Comprehension Processing in Main Idea Construction: Teachers as Expert Readers

by

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ABSTRACT

If teachers of reading are to provide comprehension strategies to enhance both student understanding and memory for text, they may require a more explicit, more definitive model illustrating the comprehension processing employed in main idea construction. It is hypothesized that teachers who understand their own comprehension processing are more likely to provide better main idea construction instruction. Just how teachers, as expert readers, construct main ideas while reading expository test is not known.

The purpose of this study was to: (a) describe the comprehension strategies that teachers as expert readers use in constructing main ideas from expository text and (b) build upon and confirm the work of Peter Afflerbach. Using both on line think-aloud reports and reflective reports, the current study reexamined a series of categories developed in a pilot study (Wood, 1988) ; reevaluated these categories in the light of the performance of a new sample of expert readers; and compared the resultant categories with those identified by Afflerbach (1985). The aim of this study, therefore, was to increase theoretical

understanding of expository text comprehension processing as evidenced by expert readers' construction of main ideas.

Two categories of text processing strategies evolved. These were main idea construction processes and monitoring and regulation processes. Five construction processes were identified. These were the use of: structural cues, summarization, examples and analogies, weighing importance, and determining word meaning. Seven monitoring processes were identified. These included: looking back in the text when a reader related problem was detected, looking back in the text when a text related problem was detected, monitoring the nature of the breakdown, monitoring the knowledge match between reader and text, monitoring the level of reader attention, monitoring reader purpose, and monitoring affect.

When serious text processing difficulties were encountered readers appeared to engage in a problem solving process that involved five actions. These were: detection of a problem, specifying the nature of the problem, selection of a fix-up strategy, application of the strategy, and evaluation of the strategy's effectiveness.

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Chapter I

NATURE OF THE STUDY

Research into the comprehenesion processing of good and poor readers has revealed metacognitive differences in reading behaviors (Flavell, 1976). Students who monitor what and how they know are seen to be more successful at finding the gist of text than are those who do not read with self-awareness (Brown, 1985; Garner, 1987). Monitoring requires the reader to take an active role in the process of unlocking meaning from the text. (Winograd, 1984). The effective reader is described as a strategic learner (Cook, 1989). Much work has been done in identifying and describing the comprehension processes of effective readers (Afflerbach, 1985; Armbruster, Anderson, & Ostertag, 1987; Brown, 1985; Brown and Day, 1983; van Dijk and Kintsch, 1983).

If teachers of reading are to provide comprehension strategies to enhance both student understanding and memory for text, they require a more explicit, more definitive model illustrating the comprehension processing employed in main idea construction. It is hypothesized that teachers who understand their own comprehension processing are more likely to provide better main idea construction instruction. The instructional use of an overly complex model or vague model of main idea construction may resullt in teaching skills in isolation when

research (Duffy, Rhoeler, Sivan, Rackcliffe, Book, Meloth, Vavrus, Weselman, Putnam, & Bassiri, 1987) suggests comprehension instruction is most effective when teachers model their own though processes. Just how teachers, as expert readers, construct main ideas while reading expository test in not known.

A number of authorities including van Dijk and Kintsch (1983), Brown and Day (1983), and Garner (1982) describe the strategies expert readers use during text processing. Subjects in their studies have not been public school teachers. Van Dijk and Kintsch (1983) suggest readers possess schemata for the structure of text. These schemata include knowledge of specialized text structures such as the organizational frameworks represented by narrratives, arguments, and reports. Readers also possess schema for text content. To aid memory, they process content using a series of macrorules that include deletion, generalization, and construction.

Based upon the van Dijk and Kintsch model, Brown and Day (1983) identified five rules that readers use to develop text summaries. As a result of their three part study (1983) Brown and Day identified a set of five macrorules rules used by adults and, progressively, by children as they develop as readers. The rules are 1) deletion of trivial information, 2) deletion of redundant information, 3) superordination of lists, 4) selection of a topic sentence, and 5) invention of a topic sentence. Brown and Day point out that there is underlying agreement between these five

text processing rules and the three rules advanced by van Dijk and Kintsch. Their two deletion rules and rules of selection and invention respectively are more specific descriptions of the van Dijk and Kintsch deletion and construction rules, while superordination is similar to the generalization rule.

Another study that described the processes expert readers use as they prepare summaries of text was conducted by Garner (1982). After analyzing the reflective reports of subjects who wrote summaries, she established ten summarizing behaviors. In order of frequency these behaviors are listed below:

Table 1

Ten Comprehension Strategies Suggested Garner (in order of frequency)

1)	Referring back to text, rereading for key ideas or details
2)	Comparing the text and summary to see if the main ideas maintained or deleted were appropriate
3)	Reading for key ideas and words
4)	Underlining main points and key words while reading
5)	Skimming first to get an overall meaning gist
6)	Substituting general words or phrases for more specific summarizing terms
7)	Thinking about personal experience related to parts of the text
8)	Rereading the summary as a coherence check
9)	Looking in the summary for redundancy to eliminate it
10)	Directing attention to (boring) text

(p. 164)

The studies described above have involved expert readers. There is, however, some evidence that less competent readers use a

"passive approach to reading" (Johnson & Winograd, 1985) which is a practice that classroom teachers must address. Durkin (1978-79) has explained that students at grade four are undergoing a transition from learning to read to reading to learn. The curricular emphasis at this level also begins to focus more on expository text. These simultaneous changes, in both students' reading development and the the type of content area learning activities encountered may present difficulties for children who lack text processing strategies. Such children may begin to fall behind. To counteract singlemindedness of purpose, disposition and rate instruction leading to the development of a more broadly based schemata for text processing is required (Rumelhart, 1981). Metacognition requires emphasis; the goal of instruction being to enhance poor readers' awareness and control over the reading comprehension task (Spring, 1985). More understanding of the comprehension processes that expert readers employ should lead to better instruction, and in turn, enhanced reading comprehension for poor readers.

Using doctoral students as expert readers, Afflerbach (1985), developed a model of text processing that contained two major categories: main idea construction processes and processes related to main idea construction. These categories and their sub-categories are listed in table 2.

Table 2

Afflerbach's Categories of Main Idea Construction Processing and Related Processes

A. Main Idea Construction Processes
   1. Initial Hypothesis
   2. Crunching
   3. Listing
   4. Topic/Comment
   5. Draft and Revise

B. Processes Related to Main Idea Construction
   1. Hypothesis Generation and Testing
   2. Importance Assignment
   3. Evaluative Processes
   4. Reader Affect and Attribution
   5. Comprehension Monitoring and Executive Management Processes

Afflerbach's model may, nevertheless present some difficulties for teacher-practioners. These include the need for further explanation regarding: 1) the "crunching process", which as currently defined may be a difficult concept to impart to students; 2) the reason for separating the processes of "initial hypothesis" and "hypothesis generation and testing" which are categories that appear to overlap. In addition, clarification of the relationship between the metacognitive categories of knowledge of cognition and regulation of cognition is required. These issues will be addressed in detail in chapter five of the study.

The question for study is, what text processing model should teachers employ when teaching novice readers to identify main ideas? The concern at the present time is that Afflerbach's model may be overly complex for teachers to use as an instructional

reference. Building on the work of Afflerbach, the goal of this study is to use the verbal reports of teachers as a guide to confirming and refining a model of text processing and comprehension.

Pitts (1983) points out that learners avoid processes that involve a great deal of instruction or that are time consuming to employ. If, in this instance teachers are regarded as the learning targets, it is likely that they will avoid overly complex, new, metacognitive models of text processing.

Identifying the comprehension processes that readers use in finding the main ideas in expository text is a difficult question to answer, particularly because many of the processes used by skilled readers are thought to be automatic and are therefore relatively inaccessible (Afflerbach, 1985, Afflerbach & Johnson, 1986). Since much of text processing is not at the conscious level, investigators have found it difficult to confirm the text processing hypotheses they inferred through observation.

Johnston and Afflerbach (1983) have argued that it is possible to de-automate the reading processes of expert readers, thus making the processing more reportable. This is accomplished by giving subjects either unfamiliar or difficult tasks. The use of text that is unfamiliar in terms of subject matter or content can fulfill the demands of task difficulty. Readers become novices in regard to the topic, but maintain their text processing

skills. This approach was emulated in the present study in conjunction with the use of verbal reports.

Purpose of the Study

The purpose of this study was to: (a) describe the comprehension strategies that teachers as expert readers use in constructing main ideas from expository text and (b) build upon and confirm Afflerbach's work. The current study reexamined a series of categories developed in a pilot study (Wood, 1988) that readers use for main idea construction; reevaluated these categories in the light of the performance of a new sample of expert readers; and compared the resultant categories with those identified by Afflerbach (1985). The aim of this study, therefore, was to increase theoretical understanding of expository text comprehension processing as evidenced by expert readers' construction of main ideas.

Verbal Reports

The issue of gathering de-automated information has been addressed by previous researchers (Afflerbach, 1985; Afflerbach and Johnson, 1986; Garner, 1982) typically by using verbal reports. Verbal reports are gathered in one of three forms: as predictive, as think-aloud, or as retrospective reports. Predictive reports are usually interviews in which subjects give information about how they would approach a task. Think-alouds are

reports given orally while subjects are actually engaged in the task of reading. Retrospective reports are given after the subject has completed the task.

The Disadvantages of Verbal Report Data

The use of verbal reports raises issues regarding reliability and validity. These relate to: inability to tap automatically operated thinking processes (Garner, 1987); lack of formality (Ericsson & Simon, 1984); and interference associated with the additional cognitive load (Afflerbach, 1984; Brown, 1982). Brown (1981) also criticizes the use of verbal reports for young subjects who may be unable to verbalize their thought processes.

Concerns about formality are directed specifically at validity and reliability. The verbal reporting process does not allow for testing the relationships between or among variables (Kamil, Langer & Shannahan, 1985,). In this study, the issue of validity and reliability is addressed through the the use of retrosrective reports; the investigator's repeated reviewing of the data and the use of a second rater to establish interrater reliability.

Data collected by predictive verbal report procedures are often sketchy (Ericson & Simon). Another problem associated with predictive reports is cited by Lundeberg (1987). Given case studies to analyze and the task of describing their comprehension

processing, two legal experts were unable to give answers of more than one or two sentences in identifying their strategies for determining what the cases were mostly about. Garner (1987) points out further that during interviews,rather than describing what they actually do, subjects may respond by telling what they think is expected.

The Advantages of Verbal Report Data

Brown (1982) argues that the limitations associated with accessing comprehension processing strategies apply to research that employs predictive reports only, and does not pertain to the use of concurrent or retrospective reports. She maintains, that in predictive reports, individuals are so far removed from the task that they are likely to be unable to access strategies they might employ. In contrast, information obtained from concurrent and retrospective reports is likely to be valid because these types of reports are more task related and therefore more stable.

The use of verbal reports as instruments for data collection is also related to ecological validity (Kamil, Langer & Shannahan, 1985). Verbal reports address the complex context in which the research occurs (Wilson, 1977) and allow task-specific investigation yielding rich data about unseen processes (Garner,1987); processes which could not otherwise be investigated indirectly (Afflerbach, 1986).

Verbal Report Methodology in the Present Study

This study uses think-alouds to examine cognitive processing while reading. Concurrent, on-line reporting not prone to memory failure was employed, thereby counteracting the limitation of using retrospective reports alone (Garner 1987). To prevent any inferences which might be caused by the investigator, retrospective reports were gathered the following day. To limit the effect of temporal distance subjects were provided with both the protocol of the text and their previous think-aloud reports. This provided a degree of triangulation and tempered any possible biasing effects that might be caused by the interpretations of the investigator alone.

This research procedure is modeled after methods used in several recent research projects that attempted to gain access to cognitive thought processes. Brown and Day (1983) reported very little evidence of knowledge of summary writing was obtained from open-ended, predictive interviews. "Deautomatization" of thought processes when the "expert summary writers" were asked to "talk-aloud" as they worked on their summaries was more successful. Similarly, in deriving a list of comprehension strategies employed by expert readers as they analyzed law cases, Lundeberg (1987) reported that predictive reports provided very little evidence of knowledge of cognitive processes.

Garner (1982) advocates minimizing the processing-reporting distance in order to maximize the completeness of verbal reports that describe cognitive activity. In her study to induce conscious, analytic cognitive processing in reading comprehension she made use of an unfamiliar topic and elicited reflective reports immediately following the reading and summarizing activity. Subjects in this condition included more "cognitive events" and included less trivial information than did those who provided reports two days after the activity.

Afflerbach (1985) also addressed methodological concerns associated with think-aloud reports. He was concerned that prompted verbal reports might produce reconstructions by the reader of what probably happened rather than reports of the contents of working memory. Employing graduate students as subjects, he examined latency effects in regard to the delay between the act of reading the text and reporting on cognitive processes. He found that latencies were equivalent in both prompted and unprompted conditions and with unfamiliar and familar text and argued that the equivalence of the latencies under these experimental conditions indicated an equivalence in the memory system conditions under which they were reported. Consequently, he employed think-aloud reports, in combination with demanding reading passages, to "deautomate" the cognitive processing of "expert readers" in his subsequent study. Afflerbach reported that

the think-aloud reports do reflect the contents of working memory at the time of the prompt.

Scope of the Study

The ultimate objective of this study is to build a coherent model of text processing that may be used by teachers to facilitate reading comprehension instruction. Teachers who as expert readers possess high metacomprehension (Holbrook, 1986) will serve as subjects. The research will categorize and describe their metacognitive processing in order to develop a model from an analysis of their responses. Their verbal reports will be categorized and described in a fashion suggested by Afflerbach (1985). The model that develops will also be compared with a model of main idea construction developed by Wood (1988).

In metacognitive terms, the study will attempt to find common ground among subjects' comprehension processing through the reports they give about the cognitive strategies they use as they read. Using the procedure of repeated searches of the transcripts, inferences will be made as to how subjects regulate themselves in using that knowledge. An effort will then be made to draw the inferences together to make some overall sense of how metacomprehension occurred among these subjects as they read for main idea.

Research (Johnston and Afflerbach 1983) has reported that it is possible to de-automate the reading processes of expert readers, thus making the processing more reportable. This is accomplished by giving subjects unfamiliar or otherwise difficult tasks. The use of text that is unfamiliar in terms of subject matter or content can fulfill the demands of task difficulty. Readers become novices in regard to the topic, but maintain their text processing skills. This approach was emulated in the present study.

Two samples of naturally occurring expository text were selected with the view to making the readers novices in reading for main idea and to provide ecological validity.

The twelve subjects recruited for this study ranged from those teaching kindergarten programs to those teaching in the middle and senior years. School administrators were also represented. The subjects were conferred "expert reader" status based upon their educational standing and their experience as public school teachers.

Data collection took place in two stages. In the first stage, six subjects individually read the two expository text passages (see appendix A 1) and gave think-aloud responses as they read. The second group of six subjects also read and gave think-alouds. In addition, the second group of subjects each met

with the investigator the next day and provided retrospective reports, based upon the texts and their transcribed protocols.

Study Questions

To describe the comprehension strategies teachers as expert readers use in constructing main ideas from expository text, the following questions were investigated:

1. How did the expert readers approach the task of reading for main ideas in the two demanding expository passages? What generalizations can be made about their strategies using Afflerbach's model for comparison?

2. How do the categories developed in this study compare with Afflerbach's model of main idea construction processes? What are the similarities? Are there specific differences in the models that reflect differences in teachers' as opposed to graduate students' processing of text?

3. Will the previously identified categories (Wood, 1988) need to be modified or augmented, or will a new or composite set of categories be reguired?

4. Can a more concise model of text processing be developed?

Limitations of the Study

There are a number of limitations to the findings of this study. First, no mechanism was used to determine subject prior knowledge in advance of the think-aloud activity. Although it was necessary to choose selections that "challenged" the readers in order to meet the criticisms of "think-alouds" as data gathering instruments, the selection of the two demanding reading passages was directed by the belief that literary criticism and biology are content domains that are a part of the curriculum or study in the public school system. In selecting these two domains, it was intended that the reading behaviors be representative of the diverse demands placed upon students during their study of expository materials. It is evident in examining the protocols that the expert readers, even those who expressed concerns about how little they knew about a particular content domain, were able to make connections between the content of the texts and their own experiences. It seems reasonable to expect that expert readers have a wide general knowledge that contains some schemata relative to those represented in these demanding reading passages.

The texts used in this study were of similar length and were drawn from professional journals. The articles were

condensed somewhat to arrive at similar lengths. No critical content information was deleted from the passages. The information in chapter three indicates the similarities in the passages both in terms of sentence and word length. However, text alterations do have an impact on the ecological validity of the study.

The study does not examine whether or not the the main idea statements given by the subjects reflect "correct comprehension of the article". Provision of post think aloud opportunities in the second phase of the study, however, allowed subjects an opportunity to reflect and clarify their thoughts through retrospective reports. The information the retrospective reports provided lends credibiity to the inferences the investigator made about the processes the readers selected as they attempted to determine the gist of the texts.

A further difficulty associated with a study of this type is found in establishing acceptable interrater reliabities. This difficulty is noted in Afflerbach's study (1985) where he indicated that he and his raters have a long history of collaboration in coding verbal report studies. It is also possible to infer that Lundeberg (1987) was aware of the potential difficulties inherent in interrater reliabilities in her decision to recode passages and arrive at a rating herself. This study has worked through the

processes found in both the Afflerbach (1985) and Lundeberg (1987) studies. Both an independent rater and repeated searches through the data were used to establish reliability.

It is also recognized that for expert readers, oral reading is not a typical behavior in constructing main ideas. However, it would be impossible to specify the reader's place in the text if oral reading were not a part of the task in this study. It should be noted that very few comments expressing discomfort with oral reading were given. It is also noteworthy that there were many instances of spontaneous mid-sentence reports. These spontaneous utterances may be indicative of the fact that the oral reading task was not overloading the text processing of the subjects.

A further limitation of this study is task commitment - the need to be highly motivated to carry through and complete the task. The readers in this study were all individuals who, given the nature of their professional membership, would be deemed to be competent readers and writers. The protocols contain a number of reports that indicate the reader would "give up" under other circumstances. However, it is also true individuals frequently marshall their resources to accomplish difficult cognitive tasks either in the course of the school day or in

other work settings. Therefore, it is reasonable to assume that expert readers would find themselves in reading situations equally as demanding as the ones created in this study. It is also reasonable to assume that expert readers would be highly motivated to succeed as a demand of their professional responsibilities.

Definition of Terms

General Terms

Coding: The allocation of a number and a letter to a think-aloud response to indicate it's strategy category and sub-category.

Intersentence markers: Prompts made to remind the subjects to give a think-aloud report. The markers were a series of asterisks highlighted with marker and placed at the end of each sentence.

Metacognition: The knowledge of one's own cognition and the regulation of that cognition (Brown, 1985).

On-line Report: A think-aloud report given during the time the subject was reading the text.

Protocol: A transcription of the reading aloud of the expository text and the think-alouds that accompanied it. In the case of six subjects the protocol also included the retrospective reports.

Retrospective/Reflective Report: A report given by the subject during an interview on the day following the think-aloud task.

Solicited Reports: Think-aloud reports given at the point where the intersentence markers were placed.

Unsolicited Reports: Think-aloud reports that were given in the middle of a sentence.

Verbal Report: An introspective report given as a think-aloud or as a reflective report.

Terms Related to Text Processing

Allocation of Attention/Processing Time: The amount of time (indicated by the length of a think-aloud report) devoted to monitoring comprehension.

Expert Readers: Individuals, who as they read, possess a high level of flexibility and initiative, and who are aware of what they understand and what they do not (Holbrook, 1986). By virtue of their status, in this study, teachers are designated as expert readers.

Fix-up strategy: A strategy indicated by a subject as one being used when a comprehension break down occurred.

Gist: See main idea

Hypothesis: A reader statement that indicated a macrostructure for the text (Afflerbach, 1985).

Instantiation: An instantiation is said to occur when there is a The match between schemata in the reader's prior knowledge and information found in the text (Dreher, 1985).

Main Idea/Gist: A macrostructure developed from the text that can also be described as superordinate ideas contained in a paragraph or complete passage (van Dijk & Kintsch 1983).

Poor or Less Competent Readers: Readers who use passive, rigid approaches to reading expository material and who rely on external sources for direction as they read (Johnson & Winograd, 1985).

Strategy: A process used by the subject to determine the main ideas of the texts.

Chapter II

REVIEW OF THE LITERATURE

To illustrate its broad base, this portion of the study examines theory and research related to main idea comprehension. The intention is to show linkages not only between learning theory, the study of metacognition and metacomprehension, and integrated models of reading comprehension, but also to justify the use of verbal reports as a data source to support the qualitative findings that follow.

Learning Theory

Learning theory has vacillated in defining the role of the individual in learning. In the mid-1600's, John Locke wrote of the processes for understanding learning, which he called reflection:

> "... the ideas it affords being such only as the mind gets by reflecting on it's own operations within itself..... by reflection ..... I would be understood to mean the notice which the mind takes of its own operations and the manner of them by reason whereof there come to be ideas of these operations in the understanding."
>
> p.44

Locke, it seems, saw the individual as a learner who actively engaged in examining and questioning his or her own thinking processes in developing a world view.

Brown (1982) traces the development of learning theory in this century indicating that during the 1940's and up until the late 1960's American researchers did not share this view of the learner. Learning theory studies during this time viewed learners as being "passive organisms" responding to "environmental influences". Since the 1960's, behaviorism as a model to explain learning has been abandoned with attention shifting to a more cognitive-based theory. The studies which have accompanied this shift have focused more and more on the child's strategies for learning. In examining the strategies learners use, investigators have also used with realistic learning tasks and materials.

The Tetrahedral Model of Learning

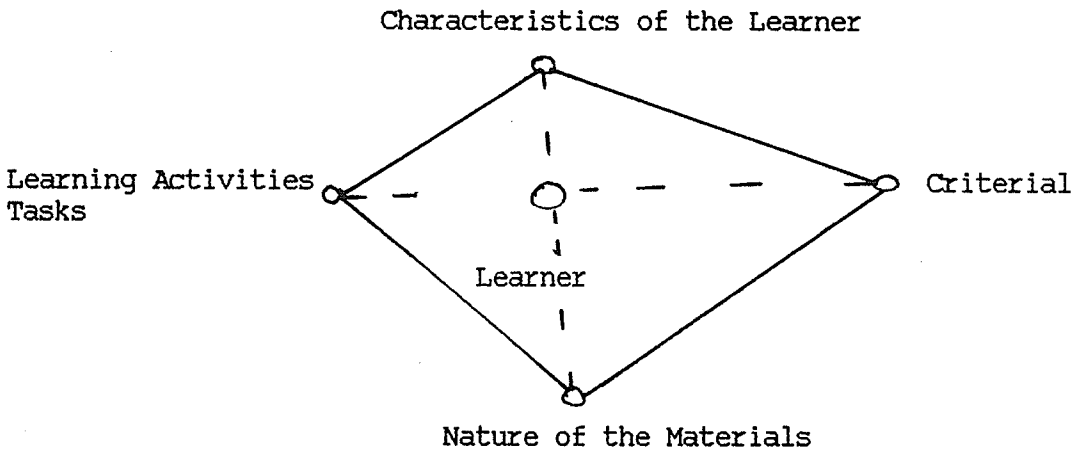
J.J. Jenkins' tetrahedral model of learning and memory (Jenkins, 1979) shown in Figure 1 illustrates the complexity of the learning process. According to Jenkins four interactive factors influence learning: the learning activities engaged in by the reader, the characteristics of the learner, the nature of the material to be learned, and the criterial task. These four elements place the learner in context (Brown, 1982).

Learning Activities

Learning activities are the deliberate plans and routines that learners call into service for remembering, learning, or problem solving (Brown, 1982). Examples of specific learning

activities include repeated rehearsal or rearrangement of lists based upon their conceptual nature (Brown and Smiley, 1977), the use notetaking or underlining to aid memory (Short and Ryan, 1984; Brown, 1985), and the selection of topic sentences, or the creation of topic sentences where none are given to aid memory for expository text (Brown and Day, 1983).

Figure 1 Jenkins' Tetrahedral Model



Characteristics of the Learner

The characteristics of the learner include: knowledge of plans and routines, the individual's resevoir of content knowledge, and limitations associated with attentional capacity (Brown, Campione and Day, 1981). These are a representative of what the individual brings to the task. It is significant to later discussion that some evidence exists to indicate that the learner may or may not choose to apply these routines to the problem at hand (Flavell, 1976).

The Nature of the Materials

The nature of materials related to the task of reading expository text includes the following elements: advance organizers, as well as titles and paragraph headings present within the text, the availability of pictures, and the choice of vocabulary (Jenkins, J.R and Pany, D., 1981). Thus differences may exist within the text itself.

Interactions Between and Among Variables

Interactions may take place between and among model elements. The nature of the materials and how they are organized, for example, dictate the type of strategy that a successful learner may select. The characteristics of the learner also come into play in a number of ways. Learners may not be aware of an effective strategy for organizing the material. Conversely, learners may possess an effective strategy but fail to select it from their list of approaches for solving problems. Further, the materials may be such that the desired learning is beyond the capacity of the individual because the learner lacks pertinent background knowledge.

The Criterial Task

The final corner of Jenkins' tetrahedral model, the criterial task, interrelates with all the other elements. Brown, Canpione,

and Day (1981) and Brown (1982) have demonstrated that knowledge of the task relates to the selection of learning activities. Their studies illustrate that better informed students have shown more transsituational usage of strategies. As will be argued later, learners who account for the four elements of the model and the interactive effects of each element during a learning activity can be said to be exhibiting metacognitive awareness.

Metacognition

Simply described, metacognition is: 1) knowledge about cognition and 2) the regulation of cognition (Brown, 1985). Paris, Cross, and Lipson (1984) explain metacognition as 1) knowledge about cognition and 2) self-directed thinking. Metacognition is a "second self" standing nearby directing the learning process; telling what, how, and when with regard to applying learning strategies. Flavell (1976) described metacognition as:

> "...ones' own knowledge concerning one's own cognitive processes and products or anything related to them, e.g., the learning of relevant properties of information or data.... Metacognition refers, among other things, to the active monitoring and consequent orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete object or goal."
>
> p. 232

Heller (1986) describes metacognition as a question to the learner: "How do you know what you know and how did you come to know it?" These issues, central to individual problem solving and

becoming an active participant in one's own learning, are of great significance to researchers and teachers alike (Brown and Day, 1983; Brown and Smiley, 1977; Flavell, 1976; Johnston, P.H. and Winograd, P.N., 1985; Paris, Cross, and Lipson, 1984).

According to Brown (1975), Gagne and Dick (1983) and Paris and Lindauer (1982) three elements come into play in learning. These elements are: 1) the organization and activation of knowledge, 2) the selection and application of cognitive strategies, and 3) the awareness and monitoring of variables that influence learning. Paris, Cross, and Lipson (1984) categorize the knowledge manifested by these three elements of learning behavior as declarative, procedural, and conditional, representing respectively: "knowledge that" (knowing about the topic), "knowledge about knowing" (knowing how to perform various actions), and "strategic knowledge" (knowing when and why various strategies should be used).

Knowledge Of Cognition

These descriptions of declarative, procedural, and conditional knowledge are compatible with the definition of knowledge of cognition in that knowledge of cognition accounts for background knowledge, knowledge of strategies, and knowledge of the conditions under which the first two types of knowledge will need to be applied. Similarly, Garner (1987) has named knowledge of cognition "metacognitive knowledge" and states that

it includes knowledge of ourselves, of the tasks we face, and of the strategies we employ. These definitions of knowledge of cognition are refelected in the functioning of learner characteristics in the tetrahedral model.

Readers demonstrate declarative knowledge or knowledge of self when they can recall personal background knowledge that relates to the textual material. The use of declarative knowledge is also demonstrated when individuals identify their learning strategies, such as summarizing the text or skimming for main ideas.

Procedural knowledge or knowledge of the task includes being aware that one will be asked to recall the gist of an article, identify topic sentences (knowing that topic sentences are often found near the beginning of a paragraph), or group items into categories from memory.

An individual's knowledge of strategies may include knowledge that structural analysis is useful in determining the meaning of an unfamiliar word, that rereading a long piece of text will aid memory, and that generating a personal example may facilitate recall by tying ideas in the text to personal experiences (Afflerbach, 1985; Afflerbach and Johnston, 1986).

Knowledge of cognition, the personal awareness of how an individual's thinking occurs, is said to be statable, stable, fallible, and late developing (Brown, 1982). It is statable since

individuals are able to tell others about their thinking. Such knowledge is stable, in that background knowledge about a topic will aid understanding of the main idea. Such knowledge will likely remain in the individual's memory. Knowledge of cognition is prone to fallibility in that readers may develop notions about the topic that are inaccurate. Learners are also fallible regarding the application of procedural knowledge. Some study skills and problem solving strategies may be inappropriate in certain circumstances. Thus knowledge of cognition requires considerable learner sophistication.

Knowledge of self, task and strategy are the most straightforward components of metacognition and more easily assessed because learners are more commonly aware of these elements (Garner 1987). A recognized difficulty is that learner self-reports are subjective and therefore prone to the potential weaknesses of subjectivity (Brown, 1982).

Regulation of Cognition

The regulation of cognition deals with executive processes such as planning, monitoring and checking outcomes (Brown, 1985). Executive processes tie together and manage all other learning processes. An individual's regulation of cognition gives learners the capacity for strategy application in a variety of learning situations. Behaviors that comprise executive learning actions have also been described as the individual's evaluation, planning,

and regulation activities (Paris, Cross, and Lipson, 1984). In any case, such regulation could include checking the reader's knowledge match with the knowledge required to construct main ideas, checking the level of attention to task, weighing the value of the task or checking the efficiency of the strategy currently being employed. These metacognitive experiences are judged most often at the point where learners recognize that cognition has broken down (Garner, 1987).

In contrast to knowledge of cognition, regulation of cognition is said to be less statable, less stable and less age-dependent (Brown, 1982). Regulatory activities are certainly less statable in that they involve a complex series of actions and decisions that may be erratic, inconsistent in direction, subject to multiply embedded interruptions and detours (Flavell, 1976). Regulatory activities are less stable in that although experienced learners use them, they do not use them all the time. Inexperienced learners may demonstrate them when solving simple problems in familiar environments (Brown 1982; Brown and Day, 1983; Brown, 1985). Regulatory activities are said to be age independent in that very young children have been observed to monitor their thinking, given a suitable task and a familiar learning environment.

In accomplished learners, the regulatory functions are derived from within the learners themselves. The significance of regulatory functions is most apparent when the behavior of young

children, beginning learners and poor learners is examined. In such cases, teachers often serve as an external source of direction (Paris, Cross, and Lipson, 1984). Teachers assume responsibility for the regulatory function and selectively organize and activate learner knowledge, by, for example: providing background knowledge where gaps are known to exist, selecting and directing cognitive strategies as part of the guided practice, and providing feedback (thereby subsuming the learner's awareness and monitoring functions). Palinscar and Brown (1984) show that the transfer of knowledge and responsiblity can occur by having students adopt the roles and cognitive activities of the teachers.

The learner's inability to reflect easily on the regulatory processes, the varying times and circumstances in which the learner may choose to employ them, and the influence of task on the effectiveness of the regulation, make it difficult for the learner or others to describe self-regulating behaviors. The complexity of the regulatory processes makes it apparent that the workings of Jenkins' model of learning are not as simple in their interaction as his diagram first implies.

Metacomprehension

The distinction between readers who use metacognition in reading to learn, and those who do not, is well described. Readers who possess high metacomprehension are readers who possess

an awareness of what they understand and what they do not (Holbrook, 1986). Poor readers, those with low metacomprehension, are identified as those who read with a singlemindedness related to purpose, disposition and one may assume rate (Johnston and Winograd, 1985). Many students are passive and rigid in reading content area materials, depending heavily upon teacher direction (Davey, 1986). Short and Ryan (1984) describe the distinguishing characteristics of skilled and unskilled readers. Skilled readers appear to apply declarative, procedural, and conditional knowledge while less skilled readers exhibit passivity and rigidity through lack of: knowledge regarding purpose, sensitivity regarding the need to behave strategically, facility in terms of ability to evaluate the appropriateness of strategies, spontaneity in strategy selection and perseveration in applying chosen strategies. In summary, readers with low metacomprehension fail to act upon their knowledge of the interactive factors that influence learning as presented in Jenkins' model. The inactive learning approach of poor readers with low metacomprehension has been characterized by Johnson and Winograd (1985) as passive reading failure.

Passive reading failure is a worrisome condition for educators faced with the problem of teaching children to learn independently from text. A number of researchers have made statements to that effect. Durkin (1978-79) states: students at grade four are undergoing the transition from learning to read to

reading to learn. What exacerbates the situation is that at the beginning of the middle years there is greater emphasis upon content subjects. Rumelhart (1981) has pointed out that less competent readers require instruction to foster the development of more broadly based learning strategies to cope with the increased reading demands of schooling. Spring (1985) urges that in teaching reading comprehension educators emphasize metacognition, that is assist students in exercising control over their own reading and learning strategies.

Models of Reading Comprehension

Schema Theory

The explanation of the tetrahedral model and the information regarding metacognitive awareness indicates the importance of learner prior knowledge. In this study the schema-theory model is intended to explain processes that extend beyond the comprehension of text to include general learning. The schema theory model is used as a way of explaining the organization of incoming information. Garner (1987) describes the reader's schema as a set of expectations. When the new information meets the reader's expectations it is encoded in memory. The patterns that guide its encoding also guide its retrieveal. In the applying the schema theory model to reading, expectations of the reader extend beyond the schema associated with text content and include expectations

regarding the conventions of writing, the textual schemata (Afflerbach, 1985, Anderson, 1985).

Rumelhart (1981) writes that schemata are conceptual frameworks of knowledge called schema theories. Schema theories developed by the reader therefore have impact upon the declarative, procedural, and conditional knowledge that indivduals bring to learning tasks, in this case, the task of reading. The feature of the schema theory model that is important at this point is the quality of embedding. A schema and its sub-schemata are like trees of information. An allegory in content classroom instruction would be a herringbone diagram representing information beyond the text. Individuals searching for knowledge in memory can work their way along the herringbone of information from the simplest detail to more general concepts. The reverse sequence also applies. Students can trace information in their memory in much the same manner as they can from a class diagram. A schema embedded in a person's memory, however, would contain much more complex relationships and would have connections linking it to many other schemata.

Rumelhart (1981) believes that this embedding feature allows schemata employed by a learner to be either conceptually or data-driven. Conceptually-driven schema represent top-down information or whole-to-part processing. Data-driven schema correspond to bottom-up processing, also known as part-to-whole processing. In the act of reading, top-down processing would be

based upon the background knowledge the reader brings to the text. In the act of reading, bottom-up processing would be what the author and text bring to the reader. Top-down and bottom-up processing are said to occur simultanteously. This simultaneous quality of the model characterizes the schema theory model as interactive. When conceptually-driven schema are activated, a general theory or image may be called up by the individual and a series of sub-schema activated. The degree of fit between the subsequent textual details and the sub-schema determines whether the reader's general image of the text is retained. When data-driven schema theories are developed, the details from the text activate a sub-schema. In this case, the evaluation of the fit proceeds upward through the tree of information, with readers again checking for the degree of fit with their general knowledge. When the reader is satisfied with the fit, a slot in the theory is filled and an instantiation is said to have occurred (Dreher, M.J.1985). Adams and Collins (1985) state:

> " Bottom-up processing insures that the reader will be sensitive to information that is novel or that does not fit their ongoing hypothesis about the content of the text; top-down processing helps them to resolve ambiguities or to select between possible interpretations of the incoming data."
>
> p. 408

Anderson (1985) proposes the following six functions of schema theory:

1. Supplying an ideational scaffolding for assimilating text information. (a niche or slot for certain information)

2. Facilitating the selective allocation of attention. (part of the basis for determining the important aspects of text, reader's may use importance as one basis for deciding where to pay close attention)

3. Enabling inferential elaboration. (provides the basis for making inferences that go beyond the information literally stated in the text)

4. Allowing for the orderly search of memory (a guide to the types of information that need to be recalled by tracing through the schema used to structure the text the reader is helped to gain access to the information learned while reading the text

5. Promoting editing and summarizing. (since, within itself, a schema contains criteria for importance, it enables the reader to produce summaries that include significant propositions and delete trivial ones)

6. Permitting inferential reconstruction. (when there are gaps in memory the reader's schema along with the specific text information that can be recalled helps generate hypotheses about the missing information

(pgs 376-77)

Anderson has indicated that these points are tentative and that research must now focus upon the development of schema-based processes. An area of concern is that nearly all the experiments used to support schema theory involve situations where the students are prompted to activate preexisting schemata with inadequate context (Bransford and Johnson, 1972) as escaped prisoners or hunters (Bransford and Johnson, 1973) or as as homebuyers or burglars (Anderson & Pichert, 1977). Bransford

(1985) reports that many schema theorists have very little to say about the processes by which novel events are comprehended and new schemata acquired. This he states is an inherent weakness in their explanation of the role of schema rtheory in learning However if schema theory is to explain text comprehension, a learning activity, it must account for more than the activation of preexisting schemata. The model of schema theory represented is not a static one in which the learner/readers search through networks of information that already exist within the their minds. An explanation must also be found for the construction of new schemata. Whitney (1987) proposes that:

> "comprehension is a schema assembly process ... the knowledge base is an associative network of hierarchically and thematically connected concepts. Schema can be thought of as groups of associated nodes in the network, which are assembled when particular combinations are activated."
>
> pp. 306-307

This quotation supports the argument that the structure of a schema is organized at the time the learner requires the theory rather than being a rigid pre-cast structure. Whitney goes on to argue several other propositions about schema theory. He first

believes that the degree to which schema is activated is dependent upon the amount of priming it receives from new data. Second, he believes that a schema may also be primed by other schema which is data from an individual's background knowledge. Third, schema activation is also dependent upon the extent and complexity held of the activated node. Whitney refers to this as the base-line strength of the schema.

These propositions would seem to account for the acquisition of new schemata since elements of the schema would be organized and reorganized as the reader faced new learning tasks. Schema organization would take into account recently acquired information as well as established information. The knowledge structure would, according to this premise, be flexible.

The theoretical outline of the schema theory model provides insight into the workings of an interactive model of learning from text. Specifically the schema theory model provides an explanation of the manner in which individuals may store and access information. Additionally, although less explicitly, the model also illustrates how readers manage the storage and access of information without over-extending their attentional capacities. These two functions, storage and access, and management of attentional capacity are dealt with through embedding.

The embedding of information in the memories of readers or learners allows individuals to access background knowledge and

relate that knowledge to the information and text structures employed by the author of the text. Three of Anderson's suggested roles for schemata explain how this might happen. First, the provision of an ideational scaffolding or niche for information explains the location of information regarding features such as content and structure in the reader's mind. Second, enabling inferential ellaboration and third, enabling inferential reconstruction, allow the reader to make use of the text to make broad hypotheses regarding text content that extends beyond the text through the networking and association of textual information with a variety of personal schemata.

The embedding of information encourages the smooth occurrence of the three abovementioned activities by reducing the load on working memory. The specific functions of the schema theory model that reduce the load are explained below. First, embedding information on information trees provides a hierarchy for the individual's knowledge (Adams and Collins, 1985). Organizing information from general to specific allows the reader to pay attention to what is significant and to reject what is trivial (Hare, Rabinowitz and Schieble, 1989; van Dijk and Kintsch, 1983). Second, the structure or criteria found in a schema-theory create opportunities for summarizing. An example of this function is found in a reader's schema for text structure. When readers encounter a probable topic sentence they may attempt to subsume parcels of information under that heading (Afflerbach, 1985;

Afflerbach and Johnston, 1986, Short and Ryan, 1984; van Dijk and Kintsh, 1983). Third, embedding the information allows the reader to search for information related to the schema-theory rather than searching randomly (Garner, 1988, Whitney, 1987). This minimizes the energy that would otherwise be required.

Main Idea Research

Discourse Comprehension Model

Van Dijk and Kintsch (1983) also propose an interactive model of text processing called the discourse comprehension model. They propose that the reader uses the microstructures and the macrostructures of the text to arrive at the gist or main idea. The use of text microstructures represents bottom-up processing, while the use of macrostructures involves top-down processing. A significant point to make is that microstructures are used to develop a list of individual propositions and macrostructures are an ordered list of major propositions that form the gist of the text.

Van Dijk and Kintsch's representation of microstructures includes the smallest units of sound and meaning, phonemes and morphemes, which produce larger clause and sentence units. These theorists suggest, additionally, that at the microstructure level, the reader looks for logical connections among the clauses to construct sentences and for coherence among the sentences to

confirm the logic of the clause level connections. Thus at the sentence level the reader forms a proposition of the writer's message to the reader. This is the individual proposition mentioned above. Macrostructures represent the gist or general proposition formed by the reader. Macroporpositions are formed using both the knowledge that the reader brings to the task and the information in the text. Coherence at the macropropositional level occurs when there is overlap among these major propositions. Comprehension monitoring is carried out simultaneously through both micro and macroprocessing.

The van Dijk and Kintsch discourse comprehension model proposes that comprehension processes are performed with little or no conscious attention allocated because if conscious attention were required, then there would be insufficient mental resources available for comprehension itself. These mental capacity limitations are addressed through the concept of cycles of memory. A phrase or sentence represents a basic cycle. Only a limited amount of information can be stored in working memory. It is argued that readers attempt to integrate each cycle into more general, more memorable propositions as the cycles are performed. Central, important arguments have the largest number of direct or indirect links and these become the macropropositions.

The linking and integrating of individual propositions occurs through three macrorules: deletion, generalization, and construction. Deletion of a proposition occurs when a reader

discovers trivial or redundant material. Generalization of a proposition occurs when a reader discovers a series of propositions that can be listed under a given general proposition. Construction of a proposition occurs when the reader can replace a set of propositions and the text does not supply one that is appropriate for the role.

According to the discourse comprehension model, the reader sets up a hierarchy of propositions branching downward. The hierarchy begins with the largest macrostructure or central idea statement. This can be called the main idea statement. The hierarchy then branches down to less central macropropositions and continues to network downward to individual propositions provided that sufficient space is allowed in working memory.

The van Dijk and Kintsch model is important to this study for three reasons. First, the model deals with the capacity limitations of working memory. Second, it provides a potential explanation for the strategies the learner employs in constructing main ideas. Third, the model argues that the reader constructs a situational model or macrostructure of the text prior to reaching the end.

Brown and Day's Main Idea Construction Processes

At the conclusion of their series of three studies, Brown and Day (1983) suggest that their research supports the condensation

processes proposed by the van Dijk and Kintsch model. Brown and Day suggest that their findings contribute to the understanding of main idea construction by explaining the developmental pattern relating to the acquisition of condensation rules. Their three studies examined the following issues: a) the developmental trend inherent in the acquisition of macrorules when paraphrasing expository texts, b) experts' use of summarization rules using on-line think-aloud protocols, and c) the diagnostic value of the developmental norms for enhancing the performances of novice readers.

Subjects in Brown and Day's first study (1983), were fifth, seventh, and tenth graders and college students in a four year university. The expository material developed for this experiment was used in all three studies. Two passages, one on the desert and one on noise, were rewritten to correspond to a grade five level. The passages were of similar length; 492 and 532 words. Subjects were asked individually to write a "good summary" of the text. After doing so, they were asked to write a second 60 word summary using whatever methods were helpful. Student performance on the summary writing was then examined for evidence of the use of five summarizing strategies derived from the van Dijk and Kintsch comprehension processing model. The Brown and Day summary writing rules with the van Dijk and Kintsch terms in parentheses were: first, deletion (deletion) of unimportant or trivial information; second, deletion (deletion) of redundant information; third,

superordination (generalization) of lists; fourth, selection of a topic sentence; and fifth, invention (construction) and use of a topic sentence that did not appear in the text but could have. Brown and Day concluded that all subjects made use of the deletion rules and that seventh and tenth grade subjects made some use of the the selection and superordination rules. College students were most likely to use the superordination and selection rules but encountered difficulty in making use of invention when the preliminary development of the study masterials suggested it was called for by the text structures. Brown and Day's study strongly suggests that their rules for summarizing text are acquired by readers as they mature.

In Brown and Day's second study (1983), two fourth-year students used the same passages as in experiment one. In addition to the tasks of the first experiment, the subjects were given a second task. Prior to reading the second passage they were asked to explain how they taught summary skills to students in their undergraduate classes and to outline the basic rules of good summary writing. They were then asked to talk-aloud as they worked on their summaries. The protocols were taped and transcribed. Brown and Day reported that the performance of the expert summarizers confirmed the developmental pattern found in the previous study. They also reported that the open-ended interviews yielded very little evidence of knowledge of effective rules of summary writing. During the talk-alouds the two students provided

more detail indicating knowledge about summary writing. Brown and Day stated that 40 percent of the protocol related to the rules of summary writing and 68 percent explicitly stated one of the five rules they had devised. Brown and Day noted that the expert summarizers tended to combine topic sentences across paragraphs and approached the task of summarizing less sequentially than did the younger subjects in experiment one.

The third experiment reported by Brown and Day (1983), was intended to assess the diagnostic value of the age norms developed in the first and second studies. The subjects were twenty freshmen attending a junior college. The materials and the procedures employed were the same as those used in the first experiment. The resulting summaries were scored by two independent raters. The research designers indicated that the subjects of experiment three had been selected on the basis of having less academic background. This, they stated, related to the fact that the admission requirements for a two-year junior college program were less stringent than those for a four year university. Brown and Day reported that the subjects performed as effectively as any others on the two simpler summarizing strategies, and the deletion of redundant and trivial information. Their performance on the remaining tasks was similar to that of the seven subjects in experiment one. Brown and Day propose that this data provides specific diagnostic information about the types of difficulty that less successful students encounter in text processing.

These Brown and Day studies provide quantitative confirmation of the van Dijk and Kintsch model of text processing. Other studies that support Brown and Day's work on devising instructional routines for enhancing learning from text include: Brown and Smiley's (1977) study on the developmental nature of rating importance in prose passages, and work on devising instructional routines for learning from text (Armbruster, Anderson, and Ostertag 1987; Brown, Campione, and Day 1981; Duffy et al 1987; and Paris, Cross, and Lipson 1984).

The studies by Brown and Day have a significant relationship to the present study for several reasons. First, they indicate the use of specific summarizing strategies by expert readers. These strategies serve as a beginning point for developing a better understanding of how expert readers process and monitor their text comprehension strategies. Second, Brown and Day report a sharp contrast between the limited information they gathered during the retrospective interviews with expert readers and the more extensive amounts of information acquired during the on-line think aloud activities. This is supported in the findings of Lundeberg (1987), thus lending credence to the think aloud task employed in this study. Third, Brown and Day note that their expert summarizers tended to combine topic sentences across paragraphs and approached the task of summarizing less sequentially than younger subjects in experiment one. This last point supports the reader's construction of a macrostructure for

the text as proposed by van Dijk and Kintsch's comprehension processing theory and explains some of the reading behaviors discussed in the findings of this study.

The Influence of Prior Knowledge on Main Idea Construction Processes

A criticism that can be made of Brown and Day's study is that the second experiment relied upon two subjects only for the data with which to compare expert with less skilled reading. A study that addresses this limitation is that of Afflerbach (1985). Afflerbach conducted a series of three experiments related to main idea construction processing. The studies were designed respectively to determine the: (a) influence of the verbal report methodology upon the quality of the reports, (b) effects of different levels of content domain knowledge upon expert reader's main idea construction processes, and (c) main idea construction processes in relation to their details and related processes. The first of these three studies has been discussed in Chapter 1. The second study is reviewed here.

Eight subjects participated in Afflerbach's second study. This study examined the influence of prior knowledge on main idea construction processes. Expert reader status was assigned by virtue of the fact that subjects were doctoral students of either anthropology or chemistry. The texts were excerpts from professional journal articles; one on antropology and one on

chemistry. The passages were 596 and 590 words each. No formulae were present in either article. These same articles were used in all three of Afflerbach's experiments. One week before participating in the actual task, the eight subjects were asked as individuals to think about the processes they used in reading. Immediately before the actual think-aloud task, subjects were given practice tasks and asked to report on their thinking processes. Subjects were required to think out-loud while reading the text aloud. Prompts were red dots placed at the end of the sentences and at the end of every paragraph. To encourage verbalization, prompts were limited to general questions such as, "What are you doing now?". The data were tape recorded and typed as protocols.

The protocols were examined in order to classify the statements into five main idea construction process categories established in a pilot study by Johnson and Afflerbach. These processes were labelled as: initial hypothesis, crunching, draft and revise, topic comment and listing. To establish coding reliabilities fifteen instances of each classification were randomly selected and read to a second coder. Coding reliabilites were reported as: crunching r =1.0, initial hypothesis r=.87, draft and revise r=.93, topic/comment r=.87 and listing r=1.0. Frequency of use of the main idea construction processes was also calculated.

Afflerbach suggests that this study is significant in several ways. First, it defines a specific set of main idea construction processes. Second, it gives a description of how and under what conditions the processes operate. Third, he believes the study sheds light upon the relationship between content familiarity and the selection of main idea construction processes. Fourth, Afflerbach proposes that his data explains the weakness in schema theory regarding its inability to explain the role of schemata in the acquisition of new knowledge. Afflerbach suggests that the deliberate, conscious processing observed in his second study provides an explanation of the unconscious text comprehension processes that develop new schemata.

Afflerbach's third study involved the re-examination of the protocols from study two. Afflerbach undertook a qualitative analysis of the protocols, examining them for processes related to main idea construction. He identifies the related processes as: (a) importance assignment and other evaluative processes, (b) hypothesis testing, (c) comprehension monitoring, (d) reader affect, and (e) reader attributions. As a qualtitative account, excerpts from the subject protocols have been used to illustrate each different facet of the identified process.

These two studies are significant to the present study in that the findings regarding main idea construction processing extend knowledge gained from the series of studies carried out by Brown and Day (1983). Further, Afflerbach's studies establish a

series of categories against which the categories developed in this study can be qualitatively compared. Also, the methodology of the study is similar to the methodology used in this study.

Interest in the study of the metacognitive aspects of main idea construction has extended to the study of how experts within specific disciplines process text. Lundeberg (1987) conducted a series of three studies to investigate the strategies used by both expert and novice readers in the study of case law. The first of these three studies is pertinent to this discussion.

Lundeberg recruited ten novice and ten expert readers. Expert status was arbitrarily assigned to law professors and practicing lawyers. Novice readers were individuals with at least a master's degree in another discipline. Two legal case studies were chosen. The cases were 1,098 words and 1,505 words in length. Subjects, who were interviewed and observed individually, were required to read the texts and to think-aloud as they attempted to determine the answers to three questions which Lundeberg describes as typical of the study of case law: (a) What are the relevant facts of the case? (b) What is the issue? (c) What is the rule (according to the judge's reasoning) of the case? No rehearsal of think-aloud procedure was provided to avoid biasing subjects' reports. Lundeberg later suggested that she felt such bias was a concern because of the specific nature of the inquiry; the processing of case studies. Prompts were described

by the investigator as being general, spontaneous, and based upon the subjects' actions.

Analysis of the protocols took place in three steps. The first step was reading of the expert protocols to compare them with the relevant case study and to discern patterns in the responses. Second, the protocols of the novice readers were examined in the same fashion. Five of the forty protocols were randomly selected and the responses in each protocol were reclassified by the investigator. Lundeberg explains that this was intended to provide intra-rater reliability, r=.92. Six strategies used by experts emerged from the analysis. These were labelled: use of content, overview, rereading analytically, underlining, synthesis, and evaluation. See Figure 2 for the frequency of strategy use. Lundeberg also identified five behaviors that only novice readers demonstrated. These included: expressing confusion about legal terms, expressing confusion about English words having legal meanings, using context to define words, adding incorrect information and attempting to assign names to the plaintiff and the defendant.

Lundeberg suggests that this study is significant as it contributes to our understanding of reading strategies related to the comprehension of legal texts. It demonstrates the importance of prior knowledge in reading: knolwledge of law, knowledge of text type, and knowledge of case analysis strategies.

Figure 2

Frequency of Strategy Use by Category and Group

Category	Group: Novice	Group: Expert
Use of Context		
- headings	1	10
- parties	4	9
- type of court	1	9
- date	1	9
- name of judge	0	8
Overview		
- length	4	9
- decision	0	8
- marking the action	0	8
- summarizing facts	2	10
Rereading Analytically		
- terms	3	6
- facts	5	9
- rule of the case	3	9
Underlining	5	6
Synthesis		
- cohesion	3	6
- hypotheticals	0	4
Evaluation		
- approval/disapproval	1	10
- sophisticated view of jurisprudence	2	9

NOTE: Each value represents the number of subjects who used a specific strategy, not the number of times a strategy was used. N = 10 for each group.

It is difficult to make comparisons between this work and that of Afflerbach because the nature of the tasks was different and the interpretations of the protocols emphasized different comprehension processing strategies. The tasks differ in that

Afflerbach required his subjects to establish the gist of the expository passages, while Lundeberg set three very specific questions. Additionally, Lundeberg's observed strategies appear to be of a lower order than those of Afflerbach. In her defence, this may be the result of the very specific type of reading text Lundeberg studied. Protocol interpretations have taken a different focus in these two works as well. Each study generated ten categories. In the Afflerbach study five dealt with main idea construction strategies and five dealt with associated processes. In Lundeberg's case, five categories were strategies employed by legal experts and five were associated with the reading of novices.

Lundeberg's study is useful to the present study, however, in that a number of her identified reading behaviors correspond to: 1) main idea construction reading behaviors identified by Afflerbach (1985), and Brown and Day (1983); and 2) summarizing behaviors (Brown, Bransford, Ferrara, and Campione, 1982; Winograd, 1984) and 3) sources of comprehension failure (Collins and Smith, 1980).

Assessing Verbal Report Data

Winograd (1982) indicates that research into the analysis of metacognition and reading comprehension has used measures such as disorganized passages, inappropriate transition words, incomplete instructions, unclear pronominal references and contradictory

information. These techniques have not fully explained the processes which readers use to process text. Verbal report data gathered during typical learning situations can provide a richness that controlled studies cannot.

Limitations

The use of verbal reports invariably raises some specific concerns about a study. These relate to: the lack of formality (Ericsson & Simon, 1984); the inability of the strategy to tap automatically operated thinking processes (Garner, 1987); the use of young subjects (Brown, 1981); and in addition concerns that verbal reporting may interfere with the task becauses it places an additional cognitive load on the subject (Afflerbach, 1984, Brown 1982).

Concerns about formality are directed at validity and reliability. The verbal reporting process does not allow for testing relationships between or among variables (Kamil, Langer & Shannahan, 1985,). The methodology of the data collection and reporting procedures are also sketchy (Ericsson & Simon, 1984). Brown (1982) argues that this criticism focusses on research that assessed predictive reports only and does not apply to concurrent or reflective reports. It can be argued that concurrent and reflective reports deal with more task related activities and are therefore more stable.

Advantages

The advantage of this type of data collection is founded in the ecological validity of the approach (Kamil, Langer & Shannahan, 1985). Also, verbal reports are seen to address the complex influence of the context in which the research occurs (Wilson, 1977). This is " the learner-in-context" mentioned by Brown, Campione, and Day (1981). Verbal reports allow task-specific investigation yielding rich data about unseen processes (Garner,1987); processes which could not otherwise be investigated indirectly (Afflerbach, 1985). In addition, the concurrent reporting used in this type of investigation is not prone to memory failure which could be an issue in retrospective reporting (Garner 1987). Furthermore, the issue of how cognitive processes are controlled during reading can be examined according to what is automatic and what requires conscious control. The argument is that the more automatic or subconscious the self-monitoring, the more that personal resources can be allocated to the task at hand(Afflerbach, 1986; Brown 1982; Kintsch and van Dyke, 1983). Richard Anderson (1985) lends some suppport to this notion in his description of schema theory at work:

> "...a reader is able to comprehend a message when he is able to bring to mind a schema that gives a good account of the objects and events described in the message. Ordinarily comprehension proceeds so smoothly that we are unaware of the process of cutting and fitting a schema in order to produce a satisfactory account of a message. It is instructive, therefore, to try to understand material that gives us pause, so that we can reflect upon our own minds at work."
>
> p. 372

Afflerbach (1985) indicates that automatic processes can be deautomated through the use of text that is challenging to readers but still within their grasp in terms of content and structure. The verbal reporting strategy can be described as being employed in three different fashions. Reports can be made to observers predictively, and as previously mentioned, either retrospectively or concurrently (Brown, 1982). The concurrent report allows for reporting about the processes the reader is employing as the reading actually occurs. This eliminates the memory loss difficulty associated with retrospective reports and the generalizing difficulty associated with the predictive report (Brown, 1982).

Verbal reports making use of young subjects must acknowledge the inherent procedural limitations regarding children's linguistic skills and the variations between the language of adults and children (Garner, 1987). There is concern that children distort and modify their thought processes, just as they do their perceptions of the world around them (Brown, 1982).

Use of Verbal Report Data in the Present Study

This study makes use of adult subjects who are assumed, due to their status as degree teachers, to be competent adult readers.

In making this selection, it is acknowledged that a bias will occur in the type of data collected in the protocols.

Verbal reports were expected to result in the subjects' identification of comprehension processing as they reduced the texts to their gist (Brown, Campione & Day, 1981; Johnston & Afflerbach, 1984). In instances where the subjects did not volunteer statements about their reading through think-alouds, general prompts were used. As was the case in the studies of Afflerbach, 1985; and Lundeberg (1987) the prompts followed no fixed pattern and were based upon individual subject's actions. The prompts included statements like, "What made you laugh?", "What are thinking about now?". Any prompting statements were transcribed with the protocols to preserve the context of the prompt and the report.

The think-alouds were inserted directly into the text to maintain the sequence of reading and think-aloud response when the taped protocols were transcribed. This provided the subjects with a sequential report when they were asked to report reflectively on the text and their think-aloud comments from the day before. Provision of the transcribed information at the time of the reflective reporting was intended to counter the difficulty that Garner (1987) has identified. She has indicated that reflective reports have been critisized when used to identify processes in which individuals engage automatically. She points out that automatic processes are seen to be inaccessible upon reflection.

Having a record of the task and the think-aloud report in hand during the reflective report does much to counter this problem.

Chapter III

METHOD

Data for the study were gathered in two phases. In the first phase six subjects were required to give think-aloud reports as they read each of two demanding reading passages. The passages are described below under the heading, materials. Protocols were transcribed from the audiotapes made at each reading. Initial categories were developed by the investigator using the data pool of the first six subjects. In the second phase of the study an additional data gathering procedure was added. Each of six new subjects was asked to read and report retrospectively on the transcript of their think-aloud completed the previous day. These additional retrospective reports were also audiotaped. The retrospective reports were included in a final transcription of each subject's protocols. The think-aloud task and the materials used were the same in phase one and in phase two.

Subjects

Twelve teachers were recruited for this study, six for each phase. The twelve subjects were all teaching in one of two rural school divisions in south-central Manitoba. Six of the subjects were male and six female. All subjects had been teaching for at least five years. All twelve subjects had at least one degree from a four year program at the university level. The overall

range of teaching responsibilities included: three early years teachers, three middle years teachers with some resource program responsibilities, three high school administrators, two high school teachers, and a high school guidance counsellor.

The subjects in the first phase of the study included: two high school administrators, one early years teacher, one middle years teacher with resource responsibilities, and two high school teachers. Of this group three were male and three female.

The group of subjects in phase two included: one high school administrator, a high school guidance consellor, two early years teachers, and two middle years teachers with resource responsibilities. This group also consisted of three males and three females.

None of the subjects were familiar with the questions of the study. The subjects were assigned the status of "expert reader" based upon their educational standing and their experience in public schools.

Materials

The same reading passages were used in both phases of the study. The texts were from the content domains of literary criticism and plant biology. Copies of the texts have been included in Appendix A. Specifically, the literary criticism text discussed imagery and the use of irony in a current film,

"The Natural", and the plant biology text discussed recent developments in studies of the genetic potential of the pea plant. The passages were selected from two content domains to broaden the content knowledge base and meet the demands of ecological validity as far as was possible given the demands of the task and the risk of overburdening subjects. Both texts were excerpts from professional journal articles. The articles were condensed to produce two passages of similar length and they were then analyzed for readability and the number of idea units. This information is provided in Table 3 below.

The passages were typed with double spacing and photocopied. Intersentence prompts were added in the form of a series of asterisks after each sentence. The asterisks were made more noticeable by the addition of yellow highlighter.

Table 3

Readability Information for the Two Demanding Reading Passages

	Science	Literature
N of Sentences	25	26
N of words	705	667
Avg. Sentence Length	28 words	26 words
N of paragraphs	7	8
% of words 3 or more syllables	21%	14%
Dale - Chall Readability	College Grad.	College Grad.
Fry Readability	Gr. 15	Gr. 12
Gunning - Fog Readability	Gr. 19.7	Gr. 15.9
Flesch Readability	College Senior	College Jr.

Tasks

In both phases of the study, subjects were contacted in advance and told that they would be asked to read two demanding reading passages and tell outloud what they were thinking about as they read. In the first phase, the six subjects read the two college level passages of text and gave think-aloud on-line responses as they read. In the second phase, the six subjects were asked to read and think aloud as the first group had. As a further task, these subjects were asked to meet with the investigator the following day and give retrospective reports based upon their transcribed protocols.

Each think-aloud and reflective reporting session was conducted individually and the investigator was present throughout the session. At the beginning of each session, subjects were given the following instructions:

"I would like you to read out loud and to tell me how you are going about finding the main ideas in these articles. The stars highlighted in yellow have been placed between the sentences to remind you to think-out loud. You do not need to wait until you get to a marker to tell me what you're doing.

You should be aware that these passages have been chosen because the main idea statements are hard to summarize. Don't worry if a passage seems difficult."

This procedure was used because it was expected to result in identifying the comprehension processing of subjects as they reduced the articles to their gist (Brown, Campione & Day, 1981; Johnston & Afflerbach, 1984). In both phases of the study, subjects read the two passages aloud. As indicated earlier in chapter two, think-alouds were elicited from subjects in the same fashion used by Afflerbach (1985) and Lundeberg (1987). No specific, structured prompts were prepared in advance. When subjects did not volunteer statements about their reading, general prompts were used. The prompts included statements like, "What made you laugh?", and "What are you thinking about now?". Any

prompting statements were transcribed with the protocols. Interview time required of each subject averaged one hour. In the second phase, interview time to gather the six reflective reports on the following day averaged one hour and thirty minutes.

Recording of Data

When the taped protocols were transcribed, the think-alouds responses were inserted directly into the text to maintain the sequence of reading and think-aloud response. In the second phase, the subjects were asked to read through the protocol and to report reflectively on the text and their think-aloud comments from the day before. Provision of the transcribed information at the time of the reflective reporting was intended to counter the difficulty that Garner (1987) has identified. She points out the limitations of reflective reports when they are used to identify processes in which individuals engage automatically. Automatic processes are seen to be inaccessible upon reflection. This study sought to counter this difficulty by providing a record of the task and the think-aloud protocol during the reflective report.

Protocol Analysis

Phase One

The findings from the interviews were validated by the use of the regrounding procedure of repeated searches through the data

(Kamil, Langer & Shanahan, 1985). Applying the procedure of regrounding, the responses of the first six subjects were initially read through by the investigator on three separate occasions. A series of categories was developed to attempt to identify the various behaviors that the subjects described themselves as using. This was done to define the main idea comprehension processes and the comprehension monitoring and regulating processes by making inferences based upon the comments of the subjects. (See Appendix B for the summary of the categories developed by Afflerbach, 1985.)

As was previously stated, the transcriptions for each passage and for each subject included the text which had been read aloud and any think aloud comments the readers made about the text. The comments were inserted directly after the portion of text to which they applied. (See Appendix C for an example of a transcribed passage.) The comments were numbered in order of verbalization. Using the written transcripts and the audiotape together, the investigator reviewed the data and made notations as to the possible strategies being described by the subjects. This procedure occurred three times, at which point the investigator developed seven initial categories into which the readers' strategies for processing main idea were organized.

The think aloud comments were then coded for each subject and for each reading selection using the general categories. Additional descriptors were added to the coding resulting in the

generation of sub-categories. Appendix D illustrates the categories developed by the investigator in phase one of the study. The coded responses could include all of the comment made at the time the reader offered a think-aloud or parts of the comment could be separated. Think-alouds were separated into more discrete comments to indicate that the investigator believed the response was a series of self-reports about different processes. Each coding included a numerical identifier indicating the sequence of the comment in the protocol. The specific coding of the type of think-aloud response was based upon the general categorization of the response. This general categorization was followed by a letter indicating the sub-type of the reponse such as a lower case "a", the "a" signaling that the response related to the first sub-category of the general category. Thus "7-1a" indicated the response was the seventh think-aloud comment in the protocol and identified it as a structural strategy using a function word. Coding of the raw data involved marking the numerical sequence code for each response in the box for that subject, strategy, and passage. (See Appendix E for the chart used in the initial part of the study.) The summary sheet provided a cross-reference for the protocol, the subject, and the strategy.

In addition, the responses for each passage by each subject were mapped in sequence by strategy. This created an illustration of the subject's individual strategies over time as each went

about constructing main ideas. See Appendix F for an example of the sequential tabulation of responses.

Phase Two

In the second phase of the study the same procedures for analysis and coding of the data were used. The second phase involved the use of the retrospective reports of the subjects. This data provided triangulation with the analysis of the investigator. As a result of the analysis of this data the number of general categories was reduced from seven to six. Additionally, several additions and deletions were made to refine the sub-categories. This will be discussed in greater detail in chapter 4.

Reliability

The teacher/subjects think-aloud responses were also coded and catalogued into the seven general categories by another rater. The second rater was an early and middle years resource teacher. She was also a fellow graduate student specializing in the study of reading.

The method used was modelled after Afflerbach's (1985) method of establishing reliability. It was selected in preference to a method used by Lundeberg (1987). In Afflerbach's analysis of protocols, (8 subjects x 2 passages) he provided his reliability

rater with fifteen examples of each of his five categories. In Lundeberg's analysis of the protocols (10 subjects x 2 passages) she randomly selected five protocols and recategorized them herself. The use of another rater appeared to provide more objectivity to the analysis.

The second rater reviewed a selection of six of the twenty-four protocols. Three of these were protocols with on-line reports only. These were selected from the twelve protocols (6 subjects x 2 passages) of the first phase of the study. Three protocols with on-line and reflective reports were also selected from the twelve protocols (6 subjects x 2 passages) of the second phase of the study. The other condition involved in the selection was that three protocols were reports on the literary passage and three were reports on the science passage. No subject was included in the sample more than once. This sample reflected a second rating of one of very four protocols or twenty-five percent of the total protocols.

In addition, the second rater was asked to indicate the type of response based upon the six general categories of comprehension processing. The total number of think-aloud reports in the six protocols she was given amounted to 174. Therefore she rated 19 percent of the total number of think-alouds given by the subjects. Of these the investigator and the rater were in agreement on 85 percent of the think-alouds.

Chapter IV

RESULTS

The purpose of this study was to address the following questions: 1) How did expert readers approach the task of reading for main ideas in two demanding expository reading passages; and were the categories established in the initial study by Wood (1988) sufficient for the explanation of expert reader's reading behaviors? 2) How did the categories developed in this study compare with the model of main idea construction processing outlined by Afflerbach (1985) and what are the similarities and differences? 3) Can a more concise model of text processing be developed?

Protocols examined in this study included the text from the demanding reading passages, the think-aloud reports inserted sequentially after the portion of text read, and in six of the protocols (50 percent), a reflective report inserted after each think aloud report. This amounted to protocol information of 214 pages.

The examination of the approaches expert readers used, resulted in the development of two general comprehension processing categories as well as a series of sub-categories that subsumed further specific strategies. The categories were

identified as "main idea construction processes" and "monitoring processes".

Will the Previously Identified Categories (Wood, 1988) Need to be Modified?

Examination of the data after completion of the second phase of the study required that refinements be made to the model identified in the initial phase. The detailed discussion addressing question one, "How did expert readers approach the task of reading for main ideas in two demanding expository reading passages?", has been preceded by an outline of the refinements made to the model given in answer to the secondary question found in question one, " Were categories developed in the first phase of the study sufficient to describe the expert readers behaviours."

In the initial phase of the study of reading strategies, six expert readers were recruited. General categories, sub-categories, and strategies were identified through a qualitative analysis of the protocols. Each subject generated two protocols, constituting a total of twelve. The protocols consisted of the taped and transcribed think-alouds described earlier in chapter three.

The main idea construction strategies were divided into six sub-categories or types of behaviors. These sub-categories were 1) using structural cues, 2) using summarizing techniques, 3)

using examples 4) weighing the importance of concepts presented by the writer, 5) determining word meaning and 6) resorting to look backs to review the texts. See Figure 4 below for the sub-categories and a description of their specific processing strategies.

Figure 4

Sub-categories of Processes and Strategies Used in Main Idea Construction

1. Use of Structural Clues
   - function words
   - topic sentences
   - topic/pivotal paragraphs
   - familiar text structures

2. Application of Summary Techniques
   - repeats
   - paraphrasing
   - evaluate
   - confirm reader theory

3. Using Examples
   - confirming reader theory
   - unneeded information
   - validate author's theory
   - generate personal example

4. Weighing Importance
   - familiarity
   - early introduction
   - frequency of appearance
   - withholding judgement

5. Determining Word Meaning
   - by context
   - by structural analysis
   - by author definition

6. Resorting to Look Backs
   - reader error
   - unexpected text structure
   - verify theory
   - reread/skim

Comprehension monitoring, the second major category, described those behaviors observed when subjects were checking their progress or appeared to encounter difficulty with the text. The behaviors categorized as being of the comprehension monitoring

and regulation type included five sub-categories of behavior. These were monitoring: 1) the nature of the breakdown 2) the knowledge match, 3) the level of reader attention 4) the purpose for reading (the type of thinking required by the text and 5) reader affect, depicted in Figure 5.

Figure 5

Sub-categories of Processes Used in Comprehension

Monitoring

The nature of breakdown
The knowledge match
The level of reader attention
The type of thinking
Affect

As was stated in chapter three, the second part of the study involved the collection of the protocols of six additional subjects. These twelve additional protocols (six subjects x two passages) included a retrospective report along with the think-aloud reports. Adding this information to the data pool resulted in a total of twenty-four protocols from twelve subjects. As the following discussion suggests, the categories developed in the first phase of the study had to be modified.

General Refinements to the Original Model

The subsequent repeated reviews of all of the protocols from both the first and second phases of the study brought about several adjustments regarding the two original categories and their sub-categories. These included: 1) clarifying the reading behaviors by labeling the sub-categories more fully; 2) adding an evaluative sub-category under the the first main idea construction sub-category, structural cues; 3) transferring one sub-category, determining word meaning by author definition from the word meaning category to the structural cues category; and most significantly to the model, 4) the removal of the "look back" strategy from the category of main idea construction strategies and its inclusion in the group of behaviors associated with monitoring and regulation. These changes are illustrated in Table 3, as are the frequency of subject reports for the categories, sub-categories and strategies. The specific rationale underlying these changes is presented following the discussion of each of the behaviors. The discussion has been organized according to the two text processing categories, with explanations and supporting evidence for the sub-categories and strategies.

Discussion of findings in relation to each of the main idea construction subcategories consists of five separate sections which consider: structural cues, summarization, use of examples and analogies, weighing importance and determining word meaning.

This is followed by a separate discussion of the monitoring and regulation of comprehension. Within each of these sections is a table illustrating the frequency of each of the reading behaviors found under that category and excerpts from the protocols that describe different elements of that reading behavior. The excerpts are samples of the text, the think-aloud protocols, and in some cases the reflective report. The reflective reports were used to confirm the investigator's coding and help to illustrate and clarify the examples. The excerpts used are intended to be examples that best represent the processes used by the twelve subjects.

Table 3

Frequency of Think-aloud Reports by General Strategy and Sub-Category

Main Idea Construction Processes				
Category	Total number of Reports			Percent of Total
	Literature	Science	Total	
Structural	52	37	89	10%
Summarization	126	147	273	30%
Examples	63	59	122	13%
Importance	59	45	104	11%
Word Meaning	12	17	29	3%
Comprehension Monitoring				
	Total number of Reports			Percent of Total
	Literature	Science	Total	
Look Backs (reader cause)	29	40	69	8%
Look Backs (text cause)	12	17	29	3%
Nature of Breakdown	42	30	72	8%
Knowledge Match	32	34	66	7%
Reader Attention	14	9	25	3%
Purpose	9	5	14	2%
Affect	11	17	28	3%
Total Responses For Passage Type	461	457	918	

Main Idea Construction Processes

Use of Structural Cues

Five strategies pertaining to the use of structural cues were identified in the examination of the expert readers' protocols.

The structural cueing strategies included use of: function words, topic sentences, topical paragraphs, reader knowledge of text genre, and reader evaluation of the text structure. In using the last three of the structural cueing strategies mentioned above, readers appeared to examine large units of text and to make generalizations across large blocks of text. The fifth strategy, reader evaluation of the text structure, seemed to emerge when readers found their expectation regarding the structure of the text was not met. Using all of these cues the readers appeared to develop a structural pattern that they would sample as they read on. Table 4 below illustrates the frequency of the use of these strategies by the twelve subjects.

Function Words

The strategy of using function words was coded as the use of a word which did not have a specific conceptual meaning in the passage but which the subject, judging by the verbal report, appeared to be using as a road map or organizational cue to the text.

Examples of function words are represented by the following excerpts.

Excerpt 1

Reads: "For example, one finds throughout the movie the recurring presence of water symbolism often being associated with creation, fertility, or the mystery of origin."

Thinks aloud: "Ok ... sounds like he's starting to develop this first sentence."

Reflects: "I am pleased that he's fulfilling an expectation that I have that he's going to follow the linear track that I want him to ... he's said that we're talking about mythic component and then he carries on with water symbolism."

Table 4

The Frequency of Usage of Strategies Using Structural Cues

Sub-category	Total in Each Passage		Total Response
	Literature	Science	
Function Words	14	7	21
Topic Sentences	9	7	16
Topical Paragraphs	7	9	16
Familiar Text Structures	10	9	19
Evaluation of Structure	12	5	17

Excerpt 2

Reads: "Contrasting father figures give an archetypal balance to the movie's symbolic structure."

Thinks aloud: " Now I'm thinking about the balance there... the balance betwenn father figures and... the what... ."

"For example" and "balance" appear to act as cues to the readers as to the organization of the concepts surrounding those

words. In the case of "for example" the subject reported finding in the think-aloud that he anticipated the concept in the preceding sentence would be developed in the sentence beginning with "for example". This interpretation of the strategy was reinforced by the comment found in the reflective report where the subject stated that he anticipated a linear structure. In the instance of the word "balance" the reader appeared to know that the writer expected readers to make judgements about another element of equal importance to the concept "father figures". Other reports found in the protocols demonstrated similar reader understanding of the use of function words. These included the knowledge that the word "if" could indicate the beginning of a summary statement and that readers were very sensitive to the need for proper anaphoric references.

Topic Sentences

Readers appeared to use topic sentences to make an outline of the text's organization. Topic sentence usage was coded as those reports in which the subject made specific reference to a sentence as a means of organizing the text. Excerpt three illustrates this.

Excerpt 3

Reads: "Nitrogen fixation provides the greatest challenge to this physiologocal selection approach because the process really occurs in modified bacteria living in the plant roots."

Thinks aloud: " so we're obviously going on to the second stream he mentioned, this is nitrogen fixation.. one of the two major ones... obviously they've dealt with all they're going to about photosynthesis.. this is nitrogen".

The subject's report appears to indicate that the sentence was a sign post signalling the beginning of a paragraph and in this case end of a discussion that took up a large portion of the text. The reader has made a reference in his on-line report to a previous sentence near the beginning of the article in his reference to "one of the two major ones". The reference "one of the two major ones" and others like it may add weight to the belief that expert readers develop structural patterns and then sample the text to test the validity of their self-constructed structural pattern.

Topical Paragraphs

The use of topical paragraphs was coded as a response in which subjects indicated in their reports that they had organized the structure of the passage globally, based upon a series of cues from within a paragraph. This strategy was most often observed to occur at the beginning of the text. In some instances the reader referred to the paragraphs found later in the text. The expert reader seemed to find that the later appearing paragraphs served a function like that of an introductory paragraph. The later paragraphs appeared to play a pivotal role for the reader. That is to say, the paragraph provided further clarification of the text's

structure where the reader may have been anticipating a number of potential patterns to occur.

Excerpt 4

Reads: "And the teacher can easily use this film to show how archetypes and irony make their appeal to the serious audience, without in any way making the film less entertaining."

Thinks aloud: I'd say that's an introductory paragraph that's introducing the film "Swinging for the Fences" and I'm skimming now to find out if that's right".

Excerpt 5

Thinks-aloud: ".... I can see why he's split the paragraphs now.. he's followed through... he's talked about the women... and then goes back into the father.. I can see his purpose"

In excerpt four, the reader identified the paragraph as an introductory one and appeared to move on into the text to determine whether or not the writer would continue to focus on the film. In excerpt five, the reader made a reference to the writer's decision to organize the middle of the passage into a series of paragraphs. The reader's use of the word "now" in the think-aloud may indicate that the reader had some concern as to the logic of the writer's organizational pattern. At this point in sampling the text structure, the subject may be revising her pattern based upon this new text sample.

Familiar Text Structure

Familiar text structures were coded as those responses that seemed to indicate the reader had knowledge of certain conventions of writing. In some instances readers reported that they anticipated a word would be defined after it's introduction. In other instances, readers indicated that they expected acronymns would be used only after the full name had been given. Of the responses that were coded as showing familiarity with written convention, the subjects most frequently appeared to identify a style of writing.

Excerpt 6

Reads: 'In a May 14, 1944, Time review,"Swinging for the Fences", Richard Schickel says that The Natural is an American myth Bub, and don't you forget it.'

Thinks aloud: " Ok this is a Time review".

Reports reflectively: " I'm trying to look at it...well usually if I look at a story..I was thinking of reading the movie reviews in the Time magazine..it's going to tell me about the movie and whether I'd like to see it or not."

Excerpt 7

Reads: 'The "American Dream" constitutes the movie's mythic foreground: the country boy leaves the farm on an interrupted journey toward success as a major league baseball player'.

Thinks aloud: "So here we have the typical boy who grows up on a farm and as he journeys he is stopped along the way and I'd imagine here he's having varied experiences as he's stopped and then he reaches his goal as a major league

baseball player so he comes to his career with all of these background experiences from the farm and his journey."

In excerpts six and seven the readers have identified patterns of writing with which they are familiar. The subject who reported in excerpt six appears to be identifying a familiar structure used in expository writing,a critical review. The subject who reported in excerpt seven seems to be familiar with a structural pattern used in narrative writing. Think-aloud and retrospective reports found in the protocols may support the argument that expert readers make use of their familiarity with genre to provide them with a general pattern with which to follow the text.

Evaluation of Text Structure

In the opening of this chapter it was indicated that the initial study resulted in the grouping of the subjects' evaluative comments as a strategy called evaluation under the sub-category of summarization. With the addition of the protocols of six more subjects and the repeated reviews of all twenty-four protocols, it became apparent that readers were making evaluative comments of two kinds, about: the organization of the text itself and the the concepts being presented. To accommodate the differences between these two types of responses, the evaluative comments about structure were coded under the heading of structural cues. The evaluative comments about the content or concepts were coded under the heading of summarization and will be addressed later. After

examination of the evaluative comments about structure which readers reported in their think alouds it seemed that often such a report was made at a time when comprehension broke down.

Excerpt 8

Reads: "Universal archetypes are there as well, often integrated into the ironic spirit of the film"

Thinks aloud: " I don't know why he has to get the two all tied up together..why can't he just do it with one ... I guess I'll have to find out."

Reports reflectively: "Yeah ... and there's just carrying on with that same feeling because my preference is for a linear progression following one thing through and picking up another and following it through ... ."

Excerpt 9

Reads: "If individual physiological processes do determine the pattern of growth, if they are indeed genetically determined and if the technology to measure them can be developed, then plant breeders will have powerful new tools to use for plant selection."

Thinks aloud: " It sounds like a conclusion... it sounds like a concluding sentence to me but... I'm feeling at this point he hasn't really told me that much.. so I'm going to read the last sentence and then confirm that."

Reports reflectively: So I'm creating an expectation for the last sentence here like it's gonna tie everything up in such economical and efficient terms that it will be really impressive."

Evaluation of the structure of the text appeared to be a strategy that the expert readers employed when main idea comprehension did not occur. This interpretation is based upon think aloud reports like those in excerpts eight and nine that express reader dissatisfaction. The readers in this moment of dissatisfaction identified a feature of the text structure they

believed caused them to have comprehension problems. In excerpt eight, which occurred early in the passage the subject identified the problem as being what the reader regarded as a complicated way of presenting the concepts. In excerpt nine the subject identified the problem as being a concluding sentence in the text prior to the subject being prepared to conclude.

Summary

The study's interpretations of the reports given by the expert readers appear to be compatible with current theory. Anderson (1985) proposed that readers possess schema-theories both for text structure and for content. It is argued that the expert readers in this study demonstrated organized knowledge of expository text in both content and structure. Specifically, they showed knowledge of the roles of function words, topic sentences, topical paragraphs, genres and writing patterns, and evaluated the structure of a passage. The fashion in which the subjects made use of text to create a pattern and then sampled structural elements to verify or to change the pattern appears to be consistent with the schema-theoretic view of the use of structural cues as strategies for determining main idea. Sampling to verify and change was a strategy Afflerbach (1985) labelled "draft and revise". Afflerbach also reported that his subjects made use of text structure knowledge in their "hypotheses testing", a strategy he considered to be related to main idea construction.

Additionally the comprehension processing reported by subjects in this study appears to be consistent with van Dijk and Kintsch's (1983) discourse comprhension model in that the expert readers reported using function words. These compare to microstructure elements described by van Dijk and Kintsch. The expert readers also reported examination and revision of larger text elements that may be likened to macrostructures.

The most significant element of the reading behaviors of subjects in this study related to structural cues appears to be the evaluative statements made about the text structure. The think aloud reports indicate that expert readers possess the ability to define the nature of the interference in their comprehension processes. It appears that identifying the problem is an important step in comprehension monitoring and the subsequent selection of a fix-up strategy.

Application of Summary Techniques

Four strategies pertaining to summarizing were identified in the examination of expert readers' protocols. The summarization strategies included restatement, paraphrasing, evaluation of content and confirming a reader's theory. Summarization was the category of strategies reported with the greatest frequency. Summarization accounted for 34.9 percent of all think aloud responses. Table 5 illustrates the frequency of the use of these strategies by the subjects.

Table 5

The Frequency of Use of Summarization Stategies

Sub-category	Total in Each Category		Total Responses
	Literature	Science	
Restatement	17	24	41
Paraphrase	30	43	73
Confirm Reader Hypothesis	50	47	97
Evaluate Content	29	33	62

Restatement

Restatement is included as a summary strategy since it was similar to another summarizing strategy that subjects frequently used, paraphrasing. As the subjects thought out loud in their

efforts to determine main idea, there were examples of individuals repeating the text verbatim.

Excerpt 10

Thinks aloud: "If you can use genetic engineering techniques on cell structure you can scientifically control ... selection ... breeding ... I think I just regurgitated it ... I've got to read it again ... I was saying it but I didn't understand it."

Excerpt 11

Reads: 'When plant breeder's survey a plant species, they hunt for traits that they know will make it a better food crop; this "agronomic performance" as they call it is determined by a number of the plants traits, things like plant height, the time of flowering, resistance to disease, and so on.'

Thinks aloud: "Ok the traits ... height, time disease ... ok."

Reflects: ".... this is an ok it's sort of a note to myself to start thinking (laughs) and this is an ok I've filed it."

Restating the text may serve as a breathing space for the reader to refocus attention on comprehension of the text. Reports that included restatements of the text also indicated some regulation of thinking. In excerpt ten, the subject returned to the text for a second reading. In exerpt eleven, the subject reported using the restatement to file the information in memory. Additonally in excerpt eleven, it was noted that the reader appeared to be developing a list of terms.

Paraphrases

Paraphrases were coded as those responses that readers gave in which the text had been restated in different words.

Excerpt 12

Reads: "Situational irony supports the plot at this time because in order to acquire the remaining shares of the team, the judge must insure that the Knights lose, rather than win the pennant."

Thinks aloud: "Hum ... easier to attain the shares if they lose ... cheaper team ... cheaper shares."

Reflects: "and so when I'm reading this ... I'm trying to think of the plot itself and why the judge must insure that the Knights lose."

Excerpt 13

Reads: "But once again irony supports the mythic dimensions because, thinking him too old to help the team, Pop himself is not wise enough to put Hobbs in the lineup immediately."

Thinks aloud: "So even his father figure can't credit him"

Paraphrasing appeared to be a strategy that indicated the reader was able to accommodate the information successfully. Generally, subjects restated the information in their own words which seemed to function as a means of emphasis in order to aid memory.

Confirming a Reader Hypothesis

Coding responses as confirmation of the reader's hypothesis occurred when the think aloud indicated that the subject was

reviewing the conceptual details of the article with regard to a main idea. The intent of the subjects appeared to be to make a comparison between a hypothesis they had held and a hypothesis presented in the text.

Excerpt 14

Reads: '"The American Dream" constitutes the movie's muthic foreground: the country boy leaves the farm on an interrupted journey towards success as a major league ball player.'

Thinks aloud: '"Swinging from the Fences" is the name of the review and "The Natural" is the name of ... the movie so he's just talking about the term the American Dream and it's the myth in the movie.'

In excerpt fourteen, the subject has reviewed a series of key phrases from the text and then has paraphrased them making a global statement about the text. Because the paraphrased global statement deals with ideas beyond a single sentence it may be an attempt at confirming a reader hypothesis about the text's content. It was also noted in reviewing the protocols that simple paraphrasing statements were often followed soon after by global statements that appeared to confirm a reader hypothesis about the text.

Excerpt 15

Reads: 'Nevertheless as exciting as this is, Mahon is only cautiously optimistic: "Even though we can genetically increase the photosyntheitc efficiency of each square centimeter of leaf and show that this leads to increased growth, differences in the plant's ability to produce leaves can make an apparently high photosynthetic type seem very unproductive."'

Thinks aloud: 'This one is a little difficult I think I'm going to reread here ... "the efficiency of each square centimeter of leaf" and "show that this leads to increased growth" ... "differences in the plant's ability to produce leaves can make an apparently high photosynthetic type seem unproductive"... so this knowledge that the scientists have doesn't seem like it can be applied to all plants.. that it depends a lot on the plant's make up as to whether it will be successful or not and it seems to me by what I've read that peas would seem to be an ideal plant to work with in this regard.'

Excerpt fifteen illustrates a second pattern associated with the confirming strategy. Confirming a hypothesis was observed to follow comprehension breakdown. In the verbal report above, the subject has indicated a breakdown in comprehension. The breakdown was identified by a need to reread the text. The subject then proceeded to confirm a hypothesis about a portion of the text that extends back to the statement about peas. This block of text spanned six sentences that included over one hundred and thirty words.

Evaluation of Content

The last and what appeared to be the most wide ranging summarizing strategy exhibited by the subjects was the strategy of evaluating the content of the text. The expert readers made statements that were interpreted as being judgements about the value of the text.

Excerpt 16

Reads: "because there is a sudden change of tone: the insidious illusion of a beautiful siren turns rapidly and unexpectedly ugly."

Thinks aloud: "I'm thinking well that's not a sudden change of tone either because a siren is someone who's going to shipwreck you ... so I'm just ... what an I thinking ... I don't think he's developed that as well as ... he hasn't made the point I think he wanted to make there"

Reflects: "There's another expectation that's contradicted I think he's ... I'm mentally arguing with him about the siren image."

In the excerpt above, a comprehension breakdown seemed to have occurred in the form of a difference of opinion between the reader and the writer. The subject appeared to evaluate the logic or validity of the writer's argument. Other evaluations of the content that were reported included making note of similarities or differences in the experience of the subject and the argument of the text. In such cases, the reader would suppport the text if the argument supported his or her experience and would take a different stance from the writer's argument if in the reader's opinion the writer's argument was not valid. In some instances subjects would supply a summary sentence of their own to emphasize the difference.

Excerpt 17

Thinks aloud: "I guess my mind was looking for something to carry on ... a few words beyond that ... genetic engineering techniques to improve such and such ... it ended too soon ... to quickly for me."

Reflects: "I think I've been conditioned to expect more complete or more florid concluding statements you know more wordy ones maybe and he took me out almost to the end of the dock but we didn't jump off there at the end of the sentence"

It was difficult for the purposes of the study to determine whether the provision of such a summary sentence should be reported as an evaluative comment or as a confirmation of a reader hypothesis. The summary statements reported were relatively few in number. Since these summary statements were a criticism of the text, they have been reported as evaluative.

Summary

The interpretations placed upon the strategies demonstrated by the expert readers in this study have support in other research. This study suggests that restating the text is a strategy used to create a focus for attention and perhaps to identify the point at which to attack a breakdown in comprehension. As such, it may illustrate a regulation of cognition (Brown 1985). Additionally, Afflerbach (1985) describes "listing" as a main idea construction strategy in which readers actively search for key words in the text or their memory store to be used in main idea construction. There appear to be similarities between Afflerbach's main idea construction listing process and this study's strategy of restatement.

Paraphrasing, as a form of summarizing, finds support from the schema-theoretic model. Anderson (1985) indicates that one function of a schema may be to allow readers to retain important propositions and eliminate trivial ones. As was indicated earlier, the findings of this study were that paraphrasing functioned in conjunction with making more global statements. It may be argued that the paraphrasing strategy provided a means for expert readers to accommodate more signicant parts of the text into their schema. The use of paraphrasing as it is described in this study can also be related to van Dijk and Kintsch's (1983) model. The expert readers in this study have used paraphrasing to create more global statements. This seems to parallel the van Dijk and Kinstch proposition that since only a limited amount of information can be stored in working memory, readers make efforts to create cycles of memory to integrate the information into more general, more memorable macropropositions.

Although they have been catalogued under different headings, the evaluative strategies reported by the subjects in this study are similar to those in the Afflerbach study (1985). Afflerbach has identified evaluation as a strategy related to main idea comprehension. He describes three general types of evaluative strategies: author related, text related, and reader related.

The evaluative strategies reported as content evaluation in this study relate closely to Afflerbach's subcategory of author related strategies in which the expert readers evaluate the

writer's command of the subject matter. This type of evaluation was illustrated previously in excerpt sixteen.

Afflerbach's text related strategies were also observed in this study. These strategies have been characterized as content strategies in this study because readers identified their experiences as being similar or dissimilar with the content or theme described in the text. Some elements of Afflerbach's evaluative straegies have been previously addressed in the discussion of the category of strategies related to structural cues. Others will be dealt with under the general heading of comprehension monitoring strategies.

The strategies of confirming a reader hypothesis and of evaluating the content provide some evidence to support the work of Brown and Day (1983). The condensation of thought that is involved in creating a global statement to state a reader hypothesis shares similarities with two of Brown and Day's rules for summary writing. The stating of a hypothesis seems to be like the rule for superordination of lists and the rule for selection of a topic sentence. The evaluation of the content suggested as a strategy in this study provided examples, such as in excerpt 17, in which the think-aloud statement generated a summary sentence for the paragraph. This resembles the fifth rule of Brown and Day's rules for summary writing, invention.

The Use of Examples as a Construction Process

Four strategies related to the use of examples were identified in the reports of the expert readers. These were: confirming a reader hypothesis, recognition of unneeded information, validation of text, and generation of a personal analogy. Table 6 illustrates the frequency of the use of these strategies by the expert readers who participated in the study.

Table 6

The Frequency of Usage of Examples as a Strategy

Sub-category	Total in Each Passage		Total Response
	Literature	Science	
Confirm a Reader Hypothesis	24	11	35
Unneeded Information	7	14	21
Validate Text	27	12	39
Generate a Personal Analogy	5	22	27

Confirming a Reader Hypothesis Using Examples

Confirming a reader hypothesis through the use of examples appears to be distinct from confirmation of a hypothesis as a summarizing strategy in that readers made specific reference to examples in the text in making the hypothetical statement. Two features of the strategy of confirming a reader hypothesis with

examples were observed. The first was expressing the expectation that examples would be given to aid the development of a reader hypothesis. The second was the generation of a reader hypothesis in the presence of text examples. Excerpts seventeen and eighteen illustrate two features of the use of examples in confirming a reader hypothesis. In excerpt seventeen, the reader states that she has developed a hypothesis, but her comprehension monitoring requires that it be confirmed.

Excerpt 17

Reads: 'Barbera Hershey plays a femme fatale, a "terrible mother" type who veils herself in symbolic black (evil, mystery, death) before pulling the trigger'.

Thinks aloud: "Okay when I read that word femme fatale it says...okay archetypal talks about a particular type like a femme fatale and so I'm going to look to see if they give some specific examples to see if my definition fits."

Excerpt eighteen illustrates the fashion in which ideas from the text and ideas from the reader's store of background information can combine to complete the process of confirming a hypothesis through the use of examples. The term being defined is one introduced in the opening paragraph of the article and reintroduced in the opening sentence of this paragraph. The subject was apparently motivated to "fit" the term into her hypothesis. The confirming hypothesis statement that concludes the think aloud was interpreted by the investigator to mean that she had been successful.

Excerpt 18

Reads: 'This is a true "symbiosis" with the bacteria receiving energy from the plants phtosynthesis and giving up usable nitrogen to the plant for growth."

Thinks aloud: "I know what nitrogen fixation is!! I think nitrogen fixation is the plants ability to give the nitrogen back to the soil as a natural fertilizer sort of ... or to take the nitrogen from the soil".

Examples as Unneeded Information

The reader/subjects of this study identified unneeded information in the examples that the writers of the texts used. Two behaviors were observed. The first was the simple provision of a label for a list. The second behavior was the generation of a hypothesis statement. Identifying the list by a label , "the two guys", as in excerpt 19, may be a way of reducing the information required in working memory. In excerpt twenty, it appears that the subject may be dismissing the example as unneeded information, since his recognition of the example is followed by a global statement that can be described as a confirmation of the reader's hypothesis.

Excerpt 19

Reads: "During the last seven years, John Mahon and geneticist Dr. Shaun Hobbs have been studying the genetics of physiological characters and how they relate to the usual agronomic traits such as seed yield, seed protein, and harvest index (the economically valuable proportion of the plant)".

Thinks aloud: "Okay this is just about the two guys who start studying the genes ... and the cells and things to see if there is some trait."

Excerpt 20

Reads: " This is a true "symbiosis" with the bacteria receiving energy from the plant's photosynthesis and giving usable nitrogen to the plant for growth."

Thinks aloud: "it's not a definition of symbiosis but it's an example ... symbiosis doesn't need to be plants ... it's two organisms living off each other with both benefitting"

Using Examples to Validate Text

The behavior observed in validating the text involved the reader examining the within-text-match between text examples with the text's arguments. The strategy of validating text has similarities to two previously considered sub-categories; evaluation of content and evaluation of structure. It also has similarities with the strategy of using text examples to confirm a reader's theory. Validation of text was separated from evaluation of content and of structure because it appeared to be a specific strategy sparked by the presence of text examples. It is also separate from the strategy of using examples to validate the reader's hypothesis. In the case of confirming a reader hypothesis discussed earlier in this section, the expert readers seemed consumed with this inability to comprehend by using the examples. Validating the text is specific to the match between arguments and examples within the text. Excerpts twenty-one and twenty-two provide examples of the expert reader finding fault

with the within-text-match. Excerpt twenty-two provides an example of an expert reader approving of the within-text match.

Excerpt 21

Reads: "Played by Glenn Close, she is named Iris, suggesting the Greek goddess of the rainbow."

Thinks aloud: "I wonder if the guy who sat down to name her knew that Iris was the Greek goddess of the rainbow but maybe he did."

Excerpt 22

Reads: "Once again, an ironic contrast heightens the dramatic effect, because Iris, at this point, is the foil whose presence underscores the detrimental influence of Memo, am influence to which Hobbs is blind."

Thinks aloud: "... I want to see how she's the foil but I can't ... he's left you with a question, a question he hasn't answered."

Reflects: "I've got a bit of a reaction ... you should be writing this so that people who haven't seen the movie can still get a sense of it but he seems to have contained the audience."

The above excerpts were critical of the within-the-text match between the statement and the examples given to support the statement. In excerpt twenty-two, the subject directed his criticism at the writer personally. Referring alternately to the text and the author was a pattern that occurred in almost all subjects. The expert readers appeared to identify the problem as insufficient detail in the example.

Excerpt 23

Reads: ... this "agronomic performance as they call it is determined by a number of the plant's traits, things like plant height, the time of flowering, resistance to disease and so on."

Thinks aloud: "looking for traits that make it a better food crop and then they list them here for you."

Generating Personal Analogies

Readers exhibited a tendency to use the the text as a jumping off point for personal analogies. In some cases the purpose for the analogy could be easily identified as an attempt by subjects to relate their personal knowledge to the text. In others, the analogy was not directly related to resolving the main idea of the text.

Excerpt 24

Thinks aloud: "I'm thinking that makes a lot of sense and I'm assuming that would include things like production..the amount of water it might need ... the amount of sunlight it might need ... I can relate it to wheat ... a long time ago there were a really small number of wheat varieties grown on the prairies."

Excerpt 25

Thinks aloud: "Hm ... almost comparable to human beings when their looking for characteristics in a plant you also have characteristics in a human being that are produced by different types of genes."

In excerpts twenty-four and twenty-five, the subjects have made hypotheses using a portion of the text where the writer has used examples. At that point the readers have also generated

analogies of their own. The generation of personal examples may be indicative of the top-down processing of text in that the reader seems to have made determinations as to what background knowledge they have "fits" the schema for the text.

Excerpt 26

Thinks aloud: " I don't really like this passage ... it's just like ... to me it brings back memories from doing that course and how I struggled to get through it."

Excerpt 27

Thinks aloud: "... water symbolism I remember doing a paper on Middlemarch and water imagery so my interest is piqued."

In excerpts twenty-six and twenty-seven, the readers have called up personal experiences in response to the text. In excerpt twenty-six, the subject has identified an unpleasant experience that she related to the text. In excerpt twenty-seven, the reader indicates growing interest. The reason for the generation of affective statements in the presence of text examples is unclear. It may be explained by the fact that the test passages used frequently employ specialized content vocabulary when examples were given. Such vocabulary may spark comprehension monitoring which would engage a variety of other strategies indicating relative success or failure in main idea comprehension.

Summary

The readers' expectation of examples may be illustrative of several of the elements of the schema theory model. First, Adams and Collins (1985) describe the instantiation of schemata with data that is processed from the bottom up. This means from the text to the reader. The term instantiation refers to the match between reader knowledge and information from the text. Adams and Collins suggest that bottom-up processing insures reader sensitivity to information that is novel or that does not fit the reader's on-going hypothesis. Second, top down processing helps the the reader resolve ambiguities or select between alternative interpretations. It may be that the reader strategy of expecting examples to follow statements is a form of bottom-up data processing. The reader then makes use of that data to confirm a top-down process, a reader hypothesis of the text.

Treating examples as unneeded information was illustrated in excerpts ninteen and twenty. Identifying the names of the researchers by the term "the two guys" as illustrated in excerpt nineteen may be a behavior consistent with van Dijk and Kintsch's (1983) condensation rules of deletion or generalization. There is also consistency with two of the five rules Brown and Day (1983) give for summary writing. The report may be an example of Brown and Day's "deletion of redundant material" or "superordination of lists". Afflerbach (1985) suggests that in listing examples,

readers may have be performing an importance assignment task. In these excerpts importance assignment would include the following steps: a) the assessment of reader prior knowledge followed by b) the limitation of the resources engaged in the task when the reader discovered insufficient prior knowledge. The strategies described by van Dijk and Kintsch, Brown and Day, and by Afflerbach are all designed to reduce the text to a more managable "gist". Making global statements about the text in the presence of examples, as was the case in this study, illustrates another strategy readers use to construct a hypothesis regarding the gist of the texts they read.

It is worthy of mention that in voicing their criticisms or approval, readers frequently made communicative comments to the writer. These comments were found chiefly in three areas: 1) evaluating the structure of the text, 2) evaluating the content of the text and 3) validating the within-the-text-fit of examples and text arguments. These evaluative comments indicated that the expert readers regarded themselves as being the writer's peers. Also, the text was not regarded as an abstract thing, but as a means of communicating between individuals. In addition, readers frequently expressed the expectation that competent writers would keep the needs of the reader in mind. These attributions will be dealt with in more detail under the heading of comprehension monitoring.

In the excerpts used to illustrate validating text, it is apparent in excerpt twenty-one for example, that the reader is very critical of the text. This is apparently due to the fact that the example is not given in sufficient detail. Validation of the statements within the text through the writer's examples may be tied closely to the ability of subjects to monitor their knowledge match. Adams and Collins (1985) suggested that bottom-up processing insures reader sensitivity to information that is novel or that does not fit the reader's on-going hypothesis. Validation of the text may have occurred when the reader used the writer's examples to develop a schema for the text, thereby engaging in bottom-up processing. The effect of this strategy may have been an unsuccessful attempt to instantiate the data from the text with the subjects' schema and in turn this activated comprehension monitoring. The result of the monitoring was the subjects' identification of the problem as an inadequacy in the examples.

The suggestion that readers are able to use the analogies to "fit" information into their hypotheses has some support from other research. Afflerbach (1985) reports that in his qualitative analysis, analogy served to put less familiar text within a framework where it was better understood, and where the relative importance of the text might be more accurately determined. In excerpt eighteen, the subject made a judgement about the relative importance of a term from early in the text using the text example that followed much later. This resulted in her statement of

hypothesis. As was indicated in the reporting of the results related to analogies, the reason for the generation of affective statements in the presence of text examples is unclear. It may be explained by the fact that the test passages used frequently employed specialized content vocabulary when examples were given. Such vocabulary may spark comprehension monitoring, which would engage a variety of other strategies, indicating the relative success or failure of main idea comprehension.

Weighing Importance as a Construction Process

Strategies used for weighing importance were pertinent to the readers main idea construction processing in that the strategies reported appeared to aid in determining where text processing energy was to be directed. Four strategies pertaining to the use of weighing importance were identified in the examination of the expert readers' protocols. The strategies related to weighing importance included 1) familiarity, 2) early introduction, 3) frequent appearance, and 4) withholding judgement about the term or concept. The subjects often selected the same passage as their peers for the focus of their attention. Table 7 below illustrates the frequency of the use of these strategies by the twelve subjects.

Table 7

Frequency of Usage of Weighing Importance as a Construction Process

Sub-category	Total in Each Passage		Total Response
	Literature	Science	
Familiarity	17	20	37
Early Introduction	10	3	13
Frequency of Appearance	7	3	10
Withholding Judgement	25	19	44

Familiarity

In some reports the expert readers indicated that they possessed high content knowledge of the term and were able to assign importance on this basis.

Excerpt 28

Thinks aloud: " Antagonist ... ... I've come across that word in other literature that means someone who causes conflict ... who's antagonistic ... ok".

In excerpt twenty-eight the subject identified the term as being important by stating it in his think-aloud. The familiar word allowed him to access prior knowledge. The subject made accessing the prior knowledge apparent in calling up of the related terms "conflict" and "antagonistic".

Prior knowledge was also accessed in instances when the word was familiar but the content knowledge was apparently low.

Excerpt 29

Thinks aloud: "I didn't think of that as a physiological process although I know it is ... I think of physiological ... you know the geographic term ... mountain ranges ... one set of vocabulary getting in the way of another set"

In excerpt twenty-nine the subject appears to be sure of a meaning of the term physiological. The subject has also identifed the fact that the term is used differently in the text. Because of her familiarity with the word she attached significance to it.

It is worth re-emphasizing the significance of the expert readers' use of text structure cues which was discussed earlier. In addition to accessing their prior knowledge in assigning importance based upon familiarity arising from content knowedge expert readers assigned importance based upon familiarity with text structures. Schema for text structure was apparently used as a compensatory stategy when schema for content appeared to be low.

Excerpt 30

Reads: "Physiological processes, on the other hand, tend to be components of these larger characteristics, and thus controlled by a smaller number of genes."

Thinks aloud: ".. it tells me I've missed something and I have to go back and read the last sentence.... visible ones are controlled by a large number of genes ... physiological ones by a small number of genes.

The expert reader noted the statement, "on the other hand", and used it to assign importance to the terms from the text mentioned in the think aloud. This excerpt illustrates the interrelationship between weighing importance strategies and the other comprehension strategies employed by expert readers. The summarizing staement of the reader indicates that the contrast indicated by the strucural cue "on the other hand" has been confirmed in the reader's schema for the content.

In some instances the expert readers with low content knowledge chose to disregard knowledge of text structure as a compensatory strategy. In these cases expert readers assigned importance to text based upon content knowledge rather than upon text knowledge. Excerpt thirty-one uses the same portion of the science text as was used in excerpt thirty as a contrasting example of how a miscomprehension occured when the subject attempted this.

Excerpt 31

Reads: "Physiological processes, on the other hand, tend to be components of these larger characteristics, and thus controlled by a smaller number of genes."

Thinks Aloud: "that's new I hadn't realized that the different numbers of genes in a plant would account for the different characteristics ... "

The think-alouds of the two subjects in excerpts thirty and thirty-one are in sharp contrast. A closer reading of the text

confirms the interpetation of the expert reader quoted in excerpt thirty. In the one sentence the writer mentioned that visible characteristics of plants were controlled by a large number of genes. The writer used "on the other hand" to signal a difference in his examples. In the think-aloud in excerpt thirty-one the subject overlooked the structural cue "on the other hand" and assigned importance to the phrase "controlled by a smaller number of genes". This importance assignment occurred within a sentence and ignored the larger context of the paragraph. The confirming hypothesis of the the second subject is that two plants could have different numbers of genes controlling the same feature and this would account for the differences in the way they developed.

An issue arises as a result of this type of importance assignment. Readers with low content knowledge who relied on content knowledge assigned importance to elements of the text that differed so much from the writer's intended schema that they had to devote considerable energy in revision. It is arguable that readers with low content knowledge were required to assign importance to items because they were unsure of the relationships between the items. Readers with higher content knowledge did not need to do so. This will be examined more closely in the portion dealing with withholding judgement.

Early Introduction of a Term

Early introduction of a term seems to be a signal establishing importance. Identifying importance in this fashion further illustrated the close relationship between comprehension and the subjects' text-schema. Terms identified as important in the think alouds were often at the beginning of the passage where the readers appeared to anticipate the writer outlining the overall hypothesis of the text. Identifying importance also occured at the beginning of a paragraph where subjects would be aware that a writer would likely outline the argument or hypothesis for the paragraph.

Excerpt 32

Reads: "During the last few years, scientists at NRC's Prairie Regional Laboratory have taken a long second look at at the art of plant breeding to see if advancec in plant physiology can be used to help the breeder make his selections."

Thinks aloud: "we're talking about plant breeding.. plant physiology .. a wierd word I wonder what we're talking about."

The subject indicated that the term appearing in the first sentence of the passage is an unfamiliar one. The comment "I wonder what we're talking about" indicates the reader willbe devoting processing energy to looking for supporting details as he reads ahead.

Frequency of Appearance

Frequency of appearance of a term or concept resulted in allocation of attention and in a corresponding allocation of energy to determining importance.

Excerpt 33

Reads: "The women in the movie have an archetypal aura as well"

Thinks aloud: "I don't know what archetypal is again .. I still don't know

The use of the word "again" indicates that the reader monitored the appearance of the term "archetypal" to this point. The word "still" indicates the allocation of importance in the processing time used to determine it's meaning.

Excerpt 34

Reads: "Genetic studies at PRL show that photosynthesis is controlled by several genes in such a way that the good qualities of two high photsynthesis types can be combined to produce offspring superior to either parent."

Thinks aloud: " ... this looks like it's going to be the meat of the whole thing because they've been talking about genetic control ... photosynthesis high on the list and if you have two photsynthesis types you're going to get a great plant ... I would guess we're getting to the meat of the article based upon what has come before and now they're talking about genes, about photosynthesis being so important."

The reading passage contained six references to "traits" and "genes" in addition to the two references to "genetic" and "genes" in excerpt thirty-four. The comment about "the meat of the whole thing" indicates that the reader was sensitive to the frequency in his importance assignment. Having assigned importance the reader thought aloud through a series of strategies indicating allocation of a large amount of processing time. The remark "because they've been talking about genetic control" is a summarizing staement in reference to the words "genetic" and "genes" that have appeared before this sentence. The comments about "genes" and "photosynthesis" that follow are a reader hypothesis about the upcoming text. The hypothesis underlines the reader's assignment of importance to the concept of genes.

Withholding Judgement

Withholding judgement is a strategy that appeared to work in conjunction with the other importance assignment strategies. The expert readers gave reports indicating they mixed withholding judgement with other strategies involving their knowledge of textual and content information in their quest to confirm the significance of a term or concept.

Excerpt 35

Reads: "Universal archetypes are there as well, often integrated into the ironic spirit of the film."

Thinks aloud: "When I look at the word archetypes, it's not one that I'm particularly familiar with so I want to try to define it in my own mind I have an idea of what I think it is and I will try to see if that is defined somewhere else in the reading."

In excerpt thirty-five the subject expressed the belief that if the term was important it would be raised again later in the text. The subject also stated that she would read ahead and make a judgement. The assumption is that she would be trying to determine how the term fits in her hypothesis of the text. The fit between the schema of the reader and the schema of the passage was tentative in the subject's mind. Withholding judgement appears to be strategy that allowed the reader who was unfamiliar with the content to use processing space for text elements temporarily without restructuring the existing hypothesis.

Excerpt 36

Reads: "Contrasting father figures give an archetypal."

Thinks aloud: "How come I've never heard of that word before."

Reflects: "And I guess it really didn't matter to the passage."

Expert readers deleted text that they perceived to be unimportant to their understanding of the text. "Archetypal" or "archetypes" had appeared three times in the text prior to this reference. Two of the appearances were in the opening paragraph. At the time of the first appearance of the term the subject

indicated a need to define it. Apparently the subject maintained the search for meaning to this later point in the passage as a result of early introduction and frquency of appearance. At this stage of processing the reader dropped the search as being unproductive. The comment that "it didn't matter to the passage" indicated that the subject was prepared to sacrifice a more complete schema for a reduction in the amount of energy necessary to resolve the ambiguity of the term "archetype".

Withholding judgement occurred with terms as above and also with more global summaries of the text. This is illustrated in excerpt thirty-seven below.

Excerpt 37

Reads: "Selecting for these processes then, really amounts to fine tuning the control over plant genes."

Thinks aloud: "I'm still confused about what he's made that distinction between large numbers of genes and small numbers of genes because I was expecting that in his final sentence he would say selecting for these processes requires control over a small number of genes."

Reads: "During the last ... "

Thinks aloud: " I'm still looking."

In excerpt thirty-seven the reader reported a mismatch between the author's message and the hypothesis the reader developed. Comprehension monitoring occurred. The think-aloud indicated that significant amount of processing may have occured before withholding judgement was selected as the fix-up strategy.

The reader identified the problem as a need to revise the summary he was about to draw together. The summarizing behavior was illustrated by the phrase in the think-aloud, "selecting for these processes requires control over a small number of genes". The subject's subsequent comment in the middle of reading the next sentence, "I'm still looking", indicates that the subject is withholding judgement about how the information "fits" his schema for the text until more information is processed.

Summary

The findings related to strategies used for weighing importance may lend weight to two established theoretical views. First, readers regulate their cognition by selective allocation of attention (Anderson, 1985; Brown, 1982). Second, expert readers have highly developed but separate text and content-schema. (Afflerbach, 1985; Anderson, 1985; van Dijk and Kintsch, 1983).

Expert readers' attention to familiar words allowed them to access their content knowledge. The success of this strategy was apparent in their ability to produce statements summarizing the text after identifying the familiar terms. Prior knowledge of content was also accessed in instances when the word was familiar but the content knowledge was apparently low. Similar behaviors were reported in Afflerbach's (1985) study. Afflerbach labelled this a "foot-in-the-door" strategy. Expert readers were attempting to make what limited connections they could between the content of

the text and their own content knowledge. The strategy of assigning importance to familiar words appears to allow an orderly memory search limiting the breadth of the search and the amount of attention allocated to the task.

When necessary, expert readers appeared to ignore lack of content knowledge and employed strategies for determining importance that relied on knowledge of how text is organized. Afflerbach (1985) has described this as the use of "compensatory strategies". Findings from his study indicate that there were no significant differences in expert readers' capacity for generating initial hypothesis statements when compensatory strategies were employed. Assigning importance based upon text structure knowledge as a compensatory strategy appears to be valuable when examining limits to attentional capacity. By focussing on what strategic behaviors are known and examining the familiar text features in the passage it is likely expert readers limit the amount of text processing energy required for the task.

Another option used by expert readers for establishing importance was early introduction of a term. Terms identified as important in the think-alouds were often at the beginning of the passage where the readers appeared to anticipate an overall hypothesis of the text. Identifying importance also occured at the beginning of a paragraph where subjects were aware that writers usualy outline the argument or hypothesis.

Frequency of appearance of a term or concept also sparked allocation of attention and a corresponding allocation of energy to determining importance.

Examples of non-productive behaviors were present in the protocols. In some instances expert readers with low content knowledge chose to disregard knowledge of text structure as a compensatory strategy. Readers who relied on limited content knowledge assigned importance to elements of the text that differed so much from the writer's intended schema that they had to devote considerable energy in revision. One inescapable difficulty may have been presented to the expert readers. Lack of content knowledge may have created the need to assign item importance because readers were unsure of the relationships between the items. In such cases, withholding judgement was a strategy that appeared to work in conjunction with the other importance assignment strategies. Afflerbach has labelled this strategy "assignment of conditional importance". Subjects would report that they read ahead and made judgements as to how the information fit existing hypotheses of the text. The fit between the schema of the reader and the schema of the passage was tentative in the subject's mind. Withholding judgement appeared to be an effective strategy that allowed the reader who was unfamiliar with the content to use processing space for text elements temporarily, without restructuring their existing hypotheses.

Word Meaning Strategies Used In Main Idea Processing

Two strategies involving word meaning to aid in the construction of main idea were observed in expert readers as they attempted to determine the gist of the demanding reading passages. These were strategies determining word meaning from context and determining meaning through structural analysis. Other strategies related to meaning generally, have been discussed in the portions of the chapter dealing with structural cues, summarization, examples, and weighing importance. Table 8 below illustrates the frequency of the use of these strategies by the expert readers.

Table 8

The Frequency of Usage of Word Meaning Strategies

Sub-category	Total in Each Passage		Total Response
	Literature	Science	
Context	8	12	20
Structural Analysis	2	3	5

Context

Determining word meaning through context appeared to require the reader to have some schema for the content of the text. The reader appeared to have knowledge of terms within the sentence or in nearby sentences that aided in defining the unknown term. The way in which

inferences regarding word meanings were made by the subjects is illustrated in excerpt thirty-eight, below.

Excerpt 38

Reads: "They are studying the physiological characters which as the name implies, are traits of the cells's metabolism."

Thinks aloud: "They're talking about something to do with how the plant's made up and I guess that's what they mean by physiological characters ... like what actually makes up the cell of the plant."

In the think-aloud the subject made a summarizing statement about the sentence from the text. The reference to the term "physiological characters" and the second summarizing statement that follows the term were taken to indicate the reader felt the initial summary was incomplete and required revision. Identifying "physiological characters" appeared to focus comprehension monitoring on word meaning. Since the expert reader made no references to other portions of the text, the investigator inferred that the words "traits" and "cell's" found in the context of the sentence, had been used to arrive at the definition of the term and to arrive at the more specific summary that concludes the think-aloud.

Structural Analysis

Expert readers were also observed to use their schema for the content of the text as a strategy for determining word meaning through structural analysis.

Excerpt 39

Reads: "They for traits they know will make it a better food crop this agronomic."

Thinks aloud: "I presume comes from agrarian."

The immediate stoppage in mid-sentence was an unsolicited report. The subject was able to arrive at a definition making use of root word clues found within the word itself. The rapid and spontaneous nature of the report seemed to indicate that little effort was needed to access this information.

Summary

Both the use of context and the use of structural analysis appear to require at least a limited content knowledge. The fact that readers reported using definitions of word meanings as a strategy may indicate only partially developed content schema.

With highly developed content schema, word meaning would flow down from the top with reader attention devoted to instantiation of the details as the search for main ideas progressed. In cases where the expert reader's content schema was highly developed, few

reports of using word meaning strategies would be anticipated indicating little attention to defining terms. These strategies are in contrast to others where experts indicated knowledge of the word. Word knowledge reports were given as part of importance assignment due to term.

As was suggested earlier in the portion of the chapter dealing with weighing importance, having only partially developed schema would have impact upon importance assignment. Readers would need to be more tentative in accepting or rejecting items from working memory. More processing would need to occur. In examining the excerpts above, the use of context appears to have required more processing attention than the use of structural analysis. In both instances, readers may be defining a term through context in the hope of attaching the new term to another schema with a somewhat limited fit to the text content. This is what Afflerbach (1985) called the "foot-in-the door" strategy.

Comprehension Monitoring and Regulation

The second major category of main idea processing expert readers were observed to use was the monitoring and regulation of main idea construction processes. In determining the main idea of the passages,the expert readers were observed to use the following seven comprehension monitoring strategies: 1) looking back in the text when they detected a problem they attributed to themselves, 2) looking back in the text when readers detected a problem they attributed to the text, 3) monitoring the nature of the breakown, 4) monitoring their knowledge match between with the text, 5) monitoring the level of attention required for the task, 6) monitoring their purpose for reading and, 7) monitoring affect. Table 9 below illustrates the frequency and distribution with which the expert readers reported comprehension monitoring.

The relationship between comprehension monitoring and fix-up strategies is identified in statements that follow. These statements describe the cycle of events that occurs when readers suspend strategies underway.

Afflerbach (1985) has reported that his subjects employed the following steps in resolving a comprehension difficulty: 1) a problem with comprehension is detected, 2) the problem is specified, 3) a fix-up strategy to alleviate the problem is

proposed, 4) a fix-up strategy is initiated, and 5) the effectiveness of the strategy is evaluated.

Table 9

The Frequency of the Usage of Comprehension Monitoring

Sub-category	Total in Each Passage		Total Response
	Literature	Science	
Look Backs Attributed to Readers	29	40	69
Look Backs Attributed to Text	12	17	29
Monitoring Nature of Breakdown	42	30	72
Monitoring Knowledge Match	32	34	66
Level of Reader Attention	14	9	23
Purpose	9	5	14
Affect	11	17	28

Look Backs as A Monitoring Strategy

Look Backs Readers Attributed To Self

Correcting lapses of memory was one usage of look backs. Other look backs related to reader errors resulted in more global revisions of the reader's hypothesis. Look backs that dealt with lapses of memory were often followed by statements about comprehension strategies that required short allocations of

attention. Lookbacks that dealt with more global revisions of the reader's hypothesis were often followed by longer think-alouds which contained more complex strategies and indicated longer allocations of attention in order to regain comprehension of the main idea.

The look back used in excerpt forty, below, illustrates how expert readers used look backs to refresh memory. When a summarizing statement followed a look back of this type, it was generally a restatement of the text. Restatement was described earlier as a strategy that was used to fix details in working memory. The strategy used in conjunction with a look back, therefore, seemed to confirm that the reader was simply retrieving an item from working memory.

Excerpt 40

Reads: 'Dramatic irony supports the scene for the audience knows what Mercy has forgotten: sixteen years before Mercy had umprired , and lost a wager on a carnival lot confrontation between "The Whammer" and the young Roy Hobbs.'

Thinks aloud: "So I'm just going back to connect Mercy again .. Max Mercy is the sportswriter interviewing him ..but he doesn't remember that sixteen years before he umpired and lost a bet on a confrontation between the Whammer and..ok.. so I just kind of sorted that one out."

In the example above, the reader referred to the text a second time and reread when he came to a name that had been mentioned earlier in the text. The subject's comment "to connect Mercy again" is taken as evidence that the problem was a lapse of

memory. The subject reread a small portion of the earlier text reference and a portion of the later text reference as a fix-up strategy. At the conclusion of the think-aloud, the reader confirmed that the name had appeared before.

Excerpt forty-one is an example of a more global revision.

Excerpt 41

Reads: "But right now you can't tell from examining an individual cell what the yield or grain quality of a plant produced from it will be."

Thinks aloud: 'I have to reread that last sentence ... "in general physical characteristics determine" ... just a minute ... "says Mahon the ability to work with a hundred million potential plants in a single flask of cell culture has given plant breeders a similar large population to that which has been so successfully exploited by microbiologists ... but right now you can't tell from examining an individual cell what the yield or grain quality ... will be" ... so that's the difficulty they're going to have with this thing ... they've got all this potential but they cannot determine in advance which ones to take because they don't know what they'll get from it so it's I imagine a bit of a guessing job there.'

Reflects: "I had to reread a lot didn't I ... I guess I was going back over that sentence there ... and again still trying to understand it and fitting it into his conclusion there."

In excerpt forty-one, the subject appears to have used a look back as a means of fixing up an incomplete understanding of the concluding sentence of a paragraph. Judging from the subject's approach to resolving the text processing difficulty, the reader attributed his problem something within himself rather than to a

problem originating from the text. The subject read the concluding sentence of the paragraph, then looked back to reread, beginning at the second paragraph of the text. After rereading a short piece of the second paragraph, the reader jumped to the place where he had been reading in paragraph six. The comment "just a minute" indicated the point where the reader moved ahead. The subject fixed up his incomplete understanding with a summarizing statement that constituted a reader hypothesis.

It is interesting to note that the subject did not read through all of the text from paragraph two to the end of paragraph six. Apparently he was able to narrow the search to the information in paragraph six. This suggests that some unreported weighing of importance was ocurring as he examined the passage. It is also noteworthy that this fix up strategy takes up more attention than did the fix up strategy in excerpt forty. This second point suggests that identifying the nature of the problem has some impact upon the the amount of attention required. This will be discussed in detail under the heading monitoring the nature of the breakdown.

Look Backs Readers Attributed to Text Difficulty

Other examples of the use of look backs reflected the reader's sensitivity to the effect that text could have upon comprehension. Look backs accompanied by a statement about text structure illustrate this. In the example represented by excerpt

forty-two, the reader indicated a problem with comprehension when he annnounced his intention to reread. The evaluative comment that followed confirmed that the comprehension breakdown was attributable to text structure. The subject specifically identified the comprehension difficulty as due to the lack of detail accompanying the writer's "major thoughts". It is also noted that the reader assigned his text comprehension difficulty in a very personal way in his comment, "maybe that's why I don't like him". This type of comment occurred in more than one protocol, and will be examined later in the results under the heading of affect.

Excerpt 42

Reads: "Here the deceptive tension between appearance and reality constitutes romantic irony, because there is a sudden change of tone: the insidious illusion of a beautiful siren turns rapidly and unexpectedly ugly".

Thinks aloud: "Okay ... back up reread ... he's having a problem he's trying to condense major thoughts into short paragraphs maybe that's what I don't like about him ... he's leaving room to interpret a great deal unless you've seen the movie."

It is important to note that identifying the nature of the breakdown and selection of a fix-up strategy is frequently followed by an evaluative comment. The importance of these evaluative comments to the regulation of comprehension strategies will be addressed in the summary.

Summary

Garner (1982) uses the term "look backs" to denote a rereading strategy in which subjects refer back to the text to seek key ideas or details. It appeared from the expert reader reports in this study that "look backs" were used in a broader capacity than that which Garner described. Excerpts forty-one and forty-two suggest that look-backs work in conjunction with other strategies as well, especially in regard to the nature of the comprehension difficulty. It seems that look backs may signal the beginning of a concerted effort to monitor and regulate comprehension.

Monitoring the Nature of the Comprehension Breakdown

Discussion of comprehension strategies related to comprehension monitoring has alluded to "monitoring the nature of the breakdown". Monitoring the nature of the breakdown appeared as a declarative statement in which the subjects verbalized what they believed to be causing the interference with successful comprehension.

Excerpt 43

Reads: 'The antithetical figure is the team manager, "Pop" Fisher - a name suggesting in mythic terms both "the wise old man" and the Fisher King, the wounded ruler who must be healed by a questing knight.'

Thinks aloud: "I'm trying to get a meaning out of it because I've really got nothing to relate it to ... at first I thought they meant a bird ... Kingfisher but there's nothing I can think of that ... I think I'll have to go on to see what it means."

In this excerpt, the reader's think-aloud has identified the nature of the breakdown. She has implied that it was the low content schema she possessed relative to the examples the writer provided. Nevertheless, in her initial selection of a fix-up strategy, she tried to connect "Fisher King" from the text with "king fisher" from her content knowledge. She abandoned that fix up strategy and opted to read on instead as an alternate strategy.

This excerpt provides an example of how expert readers regulated comprehension by selecting comprehension strategies to remedy a comprehension breakdown. This excerpt also provides an example of how readers evaluate the success of their comprehension strategies. It demonstrates that expert readers are not always successful, and that they then select an alternate comprehension strategy to remedy their comprehension failure. Regulation appeared to begin with the selection of the fix-up strategy of accessing "king fisher" and it's related schema. She evaluated that strategy as impractical and selected reading on as the alternative.

Excerpt forty-four illustrates the amount of attention to comprehension monitoring an expert reader is prepared to devote to overcoming comprehension difficulties. The excerpt also provides a

more extensive example of the regulation of comprehension strategies.

Excerpt 44

Reads: "During the last seven years, John Mahon and geneticist Dr. Shaun Hobbs have been studying the genetics of physiological characters and how they relate to the usual agronomic traits such as seed yield, seed protein, and harvest index (the economically valuable proportion of the plant)."

Thinks aloud: " To get myself more comfortable I'm trying to relate this to the farm ... but it's almost impossible the way they've got it worded ... why are they using all this..ok they've been studying the plants the last seven years ... because this is what my husband is interested in right ... better seed yield ... seed protein ... harvest index ... I'm sure if you had to sit down and read this couldn't it be put in simpler words?"

Reflects: "As soon as it started talking about seed yield that's uppermost in our minds so I've gone back to the farming aspect now but I can't understand why it has to be in such a complicated form ... I would be more interested if it were more straightforward."

The subject began dealing with the comprehension problem by selecting a strategy for accessing a personal schema for content to relate to the content schema of the text. The second step of her action was to identify the nature of the breakdown as author's choice of unfamiliar words. The third step was to select the summarizing strategy of restating the words from the text. The subject's fourth step was to return to the strategy of accessing a content schema and to identify familiar terms from the text. The subject concluded by reindentifying the nature of the comprehension breakdown.

The think-aloud and the reflective report suggest that the subject dropped the search for the relationship between this chunk of the text and and the gist of the entire text. It has been noted in the protocols that readers were prepared to eliminate unresolved elements to achieve a less developed schema for the text.

Summary

Expert readers appear to exert attention to comprehension breakdowns in a flexible way. The think-alouds dealing with breakdowns the readers attributed to their own errors show evidence of varied amounts of attention devoted to breakdown resolution. The suggestion is that this flexibility is the result of the readers' ability to: 1) select an appropriate strategy and 2) judge whether the lack of comprehension has been resolved. This capacity to be flexible in strategy selection is what Brown et al (1982) have described as conscious access to strategies.

A further feature of comprehension monitoring can be addressed here. Expert readers seem to be able to evaluate the success of their fix-up strategies. The think-alouds in dealing with "look backs attributed to text difficulty", and the preceeding section, "look backs readers attributed to self", both contain references to reader evaluations. This may suggest the regulation of main idea construction processes by expert readers. Afflerbach (1985) has described this as "process efficiency

evaluation". He argues that statements of this type indicate the operation of executive control.

Monitoring the Knowledge Match

Earlier discussion in the review of the literature and in this chapter has identified a theoretical division between reader schema for structure and reader schema for content. Readers were not observed to express concerns about the fullness of their schema for text structure. Readers did make statements in their think-alouds that indicated an awareness of the relationship between the content schema in the reading passage and their own related content schema.

Excerpt forty-five illustrates what expert readers did when they encountered a high degree of agreement between the content knowledge of the passage and their own content knowledge.

Excerpt 45

Reads: "Genetic studies at PRL show that photosynthesis is controlled by several genes in such a way that the good qualities of two high photsynthesis types can be combined to produce offspring superior to either parents."

Thinks aloud: so here two plants ... are producing one seed so there must be some cross pollination and I know what it's all about and ... these two plants their seeds can produce superior plants to either of the parents so therefore this would be very helpful I can see to agriculturists."

In excerpt forty-five, there is no evidence of a comprehension breakdown. The reader makes a statement of

hypothesis about the text and evaluates this match in relation to his schema for content. As a result, he is able to generate a more specific hypothesis that precedes a simliar sentence made in the passage.

Excerpt forty-six is a further example of the type of behavior exhibited by expert readers when the knowledge match is monitored and found to be acceptable. In excerpt forty-six, the subject has evaluated the match between text content and his content knowledge. His comfort with the knowledge match apparently led to the generation of an analogy or image and then to raising a question that can be taken as a hypothesis about the future content of the text.

Excerpt 46

Reads: " Selecting for them, really amounts to fine tuning the control over the plant."

Thinks aloud: "Control that means they're able to organize to some extent their outcome and here when I go down to the research station I see little bags put over sunflower heads and rose hips so I guess they're doing that so they have eliminated a lot of the outside variables ... so fine tuning over plant genes ... I wonder how they do this?"

The regulation of comprehension strategies appeared to be occurring when monitoring indicated success. In this case, the reader has been able to identify the nature of the success by defining the term control. In his next step, he generated an analogy that allowed him to access what appeared to be a highly developed schema of his own that matched the content schema of the

text. The result was that in the next series of strategies employed by the reader, he was able to select the strategy of creating a hypothesis that anticipated the upcoming text content.

Excerpt forty-seven illustrates what expert readers did when they encountered a low degree of agreement between the content knowledge required by the passage and their own content knowledge.

Excerpt 47

Reads: "Even if we can genetically increase the photosynthetic efficiency of each square centimter of leaf and show that this leads to increased growth, differences in the plants' ability to produce leaves can make an apparently high photosynthetic type seem very unproductive."

Thinks aloud: "If there's more leaves and there's high photosynthestic efficiency there should be ... I'm confused I'm going to go back ... Nevertheless as exciting as this is ... cautiously optimistic even though we can genetically increase the photosynthetic efficiency of each square centimeter of leaf ... ok ... and show that this leads to increased growth differences in the plants' ability to produce leaves can make an apparently.. high photosynthetic type seem very unproductive ... I'm still foggy I'm going to read on."

Reflects: "So ... he added something new into this and I stopped and read back and first I picked key words and read but then I read the whole thing over again and then I still didn't have it clear so I thought I'd read on."

In this excerpt, forty-seven, as in excerpts forty-five and forty-six, the subject identified the knowledge she had for the content of the material as being low, rather than high. It seems likely that strategy selection differed because of the low knowledge match. Here the subject began with a statement hypothesizing about the content of the text and abandoned it. The

next step was to identify the nature of the breakdown, the gap between the content of the text and her content knowledge. The third step was to use the strategy of restating the text. She then evaluated this strategy as ineffective and opted to read on instead.

Summary

Earlier discussion distinguished between content knowledge required by the text and the readers' actual knowledge of the content domain. Afflerbach (1985) has described this strategy as "prior knowledge evaluation". He suggested that evaluation is a strategy "related to" main idea construction that establishes a realistic level for understanding the text and results in lesser allocation of resources in a futile task. In this study, use of this strategy was illustrated in comments found in excerpts forty-five through forty-seven. Monitoring the knowledge match appeared to control not only the type of strategy selected for main idea construction but also the depth and breadth of the hypothesized main idea. These observations seem to add weight to Afflerbach's (1985) position. It appeared that in cases where readers were aware of the low level of their knowledge match they were prepared to make conscious sacrifices by not accommodating information from the text in their hypotheses. Also, they appeared to be aware that they had arrived at less elegant hypotheses.

Monitoring the Level of Reader Attention

Subjects reported an awareness of their le vel of attention to the task. In some reports they also identified the item that was distracting them from the task.

Excerpt 48

Thinks-aloud: "The writer has turned me off by his style of writing and at this point I'm not trying all that hard to make sense out of what he's saying.. as a consequence I'm probably in the same boat as the kid who's bored."

In excerpt forty-eight, the reader states an awareness of his level of involvment with the text and has identified the problem as the style the writer chose to use. It is possible for the observer to speculate that the difficulty stemmed from some other area such as content knowledge. However, the reader has focussed on style, as being the cause, in his statement. Examples of positive responses about attention were also noted. Examples of places where positive comments appeared included: where the reader gave an analogy and then found the same or compatible analogy in the text, in places where the text structure matched the readers expectation of text structure, and in places where readers gave a summarizing statement and then found a summarizing statement in the text that closely matched theirs.

Summary

Think-aloud statements that contained statements about reader attention were places where the tension that existed between the expert reader and the text became clear. Expert readers placed a clear respoonsibility upon the text or the writer,"he", to present the material in a fashion that would make comprehension of the main ideas as fluid a process as possible.

Monitoring the Purpose for Reading

Excerpt 49

Thinks aloud: "I don't have to read it like I did the last one ... It's calling on me to understand information but not to do a lot if inferences."

Excerpt 50

Thinks aloud: 'When I watched "The Natural" it was purely for entertainment and I wasn't thinking of any educational purposes.'

Excerpts forty-nine and fifty illustrate two types of statements that expert readers made about monitoring their purpose. In excerpt forty-nine, the reader examined a local example and appeared to indicate that the summary she is required to make is a simple one. In excerpt fifty, the reader examines the text and her statement suggests that she recognized the need to revise her text processing to a style requiring a more critical approach.

Summary

Expert readers appeared to be conscious of the task they were undertaking. This occurred both in a "local" and in a "global" sense. Examples of awareness of "local tasks" are those related to the selection of strategies needed to solve a specific comprehension breakdown. This aspect has already been been discussed. However readers also appeared to make judgements regarding their overall purpose for reading. It is expected that global understanding of the purpose would have an impact upon the strategy selection used to fulfill local purposes. What this impact would be is unclear. Think-alouds indicated that readers attempted to match their purpose for reading to the purposes they believed to be set by the writer. However, expert readers also seemed to set personal and sometimes divergent purposes. The conscious decision to overlook potentially important content is one illustration. Readers who were critical of the text offered reports that indicated their purpose for reading had become that of ferreting out examples that confirmed their dislike for the style or structure of the article.

Monitoring Reader Affect

Statements indicating affective responses were often found in the context of statements about level of attention.

Excerpt 51

Thinks aloud: "That's interesting because when I had read one of the earlier sections I had predicted those types of things and now I'm finding the things being referred to when it talked about physiological characters earlier."

Reflects: I'm confirming that what I read earlier was indeed the types of things that the author is now referring to ... I felt more comfortable because I could now relate to it because I had some knowledge and I also felt good that I was able to predict where they were going."

Excerpt 52

Thinks aloud: "Oh oh at the end of that sentence my feeling was ok ... when he starts off saying universal archetypes I'm ready for that ... I'm ok to start dealing with that but when he says often integrated into the ironic spirit of the film then ... I think he's playing ... too heavy ... I'm getting this oh no here go feeling but ... uhm I guess I'll carry on and see what he's saying."

The two excerpts reveal contrasting examples of affective response. In excerpt fifty-one, the expert reader expressed comfort with the match between his content-schema and the text's content-schema. In excerpt fifty-two, the reader expresses feelings of discomfort with the writer's choice of vocabulary. Both excerpts show a close relationship between the readers' affective response monitoring and attention monitoring. In the first of these excerpts, the expression, "that's interesting", in the think-aloud suggested a desire to find other examples of accurate prediction. In the second excerpt, the expression " I

guess I'll carry on and see what he's saying", suggested a grudging commitment to the task.

Summary

The readers' affect has been described as a sense of comfort or discomfort with the text. Affective think-aloud reports often conveyed a sense of audience between the reader and the writer. One subject, unfamiliar with reading research, spoke of a "contract" that he felt he had with the writer. The terms of this relationship may be tied to the issue of how much knowledge the reader possesses and how much knowledge the writer assumes the reader to have. Afflerbach (1985) has pointed out that there is also a close relationship between affect and content knowledge. Garner (1982) noted that her subjects reported the need to monitor "boring" text. The excerpts that illustrate affect are closely related to monitoring attention, as well. In addition to prior knowledge of content and attention to task, reader protocols from this study also demonstrate that readers' knowledge of text structure and the reader's expectations also influence affect.

Summary

How Expert Readers Approach the Reading Task

In addressing the first question of the study, it is possible to say that there is consistency between previous research and this study's findings of how expert readers approach the task of reading demanding reading passages.

Anderson (1985) proposed that readers possess schema-theories both for text structure and for content. Brown (1985), Flavell (1976), and Garner(1987). Others have stated their belief that readers organize learning according to what they know about the topic, knowing how to perform various actions, and knowing when and why various strategies should be used. Paris et al (1984) refer to these organizational frameworks as declarative, procedural, and conditional knowledge. In keeping with these views, the expert reader think alouds and retrospective reports were organized into two general comprehension processing categories, "main idea construction processes" and "monitoring and regulation processes".

The main idea construction processes reported by the readers in this study were classified as: 1) structural cues, 2) summarization, 3) use of examples and analogies, 4) weighing importance and 5) determining word meaning. Expert readers were observed to use the following seven comprehension monitoring and

regulation strategies: 1) looking back in the text when they detected a problem they attributed to themselves, 2) looking back in the text when readers detected a problem they attributed to the text, 3) monitoring the nature of the breakown, 4) monitoring their knowledge match between with the text, 5) monitoring the level of attention required for the task, 6) monitoring their purpose for reading, 7) monitoring affect.

Main Idea Construction Processes

Use of Structural Clues

Expert readers in this study demonstrated organized knowledge of expository text structure. The sub-category of main idea construction processes called structural clues, illustrates reader knowledge of the roles of: 1) function words, 2) topic sentences, 3) topical paragraphs, 4) familiar text structures (genres and writing patterns), and 5) the capacity to evaluate the structure of a passage. The reader awareness of the utility of function is consistent with some elements of microstructure described by van Dijk and Kintsch (1983). The expert readers also reported examination of larger text elements that may be likened to macrostructures. The fashion in which the subjects made use of text structure to create a pattern and then sampled further structural elements to verify or to change the pattern lends suppport to the schema-theoretic view of the use of structural cues as strategies for determining main idea.

It is important to note that the expert readers used text structure knowledge to make evaluative statements related to their perceived success or difficulty with comprehension. The think aloud reports indicate that expert readers possess the ability to define the way text structures aided or interfered in their comprehension processing. This reader capacity is an indicator of the suggested between main idea construction processes and comprehension monitoring processes. Identifying the problem has been noted as a step in comprehension monitoring leading to the subsequent selection of a fix-up strategy.

Summarization Strategies

This study suggests that summarizing was a sub-category of the main idea construction process used to focus attention on content information and perhaps to identify the point at which to attack a comprehension breakdown. Reader think alouds and retrospective reports suggest: 1) repeating or restating the text, 2) paraphrasing, 3) confirming a reader theory, and 4) evaluating content, were summarizing strategies. Anderson (1985) indicated that one function of schema-theory may be to allow readers to retain vital propositions and eliminate trivial ones. It may be argued that the summarizing strategies provided a means for expert readers to accommodate more significant parts of the text into their schema. The use of summarizing, as it is described in this study, can be related to van Dijk and Kintsch's (1983) model. They

proposed that since only a limited amount of information can be stored in working memory, readers make efforts to create cycles of memory to integrate the information into more general, more memorable macropropositions. The think-aloud reports identified a focus upon content knowledge when summarizing strategies are used. If this is the case, then readers may have identified the successful comprehension and potential intereference that were content driven. As such, summarizing could be closely tied to regulation of cognition (Brown 1985).

Use of Examples

The readers in this study used examples: 1) to confirm a reader theory, that is as supporting evidence for a hypothesis about the main idea, 2) as unneeded information, meaning that the detail of the example could be discounted, 3) to validate the author's theory, that is as evidence which the reader saw as consistent with the author's argument, or 4) to generate personal examples, meaning that the example in the text sparked the reared's previous knowledge or experience.

Use of examples may be illustrative of several of the elements of the schema theory model. Adams and Collins (1985) describe the instantiation of schemata with data that is processed from the bottom up. This means from the text to the reader. The term instantiation refers to the match between reader knowledge and information from the text. Adams and Collins suggest that

bottom-up processing insures reader sensitivity to information that is novel or that does not fit the reader's on-going hypothesis. In contrast, top down processing helps the the reader resolve ambiguities or select between alternative interpretations. Validating the author's argument through the examples is specific to the match between writer arguments and examples within the text. The behavior observed in validating the author's argument involved the reader examining the congruency between examples in the text and the text's arguments. The strategy of validating through examples has similarities to two previously considered sub-categories; evaluation of content and evaluation of structure.

Treating examples as unneeded information may be a behavior consistent with van Dijk and Kintsch's (1983) condensation rules of deletion or generalization. Treating examples as unneeded information also seems consistent with two of the five rules Brown and Day (1983) give for summary writing - "deletion of redundant material" and "superordination of lists".

The two evaluative activities associated with examples, confirming reader theory and validating writer arguments were treated separately from evaluation of content, found in the summarizing sub-category, and evaluation of structure, found in the use of structural clues category, because they appeared to be sparked by the presence of text examples.

Weighing Importance

Readers weighed importance as a main idea construction process. They did this by: 1) giving familiar terms importance, 2) watching for early introduction of terms or concepts and assigning these importance, 3) being sensitive to a term or concept's frequency of appearance, 4) noting a term or idea and withholding judgement about it's relative importance. The findings related to strategies used for weighing importance lend themselves to two established theoretical views. First, readers regulate their cognition by selective allocation of attention (Anderson, 1985; Brown, 1982). Second, expert readers have highly developed but separate text-schema and content-schema. (Afflerbach, 1985; Anderson, 1985; van Dijk and Kintsch, 1983).

Expert readers' attention to familiar words allowed them to access their content knowledge. The success of this strategy was apparent in their ability to produce statements summarizing the text after identifying the familiar terms. Prior knowledge of content was also accessed in instances when the word was familiar but the specific content knowledge was apparently low.

Monitoring and Regulating Strategies

Lookbacks

Garner (1982) uses the term "look backs" to denote a rereading strategy in which subjects refer back to the text to seek key ideas or details. It appeared from the expert reader reports in this study that "look backs" served broader functions than that which Garner described. Excerpts forty-one and forty-two suggest that look-backs work in conjunction with other strategies as well, especially in regard to the nature of the comprehension difficulty. It seems that look backs may signal the beginning of a concerted effort to monitor and regulate comprehension.

Monitoring the Nature of the Breakdown

Expert readers appear to exert attention to comprehension breakdowns in a flexible way. The think-alouds dealing with breakdowns the readers attributed to their own errors show evidence of varied amounts of attention devoted to breakdown resolution. The suggestion is that this flexibility is the result of the readers' ability to: 1) select an appropriate strategy and 2) judge whether the lack of comprehension has been resolved. This capacity to be flexible in strategy selection is what Brown et al (1982) have described as conscious access to strategies.

Monitoring the Level of Attention

Think-aloud statements about reader attention illustrated where the tension that existed between the expert reader and the text became clear. Expert readers placed a clear respoonsibility upon the text or the writer, to present the material in a fashion that would make comprehension of the main ideas as fluid a process as possible.

Monitoring Purpose

Expert readers appeared to be conscious of the task they were undertaking. This occurred both in a "local" and in a "global" sense. Examples of awareness of "local tasks" are those related to the selection of strategies needed to solve a specific comprehension breakdown. However readers also appeared to make judgements regarding their overall purpose for reading. The nature of the reader's global understanding of the purpose would appear to have an impact upon the strategy selection for local purposes. What this impact would be is unclear. Think-alouds indicated that readers attempted to match their purpose for reading to the purposes they believed to be set by the writer. However, expert readers also seemed to set personal and sometimes divergent purposes. The conscious decision to overlook potentially important content is one illustration.

Monitoring Reader Affect

The readers' affect has been described as a sense of comfort or discomfort with the text. Affective think-aloud reports often conveyed a sense of contract between the reader and the writer. The terms of this relationship may be tied to the issue of how much knowledge the reader possesses and how much knowledge the writer assumes the reader to have.

Comparison With Afflerbach's Model

General Organizational Premises

Both this study and Afflerbach's study used demanding passages in conjunction with think alouds to deautomate the strategies that expert readers use to construct main ideas from expository text. This same strategy for deautomtion was also used by Lundeberg (1987) in her study examining strategies used to construct meaning from case law. In both the Luneberg and Afflerbach studies, the specific strategies reported by the reader/subjects were similar. However, Afflerbach organized the strategies under different descriptive headings. He has labelled his major categories "main idea construction processes" and "processes related to main idea construction". Afflerbach's main idea construction processes have been developed to reflect the behaviors of readers as they invent main ideas before, during, and after reading the text.

The related processes are intended to show how the construction or invention of the main idea is refined. This study has attempted to organize the strategies so that the grouping is consistent with metacognitive categories: 1) knowledge about cogniton, and 2) the regulation of cognition (Brown, 1985, Paris, Cross & Lipson, 1984). The categories developed by this study are classified as "main idea construction processes" and "processes for monitoring and regulation". This study's category, "main idea construction processes", clarifies the knowledge readers have about the topic and the knowledge that readers have about how to perform certain tasks. Paris et al (1984) have labelled this declarative and procedural knowledge. The category, "monitoring and regulatory processes", is intended to indicate the knowledge readers have about when and why certain strategies should be used.

Text and Content Schema

Afflerbach's study and this study reported reader use of text and content schema. Additionally, both studies described reader reports indicating the capacity to use text schema in a compensatory manner when content domain knowledge failed. Afflerbach's study indicated the use of a variety of textual clues including anaporic references, topic sentences and topical paragraphs, as well as more global predictions based upon familiarity with text structures.

Sumarizing Strategies

Afflerbach describes summarizing strategies under the headings crunching, listing, and topic/comment. Crunching is a process which occurs when the reader stops taking in text and consolidates the material. Listing occurs when the reader scans the material searching for key words. As such it is said to occur in conjunction wih crunching. Topic/comment is described as being a strategy for overcoming processing limitations. The reader stated the topic as a partial solution to inventing a main idea. The reader then set about finding a qualifying comment.

The present study listed a series of summarizing strategies as a sub-category of the main idea construction process. These sub-categories include restating the text which is very similar to the topic portion of Afflerbach's topic/comment strategy. The value of restatement was suggested to be that restatement provided a focus for the task of constructing a main idea, much as Afflerbach described the topic statement as providing a partial solution to inventing a main idea. Paraphrasing the text as described in this study was a summarizing strategy that provided consolidation of the information in the reader's working memory. Paraphrasing statements given in the think alouds may correspond to the crunching process Afflerbach has suggested. Afflerbach has debated whether crunching was an automated form of his other construction processes. Therefore, there may be grounds for the

argument that paraphrasing, as a summarizing strategy serves the same function as crunching.

Evaluative Strategies

Afflerbach differs in his organization of evaluative strategies although the strategies reported by his subjects are similar. He has identified evaluation as one of the strategies related to main idea comprehension, whereas, the present study has chosen to name the evaluative strategies as: evaluation of text structure, evaluation of content, confirming a reader hypothesis, validating text and the comprehension monitoring strategies. It is possible to argue that the sub-category, withholding judgement, contains evaluative elements also, However, for the purposes of this study, the rule for an evaluative comment was that the think aloud needed to contain a direct evaluative comment.

Afflerbach describes three general types of evaluative strategies: author related, text related, and reader related. As was the case in this study, Afflerbach reported that many of the comments addressed to the author could have been addressed to the text itself. Author related comments were said to include evaluations of style, sequencing, writer bias and command of the subject matter. Afflerbach's reports of text related evaluations included comments about text veracity and evaluations of clarity. In this study, similar comments were classified respectively as evaluation of content and structure. His reports about reader

related evaluations were said to be about prior knowledge, efficiency at the task and the effect of external influences. The studies are similar in that both report these as processes of monitoring and regulation. The major difference between the two studies is that the present study has chosen to organize the evaluative components separately under the categories of structure clues, summarization, and monitoring, while Afflerbach's study reports them all as a distinct grouping of related construction processes.

Comprehension Regulation

The most significant agreement between the two studies is in the sequence of fix-up strategies. The present study lends support to Afflerbach's report that his subjects employed the following steps in resolving a comprehension difficulty: 1) a problem with comprehension is detected, 2) the problem is specified, 3) a fix-up strategy to alleviate the problem is proposed, 4) a fix-up strategy is initiated, and 5) the effectiveness of the strategy is evaluated.

Earlier discussion distinguished between content knowledge required by the text and the readers' actual knowledge of the content domain. Afflerbach (1985) has described this strategy as "prior knowledge evaluation". He suggested that evaluation is a strategy "related to" main idea construction that establishes a realistic level for understanding the text and results in lesser

allocation of resources in a futile task. In this study, use of this strategy was illustrated in comments found in excerpts forty-five through forty-seven. Monitoring the knowledge match appeared to control not only the type of strategy selected for main idea construction but also the depth and breadth of the hypothesized main idea. These observations seem to add weight to Afflerbach's (1985) position. It appeared that in cases where readers were aware of the low level of their knowledge match they were prepared to make conscious sacrifices by not accommodating information from the text in their main idea hypotheses. Also, they appeared to be aware that they had arrived at a less elegant main idea hypotheses for the text.

Chapter V

CONCLUSIONS

General Aims of the Concluding Chapter

The purpose of the study was to determine how expert readers approached the task of reading for main ideas in two demanding reading passages and additionally, to determine whether the categories established in an initial study by Wood (1988) were sufficient in explaining the comprehension text processing of expert readers. A second study question was related to how the categories developed in this study compared with the model of main idea construction processes outlined by Afflerbach (1985). The third question asked if a more definitive model could be developed.

In the preceding chapter, categories, sub-categories, and individual strategies identified in this study have been examined in light of current theory and research. This chapter reviews the following: 1) the relationships between main idea construction and comprehension monitoring; 2) how processing of text occurs both when the task is proceeding smoothly and when readers report difficulty; 3) comparisons between the strategies of text processing found in this study and Afflerbach's description of main idea processing 4) educational implications arising from this study, and 4) some considerations for future research.

General Relationships Between Strategies

The think-aloud and confirming reflective reports of subjects in this study indicated that the behaviors of expert readers may be sub-divided into two general categories. The categories are: 1) the processes that expert readers use to construct main idea from expository text, and 2) the monitoring and regulatory processes that expert readers use to evaluate their success and redirect their comprehension efforts when necessary. See Figure 5 below for a chart representing the main idea construction processes and the monitoring and regulatory processes with the sub-categories for each.

The second group of behaviors, labelled comprehension monitoring and regulation, appear to work in combination with the first group, the main idea construction category. The monitoring and regulatory strategies test and evaluate the success of main idea construction and subsequently revise and redirect comprehension processing efforts in order to construct meaning.

Figure 5

Categories and Sub-categries of Behaviors Reported by Expert Readers

Category	Sub-category
A. MAIN IDEA CONSTRUCTION PROCESSES	
1. Strategies Using Structural Cues	a) function words b) topic sentences c) topic/pivotal paragraphs d) familiar text structures e) evaluation of text structure
2. Strategies Using Summarizing	a) repeats b) paraphrasing c) evaluation of content d) confirm reader theory
3. Strategies Using Examples	a) confirming reader theory b) unneeded information c) validate author's theory d) generate personal example
4. Strategies Using Weighing Importance	a) familiarity b) early introduction c) frequency of appearance d) withholding judgement
5. Strategies Using Word Meaning	a) context b) structural analysis
B. MONITORING AND REGULATORY PROCESSES	
1. Comprehension Monitoring and Regulation	a) look backs attributed to reader b) look backs attributed to text c) monitoring nature of the breakdown d) monitoring knowledge match e) level of reader attention f) reader purpose g) reader affect

Analysis of the think-aloud protocols in this study suggests that when the expert readers encountered difficult text they engaged in an integrated assault upon the problem of constructing

a main idea from the demanding reading passages. The reports appear to provide evidence that while processing text expert readers are 1) considering strategies, 2) allocating attention, 3) making determinations of the strengths and weaknesses of the text as a tool for resolving the problem, and 4) keeping purpose in mind. The findings of this study are consistent with Jenkins' description of the four corners of the tetrahedral model. Readers vary their text processing strategies depending upon: 1) the criterial tasks, 2) the nature of the materials 3) the learning activities and 4) their own characteristics as learners.

Text Processing In Satisfactory and Difficult Conditions

Monitoring, Regulation and Smooth Text Processing

The think-aloud reports generated by the expert readers in this study suggest that if in their judgement, main idea construction is occurring smoothly, readers continue to process the text with little energy being allocated to monitoring and regulation. This appears to be the case even in the demanding portions of the reading passages used in this study. When the construction process is smooth, expert readers appear to move through the text in a start-to-finish fashion. As indicated bt the verbal reports, there are few interruptions to the of expert readers as they construct the main idea of the pasage.

It is important to note, however, that monitoring and regulation are occurring. The presence of this monitoring activity can be inferred from the fact that expert readers reported changing from one main idea construction strategy to another when they reached the prompt markers in the prepared text. The reported strategy selections were made without readers verbalizing a need to reflect on the effectivness of the main idea construction strategy they had selected. This is taken to mean that there was little need to halt reading to allocate energy to strategy selection.

The reported adjustments during smooth text processing are taken to indicate several features about the approach that expert readers employ in processing text: 1) Even when processing is smooth, expert readers are aware that they are encountering new reading conditions and that the new conditions require changing strategies. 2) It appears from the think-aloud reports that the new conditions are determined either by features found within the text or by features found within the readers' own knowledge or experience.

The discussion which follows on difficult text processing conditions elaborates on this point. The findings in the reader reports relative to text-based and reader-based processing features lend support to studies identified in chapter two (Afflerbach 1985; Afflerbach & Johnston, 1986, Garner, 1987; van Dijk & Kintsch, 1983). In addition, the think aloud and

retrospective reports appear to support the concept of two and even three-way interactions between elements of Jenkins' tetrahedral model: the criterial task, the nature of the materials, the learning activities, and the learner (Jenkins 1981; Brown & Smiley, 1977).

Monitoring, Regulation, and Difficult Text Processing

If in the judgment of expert readers comprehension is not occurring satisfactorily, a different text process is engaged. Expert readers appear to activate a complex plan when new reading conditions result in comprehension breakdown. The activation of this plan, as it was revealed in the reader think-aloud and reflective reports, was consistent among the expert readers and indicated a much greater allocation of resources to the selection of alternative meaning construction proceses and subsequent monitoring of strategy effectiveness.

When serious text processing difficulties were encountered the reader often signalled an interruption in the start-to-finish reading style mentioned earlier in the discussion of smooth text processing. Often a "text look-back" reported by readers initiated the beginning of a problem solving process. The problem solving process involved five actions by the expert readers: 1) detection of a problem, 2) specifying the nature of the problem, 3) selection of a fix-up strategy, 4) application of the strategy, and 5) evaluating the strategy's effectiveness. The process

described above is consistent with that outlined by Afflerbach (1985).

It is significant that the start-to-finish style expert readers use when they are processing difficult expository text smoothly is superficially similar to the style employed by readers with low metacomprehension. The monitoring and switching of strategies reported by accomplished readers is automatic and therefore would be undetected in the processing of less demanding reading material (Afflerbach, 1985; Afflerbach & Johnston, 1986). Less skilled readers have also been said to use a start-to-finish style in their efforts to process text. Readers with low metacomprehension read without making a distinction between what they understood and whay they did not (Holbrook, 1986). Less competent readers have also been said to read with a singlemindedness relative to purpose, disposition, and one may assume, rate (Short & Ryan, 1984; Johnston & Winograd, 1985; Davey, 1986).

The superficial similarity between succesful and unsucessful readers underscores the need to make teachers and novice readers aware of appropriate main idea construction strategies and strategies for monitoring and regulating their comprehension. Teachers may misdirect novice readers into an inefficient start-to-finish style of reading if teachers are unaware of the flexible, automatic way in which strategies are employed. The result of misdirected instruction might be students who decode

accurately, but when they reduce the text to its gist, lack any fullness and depth in their content area knowledge.

Comparisons with Afflerbach's Model

Afflerbach's Two Categories of Processes

The strategies employed by the expert readers observed in this study, appear similar to those reported by Afflerbach (1985). However, Afflerbach organizes the strategies under different descriptive headings. He has labelled his major categories "main idea construction processes" and "processes related to main idea construction".

Afflerbach (1985) and Afflerbach and Johnston (1986) illustrate five main idea construction processes. These five processes are: 1) hypothesis generation, 2) crunching, 3) listing, 4) topic/comment and 5) draft and revise which reflect the processing that expert readers use before, during, and after reading. Hypothesis generation is said to occur before reading. Afflerbach describes hypothesis generation as a global, predictive statement made at the beginning of the text or paragraph. These hypotheses are checked as the reader proceeds through the text. They are based upon either text or content cues. The other four processes: listing, crunching, topic/comment, and draft and revise, are described as occurring either during or after reading. Afflerbach states that he is unable to describe crunching as a

process other than to say that crunching occurred when a reader stopped reading but failed to generate a verbal report. Listing was a process that Afflerbach describes as occurring in concert with other construction processes including crunching or topic/comment. Afflerbach's interpretation of this behaviour was that essentially, the expert reader appeared to scan the text looking for key ideas or phrases. Topic/comment is described as a statement of the topic followed by a comment about the text. Draft and revise also involves two stages. Afflerbach states that this process occurs when the expert reader makes a main idea statement and then sets about to improve upon it.

Afflerbach's "related" processes include: 1) hypothesis testing, 2) assigning importance, 3) evaluating, 5) responding affectively and attributing, and 6) comprehension monitoring and management. Hypothesis testing processes involve making predictions, modifying, and verifying hypothesis which the reader would have generated before reading the text. Importance assignment processes involved using context; assigning unimportance; using text structure clues; becoming aware of authors and their purposes, task, personal purpose and goals, and assigning conditional importance. Evaluative processes included evaluation of the author, of the text, and of the reader. Processes of reader affect and attribution involve the level of prior knowledge, reader attitudes, positive reactions to reading, and external and internal attributions. Comprehension monitoring

processes consist of monitoring at the end of meaning units and for text already read. Executive management processes involved the sequence in which fix-up strategies were applied, avoiding processing system overload, controllling the reading rate, and monitoring strategy effectiveness.

The Two Categories of Processes in This Study

This study has attempted to organize the strategies so that the grouping is consistent with metacognitive categories: 1) knowledge about cogniton and 2) the regulation of cognition (Brown, 1985, Paris, Cross & Lipson, 1984). The two major categories suggested by this study are : 1) main idea construction processes and 2) processes for monitoring and regulation. This study's category, "main idea construction processes", encompasses the knowledge readers have about the topic and the knowledge that readers have about how to perform certain tasks. Paris et al (1984) have labelled this declarative and procedural knowledge. The category, "monitoring and regulatory processes", is intended to indicate the knowledge readers have about when and why certain strategies should be used. Paris et al (1984) call this strategic knowledge. While Afflerbach classifies, "comprehension monitoring and executive management" as a sub-category of the "related" processes, the model presented in this study may be more helpful to teachers who wish to organize their instruction along metacognitive lines. The two major headings are consistent with

the major categories of knowledge described in the metacognitive model. This model may be more informative for teachers who are planning direct explicit instruction in how to process main ideas.

The second area of difference between this model and that of Afflerbach lies in the descriptions of the main idea construction processes of "crunching" and "topic/comment". For Afflerbach, the "crunching "process is described as an automatic one because it was mainly absent in the verbal reports made by the subjects in his study while they were reading. "Crunching" was a time in which readers paused in their intake of text. This study has no strategy comparable to "crunching". Afflerbach suggests that "crunching" may be an "automatic" process affiliated with either the "topic/comment" strategy or another strategy he labels "draft and revise". Lack of information in Afflerbach's commentary surrounding "crunching" seems to limit its usefulness as a comprehension strategy to be taught to novice readers.

Afflerbach describes the topic/comment strategy as being a two stage process in which the reader has partially constructed the main idea statement and then returns to sample the text once more to construct the remaining portion. The fashion in which this process occurs is not explained in any detail. The text processing strategies of summarizing, weighing importance, using structural cues, and using examples as text processing strategies as identified in this study provide more detail about what occurs

when readers return to the text. As such, these categories may prove more helpful in teaching novice readers.

The present study also chose to develop a category of strategies designated as summarizing strategies with the intent of elaborating upon Afflerbach's construction processes. This is consistent with the research of van dijk and Kintsch (1983) and Brown and Day (1983). The sub-category of summarizing strategies was divided into four parts that included restatement, paraphrasing, evaluation of content, and hypothesis confirmation. The purpose was to provide a picture of the information gathering process that might be more familiar to classroom teachers than that provided by Afflerbach's topic/comment rule. Additionally, these summarization strategies are described in terms that may be more familiar to classroom teachers. Whereas summarizing is a familiar term for class teachers, "topic/comment" is not consistent with previous devlopmental studies (Brown, 1981; Brown, Campione & Day, 1981; Brown & Day, 1983). The summarizing strategies are organized in an order from the least (restatement of the text) to most complex activity (confirming a reader hypothesis). Given the present trend toward teaching reading as a developmental process, the categorization of summarizing strategies may be more instructionally relevant.

Another area in which the model developed through this study differs from Afflerbach's model is found in the separation of "hypothesis generation" as a main idea comprehension strategy and

"hypothesis testing" as a "related" main idea constructon process. Afflerbach has divided the process of hypotheisizing into: 1) generation and 2) subsequent hypothesis testing or verification. This study has addressed the issue of how readers develop a hypothesis by subsuming all related expert reader behaviours under the category of main idea construction. This study's sub-categories regarding the use of structural cues, summarizing, examples, and weighing importance, all contain strategies that aid in the construction and verification of a main idea hypothesis. It is noted that in Afflerbach and Johnston's later article (1986) "hypothesis testing" is not given the same level of importance as it was in Afflerbach's dissertation (1985). The reference to "hypothesis testing" is found in the description of the "crunching" process. It may be that Afflerbach has recognized a need to collapse the strategy of hypothesis testing within a main idea construction process. If this is the case, Afflerbach has provided additional clarity about the relationship between the constructive process of generating a hypothesis and the process of hypothesis testing, which would now appear to be a main idea construction process.

Common Elements in the Models of Text Processing

An area in which there appears to be common elements between this study and Afflerbach's test processing categories is the relationship between the process of main idea construction and the

management of comprehension monitoring. Expert readers in both studies reported similar patterns of monitoring and regulation in the presence of a comprehension breakdown. As in Afflerbach's study, in the absence of content knowledge, readers in the current study regulated their comprehension by using text structure as a cue to main idea construction. A further common element between this study and Afflerbach's was the strong sense of affect and of attribution expressed by readers. This aspect of personal involvment was regarded as being consistent with the active role that expert readers assume in reading expository text.

A second area in which this study and Afflerbach's share commonality is in the role ascribed to schema theory in constructing main ideas. The model of main idea construction processes described in this study reflects a schema-theoretic view of text-processing involving text-based processing on the one hand and content-based processing on the other. Afflerbach's study examined the impact of familiar and unfamiliar text content upon the reading behaviour of expert readers. His findings are consistent with findings in this study. In the absence of schema for content readers tend to rely upon schema for text .

Considerations for Future Research

The limitations of this study suggest areas for future inquiry. Think-aloud and reflective report data might be gathered from students of different ages to establish a developmental

pattern in main idea comprehension processing bearing in mind that Brown (1982) and Garner (1987) suggest that data collected from young subjects are prone to greater fallibility. Children may also lack the vocabulary needed to express themselves adequately.

Other inquiry might be directed at the strategies expert readers employ in examining texts of other genres. Such studies could be conducted using narrative text resulting in additional information to confrim or deny the text processing strategies outlined here. Such research could be related to the text processing of story grammars.

This study does not examine whether or not subjects gave correct main idea statements, nor does it provide any insight into which strategies resulted in better comprehension and more accurate main idea statements. Investigation into the relationship between accuracy and strategy selection would be valuable.

Finally, a study aimed at training teachers to recognize their own main idea processing strategies could be undertaken with the view of answering the question of whether teacher self-awareness of text processing enhances instruction and results in better comprehension on the part of their students.

Educational Implications

It is apparent from the think-aloud reports that reading text from unfamiliar content domains places a heavy demand upon the cognitive resources of expert readers. It is apparent that educators place similar demands upon students. This suggests that, as teachers we need to be reflective regarding: 1) the task demands we place on students, 2) the material we assign, and 3) the prereading activities we provide. These are elements over which we have immediate control. Additionally, we must give some thought to how we might improve instruction regarding both the process of main idea construction, and the regulation and monitoring of comprehension. A danger exists that presenting a list of processes may mean additional tasks for students to perform in isolation from actual reading tasks. There is value in giving teachers the opportunity to activate and reflect upon their own reading processes. In providing this opportunity, we may be able to encourage classroom teachers to provide students with similar opportunities. Once classroom teachers and school administrators become informed of the purposes, teacher modeling of the think-aloud activities and use of peers as strategy coaches could provide low achieving students with useful examples and ultimately enhance their content area performance.

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Appendix A

TEXTS USED IN THE STUDY

Literary Criticism

Giles, R.K.. (1986, April) Archetype & Irony in The Natural.English Journal.

In a May 14, 1944, Time review,"Swinging for the Fences", Richard Schickel says that The Natural "is an American myth, Bub, and don't you forget it". **** But there is more than just an American myth at work in this movie. Universal archetypes are there as well, often integrated into the ironic spirit of the film.**** And the teacher can easily use this film to show how archetypes and irony make their appeal to a serious audience, without in any way making the film less entertaining.****

The "American Dream" constitutes the movie's mythic foreground: the country boy leaves the farm on an interrupted journey toward success as a major league baseball player.**** Even his plebian name, Roy Hobbs, suggests his common origin. And ,of course, baseball is the national pastime- itself a metaphor, as in E.B.

White's well-known definition: "Democracy is the score at the beginning of the ninth."****

But the mythic component of the film extends far beyond the ideas and images which form the strictly American grain in our common culture.**** For example, one finds throughout the movie the recurring presence of water symbolism, water often being associated with creation, fertility, or the mystery of origin. **** At significant moments in the movie, the rain begins to fall in the background, as when, talking with sportswriter Max Mercy, Roy Hobbs stands in front of a downpour at the tunnel to the stadium and refuses to reveal his mysterious past.**** Dramatic irony supports the scene, for the audience knows what Mercy has forgotten: sixteen years before Mercy had umpired, and lost a wager on, a carnival lot confrontation between "The Whamer" and the young Roy Hobbs.**** Water also forms the backdrop when Memo Paris attempts to learn about Hobbs' past as they stand next to the pier with the sea behind them.****

The women in the movie have an archetypal aura as well.**** Barbera Hershhey plays a femme fatale, a "terrible mother" type who veils herself in symbolic black (evil, mystery, death) before pulling the trigger.**** Here the deceptive tension between appearance and reality constitutes romantic irony, because there

is a sudden change of tone: the insidious illusion of a beautiful siren turns rapidly and unexpectedly ugly.****

On the other hand, there is a "good mother' type, dressed in spiritual white (light, purity, life), who provides the spiritual nourishment which Hobbs needs in order to break out of his slump.**** Played by Glenn Close, she is named Iris, suggesting the Greek goddess of the rainbow.**** Once again, an ironic contrast heightens the dramatic effect, because Iris, at this point, is the foil whose presence underscores the detrimental influence of Memo, an influence to which Hobbs has been blind.****

Contrasting "father figures" give an archetypal balance to the movie's symbolic structure.**** On the evil side there is the corrupt judge who schemes to seize complete ownership of the team. Situational irony supports the plot at this time because, in order to acquire the remaining shares of the team, the judge must insure that the Knights lose, rather than win, the pennant.****

The antithetical figue is the team manager, "Pop" Fisher -a name suggesting in mythic terms both "the wise old man" and the Fisher King, the wounded ruler who must be healed by a questing knight.**** "Pop" owns the other shares in the team, a circumstance of plot which makes the judge not only his symbolic

but also his literal antagonist.**** "Pop" is an appropriate sobriquet because he becomes, in effect, a surrogate father for the hero, and Pop's wisdom is most evident when he warns Hobbs against a romantic infatuation with Memo. **** But once again irony supports the mythic dimensions because, thinking him too old to help the team, Pop himself is not wise enough to put Hobbs in the lineup immediately.****

In the movie, the closing scene not only recalls the opening one but also scales down the action and relocates Roy and Iris, his arcetypal "soul-mate", in an idyllic setting where the cycle may begin anew.****

Science Article

Science Dimension 1983, Vol. 2 pgs. 29 - 31

During the last few years, scientists at NRC's Prairie Regional Laboratory have taken a long, second look at the art of plant breeding to see if advances in plant physiology can be used to help the breeder make his selections.*****

They are studying the "physiological characters" which, as the name implies, are traits of the plant cell's metabolism.*****

Many of these, like photosynthesis, respiration, nitrogen fixation, seed growth, and leaf production, can profoundly affect the agricultural usefulness of the plant.*****

The PRL group has been looking into selecting plants on the basis of their ability to carry out these processes, and the indications are that at least some of them, notably photosynthesis and nitrogen fixation, can be genetically improved.***** When plant breeder's survey a plant species, they hunt for traits that they know will make it a better food crop; this "agronomic performance" as they call it is determined by a number of the plant's traits, things like plant height, the time of flowering, resistance to disease, and so on.***** In general, such visible characteristics are determined by relatively large numbers of genes in the plant.***** Physiological processes, on the other hand, tend to be components of these larger characteristics, and thus controlled by smaller numbers of genes.*****
Selecting for these processes then, really amounts to fine tuning the control over plant genes.*****

During the last seven years, John Mahon and genticist Dr. Shaun Hobbs have been studying the genetics of physiological characters and how they relate to the usual agronomic traits such as seed

yield, seed protein, and harvest index (the economicaly valuable proportion of the plant).*****

They work with the common, garden variety field pea because it carries on nitrogen fixation , it grows well in Saskatchewan and the species exhibits considerable genetic diversity.*****

Genetic studies at PRL show that photosynthesis is controlled by several genes in such a way that the good qualities of two high photosynthesis types can be combined to produce offspring superior to either parent.***** In fact, this kind of selection, crossing and re-selection has shown photosynthetic efficiency can be improved by as much as 25 per cent.***** Nevertheless, as exciting as this is, Mahon is only cautiously optimistic: "Even though we can genetically increase the photosynthetic efficiency of each square centimeter of leaf and show that this leads to increased growth, differences in the plant's ability to produce leaves can make an apparently high photosynthetic type seem very unproductive.***** The question we are now asking is whether we can combine a high photosynthetic ability with a good production of leaf area."*****

Nitrogen fixation provides the greatest challenge to this physiological selection approach because the process really occurs in modified bacteria living in the plant roots.***** This is a

true "symbiosis" with the bacteria receiving energy from the plant's photosynthesis and giving usable nitrogen to the plant for growth.***** Thus, the overall process is controlled by two independent sets of genes, one in the plant and the other in the bacterium; improvement will probably require changes in the genetic makeup of both partners.*****

As John Mahon sees it, the work with these physiological processes is bringing plant genetics closer to the ultimate stage of scientific control over breeding - the use of cell structure and genetic engineering techniques.***** Says Mahon: " The ability to work with one hundred million 'potential plants' in a single flask of cell culture could give plant breeders the same large population which have been so sucessfully exploited by microbiologists in finding rare and useful genetic traits in bacteria and other micoorganisms.***** But right now you can't tell from examining an individual cell what the yield or grain quality of a plant produced from it will be.***** In other words we need to to find characteristics which are both detectable in single cells and useful in a farmer's field".***** Until scientists know which genes to modify, he feels, genetic engineering will be largely unavailable to plant breeders.*****

If individual physiological processes do determine the pattern of growth, if they are indeed genetically determine, and if the technology to measure them can be developed, then plant breeders will have powerful new tools to use for plant selection.***** Better yet tomorrow's genetic engineers will be able to aim their new weapons at specific targets.*****

Appendix B

Summary of Afflerbach's Categories
of
Main Idea Construction Processing
and
Related Processes

A. Main Idea Construction Processes

1. Initial Hypothesis

2. Crunching

3. Listing

4. Topic/Comment

5. . Draft and Revise

B. Processes Related to Main Idea Construction

1. Hypothesis Generation and Testing

2. Importance Assignment

3. Evaluative Processes

4. Reader affect and attribution

5. Comprehension Monitoring and Executive Management Processes

Appendix C

Sample Protocol
Containing Text, Think-aloud,
and Reflective Reports

During the last few years, scientists at NRC's Prairie Regional Laboratory have taken a long, second look at the art of plant breeding to see if advances in plant physiology can be used to help the breeder make his selections.*****

(Laughs) I'm going back and reading that's what I'm doing and after a sentence like that I'd go back and read it again probably

**
****
I suppose because it's a long sentence and because it's at the beginning of the article and nervousness at the start
****
**

Investigator: When you went back to read what were you looking for?

...I guess I read... to see what I'mlooking for.. probably when I read orally I don't comprehend as much as when I read to myself... I never noticed it was "second look" until I went back a second time

**
****
When I'm reading orally I pay more attention to the pronunciation of the words then when I read to myself so some of those words where I was very conscious of saying them properly if I were reading it silently I wouldn't have thought of it
****
**

They are studying the "physiological characters" which, as the name implies, are traits of the plant cell's metabolism.*****

So I go back and try to figure out what is meant by physiological characters

**
****
That was just going back to check the definition in the previous sentence
****
**

Many of these, like photosynthesis, respiration, nitrogen fixation, seed growth, and leaf production, can profoundly affect the agricultural usefulness of the plant.*****

What am I doing now I guess I'm going back and look at those characteristics and try to figure out what they all mean

**
****
I think there was a lot of information in a couple of sentences and it would take me more than one reading to digest that
****
**

The PRL group has been looking into selecting plants on the basis of their ability to carry out these processes, and the indications are that at least some of them, notably photosynthesis and nitrogen fixation, can be genetically improved.*****

I'm going back to see what PRL was again..."Prairie Regional Laboratory".. I guess I wonder why their choosing those two

**
****
oh those two characteristics... I was trying to figure out in my mind .. why it would be those two

Investigator: Are you saying that you are making some guesses then

Yeah.. nothing in relation to the article but to what I know about plants which is minimal
****
**

When plant breeder's survey a plant species, they hunt for traits that they know will make it a better food crop; this "agronomic performance" as they call it is determined by a number of the plant's traits, things like plant height, the time of flowering, resistance to disease, and so on.*****

I guess I'll go back and read that sentence because it's a long sentence

**

****

When I get through a sentence like that.. when it's that long and .. maybe it's the structure of that particular sentence I'll get about three quarters of the way through and start realizing I don't know what they're saying here.. because of the structure I'll go back and reread it very slowly

Investigator: When you say you don't realize are there certain things that are happening in your mind at that point.. what sets off that little alarm bell in your head

I think that a sentence like that..... let me read that sentence again.... about halfway through that sentence this "agronomic performance as they call it" .. the sentence refers to something different here than it did at the beginning.. it's almost like something in brackets ..... so the sentence is.. the author is referring to something here in his thought and then he throws this in which to me .. throws me off and then he goes back to it I believe and that's where I'll get mixed up.. I'll slow down and read it again

Investigator: So that "agronomic performance as they call it" you're going back to find the relationship between that term and what was said before

..... he could have left that part of the sentence out.. he could have said, When plant breeders survey a plant species they hunt for traits that they know make it a better food crop as determined by a number of plant traits things like plant height and so on... this is supplementary.. he's defined it but when it's all in one sentence I'm thinking about this and suddenly he throws in a definition and I guess that's a different thought

****

**

In general, such visible characteristics are determined by relatively large numbers of genes in the plant.*****

You wonder what I'm doing right then... I'm going back and checking what there is about characteristics we're looking for right then .....

**
****
I guess again there's a lot of information which ..I'm going back because I don't remember
****
**

Physiological processes, on the other hand, tend to be components of these larger characteristics, and thus controlled by smaller numbers of genes.*****

..... I'm now trying to make sense out of that... .well we've got the ..... I went back and looked at these physical traits .... which are determined by a large number of genes in the plant and then uhm.. components of that ..physiological processes..makes sense that a smaller number of genes would control them

**
****
I guess I'm rereading ..... I was breaking the sentence down. reading parts of it to digest it a bit at a time
****
**

Selecting for these processes then, really amounts to fine tuning the control over plant genes.*****

So if they want to control these things here they've got to they've got to figure out this small number ..or these small groups of genes to get control

**
****
I'm trying to determine his logic in what they have to do to control.. what genes they have to control to get their final product
****
**

During the last seven years, John Mahon and genticist Dr. Shaun Hobbs have been studying the genetics of physiological characters and how they relate to the usual agronomic traits such as seed yield, seed protein, and harvest index (the economicaly valuable proportion of the plant).*****

"to evaluate the economically valuable proportion of the plant" .. "Harvest indext" ... I guess I was thinking of what "index" means it obviously means the propensity of that particular plant to uhm..... produce in terms of economics

**
****
He did it again.. to me reading the sentence and then he throws something else in there.. it's adefinition so I'm concentrating on that and proboably forget to focus on the sentence and focus on the term in the sentence

Investigator: When that happened you appeared to be aware of it because you didn't just go blithely on

Yeah I stopped and was reading about that harvest index and then I kept goinf but I find that type of thing does take me away from the article.. the theme of the article but then I might have gone over that term and not thought about it's meaning too
****
**

They work with the common, garden variety field pea because it carries on nitrogen fixation , it grows well in Saskatchewan and the species exhibits considerable genetic diversity.*****

That makes sense

Genetic studies at PRL show that photosynthesis is controlled by several genes in such a way that the good qualities of two high photosynthesis types can be combined to produce offspring superior to either parent.*****

I've got to go back and redo that sentence..... now I've gone back to photosynthesis.. controlled by several genes..... ..."two high photosynthesis types can be co... ok..I'm going back to combining two of them to produce offspring superior to either one of the parent

**
****

Why did I go back and redo that sentence. ..... it's along sentence it's a compound sentence.. I would imagine that..... since the terminology is somewhat unfamiliar to me and I'm trying to keep track of the meaning of the terms and then he comes to a conclusion there and there are two things I'm thinking about trying to understand what the terms mean and also understanding his reasoning..... and if I concentrate on one and lose the other I'll read it again

Investigator: So you're not going to go on then until you've got those two things done

That's right.... I can't understand his reasoning if I'm not sure of the meaning of the terms

****
**

In fact, this kind of selection, crossing and re-selection has shown photosynthetic efficiency can be improved by as much as 25 per cent.*****

OK

Nevertheless, as exciting as this is, Mahon is only cautiously optimistic: "Even though we can genetically increase the photosynthetic efficiency of each square centimeter of leaf and show that this leads to increased growth, differences in the plant's ability to produce leaves can make an apparently high photosynthetic type seem very unproductive.*****

Ok I was Ok with that sentence until this "differences in the plant's ability to produce leaves can make an apprently high photosynthetic type seem very unproductive" ... They're able to .... produce plants that are of higher quality even though they can't increase the photosynthetic efficiency of each square centimeter of leaf but there must be something else there that is running counterproductive to what they are trying to do which..... differences in the plant's ability to produce leaves so that is not a factor which they are controlling

**
****

I think it's the same thing again if you just have this here differences in the plant's ability to produce leaves can make a very high photosynthetic type seem very unproductive... I would understand that in fact after reading I did understand but he's got that "but" in there "even though" going through all that and that's related to uh..what he talked about earlier

Investigator: So the but did something

uhm.. the even though did yes..... I would think that even though would cue to me that he's uhm..... summarizing the point that he's just made .. so I would in reading that want to make sure that I understood that or remembered that he had stated that or I agreed with it and then he got to his conclusion

****
**

The question we are now asking is whether we can combine a high photosynthetic ability with a good production of leaf area."*****

I'm trying to compare those two.."high photosynthetic ability".."good production" and I don't understand that right now maybe I'll get it ...I assume he's going to talk about that

**
****

I think just the expression high photosynthetic ability was a term that probably wouldn't quite fully understand ... how you would tell a plant has high photosynthetic ability ..... I have an understanding of photosynthesis but photosynthetic ability is a trait of a plant and it's a relative term.. I

probably wouldn't fully understand what..... of how a pant has more of that ability than another one does

****

**

Nitrogen fixation provides the greatest challenge to this physiological selection approach because the process really occurs in modified bacteria living in the plant roots.*****

I'm not to sure what nitrogen fixation means.... I'm not really a biology expert (laughs)

**

****

Exactly... I'm laughing again ..... I guess the term.. I would go over that and not worry about it

****

**

This is a true "symbiosis" with the bacteria receiving energy from the plant's photosynthesis and giving usable nitrogen to the plant for growth.*****

I'm going back and reading that sentence "bacteria receiving energy from the plant's photosynthesis and giving usable nitorgen to the plant for growth"..Ok.... so the bacteria is using energy from photsynthesis and giving nitrogen to the plant

**

****

The way he's worded that.. this is a true symbiosis ..with the.. and he's.. .. to me he saying in the way he writes that is ... giving a definition of symbiosis and I'm trtrying to understand that

****

**

Thus, the overall process is controlled by two independent sets of genes, one in the plant and the other in the bacterium; improvement will probably require changes in the genetic makeup of both partners.*****

So the overall process uhm.. two factors here the genes in the plant and the genes in the bacteria and I think they'll have to want to uhm.. look at both sets of genes

**
****
I'm reading the summary that he did ..... and trying to understand it from what I thought his main statement was

Investigator: I had a sense that you were making a prediction with this last part of the sentence....when you said they'll have to want to look at that...

Yeah this is half way through the article isn't it.. two thirds of the way through..... yeah that's right they've got two ways to go here and uh...both factors are independent of one another so I was making a guess as to what he was going to do in the rest of the article
****
**

As John Mahon sees it, the work with these physiological processes is bringing plant genetics closer to the ultimate stage of scientific control over breeding - the use of cell structure and genetic engineering techniques.*****

That just makes sense .. where he's going with it

Says Mahon: " The ability to work with one hundred million 'potential plants' in a single flask of cell culture could give plant breeders the same large population which have been so sucessfully exploited by microbiologists in finding rare and useful genetic traits in bacteria and other micoorganisms.*****

Again it's a long sentence..... so plant breeder's can work with these cells... ..because they're working with the cells they're working with potential plants..... ....potential there I guess.. uhm.. I guess I'm trying to figure out how they can take one hundred million potential plants and use that for testing for all these things and the same large population that micobiologists would use..... so plant breeders can do this..... ... .I'm going back to review some of the things I said to you earlier.. just tying it together ..who was doing the survey.. where it was being done..just trying to make an outline in my mind....I guess normally I'd have gone back more.. I tend to do that.. it's

difficult.. I would read it slowly.. rather than reading it all I'd go back halfway through..

**
****

I don't fully understand how they would use or take those millions of cells and uh experiment with them and that's because I don't have the background in biology it sort of lost me there and I was trying to compare whjat they're doing with these plant breeders to microbiologists which I assume he's talking about a different laboratory setting where they have better equipment and facilities than the plant bredders have and I was trying it's in the back of mind and I don't know if it's still there ..... the sentence isn't difficult to understand what he's saying .... I was having difficulty understanding how microbiologists would be able to do this more easily than these plant breeders

Investigator: So this is a different kind of problem than the one you were talking about before with the definitions

Yes

****
**

But right now you can't tell from examining an individual cell what the yield or grain quality of a plant produced from it will be.*****

I have to reread that last sentence..."in general physical characteristics determine.. just a minute..."says Mahon the abiity to work with a hundred million potential plants in a single flask of cell culture has given plant breeders a similar large population to that which has been so successfully exploited by microbiologists in finding rare and useful genetic traits in bacteria and other micoorganisms.....But right now you can't tell from examining an individual cell what the yield or grain quality of a plant produced from it will be".. so that's the difficulty they're going to have with this thing they've got all this potential but they cannot determine in advance which one's to take because they don't what they'll get from it so it's I imagine a bit of a guessing job there

**
****
I had to reread a lot didn't I... I guess I was going back over that previous sentence there ..... and again still trying to understand it and fitting it into his conclusion there which is basically this last thing it cannot be determined in advance because

Investigator: I had a sense that you have been holding on to this problem in your mind as you went along and did some more reading and then at the very end when he made that statement you went back and had another look at it to see if it still fit your problem

Well I would have to because it's tied in to that.. that's a premise to his argument for that conclusion
****
**

In other words we need to to find characteristics which are both detectable in single cells and useful in a farmer's field".***** Until scientists know which genes to modify, he feels, genetic engineering will be largely unavailable to plant breeders.*****

They can isolate it but they cannot tell which genes produce which results

**
****
To me that was a fairly major point I was just summing it up
****
**

If individual physiological processes do determine the pattern of growth,

Read that again

If individual physiological processes do determine the pattern of growth, if they are indeed genetically determine, and if the technology to measure them can be developed, then plant breeders will have powerful new tools to use for plant selection.*****

There are three things there.... "individual physiological processes" so if those three statements are true.. he's

going to have a conclusion here....."individual physiological processes.. and if they are indeed genetically determined..ok..genes determine those processes....the technologhy to develop them... to measure them can be developed..then plant breeders will have powerful tools to use for plant selection... sure

**
****
I know that word if would cue me that he's going to make a logical type statement.. it's probably my training in computers and language and I went back to read it again because I hadn't absorbed that statement.. it was probably that second if..... and I think I would have known when I was reading up here that there were three if's... I would have seen that third if

****
**

Better yet tomorrow's genetic engineers will be able to aim their new weapons at specific targets.*****

Investigator: You made a comment there were three things there and then you started doing something what were you doing?

I was counting the three things and trying to relate them back to what they'd said earlier in the article and that's the conclusion he get's from them

Investigator: you'd said there's going to be a conclusion here.. what made you say that?

Well because he says "if" and "if" and "if"

Investigator: You said earlier you would like to back and reread you wanted to that here but perhaps didn't feel comfortable .. what would you look for when you were doing that?

I would look at any sentence that was giving me some trouble ..... and I would go back to where there might have been reference to that before... quite often when I'm reading something that I find difficult and I'm trying to understand the whole gist of it..I'll read a bit and then read it again and go a bit father and I'll read it again and go a bit farther and I'll be skimming the beginning trying

to take parts out of the beginning break it down so I can make sense out of it and go on.... I was ah.. I would glance through that and try to make something that .... a phrase or a sentence in my head of what it was about..... .... my outline is a picture I guess.. if I were studying and had to know that I would draw something a chart and I would take the points out of it and draw down here to a subpoint or try to do that in my head

Appendix D

Sample of the Sequential Tabulation
of
Think-aloud Responses

NOTE: The subject code identifies the subject t with the first two letters. the "L" or letter "S" which are in the third place indicate that the responses were for the literary criticism text or for the science text. The entry number indicates the order of the verbal report in the protocol. The description is the investigator's comment about the think aloud.

SUBJ CODE	ENTRY #	DISCRIPTION
CS-L	1	context for article based on title
CS-L	2	affective response to article, negative
CS-L	3	Identify key word and relate to own knowledge
CS-L	4	evaluation of the style/structure across paragraphs
CS-L	5	reader prediction confirmed as to intent of article
CS-L	6	affective response to writer's complex structure
CS-L	7	question to himself about writer's organization
CS-L	8	eval. comment about author's use of and
CS-L	9	refer to background experience related to use of "and"
CS-L	10	comp. monitoring - problem is unexpected statement,
CS-L	11	prediction about what the writer will make important
CS-L	12	Read on
CS-L	13	affective,negative, response to writer's word choice
CS-L	14	eval. comment about a pattern the reader sees
CS-L	15	validates the writer's argument with writer example
CS-L	15b	a reader analogy that supports a writer example
CS-L	16	eval. of the writer's sent. structure
CS-L	17b	Comp. monitoring, doesn't understand example

SUBJ CODE	ENTRY #	DISCRIPTION
		reads on
CS-L	18	reader makes question to himself
CS-L	19	paraphrases writer
CS-L	20	question to self about the author's example
CS-L	21	comp. mon., question to himself, about writer's state
CS-L	21-b	identifies problem as "purple prose"
CS-L	22	decides to carry on without resolution
CS-L	23	comp. mon., problem said to be sentence structure,"but
CS-L	24	prediction made as to what will follow, mythology
CS-L	25	writer example seen to confrim reader prediction,
CS-L	26	recall of related reader experience with Middlemarch
CS-L	27	reread to make a list of things related to water
CS-L	28	summary statement about mysterious past
CS-L	29	monitoring statement - "gotten a grip on it"
CS-L	30	comp. mon., identifies overly complicated structure
CS-L	31	reread to find info about Max
CS-L	32	paraphrase author's words
CS-L	33	monitoring statement indicating "sorted that one out"
CS-L	34	eval. staement about the writer shifting topics
CS-L	35	comp. mon., reader misinterpretation, reread, summarize
CS-L	36	predicting based on topic sentence, structural
CS-L	37	reader question to himself re: trigger
CS-L	38	comp. mon., length/complexity of sentence, reread
CS-L	39	reader theory summarized, conflicts with writer
CS-L	40	continues reading, judgement about theory withheld
CS-L	41	comp. mon., eval of writer's argument, own example in

SUBJ CODE	ENTRY #	DISCRIPTION
CS-L	42	predicts parallel structure based on earlier structure
CS-L	43	evaluates the writer's example re:fullness, Iris
CS-L	44	comp. mon., writers purple prose
CS-L	45	rereads as a fix-up strategy
CS-L	46	identifies the lack of comp as incomplete writer example
CS-L	47	predicts father figures based on topic sentence
CS-L	48	OK validation of the reader's prediction, corrupt judg
CS-L	49	comp. mon. reread, length of sentence?
CS-L	50	paraphrase author
CS-L	52	comp. mon., unknown word
CS-L	53	Re-read text to get meaning from context,
CS-L	54	reads 2nd half of sentence, can't unlock word,
CS-L	55	Comp mon statement "I'm not clear on this"
CS-L	56	paraphrases the writer
CS-L	57	summary statement about key word "wise"
CS-L	58	comp. mon., rereads
CS-L	59	expectation of an example and eval comment