as a simple problem solving sequence in which a protagonist encounters a problem and sets about solving it. The story tells about this attempt and whether or not it succeeds.

The set of rules used to describe the structural characteristics of a

folk tale is called a story grammar. The story grammar is a useful tool for describing the simple stories of the oral tradition (Mandler, 1984). The Stein and Glenn (1979) grammar has been used in a number of developmental and individual difference studies, and is the grammar used in this thesis. Stein and Glenn proposed that a story consists of a setting, which describes the main characters and context of a story, followed by one or more episodes. Each episode contains one behavioural sequence. In multiple episode stories, these behavioural sequences can be related in three ways. One episode may cause the next to happen. Alternatively, two episodes may be temporally related, so that one follows but is not caused by another. If two episodes occur simultaneously in time, or are unrelated to one another they are described as "and" related episodes.

Each episode contains five story categories. The first category, the initiating event, involves a change in circumstances, which causes some kind of response, in the main character. The response can be emotional, cognitive, or both, and frequently includes making a goal plan. The active application of this plan is called an attempt. In other words the protagonist actively tries to change the circumstances imposed by the initating event. The outcome of the attempt is the consequence which may or may not facilitate the attainment of the character's goal. The final category is the protagonist's reaction to the consequence. Each category is comprised of propositions, which are the basic units of the story. Although a proposition may be just part of a sentence (e.g., a clause), it can be rewritten as a simple sentence (Stein & Glenn, 1979). For example, the sentence "Julie hid under her covers until she fell asleep", contains

the two simple ideas that Julie hid under the covers, and Julie fell asleep, connected by a temporal relationship 'until'.

The grammars were originally used to describe existing folk tales. It was assumed that stories that conformed to the ideal described by the grammars would be easily remembered. Furthermore a story grammar analysis could be used to predict which parts of a story would be easy or difficult for subjects to understand. For example, Mandler and Johnson (1977) re-examined Bartlett's "War of the Ghosts" story using their story grammar to predict which parts of the story would be difficult for subjects to understand and remember. They then reanalyzed Bartlett's protocols and showed that recall was lower for parts of the story that were not logically related to one another. Other studies have shown that parts of a story that are central to its causal structure are better recalled than supporting details (Black & Bower, 1980; Mandler & Johnson, 1977; Omanson, 1982).

Mandler and Johnson (1977) maintained that by listening to many stories children develop a set of expectations about how stories are sequenced. They called this set of expectations a schema, and claimed that the mental representation (schema) reflects the regularities in the text that the rules (grammar) describe. Mandler (1984) and Stein (1982) argued that, because story grammar rules describe the organizational principles of story schemata, story grammars can be used as tools to study story representation in memory. The grammars have been used in two ways. First, researchers have asked subjects to recall stories that conform to the grammar, and have used the grammar to analyze story recall protocols. Results of a large number of studies

have confirmed that stories are recalled in similar ways by adults and children (Mandler & Johnson, 1977; Stein & Glenn, 1979). In addition, Weaver and Dickenson (1982) reported similar patterns of story category recall for average and very poor readers. Such evidence has been used to support the validity of the story grammar as a descriptive tool.

Story grammars have also been used to manipulate story organization, in order to examine the effects of structural disruptions on story comprehension (Kintsch, Mandel, & Kozminsky, 1977; Mandler & DeForest, 1979; Stein & Nezworski, 1978). Mandler and DeForest (1979) had subjects in Grades 2, 4, and college listen to simple two-episode stories. In one condition (canonical), one episode followed the other as in a normal story. In the second condition, the two episodes were interleaved, so that the beginning statements of both episodes occurred together, followed by the two responses and so on. Thus story organization was disrupted. In the interleaved conditions, subjects were instructed to recall the story either as a good story, by separating the episodes, or to recall the story exactly as they heard it. Mandler and DeForest found that all subjects in the canonical condition recalled the stories in canonical order. Subjects of all ages were able to recall interleaved stories in canonical order, but had difficulty recalling them in the interleaved order. The Grade 2 children were differentially penalized by this condition, relative to the older readers. Mandler and DeForest argued that Grade 2 children were differentially dependent on their story schemata in remembering stories, and could not use other means to organize retrieval of story information.

Stein and Nezworski (1978) studied adults' memory for stories using

four levels of story organization. They used a normal well-organized story in the first condition. For the second and third conditions, this story was disrupted in two ways. Slightly disorganized stories had one category removed from its original position in the story. Randomly ordered stories had all propositions randomly scrambled. The fourth condition consisted of a list of unrelated propositions. Subjects in each condition were required to recall stories either exactly as they heard them, or to try to make a coherent story. Later, after a free recall task, subjects were given the propositions typed on strips of paper, and asked to reconstruct the story. Stein and Nezworski found that as text organization decreased, story recall decreased. Subjects were able to recall more from random and unrelated stories, however, when asked to "make a good story". These results are similar to those reported by Mandler and DeForest (1979). Stein and Nezworski found that subjects had great difficulty reconstructing stories in the random and unrelated conditions. Subjects were not able to reconstruct stories to conform to the story grammar. Their reconstructions were at least as disorganized as the original stories they had heard.

In a developmental study, Poulsen et al. (1980) asked 4- and 6-year-old children to describe the pictures in a picture story, and then to retell the story without the pictures. Even 4-year olds told good stories when they described pictures in a normal story sequence. When the pictures were scrambled, however, the 4-year olds merely labelled them. By 6 years of age, children tried to make a sensible story of the scrambled picture sequence by adding inferences about the character's thoughts and feelings. At both ages

recall reflected the degree to which the children were able to impose an organization on the sequence. Thus even very young children showed sensitivity to story organization.

Mandler, Scribner, Cole, and DeForest (1980) reported that literate and illiterate adults and children of the Vai culture showed similar patterns of story recall to those of American subjects. Mandler et al. argued that people around the world have similar mental representations of story structure. Their findings do not agree with those of Bartlett (1932), who found that culturally unfamiliar stories were difficult to recall.

Bartlett's findings have been confirmed by a study by Kintsch and Greene (1978). Kintsch and Greene found that American college students were better able to understand and recall a European fairy tale than an Apache Indian tale. Kintsch and Greene argued that the students had schemata for fairy tales, but not for Indian tales. Unfortunately, their study did not include a group of Indian students. Thus we do not know whether or not Indian students would have shown the opposite performance pattern (Brewer, 1985). Brewer argued that without the opposite pattern of results, it is not possible to determine whether the stories were more difficult for subjects because they lacked the schemata for Indian tales, or whether they were just more difficult stories. Mandler et al. (1980) argued that the Kintsch and Greene Indian stories were loosely structured, and therefore difficult for anyone to understand. Furthermore Mandler and Johnson (1977) maintained that the story grammar could predict the parts of Bartlett's story that were hard to recall. These sections were not logically related to one another. Bartlett's (1932) and Kintsch

and Greene's (1978) results suggest, however, that stories from different cultures have different structures, and that no single grammar can describe all stories. The Kintsch and Greene results also demonstrate the difficulty of separating effects of world knowledge from knowledge of story structure. In their study subjects may have lacked knowledge about cultural traditions (content) or knowledge about the organization of stories from a different culture (structure). The literature reviewed in this chapter suggests that both kinds of knowledge contribute to story comprehension, and that both may be affected by cultural differences. Thus subjects may fail to understand a story because they lack the relevant world knowledge, or because the story's structure is incompatible with their schemata for stories. Given that cultural differences in story representation exist, they may be an important factor in story understanding of children from different cultural backgrounds.

Little is known about use of story structure by children from different socioeconomic backgrounds. Most of the story grammar studies have employed children from middle or upper middle class backgrounds (e.g., Poulsen et al., 1979; Stein & Glenn, 1979). Yet Wells (1985) reported that tests administered early in kindergarten showed a relationship between social class and "readiness" for reading. And this test was correlated with a test of reading comprehension two years later ($r = .80$). Wells found this relationship surprising, given that all children had demonstrated adequate oral language for daily interactions with their families in the preschool years. He noted that such children were at a disadvantage in question and answer sessions that required a display of knowledge of particular information. Wells maintained that the

problem was partly due to lack of knowledge, but that this was not the only factor affecting performance. If asked in the appropriate context, the children could show that they knew many of the necessary concepts. The problem occurred when information was requested for its own sake, rather than in a context that made it relevant to the child. Wells hypothesized that many school activities that employ written language demand knowledge that is independent of the child's immediate context. He proposed that experience with stories at home helped children to learn to deal with written language. In order to test this hypothesis, Wells observed children from 1 year 3 months to 4 years 6 months in their own homes, to determine what kinds of experiences they had with written language. He found that, relative to children who only had experience with picture books and colouring pictures, children who listened regularly to stories showed greater awareness of print and superior word identification skill at age 5. Thus having stories read to them made children more aware of the printed symbols that are basic for reading. They also scored higher in reading comprehension at age 7. Wells argued that listening to stories made children more aware not only of print, but of the symbolic and context-independent characteristics of written language. Thus children appear to gain from the traditional bedtime story.

Wells' findings are supported by studies reported by Young (1983), who was interested in children's acquisition of knowledge about stories. Young hypothesized that children of lower socioeconomic backgrounds did not hear bedtime stories and might be delayed in their acquisition of story schemata. Using the Poulsen et al. (1979) picture-arrangement task, she found that normal

story recall of lower class 6-year olds was similar to that of middle class 4-year olds. These 6-year olds had difficulty in re-arranging and in recalling a scrambled story. The lower class 4-year olds did not distinguish between normal and scrambled stories in either their descriptions or in recall. Young proposed that the delay in story schema acquisition put the children at risk in story-oriented primary grades. Young's and Wells' findings suggest that early exposure to stories provides the child with two advantages. First, the child becomes aware of the symbolic nature of written language. Second, he or she develops knowledge about the structure of stories.

The literature suggests that children who begin school without well-developed story schemata may not have adequate opportunities to develop them. Stories in primary grade basal readers are not tightly structured (Beck et al., 1982; Brennan, Bridge, & Winograd, 1986). Basal reader stories are constrained by traditional readability formulas that are based on sentence length, word length, and word familiarity. The resulting stories are poorly structured (Brennan et al., 1986). Moskow (1980, cf. Brennan et al., 1986) reported that basal reader stories did not meet Prince's (1973) minimal requirements that a story should contain three temporally and causally related events, and have some kind of resolution. Improving the structure of basal reader stories makes them easier to understand (Beck, McKeown, Omanson, & Pople, 1984; Brennan et al., 1986). Brennan et al. changed two basal reader stories to make them conform to the Stein and Glenn (1979) story grammar. The changes made the stories more difficult according to traditional readability formulas. The second grade average readers in the study showed higher

performance for the revised stories, relative to the originals, on four measures of comprehension.

One would expect children to acquire knowledge about story organization in school. The evidence suggests, however, that this may not be the case for children who are slow to learn to read. Whereas high-skill reading groups spend most of their time on reading, low-skill groups spend time establishing rituals such as raising hands to ask questions, and taking turns (Brown, Palincsar, & Armbruster, 1984). In addition the emphasis in the bottom reading groups is on word decoding. They rarely engage in activities that teach comprehension (Brown et al., 1984). Thus the poor readers may not get enough school experiences to help them learn about story structure.

There are few studies of individual differences in the use of story organization by older children. Studies that have used well-structured stories have reported lower recall levels for poor readers, but have found that in terms of category recall, their performance patterns are similar to those of good readers (McConaughy, 1985; Weaver & Dickenson, 1982). Fitzgerald (1984) showed, however, that relative to good readers, poor readers in Grades 4 and 6 were poorer at anticipating narrative structure during reading. When asked to complete an unfinished story, or fill in the blanks in a story, their responses were less likely to match the story parts predicted by the story grammar. Rahman and Bisanz (1986) used the Mandler and DeForest (1979) paradigm, in which propositions from different episodes are interleaved, to examine knowledge of story structure in good and poor Grade 6 readers. They found superior performance for the good readers in free recall, and on a

reconstruction task that required the subjects to re-order the propositions to make a good story. Rahman and Bisanz compared the performance of their poor Grade 6 readers with the average Grade 3 readers in the Mandler and DeForest (1979) study. Because the poor readers in Grade 6 were less able to use story structure than the Grade 3 subjects in the Mandler and DeForest (1979) study, Rahman and Bisanz argued that the poor readers' performance was not just developmentally delayed. Their performance was qualitatively different from that of younger readers. Such evidence suggests that although most readers make use of story structure to direct story processing, some poor readers may not rely on story structure to help them understand and remember stories. It is possible that such children have not developed schemata for stories. Alternatively, they may know what makes a good story but fail to use this knowledge in reading situations, because they are not aware of its importance to story processing. Thus they may lack a metacognitive strategy rather than knowledge about story structure (Ryan, 1981).

In summary, the literature demonstrates the importance of knowledge of real world events and of text organization to story comprehension. Readers/listeners who lack knowledge about a story's topic remember not only less, but different story information than those who are more knowledgeable about the topic (e. g., Spilich et al., 1979). Furthermore presentation of appropriate knowledge prior to reading a text facilitates comprehension, provided that such information is organized and relevant to the passage (Arnold & Brooks, 1976; Bransford & Johnson, 1972). Such organized information appears to be most useful when it provides a) information not available in the

text itself, or b) knowledge that the reader/listener does not already possess. The importance of story organization to story comprehension is well established, even in young children (e.g., Poulsen et al., 1980). There is emerging evidence, however, that some children may not rely on story organization to help them understand stories (Young, 1983). In terms of the Rumelhart (1977a) interactive reading model, such children may lack or fail to use an important source of "semantic level" knowledge that is used in story comprehension. In the thesis, children's reliance on story organization is examined in both reading and listening situations.

CHAPTER 4

Rationale for the Thesis Research

The thesis research adopted the information processing assumption that knowledge from many sources contributes to comprehension and memory for stories. The literature reviewed in Chapter 2 indicates that fluent reading depends on rapid, accurate decoding of words from print. Chapter 3 demonstrates the importance of story organization to memory for stories in children and adults. But it is not clear how word-decoding skill and use of story organization relate to one another. Because studies that have demonstrated reliance on story organization by young children and poor readers have used listening tasks, it is not known whether children who rely on text structure in listening also do so in reading. If inefficient word-decoding skills preclude comprehension as data-driven models suggest, some children may not be able to take advantage of text organization because they cannot read the words. Alternatively, if children have not developed knowledge of story organization, they should be penalized in story comprehension in both reading and listening. Given Rumelhart's (1977a) assumption that word level and semantic level sources of knowledge contribute simultaneously to reading, and interact with one another, it is important to study both word decoding and reliance on text

organization within the same experimental design. This approach was adopted in the thesis research. Two experiments were conducted. In the first experiment, the contributions of word decoding and reliance on story organization to the story comprehension of readers who varied in age and skill were examined. In the second, two means of improving story comprehension, in children who had difficulty reading and remembering stories, were investigated.

Issues of Subject Selection

Extreme skill group designs. The literature reviewed in the previous two chapters indicates the diversity of methodologies and populations used in individual difference research about reading. Some studies have focused on a single processing task. Others have obtained multiple measures of processes related to reading to determine their relationships to fluent reading and to one another. Whereas some studies have examined skill differences among children in regular classrooms (e.g., Backman et al., 1984; Hogaboam & Perfetti, 1978), others have focused on clinical populations (e.g., Denckla & Rudel, 1976). Because different age and skill criteria have been used by different investigators, comparisons among studies are difficult. A coherent view of the processing deficits of poor readers has been slow to emerge.

Many of the individual difference studies conducted in the 1970s employed subjects who represented the extremes of the skill distribution on standard reading tests. Investigators assumed that by employing subjects with equal IQs, but extreme reading scores, they could identify processing differences that were specific to reading. The goal was to identify a specific skill deficit that could account for reading failure. The literature reviewed in this thesis

confirms that no single deficit can explain the reading problems of poor readers. Skill differences have been found on almost every processing task employed (Stanovich, 1986). Stanovich argued further that reading skill deficits are not specific to the reading task. In many cases good and poor readers also differ on other cognitive tasks. For example, Siegel and Ryan (1987) showed that disabled readers, selected by a word-decoding criterion, had deficits in short-term memory, as well as on several oral language tasks that required knowledge of sentence structure. For example, they had difficulty in finding errors in sentences, and in completing unfinished sentences. In addition, poor readers often fail to use efficient strategies to help them understand and remember what they read, even when they are capable of using them (Stanovich, 1986). Because of their failure to use appropriate strategies, researchers claim that poor readers lack metacognitive awareness (i.e., awareness that particular strategies can aid learning). Thus poor readers are frequently called inactive learners (e.g., Ryan, 1981).

The relationship of IQ to reading. Stanovich (1986) questioned the practice of trying to equate good and poor readers on IQ. He maintained that poor readers' language difficulties and their lack of metacognitive awareness are reflected in IQ scores, and that readers who vary in reading skill also vary in IQ. For example the Peabody Picture Vocabulary Test (PPVT) is often used to equate good and poor reader groups. Yet the PPVT is correlated with reading achievement (Stanovich, Cunningham, & Feeman, 1984a). Stanovich (1986) argued that poor readers tend to have lower I.Q.s than good readers, and that attempts by investigators to ensure that good and poor readers have equal IQs

have not been as successful as was intended. Furthermore the nature of the IQ-reading relationship is not understood, and by controlling IQ, experimenters may remove the most interesting variance related to reading comprehension (McClelland & Jackson, 1977).

McClelland and Jackson (1977) and Stanovich (1986) have challenged the assumption that IQ represents a general level of cognitive function that can be measured by a single score. They have argued that both IQ tests and reading are cognitive tasks that require complex processing skills. Although many processes are common to both, the IQ-reading correlation does not establish a causal relationship (i.e., a high IQ does not cause reading fluency). McClelland and Jackson argued that the many component processes that are common to both IQ and reading should be examined to determine their relationships to one another. Some individual difference studies have adopted this approach, and have obtained multiple measures of processing skills to determine their relationships to reading and to one another (e.g., Jackson & McClelland, 1979; Stanovich et al., 1984a). Stanovich et al. tested children in Grades 1, 3, and 5 on four factors related to reading comprehension; IQ, word- and pseudoword-decoding speed, listening comprehension, and linguistic awareness. Stanovich et al. found that all factors correlated with reading comprehension. The best predictor of reading achievement was speed of word and pseudoword decoding. Furthermore, IQ was not a good predictor of reading achievement, especially in Grade 1. Stanovich et al. attributed an increased relationship between IQ and reading in Grade 5 to mutual facilitation. In other words, success in reading enhances intellectual

development, which in turn has a positive effect on reading performance.

Poor readers: A heterogeneous population. One problem with using an extreme-skill-groups design is that it suggests a dichotomy between those who can and cannot read (Carr, 1981). Furthermore, the studies do not indicate how the skills of these extreme groups relate to those of average children. Carr (1981) and Lovett (1981) argue that poor readers comprise a heterogeneous population. Lovett (1984b) argued that there are many subtypes of disabled readers, and that one approach to the study of such children is to identify groups of poor readers who differ on tasks that measure a particular process, and to examine other skills that relate to that performance. The goal is not to generalize results to all poor readers, but to identify particular problems in specific subgroups of children. For example, Lovett (1984a) identified two subgroups of readers in a group of 8- to 13-year olds referred to a remedial treatment program. One group was 1.5 years delayed in both accuracy and speed of word naming. She called these children accuracy disabled and argued that they had not yet achieved the first (accuracy) criterion for fluent reading proposed by Laberge and Samuels (1974). These children displayed problems with oral language as well as with reading, suggesting that they had a pervasive problem in language development. Lovett identified a second group who had well developed oral language, and average levels of accuracy in word decoding, but who were very slow (1.5 years delayed) in speed of word decoding. She stated that these children had achieved accuracy but not speed in word identification, and called them rate disabled. Lovett (1984b) maintained that there are many subgroups of poor readers, and that her accuracy-disabled and

rate-disabled groups represent two points on a skill continuum.

Experiment 1

Population. The first experiment in the thesis addressed some of these issues of subject selection. The goal was to obtain results that could be generalized to a large population of normally progressing readers, and to examine individual skill differences within this context of normal development. Therefore the experiment included 345 children in Grades 3 to 6, who represented the full range of intellectual and socioeconomic backgrounds found in regular classrooms. In order to maximize the variance in the population, children were selected from nine Hamilton elementary schools that represented different socioeconomic areas of the city. All children were given the Wechsler Intelligence Scale for Children-Revised (WISC-R) to ensure that their IQs were in the normal range, but no attempt was made to match children who varied in reading skill on the IQ measure. Thus IQ was left free to vary as one of the many factors that contribute to reading comprehension. Gates-MacGinitie Reading Comprehension and Reading Vocabulary scores were also obtained for all children. Both scores were used as criteria for selecting good and poor readers for the individual difference comparisons.

By including a wide range of age and skill in the population, two issues of subject selection could be addressed. First students at the extremes of the reading skill distribution on a standard reading test (Gates-MacGinitie) could be compared with average readers in each grade to determine how their reading processes differed. Good and poor readers selected by the Gates-MacGinitie Vocabulary and Comprehension tests are referred to as the general

groups in the thesis. From the general group, subgroups of children with extreme scores on the story tasks (specific) groups were isolated. The good and poor readers in the specific group not only had high and low standard reading scores, respectively, but had high and low levels of free recall and question answering on the story task. Thus Lovett's approach of isolating a subgroup of poor readers with a specific reading problem was adopted. The goal was to determine whether the story comprehension task could add to our understanding of the comprehension problems of these poor readers, and further to evaluate a possible means of remediation.

Method. In order to study the contributions of word decoding from print and reliance on story organization to reading comprehension, the first experiment used simple children's stories and manipulated two variables. To separate the word-decoding factor from the structure variable, modality of presentation was varied. Stories were read silently, orally, or were listened to. Reliance on story structure was examined by manipulating story organization. Three levels of organization were used. Normal stories were well organized and conformed to the ideal proposed by the Stein and Glenn (1979) story grammar. A scrambled version of each normal story was created by scrambling the story categories (except the setting) to disrupt story organization. Thus scrambled stories contained the same materials as the normal stories, but they lacked logical relations among the story categories. A third level of structure (random stories) were the same length as the normal stories, but lacked both thematic and structural relations among the propositions. Each child read one story silently and listened to one story at each level of structure (normal, scrambled

and random), for a total of six stories, in a within subjects design. In addition each child read one normal story aloud.

Modality and structural effects were assessed with four measures of comprehension. The first was free recall. When a person reads a good story he or she may want to be able to tell someone about it. In order to tell a story well it is necessary to understand it. Thus memory for a story provides a good index of story comprehension. Memory for stories has been widely used as a sensitive indicator of reliance on story organization (e.g., Stein & Glenn, 1979). Although younger children recall fewer story propositions than older children, their similar patterns of recall show that they use story organization to aid story comprehension at an early age (Poulsen et al., 1980; Stein & Glenn, 1979). Because a memory measure is sensitive to the organization variable, and because use of a memory measure makes contact with the large literature on story grammars, free recall was used as one measure of story comprehension. Free recall has an additional practical advantage. It allows the child to tell his or her own version of the story. Experimenter-designed comprehension tests assess what the experimenter thinks is important in the story. A great deal can be learned about how children process stories from their free recall protocols, because they can include ideas not tapped by experimenter's tests. It was expected that children who relied on story structure to facilitate story processing would recall more from normal (well-organized) stories than from scrambled (poorly organized) stories. They should recall least from random stories that lacked both theme and structure.

Because free recall is a demanding memory task, however, other

measures of sensitivity to story structure were also obtained. Reading rates were obtained for stories at all three levels of structure to provide a measure of sensitivity to story organization at encoding. It was hypothesized that children who relied on story structure should find normal stories easier to read, and therefore read them more quickly than scrambled or random stories. Comprehension questions were asked about each story. It was possible that some children would have difficulty retelling a story, but could indicate story comprehension when asked questions about it. Children who relied on story organization while reading might be able to answer more questions for normal than for scrambled stories, even though this difference did not appear in free recall. Such a result would indicate that they had encoded structure, but that they were unable to use it to retrieve story information in free recall, possibly because of the heavy memory demands of the free recall task. In addition children rated each story in terms of its ease of understanding. The ratings provided a measure of awareness of story organization. Children who found well-organized stories easier to understand should give higher ratings to normal than to scrambled or random stories. Thus they could indicate awareness of story structure that was not evident in their recall scores. Alternatively they might indicate reliance on story structure in free recall despite no differences in ratings, suggesting that they are affected by text structure, even though they are not aware of it. These four comprehension measures were obtained to provide converging evidence of sensitivity to story organization.

In summary, the first experiment manipulated two factors, presentation modality and story organization in a within subjects design. This

design, in conjunction with the large and varied population of children included in the experiment, allowed two sets of comparisons. First, because normal stories were presented in all three modalities (oral, silent, and listen), the effects of presentation modality on normal story performance could be examined, as a function of age and skill. If poor word decoding from print precludes reading comprehension, as data-driven models suggest (Laberge & Samuels, 1974), then children whose comprehension difficulties stem from difficulty in reading the words should gain from a listening task that requires no analysis of print. The literature suggests that a listening advantage should occur for younger and poorer readers, but that with increasing word analysis skills, reading and listening should produce equivalent performance (e.g., Curtis, 1980; Stanovich et al., 1984a; Stanovich, 1986). In other words, the advantage of listening should decrease as children gain experience and skill in word decoding from print. Alternatively if their comprehension difficulties result from higher level processes related to general language comprehension, then reading and listening should produce equivalent performance (K. S. Goodman, 1976). According to K. S. Goodman's view, children who fail to engage in active construction of meaning while reading or listening should have difficulty understanding stories in both modalities.

Given K. S. Goodman and Y. M. Goodman's (1977) argument that oral reading reduces comprehension because it slows reading rate, and divides attention between oral output and reading for meaning, oral reading should reduce performance relative to silent reading or listening. Both good and poor readers should be penalized by reading aloud. Given that poor readers are less

skilled at reading for meaning, this divided attention task should penalize them differentially, relative to good readers.

The second set of comparisons examined the effects of structure under two modality conditions (silent reading and listening). The main interest in these analyses was in children's use of story structure in reading and remembering stories. Given that normal and scrambled stories contained the same words and sentences, any differences between normal and scrambled story comprehension would be attributed not to differences in decoding individual words or sentences, but to use of story organization to guide story comprehension. It was expected that children who relied on story organization to help them understand and remember stories would find it easier to comprehend normal than scrambled stories. Random stories that contained no thematic or structural relations should produce lowest levels of performance. They were included as a means of estimating possible floor effects.

The story grammar literature suggests that both young children and poor readers are sensitive to the structure of a good story (Poulsen et al., 1979; Stein & Glenn, 1979; Weaver & Dickenson, 1982). Therefore all readers should recall more from normal than from scrambled stories. Because these studies have used listening tasks, however, it is not known whether poor readers use story organization in reading situations. Data-driven reading models propose that children with poor word-decoding skills must attend to decoding individual words, and therefore have reduced attentional capacity to attend to meaning. Such children may not be able to take advantage of the structure of a story to facilitate comprehension, while reading. Because a listening task

requires no analysis of print, poor readers may show greater sensitivity to story organization in listening, where they can take advantage of story structure, than in reading where they must attend to decoding the words. Alternatively, if reading is conceptually driven (K. S. Goodman, 1976), and if poor readers rely on story organization in text processing (Weaver & Dickenson, 1982), they should recall more from normal than from scrambled stories in both modalities. If they do not use story structure in story processing, performance should be depressed in both modalities.

By proposing that both data driven and conceptually driven processes contribute simultaneously to reading comprehension, interactive reading models suggest that deficits in either word decoding or reliance on story structure can contribute to individual differences in reading comprehension. Perfetti and Roth (1981) proposed that there may be at least two kinds of poor readers; those who have deficits in word decoding, and those who can read the words and not understand the text. Either deficit should produce low levels of comprehension.

A major interest of the first experiment was the comparison of good and poor reader groups chosen by two sets of criteria (the general groups, selected on the basis of high or low Gates-MacGinitie Reading scores, and the specific groups, selected to represent children with a specific deficit in story comprehension, in addition to extreme Gates-MacGinitie Reading scores). The groupings chosen by different criteria might show different patterns of performance. Poor readers who recalled very little of what they read following silent reading were of particular interest. If their low recall levels stemmed

from failure to decode the words from print, these children should gain most from the listening task, relative to average or good readers, showing both improved performance over all and increased reliance on story organization in listening. Young (1983) and Rahman and Bisanz (1986) have suggested, however, that some children fail to develop knowledge about story organization. The performance patterns of the poorest recallers in the first experiment were examined to determine whether they distinguished between normal and scrambled stories on the four comprehension measures. If such children have not developed awareness of story organization, or have not learned to use it in reading or listening to stories, they should show reduced sensitivity to story organization in both modalities, relative to good or average readers, and possibly relative to poor readers selected by the standard reading test.

In summary, it was hypothesized that children whose comprehension difficulties stemmed from a deficit in word decoding should gain from a listening task that required no print analysis. If reading and listening produced equal performance, however, comprehension differences could also be attributed to some other factor common to both modalities. Second, it was hypothesized that children who relied on story organization in reading and comprehending stories should indicate better comprehension of normal than of scrambled stories. Random stories that lacked thematic as well as structural relations among story statements should produce lowest performance levels. In addition, interactions of modality with structure, and of both factors with grade and skill were predicted. Of particular interest were the performance patterns shown by the good and poor reader groups selected by different criteria.

Experiment 1 produced two interesting findings that were pursued in a second experiment. First, a group of children was identified who recalled very little story information in either silent reading or listening. These children recalled significantly more from normal stories when they read aloud. Second, this group of poor readers showed almost no sensitivity to story organization on any measure, in either modality. Experiment 2 focused on two questions: a) How does oral reading help poor readers? and b) Can these poor comprehenders use story structure to guide story comprehension, if the story structure is presented prior to reading the story?

Experiment 2

Two groups of poor Grade 6 readers participated in the second experiment. One group had low recall levels and failed to distinguish between normal and scrambled stories in silent reading. This specific group was similar to the specific group in Experiment 1. Children in the second general group were also poor readers according to standard reading test scores, but they recalled more from the stories they read. The nature of the relationship between oral and silent reading was examined by having children read normal and scrambled stories aloud and silently. Based on the results of the first experiment, it was predicted that the poorest recallers would gain differentially from reading aloud. Miller and D. E. P. Smith (1985) proposed that oral reading increased attention to individual words in text. Goldman et al. (1980) suggested that oral reading increased the quality of the verbal code produced by poor readers, making the words easier to remember. By proposing that the effect of oral reading is at the word level, either of these arguments predicts that

reading aloud should increase performance for both normal and scrambled stories. Alternatively, if oral reading changed story processing by inducing the child to generate meaningful sentences and to predict upcoming text (Clay & Imlach, 1971), or to aid integration of text propositions (Salasoo, 1986), it should increase recall of normal (organized) stories but not of scrambled (disorganized) stories.

Experiment 2 also investigated the malleability of the poor comprehenders' deficit in reliance on story structure, by teaching the children an advance organizer that focused on story structure, prior to reading stories. It was hypothesized that children who used this structure to help them process stories should increase recall of normal stories that matched this structure, but not of scrambled stories that did not match it. The literature on advance organizers suggests that an organizer is most effective when it provides information that is not inherent in the text itself (Ausubel, 1960), or when it provides information that the reader does not already know (Tyler et al., 1983). Based on such evidence, it was expected that the greatest benefit of the organizer should be for children who did not use story organization to direct story processing on their own. Experiments 1 and 2 are reported in detail in the next two chapters.

CHAPTER 5

Experiment 1

The goal of Experiment 1 was to examine the contributions of word decoding from print, and reliance on story organization, to the story comprehension of children who varied in age and skill. The experiment employed simple children's stories and manipulated two variables. First, in order to separate the word-decoding variable from the structure variable, modality of presentation was varied. Children read silently, read orally, or listened to stories. It was hypothesized that children whose reading comprehension was limited by poor word-decoding skills should gain from a listening task that required no analysis of print. Alternatively, children whose comprehension was limited by higher level language comprehension difficulties should perform equally in both modalities. Oral reading was included as an additional index of word-decoding problems. If oral reading reduced reading rates, and forced the child to divide attention between producing the words and reading for meaning (K. S. Goodman & Y. M. Goodman, 1977), then oral reading should produce lowest levels of performance.

Second, in order to study children's reliance on story structure in reading and remembering stories, text organization was varied. Normal stories

were well-organized according to Stein and Glenn's (1979) story grammar. Scrambled stories contained the same propositions as the normal stories, but the story categories were scrambled to disrupt story organization. Because the normal and scrambled stories contained the same words and sentences, differences in recall between the two versions cannot be due to differences in decoding individual words or sentences. Given that they differ only in story organization, comprehension differences between normal and scrambled stories reflect the use of text organization to aid story comprehension and recall. Random stories were the same length as normal stories, but lacked both structural and thematic relations among the story propositions. Random stories were expected to produce the lowest levels of performance. Interactions between modality and structure were also expected. Children who experienced difficulty reading the words should recall more, and show greater sensitivity to story organization following listening, because no print analysis was required. Furthermore, if inefficient word decoding is a limiting factor in comprehension (Perfetti & Roth, 1981), these listening benefits should be greatest for the youngest and poorest readers.

The effects of these variables were examined for a large population of children in Grades 3 through 6. The experiment first examined developmental changes across the four grades, and then compared individual differences at each grade level. The data thus address the role of word decoding and general comprehension skills as they develop with experience. They also show the role of each variable in relation to good versus poor readers over a considerable range of early reading skill acquisition.

Method

Subjects. In order to obtain a wide range of developmental and skill differences, 345 children in Grades 3 to 6 were included in the study. They were students at nine elementary schools in Hamilton, Ontario, representing a broad cross-section of socioeconomic backgrounds. The study included 175 males and 170 females. Children were not preselected on any standardized measures prior to testing. Rather all children from each classroom whose parents consented to their participation were included in the study. Variation in backgrounds was achieved by selecting schools from different socioeconomic districts in the city. All children came from normal classrooms and had no uncorrected visual or auditory deficits. All children were given the Wechsler Intelligence Scale for Children - Revised (WISC-R; Wechsler, 1974), which provides measures of Verbal and Performance IQ. The verbal IQ score is based on 6 tests that tap different aspects of verbal performance. These include Information, Similarities, Vocabulary, Comprehension, Arithmetic and Digit Span. The first five of these require the child to give oral answers to questions that increase in difficulty as the test proceeds. Digit span measures the number of digits the child can repeat either in the same sequence, or in the correct backward sequence. The performance IQ is assumed to test nonverbal abilities. In Picture Completion the child must find the missing feature on a picture. Picture Arrangement requires the child to arrange a series of pictures in the correct order to depict a short story. In Block Design the child uses patterned blocks to match a pattern set by the tester. Object Assembly consists of puzzles that represent common objects. Coding requires the child to copy picture codes as

quickly as possible. All of the tasks for both verbal and performance IQ are timed. Thus the child must be fast as well as accurate to obtain a high score. The overall (Fullscale) IQ score is based equally on all tests. The mean fullscale, verbal and performance standard scores are 100 with standard deviations of 15.

Vocabulary and comprehension scores were obtained for all children on the Canadian edition of the Gates-MacGinitie Reading Tests (1979). These group tests are administered to all children in Hamilton Public Schools. In Grade 3 the vocabulary subtest requires the child to choose a word that best describes a picture from a group of four words. The comprehension test requires the child to choose one picture from four that portrays the meaning of a short paragraph. In Grades 4 to 6 the vocabulary test requires the child to choose a word from five words that most nearly matches the meaning of a given word. The comprehension test requires the child to read a paragraph containing blanks, and to fill in each blank with the appropriate word from a group of five words. Standard scores were calculated for each child. Each test has a mean standard score of 50, and a standard deviation of 10. Descriptive statistics for the population are shown in Table 1. It shows that mean IQ scores were close to the mean for the population. The mean standard scores for the Gates-MacGinitie comprehension and vocabulary subtests were also close to the population mean. On each test the distribution of scores was normally distributed.

Materials. The experiment used simple children's stories that were consistent with the difficulty level of the readers used in Grade 3 in Hamilton

TABLE 1

Descriptive Statistics for the Developmental Sample

Grade		Age (yr-mos.)	VIQ	PIQ	FIQ	GV	GC	Sex M	Sex F
3	M	8-6	104.5	106.4	105.9	50.9	50.9	44	44
	SD		12.2	12.0	11.1	9.1	9.7		
4	M	9-10	106.3	111.2	109.6	53.2	51.8	53	39
	SD		13.4	12.0	12.3	10.0	10.1		
5	M	10-9	101.6	106.0	103.9	50.5	50.7	38	44
	SD		12.1	11.5	12.0	8.5	8.0		
6	M	11-9	101.0	106.7	103.7	51.4	51.8	40	43
	SD		10.3	11.9	10.5	8.1	9.4		

M Mean
SD Standard deviation
VIQ Verbal IQ
PIQ Performance IQ
FIQ Full scale IQ
GV Gates-MacGinitie Vocabulary
GC Gates-MacGinitie Comprehension
M Male
F Female

schools. The Stein and Glenn (1979) story grammar was used to construct five stories that were structurally similar. Each normal (well organized) story had three episodes with a total of 30 propositions divided equally among the following five story categories: setting, event, reaction, attempt and consequence. A second version of each normal story was created by leaving the setting intact, and randomly scrambling the remaining story categories to disrupt the story's organization. These were called scrambled stories. Thus the scrambled stories contained the same materials as the normal stories, but lacked the logical relationships among the story categories.

A third level of story structure was represented by two random stories. These stories were matched to the normal stories only in length. Their 30 propositions were unrelated, except that they referred to the same character. Thus they lacked both structural and thematic relations among the sentences. All of the stories used in the experiment are included in Appendix A.

In summary, there was a normal version and a scrambled version of each of five stories. In addition there were two random stories. These stories were typed on white paper for the reading conditions. For the listening condition the stories were recorded on a high-quality tape recorder, and were read at a normal rate, with normal story-telling intonation. Mean presentation rates in the listening condition were 140.11, 143.45 and 134 words/min. for the normal, scrambled and random stories, respectively.

Design. The two experimental variables, presentation modality and text structure, were manipulated within subjects. Each child read one story silently and listened to one story in each of the normal, scrambled, and random

conditions, for a total of six stories. One normal story was read aloud. The five normal/scrambled conditions were always tested first, followed by the two random passages. The random stories were presented last to reduce the likelihood that children might become frustrated and lose interest in the experiment if these difficult stories occurred early in testing. Any practice effects should be greatest for random stories, and should therefore reduce the expected effects. Because the random passages were included to estimate floor-level performance for sets of 30 propositions, and because they were not matched for materials' difficulty with the normal/scrambled stories, the main structural analyses compared only the normal and scrambled stories. The order of the five normal/scrambled story conditions was approximately counterbalanced across subjects within each grade. This was accomplished by leaving story order constant and rotating the five presentation conditions (oral normal, silent normal, silent scrambled, listen normal, and listen scrambled). Thus each of the five Modality X Structure conditions was tested approximately equally often in each of the first five test conditions. Each condition occurred approximately equally often in each condition for each grade. Because of unequal sample sizes at different grade levels the numbers in each counterbalanced order could not always be perfectly matched. For the random passages, the order of listening/reading conditions was counterbalanced within grades.

Procedure. Each child was tested individually in two 1/2 hour sessions. Session 1 included a practice story and the first three experimental passages. The remaining four passages were tested in Session 2. The task was

introduced by talking about the birthday game in which one person whispers a message to the next person, until the last person must say it out loud. The child was told how the message sometimes gets mixed up, and that it was important to get the ideas right, even if he or she forgot the exact words. The experimenter explained that because all of the children could not be there, each child in the game was passing on the story via tape recorder. A few minutes were spent talking about the tape recorder in order to make the child comfortable with it.

The child then read a simple one episode practice story to learn the procedure, which was the same for all passages. The children were told that they would read some stories and listen to other stories. Some stories would be easy to read or listen to because they were well-organized and easy to follow, and some stories would be harder to follow, because they were mixed up and out of order. The children were told that, even if they thought that a story was mixed up, they should read or listen carefully, so that they could tell all of the ideas of the the story. Oral and silent reading times were timed by stopwatch. Before recall the children were asked to count backwards for one minute as a distractor task. In memory tasks, subjects tend to recall the last few items presented, immediately from short term memory. This is called a recency effect. In recalling a story, for example, subjects might tell the last two or three propositions immediately, thereby disrupting the overall story output. Because a distractor task requires the subject to process different material prior to recall, it prevents this from happening. The children then completed three tasks.

Free recall. The child was asked to retell the story just as it was read or heard (free recall). It was emphasized that the ideas of the story were most

important, and that the words didn't have to be exactly the same. All recall protocols were tape recorded for later transcription and scoring.

Story ratings. In order to assess the child's awareness of the story structure, each child was asked to pretend to be a teacher and grade the story out of 5 (story ratings). Well-organized, easy to understand stories would get a score of 5. Mixed-up, hard-to-follow stories would get a score of 1. Those between these extremes would get a 2, 3, or 4. The child was encouraged to use all of the scores in rating the stories.

Comprehension questions. Each child was asked 10 questions as another measure of story comprehension. Children with a production problem in free recall might benefit from the cues provided by these questions. Two questions tested propositions in each of the five story categories. The story questions are included with each story in Appendix A.

Results and Discussion

The free-recall data were scored in terms of the number of story propositions (from the possible 30) that were correctly recalled. A proposition was scored correct if its gist or meaning matched that of an original story proposition irrespective of wording changes. The temporal order in which statements were recalled was also considered not important. Because of the large number of protocols involved, two judges shared the task of scoring after discussing and agreeing on scoring criteria. Interscorer reliabilities were .95, .90, and .87 for normal, scrambled, and random stories, respectively, on a randomly selected 12% of the passages of each type that were scored by both judges. Overall, 287 of the 2,394 stories in the experiment were scored by both

judges. Comprehension questions were scored by the same criteria as free recall, (i.e., scoring meaning rather than wording). Because some questions elicited more than one proposition each answer was given a score of 2, 1, or 0 and was converted to the proportion correct for analysis. The oral and silent reading rates were converted to words per minute for purposes of analysis, and the ratings were analysed in terms of the 1-5 scale. These data (free recall, comprehension questions, reading rates, and ratings) were then analyzed for developmental trends, and for individual differences in reading skill at each grade level. First all of the developmental analyses are presented. The individual difference results follow.

Developmental Analyses.

The developmental analyses were based on the data from all children in the experiment. Because recall protocols of three children could not be transcribed, the final sample included 342 children, with 88 and 90 children in Grades 3 and 4 respectively. Grades 5 and 6 each included 82 children. Reading rates were not available for all children. The reduced sample sizes for this measure are reflected in reduced degrees of freedom for the reading rate analyses. The data were submitted to analysis of variance (ANOVA) using the BMDP2V software package. BMDP software was used because it can handle experimental designs containing multiple between and within subject factors, and because it is not dependent on equal cell sizes. Tukey tests were used for post hoc means comparisons, because of the large number of means being compared in the experiment. The Tukey test is a very conservative test that reduces the chance of accepting a finding as significant, or true, when it is not.

First, the effect of presentation modality (oral reading, silent reading and listening) on normal story performance was assessed. Then, the effect of structure for stories that were read silently or were heard was examined.

Modality effects. Because only normal stories had been tested in all three modalities (silent reading, oral reading and listening), these data were first examined to see how normal story comprehension was influenced by these modality variations. The data showed an increase in performance with grade, confirming other findings in the developmental literature (e.g., Stein & Glenn, 1979). They also showed that silent reading and listening did not differ, but that oral reading led to superior performance, relative to either silent reading or listening. Table 2 shows mean performance for each measure as a function of grade and modality. For each measure a 4 X 3 (Grade X Modality) mixed analysis of variance was conducted.

There was a gradual increase in free recall from grade to grade, $F(3,338) = 7.84$, $MSe = 41.13$, $p < .001$. The main effect of modality, $F(2,676) = 12.03$, $MSe = 12.04$, $p < .001$, was due to superior recall following oral reading, relative to either silent reading or listening. Tukey tests confirmed the benefit of oral reading relative to silent reading or listening ($p < .01$ in both cases). There was no interaction of modality with grade.

Similarly, the proportion of comprehension questions answered correctly increased with grade, $F(3,338) = 3.35$, $MSe = .04$, $p < .02$, and silent reading did not differ from listening. The main effect of modality, $F(2,676) = 17.16$, $MSe = .02$, $p < .001$, was again due to superior performance following oral reading, relative to silent reading or listening (Tukey's $p < .01$ in both cases). There was no Modality by Grade interaction. These results replicate

TABLE 2

Mean Performance as a Function of Grade and Presentation Modality for the Developmental Sample in Experiment 1.

		Modality					
		Oral		Silent		Listen	
Measure	Grade	M	SD	M	SD	M	SD
Free Recall (Total = 30)	3	12.78	5.14	11.27	4.72	11.28	4.57
	4	13.49	4.15	12.26	4.96	11.92	4.50
	5	13.70	4.80	12.40	4.22	12.20	4.59
	6	14.58	4.44	14.43	4.88	14.38	4.87
Questions (Proportion correct)	3	.66	.13	.56	.27	.57	.17
	4	.66	.15	.61	.17	.60	.16
	5	.64	.16	.60	.17	.61	.16
	6	.68	.13	.65	.18	.64	.14
Reading Rate (Words/min.)	3	106.00	35.49	122.28	59.55		
	4	124.36	33.85	163.86	76.35		
	5	141.55	32.77	176.20	65.10		
	6	150.98	32.27	182.50	50.34		
Rating (1-5)	3	4.15	.94	3.92	.95	4.00	.97
	4	4.07	.80	3.94	.81	4.00	.85
	5	4.09	.77	4.00	.80	4.01	.82
	6	3.91	.65	4.00	.72	3.98	.77

the free recall performance.

Reading rates increased with grade, $F(3,288) = 13.90$, $MSe = 3898.12$, $p < .001$. The reduced degrees of freedom on this measure are due to the fact that reading rates were available for only 38 children in Grade 3. Oral reading was slower than silent reading, $F(1,288) = 87.55$, $MSe = 1374.26$, $p < .001$. Grade did not interact with modality, indicating that children in all grades read more slowly orally than silently. Finally, the analysis of the ratings showed that they were not affected by grade or modality, indicating that children of different grades responded similarly to well-organized stories.

Two consistent findings emerged from the analyses. First, recall was equivalent for normal stories that were heard or read silently. Second, oral reading produced higher performance than either silent reading or listening. The gradual increase in reading rates from grade to grade suggests that children became more fluent at word decoding with grade. Because reading did not differ from listening at any grade level, however, the comprehension differences between younger and older children cannot be attributed only to differences in decoding the words from print. Some other factor must also contribute to the poorer comprehension of younger readers. Further, the oral reading superiority might be considered surprising because it has been claimed that the need to articulate words slows reading rate and diverts attention from comprehension, and therefore harms reading for meaning (e.g., K. S. Goodman & Y. M. Goodman, 1977). The oral reading benefit observed here may challenge this assumption. The oral reading effect is pursued further in Experiment 2.

Structural effects. The second set of analyses examined the effects

of structure (normal, scrambled, random) for the listening and silent reading conditions. Silent reading and listening produced equivalent performance on all measures. Because the initial analyses did not yield any effects of modality, and modality did not interact with any other variables, the data were collapsed across modality to examine the structural effects.

Table 3 contains these data for all four measures. The random stories produced the poorest recall, question answering, and ratings, indicating that children were sensitive to their lack of theme and structure, and that no floor effects were involved in the normal/scrambled comparisons. A brief description of the role of random stories in the research is presented in Appendix B. Because the materials were the same for the normal and scrambled stories, but not for the random stories, only the results of the normal and scrambled comparisons will be reported. A 4 X 2 (Grade X Structure) analysis of variance was conducted for each measure.

Table 3 shows that in free recall more correct propositions were recalled with increasing grade, $F(3,338) = 8.95$, $MSe = 16.99$, $p < .001$. Normal stories were better recalled than scrambled stories, $F(1,338) = 503.14$, $MSe = 6.62$, $p < .001$. A Grade X Structure interaction, $F(3,338) = 3.92$, $MSe = 6.62$, $p < .01$, stemmed from the fact that only normal story recall increased systematically with grade ($p < .01$). For the comprehension questions, there were main effects of grade, $F(3,338) = 9.91$, $MSe = .02$, $p < .001$, and of structure, $F(1,338) = 270.13$, $MSe = .01$, $p < .001$, but no Grade X Structure interaction. In this task both normal and scrambled story performance improved with grade level.

TABLE 3

Mean Performance as a Function of Grade and Structure for the Developmental Sample in Experiment 1.

		Structure					
		Normal		Scrambled		Random	
Measure	Grade	M	SD	M	SD	M	SD
Free Recall (Total = 30)	3	11.28	4.01	7.61	2.75	4.81	2.31
	4	12.09	4.05	8.04	2.95	4.46	2.03
	5	12.30	3.79	7.77	2.38	4.20	2.11
	6	14.40	4.25	8.94	2.71	5.08	2.18
Questions (Proportion correct)	3	.57	.14	.43	.11	.37	.14
	4	.61	.13	.47	.11	.40	.13
	5	.60	.14	.48	.10	.41	.13
	6	.64	.13	.52	.11	.41	.13
Reading Rate (Words/min.)	3	121.93	61.11	100.45	36.23	104.56	43.41
	4	162.66	78.69	141.21	58.14	135.99	45.31
	5	176.20	65.10	158.49	50.92	155.04	47.40
	6	182.50	50.34	157.48	46.24	151.44	39.52
Rating (1-5)	3	3.96	.77	3.56	1.00	2.98	1.27
	4	3.97	.70	3.39	.87	2.46	1.13
	5	4.01	.65	3.24	1.00	1.95	1.06
	6	3.99	.64	2.82	1.00	1.70	.89

Reading rates also increased with grade, $F(3,271) = 11.54$, $MSe = 5758.86$, $p < .001$, and as a function of good story structure, $F(1,271) = 60.85$, $MSe = 945.12$, $p < .001$, but again no interaction emerged. For story ratings, the effects of grade, $F(3,338) = 4.67$, $MSe = 3.33$, $p < .005$, and of structure, $F(1,338) = 154.40$, $MSe = 2.34$, $p < .001$, were qualified by a Grade X Structure interaction, $F(3,338) = 7.70$, $MSe = 2.34$, $p < .001$. Children became more critical of poor story organization with increasing age. The normal-scrambled differences in story ratings were significant only for Grades 5 (Tukey's $p < .05$) and 6 ($p < .01$).

Grade X Structure interactions on the free recall and the rating measures suggest an increasing awareness of and reliance on good story organization as children proceed from grade to grade. Because reading rates and comprehension questions produced no such interactions, however, the free recall interaction may be due to retrieval problems, rather than failure to encode structure, for the younger children. Given that Grade 3 and 4 children failed to assign lower ratings to scrambled stories, it may have been that they did not know that story structure could be used to aid retrieval. When cued by questions, however, they were able to recall information from all parts of the story, suggesting that the information had been encoded. Because the rating measures were given immediately after free recall, however, it is also possible that they were influenced by the child's perceived success or failure on the free recall task. The data as a whole, then, suggest that children at all grade levels were sensitive to story organization. Younger children may have been less sensitive to story structure during encoding, or they may have been less able to

use such information to guide retrieval.

Individual Difference Analyses.

Individual skill differences at each grade level were examined using two definitions of good and poor readers. One grouping was based entirely on standard scores from the Gates-MacGinitie reading test. Good readers obtained either comprehension or vocabulary scores that were 1/2 standard deviation above the mean for their respective grades. Poor readers obtained either comprehension or vocabulary scores tht were 1/2 standard deviation below the mean for their respective grades. The good and poor readers were reading at least one year ahead of or behind their expected grade levels. Gates-Macginitie scores for these general groups are shown in Table 4.

The second grouping used more stringent criteria for defining comprehension skill. In addition to high Gates-MacGinitie scores, children in the good reader group received scores on either free recall or comprehension questions for normal stories that were in the upper quartile of the distribution for their respective grades, with the constraint that the remaining score was above the median. The poor readers had low Gates-MacGinitie scores. In addition they had either free recall or comprehension question scores in the lowest quartile of the distribution for their respective grades, with the constraint that the remaining score was below the median. Table 5 contains the Gates-MacGinitie scores for these specific comprehension groups.

When children are selected to represent the extremes of the skill distribution on a given measure (in this case free recall and question answering), it is possible that they might represent the most skilled and the least

TABLE 4

Gates-MacGinitie Scores for the General Groupings in Experiment 1.

Good Readers		Gates-MacGinitie Scores				Sex	
Grade	N	Vocabulary		Comprehension		M	F
		M	SD	M	SD		
3	34	59.9	6.1	60.9	5.5	14	20
4	39	61.7	6.8	61.0	6.0	24	17
5	28	59.9	6.0	58.7	6.3	15	13
6	32	59.2	5.9	60.3	7.2	15	17
Poor Readers							
3	34	42.4	4.7	41.5	4.3	19	15
4	35	44.2	5.7	42.3	5.3	21	14
5	32	43.4	4.0	44.6	5.1	13	19
6	27	43.4	3.8	43.3	6.4	11	16

TABLE 5

Gates-MacGinitie Scores for the Specific Groupings in Experiment 1.

Good Readers		Gates-MacGinitie Scores				Sex	
Grade	N	Vocabulary M	Vocabulary SD	Comprehension M	Comprehension SD	M	F
3	14	57.6	5.5	60.9	4.1	4	10
4	11	59.6	6.0	60.3	9.1	9	2
5	11	61.5	6.9	61.5	6.2	3	8
6	11	59.1	5.3	61.8	6.2	5	6
Poor Readers							
3	14	42.7	4.3	41.9	5.0	5	9
4	15	44.3	5.0	42.2	3.9	7	8
5	14	43.6	3.0	43.8	5.5	8	6
6	14	43.1	4.4	41.6	5.5	5	9

skilled in the sample. A comparison of the mean standard scores (collapsed over grade) for the general and specific groupings, shown in Table 6, shows that this is not the case. A comparison of the good readers in both groupings shows that they had virtually identical scores on both the IQ and reading measures. In addition, the poor readers in both groupings had similar levels of performance on all measures. The discrepancy between verbal and performance IQ is commonly found in poor readers (Kaufman, 1979), and is taken as evidence of the relationship between reading and other verbal abilities. It is important that the children in the poor specific group were not just at the bottom of the distribution of the general group. Given that the distributions of scores overlapped completely on all measures, their greater comprehension difficulties could not be predicted on the basis of either WISC-R or Gates-MacGinitie scores alone.

The modality analyses are presented first for the general and then for the specific groups. Following this are the structural analyses for the general and then for the specific groups.

Modality effects. These individual difference data were first examined for the effects of modality of presentation (silent, oral, listening) on performance for normal stories only. Table 7 shows the data for all four measures for the general group good and poor readers.

In free recall, children recalled more correct propositions with increasing grade, $F(3,253) = 5.78$, $MSe = 37.35$, $p < .001$. The good reader group recalled more than the poor reader group, $F(1,253) = 42.45$, $MSe = 37.35$, $p < .001$. A modality effect, $F(2,506) = 10.77$, $MSe = 12.41$, $p < .001$,

TABLE 6

WISC-R IQ Scores and Gates-MacGinitie Scores for the General and Specific Groupings in Experiment 1.

		WISC-R Scores		Gates-MacGinitie Scores	
		Verbal	Performance	Vocab	Comp
General Groups					
Good Readers	M	111.90	112.41	60.25	60.31
	SD	10.64	11.71	6.26	6.25
Poor Readers	M	96.09	103.41	43.35	42.91
	SD	9.61	11.08	4.67	5.33
Specific Groups					
Good Readers	M	112.83	112.83	59.34	61.11
	SD	9.55	11.80	5.91	6.33
Poor Readers	M	94.30	101.53	43.42	42.36
	SD	9.24	10.33	4.18	4.92

TABLE 7

Mean Performance as a Function of Grade and Modality for the General Groups in Experiment 1.

		Modality					
		Oral		Silent		Listen	
Good Readers							
Measure	Grade	M	SD	M	SD	M	SD
Free recall (Total = 30)	3	13.82	4.91	12.94	4.49	12.86	3.92
	4	15.03	3.70	13.67	4.23	13.08	4.21
	5	15.00	5.91	13.25	3.38	13.04	4.48
	6	15.72	4.54	15.94	3.21	16.50	3.76
Questions (Proportion correct)	3	.70	.12	.57	.21	.62	.15
	4	.70	.14	.65	.15	.64	.12
	5	.69	.14	.63	.15	.63	.15
	6	.71	.12	.67	.11	.70	.12
Reading rate (Words/min.)	3	132.01	22.05	158.22	73.70		
	4	146.74	27.58	209.41	87.32		
	5	157.71	20.34	220.32	65.08		
	6	163.84	23.92	204.37	52.64		
Rating (1-5)	3	4.12	.91	3.94	.92	3.82	1.06
	4	4.10	.64	3.85	.78	3.87	.83
	5	4.04	.74	3.96	.79	4.04	.79
	6	3.97	.54	4.16	.72	4.09	.78
Poor Readers							
Free Recall (Total = 30)	3	11.50	5.52	10.06	4.73	9.35	4.53
	4	11.89	4.24	10.11	5.03	10.86	4.49
	5	12.78	4.35	11.44	4.18	10.81	5.29
	6	13.30	4.50	12.44	5.74	11.93	5.35
Questions (Proportion correct)	3	.62	.14	.51	.21	.53	.18
	4	.62	.16	.56	.21	.56	.20
	5	.61	.15	.55	.19	.58	.19
	6	.65	.12	.58	.23	.56	.17
Reading rate (Words/min.)	3	64.17	20.93	79.98	20.25		
	4	97.86	26.02	121.51	35.06		
	5	131.26	40.21	139.03	47.95		
	6	140.29	31.06	169.19	51.62		
Rating (1-5)	3	4.24	.92	3.97	.94	4.15	.96
	4	3.97	1.01	3.94	.94	4.09	.92
	5	4.16	.85	3.81	.86	3.94	.98
	6	3.78	.70	3.74	.66	3.81	.79

was due to the fact that oral reading increased free recall relative to either silent reading (Tukey's $p < .01$), or listening ($p < .01$). Silent reading and listening did not differ. There were no interactions. The lack of a Grade X Skill interaction suggests that developmental increases in recall were similar for both skill groups. Furthermore, neither group benefitted from listening, and both groups gained from reading aloud.

In the comprehension question analysis, good readers answered a higher proportion of questions correctly than poor readers, $F(1,253) = 31.25$, $MSe = .04$, $p < .001$. Silent reading and listening produced equivalent performance. A main effect of modality, $F(2,506) = 20.67$, $MSe = .02$, $p < .001$, stemmed from an increase in performance following oral reading, relative to either silent reading or listening ($p < .01$). There were no effects of grade and no interactions. Thus for this general grouping modality of presentation acted similarly for good and poor readers. Oral reading improved their comprehension relative to silent reading and listening, which were equivalent.

An analysis of reading rates showed that reading rates increased with grade, $F(3,213) = 17.83$, $MSe = 3001.22$, $p < .001$, and skill, $F(1,213) = 100.32$, $MSe = 3001.22$, $p < .001$. A significant Skill X Grade interaction, $F(3,213) = 3.37$, $MSe = 3001.22$, $p < .02$ stemmed from a larger developmental increase in reading rates for the poor readers. For the good readers an increase from 145.02 to 189.11 words/min. (collapsed over oral and silent reading) between Grades 3 and 5 was the only difference to reach significance (Tukeys, $p < .05$). In contrast, reading rates for the poor readers more than doubled from 72.07 to 154.74 words/ min. between Grades 3 and 6. Thus fluency for reading words in

text developed very rapidly during this period for the poor readers. Oral reading was slower than silent reading, $F(1,213) = 79.51$, $MSe = 1348.42$, $p < .001$. A Mode X Skill interaction, $F(1,213) = 14.85$, $MSe = 1348.42$, $p < .001$ stemmed from a larger silent-oral difference for the good readers (M = 51. 42 words/min.) relative to the poor readers (M = 20.3 words/min.). The poor readers, however, also read more quickly in silent than in oral reading (Tukeys, $p < .01$). The lower reading rates for the poor readers indicate that in reading connected text they are less fluent than their skilled counterparts. The equivalent effects of silent reading and listening on free recall and question answering, however, suggest that slow reading rates alone cannot account for the comprehension deficits of poor readers, because auditory presentation would have been expected to eliminate that problem. Story ratings were not affected by grade, skill or modality.

These findings can be contrasted with the effects of modality for the specific comprehension groups shown in Table 8. In free recall, children recalled more correct story propositions with increasing grade, $F(3,96) = 4.54$, $MSe = 16.39$, $p < .006$. Main effects of skill, $F(1.96) = 356.30$, $MSe = 16.39$, $p < .001$, and of modality, $F(2,192) = 8.05$, $MSe = 12.81$, $p < .001$, were qualified by a Skill X Modality interaction, $F(2,192) = 3.98$, $MSe = 12.81$, $p < .03$. Whereas the good reader group was unaffected by modality, the poor reader group demonstrated superior recall following oral reading, relative to either silent reading or listening, Tukey's $p < .01$ in both cases. Silent reading and listening did not differ. Thus the best comprehenders gained nothing from oral

TABLE 8

Mean Performance as a Function of Grade and Modality for the Specific Groups in Experiment 1.

		Modality					
		Oral		Silent		Listen	
Good Readers							
Measure	Grade	M	SD	M	SD	M	SD
Free recall (Total = 30)	3	16.00	3.60	15.36	2.44	15.36	2.13
	4	17.45	3.45	17.73	3.50	17.18	2.60
	5	19.00	4.47	15.18	2.96	17.18	2.27
	6	17.64	6.07	18.45	2.46	19.55	2.07
Questions (Proportion correct)	3	.72	.16	.71	.14	.70	.10
	4	.72	.11	.77	.12	.66	.10
	5	.76	.11	.72	.11	.70	.10
	6	.76	.14	.72	.11	.78	.12
Reading rate (Words/min.)	3	136.28	21.11	150.27	73.54		
	4	145.21	27.90	207.67	52.97		
	5	160.03	20.01	245.27	80.92		
	6	158.29	18.63	195.30	46.22		
Rating (1-5)	3	4.14	.86	3.93	.62	3.64	1.08
	4	4.36	.67	3.82	.75	4.00	.63
	5	3.82	.87	3.91	.54	4.00	.89
	6	3.82	.40	4.18	.75	4.27	.65
Poor Readers							
Free Recall (Total = 30)	3	10.57	5.24	6.79	4.73	6.57	5.17
	4	9.13	3.64	6.00	3.85	7.87	3.40
	5	9.93	3.45	8.57	2.41	6.86	3.67
	6	11.93	4.02	8.57	4.59	8.64	3.91
Questions (Proportion correct)	3	.63	.16	.37	.20	.42	.22
	4	.56	.18	.38	.18	.42	.17
	5	.55	.13	.40	.13	.48	.21
	6	.63	.10	.41	.18	.50	.15
Reading rate (Words/min.)	3	51.20	19.48	80.17	25.78		
	4	96.39	22.11	127.38	41.02		
	5	124.55	47.37	116.12	22.04		
	6	137.62	31.99	159.72	41.22		
Rating (1-5)	3	4.00	1.11	4.00	1.11	4.21	1.05
	4	3.73	1.16	3.73	.80	3.80	.94
	5	4.14	.86	3.64	.84	3.57	1.16
	6	3.71	.61	3.57	.65	3.93	.83

reading, and the poorest comprehenders understood more when they read aloud.

Similarly, the proportion of questions answered correctly increased as a function of skill, $F(1,96) = 178.02$, $MSe = .03$, $p < .001$, and modality, $F(2,192) = 15.40$, $MSe = .02$, $p < .001$. These effects were qualified by a Skill X Modality interaction, $F(2,192) = 10.94$, $MSe = .02$, $p < .001$. Again, the good reader group was unaffected by presentation modality. For the poor reader group, however, more questions were answered correctly following oral reading, relative to either silent reading, or listening (Tukey's $p < .01$ in both cases). The difference between listening and silent reading was not significant.

Reading rates increased with grade, $F(3,81) = 9.54$, $MSe = 2339.12$, $p < .001$, and skill, $F(1,81) = 67.57$, $MSe = 2339.12$, $p < .001$. Silent reading was faster than oral reading, $F(1,81) = 42.70$, $MSe = 1075.69$, $p < .001$. A Grade X Skill X Modality interaction, $F(3,81) = 4.85$, $MSe = 1075.69$, $p < .005$ stemmed from a greater gain in reading rates with grade for the poor readers. They doubled their rates between Grades 3 and 6 in both modalities. For the good readers only silent reading rates increased with grade ($p < .05$). There was no significant developmental increase in oral rates. As in the general group, the poor readers showed rapid gains in reading rates during this period. Their differential gains in reading rates, however, did not produce commensurate gains in story recall or in question answering, suggesting that reading rate is only one factor that contributes to comprehension. Story ratings were not affected by grade, skill or modality, indicating that good stories were given high ratings by all age and skill groups.

In summary, silent reading and listening produced equivalent free recall and question answering for all skill groups. The equivalence of silent reading and listening performance for the poorest recallers confirms that their comprehension was not limited only by inefficient word-decoding skills. Whereas skill groups identified by Gates-MacGinitie scores alone showed small, similar gains from oral reading, this was not true for the groups chosen by the more stringent criteria. The poor readers in the specific group showed large gains from oral reading. When induced to produce every word orally, these children remembered more of what they read. In contrast, the best comprehenders gained no benefit from oral reading on either measure.

Structural effects. The second set of analyses focused on the effects of structure (normal, scrambled) for the good and poor readers. Grade and modality (listening, silent reading only) were included in the initial analyses. The grade effects were as described in the developmental analysis and there were no Grade X Skill interactions. Similarly, silent reading and listening did not differ except for two cases where listening slightly improved free recall for Grade 6 good readers only. Because this was neither a large nor consistent effect it will not be discussed further. The data for the general groups (collapsed across grade and modality) can be seen in Table 9, which includes the random scores to indicate the lowest levels of performance. The interesting comparison is between normal and scrambled stories for good versus poor readers.

Good readers gained differentially from good story structure on all four measures. This was confirmed by a Skill X Structure interaction on every

TABLE 9

Mean Performance as a Function of Skill and Structure (collapsed over modality) for the General Groups in Experiment 1

		Structure					
		Normal		Scrambled		Random	
Measure	Skill	M	SD	M	SD	M	SD
Free Recall (Total = 30)	High	13.89	3.55	8.87	2.68	5.12	2.26
	Low	10.80	4.18	7.44	2.63	4.13	2.10
Questions (Proportion Correct)	High	.64	.11	.50	.11	.43	.15
	Low	.55	.16	.46	.11	.36	.12
Reading Rate (Words/min.)	High	203.67	73.87	168.05	57.02	162.25	46.66
	Low	134.87	50.67	124.45	42.29	122.53	41.62
Rating (1-5)	High	3.96	.69	2.97	1.00	1.89	.95
	Low	3.94	.73	3.57	.95	2.73	1.30

measure. For free recall, the main effects of skill, $F(1,259) = 42.26$, $MSe = 15.78$, $p < .001$, and of structure, $F(1,259) = 364.34$, $MSe = 6.28$, $p < .001$, were qualified by a Skill X Structure interaction, $F(1,259) = 14.29$, $MSe = 6.28$, $p < .001$. Although the poor reader group gained from good story organization (Tukey's $p < .01$), the interaction confirms that the benefit was greater for the good group.

The comprehension questions analysis yielded main effects of skill, $F(1,259) = 23.61$, $MSe = .02$, $p < .001$, and of structure, $F(1,259) = 159.32$, $MSe = .01$, $p < .001$. A significant Skill X Structure interaction, $F(1,259) = 6.52$, $MSe = .01$, $p < .02$, confirms the differential reliance on good story organization by the good reader group. A Tukey test confirmed, however, that the poor readers also gained from well-organized text ($p < .01$).

The analysis of reading rates yielded main effects of skill, $F(1,208) = 58.31$, $MSe = 5679.84$, $p < .001$, of structure, $F(1,208) = 59.43$, $MSe = 935.27$, $p < .001$, and a Skill X Structure interaction, $F(1,208) = 17.79$, $MSe = 935.27$, $p < .001$. Although the poor readers slowed their reading rates for scrambled text ($p < .05$), the larger normal-scrambled difference displayed by the good readers indicates that they are differentially sensitive to text organization at encoding. This result differs from the developmental finding that younger and older readers equally slowed their reading rates for scrambled compared with normal text.

For the story ratings, main effects of skill, $F(1,259) = 13.41$, $MSe = .85$, $p < .001$, and of structure, $F(1,259) = 98.76$, $MSe = .61$, $p < .001$, were qualified by a Skill X Structure interaction, $F(1,259) = 20.89$, $MSe = .61$, $p <$

.001. Although both groups differentiated between normal and scrambled stories (Tukey's, $p < .01$), the interaction confirms that relative to poor readers, the good readers were more critical of scrambled stories.

In summary, the poor readers in the general group demonstrated reliance on story organization on all four measures. Skill X Structure interactions, however, indicated that, relative to good readers, the poor readers were less sensitive to story structure. These results can now be compared to those from analyses of the specific group, containing the best and worst comprehenders in the sample. The main difference is that for the specific sample the poor readers showed little or no sensitivity to story structure. The data for all measures (collapsed across grade and modality) are included in Table 10.

In the free recall analysis for the specific group the main effects of skill, $F(1,102) = 246.87$, $MSe = 9.14$, $p < .001$, and structure, $F(1,102) = 228.27$, $MSe = 3.25$, $p < .001$, were qualified by a Skill X Structure interaction, $F(1,102) = 124.56$, $MSe = 3.25$, $p < .001$. The interaction is due to a large difference of 6.52 propositions between normal and scrambled stories recall for the good readers, but only .99 propositions for the poor readers. In order to evaluate whether the poor readers' lack of sensitivity to structure resulted from averaging across some sensitive and some insensitive poor comprehenders, or whether it represented a general lack of sensitivity for children in this group, a normal-scrambled difference score was calculated for each subject. Table 11 shows the number of children who did and did not show structural sensitivity in each group, and the magnitude of the difference scores when more propositions

TABLE 10

Mean Performance as a Function of Skill and Structure (collapsed over modality) for the Specific Groups in Experiment 1

		Structure					
		Normal		Scrambled		Random	
Measure	Skill	M	SD	M	SD	M	SD
Free Recall (Total = 30)	High	16.82	2.23	10.30	2.51	6.28	2.51
	Low	7.47	2.70	6.48	2.45	3.46	2.01
Questions (Proportion Correct)	High	.72	.07	.51	.11	.48	.14
	Low	.42	.13	.42	.13	.33	.10
Reading Rate (Words/min.)	High	201.29	70.91	157.58	48.80	152.20	43.08
	Low	129.53	41.83	127.11	38.74	119.63	38.10
Rating (1-5)	High	3.96	.59	2.85	1.08	1.89	.98
	Low	3.81	.73	3.73	.94	3.02	1.21

TABLE 11

Number of Children Showing Differences Between Normal (N) and Scrambled (S) Free Recall.

	Number of Children per Category			Magnitude of Difference (Number of Propositions, Normal - Scrambled)		
	N < S	N = S	N > S	1-2	2.5-4	4.5 (or more)
High Skill (N = 47)	0	1	46	0	6	40
Low Skill (N = 57)	18	2	37	22	10	5

were recalled from normal than from scrambled stories. Of the 57 poor readers, 42 had differences of 2 or fewer propositions; 52 of the 57 poor readers had differences of 4 or fewer propositions. This contrasts with the good reader group, where only 1 reader had a difference of two or fewer propositions. This child had high recall levels for both normal and scrambled stories. Forty of the 47 good readers had large differences (median = 7.5, range = 4.5-12). Although one could argue that some poor readers showed some structural sensitivity, in most cases the magnitude of the difference was small, and may better be attributed to measurement error than to structural sensitivity.

The analysis of comprehension questions yielded main effects of skill, $F(1,102) = 144.31$, $MSe = .01$, $p < .001$, and of structure, $F(1,102) = 70.61$, $MSe = .01$, $p < .001$. A Skill X Structure interaction, $F(1,102) = 61.95$, $MSe = .01$, $p < .001$, stemmed from the failure of the poor readers to benefit from text organization. They recalled an equal proportion of correct answers from normal and scrambled stories. Further, good readers read faster than poor readers, $F(1,83) = 25.66$, $MSe = 4297.85$, $p < .001$. Normal stories were read faster than scrambled stories, $F(1,83) = 26.20$, $MSe = 856.64$, $p < .001$. A Skill X Structure interaction, $F(1,83) = 21.00$, $MSe = 856.64$, $p < .001$, reflected the fact that, unlike the good readers, the poor readers failed to slow their reading rates for scrambled stories. A Tukey test confirmed that there was no normal-scrambled difference in reading rates for the poor readers. Finally, analyses of the story ratings indicated that the main effects of skill, $F(1,102) = 9.11$, $MSe = .79$, $p < .005$, and of structure, $F(1,102) = 25.27$, $MSe = .71$, $p < .001$, were modified by a Skill X Structure interaction, $F(1,102) = 19.21$, $MSe =$

.71, $p < .001$. The interaction was due to the failure of the poor but not good readers to distinguish between normal and scrambled stories in their ratings. A Tukey test confirmed the nonsignificant difference between normal and scrambled story ratings for the poor reader group.

In summary, the poor readers in this group showed little or no evidence that they used story organization to guide story comprehension or recall. Although the poor readers in the general group were less sensitive to story structure than their good counterparts, the specific criteria isolated the extreme cases of children who showed almost no reliance on structure at all. Because these poor readers showed poor performance on all four measures of comprehension, they will be referred to as the poor comprehenders to distinguish them from the poor general group, who have a reading problem but less severe comprehension deficits.

Discussion.

The results of this experiment were intended to address the question of how word-decoding skills and knowledge of text structure were related to both developmental and individual differences in the comprehension and recall of children's stories. The word-decoding question was addressed by comparing performance for well-structured stories read silently and orally with stories where no reading was required (listening). The logic here was that if difficulty with word decoding explained the poorer comprehension and recall of stories, then younger and poor readers should benefit from aurally presented tales that required no analysis of print. Contrary to predictions, neither younger children nor poor readers showed any difference on any measure for stories read silently

compared with stories to which they listened. Given that a listening task provides not only individual words, but sentence syntax and the prosodic rhythm of speech, failure to find a listening benefit for poor readers is a striking result. The consistency of this finding across all age and skill groups suggests that story comprehension and recall also depend on higher level processing skills that are common to both reading and listening.

Surprisingly, it was oral reading that improved story recall across the developmental range, and differentially for the poor readers in the specific comprehension group. If oral reading is viewed as an attention-demanding task that diverts attention from comprehension to word naming (Smith, 1973), it should be detrimental to reading comprehension. The experimental results are contrary to that view. Does oral reading increase attention to the task as Miller and D. E. P. Smith (1985) argued? Alternatively does oral reading somehow alter text processing as Clay and Imlach proposed? See Chapter 2 for a review of these arguments. Experiment 2 pursues a possible explanation of this finding.

A major focus of the experiment was on children's use of text structure in story comprehension and recall. Although free recall and story ratings showed increased sensitivity to story structure for older compared with younger children, reading rates and comprehension questions showed no differential sensitivity across the developmental range tested here. A retrieval rather than encoding effect may be implicated by these results. For the individual difference groups, however, differential sensitivity between good and poor readers was clearly evident. The general comprehension groups indicated

reduced structure sensitivity for poor compared with good readers, at each grade level. The more stringent selection criteria, however, also isolated a group of very poor comprehenders (specific group) who showed almost no sensitivity at all to story structure. This was true at all grade levels. Thus the experiment was able to isolate a group of Grade 6 readers who showed no knowledge of a variable that clearly influences the average Grade 3 reader. In terms of Rumelhart's (1977a) interactive reading model, these children either lacked, or failed to use, a source of semantic level knowledge that is used in story comprehension around the world. (See Chapter 3 for a review of the literature on story structure).

Experiment 1 produced two interesting findings, the superiority of oral reading, and the isolation of a group of readers who have little sensitivity to story structure. These phenomena were explored further in Experiment 2.

CHAPTER 6

Experiment 2

Experiment 1 showed that oral reading helped children, particularly the least skilled comprehenders, to understand and remember what they read. However, the experiment provided no explanation for this effect. The literature is of little assistance here. A few studies have shown an oral reading benefit for poor readers, but they differ in their explanation for the phenomenon. Torgeson and Goldman (1977) reported that poor Grade 2 readers recalled picture sequences better when they named the pictures aloud. The authors argued that verbal labelling provided the poor readers with a verbal rehearsal strategy that they did not employ spontaneously. It is unlikely, however, that children engage in "verbal rehearsal" while reading connected text.

Miller and D. E. P. Smith (1985) reported that relative to silent reading oral reading facilitated the question answering of poor readers in Grades 2 to 5. They attributed the benefit to increased attention to individual words, but failed to explain how such an effect might occur. If the benefit is at the word level, oral reading should facilitate comprehension of normal and scrambled stories equally. This hypothesis was tested in Experiment 2.

Goldman et al., (1980) found that oral compared with silent reading

led to better probed recall for poor Grade three readers. They claimed that poor readers are inefficient at verbal coding processes, and that having to produce a verbal code for each word helps to maintain words in working memory. It is not clear from their argument, however, whether it is the quality of the verbal code or the act of generating it that is beneficial. It is clear from the first experiment that listening, which provides a verbal code for the child, yields no such benefit. This suggests that something about producing the phonological codes for the words improves memory for stories. Oral reading may act as a generation task for poor readers.

A generation task is one in which materials are generated by the subject according to some rule, rather than provided by the experimenter. Even when the generation task is very easy, leading to rapid, flawless performance, generating leads to superior retention for fluent reading adults (Slamecka & Graf, 1978). Graf (1980) asked subjects to read sentences, or to generate them by ordering a group of words according to a given sentence structure. Graf found that relative to reading, generating improved the recall of meaningful sentences, but not of anomalous sentences. He argued that generation increases memory organization, thus aiding the recall of meaningful word arrangement, but not of anomalous ones. If the oral reading advantage is due to improved organization at the text level, then following Graf's results, normal stories might benefit more than scrambled stories from oral reading. Thus, although the Miller and D. E. P. Smith word-level explanation of an oral reading superiority predicts equivalent benefits for normal and scrambled stories, a generation or organizational explanation at the text level would

predict a differential normal-scrambled benefit. Experiment 2 examined this issue.

The findings from Experiment 1 also suggested that the poor readers in the specific comprehension group did not engage in schema-directed story processing to help them to encode or retrieve story information. These findings are consistent with those of Rahman and Bisanz (1986), who looked at Grade 6 children only. The story ratings of the least skilled comprehenders suggest that their story schemata are so poorly developed that they do not recognize the difference between well-organized and poorly organized stories. Alternatively, these children may have an adequate knowledge of story structure, but fail to use this knowledge during reading.

One way to make the appropriate knowledge available to the poor readers is to present the relevant information to them just before they read the text. This can be done by using pictures, or by presenting a summary of the text prior to reading it. Advance organizers have been used to serve this purpose (e.g., Ausubel, 1960). Although Cantwell and Kirby (1983) found that an advance organizer facilitated comprehension for good, but not for poor readers in high school, Tyler et al. (1983) showed that the type of advance organizer used was critical in obtaining facilitation for college-age poor readers. Advance organizers that presented the appropriate organization of a scientific report just prior to reading a science report were particularly useful to poor readers, who lacked knowledge about the structure of such a report. Because the poor readers selected by the low recall criterion in Experiment 1 (specific group) did not use story organization in reading and remembering stories, an advance

organizer that stressed the problem structure of a story was used in this experiment.

Two groups of poor Grade 6 readers, similar to those described in Experiment 1 participated in the experiment. They were presented with two kinds of knowledge prior to reading stories. Because an advance organizer is an abstract concept for poor readers, it was presented in the context of a story. Prior to presenting the organizer, a picture depicting the story setting was produced on a flannel board, along with a brief verbal description that introduced the story characters. This picture plus verbal description will be referred to as a script. The script provided world knowledge that was relevant to the story. Then the story structure, which was the same for all stories in the experiment, was presented as a problem sequence. The children were asked to generate this sequence themselves in order to ensure that they understood and remembered the organizer. It is possible that in experiments that show no benefits of advance organizers for poor readers, the children have not understood the organizer. Children were then tested on normal stories that conformed to the organizer's problem structure and scrambled stories that were disorganized with regard to the problem structure. It was expected that if children used the problem sequence to help them to understand the stories, recall should increase differentially for normal, relative to scrambled stories that did not match the problem sequence.

In summary, Experiment 2 had two main goals. The first was to further investigate the nature of the oral reading benefit by having children read normal and scrambled stories under silent and oral reading conditions. The

second was to determine whether teaching an advance organizer that focused on story structure would encourage poor readers, similar to those studied in Experiment 1, to use text organization in reading and recalling stories. In addition, the design of this experiment allowed the replication of some of the critical findings from the first experiment. For each child the modality manipulation was studied in the first testing session, and the advance organizer training occurred in the second session.

Method

Subjects. Grade 6 children who were rated as poor comprehenders by their teachers, and who had low Gates-MacGinitie comprehension scores participated in the study. All of the children would have belonged to the poor general group in Experiment 1. Parent permission was obtained in writing for all participants. Recall performance following silent reading of normal and scrambled stories was used to divide the children into two poor reading groups. One group was selected by the same criteria used for the specific group in the first experiment. They recalled fewer than 11 correct propositions from the normal story. The score of 11 was used as the criterion because the specific group of Grade 6 poor comprehenders in the first experiment all had free recall scores below 11. In addition to low recall scores, no more than a two proposition discrepancy could exist between the free recall of normal and scrambled stories. This stringent criterion was adopted to ensure that they demonstrated both low recall and an insensitivity to story structure, as in Experiment 1. In order to facilitate comparison of Experiments 1 and 2, these poor comprehenders will be referred to as the specific group.

Children who had low Gates-MacGinitie scores but higher recall levels (over 11 correct propositions correct) constituted the general group in Experiment 2. The general group differed from the general group in Experiment 1 in that the recall scores of the general group in the first experiment were not part of the selection criteria. Whereas the specific group was a subset of the general group in the first experiment, this was not the case in Experiment 2. In the final sample used in Experiment 2, 16 children (all poor readers), were included in each group.

Materials. Eight well-organized stories each containing 30 propositions made up the normal stories. All eight stories had the same structure, consisting of two causally related episodes. For each normal story a scrambled version was created as described in Experiment 1. The script for each story consisted of a flannel board picture depicting the story setting and the main characters, with a brief verbal description of these. This was followed by a step by step description of the problem sequence (advance organizer) used by the protagonist in analyzing and solving problems. The problem sequence, which was the same for all stories is included in Table 12. Appendix C contains the normal and scrambled versions of each story, along with the picture and script used for each.

Design. All experimental variables were manipulated within-subjects. Each child read eight stories in two sessions. In Session 1, one story was read silently and one was read orally at each level of structure (normal, scrambled), for a total of four stories. This session addressed the oral reading benefit, in that the oral reading advantage could be tested for both well

TABLE 12

Problem sequence used as an advance organizer in Experiment 2.

PLACE

PROBLEM

FEEL AND THINK

TRY

RESULT

PROBLEM

FEEL AND THINK

TRY

RESULT

FEEL

-organized and poorly organized texts. In Session 2, all stories were read silently. The child read three normal stories followed by one scrambled one. The first two normal stories in Session 2 were used to teach the children the structural organizer which they could use to help them to understand and remember stories. The last two stories (one normal, one scrambled) constituted a post-test to assess the effects of learning the organizer on the reading of a new normal and a new scrambled story.

Each of the 8 stories was used equally often in all conditions in Sessions 1 and 2. Order of conditions was counterbalanced across subjects in Session 1. In Session 2, the conditions were in a constant order. The first three stories were normal, and the fourth was scrambled. Therefore any practice effects in Session 2 would be greatest for the scrambled story and would act to reduce the normal-scrambled difference.

Procedure. All children were tested individually in two 1/2 hour sessions. The first session began with a practice story to introduce the procedure. The children were told that they would read some stories silently, and some out loud. Some of the stories would seem well-organized and easy to remember. Others would seem mixed up, and hard to follow. They were told to read carefully, in either case, so that they would be able to retell the story later. Oral reading times were obtained by stopwatch. After reading a story, either silently or orally, the child completed the three tasks used in Experiment 1 (ratings, free recall, comprehension questions). Because of the concern that the ratings in Experiment 1 may have been influenced by the children's perception of success on the free recall task, ratings in this study were required prior to free

recall.

The second session consisted of two phases. In the training phase two normal stories were used to teach the child about story structure. For each story, the experimenter presented a picture depicting the story setting on the flannel board, while simultaneously using the script to verbally describe the story setting and the main character. The child was told that the main character sometimes had problems to solve, and that the story told about one of these problems. The experimenter then told about the problem, while arranging 10 cards outlining the problem structure of the story in the correct sequence in front of the child. After the child examined the cards, they were shuffled, and the experimenter asked the child to arrange them in the correct order. Thus the child used the cards to generate the problem sequence prior to reading the story. After the cards were arranged in a correct sequence, the story was presented for silent reading. The remaining tasks were the same as those in Session 1. For the second story in the training session, a new picture and script were used. This was followed by the same descriptions of how the main character solved his or her problems. Again, after ordering the cards, the child silently read the story, and then rated, recalled and answered comprehension questions.

In the post-test phase the child read silently and recalled one normal and one scrambled story. The picture and script were not used in the post-test phase. Before reading each story, the child generated from memory the problem sequence he/she expected to find in a good story. As each category was generated by the child, the experimenter laid the appropriate card on the

table, to confirm that the child was correct. All children did this perfectly. The remaining tasks were the same as those used earlier.

Results and Discussion

Measures and scoring. The same measures were obtained as in Experiment 1. The same criteria were used for scoring, except that in this experiment the comprehension questions were constructed so that only one answer was appropriate for each question. The questions for each story are included with the stories in Appendix C. All free recall protocols were transcribed and scored. A second scorer scored 25% (64) of the 256 stories, after discussing and agreeing on scoring criteria. Interscorer reliabilities were .98 and .99 for normal and scrambled stories respectively.

As in the first experiment, it was possible to identify two groups of children who did not differ on standard reading measures, but who differed in their use of text organization in reading comprehension. Descriptive data for the two groups are shown in Table 13. T tests confirmed that the specific and general groups did not differ in teacher ratings, $t(30) = .78$, and had similar Gates-MacGinitie Comprehension standard scores, $t(30) = .38$. Grade equivalent scores from the comprehension section of the Canadian Achievement Test were available for 12 of the specific group, and 11 of the general group. A grade equivalent score indicates the grade level at which the child is reading. These scores also did not differ, $t(21) = .27$. The Gates-MacGinitie scores indicated that these children were on average two years behind their peers in reading comprehension. The mean Canadian Achievement Test Comprehension scores suggested a three year lag.

TABLE 13

Descriptive Statistics for the General and Specific Groups in Experiment 2.

Measure		General Group	Specific Group
Teacher rating (Scale = 1-10)	M	3.75	4.13
	SD	1.44	1.36
Gates Comprehension (Standard score)	M	42.44	41.94
	SD	3.67	3.84
Canadian Achievement Comprehension Test (Grade equivalent score)	M	3.18	3.08
	SD	.74	1.02
Sex	Male	9	9
	Female	7	7

Although all children had comprehension difficulties, the story measures differentiated between the two groups. The specific group had low levels of free recall following silent reading of normal and scrambled stories. They recalled 7.50 and 8.38 correct propositions from normal and scrambled stories, respectively. In contrast, the general group recalled 15.06 and 11.00 correct propositions from normal and scrambled stories respectively. For each of these groups, two sets of analyses were conducted. The first analysis used the data from Session 1 to examine the effects of modality and structure. The second analysis examined the effect of learning the advance organizer as a function of structure. The silent reading data from Session 1 served as the pre-test data for this analysis, while the final two stories in Session 2 comprised the post-test data. Thus the silent reading data from the first session served three functions. They were used to identify two groups of children who differed in their initial use of story organization. They served as a baseline for comparison with oral reading in Session 1. And they served as a baseline to test the effects of learning the advance organizer.

General group: Modality effects. The first analysis examined the effects of modality (oral, silent) and of structure (normal, scrambled) during the first testing session prior to training. The general group demonstrated a reliance on text organization, but in contrast to the general group in Experiment 1, no benefit due to oral reading was found. In more detail, normal stories compared with scrambled stories yielded better free recall, $F(1,15) = 26.34$, $MSe = 8.4$, $p < .01$, better question answering, $F(1,15) = 9.97$, $MSe = 2.26$, $p < .01$, and higher ratings for comprehensibility, $F(1,15) = 9.64$, $MSe = .93$, $p <$

.01. There were no effects of modality for any measure. Although the reading rates showed a trend for normal stories to be read faster than scrambled stories, this difference was not reliable. In summary, this group of poor readers showed some reliance on structure, but no effect of modality. Because the modality effects differed for the general group of Experiment 1 and the general group of Experiment 2, the Grade 6 poor readers' data from Experiment 1 were reanalyzed, so that only those with high recall scores were included in the general group. In these reanalyses of Experiment 1, where the general group was comparable to the general group in Experiment 2, results were the same as those just described for Experiment 2. That is, the poor readers were sensitive to structure, but showed no effects due to modality.

General-group: Structural effects. The second set of analyses examined the effect of learning the organizer on recall of normal and scrambled stories read silently. The pre-test data were taken from Session 1, and the post-test data were the last two passages read in Session 2. Generating the problem sequence had no effects on any measure. Each measure showed reliably better performance for normal than for scrambled stories, but these differences were equivalent in the pre- and post-test data ($Fs(1,15) = 107.54, 5.97, 5.24, 6.76$, $MSe = 2.16, 2.52, 405.98, 1.56$, $ps < .05$, respectively for free recall, questions, reading rates, ratings), with only one exception. The exception was that the stories received lower ratings following problem generation, $F(1,15) = 9.62$, $MSe = .65$, $p < .01$, indicating that generating the problem structure of stories made the children more critical of all stories. Table 14 contains the data means. In summary, then, neither the modality manipulation

TABLE 14

Mean Performance for the General Group in Experiment 2.

			Free Recall (Total=30)	Questions (Total=10)	Reading Rates (words/min.)	Ratings (1-5)
Session 1 (pre-test)						
Oral	Normal	M	13.96	7.38	124.24	4.13
		SD	3.91	1.41	22.73	1.02
	Scrambled	M	10.56	5.88	126.07	3.38
		SD	3.29	2.19	28.75	1.31
Silent	Normal	M	15.06	7.50	142.62	4.38
		SD	1.69	1.59	32.79	.50
	Scrambled	M	11.00	6.63	133.14	3.63
		SD	2.61	2.00	33.57	1.02
Session 2 (post-test)						
Silent	Normal	M	14.25	7.44	145.68	3.81
		SD	3.02	1.21	54.97	.91
	Scrambled	M	10.69	6.38	132.11	2.94
		SD	1.99	1.59	27.73	1.34

nor the advance organizer affected the reading strategy of this group of poor readers. However, in both pre- and post-tests these poor comprehenders were sensitive to story structure.

Specific group: Modality effects. These results for the general group can be contrasted with those for the specific group of especially poor comprehenders. Because this group was selected to show no difference between silently-read normal and scrambled stories prior to learning the organizer, the interesting question from the Session 1 data was how oral reading would affect their performance. As in the first experiment, this group benefitted from reading aloud, but the new data show that this benefit was restricted to normal stories. In more detail, for free recall there were main effects of modality, $F(1,15) = 12.09$, $MSe = 4.20$, $p < .005$, and of structure, $F(1,15) = 8.89$, $MSe = 3.88$, $p < .01$, as well as a Modality X Structure interaction, $F(1,15) = 12.00$, $MSe = 7.32$, $p < .005$. The interaction resulted from oral reading increasing the recall of normal (Tukey's, $p < .01$), but not of scrambled stories. Similarly, for comprehension questions, oral reading was superior to silent reading, $F(1,15) = 10.60$, $MSe = 2.13$, $p < .005$. There was no main effect of structure, but a marginal Modality X Structure interaction, $F(1,15) = 4.12$, $MSe = 1.23$, $p < .06$, was due to an oral reading benefit for normal ($p < .05$), but not for scrambled stories. Further, oral reading was slower than silent reading, $F(1,15) = 10.53$, $MSe = 528.97$, $p < .005$, but this did not vary with structure. That is, oral reading slowed reading rates for both normal and scrambled stories. Also, ratings varied with structure, $F(1,15) = 17.62$, $MSe = .429$, $p < .001$, but not with modality. Table 15 contains the

TABLE 15

Mean Performance for the Specific Group in Experiment 2

			Free Recall (Total=30)	Questions (Total=10)	Reading Rates (words/min)	Ratings (1-5)
Session 1 (pre-test)						
Oral	Normal	M	11.63	6.69	122.49	4.19
		SD	4.18	1.20	31.56	.54
	Scrambled	M	7.81	5.75	116.65	3.38
		SD	2.74	2.08	32.17	1.26
Silent	Normal	M	7.50	4.94	142.78	4.00
		SD	2.34	1.61	52.96	1.10
	Scrambled	M	8.38	5.13	133.68	3.44
		SD	3.07	2.03	35.63	.89
Session 2 (post-test)						
Silent	Normal	M	13.56	7.56	150.85	4.31
		SD	3.44	1.41	60.07	.70
	Scrambled	M	8.69	5.69	129.66	3.56
		SD	3.03	2.18	36.23	1.36

means for these effects. Thus the children discriminated between normal and scrambled stories in their ratings, even though this distinction was not evident on other measures. In summary, following silent reading these children showed no dependence on structure in their free recall or question answering, although they did rate normal stories as better organized. Following oral reading, however, both recall and question answering was better for normal than for scrambled stories. Oral reading appeared to 'produce' a structural sensitivity during recall.

Specific group: Structural effects. For the second set of analyses examining the effect of training, the experience with the organizer increased comprehension for normal but not scrambled stories. In more detail, comparing free recall pre- and post-tests showed that generation of the problem sequence increased recall, $F(1,15) = 13.67$, $MSe = 11.9$, $p < .002$. There was also a main effect of structure, $F(1,15) = 20.43$, $MSe = 3.13$, $p < .001$, and a Training X Structure interaction, $F(1,15) = 36.23$, $MSe = 3.65$, $p < .001$. The interaction stemmed from the fact that only normal story recall increased with training, $p < .01$. Whereas normal and scrambled recall did not differ prior to training, normal recall exceeded scrambled recall after training, $p < .01$.

For comprehension questions, there were main effects of training $F(1,15) = 12.80$, $MSe = 3.17$, $p < .003$, and structure, $F(1,15) = 5.05$, $MSe = 2.56$, $p < .05$, and a Training X Structure interaction, $F(1,15) = 9.37$, $MSe = 1.82$, $p < .007$. Again only normal stories gained from experience with the organizer, ($p < .01$). Before training, structure had no effect on children's answers to questions, but after training children answered more questions

correctly for normal than for scrambled stories, $p < .05$.

Although the Structure X Training interaction failed to reach significance in the reading rate analysis, $F(1,15) = 2.72$, $MSe = 213.80$, $p < .12$, Table 15 shows that the trend was for a greater increase in the rate of reading normal compared with scrambled stories. Finally, children gave higher ratings to normal than to scrambled stories, $F(1,15) = 6.32$, $MSe = 1.09$, $p < .03$, but their ratings were not affected by the training manipulation.

In summary, the general group relied on story structure in free recall and question answering, under all conditions. They did not gain from oral reading, or from the advance organizer. In contrast, the specific group showed no sensitivity to story structure in silent reading. For these poor comprehenders, oral reading and use of the organizer both increased performance for normal but not for scrambled stories. The two manipulations had equivalent effects on performance.

Experiment 2 replicated and extended the findings of Experiment 1. As in the first experiment a group of children was identified who failed to rely on story organization to help them read and remember stories. The experiment showed two means of increasing story recall for these children, oral reading, and the use of a structural organizer. In contrast, children who already relied on story structure to facilitate story comprehension (general group) gained no benefit from either manipulation, even though they were also poor readers. The theoretical and practical implications of these findings for individual difference research are discussed in the final chapter.

CHAPTER 7

Implications of the Thesis Research

This research focused on the contributions of word decoding from print, and of general language comprehension, to children's story comprehension. In order to separate the effects of word decoding and general language comprehension, presentation modality and story structure were varied. The first experiment demonstrated developmental improvement from Grades 3 to 6 in story recall and question answering, but these improvements were equivalent whether the stories were read silently or heard. Similarly, no differences emerged between silent reading and listening for either good or poor readers. If difficulties at the level of word decoding account for the comprehension problems of younger children and poor readers, then these deficits should have been alleviated by auditory presentation, which required no analysis of print. That they were not suggests that the developmental and individual differences in story comprehension and recall are limited by some factor other than word decoding difficulties.

Oral reading compared with either silent reading or listening consistently improved performance at each grade level. Further, the individual difference analyses indicated that although oral reading generally improved story recall, it was the poorest comprehenders who benefitted the most from reading aloud. These findings are inconsistent with the view that oral reading

interferes with comprehension because it is attention demanding and slows processing (K. S. Goodman & Y. M. Goodman, 1977). The present research suggests that even up to Grade 6, and certainly for poor readers, oral reading may help children to understand and remember what they read.

The second important finding from Experiment 1 was that structural sensitivity during reading and listening is evident by Grade 3, but that there are individual differences in this sensitivity. At each grade level poor readers (specific group) were isolated who showed almost no sensitivity to disruptions in story organization. This group could not be diagnosed by standardized reading test scores, as indicated by a comparison with the general group in Experiment 1, where the selection criterion was based entirely on Gates-MacGinities scores. The poor readers in the general group appeared to be sensitive to structural disruption. However, by isolating the best and worst comprehenders in this group, the experiment demonstrated that some poor readers at each grade level were insensitive to story structure. Traditional story grammar analyses have shown that, relative to good readers, poor readers recall fewer story statements, but that the story information they do recall is similar to that of more skilled readers (e.g., McConaughy, 1985). Such findings have prompted story grammar theorists to argue that a story grammar analysis is not sensitive to individual differences (Mandler, 1984; Stein, 1982). By using the grammar to disrupt story organization, however, the thesis has identified children who appear to lack sensitivity to story structure.

These basic findings from Experiment 1 were pursued further in Experiment 2. Here Grade 6 poor readers were studied to a) investigate the

nature of the oral reading benefit, and b) explore the malleability of the structural deficit at this stage of reading acquisition. This study replicated the finding that there were poor comprehenders (specific group) at this level who showed very little sensitivity to disruptions in story structure. These readers could not be differentiated from other poor readers (general group) in terms of standardized reading scores, but they could be diagnosed by level of recall and question answering on a story task. Except for a small difference in ratings, the spcific group of poor readers showed no structural sensitivity. The general group (though they were still poor readers) showed structural sensitivity. These better comprehenders gained no benefit from oral reading and no benefit from the advance organizer training. The specific group, however, benefitted from both oral reading and structural training.

The remainder of this chapter discusses the importance of these findings to our understanding of individual differences in children's story processing. It contains three sections. The first two sections discuss the theoretical and practical implications of the modality and structural effects for the study of individual differences in story comprehension. In the concluding section the contributions of the thesis to the current literature are discussed.

Modality effects. This research was unique in its examination of modality effects (oral reading, silent reading, and listening) in such a large and varied population of children. The consistency of the finding that silent reading and listening produced equivalent story comprehension over this range of age and skill confirms that differences in word decoding from print are not sufficient to account for variations in story comprehension. Although the slower silent

reading rates of the younger and poor readers suggest that, relative to older and more skilled readers, they are less fluent readers of text, they did not gain from listening. Therefore some of the processing skills used in understanding and remembering stories are common to both modalities. Furthermore oral reading, which forced readers to produce every word, reduced reading rates for all readers, but increased comprehension in general, and especially for the least skilled comprehenders. These findings are contrary to the assumption of data-driven models that fast word decoding is a prerequisite for fluent comprehension. According to the data-driven view, an activity that slows text processing should decrease comprehension. In this case oral reading slowed reading, but increased comprehension. Although oral reading might produce deficits by diverting attention to the word level under some conditions (K. S. Goodman, 1976), this experiment clearly shows that there are other beneficial effects of oral reading that deserve consideration.

One interesting possibility is that the effect of reading aloud varies as a function of the task presented to the reader. If the reader is instructed to read every word correctly, and is interrupted to correct every error, the reader may indeed attend to the word level. If the child is instructed to read for meaning, and is not interrupted to correct individual words, oral reading might facilitate comprehension. Pehrsson (1974) examined the effects of oral reading instructions on comprehension in Grade 5 children. He found that the children who were asked be sure that every word was correct, and who were interrupted when they made an error, read more slowly, made more errors, and demonstrated reduced comprehension, relative to a group who were told to

read aloud, without interruption, and to remember what they read. Pehrsson's results suggest that the nature of the oral reading task affects text processing. In Experiment 2 the children were encouraged to read for meaning. The experiment provided a possible interpretation of the oral reading effect.

Experiment 2 indicated that the benefit due to oral reading was restricted to reading well-organized text. Scrambled texts, whose sentences were intact but whose text structure was disrupted, were not better recalled following oral compared with silent reading. The scrambled and normal texts shared wording and sentences, and differed only at the level of text organization. Therefore the normal-scrambled difference in performance following oral reading cannot be attributed to differences in processing at the word level. Miller and D. E. P. Smith's (1985) argument that oral reading facilitates comprehension by increasing attention to individual words cannot explain the normal-scrambled difference. Word or even sentence level benefits should have accrued to both well-organized and scrambled texts.

A more promising explanation may lie in the generative nature of reading aloud. In order to read with expression, readers use what they know about syntax and semantics to anticipate upcoming text. Readers chunk words into meaningful phrases, pause for punctuation, and vary the stress and pitch of the voice (Clay & Imlach, 1971). Clay and Imlach reported that by Grade 2, good oral readers were using intersentence information to guide their oral reading. That is, their oral reading indicated a grasp of intersentence organization. Even the least skilled comprehenders in the second experiment read with expression. There were very few errors, and most of these were self-

corrected. Thus oral reading of simple stories is one skill they have developed by Grade 6. If reading aloud induces the child to process meaningful units, it might increase comprehension in one of two ways. Because the generation of meaningful units makes them more memorable (Graf, 1980, 1982), one sentence may be easier to integrate with subsequent sentences, provided that the sentences form well-organized text. This would occur here for normal but not for scrambled stories. Alternatively, reading aloud may induce children to anticipate the next sentence (Clay & Imlach, 1971), thereby increasing inter-sentence as well as intra-sentence organization. An extension of Graf's argument to connected discourse would suggest that this should facilitate recall of well-organized but not of poorly organized stories. This argument suggests that oral reading induces the poor reader to do more conceptual processing rather than more data-driven processing as K. S. Goodman (1976) maintained. While this explanation is tentative, it does open avenues to pursue the benefit due to oral expression.

Given the controversy over the value of oral reading as a classroom activity, the limits of its effectiveness need to be defined. The children in these experiments did not experience extreme difficulty reading the words. The stories included vocabulary found in Grade 3 readers used in Hamilton schools. In spite of differences in reading rates, even the youngest and poorest children read with expression, and produced a meaningful representation of the story for the experimenter to listen to. There was no indication that the children were reading laboriously word by word when they read aloud. This finding confirms the claims of Danks and Fears (1979) and of Stanovich (1986) that there is little

evidence to support the notion of a word by word reader. The same manipulation could be employed with very young children, who are just beginning to read, to determine whether oral reading facilitates comprehension in beginning readers. Based on the evidence from this experiment that the poorest comprehenders gained most from reading aloud, I would hypothesize that if the words were within their vocabularies, younger children would also gain from reading aloud. One might also ask whether good readers ever gain from reading aloud. Although this experiment indicated that oral reading provided less benefit with increased skill, good readers may gain from reading aloud when faced with more difficult materials.

It is not an uncommon experience to find oneself mouthing the words when reading difficult text. Is this merely reverting to a strategy acquired in the early stages of learning to read, or does subvocalizing to produce an acoustic code improve comprehension? Laberge and Samuels (1974) proposed that fluent readers recode to sound when reading difficult text. This argument has gained support from memory experiments that require subjects to recall rhyming or nonrhyming items in correct order. Lower memory for rhyming items is attributed to the confusion produced by their acoustic similarity (e.g. Conrad, 1971; Shankweiler, Liberman, Mark, Fowler, & Fischer, 1979). Furthermore, studies have shown that when adult readers are prevented from subvocalizing by performing an alternate vocal task, their memory for difficult materials decreases (Levy, 1975, 1977, 1978; Slowiaczek & Clifton, 1980).

Two arguments have been advanced to account for the benefit of subvocalization. First, the acoustic code is more durable than a visual code and

facilitates retention of information in memory (e.g., Perfetti & Lesgold, 1977). This is the argument proposed by Goldman et al. (1980) to explain the benefit of oral reading on a probe memory task. They argued that poor readers did not spontaneously produce a good quality verbal code, and that production of an acoustic code in oral reading made the words more memorable for such readers. Alternatively, Slowiaczek and Clifton (1980, p.581) proposed that subvocalization induces the subject to reorganize the written text into a prosodic structure that incorporates the rhythm and stress of spoken language. They argued that subvocalization helps by changing memorial organization rather than by making acoustic codes more durable. This argument is consistent with the hypothesis proposed earlier in the thesis that oral reading acts for poor readers to increase organization at the discourse rather than at the word level. It would suggest that the poor readers in the experiment did not spontaneously produce this verbal code, and were helped when induced to do so by oral reading. This argument is consistent with Perfetti's (1985) argument that poor readers produce poor quality verbal codes in both reading and listening, but it differs from Perfetti's explanation of the effect. Whereas Perfetti attributes the benefit of oral reading to the quality of the verbal code itself (the incoming data), the results of this thesis research indicate that the effect may be at a more conceptual level, in text organization. Oral reading had no effect on poorly organized stories. Furthermore the structure manipulation, which had no verbal component, produced similar effects to oral reading on normal stories.

If oral reading increases organization among sentences, the oral reading effect might be produced by other non-oral tasks that increase

intersentence organization. For example, while reading a story, the children could be asked to complete a cloze task that requires integration of information among sentences. A cloze task requires a subject to fill in blanks in text with the appropriate letters or words. For example, in the story about Mike in Experiment 2, there are the sentences " He helped his father care for the birds. They came for food. Mike's dad built them a shelter." They could be rewritten as follows: "He helped his father with the birds. They came for food. Mike's dad built the bir_s a shelter". In order to complete the word birds by filling in the letter 'd', this task should induce the child to relate 'birds' in this sentence to the reference to 'birds' in a previous sentence. Therefore it should increase inter-sentence organization (Graf, 1980; Graf, 1982), without introducing the obvious acoustic effects produced by reading aloud.

Structural effects. The generation of story structure prior to silently reading a story was a second effective way to increase story comprehension in children who failed to engage in schema-directed story processing on their own. All children in the experiment learned to generate the problem structure of a story very quickly. Furthermore, problem generation increased recall of a normal story with just three experiences of problem generation. Children in the specific group nearly doubled their free recall of normal stories between baseline (7.5) and post-test (13.56). This increase in recall must be attributed to increased use of story structure. The picture and script were not presented with the post-test phase. Therefore the increase cannot be attributed to the prior knowledge provided by the script and picture. Nor can it be attributed only to a practice effect. The final story, which was scrambled, should also gain from

practice. Yet there was no increase in recall of the scrambled story. The research demonstrates that when prior knowledge is made salient, poor readers use it in the same way as good readers do. If similar training helps younger children with the same problem, an important source of difficulty in story comprehension might be alleviated.

Tyler et al. (1983) argued that the purpose of an advance organizer is to "bridge the gap" between what the reader already knows and the text to be read. Problem generation may have served this function in two ways. Drawing an analogy between the story structure and the child's own experience may have facilitated instantiation of a meaningful and relevant schema prior to reading. Furthermore generation of the same problem for all stories may have induced the children to notice the structural similarities among stories. Thus they were able to relate a new instance of a story to the previous one, and take advantage of their similarities. The scrambled story would not match the expected schematic representation, and should produce lower comprehension. The findings of Experiment 2 support this hypothesis. A critical factor in the success of the manipulation may have been the requirement that the child generate the problem structure himself or herself. The generation activity ensured that all children were equally familiar with the problem structure to be encountered. In addition to increasing the memorability of the sequence for the child, problem generation taught the child to anticipate what came next in a story.

Further research is needed to replicate and extend these findings. Younger children should be given the same training to determine whether it is effective at an earlier stage in reading development. Post testing following a

delay should be conducted to confirm that experience with the structural organizer has lasting effects. Would the experience transfer to other kinds of stories? This question could be addressed by following the advance organizer training with stories that vary in structural similarity to the organizer.

One interesting issue raised by the thesis research concerns the relationship between the oral reading benefit and the benefit of the structural organizer. Oral reading changed online processing without any reference to the structure variable. The advance organizer induced the child to rely on story organization, but did not involve use of an acoustic code. Although they were very different manipulations, they had equivalent effects on performance. Such evidence supports an interactive view of reading that many knowledge sources contribute to fluent reading (Rumelhart, 1977a). Stanovich (1980) argued that readers can compensate for insufficient knowledge at one level by relying on another source of information. Graf and Levy (1984) demonstrated this with fluent adult readers. The thesis research suggests a possible corollary to the compensatory argument. Increasing the quality of processing at one level of processing can have beneficial effects on the whole system. It may be that oral reading and problem generation actually effected the same processing changes that led to improved text integration and therefore recall. Do they affect processing in the same way? If they do, no added benefit should be expected when presentation of the organizer is followed by oral reading. If they affect different levels of processing, they might have additive effects (i.e., the child should recall even more when presented with the organizer, and then asked to read the following story aloud). This possibility could easily be tested. Their

effects might also be separated by a follow-up study to determine the duration of the effects of each manipulation at a later date. If learning the organizer induced the child to use structure spontaneously, it should have more durable effects than oral reading.

A further question concerns the relationship between structure and recall. Almost all of the interactions of structure with skill or developmental level are confounded with recall level. The children who show less sensitivity to story structure are also poorer recallers. Furthermore the manipulations that produce normal-scrambled differences also increase recall levels. It could be argued that when recall levels are low, there are quasi-floor effects that limit the appearance of structural differences in recall. Because the specific poor comprehenders were defined in terms of recall level, it is possible that they have a general memory problem and not an insensitivity to story structure.

This problem of confounding recall levels with differences due to experimental manipulations is fairly pervasive in the developmental and individual difference literature. Almost always the 'poorest' and 'youngest' also have lower performance levels in general. It may be that any activity that raises recall levels will increase recall. Are there ways to increase recall without introducing the structure variable? One could try to match recall performance levels by using easier stories for the poor readers. For example, they could be given stories that closely match a familiar experience such as a birthday party. This approach is advocated by K. S. Goodman (1976), who argues that materials to be read should be within the language experience of the child. This approach produces other interpretive problems. One does not know whether the child is

recalling a story, or just relating a familiar experience that could have been told without reading or hearing the story. In addition, the stories used in both experiments were already very simple relative to most materials used in school, especially for children at the Grade 6 level. The use of even simpler stories might mask the difficulties they have in reading stories in school.

Second, the kind of advance organizer proposed by Ausubel (1960) that teaches concepts found in a story with no emphasis on structure might raise recall levels for both normal and scrambled stories. The success of this kind of organizer with poor readers has been mixed, however (Barnes & Clawson, 1975). Tyler et al. (1983) showed that this kind of organizer increased performance for good readers, but provided no benefit to students who lacked knowledge of text structure. In their study, the success of the organizer depended on matching the type of organizer to the needs of the readers. Their results suggest that an organizer that stressed story concepts would not necessarily increase recall of the specific group, but it raises an interesting possibility for the general group. In the thesis research, only poor readers who lacked knowledge of text structure gained from an organizer that focused on structure. Children who already used story organization in reading stories (general group) gained nothing from the structural organizer, even though they were also poor readers. If these children lacked knowledge of the story concepts, they might gain from an organizer that taught the important concepts in a story. Such a finding would confirm the importance of specific diagnosis before designing treatment programs for poor readers.

Third, poor readers are frequently regarded as "inactive readers"

(Ryan, Weed, & Short, 1986). Possibly any activity that increases their effort or attention to the task might increase recall levels. Short and Ryan (1984) addressed this question by asking poor readers to read stories under four conditions. Two of them are important here. In one group, children asked themselves questions based on the story grammar as they read (e.g., "Who is the main character?"), and underlined the answers. The goal was to teach them a strategy which would induce them to use their knowledge about stories in reading text. Children in an "attribution" group were told to recite self statements such as "Try hard', and "Praise yourself for a job well done". Short and Ryan found that only the strategy training, which focused on the story's structure, increased story comprehension. Again increased use of structure improves performance, but increased attention to the task by itself provides no benefit.

In summary, it appears that it is difficult to increase recall without introducing the organization variable. Such evidence supports Tulving's (1962) claim that structure 'drives' learning and not the reverse.

Conclusions. The research reported in this thesis contributes to our understanding of individual differences in children's reading comprehension. By showing that silent reading and listening had equivalent effects on performance over a large range of age and skill, it confirms that variations in word decoding from print are not sufficient to explain differences in reading comprehension. This was confirmed by the finding that oral reading improved comprehension especially for the poorest comprehenders.

The finding that oral reading increased recall of well-organized

stories only extends our understanding of the oral reading benefit. It suggests that this effect is not at the word level. Rather, oral reading induces the child to generate meaningful discourse while reading. Rather than inducing the child to engage in more data-driven processing (K. S. Goodman & Y. M. Goodman, 1977), oral reading induces more conceptual processing, as the child anticipates upcoming text. Thus oral reading forces the child to engage spontaneously in the active hypothesis testing Goodman recommends for silent reading.

The research confirms that most children rely on story organization to help them understand and remember stories in both reading and listening. It supports the argument that most children are aware of story structure and use it to help them remember stories (Mandler, 1984; Stein, 1982). It demonstrates, however, that children can be identified at each grade level, up to Grade 6, who fail to show this schema-consistent behaviour. This evidence constrains the schema theory notion that all people have organized knowledge about stories (schemata), by showing that some children do not rely on story organization in either reading or listening to stories. Because listening and reading produced equivalent performance, and because children demonstrated schema-consistent behavior when they read aloud, this cannot be attributed to failure to decode the words. In addition, Grade 6 children who do not spontaneously rely on story organization can learn to use story structure in story comprehension. When story structure is made salient prior to reading a story, such children use that structure to help them understand and remember what they read. By improving a 'semantic level' knowledge source comprehension problems are alleviated.

Finally, the thesis confirms the conclusions of Carr (1981) and

Lovett (1984b) that there are different kinds of poor readers, and demonstrates the importance of specific diagnosis before designing remediation programs.

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APPENDIX A

Materials used in Experiment 1

I A Ghost at the Farm: Normal Story*

Julie was lying in her big bed at her uncle's farm.
She could see three shiny red apples on the table by the open window.
Her uncle had given them to her.
Suddenly Julie heard a thump.
A long white shape reached in.
"A ghost" thought Julie.
She hid under the covers until she fell asleep.
In the morning there were only two apples left.
One apple had disappeared.
That night the ghost came again and took another apple.
Julie was really scared.
She told her aunt about the ghost.
She asked her aunt to sit with her.
Julie's aunt came to her room.
They watched the window.
Soon a long white form appeared at the window.
Julie's aunt went to the window.
She called Julie to come.
There was Daisy the old white farm horse.
Julie laughed and patted Daisy's nose.
Instead of a ghost she had a new friend.

*Note: This story was adapted from "The Ghost at the Farm" by E. Yates (1970), in L. A. Code (Ed.), Individualized Reading Skills Program, Vol.1. Science Research Associates (Canada) Limited.

I A Ghost at the Farm: Scrambled Story

Julie was lying in her big bed at her uncle's farm.
She could see three shiny red apples on the table by the open window.
Her uncle had given them to her.
Julie was really scared.
Soon a long white form appeared at the window.
Julie's aunt went to the window.
She called Julie to come.
Suddenly Julie heard a thump.
A long white shape reached in.
That night the ghost came again and took another apple.
Julie laughed and patted Daisy's nose.
Instead of a ghost she had a new friend.
In the morning there were only two apples left.
One apple had disappeared.
She told her aunt about the ghost.
Julie asked her aunt to sit with her.
There was Daisy the old white farm horse.
Julie's aunt came to her room.
They watched the window.
She hid under the covers until she fell asleep.
"A ghost" thought Julie.

A Ghost at the Farm: Comprehension Questions

1. Where did Julie see the apples when she went to bed?
2. Who gave Julie the apples?
3. Where did Julie see the ghost appear?
4. What did the ghost take?
5. How did Julie feel about the ghost when it took the second apple?
6. What did Julie do that shows she was afraid?
7. When did Julie's aunt go to the window?
8. How many apples disappeared the first night?
9. Who did Julie's aunt see at the window?
10. What did Julie do when she saw Daisy?

II The Lost Dog: Normal Story*
Joan's family was camping near a lake.
Their little dog Sparky liked camping.
He liked to chase rabbits in the woods.
The day they had to leave Sparky was missing.
They looked by the lake and under all the trailers.
But they couldn't find Sparky.
They had to leave him behind.
Joan feared she would never see Sparky again.
Sparky had been chasing rabbits.
When he came back, no one was at the campground.
Sparky felt lonely.
He thought he would walk home.
He walked and walked till his feet were sore.
That night he slept in a cold dark field.
Sparky was very sad.
In the morning Sparky was hungry.
He began to run, following the road.
After two more days he limped home.
Sparky was happy and so was Joan.

*Note: This story was adapted from "The Lost Dog" in "An exploratory study of story structure and age effects on children's ability to sequence stories" by E. McClure, J. Mason, & J. Barnitz, 1979, p. 245. Discourse Processes, 2.

II The Lost Dog: Scrambled Story

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Their little dog Sparky liked camping.
He liked to chase rabbits in the woods.
They looked by the lake and under all the trailers.
That night he slept in a cold dark field.
Sparky was happy and so was Joan.
He began to run, following the road.
Sparky felt lonely.
He thought he would walk home.
But they couldn't find Sparky.
They had to leave him behind.
Sparky was very sad.
He walked and walked till his feet were sore.
The day they had to leave Sparky was missing.
Sparky had been chasing rabbits.
When he came back, no one was at the campground.
In the morning Sparky was hungry.
Joan feared she would never see Sparky again.
After two more days he limped home.

The Lost Dog: Comprehension Questions

1. Where was Joan camping?
2. What did Sparky like about camping?
3. Where did the family look for Sparky?
4. What did Joan's family do when they couldn't find Sparky anywhere?
5. Who did Sparky find when he returned to the campground, after chasing rabbits?
6. How did Sparky feel when he found out he had been left behind?
7. What did Sparky do when he couldn't find the family anywhere?
8. Where did Sparky sleep at night?
9. When was Sparky hungry?
10. Where did Sparky run?

III The Peter Story: Normal Story*

Peter lived on a big farm in the country.
Peter liked the farm, especially the red barn.
It smelled of horses and fresh hay.
One day Peter saw a newspaper story about a circus.
He really wanted to go.
Peter packed a lunch and started off for town.
After walking for two hours Peter reached the circus.
He liked everything he saw.
Peter was ready to go home when he saw a baby horse all alone.
He wanted to take it home.
He tied his belt around the horse's neck and began the long walk home.
The horse followed Peter along the road.
At last they reached the farm.
They were both tired.
Peter took the horse to the barn.
He brought it some hay.
The horse ate the hay and drank some water.
Peter was happy because he had a new pet.

*Note: This story was adapted from "The Peter Story" in "The role of story structure and of story length in children's recall of simple stories", by C. Glenn, 1978. Journal of Verbal Learning and Verbal Behavior, 17.

III The Peter Story: Scrambled Story

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Peter liked the farm, especially the red barn.
It smelled of horses and fresh hay.
The horse followed Peter along the road.
After walking for two hours Peter reached the circus.
He liked everything he saw.
He wanted to take it home.
Peter packed a lunch and started off for town.
Peter was happy because he had a new pet.
They were both tired.
The horse ate the hay and drank some water.
Peter took the horse to the barn.
He brought it some hay.
Peter was ready to go home when he saw a baby horse all alone.
He tied his belt around the horse's neck and began the long walk home.
He really wanted to go.
One day Peter saw a newspaper story about a circus.
At last they reached the farm.

The Peter Story: Comprehension Questions

1. Where did Peter live?
2. What did Peter like about the barn?
3. How did Peter find out about the circus?
4. How long did it take Peter to get to the circus?
5. What did Peter see as he was leaving the circus?
6. What did Peter tie around the horse's neck?
7. How did Peter and his horse feel when they got to the farm?
8. Why did Peter take the horse to the barn?
9. What did the horse do in the barn?
10. Why was Peter happy at the end of the story?

IV A Midnight Visitor: Normal Story*

Mr. White was away.
Mrs. White and her two daughters were alone.
It was night.
The windows were closed and the doors were safely locked.
Everyone was asleep.
Suddenly Ann heard a thump from the downstairs.
She was afraid.
Ann wakened Susan.
The two girls slipped into their mother's room and crawled into her bed.
Mrs. White woke up and turned on the light.
Mrs. White heard a clatter in the living room below.
She picked up the phone to call the police.
There was no dial tone.
Mrs. White heard another bump from the downstairs.
"That is a noisy burglar", she said.
"I think we can scare him off".
She turned on the hall light.
At the bottom of the stairs they saw a big raccoon.
He was covered with soot.
Mrs. White laughed.
"First we chase the coon out and then we clean up", she said.

*Note: This story was adapted from "A Midnight Visitor" in L. A. Code (Ed.). (1970). Individualized Reading Skills Program, Vol.1. Science Research Associates (Canada) Limited.

IV A Midnight Visitor: Scrambled Story

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Everyone was asleep.
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She turned on the hall light.
Mrs. White laughed.
"First we chase the coon out and then we clean up", she said.
She picked up the phone to call the police.
"That is a noisy burglar", she said.
"I think we can scare him off".
Mrs. White heard another bump from the downstairs.
At the bottom of the stairs they saw a big raccoon.
He was covered with soot.
She was afraid.
Mrs. White heard a clatter in the living room below.
Suddenly Ann heard a thump from the downstairs.
Mrs. White woke up and turned on the light.
Ann wakened Susan.
The two girls slipped into their mother's room and crawled into her bed.

A Midnight Visitor: Comprehension Questions

1. What did Mrs. White do to make the house safe before she went to bed?
2. Why were Mrs. White and her girls alone?
3. What woke Ann?
4. How do you know that Ann and Susan were afraid?
5. What did Mrs. White do when she first woke up?
6. Why did Mrs. White pick up the phone?
7. Where did Mrs. White hear a clatter?
8. What did Mrs. White say about the burglar?
9. What did the White's see at the bottom of the stairs?
10. What did Mrs. White say when she saw the raccoon?

V A Cold Adventure: Normal Story*

Cliff Jones was flying his airplane over Lake Ontario.
The day was sunny.
Cliff was worried about his plane.
Something sounded strange but he couldn't find anything wrong.
Suddenly he saw flames by the left wing.
He leaped out and pulled his parachute ring.
It opened and he drifted down.
Cliff wondered if the lake was cold and if anyone would rescue him.
Cliff immediately felt the cold as he sank into the deep water of Lake Ontario.
He tried not to panic.
Cliff got out of his parachute and began to swim.
The waves kept washing over him.
But he knew he mustn't give up.
Just then he saw a small boat.
Cliff called "Help" as loudly as he could.
The boat pulled up beside him and picked him up.
They headed for shore.
Although Cliff was shivering he felt safe at last.

*Note: This story was adapted from "The Parachutist" in "An exploratory study of story structure and age effects on children's ability to sequence stories" by E. McClure, J. Mason, & J. Barnitz, 1979. Discourse Processes, 2.

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The boat pulled up beside him and picked him up.
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Suddenly he saw flames by the left wing.
Cliff immediately felt the cold as he sank into the deep water of Lake Ontario.
Although Cliff was shivering he felt safe at last.
Cliff got out of his parachute and began to swim.
It opened and he drifted down.
Just then he saw a small boat.
Cliff called "Help" as loudly as he could.
He leaped out and pulled his parachute ring.
But he knew he mustn't give up.
The waves kept washing over him.
He tried not to panic.

A Cold Adventure: Comprehension Questions

1. Where was Cliff flying?
2. What was the weather like?
3. Where did Cliff see flames?
4. What did Cliff do when he saw the flames?
5. What happened when Cliff pulled the parachute rings?
6. What did Cliff think about as he drifted down?
7. Why did Cliff get cold?
8. Who did Cliff call to for help?
9. How did the people in the boat help Cliff?
10. How did Cliff feel when he was rescued?

VI Alice's Trip: Random Story*

There was a little girl.
Alice loved to look at swans.
She was very careful with the balloons.
Alice needed to fix the bicycle.
The path was always muddy.
Alice had gotten very sick.
Alice ran quickly through the room.
She tried to untie the knot.
The glass had broken.
She decided to look in the closet.
Alice had to buy two presents.
Alice knew John wanted the car.
She knew how nice the picture looked.
He wanted to sing the song.
Alice hoped to go home soon.
Alice swam very close to the boat.
The jar fell down.
All the money was gone.
Alice wanted to drink.
Alice thought she had read with no mistakes.
She would try to find him tomorrow.
She hoped the pants would fit her.
Alice walked quietly.
Alice pulled the board over the hole.
The dog barked loudly.
Alice laughed and laughed.
She drank some juice.
Alice read a story.
Alice knew a secret.
She could run fast.

*Note: This story was adapted from the unrelated sentence set in "The Effects of Organization and Instructional Set" by N. L. Stein and T. Nezworski, 1978. Discourse Processes, 1.

Alice's Trip: Comprehension Questions.

1. What did Alice need to fix?
2. Where did Alice run?
3. What had broken?
4. Where did Alice swim?
5. Where was the money?
6. How did Alice think she had read?
7. Where did Alice pull the board?
8. What did the dog do?
9. What did Alice drink?
10. What did Alice know?

Colin's Present: Random Story

Colin was a little boy.
Colin always wanted to drive a car.
Colin liked to help bake cookies.
He wanted to buy a game.
It seemed that it always rained.
He tried to reach the doorbell.
The dog just rolled over.
Colin enjoyed reading.
Colin was happy about his mark.
Colin wanted to wait until it was dark.
He heard footsteps.
He tried to clean up the mess.
The tree fell over.
Colin hoped that Kim would bring the book.
Colin wanted to jump down.
He decided to return the key.
Colin sat on the chair.
He had to ask the teacher first.
Colin tied the rope around the tree.
He yelled as loud as he could.
Colin wondered if they liked the present.
He knew the ruler would break.
Colin carried it to his aunt's house.
Colin had to take a bath.
The ice had all melted.
Colin jumped for joy.
Colin helped his mother.
The book was about the stars.
It made a bang.
Colin ate supper.

Colin's Present: Comprehension Questions

1. What did Colin like to do?
2. What did he try to reach?
3. What did Colin hear?
4. What did Colin hope?
5. Where did Colin sit?
6. Where did Colin tie the rope?
7. What did Colin wonder?
8. What happened to the ice?
9. Who did Colin help?
10. What did Colin eat?

APPENDIX B

The Role of Random Stories in Experiment 1

In Experiment 1 normal, scrambled, and random stories were used to represent three levels of text structure. Normal and scrambled stories contained the same materials, and differed only in story organization. The random stories contained the same number of propositions as the normal and scrambled stories (30), but had no thematic or structural relations among the story propositions. Because the random stories contained different materials than the normal and scrambled stories, one could not assume that the three levels of structure formed a single continuum. Therefore it was not appropriate to include the random stories in the same analyses as the normal and scrambled stories.

The random stories were of interest, however, because they were expected to yield the lowest levels of performance. They served two functions in the experiment. They provided a means of determining whether younger and poorer readers were sensitive to the thematic relations in stories. If they were, then random stories, which lacked both theme and structure, should yield lower

performance than scrambled stories, in which the story propositions were thematically related. In addition a comparison of random stories with scrambled stories made it possible to examine floor effects. If younger or poorer readers had low performance on all three kinds of stories, their performance might reflect floor effects. In other words, failure to find structural sensitivity might reflect the fact that there was no room for performance to drop.

In order to examine these questions, a complete set of analyses, similar to the analyses conducted for normal and scrambled stories, was conducted for scrambled and random stories. Scrambled and random stories were taken as two levels of text destructuring. Because of the large number of analyses to report in the thesis, the results of the scrambled-random comparisons are not included in detail, but they yielded two interesting and consistent results. First, performance was lower for random than for scrambled stories for all age and skill groups. Relative to scrambled stories, random stories yielded lower free recall, question answering and ratings. Furthermore, no Age X Structure, nor Skill X Structure interactions emerged in the scrambled-random analyses. These findings are especially important for the specific group of poor readers who failed to distinguish between normal and scrambled stories. They indicate that, in spite of their lower performance levels, the poor comprehenders in this group made the same distinction between scrambled and random stories as did the good comprehenders. Thus the poor comprehenders showed awareness of and reliance on the thematic relations in stories, even though they failed to take advantage of text organization. In

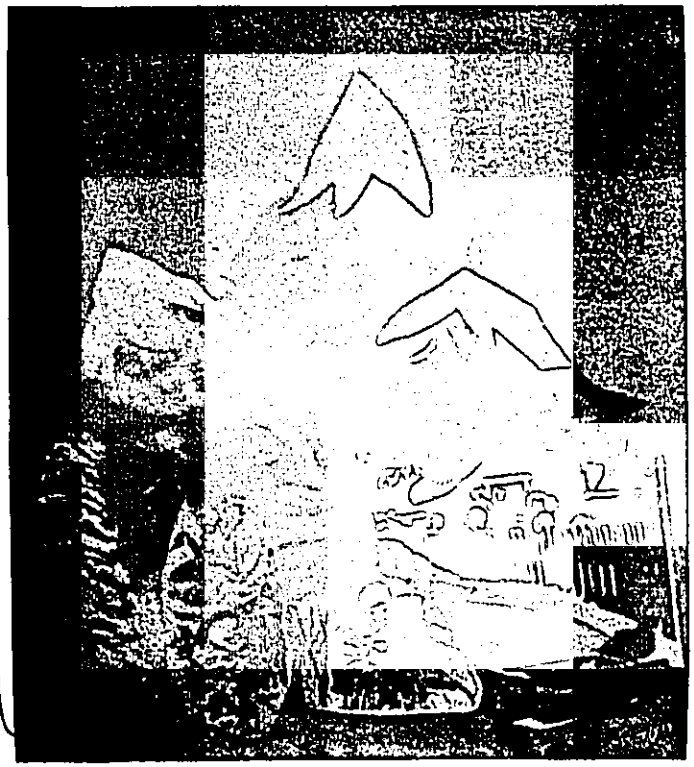
addition, the drop in scores for random stories provides evidence that the failure of these poor comprehenders to distinguish between normal and scrambled stories was not due to a floor effect.

APPENDIX C

Materials Used in Experiment 2

I Mike to the Rescue: Script and Picture

Mike's house was high up in the mountains. The mountains were so high that there was snow everywhere. When it was stormy, the birds and animals came to Mike's place for food, and to get away from the wind and snow. Mike's dad had built a shelter for them. Mike loved to help his dad care for the birds.



I Mike to the Rescue: Normal Story

Mike liked living on the mountain. He liked it best when the snow was deep. He helped his father care for the birds. They came for food. Mike's dad built them a shelter, so that they could escape the winter storms.
One day Mike saw a bird. It was on a rock high above him. It seemed to be hurt.
Mike decided to rescue the bird.
He climbed over the rocks. In some places he pulled himself up, because it was too steep to climb.
At last Mike reached the bird. It had a broken wing and looked very weak.
Mike looked at the snowy rocks. He had never been so high before. It looked like a long way down.
Mike wondered how to climb down with an injured bird. He decided to slide down.
He sat in the wet snow and started to slide, trying to protect the bird.
When Mike reached the house, his father helped put a splint on the broken wing. They fed the bird.
Mike felt grown up, because he had saved a bird's life.

I Mike to the Rescue: Scrambled Story

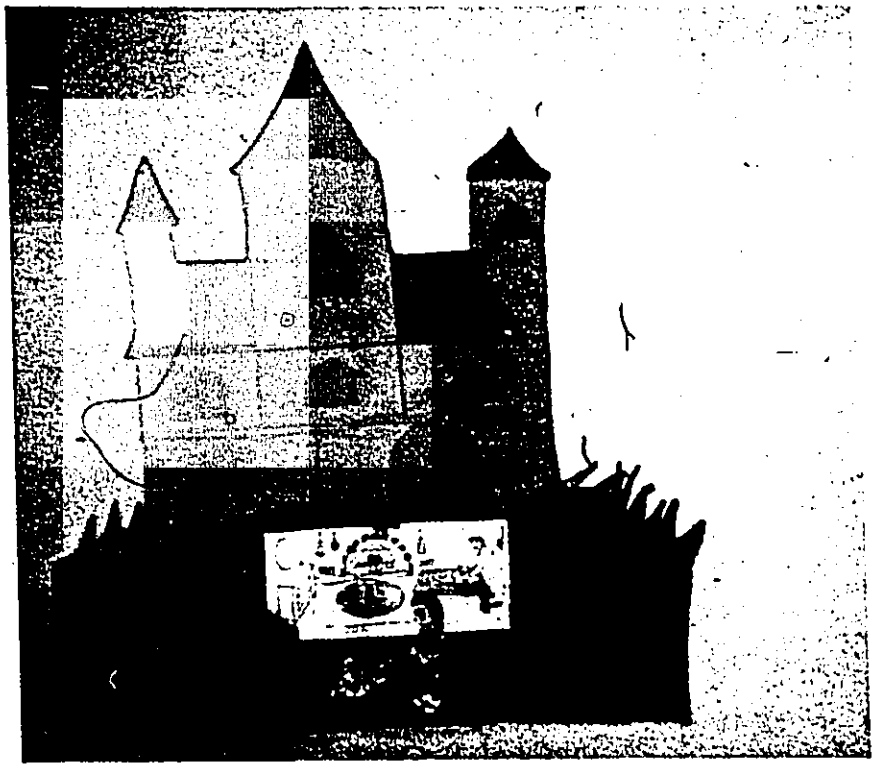
Mike liked living on the mountain. He liked it best when the snow was deep.
He helped his father care for the birds. They came for food. Mike's dad built them a shelter, so that they could escape the winter storms.
He sat in the wet snow and started to slide, trying to protect the bird.
Mike decided to rescue the bird.
When Mike reached the house, his father helped put a splint on the broken wing. They fed the bird.
Mike looked at the snowy rocks. He had never been so high before. It looked a long way down.
Mike felt grown up, because he had saved a bird's life.
He climbed over the rocks. In some places he pulled himself up, because it was too steep to climb.
Mike wondered how to climb down with an injured bird. He decided to slide down.
At last Mike reached the bird. It had a broken wing and looked very weak.
One day Mike saw a bird. It was on a rock high above him. It seemed to be hurt.

I Mike to the Rescue: Comprehension Questions

1. How did Mike help his dad?
2. Why did Mike's dad build a shelter for the birds?
3. What did Mike see on a rock?
4. What did Mike decide to do when he saw the bird?
5. Why did Mike have to pull himself up in places?
6. Why was the bird weak?
7. What made climbing down harder for Mike?
8. How did Mike get down the mountain?
9. What did Mike's father do when Mike got home?
10. Why did Mike feel grown up?

II The Secret Tunnel: Script and Picture

Sara and her family lived in a big castle. It had many rooms. Sara liked the kitchen in the basement best. Sara and her little dog Sam would go down and talk to the cook. The cook told them stories. The kitchen had a mysterious little door that no one opened. Sara wondered where it went.



II The Secret Tunnel Normal Story

Sara liked living in a castle, because there were so many places to explore. Her favourite place was the kitchen in the basement. Her dog Sam liked it too. It had a funny little door that nobody opened.
One day Sam pushed the door open and ran down a long tunnel. He wanted to see where it went.
Sara wondered where Sam would go. She decided to follow him.
As Sara ran down the tunnel, she bumped into cobwebs. The tunnel smelled rotten.
At last the tunnel opened into a big room, that was full of old furniture. Everything was covered with dust. The room looked spooky.
Now Sara had to find her way back to the kitchen. But the tunnel was dark, and Sara couldn't find a light.
Sara wished she had a candle to light her way back.
Sam sniffed his way along the tunnel. Sara followed Sam. Every footstep echoed in the long tunnel.
When they reached the kitchen, they were covered with cobwebs.
Sara was so cold she was shivering. Never had hot soup smelled so good!

II The Secret Tunnel: Scrambled Story

Sara liked living in a castle, because there were so many places to explore. Her favourite place was the kitchen in the basement. Her dog Sam liked it too. It had a funny little door that nobody opened.
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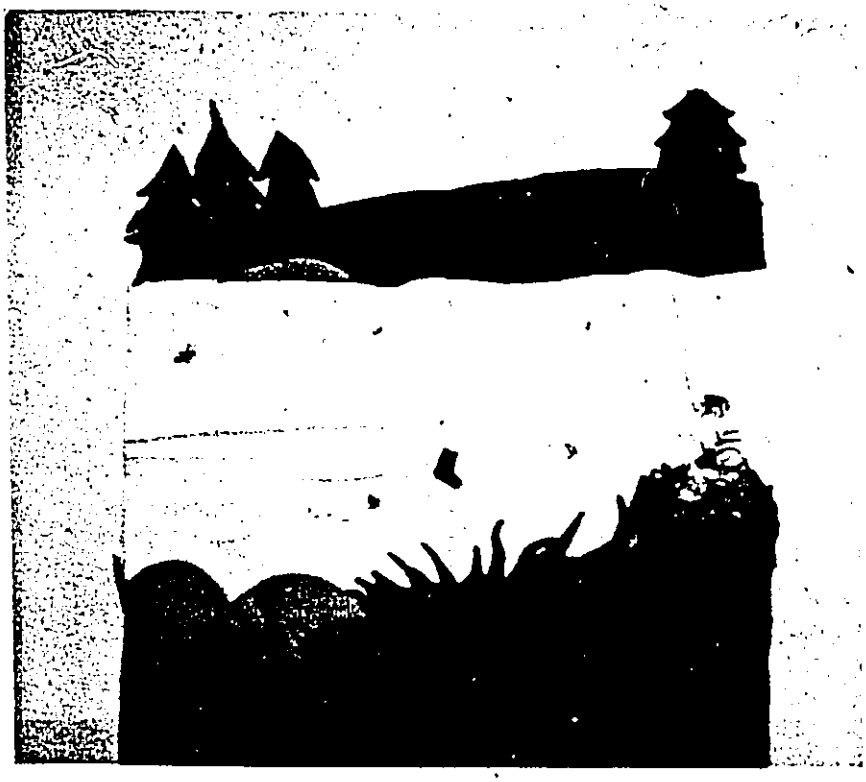
Sara wondered where Sam would go. She decided to follow him.
When they reached the kitchen, they were covered with cobwebs.
Now Sara had to find her way back to the kitchen. But the tunnel was dark, and Sara couldn't find a light.
Sara was so cold she was shivering. Never had hot soup smelled so good!
As Sara ran down the tunnel, she bumped into cobwebs. The tunnel smelled rotten.
Sara wished she had a candle to light her way back.
At last the tunnel opened into a big room, that was full of old furniture. Everything was covered with dust. The room looked spooky.
One day Sam pushed the door open and ran down a long tunnel. He wanted to see where it went.

II The Secret Tunnel: Comprehension Questions

1. Why did Sara like living in a castle?
2. What was Sara's favourite place in the castle?
3. What did Sam find when he opened the door?
4. What did Sara bump into as she ran down the tunnel?
5. Where did the tunnel lead?
6. Why was it hard to get back to the kitchen?
7. What did Sara wish she had when she started back through the tunnel?
8. How did Sara find her way back to the kitchen?
9. What were Sara and Sam covered with when they got back to the kitchen?
10. What smelled good in the kitchen?

III Bob's Fish: Script and Picture

Bob lived beside a river. He liked to watch the river. The water flowed fast in some places, but it would slow down when it reached a bend in the river. Bob liked to sit on a rock on the edge of the bank and fish. He caught all kinds of treasures. Some of these he could eat and some he couldn't.



III Bob's Fish: Normal Story

Bob was fishing by the river. The water was so clear that Bob could see fish at the bottom of the creek. He hoped he could catch one for supper. His mother had promised to cook it, if he got home in time.
Suddenly a big fish swam by his hook. It was moving so fast that he couldn't catch it.
Bob really wanted that fish. He decided to follow it.
Bob ran along the river bank, trying not to catch his line on the bushes. It was hard to see the fish.
Finally he saw the fish. It had stopped in a little pool, where it was easy to catch.
By now the sun was going down. Bob was far from home, and the fish was heavy.
Bob wondered if supper was already over.
He scrambled madly up the bank until he reached the path. Then he began to run.
When he got home, Bob quickly cleaned the fish. Then his mother cooked it.
By now Bob was starving. He wished he had caught two fish, because it was the best fish he had ever tasted.

III Bob's Fish: Scrambled Story

Bob was fishing by the river. The water was so clear that Bob could see fish at the bottom of the creek. He hoped he could catch one for supper. His mother had promised to cook it, if he got home in time.
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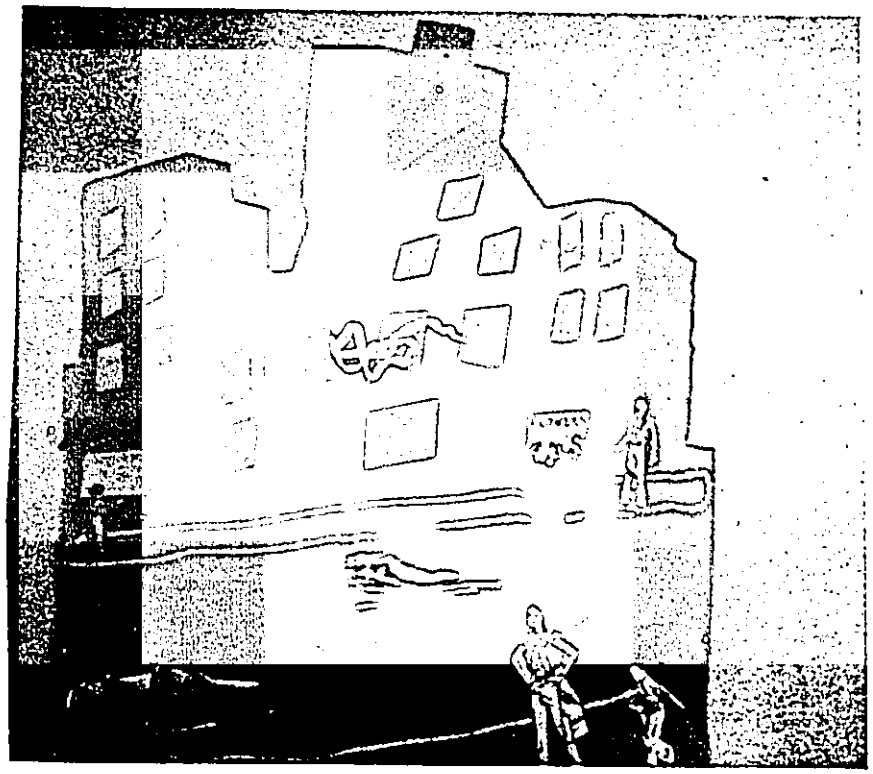
When he got home, Bob quickly cleaned the fish. Then his mother cooked it.
By now the sun was going down. Bob was far from home, and the fish was heavy.
By now Bob was starving. He wished he had caught two fish, because it was the best fish he had ever tasted.
Bob ran along the river bank, trying not to catch his line on the bushes. It was hard to see the fish.
Bob wondered if supper was already over.
Finally he saw the fish. It had stopped in a little pool, where it was easy to catch.
Suddenly a big fish swam by his hook. It was moving so fast that he couldn't catch it.

III Bob's Fish: Comprehension Questions

1. Why was it easy to see the fish in the creek?
2. What hd Bob's mother promised to do if he got home early?
3. Why couldn't Bob catch the fish when he first saw it?
4. What did Bob decide to do after the fish swam past?
5. Why was Bob careful with his line?
6. Where did the fish stop swimming?
7. Why was the fish hard to carry?
8. How did Bob get to the path?
9. What did Bob do first when he got home?
10. What did Bob wish when he was eating supper?

IV The Runaway Cart: Script and Picture

Karen worked at a flower shop in the city. She liked the job because she met so many people. Her job was to arrange flowers in bouquets and sell them to customers. It was nice in the summer because she could sell her flowers outside on the sidewalk. She had a little cart that she could fill with flowers and take outside.



IV The Runaway Cart: Normal Story

Karen worked at a flower shop. When the weather was warm, she took a cart of flowers outside. Many people stopped to buy them. She had to set the cart up carefully, because the shop was on a hill.
One day a customer knocked the cart, and it started to roll down the hill.
Karen was afraid it would hit someone.
Karen dropped her cash box, and raced after the cart.
Finally the cart bumped into a parking meter, and one wheel was broken. Most of the flowers fell on the street.
Karen looked at the cart, and at the long hill. The cart would be hard to push, but she had no tools to fix the wheel.
Karen could feel tears on her cheeks. She was afraid she would lose her job.
And she knew it wasn't her fault.
Carefully, Karen moved the cart away from the parking meter, trying to keep it straight, so that the remaining flowers wouldn't fall. She started up the hill.
Just then the owner's van pulled up. Her boss helped her lift the cart into the van, and they returned to the shop.
Karen thanked her boss for the ride. She was very glad he wasn't angry.

IV The Runaway Cart: Scrambled Story

Karen worked at a flower shop. When the weather was warm, she took a cart of flowers outside. Many people stopped to buy them. She had to set the cart up carefully, because the shop was on a hill.
Carefully, Karen moved the cart away from the parking meter, trying to keep it straight, so that the remaining flowers wouldn't fall. She started up the hill.
Karen was afraid it would hit someone.
Just then the owner's van pulled up. Her boss helped her lift the cart into the van, and they returned to the shop.
Karen looked at the cart, and at the long hill. The cart would be hard to push, but she had no tools to fix the wheel.
Karen thanked her boss for the ride. She was very glad he wasn't angry.
Karen dropped her cash box, and raced after the cart.
Karen could feel tears on her cheeks. She was afraid she would lose her job.
And she knew it wasn't her fault.
Finally the cart bumped into a parking meter, and one wheel was broken. Most of the flowers fell on the street.
One day a customer knocked the cart, and it started to roll down the hill.

IV The Runaway Cart: Comprehension Questions

1. When did Karen take her cart outside?
2. Why did she have to be careful setting up the cart?
3. What made the cart start rolling?
4. Why was Karen afraid when the cart started to roll?
5. What did Karen drop when she started to run?
6. Why did one of the wheels break?
7. Why couldn't Karen fix the wheel?
8. Why did Karen start to cry?
9. Why did Karen try to keep the cart straight?
10. How did the cart get back to the shop?

V Tim's Climb: Script and Picture

Tim lived beside a forest. He had a tree fort in one of the big trees near his house. He liked to climb up the ladder to the tree fort. Tim's kitten, Fluff, liked the tree fort too. Fluff liked to play and climb. Fluff pretended he was brave, but really he was a coward. He ran away from anything that made a noise.

V Tim's Climb: Normal Story

Tim was playing with his kitten, Fluff in the tree fort. Fluff was very playful. He liked to chase a string, when Tim pulled it across the fort. He loved to chase his tail.
Suddenly a bear growled. Fluff scampered up the tree, where the bear couldn't reach him.
Tim knew the kitten would not come down. He would be too scared.
And so Tim followed Fluff. He climbed from branch to branch, right to the top of the tree.
At last Tim reached Fluff, who was clinging to a skinny branch. Fluff wouldn't move.
Tim had to find a way down. But it was hard to climb down holding the kitten. Fluff was too wriggly.
Tim wondered how to get Fluff down. Then he remembered his toy mouse.
Tim took the mouse from his pocket, and backed down the tree, holding the toy mouse where Fluff could see it.
Luckily, Fluff followed the mouse until they reached the tree fort. Then they climbed down the ladder.
Tim hugged his kitten. They were both glad to be on solid ground again.

V Tim's Climb: Scrambled Story

Tim was playing with his kitten, Fluff in the tree fort. Fluff was very playful. He liked to chase a string, when Tim pulled it across the fort. He loved to chase his tail.
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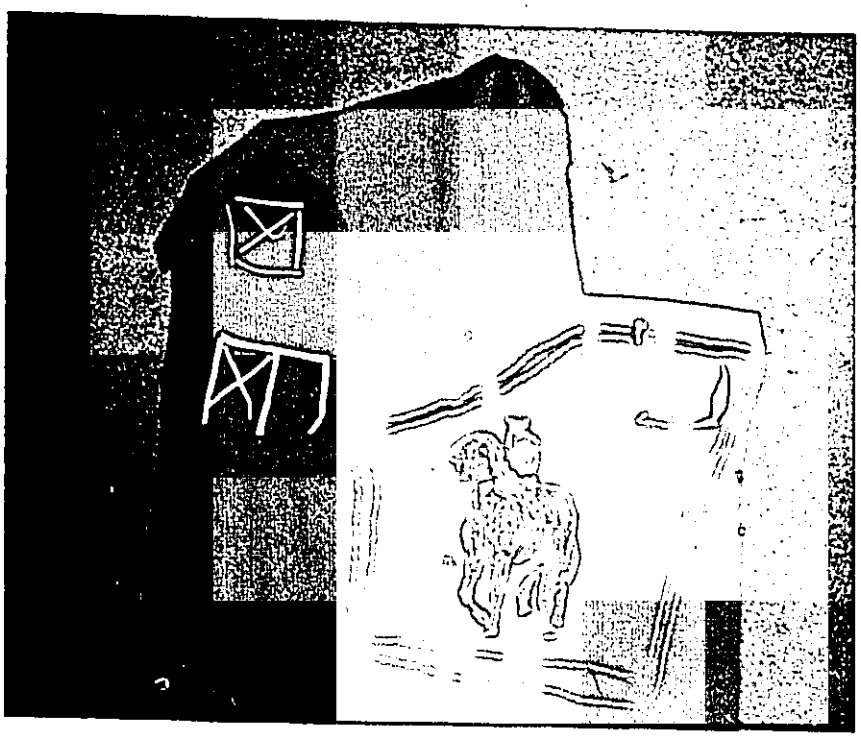
Tim had to find a way down. But it was hard to climb down holding the kitten. Fluff was too wriggly.
Tim hugged his kitten. They were both glad to be on solid ground again.
And so Tim followed Fluff. He climbed from branch to branch, right to the top of the tree.
Tim wondered how to get Fluff down. Then he remembered his toy mouse.
At last Tim reached Fluff, who was clinging to a skinny branch. Fluff wouldn't move.
Suddenly a bear growled. Fluff scampered up the tree, where the bear couldn't reach him.

V Tim' Climb: Comprehension Questions

1. Where were Tim and Fluff playing?
2. When did Fluff follow the string?
3. What scared Fluff?
4. Where did Tim follow Fluff?
5. What was Fluff doing when Tim reached him?
6. Why was the kitten hard to carry?
7. What did Tim decide to use to get Fluff down?
8. How did Tim use the toy mouse?
9. What did Tim and Fluff do when they got back to the fort?
10. What did Tim do to Fluff when he reached the ground?

VI Star Escapes: Script and Picture

Mary lived on a big ranch where they kept lots of horses. She helped her father feed the horses. She walked them around inside the corral. Mary got a horse for her birthday. She called it Star. Star was a very fast horse. She loved to gallop.



VI Star Escapes: Normal Story

Mary loved to ride her new horse Star. Star would take her around the corral by the barn. Sometimes Star got tired of going round and round. She really wanted to gallop. But the corral was too small for galloping.
One day Star noticed a hole in the fence. She trotted out into the big field.
Mary was afraid Star would get stuck in the creek. She decided to try to catch her.
Mary climbed on another horse and galloped after Star. Faster and faster they went.
At last Star got tired. When Star slowed down, Mary threw a rope around her neck.
Now Mary had to take Star home, but this was going to be hard. Star wouldn't move. She just looked at Mary.
Mary was afraid that if she rushed, Star would kick the other horse.
Mary held the rope tightly, and slowly walked down to the creek to give the horses a drink.
After they got back to the barn, Mary fed the horses some carrots. Even Star looked glad to be back.
Mary was proud. She hadn't had to ask her uncle for help.

VI Star Escapes: Scrambled Story

Mary loved to ride her new horse Star. Star would take her around the corral by the barn. Sometimes Star got tired of going round and round. She really wanted to gallop. But the corral was too small for galloping.
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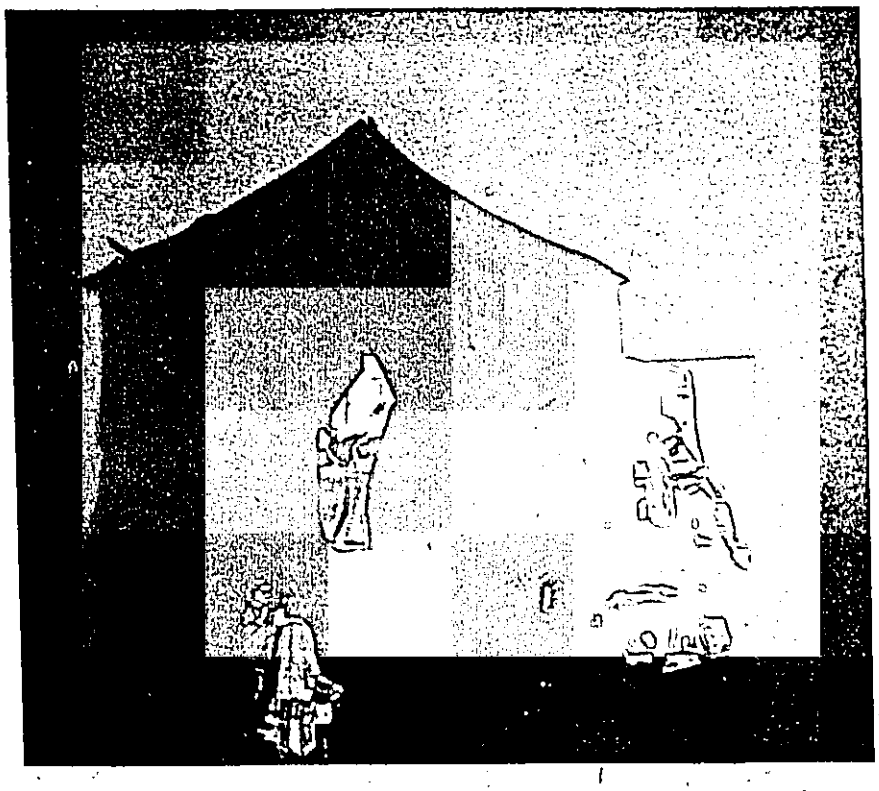
Now Mary had to take Star home, but this was going to be hard. Star wouldn't move. She just looked at Mary.
Mary was proud. She hadn't had to ask her uncle for help.
Mary climbed on another horse and galloped after Star. Faster and faster they went.
Mary was afraid that if she rushed, Star would kick the other horse.
At last Star got tired. When Star slowed down, Mary threw a rope around her neck.
One day Star noticed a hole in the fence. She trotted out into the big field.

VI Star Escapes: Comprehension Questions

1. Where was the corral?
2. Why couldn't Star gallop in the corral?
3. How did Star get out?
4. Why was Mary afraid when Star ran away?
5. How did Mary follow Star?
6. What did Mary do when Star slowed down?
7. Why was Mary afraid to rush with Star?
8. Where did Mary walk with Star?
9. What did Mary give the horses to eat?
10. Why was Mary proud?

VII The Monkey Escapes: Script and Picture

Tony lived with his uncle at the circus. He liked to watch the people come to the big striped tent. Out behind the tent were the cages where the animals were kept. There were many kinds of animals there. Tony's uncle fed the animals and helped to keep them clean.



VII The Monkey Escapes: Normal Story

Tony liked living at the circus. He enjoyed helping with the animals. Tony's uncle cared for the elephants. Tony watched the monkeys, when the show was on, because all the noise got the monkeys excited.
One day a baby monkey escaped. He ran past the people, and right into the circus tent.
Tony was afraid the monkey would be killed, because the lions were in the ring.
Tony ran into the tent. He ran as fast as he could, but he couldn't catch the monkey.
Suddenly the monkey saw the lions. He stopped right in front of them.
When the lions saw the monkey, they stamped their feet. The lion tamer looked angry.
Tony knew that everyone was watching to see what he would do next.
Quickly, Tony picked up the monkey. Then, holding him by the scruff of the neck, he ran from the tent.
Soon the monkey was in his cage. The door was safely locked, and Tony returned to work. The show went on.
But Tony's head was pounding, because he knew he could have been killed.

VII The Monkey Escapes: Scrambled Story

Tony liked living at the circus. He enjoyed helping with the animals. Tony's uncle cared for the elephants. Tony watched the monkeys, when the show was on, because all the noise got the monkeys excited.
Quickly, Tony picked up the monkey. Then, holding him by the scruff of the neck, he ran from the tent.
Tony was afraid the monkey would be killed, because the lions were in the ring.
Soon the monkey was in his cage. The door was safely locked, and Tony returned to work. The show went on.
When the lions saw the monkey, they stamped their feet. The lion tamer looked angry.
But Tony's head was pounding, because he knew he could have been killed.
Tony ran into the tent. He ran as fast as he could, but he couldn't catch the monkey.
Tony knew that everyone was watching to see what he would do next.
Suddenly the monkey saw the lions. He stopped right in front of them.
One day a baby monkey escaped. He ran past the people, and right into the circus tent.

VII The Monkey Escapes: Comprehension Questions

1. What animals did Tony's uncle look after?
2. What was Tony's job when the show was on?
3. What animal escaped from its cage?
4. Why was Tony scared that the monkey would be killed?
5. Where did Tony chase the monkey?
6. What made the monkey stop?
7. What did the lions do when they saw the monkey?
8. Why did Tony think that everyone was watching him?
9. How did Tony carry thew monkey?
10. What did Tony do to make sure that the monkey wouldn't escape again?

VIII Debbie the Bush Pilot: Script and Picture

Debbie worked at a forest station in the middle of a big forest. She was a bush pilot. She had her own helicopter so that she could fly over the woods every day. Debbie looked for signs of trouble in the woods. Most of the bush pilots used helicopters because they were easy to land in a small space.

VIII Debbie the Bush Pilot: Normal Story

Debbie was a bush pilot. Every day she flew her helicopter over the forest. She looked for fires or for people in trouble. Debbie had a radio so that she could report back to the forest station.
One day Debbie saw smoke signals coming from a clearing in the woods. She thought people were signalling for help. Debbie was glad she had a helicopter. She might have to take them to a doctor.
She radioed the firefighters in case the fire spread. Then she flew to the clearing.
When Debbie landed her plane, she saw two men. One of them had a broken foot.
After Debbie helped the men into the plane, she noticed that the fire was spreading. It was almost to the plane. The air was very hot.
Debbie was glad she had called the firefighters. She hoped she could escape the flames.
Carefully she moved the plane, and flew it straight up to get away from the fire.
As they flew to the ambulance, both men thanked Debbie for her brave rescue. She had saved their lives.
Debbie said it was the most exciting day of her life.

VIII Debbie the Bush Pilot: Scrambled Story

Debbie was a bush pilot. Every day she flew her helicopter over the forest. She looked for fires or for people in trouble. Debbie had a radio so that she could report back to the forest station.
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When Debbie landed her plane, she saw two men. One of them had a broken foot.
One day Debbie saw smoke signals coming from a clearing in the woods.

VIII Debbie the Bush Pilot: Comprehension Questions

1. Where did Debbie fly her plane every day?
2. What was she looking for?
3. What did Debbie see coming from the woods?
4. Why was Debbie glad she had her helicopter?
5. What did Debbie use to call the fire fighters?
6. What was wrong with one of the men?
7. What did Debbie notice after she got on the plane?
8. Why did Debbie fly the plane straight up?
9. Where did Debbie fly after she left the fire?
10. What did Debbie say when the men thanked her for rescuing them?