STRATEGIES FOR READING EXPOSITORY PROSE

by

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ABSTRACT

In the context of reading strategy research, the present study explores changes with passage difficulty in the frequencies of occurrence of responses and strategies identified in expert readers' think-aloud protocols. Data consisted of tape recorded think-alouds collected from ten university undergraduates reading to summarize three expository passages ordered from simple to difficult by independent raters. Tapes were transcribed and six categories of responses and strategies were identified in subjects' protocols. The six categories, in order of frequency of occurrence, were: Metastatement, Problem Solving, Repetition, Surface Response, Surface Structure, and Divergent. There were significant differences across passage difficulty in expert readers' evidence of responses and strategies. The frequency of occurrence of problem solving increased significantly as subjects read increasingly difficult expository text. Both surface reactions to text and subjects' comments on their own reading, were high in frequency of occurrence only for the most difficult text. Interpretation suggests expert readers seem to engage with text through problem solving more often in reading more difficult text and demonstrate the existence of a lack of comprehension through reactions to the text and to their own reading. Implications for practice and research are discussed.

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Chapter One

Problem Statement

Reading research has provided valuable insights since the days of Comenius (1657/1968). Over many years both foci and methods of investigation have shifted. Early investigations of reading process were influenced by humanistic interest(e.g. James, 1890/1950). Later attempts to measure quantifiable aspects of reading behavior (e.g. Holmes, 1955) were directed by the hopes of behavioral psychology. More recently, a realignment of research has led to a focus on readers' processing within the framework provided by information-processing theories such as schema theory (Anderson, 1984; Anderson & Pearson, 1984; Kintsch & van Dijk, 1978; Norman & Rumelhart, 1972; Pearson, 1984) or cognitive flexibility theory (Spiro, et al., 1988).

The theoretical framework driving research helps determine how questions are addressed. An investigation into processes of reading requires the delineation of parameters such as the tasks to be performed or the form of the data to be collected. The task required has an influence on how reading proceeds. For example, performance on a test represents a constrained measure of the contents of memory after reading. Recall following reading (Havilland & Clark, 1974) taps more of what the reader is actually doing, providing a somewhat more personal record of reading.

More recently, the use of summaries has been effective in establishing much about readers' processing and readers' awareness of their own processing (Winograd, 1984). Attempts to relate strategies used when summarizing to frameworks provided by schema theory (van Dijk & Kintsch, 1983) promise to elucidate readers' processes within a theoretical context in common with theories which currently attempt to explain thinking and problem solving (Newell & Simon, 1972).

In the light of NAEP indications of continued reading deficiencies among students, cited recently by U.S. Secretary of Education, (Bennett, 1988) and the knowledge that students need "an increasing awareness of and flexibility in using strategies that permit readers to make sense of what they read" (Pearson, 1988, p.1), further research is needed to establish the relationships between processing strategies and reading. Since reading strategies may express some relation between a reader's world knowledge and the development of underlying gist for text, it is of particular interest to explore the power that schema theory has to explain reading strategies.

Theorizing about reading strategies requires an experimental design which directs research attention to ongoing process. Process-tracing methods recently substantiated (Ericsson & Simon, 1984) provide a conscientious analysis and synthesis of the strategies readers use. The present research portrays readers' verbalizations of ongoing process in a

controlled context.

Recent research demonstrates that prior knowledge may substantially influence strategies used by expert readers in reading and summarizing text (Afflerbach, 1985; Brown & Day, 1983; Collins, Brown & Larkin, 1980; Kavale & Schreiner, 1979; Kintsch, 1974; Kintsch, 1982; Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983; Winograd, 1984). Afflerbach (1987) identified five strategies from verbal reports of subjects asked to read for main idea (initial hypothesis, draft and revise, topic/comment, listing, and automated main idea construction). Expert readers' strategies varied according to relative familiarity of text. Automatic main idea construction was more frequent with familiar text, draft and revise, with unfamiliar text. Afflerbach's research supports and extends previous research substantially. Kintsch and van Dijk (1978) developed a comprehension model based on summarization strategies which included deletion, generalization, and construction rules observed in expert readers. This theory was extended in van Dijk and Kintsch (1983). Their work is among the most frequently cited research papers in the literature (Guthrie, Seifert, & Mosberg, 1983). Brown and Day (1983), following the model of Kintsch and van Dijk, identified six strategies more specifically: deletion of redundant and trivial information, substitution of a subordinate term for a list of terms or for a group of subcomponents of action, and selecting

or inventing a topic sentence.

It is evident that careful analysis of verbal protocols collected from expert readers can be a valuable source of information about strategic processing. It is further apparent that strategies identified seem to vary with familiarity or difficulty of expository text. It is not clear, however, what these changes might represent. In addressing a question regarding strategy differences, the present research explores the differences in frequency of strategy use across three levels of passage difficulty in order to clarify how strategies for reading expository text may change.

An alternative question, regarding the reader's gradual development of gist, appears only peripherally in the literature. Changes in strategic processes involved in recreating the gist of a passage have not been directly addressed before. It is expected that a progressive rephrasing of the overall idea, or gist, will be evident in subjects' summaries, similar to what Collins, Brown, and Larkin (1980) interpret as "progressive refinement".

Specifically, and in the light of previous research in this area, this study will investigate :

(1) strategies used by expert readers to comprehend expository text varying from simple to difficult and

(2) strategies expert readers use to trackchanging gist of text.

Understanding expository text is unquestionably important to readers of all ages from elementary school age to adult (Otto & White, 1982). There is little doubt that this transaction between reader and author relies on the construction of meaning by the reader (Pearson, 1985; Schallert, 1982). Current and previous theories about reading portray theorists' views of reading, "rather than making explicit predictions"(Rayner & Pollatsek, 1989, p.471). Nevertheless there are readers of all ages and in all settings who continue to struggle with creating meaning from text, although it may be said that "...meaning generation is the essence of learning"(Rowe, Harste, & Short, 1988; p. 5). It is essential that we learn more about the strategies readers use to make sense of expository text. The present research addresses that need.

The exploratory nature of the current study will be evident from the small number of subjects. An attempt to allow for considerable depth in this exploration of strategy differences in the reading of expository text has necessitated the collection of verbal protocols of considerable length which has precluded the possibility of studying a large number of individuals. In addition the empirical procedures used are such as to allow the data collected to be analyzed within its own context. As a result one can expect generalizations to be limited and the findings to be presented cautiously.

Hypotheses to be tested

Conditions all subjects experience will represent reading simple, average, and difficult expository text.

1) In the frequency of strategies used by expert readers reading to summarize text, differences will be found among simple, average, and difficult text. Specifically:

a) unprompted summaries of reported gist will be more frequent while reading simple and average text.

b) progressive rephrasing and restructuring of reported gist will be more frequent while reading difficult text.

2) In the frequency of strategies used by expert readers reading to summarize, no differences will be found between simple and average difficulty expository text.

3) In the frequency of strategies used by expert readers reading to summarize, no differences will be found across four naturally occurring divisions separated by paragraphing of each passage as readers' understanding of gist develops.

Rationale

The specific responses to text mentioned in these hypotheses are modelled on those reported in the literature (e.g. Afflerbach, 1987; Collins, Brown, & Larkin, 1980). Hypotheses 1) and 2) above address the strategy use readers demonstrate in approaching difficult or unfamiliar text. Although the three difficulty levels of expository text are relatively loosely defined, the hypotheses state the expectation that the reading of difficult text will be distinctly different from the reading of either simple or average difficulty text.

Each text used consisted of four parts divided by paragraphing in the published source from which it was drawn. Hypothesis 3) states simply that strategy use across each of the four parts of the passages will not be noticeably different.

Definitions of terms

Consistent meaning and use of the following terms is important to the present study:

Concurrent Verbal Protocol: refers to a record of verbalizations collected concurrently with task performance.

Macrostructure : refers to hypothetical cognitive structures (van Dijk and Kintsch, 1983) representing the overall meaning, or gist (Kintsch, 1974) of a passage in the mind of a reader. This represents a high level schema.

Process-tracing research: refers to research which attempts to elicit data directly relevant to on-going cognitive processing.

Schema : refers to a conceptual framework of world knowledge which enables understanding. One might think of schemata as primary units of meaning (Pearson & Johnson, 1978).

Summary: refers to a brief statement of the gist of a passage.

Think-aloud research: refers to research in which subjects are requested to say aloud anything that is relevant while performing a task.

Chapter Two

Review of the Literature

A Context for Reading

Schema-theoretic notions about reading have been prevalent in the literature for decades. Bartlett (1932) was among the first researchers to identify what he referred to as schemata, or knowledge structures, that seem to be active in a reader's comprehension. Bartlett hypothesized reasons for the alterations in repeated recalls of an unfamiliar story read by adult university students. Over a series of repeated recollections his subjects substantially altered the facts as well as overall aspects of a North American Indian legend, "The War of the Ghosts". He hypothesized that these alterations resulted from the influence of subjects' own frameworks of understanding, which he termed schemata. It is these schemata which Bartlett suggested, and others (Rumelhart, 1977,1980; Schank & Abelson, 1977, Minsky, 1980) have suggested more recently, represent hypothetical mechanisms in the mind of a reader which interact with text as it is read, enabling comprehension on the one hand and adding to and restructuring schemata on the other. What is important to the present research is that schema theory seems to provide a mechanism for explaining a reader's processing and understanding of the essential information, the gist, of a passage. This explanatory framework may

enable us to understand more clearly the relationships among processes readers use when extracting the gist from a passage.

Similar to current research, earlier research centered on a 'schema-theoretic' concept of the reading process (Anderson and Pearson, 1984). Rumelhart (1977,1980) extended Bartlett's(1932) concept of schemata to hypothesize how these structures may enable comprehension. " The process of comprehension is taken to be identical to the process of selecting and verifying conceptual schemata to account for the situation (or text) to be understood" (Rumelhart, 1977, p.268). Spiro (1980) emphasized the constructivity of comprehension, extending Bartlett's(1932) characterization of 'effort after meaning'. "Constructed meaning is the interactive product of text and context of various kinds, including linguistic, prior knowledge, situational, attitudinal, and task contexts, among others" (Spiro,1980, p. 246). Scardamalia and Bereiter (1984) reported Bird's (1980) and Reiger's (1977) research which hypothesized the existence of some form of cognitive structure that seems to act in two directions. It appears to be built up as one reads as well as concurrently enabling comprehension. This process may be similar to the development of 'macrostructures' whose existence van Dijk and Kintsch(1983) hypothesized.

Collins, Brown and Larkin (1980) presented evidence that may

represent in a general sense the process readers engage in to comprehend text. Their subjects demonstrated the development and alteration of overall hypotheses about difficult to understand text. Retrospective verbal reports revealed strategies that involved formulating an initial model of text meaning and refining that model as the session progressed. The actual procedures used seemed to be similar to general problem solving skills and the researchers suggest they are analogous to those followed by experienced solvers of crossword puzzles. Rules used for revising included generation of ideas represented by text, resolving conflicts with interpretation, focus or perspective taken, and synthesizing textual statements into passage meaning. A consistent pattern noted was the formation of an initial hypothesis about passage meaning which was subsequently used as a framework for understanding further and was progressively altered where indicated. Collins et al. (1980) suggest this 'progressive refinement' of inferences about text may be a mechanism that readers usually engage in. Their research task was listening, however; they did not study subjects while they were reading.

Relationship of background knowledge to reading

A conceptualization of reading must necessarily take the reader's knowledge into account in an explanation of the reader's understanding of the gist of a passage (Bransford, 1984). It has been recognized for some

time that prior knowledge plays an important role in reading (e.g. Goodman, 1970). The role prior knowledge plays in reading suggests that familiarity of text will influence not only comprehension but readers' approaches to text as well.

Bransford and Johnson (1972) demonstrated the influence of prior knowledge on comprehension. Their subjects read a relatively complex passage that was written to be virtually incomprehensible without a title. A description of washing clothes, made up of an obscure listing of mysterious procedures, was comprehensible to college readers only when preceded by a title. In schema-theoretic terms, the schematic knowledge activated by a title in their research provided readers with sufficient background to render previously incomprehensible text understandable.

The recognition induced by prior knowledge activated through a title brings familiarity to otherwise unfamiliar text. The process generated by activating personal knowledge makes formerly unfamiliar concepts suddenly familiar to the readers. The ease with which familiar text is accessed by readers may be analogous to the easy accessibility of information in relatively simple text. The ideas and concepts presented in relatively simple text fit into a framework of prior knowledge for a reader far more easily than do the concepts of a difficult text. In that sense more prior knowledge is available for the reader to use. It doesn't have to be

activated.

The importance of prior knowledge is evident in its influence on reading. Whether or not the reader has sufficient background information immediately available seems to be critical to understanding. Anderson et al.(1982) demonstrated the significance of prior knowledge by altering the information available for the formation of readers' perspectives. "Perspectives assigned before reading, shortly after reading, and long after reading all have a significant influence on recall"(Anderson et al., 1982, p.278). They interpret their findings as indicating that the activation of readers' schemata can selectively enhance both encoding and retrieval. Ausubel (1968), theorizing about the existence of cognitive structures , emphasized the beneficial effect of 'advance organizers' in reading. This is another demonstration of the influence of hypothetical knowledge structures which may be in the form of schemata.

Summarizing: a Reading Process

A considerable number of studies of the reading process have requested summaries in order to focus the reader's attention on integrating ideas from text without unduly directing processing or verbalizations (e.g. Kieras, 1981, 1982; Kintsch, 1974; Winograd, 1984). Summarizing is a task which places considerable demand on a reader's

ability to abstract and, for this reason, may provide a useful window into the thinking processes readers use to understand the gist (Kintsch, 1974) of a passage.The point to forming summaries, after all, is to portray the gist of a passage as clearly and concisely as possible.

It has been suggested that the procedures that students use to form summaries are identical to those students follow in outlining and underlining (Brown, 1980; Brown & Smiley, 1978). In fact, Kintsch and van Dijk make the point that certain "summarization rules" are basic. They are more than procedures for summarizing. Such rules as deletion, superordination, selection and invention may be general cognitive rules that direct the comprehension process itself. An understanding of cognitive strategies that students use as they develop summaries of text may be essential if we are to portray adequately the process of comprehension.

Kintsch and Kosminsky(1977) used subjects' constructions of story summaries to demonstrate the role of schemata in the formation of macrostructures during reading. Macrostructure represented an organization of sub-units of the story. One would expect a reader's summary of a passage to represent what is known about the important elements of the passage. It was hypothesized that reader's schemata represent frameworks of understanding that enable the passage to be read.

Subsequently, these hypothetical frameworks of background knowledge provide a context to enable a story to be summarized according to its important elements.

The strategies that readers use to determine how the important elements of a passage fit together to represent a reasonable summary of a passage are similar to those one would use to comprehend a passage. Kintsch and van Dijk (1978) hypothesized a number of strategies readers use in summarizing, including deletion of redundant and trivial information, generalization of sub-ideas into a superordinate term, and identification and invention of topic sentences. The task of summarization provides a medium in which the use of these strategies, in the development of a reader's understanding of a passage, can be demonstrated and observed.

Summarization: Skill or Process?

The use of a summary task in an inquiry into the process of reading is supported by the contradictory evidence arising out of research into summarizing as a skill. Researchers have often explored the educational value of summarizing, such as its use as a study technique, rather than scrutinized the actual process itself. Bretzing and Kulhavy (1979) and Taylor (1982) found creating summaries to be an effective study strategy. Germane (1921), Arnold (1942) and Howe and Singer (1975), on the other

hand, found that summarizing was not as helpful as a simple strategy of re-reading. Stordahl and Christensen (1956) found no difference between the effect of summarizing and that of several other study techniques. These conflicting results suggest it might be valuable to explore the underlying processes of reading to summarize.

Anderson and Armbruster (1984) noted that summarizing involves allocating attention to abstracting main ideas rather than to recalling facts, yet most studies of summarizing which did not show any positive effect actually measured recall with criterion-referenced tests which may tap knowledge of many extraneous facts. In other words, one could have predicted that simply re-reading would likely be more useful than summarizing for better performance on such tests. Such findings do not discount the importance or value of summarizing since criterion test performance did not rely on summarizing processes. Anderson and Armbruster (1984) concluded that (1) students need instruction in summarizing and (2) criterion task demands should reflect processes used in summarizing.

Research on the use of summarizing as a skill seems to suggest that there is a need for more reliable identification of what is involved in the process of reading to summarize. Studies of the use of summarizing as a study technique have been beneficial particularly in demonstrating the

need for a better understanding of the process of summarizing. The present research is a response to that need but does not address summarizing directly as a study skill. The present research accepts the value of prior research reported by Kintsch and van Dijk (1978), van Dijk & Kintsch (1983), Brown & Day (1980), Winograd (1984), Afflerbach (1985), and others, all of which emphasize the importance of summarizing as a means of observing a reader's use of strategies for understanding text.

Recent Process Research Using Summaries

More recently, research has focussed on identifying the processes that a reader uses in summarizing. Winograd (1984), studying eighth graders, found poor readers were not less aware of the task of summarizing but did have different, often more concrete, ideas of what was important and were less efficient in their methods of transforming text into summaries. This suggests that strategy differences may be linked to differences in reading performance.

Brown and Day (1980) used expository text with which to identify the rules used for summarization by children and adults. These rules were roughly equivalent to a model for summarization proposed by Kintsch and van Dijk (1978) which included processes of deletion, generalization, integration,and construction that all operate to form a macrostructure, or representation of the overall gist. In the Brown and Day study, six rules

were identified. Two were deletion rules by which either trivial or redundant information was deleted. Two summarization rules involved the substitution of a superordinate term for subordinates, including Kintsch and van Dijk's generalization rule in which a term represents a list of items and their integration rule in which one general activity refers to several subcomponents appearing in the text. The final two rules involved providing the main idea of a paragraph by either selecting or inventing a topic sentence. This last rule is similar to Kintsch and van Dijk's construction rule. Brown and Day conclude that these six rules "seem to capture the essence of the methods of condensation actually used by students summarizing" (p.2).

Kintsch and van Dijk (1978) argue these macrorules actually represent processes underlying comprehension in general. The need for such a mental construct as a macrostructure , similar to Reiger's (1977) 'watcher', arises out of the interaction between memory and text. That aspect of thinking which is associated with what is attended to is usually referred to as short term memory (Ericsson and Simon, 1984). It is well known that short term memory has a capacity which is usually, although not always, limited to 5 to 9 units of information. This suggests efficient processing requires that information be 'chunked' into units that are as rich as possible (Miller, 1956). At a more inclusive level of

comprehension, macrostructures represent the developing gist of a passage. It is noteworthy that re-reading referred to earlier probably draws benefit from a well-known fact about memory: information is more likely to be recorded in long term memory through rehearsal than through a single reading.

The model of comprehension proposed by Kintsch and van Dijk (1978; van Dijk & Kintsch, 1983; Kintsch, 1982) consists of four basic components or levels. The process of comprehension occurs autonomously and in parallel at each level and various levels interact. The first level, words and phrases, refers basically to the surface structure of text which supplies input to the reader. From this surface level the reader develops semantic units, which represent the elements of meaning communicated by the text. These semantic units representing a passage's microstructure, expressing immediate content, are condensed, with the help of general knowledge, into macropropositions representing the gist of the passage. Strategic decisions identify the knowledge in a semantic unit and help form knowledge structures which are used to organize other semantic units. When semantic units can no longer be fitted into the frame that is created by knowledge structures, a new knowledge structure is created while the former one is held in memory.

Although "the model says little about the details of how propositions

are formed" (Rayner & Pollatsek, 1989,p. 295), Kintsch and Miller (1984) explain that, in comprehending, a reader is maintaining coherence amongst propositions. In the event that coherence breaks down, the reader searches in a store of background knowledge for an alternative linking proposition or develops inferences on the basis of background knowledge to re-establish coherence. A representation of the macrostructure of the text, its gist, is generated at the same time as text propositions (Kintsch, 1982). The Kintsch and van Dijk model (van Dijk and Kintsch, 1983) provides a general framework and context within which comprehension research can find specific direction.

The research of van Dijk and Kintsch (1983) and of Brown and Day (1983) suggests that investigations into readers' strategic decisions while reading may prove a fruitful source of valuable information about how readers actually make sense of a passage. It is well known that readers' metacognitive knowledge of their own reading strategies is an important aspect of expert reading performance (Brown & Palincsar, 1984; Flavell, 1979). What is needed is a more direct and demonstrative investigation of the specific ways in which strategic decisions actually enable comprehension. This may become evident through the interaction among ideas that seem to be suggested from verbal protocols while readers summarize the gist of a passage.

A secondary issue is the use of strategies by readers as the gist of a passage being read develops in their minds. The progressive refinement theory of Collins, Brown and Larkin (1980) arose out of an identification of the types of inferences made as listeners attempt to understand text. The relationship of prior knowledge and reading is important enough (Brown, Campione, & Day, 1981) to warrant more extensive investigation. Using "difficult" text, as Collins, Brown, and Larkin (1980) or Bransford and Johnson (1972) did, is one way to make the influence of prior knowledge more evident. Collins, Brown and Larkin (1980) used 'difficult to understand' text to bring forth comprehenders' strategic decisions. It is expected that comparison of strategic decisions across texts of varying difficulty will cast light on how readers' decisions change in order to integrate text.

Recent Trends

Current main idea research.

Recently Afflerbach (1987) has reported innovative research which serves to extend the work of Brown and Day (1980) and van Dijk and Kintsch (1983). Studying verbal protocols of expert readers reading familiar and unfamiliar text for the main idea, Afflerbach classified processes identified into five categories: 1) initial hypothesis, in which the topic of a text is predicted prior to reading, 2) draft and revise, in which

the reader makes an attempt at a main idea statement including both topic and comment and returns to the text in order to refine this, 3) topic/comment in which the reader states the topic after reading and returns to the text in order to identify comments, 4) listing, in which the text is skimmed or scanned in search of related words or concepts with which to build a main idea statement, and 5) automatic main idea construction, or chunking, for which no reports of process or explanations are given.

These results may be obscured if the unfamiliar text used was of a sufficiently high technical level to render it nearly incomprehensible. It is possible that subjects, although expert readers in their own fields, were struggling to make any reasonable sense of words and concepts in the unfamiliar text. Does this represent a context which might occur naturally? Kintsch(1982) warns that performance may break down without a well-established knowledge base with which to organize the content of text. It must be granted that much of our research into reading explores the strategies of competent readers when placed in unnaturally difficult situations. It is as if, wanting to discover the elements of the mechanism of walking, we tripped people as they passed by. We might learn a lot about the strategies these people use to catch their balance, but what would this tell us about walking ? The question remains whether

the strategies identified in such situations represent what such readers would actually do if not constrained to read highly unfamiliar text for the main idea. When we subvert and constrain the experimental environment beyond normal limits in order to observe particular aspects of cognitive behavior, we must take these elements of experimental design into serious consideration in drawing conclusions.

Afflerbach reports that relative familiarity of text influences the particular strategies expert readers use in reading for main idea. Significant results indicate that automatic main idea construction, or chunking without any indication of process, was by far the first choice with familiar text. In unfamiliar text the most frequent strategy evident was draft and revise, in which a tentative main idea with support is stated and the text is re-read for revision.

It is noteworthy that Afflerbach has extended the work of van Dijk and Kintsch (1983) and of Brown and Day (1980). Afflerbach's innovative methodological design using inserted probes ensured adequate data from verbal reports. It is possible that verbal reports represent subjects' constructions of what they believe they are doing while following the direction to read for the the main idea. This constraint qualifies the kinds of generalizations that can be made from this data. To know what decisions readers are making during reading requires more than a simple

acceptance of their statements. Consistent inter-relations must be clearly identifiable to warrant inferences about process.

The difference between specific direction, which might suggest particular types of responses to subjects, and a less directive request, such as "summarize briefly what the passage is about", might be likened to the difference between having a light or not on a moonlit walk in the woods. Without a light, if you let your eyes adjust to the moonlight, more and more of the surroundings gradually become visible. With a flashlight, on the other hand, not only is everything in the path of the narrow beam of light illuminated, but everything else in the surroundings is cast irretrieveably into the obscurity of darkness. In reading research, task direction is the flashlight, the readers' cognitive processes, the forest.

Text structure.

A serious constraint in reading research is the particular text used for the task. If difficult or unfamiliar passages used require specific expertise to comprehend, they may be virtually incomprehensible to uninformed subjects. It is interesting to learn what strategies expert readers use when constrained by nearly incomprehensible text, although it is unlikely the information provided tells us a great deal about what readers do in normal situations.

Norman and Rumelhart (1976) suggest that comprehension may be

seen in terms of a hypothetical interaction between schemata and text. They refer to the processes of accretion, restructuring, and fine-tuning, as ways to characterize understanding within schemata, through developing new schemata, or altering old schemata, respectively. What form the interaction with prior knowledge takes depends on the familiarity of the text. But, clearly, some of these processes must occur in the midst of reading text.

Text structure has recently been a focus of research attention (e.g.Kintsch & Miller, 1984; Taylor, 1985; Taylor & Samuels, 1983). Such a research orientation is designed primarily to explore the relationship between knowledge of text structure and comprehension of ideas or supporting details in text. Where middle-grade students participate as subjects, middle-grade subject area texts are used as materials (e.g. Taylor, 1985). In the present study adults are subjects and expository text found in the popular press is used as material to ensure that material is both appropriate to expected reading abilities and potentially interesting to readers.

This study, however, does not directly address the issue of text structure and makes no attempt to assess comprehension. For these reasons a loosely defined scale of text difficulty is sufficient merely to ensure that the texts read are distinctly different in terms of reader

perception. A more comprehensive procedure for analyzing text such as propositional analysis (Kintsch, 1974) or causal link analysis (Trabasso, Secco, & Van Der Broek, 1983) is deemed inappropriate for the purpose of ranking passages in difficulty. Taylor (1985) used no more extensive analysis of text, for example, than a measure of relevant idea units. Since the number of idea units recalled is not a factor in the present study, even this relatively simple level of analysis is deemed unnecessary.

Changing gist.

Most research referring to the structure of text emphasizes the importance of 'well-formedness' of text, that is, that text which is coherent and well-structured is more easily understood and remembered (e.g. Meyer, 1984). It is evident, however, that 'natural text' does not necessarily provide a neat and coherent presentation of ideas. The general meaning portrayed by a passage is developed as the reader progresses through the passage (Kieras, 1982). Therefore it would seem the reader's impression of the gist of a passage must grow and change as the passage is read. It is basic to "schema" theories (e.g. Schank & Abelson, 1977; Rumelhart, 1977) that readers develop an idea of the gist of a passage by connecting ideas read with world knowledge, or schema retrieved from memory. Information is easier to comprehend and to retrieve when the reader can relate it to prior knowledge through overlapping content or

inferences (Kintsch & Miller, 1984).

There is no research, however, that this writer is aware of, that directly addresses the aspect of 'changing gist'. It is not clear what strategies or processes serve to construct the reader's impression of overall gist, although research does seem to support the inference that the reader's conception of gist develops as a passage is read. Collins, Brown, and Larkin (1980) report the 'progressive refinement' of inferences readers make about the meaning of a passage as it is read. Investigating subjects' retrospective analyses of their own comprehension of a passage read to them, these researchers uncover a set of strategies readers seem to use as they systematically attempt to make sense of a difficult to understand passage. A more direct record of readers' strategic decisions as they read is needed.

The strategies identified in van Dijk and Kintsch's model (1983) function at various hypothesized levels: words and phrases, semantic units, propositions, strategic decisions, and macrostructure generated. These represent a logical hierarchy which does not necessarily function as a hierarchy in the reader's experience. For example, if we were to conceive of progression from words to macrostructure as 'bottom-up' processing and in the reverse order as 'top-down' (Chall, 1967), a reader's actual experience may really involve interactions at various levels,

similar to the interactive model suggested by Rumelhart (1977) as an alternative conception of processing.

In the process of reading it is likely that interactions involving these components within the mind of the reader procede in a manner which is determined by the immediate demands of the experience. For example, while a reader may be concentrating on generating a macrostructure representing the gist of a passage, he or she may suddenly be confronted with a word or concept which is confusing or unfamiliar. Attention might immediately be redirected to the structure or meaning of this particular word. Or, if an apparent conflict with the developing macrostructure was imminent, the reader might be led to re-consider its composition, and subsequent action might take the form of a strategic decision.

Strategic reading.

Within the framework provided by Kintsch and van Dijk's model strategies represent one aspect of the process of compehension. Strategic decisions underlie and direct the on-going process of reading. From an explanatory point of view they provide the pivot around which the reading experience proceeds. Within a strategic perspective, decisions may be required at the level of words and phrases, semantic units, propositions, knowledge structures, or macrostructure.

Research on metacognition (Brown and Baker, 1980) emphasizes similar components of the reading process, but van Dijk and Kintsch's theory suggests there is no simple explanation for how these components interact. The particular components which have priority at any given moment depend on various qualities within both the reader and text. More specifically constrained research, such as Brown and Day's(1980) or Afflerbach's(1987) suggest that the general theoretical orientation of van Dijk and Kintsch provides a valuable framework within which to describe hypothetical cognitive behavior in reading. Evidence was found in their subjects' protocols that support strategic components of van Dijk and Kintsch's model. Collins, Brown and Larkin (1980) also identified several strategies including questioning, shifting focus, and case analysis as listeners attempt to develop a representative model of text.

Important questions have been raised by theoretical attempts to describe the process of understanding text. How does text difficulty influence the process of comprehension and the strategies readers use? Collins, Brown and Larkin's (1980) work suggests that listeners progressively build and revise a representation of text. Is there a consistent system evident in readers' strategies as they progress through text?

If the development of macrostructure is a process over-riding

comprehension of text, its influence can be expected to guide reading behavior in certain identifiable ways. The present exploration into readers' use of strategies to understand expository text in the context provided by van Dijk and Kintsch's model can help lead towards more effective and relevant educational practice and research.

Theoretical Question

It is clear from this review that reading comprehension is a strategic enterprise. It is not clear just how the strategies a reader may use relate to the actual text being read. It is apparent that text difficulty or familiarity may influence not only how the text is understood but also how that text is read. Familiar or easy text seems to lead a reader to formulating hypotheses about text meaning more easily; whereas, more difficult or unfamiliar text leads to a rephrasing or progressive reformulation of the main idea and supporting details (Afflerbach, 1987; Collins, Brown, & Larkin, 1980).

The present research was designed to explore the strategies expert readers use in reading expository text and the ways in which these strategies may change to accommodate the new demands of more difficult text. At the same time the research is designed to study the ways in which strategy use may change as readers proceed through the body of expository text.

Research reported leads to some serious questions regarding differences in strategy use with difficulty or unfamiliarity of expository text which in part guide the present exploration. The procedure of using difficult or confusing reading situations to allow usually automated processes to become more visible for researchers leads to some serious questions. The readers in these situations may be experiencing something similar to individuals "being tripped" as mentioned above. As researchers we may be studying readers "being confused" rather than performing reading acts they would usually be involved in. A further complication results when research designs often used in studying reading occasionally unduly constrain the reading experience. The present research addresses these concerns. Hypotheses are framed which direct attention to a variety of text difficulties in a research context which may reasonably be expected to provide a wealth of information.

Chapter Three

Methodological Review

It is the intention of the present research to clarify and extend the work of others in the identification and understanding of cognitive processing in reading. It is necessary to address certain issues in the research design. The association between the processes of summarization and those of comprehension has been discussed. Reading research using the direction to "read to formulate a summary" has proved fruitful for years (e.g. Kintsch, 1974, Brown & Day, 1980), particularly insisting on brevity to encourage subjects to make inferences rather than recall verbatim from passages (Kieras, 1980).

The use of verbal reports in reading research is not new. Harker (1974) reviews introspective/retrospective case studies in reading from the turn of the century. He identifies aspects of reading such as ideational fluency, levels of abstraction, attention, and objectivity, and idiosyncratic behaviors which have been researched over the century. He concludes that a synthesis of these studies renders a "coherent and consistent representation of the reading process" (p.93). Introspective/retrospective case studies, he recommends, have been shown to be a valuable direct portrayal of complex reading processes.

Afflerbach and Johnston (1984) remind us that "verbal reporting,

especially introspection, had been an important component of psychological investigation, including reading research, prior to the rise of behaviorism..."(p.307). They review the strengths and weaknesses of concurrent and retrospective reporting, the use of probes, subjects' ease of verbalizing, and the influences on the validity of data collected. It is important to consider means of indicating qualitative differences that are strictly verbal, such as intonation and time lapses, so that these important factors are not excluded from analysis. In assigning statements to categories it is also important to take into account alternative interpretations of strategies rather than assigning them too easily to categories.

The system of categorization must suit the particular problem being addressed. It is important to distinguish between what is actually stated by subjects and what is inferred by the experimenter. In research design, Afflerbach and Johnston recommend that small numbers of subjects be used to allow for extensive analysis of protocol data. They recommend having multiple indicators, which in the development of 'grounded theory' is known as 'triangulation' (Glaser & Strauss, 1967). Afflerbach and Johnston (1984) suggest that "to the extent that concurrent and retrospective reports represent different data sources, they may be used as multiple indicators"(p.319). They conclude "verbal reports offer a unique,

if sometimes less than transparent, window for viewing cognitive processes" (p.320).

The less than full acceptance of verbal reports as data in studies of cognitive processes is evident in a methodological review of mental process research in reading. Chang (1983) compared simultaneous with successive methods and obtrusive with unobtrusive techniques without mentioning a single study which asks more of an experimental subject than a verbal recall.

Recently, the burgeoning of research reports in the area of writing and the relationship between reading and writing have provided valuable insights about cognitive processing. Afflerbach (1987), for example, compared his 'draft and revise' strategy to 'creating text' (p.515). Without raising questions about writing specifically, we can benefit from an understanding of some of the methods which have been used to identify cognitive processing during writing. Hayes and Flower (1983) discussed methods of researching cognitive processes in writing. The traditional input-output method involves varying the inputs on the subjects, observing the effects on the outputs, and inferring what the intervening processes must have been. Hayes and Flower list alternative approaches referred to as "process-tracing methods," including behavioral protocols, in which activities are noted during performance of a task;

retrospective reports, in which subjects verbalize about how a task was performed after its completion; directed reports, in which subjects report only on certain aspects of a task while they perform; and think-aloud protocols, in which subjects report anything they are aware they're thinking while performing.

Hayes and Flower cite reasons for using process-tracing methods:

1. they tell more about the process in a direct way.

2. the subsequent richness of protocol data provides opportunities for scientific exploration and unsuspected discoveries.

3. they provide access to aspects of a process that are difficult or impossible to observe otherwise.

Hayes and Flower also discuss criticisms of process tracing methods:

1. Validity is in question because people may not be conscious of their own cognitive processes. Nisbett and Wilson (1977) concur there is a risk of invalidity in that subjects may describe what they believe their mental states should have been, not what they actually were. Ericsson and Simon(1984) argue that protocol data are certainly no more constrained than data from other sources and probably provide more information.

2. To the extent that people are aware of their own processes, verbal reporting might distort them. Ericsson and Simon (1980) counter that reporting would not alter thinking that exists in a similar verbal form to

what is reported.

3. Verbal reports are incomplete. Hayes and Flower argue that psychological processes themselves often are unconscious, and verbal protocols are characteristically more complete than most of the other methods with which they are compared. For example, the protocols of a writer in action provide more and clearer clues to process than would an analysis of written products.

4. Verbal reports are not objective and therefore are questionable sources of scientific data. For example, directed reporting may lead to invented responses. It should be noted that attempts to ensure objectivity, although appropriate for certain types of experimentation, may not be relevant to verbal reporting. It is, after all, the subject's experience which may become evident through a verbal report and the greater the depth of experience which is elucidated by this subjectivity, the more valuable the data. A question of how this might be generalized further may be a question in another frame of reference.

Hayes and Flower suggest the usefulness of a verbal protocol depends on what we are looking for and what is known about it. Because reading to summarize involves a complex integration of processes (Kintsch, 1980), it presents problems for a typical input-output method. It is difficult to determine what process is active (Minsky, 1963) since the same output

may have arisen from any of a variety of processes. Observation that is as direct as possible may help determine which combination of processes actually occurred in a given reading experience (Hayes & Flower, p. 218). Hayes and Flower conclude " protocols can provide us with a valuable window onto our thought processes," (p.219).

Ericsson and Simon (1980) present an extensive discussion and assessment of verbal report data. They specify various situations in which subjects might be requested to give verbal reports. This will always delay whatever task is being performed but will only interfere with the task if there exists some conflict between the task and the report. If the report consists of conclusions about the task, for example, in problem solving studies, reporting may actually enhance task performance. "Subjects may alter their normal mode of processing in order to be able to give requested information to the experimenter,"(p.222).If the report consists , however, of verbal data in the form it exists in working memory, reporting should not interfere. They compare concurrent with retrospective reporting suggesting that retropective reports would lack information that may have been accessible during performance, but are no longer available after completion.

They suggest that "to assess verbal data we need a model to interpret data that are to be used to test the model,"(p.223). The dilemma they alert

us to is evident when we ask whether concurrent verbal report data represent what exists in working memory or what subjects believe they ought to be doing. And if that makes a difference, how do we know? Ericsson and Simon (1980), however, conclude that " verbal reports elicited with care, and interpreted with full understanding of the circumstances under which they were obtained, are a valuable and thoroughly reliable source of information about cognitive processes"(p.247).

A summarizing task was used primarily to focus readers' attention on understanding each passage. Although the summaries are not specifically a subject of this investigation it should be noted that Kieras (1982) used the constraint of a length limit on summaries in order to ensure that subjects would infer from the text, rather than repeat it verbatim. In a similar vein, subjects in this experiment were asked to be as brief and concise as reasonably possible, in the hope that this would encourage subjects to develop their own thoughts, rather than rely on repetition.

There is some question as to what kind of cuing procedure, if any, ought to be used in eliciting verbal report data. Ericsson and Simon (1984) recommend the least obtrusive procedure that will elicit more data, such as simply stating, for example, at any significant pause, "keep talking".

They recommend further that a random cuing procedure may be the most likely to elicit a variety of the subjects' thinking at different parts of the passage. Modelling this, subjects were asked to respond at any time they are aware of thoughts, but at the very least to respond whenever they are asked to "keep talking". Although experimenter probes are often used to elicit verbal protocols (e.g. Newell & Simon, 1972; Afflerbach, 1987), pilot data for this study suggested that intervention which involved any specific request or question led subjects to direct their verbalizations to the issue raised by the intervention. In addition, systematic or random non-directive probing served to interrupt a subject's train of thought as much as encourage verbalization. For these reasons sensitive, non-directive probing only at several seconds' intervals of silence seemed to be the most reasonable compromise.

For the purpose of exploring cognitive strategies evident in reading, there is clearly strong support for the use of a process-tracing method such as the think-aloud procedure. It is important that Ericsson and Simon (1984) distinguish between think-aloud (concurrent) and talk-aloud (retrospective) protocols in terms of validity and the type of information that may be gained. It is not that one method is better than the other but that each is valuable for a different purpose. Concurrent think-aloud protocols (particularly those elicited in a random, non-obtrusive manner)

are likely to provide a reliable record of subjects' thoughts. Retrospective protocols, on the other hand, will elicit insights of the subjects' reflections on their own processing, reflections which would not be forthcoming in concurrent procedures. Both kinds of direct reporting are particularly valuable for the present research into strategic decisions in reading to summarize expository passages. A judicious combination of these recommended procedures were implemented in the present study. This study emphasized concurrent reporting in an attempt to discover on-going process. Statements, however, inevitably include reflections and retrospective reporting as subjects grapple with the task of summarizing. Periodically, summaries are given by subjects; thus protocols are obtained using both recommended procedures, providing a rich source of data on cognitive processes.

Chapter Four

Research Design

Overview

Specific questions are addressed regarding strategy use of expert readers reading expository passages varying in difficulty. Definitions and hypotheses are stated. Subjects, materials, task, and procedures used are outlined below.

Definitions of terms (operational)

Expert reader: refers to university undergraduates who score at a minimum "14th grade" level on a Nelson Denny reading test.

Expository text: refers to non-fictional text abstracted by the experimenter from articles found in certain popular published sources.

Simple, Average, and Difficult Text: refer to a range of difficulty levels of expository text, as determined by independent readers in this study.

Pilot Study

In order to establish the types of passages, specific directions, and procedures in general which might be appropriate to this research into reading strategies, a pilot study was conducted in the home of the researcher prior to finalizing design for this resarch. An excerpt was drawn from an article in the Atlantic Monthly and five adult readers participated in the pilot study.

Each subject was asked to think aloud about anything that came to mind while reading the excerpt. Verbal probes in response to their talk were used to encourage their verbalization. Explanation, trial think-alouds, and discussion were used to clarify what was expected of subjects. Taped records of verbalizaions were transcribed and some preliminary analyses were performed prior to deciding on the approach to be taken in this study.

A cursory analysis suggested that experimental passages were likely to draw sufficient verbalization from experimental subjects to provide data for analysis. In addition, it was evident that verbal probes more extensive than "try to keep talking" could influence subjects' verbalizations. It was decided, therefore, to limit verbal probes to this statement only. The idiosyncratic nature of differences in verbalizations suggested further that subjects ought to be drawn from as homogeneous a

pool as is feasible as a means opf limiting the variability among subjects, especially since it is the possible influence of passage differences that is being explored in this experiment, not differences among subjects. Since it took subjects some practice and discussion before they seemed clear as to what was expected of them, a clear statement of expectations was written for subjects and it was decided to provide a training procedure prior to the actual experiment.

Subjects

In order to limit the variability in data collected, an attempt was made to draw subjects from as homogeneous a group as possible. Eleven undergraduates enrolled at the University of Victoria were subjects in this experiment. Ten subjects scored at a minimum of 'grade 14' according to form D of the Nelson-Denny reading test, a well known standardized reading test. The eleventh subject, who did not score a minimum of college level on this standardized test, was dropped as a subject. Although there are too few subjects to warrant generalizations between strategies and reading ability, it was felt to be important that subjects all demonstrate that they were at least all reasonably competent readers, since it is the potential influence of passage difficulty that is being explored, not differences between subjects.

Although the number of subjects is too small to warrant reliability

for extensive generalization, the research focus here is really exploratory. Walter Kintsch has recommended (private communication, University of Victoria, Fall, 1988) that in reading research it is very unlikely that we can establish valid prediction without unduly constraining context, and perhaps it is not reasonable to expect more than explanations of behavior under particular conditions.

Subjects were undergraduates who answered an advertisement asking for participants in reading research.

Subjects were each paid $10 on completion of their participation.

Material

Three expository passages (Appendix A), each with four natural breaks separated by paragraphing, were excerpted from articles found in published magazines, Verve (Tesley,1987) and Atlantic Monthly, (Scarf, 1986) and one journal, Science, (Slamon, et al., 1986). Passages varied in difficulty according to 10 independent raters. An excerpt of each passage was read by graduate students and faculty in education who categorized excerpts as simple, average, or difficult. In this 'blind' test the raters matched each passage with the same difficulty category (simple, average, difficult) as the researcher had chosen. In addition the subjects themselves rated the passages according to difficulty after the completion of the experiment. Each of ten subjects rated the passages simple to

difficult in accordance with the experimenter's assignment. This constitutes a reliability coefficient of 1.00. The researcher believes that this is sufficient evidence that the passages differ distinctively in difficulty. Passages are all between 439 and 473 words in length. Although they are each written on a different topic, they were chosen (intuitively) from relatively obscure sources to be of interest to college readers. Each subject was asked on completion of each reading to indicate whether the article had been familiar and of interest to that reader. All subjects indicated that all passages were of interest to them and had never been seen or read before by them.

Each of the four natural segments, or paragraphs, of each passage was printed on a separate sheet of paper and visible only after the summary of the previous paragraph had been offered. Although this constrained readers from reading ahead whenever they wanted, this procedure did ensure that think-aloud verbalizations were confined to text that was either being read or had been read by the subject. Because the procedure required that subjects provide brief summaries after each paragraph, it was believed this constraint, of not reading ahead, would enable the researcher to identify any changes in strategy use as the readers progressed from one paragraph to the next in the passages.

One tape recorder was used to record a think-aloud session as each

subject read each passage.

Procedure

The same small, quiet, private room in the education building was used to record each subject reading individually. The room had no windows. Each subject sat in the same chair across the same table from the researcher. Each subject was free to take as long as she wished to read each passage and to re-read as often as she wished.

Each subject read each passage and summarized as briefly as possible what it was about after each of four naturally occurring breaks, or paragraphs, each printed on a separate sheet. Anything already read or being read was available to each subject during verbalization and summarizing.

Subjects were directed to think aloud into a tape recorder as they read the passages. A practice session familiarized subjects with task.

Directions.

The following instructions were read aloud to each subject:

THE PURPOSE OF THIS RESEARCH IS TO DISCOVER THE STRATEGIES WE USE TO UNDERSTAND WHAT WE READ. TO ACHIEVE THIS PURPOSE YOU WILL BE ASKED TO READ 3 BRIEF PASSAGES WHICH ARE EXCERPTS FROM MAGAZINE OR NEWSPAPER ARTICLES. EACH PASSAGE IS AN EXCERPT TAKEN

OUT OF ITS CONTEXT AND MAY THEREFORE SEEM SOMEWHAT OBSCURE AT FIRST. TO PROVIDE INFORMAION ABOUT HOW YOU COME TO UNDERSTAND WHAT YOU ARE READING YOU WILL BE ASKED TO DO THE FOLLOWING:

1. READ EACH PASSAGE ONE PAGE AT A TIME. THERE WILL BE ONE PARAGRAPH ON EACH PAGE. YOU MAY LOOK BACK OVER ANYTHING YOU HAVE ALREADY READ AS YOU PROCEED.

2. WHILE YOU ARE READING EACH PAGE, SAY ALOUD EVERYTHING YOU ARE THINKING ABOUT AS YOU READ. SINCE THE PURPOSE OF THIS ENQUIRY IS TO DISCOVER HOW YOU ARE REACHING AN UNDERSTANDING OF WHAT YOU ARE READING, YOU ARE ASKED TO BE AS AWARE AS YOU CAN OF EACH THOUGHT YOU HAVE AS YOU TRY TO UNDERSTAND THE PASSAGES AND TO VERBALIZE THESE THOUGHTS. YOU MAY READ SLOWLY OR READ ANYTHING OVER AGAIN AS OFTEN AS YOU WISH. PLEASE INDICATE AS SPECIFICALLY AS POSSIBLE WHAT AND WHY YOU ARE RE-READING WHEN YOU DO. YOU MAY STOP READING TO SAY WHAT YOU THINK OR TO EXPLAIN ANYTHING.

3. AFTER EACH PAGE SUMMARIZE AS BRIEFLY AS POSSIBLE THE WHOLE PASSAGE TO THAT POINT. THERE IS NO RIGHT OR WRONG SUMMARY. YOUR SUMMARY WILL NOT BE COMPARED

TO ANYONE ELSE'S. HOWEVER YOU CHOOSE TO SUMMARIZE IS PERFECTLY ACCEPTABLE. PLEASE DO BE AS BRIEF AS POSSIBLE. THE ANALYSIS IN THIS STUDY IS CONCERNED ONLY WITH HOW THE SUMMARY CHANGES WITH THE ADDITION OF EACH NEW PARAGRAPH, AND WITH THE RELATION BETWEEN YOUR THOUGHTS AS YOU READ AND YOUR SUMMARY.

4. YOUR SPEED OR EASE OF READING IS OF NO CONCERN TO THIS RESEARCH. WHAT YOU THINK ABOUT AS YOU READ IS THE SOLE CONCERN OF THIS STUDY.

5. WHAT YOU SAY ALOUD AS YOU READ WILL BE TAPE-RECORDED AND TRANSCRIBED FOR ANALYSIS. YOUR NAME WILL NOT APPEAR ANYWHERE ON THE TAPE OR THE TRANSCRIPT, NOR WILL ANY PUBLICATION RESULTING FROM THIS RESEARCH CONTAIN ANY PERSONAL REFERENCE.

6. A NELSON-DENNY READING TEST WILL BE ADMINISTERED TO PROVIDE A STANDARDIZED REFERENCE POINT.

7. THERE WILL BE A PRACTICE SESSION TO ACQUAINT YOU WITH THE TASK . PLEASE FEEL FREE TO ASK ANY QUESTIONS.

8. YOU MAY WITHDRAW YOUR PARTICIPATION AT ANY TIME.

9. YOU WILL BE PAID $10 AT THE COMPLETION OF YOUR PARTICIPATION.

10. THANK YOU FOR YOUR INTEREST IN THIS RESEARCH.

Instructions written above each passage:

READ THE FOLLOWING PASSAGE ONE PARAGRAPH AT A TIME AND STATE AS BRIEFLY AS POSSIBLE AFTER EACH PARAGRAPH WHAT YOU THINK THE PASSAGE IS ABOUT.

Preparation.

A practice session allowed subjects to ask questions and try verbalizing until each felt comfortable with the procedure and clear about what was expected of them so that the researcher would not have to intervene during the actual experiment.

Order of passages.

Each subject was tape recorded verbalizing whatever she was thinking while reading each of the three passages. In order to correct for some of the possible problems arising out of the limitations of using a small number of subjects, the design used randomized counterbalancing of all conditions for all subjects (Campbell & Stanley, 1966). The throw of a die determined the order in which passages were read by each subject. The numbers 4,5 and 6 repesenting passages 1,2 and 3. The throw was repeated if passage indicated had already been chosen. The use of this procedure enabled possible interaction effects between subjects and conditions to balance each other out. In addition, to reduce the amount of variance arising between subjects which could confound the findings, subjects were drawn from as homogeneous a pool as possible: upper year female education students at the University of Victoria.

The researcher intervened only to say "try to keep talking" whenever a subject was silent for a few seconds.

On completion of all three passages each subject was asked to order the three passages in terms of their difficulty. Subjects were also asked if each passage was interesting to them or had been read before.

A short 'debriefing' session allowed each subject to ask questions and make comments to provide closure to their experience.

Each subject was paid $10 at the end of their participation.

Each subject completed participation in the experiment before the next subject began. There was no communication between subjects during the progress of this research.

Transcription.

After all data were collected, tape recordings of subjects' verbalizations were transcribed on a word processor with the aid of a dictaphone playback machine. Pauses were coded with a "/" (slash) for each second of silence to help retain the meaning of subjects' verbalizations.

Transcriptions of think-aloud protocols were analysed using a procedure of constant comparison (Goetz & Lacompte, 1984) with the intention of determining strategies subjects used.

Content analysis

A system similar to "constant comparison" (Glaser & Strauss, 1967; Goetz & LeCompte, 1984) was used to establish strategies that seemed to underlie subjects' verbalizations. This procedure involves allowing a statement in the data to suggest a strategy or category. The researcher then considers whether the next statement fits in that category or a different one and codes that category accordingly. The researcher procedes with the coding, considering one statement at a time in relation to those already coded, until all statements are accounted for. One of the benefits of this method is that as more statements are considered for inclusion in a given category, the definition of that category becomes more clear. This procedure enables the researcher to categorize a statement in the data and

then top consider the categorical placement of succeeding statements.

It was a combination of the surface meaning and apparent underlying purpose evident in any statement made by subjects in this experiment which led to a determination of the category of response which was represented. These determinations necessitate a number of inferences on the part of the researcher. To find inference in research is inevitable, even desirable, but it is best when the parameters of inference are clearly described and validated. Of course it also helps if the experiment replicable. In the case of research into complex behavior this degree of definition is not always achieved (Huey, 1908/1968), particularly when the nature of the research is exploratory. As more of such research is performed, however, our abilities to define parameters more clearly and describe reading behavior more explicitly will increase.

It was evident from initial attempts to use a technique of finer distinction, such as propositional analysis, that the use of such a formal system was inappropriate for the analysis required of this data (Walter Kintsch, private communication, March, 1988).

Reliability estimate.

A selection of subjects' statements representing all categories were drawn from protocols of verbalizations while reading all difficulty levels. These statements were categorized into each category by an independent

group of 18 undergraduates. This procedure produced a reliability estimate (Appendix B). This group consisted of an intact class. None of these individuals was the same as or was in any way related to any in the experimental group.

Frequency of use.

The number of times the identified strategies were used was counted for each subject reading each paragraph of each passage. These numbers constituted the "frequency of use" of each strategy.

Mean frequency of use for each strategy was summed across prargraphs for each passage. This data appears in Table 1 (p. 65) and is graphed in Figure 1 (p. 66).

These frequencies were compared across paragraphs and across passage difficulties using Manova in Spss-x to determine possible statistical significance of the differences noted.

Chapter Five

Results

Content Analysis

Categories of responses and strategies.

A procedure involving repeatedly comparing statements with each other in terms of their apparent meaning and purpose, as mentioned above, was used. This analysis and re-analysis of protocol data resulted in a categorization of responses. The following six (6) categories of response and strategies, in order of frequency of occurrence, were identified in subject protocols (categories of response and strategies are illustrated below with samples of protocol data drawn from each of the three passages):

1. Metastatement
2. Problem Solving
3. Repetition
4. Divergent
5. Surface Response
6. Surface Structure

The categories of responses and strategies defined.

The six categories of responses and strategies are briefly described below followed by more thorough definitions with illustrations. A

combination of the surface meaning and apparent underlying purpose evident in any statement made by subjects in this experiment was instrumental in the determination of the category of response represented.

It will be evident from the illustrations and later discussion that the only category which seems to be directly instrumental as readers' construct their idea of the meaning of text is Problem Solving. Although all the statements were made while readers were directly engaged, superficially at least, in reading to summarize, by far the majority of statements made seem to be peripheral to that task.

There follows an explicit definition of each response category with illustrative examples from transcripts spanning all subjects and all passages.

1. Metastatement: similar to the concept described in Kintsch and van Dijk (1978) as comments, opinions, or attitudes. These are statements which do not appear to be direct engagements of the reader with the text. The statements, rather, are asides, emotionally based statements about the text, author, or ideas expressed, for example,

Subject 8, in passage 3, states, "but he does it in fairly technical terms...." Here the subject is making a judgement about the author's writing.

Subject 3, in passage 1, : "oh, I like this one," stating a preference, or opinion.

Subject 4, in passage 2,: "this really upsets me," demonstrating a reaction indicating her attitude.

Subject 5, in passage 1, "that's rubbish," stating her opinion.

Subject 3, passage 2, "... it's very easy to read fairly straight forward...." Subject here is making an assessment of the text, a judgement, which is coded, therefore, as a metastatement.

2. Problem Solving: involving questions (of text or author), predictions, and inferences. A direct question of the text or author indicates a problem-solving strategy. Such a question demonstrates that the reader is attempting to clarify in some way what is being read. A prediction, or statement about what is to come in the text or ideas represented, demonstrates the reader has formulated an hypothesis about what is being read. This may be interpreted as an attempt to clarify meaning or the use of a problem-solving strategy. An inferential statement, in the simplest sense, represents a problem-solving strategy in which at least two ideas explicitly found in text are combined into another unique idea which is not explicitly stated in the text. Because these categories of responses and strategies all demonstrate the reader is grappling with text in an attempt to understand the ideas represented,

they are within the problem-solving category of responses and strategies. They are found in transcripts of readers reading all passages, for example:

Subject 2, passage 2, seems to doubt the passage on the basis of lack of personal experience indicating a question of ideas represented in the text: "I'm not sure if I've come across the patterns mentioned previously about eloping childen having had eloping parents."

Subject 1, passage 1, reaches into the future: " we'll see if that's true."

Subject 3, passage 3, infers "...it seems to be saying that if you got a bigger number of these things then you are in worse shape..," while reading:" ... appears to have an effect on survival, with greater copy number being associated with a worse prognosis...."

3. Repetition: representing a verbalization which is virtually identical word for word with text.

For example, Subject 9, in passage 1, states, " women just aren't getting enough sleep" which is a verbatim repetition.

Later this same subject states, " they'd feel better with more (sleep)." while reading, "they'd feel better with more."

Although a word is added to complete the sentence, this statement is coded "repetition" since the meaning of the statement is essentially

identical to the original.

Subject 5, in passage 2, states, " that it's coincidental in a man whose mother was a hypochondriac and depressed married a woman who was warm and outgoing and then a decade later finds himself the disgruntled husband of a seriously depressed and somewhat suicidal wife" while reading words that are the same except for "is it coincidental that a man whose mother...suicidal wife".

This rewording is also coded as a repetition. Although outwardly the subject has rephrased a question as a statement, the remainder of the excerpt is repeated verbatim and the subject states an interpretation immediately following that she believes "he" (in the text) was "at fault". Subject's response in this case seems to be the answer to a question raised by the text which the subject read as a statement but interpreted, or responded to, as a question. This seems to indicate the response intended by the subject is appropriately placed in the repetition category. In many instances we say one thing out loud when we really mean another, for example, "I'll close the door. There's a draft" when what was really meant was "window" as would be obvious from the context. To interpret this subject's response as meaning any more than repetition would seem to read into the subject's statement more than the subject has indicated is justified.

Subject 6, in passage three, states, " ///neuroblastoma is a relatively rare disease with an incidence of /such and such carcinoma of the breast/ however/" during a reading of " Neuroblastoma is a relatively rare disease with an incidence of one per 125,000 children. Carcinoma of the breast, however,...". Such a rewording is coded as repetition since it basically repeats the explicit meaning of the original, replacing "one per 125,000 children" with "such and such".

4. Divergent: This category represents verbalization in the subject's own frame of reference suggested by, but not necessarily directly related to, text. A verbalization suggesting the divergent category veers away from the context of the passage. The subject's background of prior knowledge is activated and virtually leads the subject into a new frame of reference. That is, the reader goes off on a tangent from ideas presented in the text. For example,

Subject 4, reading passage 1, states: "It frustrates me sometimes when people give me the impression that I should be embarrassed that I make sure I sleep eight hours." Although the topic of subject's statement has been suggested by the passage, it is really a statement that is more specifically related to a context framed by the subject than the passage.

Subject 5, reading passage 2, states: " I don't know whether it's a

carry on from families of alcoholism, certainly from all the studies I've read that's the case that a woman will often marry an alcoholic because her father was one and that pattern that sort of rescuing pattern tends to be programmed into her." Again the topic is suggested by what the subject is reading, but subject decides to go on at length projecting from her own context. Her statements do not really clarify or extend that portion of the passage except to portray more explicitly the prior knowledge subject seems to use to understand what she has read.

Subject 9, reading passage 3, states: "I think about my friend who had cancer but I'm not going into that." The subject indicates a personal experience whose memory is activated by text.

5. Surface Response: represented by statements referring to surface aspects of a subject's reading, this category represents a reference to the reader's own functioning. Statements which reflect mechanical aspects of the subject's reading, such as speed or place in text or directional references in terms of word, sentence, paragraph, page, or passage, these types of responses arise from the actual surface level of reading as the reader progresses through the passage. These consist of a distinct response, as distinguished from Surface structure category (below) which is characterized by a significantly powerful surface aspect of the text that seems to trigger a response in the reader. Surface Response

category, by contrast, seems to distinctly arise out of the reader's own processing, for example,

Subject 9, passage 2, "I'm doing one sentence at a time."

Subject 8, passage 3, "I get to this sentence...."

Subject 7, passage 1, "this is back to the first page."

Each of these three verbalizations represents a category involving reference to the reader's own progression through the physical text.

6. Surface Structure: This category is indicated by the subject seeming to be either cued or confused by a word or phrase, through its understanding, misunderstanding, or lack of understanding. As distinguished from Surface Response category, Surface Structure category seems to arise not from the reader so much as from a distinct and specific cue in the textual environment, for example:

Subject 6, reading passage 1, states "...women feel the stress of conflict between home and parenting / between home and parenting / oops / I don't think I understand that." This subject is confused by the phrase "home and parenting" because she believes these are the same and states later she would have expected "home and work" to be distinguished instead.

Subject one, reading passage 2, "'Repetitive patterns' is getting my back up already," demonstrates being cued by a phrase. The subject later

clarifies that this reaction to the text seems to be associated with what she believes is meant by the phrase "repetitive patterns" in the context of relationships.

Subject 3, reading passage 3: "'ligand', I don't know what that means," indicates the lack of understanding of a word.

These six categories of responses and strategies serve to describe the data provided in the subjects' verbalizations.

Reliability estimate.

In order to establish some degree of reliability in the choices of categories of responses and strategies a group of 18 undergraduates were asked to participate as judges in a reliability estimate. Procedures and results of this estimate are indicated in Appendix B. Judges' categorizations were identical to the experimental coding 84.1 % of the time. In addition, this coding of categories of responses and strategies leaves less than 3% of protocol data unclassified. These results suggest that the category coding used has sufficient reliability to provide a meaningful representation of experimental subjects' reading behavior during this experiment.

Frequencies of occurrence.

The frequency of occurrence for each of these six categories of responses and strategies was counted within subject protocols for each

of four naturally occurring paragraphs comprising each of three passages of difficulty levels: simple, average and difficult. These frequencies appear in Table 1 (p. 65) and are graphed in Figure 1 (p.66).

Counting frequencies of categories within passages, there is some variability. The frequencies of occurrence of each category tabulated separately for each passage is shown in table 2 (p. 67).

Table 1.

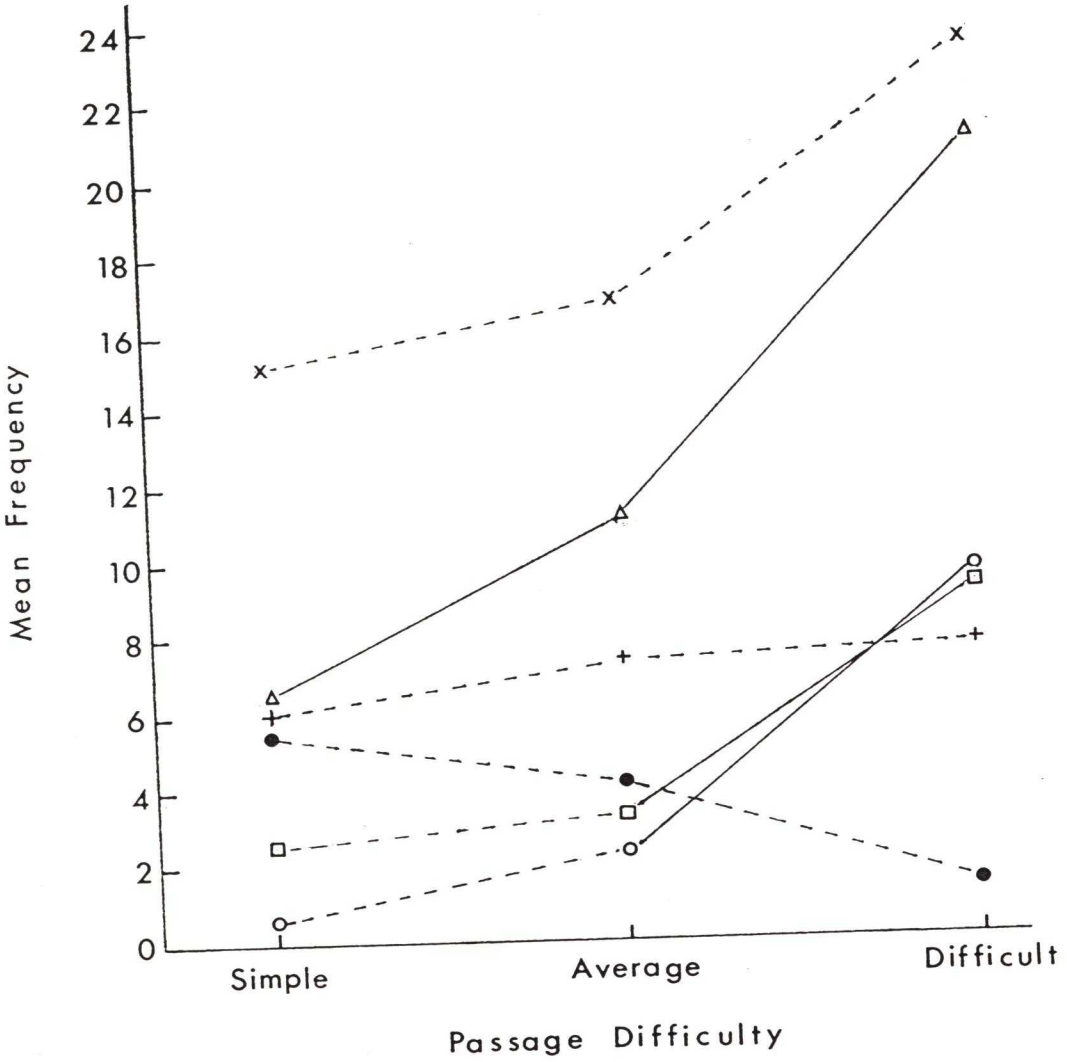
Means Table: Mean Frequency x Passage Difficulty

	Passage Difficulty			
	Simple	Average	Difficult	Sig. of F
1. Metastatement :	14.9	16.6	23.7	
2. Problem Solving*:	6.5	11.1	20.9	< .01
3. Repetition:	6.0	7.2	7.3	
4. Surface Response*:	2.3	3.3	9.2	< .01
5. Surface Structure*:	0.5	2.2	9.5	< .001
6. Divergent	5.6	4.1	1.5	< .054

N = 10

* = Differences across passages reach significance (F < .05)

Figure 1. Mean Frequency X Passage Difficulty



[1] Sig. of $F < .05$

Table 2.

Order of Category Use by Passage

	Simple	Middle	Difficult
1.	Metastate	Metastate	Metastate
2.	Probsolv	Probsolv	Probsolv
3.	Repetition	Repetition	Surface str
4.	Divergent	Divergent	Surface Resp.
5.	Surface Rsp	Surface Rsp	Repetition
6.	Surface Str.	Surface Str.	Divergent

As can be seen from the table above, the relative frequencies of occurrence for each category of response is different for responses while reading the difficult passage. The order, from most to least used, of the lowest four categories of responses changed in order from Repetition Divergent, Surface Response, Surface Structure to Surface Structure, Surface Response, Repetition, Divergent. This reflects the high incidence of Surface Structure and Surface Response use while reading the difficult passage and the decrease of use of Divergent response.

Results According to Hypotheses

In order to address the hypotheses, which are stated in terms of differences in strategy use, the frequencies of occurrence of each category were analyzed within think-aloud protocols two ways: across cumulative summaries within passages, and across difficulty of passages.

Hypotheses (1) and (2) refer to strategy differences across difficulty levels of passages:

Hypothesis one.

In the frequency of strategies used by expert readers reading to summarize, differences will be found between simple, or average, and difficult expository text.

Frequency of strategy or category use increases noticably from middle to difficult for the categories, problem solving, surface structure, surface response,

metastatement. The slopes of these graphs are considerably steeper. These results support hypothesis one which states that differences will be found in expert readers' categories of responses and strategies between reading difficult and simple expository prose. Two of the categories, however, do not follow this trend: repetition and divergent.

In more specific terms hypothesis one suggests:

a) unprompted summaries of reported gist will be more frequent while reading simple, or average, text.

In relation to specific predictions, the expectation of a higher frequency of automatic summaries of gist, predicted higher for reading simple or average text in hypothesis (1)-a, is a rephrasing of previous findings. Testing this hypothesis in the context of the present research requires first of all that the concept of "automatic gist" be expressed in terms of the strategies defined here. It appears that such automatic hypotheses would be evident in problem-solving strategy use which is the only category to include questions of the text, inferences combining ideas in text, and predictions regarding text and ideas expressed. These statements which also provide evidence of problem-solving strategy use also imply the existence of an hypothesis regarding textual meaning. If this were the case, we could say these statements represent the existence of hypotheses aothough it would be stretching a point to suggest this were the same thing as actually framing an "automatic

hypothesis".

A few examples may clarify this relation: subject 8 reading passage 2 states, "he's not talking about healthy patterns," while reading," ..toxic family situation.." This statement constitutes an inference about what the author implies by using the word 'toxic' in relation to 'family' in the context of patterns discussed in the article. Evidently in this brief statement the subject is combining several ideas suggested by the text and making a statement which suggests the existence of an hypothesis regarding what the author is not talking about. Although this may not be considered an automatic hypothesis, it seems to at least imply the existence of an hypothesis , it is spontaneous and implies the existence of an hypothesis regarding what the passage is about.

It is apparent that the other two types of statements which represent a problem-solving strategy also seem to be implying or stating an hypothesis: any question of the text implies an hypothesis about the text, for example,

Subject 5, reading passage 1, asks, "what's the conflict between home and parenting?" while reading,"...the stress of conflict between home and parenting...." In this case the subject questions the credibility or suitability of a phrase, as if that phrase did not 'fit in' with the hypothesis the subject has already developed about what the passage is saying. This also constitutes then an automatic hypothesis.

Clearly, a prediction states a direction the subject believes the article is

headed which itself is an hypothesis. For example,

Subject 1, reading passage 2, predicts, "he's going to explain how really it isn't so rational after all," while reading, "...seems to defy rational explanation." The subject effectively states a spontaneous hypothesis about what the author will explain in the text to follow.

Hypothesis (1)-a) predicting a greater frequency of use of automatic hypotheses while reading simple or average expository text, then, would seem to be supported if its frequency of occurrence were indicated to be higher with simpler text. If this discussion of problem solving statements suggests that they indicate at least the existence of an hypothesis, then these data reflect a possible rejection of this hypothesis. Rather than discuss this any further, suffice it to make two statements. One, these data do not reflect statements that are "automatic hypotheses" and two, even if they do imply the existence of such hypotheses, this still is not a clear enough test to compare to previous findings regarding "automatic hypotheses".

b) progressive rephrasing and restructuring of reported gist will be more frequent while reading difficult text.

The prediction of increased progressive re-phrasing and restructuring of gist while reading difficult text seems to be supported by the evident increases in problem-solving strategy use while reading difficult text. This strategy is the only one of the six identified which seems to provide evidence of the reader

grappling directly with the ideas in the text. As is clear from examples above, readers' use of prediction, questions, and inferences all seem to represent readers describing and clarifying the meaning (or gist) of the passages.

Hypothesis two.

Hypothesis two states: in the frequency of strategy use by expert readers reading to understand expository text, there will be no difference between simple and average difficulty text.

The results in general also provide no evidence to reject hypothesis (2) which states that there will be no differences found between average and simple expository text in categories of responses and strategies used by expert readers reading to summarize. Although these data may not provide a sufficiently sensitive test of such an hypothesis, the general trend of little change in strategy use between simple and average difficulty texts at least provides no evidence to reject hypothesis (2).

As can be seen in Figure one, some of the differences in frequency of strategy use achieve significance across passage difficulty. In general, frequency of use of all categories of responses and strategies increases slightly if at all from simple to average difficulty, in most cases the slope of the graph remaining rather flat.

Problem-solving strategy use is one discrepancy from the general trend, however. In this case there are significant differences in increases from simple

to average as well as from average to difficult. This contradicts the hypothesis that the use of automatic hypotheses would not be significantly different between simple and difficult.

Hypothesis three.

Finally, Hypothesis three states that no differences are expected in the incidence of strategies or responses representing any category across the four naturally occurring divisions separated by paragraphing in all passages.

In this study no significant differences were found in the incidences of any category of response across the four divisions. No data analysis is reported since this study did not uncover any differences in strategy use within passages.

Shapes of Graphs

Hypothesis one and two.

According to the graph (Figure one) several categories seem to demonstrate support for Hypotheses one. Of the four categories of responses and strategies, Surface Structure, Surface Response, Metastatement, and Repetition, graphs are similar in shape: flat from simple to average difficulty, steeper from average to difficult, suggesting there is little or no change in frequency of use from simple to average passage difficulty and considerably more use of these categories of responses and strategies at difficult. This suggests there may be some difference in the way subjects' reading changes, little change from simple to average difficulty, considerably more change from

average to difficult.

Some discrepancies noted

There is evident from the graph in Figure 1, three discrepancies from the general trend of change just referred to. that is, the three which show little change from simple to average and greater increase from average to difficult. It will be noted that , although the slope of the Problem Solving graph is also steep from simple to average , it continues in a steep climb, indicating considerable change, from average to difficult. This suggests the use of problem-solving strategy seems to increase to a similar extent between simple and average passage difficulty and average to difficult. This might suggest the existence of some sort of linear relationship underlying the change in frequency of use of problem-solving strategy as the difficulty of expository prose increases. However, as has been stated previously, the risk in running such a test is greater than the gain. The lack of any clear relationship among the passages precludes the possibility of such a test providing valuable information. In fact these changes in frequency of use simply suggest that we ought to look more closely at these categories and strategies and try to determine what these changes represent.

A second discrepancy is indicated in the graph of the frequency of use of Repetition across passage difficulty: the slope of the graph is relatively flat from simple to average to difficult difficulty, suggesting that there is little difference

in the use of repetition as difficulty of expository prose increases.

A third discrepancy is evident in the graph of Divergent statements. Frequency of use of divergent statements gradually decreases as passage difficulty increases, Again this would suggest some sort of inverse linear relationship underlying this change in strategy use, were it not for the obvious fact that such mathematical relations are not sufficiently meaningful without a clear definition of levels in passage difficulty. It should be noted, however, that, turning the argument around the other way, the changes in what seem to be distinctive categories of response do suggest that there is indeed some considerable difference in the task represented by the difficult passage which seems to place it in a considerably different category from the other two.

Shape of the graph suggests there may be some relationship also underlying the use of Metastatements (see Fig. 1). The changes in the use of this category of response suggests a similar relationship between its use and difficulty and that of Surface Response and Surface Category use and difficulty. There is a noticeable change in the use of all these categories of response which seems to be related to the highest difficulty level.

Statistical Analysis

Signifying results along a loosely defined scale of passage difficulty can lead to conclusions which are spurious or suspect. Given the exploratory nature of this study, however, it is recommended these results be understood as lending

support to the variations that are already evident in the data. In that sense statistical significance of any differences may suggest more strongly that underlying differences of some importance may exist but not necessarily that there has been a clear answer to a question posed of the data.

The results are in the form of frequency data in a 1 x 3 design between three passages each at a distinct level of difficulty representing different conditions, as determined by independent raters. The frequencies of use of each of the defined categories were compared using analysis of variance (Winer, 1971). Research into process commonly uses few subjects to allow for in depth analysis (Afflerbach & Johnston, 1984). Yet meeting the requirements and assumptions of parametric tests normally requires large numbers of subjects (Siegel,1956). In fact, any error resulting from too small a number of subjects would tend to a conservative type I error (Seaman, Algina, & Olejink, 1985); that is, there is less likelihood that actual differences will be found. In the present research parametric assumptions allow for a statistical test, but we should exercise caution regarding generalizations, taking full account of the constraints on gathering large amounts of relevant data.

Summing across passage portions, differences in frequency of category use were tested for significance across difficulty levels of simple, average, and difficult passages. Overall Manova for this test revealed significant differences with Hotellings < .001 and Wilks < .001 (see Table One, p. 65). These results

suggest that the separate Univariate tests may be considered (Harris, 1974). These tests will be considered in the context provided by the hypotheses.

Hypothesis 1.

There are differences in use of categories of strategies and responses between average and difficult text. Differences in the occurrences of Problem Solving, Surface Response, and Surface Structure between average and difficult text reach significance. The differences in the occurrences of other categories identified, however, are not statistically significant: Metastatement, Repetition, and Divergent.

Hypothesis 2.

No differences between simple and average text are statistically significant in the occurrences of 5 categories identified: Metastatement, Repetition, Divergent, Surface Response, and Surface Structure. The difference in occurrence of Problem Solving, however, is statistically significant between simple and average text.

Hypothesis 3.

Summing over passages, differences in occurrences of categories across portions of text, or paragraphs, were tested for significance. This test was to examine variations in strategy use as gist, or an hypothesized macrostructure, is believed to develop in the mind of the reader. In this test, a multivariate analysis of variance indicated no significant differences in strategy use across

passage portions. This suggests there is no evidence to reject hypothesis 3 which states the expectation of no differences in expert readers' use of any particular category of response or strategy in tracking the changing gist of an expository passage. That is, no evidence was found for a change in strategy use across paragraphs. No differences in strategy use are evident in this data as readers' ideas gradually develop of the gist of the expository passages studied.

Limitations

No evidence was found for a change in strategy use across paragraphs. Since everything we know about reading suggests that the use of strategies must change considerably as the challenge of reading changes, it is evident that this hypothesis and analysis must not be sufficiently precise to adequately describe a reader's strategic approach to the development of gist. It is beyond the scope of the present research, however, to speculate further on possible strategy changes as paragraphs are read.

It should be emphasized that these findings are exploratory. Any generalizations to a population beyond the subjects actually studied would be suspect, as the sample size was extremely small to enable an in-depth analysis of the results. Table one indicates the mean frequency for each category. Differences that achieved significance are noted in the significance column (See Table 1), and are graphed in Figure one (significant differences are graphed with a solid line, those which did not achieve significance, with a broken line).

As stated previously, we should be cautious in our interpretations of different responses to text of varying difficulty because the different levels of text difficulty cannot be measured on an interval scale according to difficulty. That is to say, we cannot know with any degree of certainty how much more difficult any passage is than another. Clearly this presents a problem not only for interpretation but even for the mere presentation of results. It is important to note that the three categories of text , simple, average, and difficult, are not necessarily different from each other in the same degree of difficulty. Comparison of differences across simple to average and average to difficult is therefore suspect.

Three results of interest, however, do suggest that each passage does present a distinctly different demand on readers. The occurrence of Problem Solving increases significantly from simple to average as well as from average to difficult passages. Although we should exercise caution in interpreting this result on the basis of unclear differences in difficulty, we can interpret the meaning of this result in an alternative manner. It is evident, for example, in the steady and significant increase in the use of Problem Solving that each passage does present a different demand on the readers. In other words, although we cannot say with certainty what is represented by these changes, we can at least confidently suggest that each passage seems to encourage an alteration in the approaches of the readers.

This evident change is further supported by variations in two other categories. It is clear that there is not simply a general increase with difficulty in all categories. Repetition remains virtually flat and Divergent actually decreases as difficulty increases. Again, we clearly cannot say for certain what the relationship might be between differences in strategy use and differences in passage difficulty. Differences in either case cannot be said to be on anything like an ordinal scale. However, these results do suggest that not all categories' occurrences vary identically with difficulty, and this suggests at least the existence of distinctive differences among passages.

Chapter Six

Discussion

Content Analysis

The categories of responses and strategies defined.

The six categories of responses and strategies identified in the results chapter together provide a context within which to understand the readers' progress through text. Variations in the occurrences of these categories also suggest differences in the processing of text, but specific definition of processing is not compatible with the exploratory nature of the present research. Figure one (p.66) demonstrates graphically the differences in occurrences of each category of response for each difficulty level of passage.

According to Hypotheses One and Two

For the purposes of discussion, it is recognized that Hypotheses One and Two together constitute the expectation that the occurrences of responses and strategies will not be distinctly different between readings of simple and average difficulty text but will change with difficult text.

As expected, there were differences found in the occurrence of some categories of responses between readings of average and difficult text. Specifically, the occurrences of Metastatement, Problem Solving, Surface Response and Surface Structure all show a considerable increase from average to difficult, while the occurrence of Repetition does not change appreciably and

the occurrence of Divergent decreases. As indicated on the graph, only the changes for occurrences of Problem Solving, Surface Structure, and Surface Response were statistically significant.

It is important to note that these changes in occurrence of categories of responses are not all in the same direction. As mentioned elsewhere, this suggests that each passage did present a distinctively different challenge to readers, although we should be cautious in our interpretation of what these differences may mean in the readers' processing of text.

Problem solving.

The data contain another complication suggesting that there is not a simple explanation of these increases. The qualitative nature of response categories may be different at different difficulty levels, for example, the increase in occurrence of Problem Solving from average to the highest difficulty level seems to be an increase in the use of a rather different problem-solving strategy directed more at an attempt to understand than towards a clarification of existing understanding. The latter clarification process is more characteristic of the use of Problem Solving in the readings of simple and average passages. Comparison across passages may demonstrate this:

Subject one interprets in passage one: " I see burning the candle as being more stress than sleep but" and predicts: " we'll see if that's true."

The subject has interpreted part of the passage in her own words and

predicted that she will learn from reading on whether or not this will be supported by the text.

Subject one infers in passage two: " it must be something to do with me.." and predicts, "we'll see if he's right."

In this case the subject has made an interpretation of the passage and voiced an expectation again that she expects this to be validated by the passage.

Problem Solving statements like those above suggest the increase from simple to average difficulty seems to represent an increase of qualitatively similar statements directed at interpretation and prediction of passage meaning and relation to the reader's context. It is of interest in this regard that the increase in problem solving strategy use from simple to average difficulty seems to reflect an increase which can be predicted from previous research. Increased use of inferences and prediction to check inferences while reading expository prose of increasing difficulty is corroborated by Collins, Brown and Larkin's (1980) 'Progressive Refinement Theory' and by Afflerbach's (1987) finding of a higher frequency of Topic/Comment strategy use in 'unfamiliar' text.

In the present research the increase with passage difficulty in occurrences of statements indicating subjects are making and checking inferences about passage meaning reflects what seems to be a similar use of inferences to reach understanding that has been noted in previous research.

Problem Solving occurrences reading passage three, however, seem to indicate a different purpose.

Subject one: In reading passage three, subject predicts,"...just see if I can discover what it's sort of about." In this case the prediction is qualitatively different from those cited from simple and average passage readings. The subject voices not so much an expectation regarding validation of her own interpretation, as a search for some information that will allow her to make an interpretation in the first place.

The qualitative change apparent in the increase from average to difficult passages reflects an increase of a somewhat different nature from the change from simple to average. There is a substantial quantitative increase in frequency of problem-solving strategy use that reflects a qualitatively different strategy. Inferences while reading the difficult passage indicate subjects' struggle with understanding. This different nature in the use of inference is consistently reflected in think-aloud protocols of subjects reading passage three:

Subject two: "sort of vaguely understand the way these words are used in medical jargon." Or, an inference which indicates some degree of understanding:" so they found something that will give them some prediction... enable doctors to predict who's going to survive"

Subject three: " because somehow for me it should have said 'time for relapse' and then when I reread it I realized of course that wouldn't be right."

Subject four: "..I presume this is talking about this gene that is somehow being used to cure this cancer.."

Subject five: "it's obviously something to do with cancer"

Subject six: "hmmm I guess that there are / different / types / of growth "

or, " but the positive thing is that ... I guess in studying the gene amplification they'll know how fast the tumor's going to grow "

Subject seven: " obviously, neuroblastoma has to do with a cancer of something"

Subject eight: " it sounds like something that's been / laid out / by the medical personnel but I don't know what.."

Subject nine: " it sounds like it's a new / way of / figuring out the person's prognosis for recovery"

Subject ten: "sounds like might have something to do with the blood."

While reading the difficult passage, each of these subjects indicates, through expressed lack of understanding, confusion, or vague questions, that she is experiencing some difficulty making adequate sense of the meaning of the text she is reading. Evidence of comprehension difficulty is present also in summaries, which were used primarily to focus readers' attention on understanding the passages, and in several comments subjects made throughout their readings of the difficult passage. It seems that it would be superfluous to add an analysis of summaries to emphasize this aspect of the

data.

Surface structure.

Another strategy for which differences are significant according to statistical results is Surface Structure representing a reaction to word or phrase. As is evident from figure one (p. 62), the graph for Surface Structure shows a slight increase from simple to average and a large increase from average to difficult. Surface Structure category comprises responses which indicate a specific reaction to a word or phrase, namely, being cued by a word or phrase, understanding a word or phrase, or misunderstanding a word or phrase. Surface Structure category responses seem to indicate an influence from the word level of text on the readers' formation of a conceptual framework., either in setting up a framework or in presenting some difficulties to understanding.

For example: Subject one, passage one: " 'women' , that gets me all excited because it probably has something to do with me."

Subject two, passage two: "I don't like the word reality"

Subject three, passage three: "that's a big word, I'd have to think about that one"

Subject four, passage two: " I didn't get this last example / man / his mum's.."

Subject five, passage three: " neuroblastome blastoma ok /// good grief all these big words"

Subject six, passage one: " home and parenting, oops , I don't think I understand that"

Subject seven, passage three: "and development of specific anto anta antogonist it's not antagonist could have important therapeutic implications I have absolutely no idea..."

Subject eight, passage two: " ..'remarkably literal' ok when I see literal I think straightforward."

Subject nine, passage three: "h.e.r. two new gene hmm // don't know what that means."

Subject ten, passage two: " toxic family situation, I imagine that means a bad one."

In each of these excerpts, subject's verbalization indicates their thinking about the meaning was influenced significantly or interfered with in some way by the word or phrase which was just read.

The absence of a significant difference in the occurrence of this category in readers' protocols between simple and average difficulty, and the flat shape of the graph, suggests there is no difference in the challenge presented by the text meaning at this word or phrase level for subjects while reading texts that differ from simple to average in difficulty. The high rate of use of Surface Structure category with very difficult text, however, suggests that, given very difficult text, these readers are baffled by the difficulty at the word and phrase level.

The problem presented by comprehension of the difficult passage does seem to lead to responses which may be indicators that problems exist for the readers. Whether difficulty of word and phrase in the difficult passage readings serves to create the problems of comprehension or a lack of prior knowledge leads to these problems with comprehension (see Divergent, below), however, is an open question. It is likely that the problems work both ways: unknown but significantly placed words and phrases lead readers to difficulties in comprehension and prior knowledge about the topic and genre of an excerpt (particularly the scientific one) leave readers incapable of establishing an adequate grasp of the article to make reasonable sense of it. Certainly the importance to overall comprehension of both vocabulary (Davis, 1942; Johnson & Pearson, 1984) and prior knowledge (Anderson & Pearson, 1984) is well known.

The Surface Structure response is directly tied to both vocabulary knowledge and prior knowledge. The increase in its frequency of use among readers of difficult expository text demonstrate that these underlying factors specifically constrain readers of difficult text. In fact, the extent to which the frequency of occurrence of this category in difficult text is represented by statements of lack of understanding suggests that this does not represent some mechanism for understanding difficult text, but rather is evidence that difficult text is not being understood.

Divergent.

A category which conceptually may be interesting to relate to Surface Structure is Divergent. This category may reflect the background knowledge the readers bring to the reading of each passage. As illustrated in the results section, statements which demonstrate the use of divergent category are statements which seem to jump from something in the text into a framework which is really of the subject's own. That is, Divergent strategic responses represent 'going off on a tangent' from the the ideas found in the text. For example,

Subject four, passage two, " but I think well it depends / people see so many different types of relationships"

Here the subject seems at first to be raising a question with the text but this leads to a statement which reaches for support of the reaction. The statement is coded as divergent since the subject's verbalization diverges from the sense of the text into statements which seem to reflect the subject's own context. This divergence is indicated by the subject no longer paying attention to words or ideas in the text after the first divergent statement.

Or Subject five, reading passage one: " it's rather difficult to find the right balance when you've got a report due or you've got the washing machine's over flowed or some kid needs to find something out of her room right now and you know you've got to finish that skirt before you go off to work tomorrow."

This statement indicates the subject's response to text which quickly leads from a seeming attempt to support the same argument to a reeling off of statements in support that really begin to develop the subject's own context gradually more and more removed from the original context provided by the text which constituted the jumping off point.

Also unlike the trend previously noted of at least four of the identified strategies, the frequency of use of Divergent category seems to decrease as difficulty of expository increases. The graph in Figure one (p. 66) shows that the occurrence of Divergent strategy decreases from simple to average and from average to difficult. Whether the relationship represented is actually a linearly inverse relationship cannot fairly be addressed in the present study since the relationship among difficulty levels of passages is not clearly enough defined for such a mathematical comparison.

The relationship does have logical support: the verbalization typical of divergent responses seem to suggest the subject has a substantial knowledge and understanding within her own experience or learning which relates to and supports what she is responding to in text. It is certainly reasonable to expect a decrease of verbalization related to prior knowledge as the difficulty of expository text increases. With increased difficulty will come the likelihood that the amount of prior knowledge available for the subject to bring to the task of comprehension will be less. Gradually the reader's attention is led to focus

on more superficial aspects of text meaning and structure and the deeper levels of understanding that we usually associate with comprehension disappear.

Surface Response.

Surface Response category consists of references to the subject's own reading behavior in the form of either a reflection of mechanical reading functioning or directional reference to the physical text being read. The category is represented by readers' references to mechanical aspects of their own reading behavior. The difference in the frequency of occurrence of this strategy is significant across the difference between average and difficult according to statistical results. The graph demonstrates that the difference between simple and average is not great. It seems that as difficulty approaches incomprehensibility one area of subjects' responses that increases significantly is represented by some reaction to the subject's own reading behavior.

The meaning of Surface Response category is illustrated in the following examples:

Subject one, passage three: "I'm going to have to stop and see if I can sound it out."

Subject two, passage two: " I'm rereading this first sentence."

Subject four, passage two: " I need to read the sentence over again"

Subject five, passage three : " I've just had to read those statistics again"

Subject six, passage one: " I got so caught up in reading one sentence at a

time I think I will have to just take a quick peek"

Subject seven, passage three : " ... rat neu oncogene ... this should have been on decoding skills"

Subject eight, passage two : "As I read that I'm reading it silently"

Subject nine, passage one: " I'm not reflecting on this article as much"

Subject ten, passage three: " I'm trying to figure out what this means".

Each of these responses to the passage indicates some reference to the subject's actual mechanical use of reading. Surface Response really represents a strategy that is the reverse side of the same coin as Surface Structure which is a response, or one might in some cases say a reaction, to particular words and phrases that occur in the text. This is opposed to what might be a response to the ideas underlying the passage, as the Problem Solving strategy must signify. In a sense the Surface Response category really reflects a surface aspect of the reader's response. Although this category is not based in or driven so directly by the text, it does seem to represent a kind of surfacing of the process of reading to the extent that mechanical aspects of the experience, which are not normally evident to one's consciousness, are suddenly thrust into readers' awarenesses. Readers' attention seems to shift to these mechanical aspects and the reading process begins to break down when readers are confronted with text that is sufficiently difficult to be incomprehensible. .

Both the Surface Structure and Surface Response categories, it seems,

hardly occur in the readings of simple or average difficulty. The frequency of their occurrence substantially increases in the reading of the difficult passage. It seems that the occurrence of these categories may be indicative of the subject's struggle with comprehension: either reaching out for some structure with which to frame the passage (Surface Structure) or being reduced to distraction by the breakdown of one's own reading (as in Surface Response).

The patterns of variation in the occurrences of these two categories suggests, as predicted, that an increase in difficulty alone does not lead to serious variation in the use of this category. It seems to be required that text reach a difficulty that is close to incomprehensibility before there is significantly more evidence of either of these two categories This suggests their occurrence in readers' protocols is indicative of an inability to establish even a superficial grasp of the difficult text they are in the process of reading.

Metastatement.

Metastatements indicate a category of comment or opinion about the passage, as illustrated in the results section. Interestingly, the graph of change for this category looks similar to that for Surface Structure and Surface Response, although the differences in frequency of use of the latter two reach significance, whereas differences in frequency of use of Metastatements do not. Although the amount of change in frequency of use is virtually identical (as indicated by the differences recorded in Table one (p. 65), the numerical

differences for Surface structure are as follows,

Simple to Average: 1.7; Average to Difficult: 7.3

whereas the numerical differences in frequency of use for Metastatements are as follows,

Simple to Average: 1.4; Average to Difficult: 7.4

It is apparent that the change in frequency of occurrence for Metastatement and Surface structure categories are virtually identical, yet, only Surface Structure differences reach significance. The reason for this discrepancy is that near zero frequency produced less variability in Surface Structure category compared to Metastatement category.

For Surface Structure the frequency for the lowest (simple) frequency is near zero (0..5), whereas the frequency for the lowest in Metastatement use (14.9) is considerably higher. In a statistical sense the graph which has one end very near zero indicates this data will exhibit a 'floor' effect on statistical calculations: the extent of variability among factors (a critical element in the calculation of the significance of underlying differences) is reduced to near zero. Under these conditions the difference in mean frequency from this 'floor' to a higher more variable mean is a clear difference. The identical distance between means, however, where both means represent a considerable degree of variability among factors (as in the data for Metastatement) represents a much less clear difference and for that reason does not reach statistical significance.

It is evident, in any case, because the shape of the graph suggests some considerable variation, that the differences in frequency of use of Metastatement category are important and need to be interpreted. As indicated in the results section, the Metastatement category consists of self-statements, or some reference to the self functioning, beliefs, and judgments of the author or content. As difficulty of expository text increases the frequency of use of this category increases. There is little change from simple to average difficulty, but there is a noticeable increase from average to difficult. This apparent difference could not represent any evidence of non-linearity unless a clear distinction among difficulty levels of passages could be demonstrated. This variation in the use of metastatements combined with the lowest frequency being of a considerable size suggests that there may be a base level for the occurrence of this category certainly for the readers and passages in this experiment. This base level of metastatements of opinion and belief does not seem to vary as readers become more deeply involved with text. For example, as text difficulty increases from simple to average, the occurrence of Problem Solving statements increases considerably, yet Metastatement occurrence does not change appreciably.The occurrence of Metastatement category does increase, however, as expository text approaches difficulty that is really almost incomprehensible. Statements from readings of passage three illustrate this:

Subject one, passage three: " I don't know any of it but it's medical

obviously."

Subject three, passage three: " it's a very medical kind of language."

Subject four, passage three:" I'm not getting any of this."

Subject five, passage three: " hmmm I don't know enough biology to be able to understand this very well."

Subject six, passage three:" It has very little meaning for me I have no medical background."

These subjects are expressing metastatements indicating that they lack some background in their knowledge or that the text has some qualities that lead to incomprehensibility. Difficult text seems to encourage greater occurrence of such statements.

Repetition.

Repetition category differences indicate a relatively flat curve from simple to average to difficult, suggesting there is little change in the occurrence of this category as passage difficulty increases. This in itself is interesting, particularly as several subjects mentioned while reading the difficult passage that they felt like reading aloud to try to understand it. These statements would be coded Repetition, yet there was not a great increase in this category as text difficulty increased. One of the reasons for this seeming discrepancy could be that as subjects did try rereading, the portions of text were long which were coded one repetition because they chose to repeat them. They would seem to realize by the

end of the repetition that comprehension was no closer. Subjects seemed to quickly realize that the text was more difficult than what mere repetition might make comprehensible.

If we consider this result in the context of the other categories of statements, it is evident that passage difficulty does lead subjects to verbalize statements in different categories, but not to repeat the text more often.

The categories that do show a substantially higher rate of occurrence are represented by statements such as judgements, opinions, questions, predictions-about, self-references and reactions to words and phrases. The incomprehensibility of the difficult text may lead subjects away from a strategy of repeating the text to understand it better. This strategy might seem to work when reading a poem or writing with extremely complex sentence structure, but the difficult text in this experiment is sufficiently incomprehensible to subjects that they may determine fairly quickly that repeating will lead them no closer to comprehension. They are left instead to set the text farther apart from themselves with statements such as judgements and opinions, or to side step the task of comprehension by commenting on their own performance or the surface level of text.

One thing that is provided by the apparent absence of change of use in this category is evidence that not all strategies indicate an increase with difficult text. One might expect this since there is an increase in verbalization for most

subjects with difficult text, yet it is not to be found in Repetition.

General Conclusions

Six categories of response were identified in the protocol data of ten expert readers reading three expository passages varying in difficulty through simple, average, and difficult. When compared to the two strategies found by Afflerbach (1987) to vary with difficulty of text and 'progressive-refinement', suggested by Collins, Brown, and Larkin as indicative of comprehension of difficult text, only Problem Solving category emerged as similar to automatic hypothesis as well as progressive-refinement inferences (which are analogous to Afflerbach's Topic and Comment- whose changes with unfamiliar text represent the gradual development of main idea). However, the frequency of use of problem-solving category is not as predicted. Change in use of this category increases as passage difficulty increases.

In a limited sense, the hypotheses in this study are supported by the data.

There is only one significantly different category (problem-solving) between readings of simple and average difficulty of expository text. The bulk of the strategies identified show no significant change in frequency of use from simple to average difficulty. And three strategies show significant increase from average to difficult difficulty, as predicted. It is evident that the strategies of Meta-statement, Surface Structure and Surface Response all show no significant change in frequency of use from simple to average difficulty; and

Problem-Solving, Surface Structure and Surface Response do show significant change in frequency of use from average to difficult difficulty of expository prose. The anomolies of interest are the flat curve of repetition category and the decrease of frequency of use of divergent category.

In general, the picture of the reading process which seems to emerge out of these results is one of variability and interaction. The changes and shifts which occur in readers' use of strategies seem to represent an engagement with text which seems to increase as readers grapple with increasingly difficult text. This interpretation is in agreement with the findings of Collins, Brown, and Larkin (1980).

Category use breaks down, however, and becomes representative more of struggle than resolution as passage difficulty exceeds comprehensibility. This is evident in the increase in the use of Problem-Solving behavior from average to difficult passages and in this case demonstrating a different kind of increase than between simple and average difficulty. Although this increase in Problem-Solving seems to follow an increase in difficulty, the extent of difficulty seems to lead to problem-solving statements, which in general do not lead to resolution.

There are other factors, as one might expect, that seem to be influencing reader category use and comprehension as well. Surface structure, representative of reactions to words and phrases, increases considerably with

difficulty and seems to lead to considerable frustration on the part of readers. Readers often mentioned a category not within their range in this study: referral to a reference text. Whether this strategy actually would be useful to expert readers lacking in technical knowledge and experience is a question for future research projects. It is evident from this study, however, that the Surface Structure category use increased with difficulty and seemed to represent at its highest frequency of use a breakdown in readers' understanding. What the use of this strategy means in terms of the reader's understanding of difficult text is a question for future research.

Another category whose occurrence increased with difficulty was Surface Response. Research into cognitive monitoring (Baker & Brown, 1984) suggests that readers become aware of their own reading as text becomes more difficult. It would be expected then that the occurrence of this category should increase with difficulty. Whether this increase is actually a help or a hinderance, however, is grist for future research mills. The present study did not employ a procedure which would allow for a more precise interpretation of the relative merit of any category of response in terms of its value to the reader.

It is possible that the increase in Surface Response category use represents attempts by readers to provide reasonable excuses for reading difficulties. In that sense such responses would not actually facilitate a reader's understanding of text but might demonstrate that the reader is struggling with a portion of text

and chooses to comment on her own reading, rather than act as if she expects to comprehend the text.

It is reasonable to expect that readers follow certain patterns of behavior and that the strategies identified in this study may interact together in ways that facilitate the reader's understanding of text. What patterns of interaction these might be, however, remain for future research to discover.

It is at least evident that there is an interaction of strategies which changes to deal with more difficult text. In general there is an increase with passage difficulty of the use of strategies which serve to uncover the meaning of text (Problem-Solving) and which represent the readers' struggle with difficult text (Surface Structure, Surface Response). Coincidentally, there is a decrease with passage difficulty in the occurrence of a category which represents the wealth of background knowledge readers bring to print (Divergent).

The present research has served as much to illuminate the ways in which responses and strategies are used by expert readers as it has to raise questions about the interaction between strategy use and comprehension, differences in strategy use, and differences between individual readers. As the smaller pieces and elements of the process of reading become clear, our characterization of readers' processing itself becomes more complex.

Implications

For research.

It is important that future research discover not only the relative importance of the categories of responses and strategies as they are used by readers to understand expository text, but also how individual differences are expressed in the variable use of responses and strategies by readers. The present work suggests that it will be valuable to continue research clarifying reading strategies and responses and how they serve a reader's comprehension. An implicit caution arises from this study to exercise care in our choices of experimental passages and our interpretations of changes in reading behavior that are related to the passages we have our subjects use.

It is of interest that the statements subjects verbalize while reading seem to comprise many of a more personal nature than a theory suggesting comprehension as the formulation of understanding from text would permit. These data seem to raise questions about a schema-theoretic formulation of reading. The transaction which represents the process of reading may be a much more immediate process than schema theories easily accommodate. Research into the process of priming and mental models may help to clarify this issue. The highly subjective nature of exploratory research suggests that it will be important to combine results and categorizations of readers' responses in a search for similarities among underlying processes before a

narrower focus is taken to extend research such as the present study.

For practice.

Research such as the present study can help add to a theoretical framework from which teaching practice can draw in the design of relevant educational experiences in reading strategies. Readers of all ages will benefit from instruction in the use of strategies for understanding expository text when that guidance flows from theoretical knowledge gained through exploratory studies of the process itself.

Useful classroom procedures can sometimes arise unexpectedly from research. In the current study, the subjects' comments while providing think-aloud data suggested that they found the process itself a valuable source of learning as they read each passage. Following the think-aloud sessions several subjects commented that the process of verbalizing their thoughts out loud actually provided a learning experience both in terms of reflecting on the passage meaning and enabling them to understand their own thinking processes more clearly. Evidently, there is something to be gained in the process itself that can lead to valuable practice as well as research.

Limitations

This study represents an investigation into the cognitive processes of expert readers. It is not without potential threats to validity and other methodological dangers.

As mentioned previously, the subjective influences in determinations of categories leave a lot of room to speculation. This is another reason it would be especially valuable to bring together into the same categorical system several disparate sets of response categories.

A textual analysis of the passages used might have allowed for more specific determinations of the differences between passage difficulties at least in terms of some recognizable scale.

Although process-tracing methods may serve to provide more depth and substance to protocol data, inferences drawn from verbal reports must take alternative possibilities into account. Verbalizations may not represent what is heeded in short term memory under normal circumstances. The value and meaning of reports must stand on their analysis and the careful transcription of protocols.

The requirements for 'expert reader' status in this study assumed that the skills and strategies studied represent reading behavior that is normally required for successful university performance. To ensure that reading ability did not become a confounding variable, a standardized reading test was used to determine how the reading abilities of subjects compared. Although this provided more information about the readers, reading test performance does not necessarily relate to readers' uses of particular strategies or categories of response either, and it is these strategies and categories of response which are

the focus of attention in this study.

Transcriptions from verbal data can never be complete, although they can still provide a valuable source of data. There are intonations and motions, pauses and innuendoes which may not be noticed or not transcribed. It is believed, however, that the closest approximation to what actually occurred provided useful and valuable information. Any use of cuing may introduce the risk that data is created or invented by subjects to meet the experimenter's demands. Although random cuing may introduce such risks, it is believed a greater amount of information was available in protocols as a result of some minimal degree of cuing. It was felt the gain from random cues, then, was worth the risk.

One of the factors which influenced passage choice was the need that they represent text with a changing overall idea. For this reason relatively long passage excerpts were used. They may not be representative of usual expository text, but they do provide a useful window to explore the reading of the individuals in this study.

Passages were rather loosely defined in terms of difficulty. This leads to difficulties with interpretation.

The use of the null hypothesis, whether rejected or not by the results of statistical testing, is perhaps not as meaningful as a directional hypothesis might have been. Whether a difference is indicated or not, it is difficult to

determine what this actually means in the context of the processes under study.

The reliability check may be biased as the statements were chosen to represent a selection of all types of categories of responses and strategies.

A small number of subjects was studied. The intention of this study was to investigate in depth the experience of readers while they were reading. It would not have been possible to implement the level of analysis proposed with a large number of subjects. As expected this work suggests as many questions as it answers. Other hypotheses suggested may be testable with various methodologies.

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Appendix A

Reading Passages

Passage One: simple, (451 words.)

Burning the candle at both ends means women just aren't getting enough sleep. Dr. Bennett says women carry a sleep debt they're not even aware of - while they don't feel terrible, they'd feel better with more. Although sleep requirements vary between individuals, for most women that means at least eight hours. Some studies have shown that women who got more than eight hours of sleep were less tired and anxious than those who got fewer than seven hours of sleep a night.

Another major source of fatigue is the "superwoman" syndrome - the woman who can do it all- managing a successful career, a happy marriage, wonderful children and the perfect home. By 1980 51 per cent of American women were holding full-time jobs. Studies show that after a working woman leaves her job for the day, she still faces an average of from four to eight hours of housework. By contrast, her husband puts in only 1.6 hours a day doing household chores. But the high standards women set for themselves and the expectations of their family, their bosses and society mean conflicting roles and demands that run smack up against a woman's physical and emotional limits. Debbie Bruckner, a social worker at Calgary's Women's Therapy and Research Center, says

that for many of the women she sees this model is unrealistic. "Unfortunately, a woman's self-esteem gets tied into doing it all. The result is that women run and run and run and never get there. They end up dissatisfied and exhausted."

So it's not surprising that fatigue is more common in women that in men, perhaps by as great as a two to one ratio. Another Calgary psychologist, Camillia Clark, says many women feel the stress of conflict between home and parenting much more than men, perhaps because women still take primary responsibility for the nurturing role and many feel guilty about time they are spending away from their families. The nurturing role can create other problems too. Clark laments, "Women are so busy looking after others, they often do a poor job taking care of themselves.".

Difficult as it may be, women have to learn to say no. Mary Armstrong is a Toronto psychotherapist who thrives on a full life of marriage, child and career. She says women have to learn when to recognize that they are getting over-loaded. She advises, "Instead of could, should, ought, women have to be able to say, "This is what I need to survive." What most women need: time for themselves and finding the right balance. Says Armstrong, one woman who has found that balance, " The trick is to let each part of your life enrich rather than drain you.

Passage Two: average difficulty (439 words.)

All of us have a tendency to get into repetitive patterns of relationships that are motivated by the persistence of wishes in unconscious fantasy form and derived from the way earlier needs were satisfied. Sometimes, in marriage, the repetitive aspect of sequences of partnership is remarkably literal, as when a woman whose childhood was damaged by her father's alcoholism finds hersilf marrying a man who turns out to be an alcoholic, divorces him and then gets herself into the same situation once more. Or, a man whose childhood was dominated by his mother's heart disease may marry a woman with congenital heart trouble.

This restaging of a toxic family situation, in its entirety, seems to defy rational explanation. But far eerier are the replications of problems by couples who have no knowledge of a particular problem's previous existence in their families. I encountered a replication of this sort in a set of interviews that I had with a couple in their fifties (he was fifty-five at the time , and his wife was fifty). These partners nad begun their marriage, now in its thirty-second year, by running off and eloping. It was not until many years later that the husband learned that his own parents had done the same thing.

To some degree, when we become adults, most of us have not put

away our childish things. In the very process of choosing our mates, and of being chosen - and then, in elaborating upon our separate, past lives in the life we create together - we are deeply influenced by the patterns for being that we observed and learned about very early in life, and that live on inside our heads. The possibility that there may be other options, other systems of being in an intimate relationship, often doesn't occur to us, because we don't realize that we are operating from within a system , one that was internalized in our original families. What has been, and what we've known, seems to be "the way of the world"; it is reality itself.

Perhaps this is why the way it was feels, to so many people, like the way it has to be. Perhaps this is why one stumbles across so many coincidences in the lives of families. And certainly , when encountering them, one wonders, is it coincidental that a man whose mother was hypochondriacal and depressed married a woman who was warm and outgoing, and then, a decade later, finds himself the disgruntled husband of a seriously depressed and somewhat suicidal wife ? Is that bad luck, or is it the present bending to the will of the past ?

Passage Three: difficult (473 words.)

Neuroblastoma is a relatively rare disease with an incidence of one per 125, 000 children. Carcinoma of the breast, however, is a common malignancy affecting one of every 13 women in the United States. There are 119, 000 new cases per year, and approximately 40,000 women will die of the disease in 1986 (38). Current treatment decisions for individual patients are frequently based on specific prognostic parameters. The major prognostic factors for breast cancer include presence or absence of tumor in the axillary nodes, size of the primary tumor, and presence or absence of hormonal receptors (29).

The current study indicates that amplification of the HER-2neu gene is a significant predictor of both overall survival and time to relapse in node-positive patients with breast cancer. Amplification of the gene retains its prognostic significance in multivariate analysis, even when adjustments are made for other known prognostic factors. Moreover, amplification of HER-2neu has greater prognostic value than most currently used prognostic factors, including progesterone and estrogen receptors, and is equivalent to and independent of the best known prognosticator - number of positive lymph nodes. Finally, the degree of HER-2neu amplification appears to have an effect on survival, with greater copy number being associated with a worse prognosis. A similar

phenomenon has been observed for N-myc gene amplification in human neuroblastoma (32).

The potential role of HER-2neu in the pathogenesis of breast cancer is unknown. Like N-myc, the correlation of HER-2neu amplification with disease progression indicates it may be an important gene in the disease process. the role of other cell receptors in the biology of breast cancer is well established (29, 39, 40). It is easy to speculate that a gene encoding a putative growth factor receptor, when expressed in inappropriate amounts, may give a growth advantage to the cells expressing it. Alternatively, alteration in the gene product itself may lead to a critical change in the receptor protein. A single point mutation in the transmembrane domain of the protein encoded by the rat neu oncogene appears to be all that is necessary for the gene to gain transforming ability (41). Whether this or a similar alteration is found in the amplified HER-2neu gene in human breast cancer will require sequence analysis of the homologous region in the amplified human gene.

The initial survey from the current study showed that 15% of breast cancer patients with stage I disease (node-negative) have HER-2neu amplification. Unfortunately, no long-term follow-up data were available for these patients. This stage I setting may be an additional group in which HER-2neu measurements will have an impact in predicting

biologic behavior of the tumor, and as a result, in design of treatment strategy. Finally, if the HER-2neu gene product functions as a growth factor receptor that plays a role in the pathogenesis of breast cancer, identification of its ligand and development of specific antogonists could have important therapeutic implications.

Appendix B

Reliability Estimate

In order to estimate the reliability of the choices for categories of responses and strategies a group of 18 undergraduates were asked to categorize statements according to category. Each judge categorized statements on one of three sets of representative varieties of statements selected from protocols of all subjects reading all passages. Subjects were first provided with definitions and illustrative examples for each of the six identified categories of response or strategy. Each of these definitions and examples was discussed with the group of judges When judges felt comfortable with the definitions, each completed one of three sets of eighteen strategies, coding each sample verbalization in one of the six categories: Repetition, Metastatement, Problem Solving, Surface Response, Surface Structure, or Divergent.

The results of these categorizations were tallied and it was found that the subjects' categorizations were identical to the experimental coding 84.1 % of the time.

In addition, this coding of strategies leaves less than 3% of protocol data unclassified.

Examples

Below are definitions with illustrations of six categories of response

identified in think-aloud protocols of readers reading three different passages. Please read the following to understand what is represented by each strategy. You will use these strategies to categorize a set of statements to follow.

1.Repetition: representing a verbalization which is virtually identical word for word with text.

" women just aren't getting enough sleep" which is a verbatim repetition and " they'd feel better with more (sleep),"while reading, "they'd feel better with more."

Although a word is added to complete the sentence, this statement is coded "repetition" since the meaning of the statement is essentially identical to the original

" that it's coincidental in a man whose mother was a hypochondriac and depressed married a woman who was warm and outgoing and then a decade later finds himself the disgruntled husband of a seriously depressed and somewhat suicidal wife," while reading words that are the same except for "is it coincidental that a man whose mother...suicidal wife."

This rewording is also coded as a repetition since the rewording from "is it ...that" to "that it's..", as explained in the results section, really represented a case of the subject saying one thing and meaning another.

As is evident in surrounding text, the subject's meaning does not essentially alter the sense of the original meaning.

" neuroblastoma is a relatively rare disease with an incidence of such and such carcinoma of the breast however," during a reading of " Neuroblastoma is a relatively rare disease with an incidence of one per 125,000 children. Carcinoma of the breast, however,..."

Such a rewording is coded as 'repetition' since it basically repeats the explicit meaning of the original.

2. Metastatement: similar to the concept described in Kintsch and van Dijk (1978) as comments, opinions, or attitudes.

"carcinoma of the breast immediately brings cancer an anchoring point for me." Subject here is commenting on her own thought process.

"oh, I like this one," stating a preference, or opinion.

"this really upsets me," demonstrating a reaction indicating her attitude.

"that's rubbish," stating her opinion.

"I found it hard to begin reading," commenting on her own reading behavior.

3. Problem Solving: involving questions (of text or author), predictions, and inferences , for example,

Seeming to doubt the passage on the basis of lack of personal

experience:

"I'm not sure if I've come across the patterns mentioned previously about eloping childen having had eloping parents"

Reaching into the future:

" we'll see if that's true"

Inferring:

"it's saying that decisions for what we do to patients are based on certain yardsticks," from the text: " Current treatment decisions for individual patients are frequently based on specific prognostic parameters."

4. Surface Response: referring to some surface aspect of subject's reading, for example,

"I'm doing one sentence at a time"

OR:

"I get to this sentence.."

OR:

"this is back to the first page"

5. SURFACE STRUCTURE: indicating the subject being either cued or confused by a word or phrase, through its understanding, misunderstanding or lack of understanding. For example,

" ...women feel the stress of conflict between home and parenting

between home and parenting oops I don't think I understand that"

This subject is confused by the phrase 'home and parenting' because she believes these are the same and states later she would have expected 'home and work' to be distinguished instead.

OR:

"'Repetitive patterns' is getting my back up already" demonstrating being cued by a phrase.

OR:

"'ligand', I don't know what that means," indicating lack of understanding of a word.

6. DIVERGENT: verbalization in subject's own frame of reference suggested by, but not necessarily directly related to text. For example,

"It frustrates me sometimes when people give me the impression that I should be embarrassed that I make sure I sleep eight hours."

Although the topic of subject's statement has been suggested by the passage, it is really a statement that is more specifically related to a context framed by the subject than the passage.

OR:

" I don't know whether it's a carry on from families of alcoholism, certainly from all the studies I've read that's the case that a woman will often marry an alcoholic because her father was one and that pattern that

sort of rescuing pattern tends to be programmed into her."

Again the topic is suggested by what the subject is reading, but subject decides to go on at length projecting from her own context. Her statements do not really clarify or extend that portion of the passage except to portray more explicitly the prior knowledge subject seems to use to understand what she has read.

OR:

"I think about my friend who had cancer but I'm not going into that."

Subject indicates a personal experience whose memory is activated by text.

OR:

" I've never come across that before"

Subject in this case is defending an inability to comprehend and essentially citing lack of experience with the concept in text (presence or absence of hormonal receptors).

STRATEGY CATEGORIES:

REPETITION

METASTATEMENT

PROBLEM SOLVING

SURFACE STRUCTURE

SURFACE RESPONSE

DIVERGENT

Each of these definitions and examples were discussed with the group of judges. When subjects felt comfortable with the definitions each completed one of three sets of eighteen strategies, as follows:

Categorization Forms for Judges

Name:---------- SET A

Directions: For each of the following think-alouds (TA) with associated text, PLACE THE LETTER OF THE CATEGORY INDICATED: YOU HAVE SIX CHOICES: R (REPETITION), M (METASTATEMENT), P (PROBLEM-SOLVING), SR (Surface Response), SS (SURFACE STRUCTURE), D (DIVERGENT).

1.--- Think-aloud: "burning the candle at both ends"

TEXT: "Burning the candle at both ends..."

2.--- T-A: " ..what is taking on enough and what is too much?.."."

TEXT:" ..women have to learn to say no... to recognize that they are getting overloaded.."

3.--- TA: "'between home and parenting' oops I don't think I understand that"

TEXT: "..women feel the stress of conflict between home and parenting.."

4. --- TA: "ok that's a good old saying.."

TEXT: "Burning the candle at both ends"

5. --- TA: "now I'm thinking about what I just said and not paying attention to the reading"

TEXT: "

6. --- TA: " when I had young children you know the feeling was that the woman did it all and the man made the money and went golfing and did his thing.."""

TEXT: " women still take primary responsibility for the murturing role"

7. --- TA: "you repeat things in relationships"

TEXT: " All of us have a tendency to get into repetitive patterns of relationships"

8. --- TA: "sorry I'll have to read that again"

TEXT: " we are deeply influenced by the patterns for being that we observed and learned about"

9. --- TA: " The potential role of this gene is unknown.."

TEXT: "The potential role of HER-2neu in the pathogenisis of breast cancer is unknown"

10. --- TA: "..what I call broken records.."

TEXT: " repetitive patterns.."

11. ---TA: " ..and immediately i realize that he's not necessarily talking about healthy patterns.."

TEXT: " This restaging of a toxic family situation.."

12. ---TA: "..perhaps this is why the way it is (repeats this 3 times)... ah... should be a comma there"

TEXT: " Perhaps this is why the way it was feels, to so many people, like the way it ought to be.."

13. ---TA: "I don't know whether it's a carry on from families of

alcoholism, certainly from all the studies I've read.."

TEXT: " ..when a woman whose childnood was damaged by her father's alcoholism finds herself marrying a man who turns out to be an alcoholic.."

14. ---TA: " ..because it probably has something to do with me.."

TEXT: "..women.."

15. ---TA: "..oh, it's going to be about carcinoma of the breast.."

TEXT: " carcinoma of the breast, however..."

16. --- TA: " I'm going to have to stop and see if I can sound it out"

TEXT:" neuroblastoma.."

17. --- TA: " I'm not quite sure what amplification of it means.."

TEXT: " ..the amplification of the gene.."

18. ---TA: "..I've done it and I'm beginning to resent it and wish I could start again.."

TEXT: " ..the high standards women set for themselves and the expectations of their family.."

ANSWER KEY FOR SET A: R,P,SS,M,SR,D,R,SR,R,D,P,SS,D,M,P,SR,SS,D.

Name:---------- SET B

Directions: For each of the following think-alouds (TA) with associated text, PLACE THE LETTER OF THE CATEGORY INDICATED: YOU HAVE SIX CHOICES: R (REPETITION), M (METASTATEMENT), P (PROBLEM-SOLVING), SR (Surface Response), SS (SURFACE STRUCTURE), D (DIVERGENT).

1.--- Think-aloud: " who got more than eight hours sleep were less tired and anxious than those who got fewer.."
TEXT: " women who got more than eight hours of sleep were less tired and anxious than those who got fewer.."

2. --- TA: "..they're doing too many things.."
TEXT: "burning the candle at both ends.."

3. --- TA: " 'replications', I wouldn't put that word.."
TEXT: "..replications of problems by a couple.."

4. --- TA: "..it's inaccurate in his description of what it means.."

TEXT: " ..burning the candle at both ends means .."

5. --- TA: " trying to think back to what was at the beginning of this second section."

6. --- TA: " I don't get enough sleep. I kind of go along on four hours sleep for a period of about three weeks and then I have to get a good night's sleep.."

TEXT: "..they'd feel better with more.."

7. --- TA:" and didn't know until years later that the husband's own parents had done the same thing.."

TEXT: "It was not until many years later that the husband learned that his own parents had done the same thing. "

8. --- TA:" ..sorry I'll have to .. it throws me when something else happens.."

9. --- TA: " relatively rare disease"

TEXT: " ..is a relatively rare disease.."

10. --- TA:" that's no big deal"

TEXT: " his own parents had done the same thing."

11. --- TA: " he's going to explain how really it isn't so rational after all"

TEXT: " seems to defy rational explanation"

12. --- TA: " amplification of the HER..I have no idea what that means."

TEXT: " amplification of the HER-2neu gene"

16. --- TA: " maybe go back over this sentence here.."

17. --- TA: " I don't understand what a copy number is"

TEXT: " ..with greater copy number being associated with a worse prognosis.."

18. --- TA: "I saw a program recently about group memory.. how a the parents of rats.."

TEXT: " ..replications of problems by couples.."

ANSWER KEY FOR SET B:

R,M,SR,SS,SR,D,R,SS,R,M,P,SS,M,M,P,SS,SS,D.

Name:---------- SET C

Directions: For each of the following think-alouds (TA) with associated text, PLACE THE LETTER OF THE CATEGORY INDICATED: YOU HAVE SIX CHOICES: R (REPETITION), M (METASTATEMENT), P (PROBLEM-SOLVING), SR (Surface Response), SS (Surface structure), D (DIVERGENT).

1. --- TA: "..fatigue is much more common in women than men.."

TEXT: " fatigue is more common in women than in men.."

2. --- TA: " what's the conflict between home and parenting ?"

TEXT: " ..the stress of conflict between home and parenting.."

3. --- TA: " when I see 'literal' I think 'straightforward or easily seen'"

TEXT: " ..is remarkably literal.."

4. --- TA: " I think a husband and wife have to work that out together.."

TEXT: " ..by contrast, the husband only puts in 1.6 hours of housework "

5. --- TA: " I got so caught up in reading a sentence at a time"

6. --- TA: " my religious upbringing was pretty anglican and there's a prayer that we say all the time at school about putting away childish things.."

TEXT: " most of us have not put away our childish things.."

7. --- TA: " ..one that was internalized in our original families.."

TEXT: " one that was internalized in our original families."

8. --- TA: "..ok I've gone back to reread it. "

9. --- TA: "..the major factors for breast cancer are the presence or absence of a tumor in the axillary nodes..."
TEXT: " The major prognostic factors for breast cancer include presence or absence of tumor in the axillary nodes.."

10. --- TA: " I don't like talking about relationships at this moment.."
TEXT:" ..patterns of relationships.."

11. --- TA: "..gonna have to read further to find out what that means.."
TEXT: ".. wishes derived from the way earlier needs were satisfied.."

12. --- TA: "..patterns of relationships..I wonder what that means"
TEXT: "..patterns of relationships.."

13. --- TA: "I flash back to a week course I did last summer in sort of family therapy"
TEXT: "..repetitive patterns of relationships.."

14. --- TA: "..ok it now makes sense to me.."

15. --- TA: " apparently it's significant so it's important. "
TEXT: " ..is a significant predictor of .."

16. --- TA: "I had to read that last sentence over a couple of times.."

17. --- TA: "ok I don't know what 'multivariate analysis' is "

18. --- TA: "..and thinking that's one of the things I was going to do this summer that I haven't done yet which has got me slightly off task.."

ANSWER KEY FOR SET C:
R,P,SS,P,SR,D,R,SR,R,M,P,SS,D,M,SS,SR,SS,D.

These results were tallied and it was found that the subjects' categorizations were identical to the experimental coding 84.1 % of the time.

In addition, this coding of strategies leaves less than 3% of protocol

data unaccounted for.

These results suggest that the category coding used has sufficient validity to provide a meaningful representation of experimental subjects' reading behavior during this experiment.