THESIS

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dissertation entitled

DIFFERENTIAL COMPREHENSION PATTERNS
OF MATURE SLOW AND FAST READERS
IN EXTENDED DISCOURSE

presented by

Susan Maudie Gibson Hice

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Administration and Curriculum

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Date September 30, 1983

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1983

DIFFERENTIAL COMPREHENSION PATTERNS OF MATURE SLOW AND FAST READERS IN EXTENDED DISCOURSE

By

Susan Maudie Gibson Hice

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Administration and Curriculum

1983

ABSTRACT

DIFFERENTIAL COMPREHENSION PATTERNS
OF MATURE SLOW AND FAST READERS
IN EXTENDED DISCOURSE

By

Susan Maudie Gibson Hice

The purpose of this study was to discover whether mature readers with slow or fast reading rates differed in the types of information recalled after reading. The study population contained 133 high school seniors who were good readers and high achievers. They were termed "mature" based on definitions of psychological maturity in perception and cognition. All had good near-point acuity.

Four categories of comprehension were described in ascending order of structural complexity: detail, microstructure, main idea, and macrostructure. Multiple-choice questions testing recall in these four categories were constructed from a structural map of the study discourse. (Other study variables were Nelson-Denny Reading Test scores, SAT scores, and rank in class.)

Mature readers were asked to read once through a general-interest Scientific American article of 2,698 words (4,385 syllables), using their normal internal purpose and rate for such assignments. Subjects were timed; recall in the four comprehension categories was assessed.

Rate of discourse reading was correlated with each of the four comprehension variables; only microstructure (detail relationship) was statistically significant: $r = .1609$. (Nonsignificant trends were that main idea was consistently positive, whereas detail and macrostructure were positive or negative, depending on calculation methodology.) It was concluded that (1) either speed facilitates connecting neighboring details, or (2) mature slow readers integrate microstructures into existing constructs, employing considerable idea transformation, so that the microstructures become less recognizable in their original form.

Post hoc study groups of the 30 slowest ($\overline{X}$ = 148 wpm) and 30 fastest ($\overline{X}$ = 324 wpm) discourse readers were compared based on mean comprehension patterns. An apparent interaction was noted between rate groups and micro- and macrostructure comprehension: slow readers appeared superior in macrostructure and fast readers in microstructure. Middle-rate readers ($\overline{X}$ = 212 wpm) excelled in detail comprehension.

Theories maintaining that slow reading is a cause of poor comprehension received little support within this population. It appeared more likely that rate is a reflection of the type of comprehension occurring. A "structure" hypothesis was presented maintaining that mature slow readers process and structure essentially all ideas encountered, using inductive reasoning for questions; mature fast readers focus on a smaller subset of ideas, using deductive reasoning for questions.

To my parents, Andrew and Frances Gibson,

whose unflagging support made completion

of this dissertation possible.

ACKNOWLEDGMENTS

It is doubtful that work of this type is completed without the aid and encouragement of many other persons. It is fitting that this thesis should begin by acknowledging them and their contributions. Dr. Lois Bader, my advisor and teacher, had the great wisdom to balance guidance with freedom. She allowed me to begin maturing as a scholar by not providing ready solutions to every problem. Rather, she placed in me the confidence that I could find many of the answers myself. The transition from student (sitting in class and learning from a master) to scholar (directing one's own learning) is thus made. I thank her for her confidence in me, for her guidance, and for the many things she has taught me.

A debt of gratitude is also owed to other members of my doctoral committee for their guidance and support: Drs. Laurence W. Lezotte, Eugene Pernell, and William H. Schmidt.

Laurence Bates assisted in programming the data, and Sue Cooley typed the final manuscript.

Several persons helped in the laborious process of data collection and compilation: Andrew H. Gibson, Frances Gibson, Neale E. Hice, Andrea Disbro, Bernie Olander, and Mary Ann Yaich. Although students and personnel of the participating schools cannot be identified by name, a debt of gratitude is owed them for their participation and facilitation of data collection.

My husband, Neale, and children, Jeffrey, Jennifer, and Rebecca, suffered with me through the dissertation process and were willing to take on additional duties and put up with my absences (psychological and physical) that the writing might be completed. I love them more than I can say.

My parents, Andrew and Frances Gibson, and my brother John and sister-in-law Toni provided haven and psychological comfort on my out-of-state jaunts to work at MSU's library. What a lot of love and good times we shared.

Last of all, I wish to thank the friends who prayed for me, that the ideas would come, that I might finish, that my family would be sustained--especially Donna and Ruth. And I thank God for answering their prayers.

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THE PROBLEM

Introduction

This first chapter includes a statement of the problem, the theoretical framework of the problem, the research questions, limitations of the study, and a definition of terms.

Statement of the Problem

The purpose of this study is to discover whether mature readers with slow or fast reading rates differ in the types of information recalled after reading.

Theoretical Framework

Psychology of Reading

Weaver (1977) defined the psychology of reading as "the scientific study of graphical decoding operations in the human organism." Gibson and Levin (1975) added that reading is a self-directed, active process, and not simply the act of matching appropriate sounds to written symbols.

Fluent reading, according to Cunningham (1979), is achieved when:

1. a large number of high- and medium-frequency words are recognized immediately;

2. unfamiliar words can quickly and accurately be pronounced "without isolating phonemes";

3. semantic and syntactic cues can be used to predict the meaning and usage of upcoming words; and

4. the upcoming words can be recognized without completely processing them.

Good reading, however, involves more than using good "automatic decoding" perceptions (à la Cunningham); it also involves certain thought processes necessary to good comprehension. Failure to evaluate sentence elements, in light of other paragraph elements, and purpose for reading, will result in incorrect comprehension. Incorrect meanings can be obtained from a text:

1. "because of wrong connections with the words, singly";

2. because certain elements are over-weighted or under-weighted; or

3. because ideas obtained from the reading are not treated as "provisional" and to be accepted or rejected as they are examined.

So proper paragraph understanding involves weighing elements correctly in relationship to each other, and analyzing and organizing the elements properly. Much poor comprehension is not from failure to remember what is read, or failure to organize the items read. It is because the text was never properly understood to begin with (Thorndike, 1917).

Gibson and Levin (1975) divided the psychology of reading into perception and cognition, where perception is the process of extracting the "relevant information from the manifold available stimulation," and cognition is the self-directed use of these perceptions. Perception involves extracting distinctive features and

invariant events from multiple stimuli and finding structural relationships among and between them. Cognition involves remembering, problem solving, and organizing conceptual knowledge in order that meaning may be better extracted from perceptions. Cognition in the broadest sense, of course, includes perception.

Both perceptual learning and the learning of cognitive strategies are developmental. Eye movements, reflections of what a person must do to read (Buswell, 1937), and eye-voice span, the distance the eyes move ahead of the voice, become adult-like at the fourth grade. After grade 4, improvement in reading efficiency appears to be associated less with improved oculo-motor activity than with "superiority at a deeper level of processing" (Gibson & Levin, 1975). Piaget found that the average child reaches the level of mature adult thinking (formal operational stage) by the age of 14 or 15 (Hafner, 1977; Wilson, 1979). Thus, the subjects of the present study, being above-average students, being between the ages of 16 and 18, and showing a vocabulary and comprehension ability above their grade level, should all have reached the basic level of perceptual and cognitive maturity necessary to adult reading.

The term "poor readers," in most existing studies of the reading speed variable, is used to delineate readers with decoding or comprehension difficulties. In neither of these senses could subjects of the present study be considered poor readers: their decoding and comprehension abilities were excellent. Persons with decoding and comprehension problems generally read at slow rates (the definition of "slow" varying, frequently not being described). What about

readers whose decoding and comprehension are excellent, but whose silent-reading speed is still slow (i.e., close to the speed of adult oral reading)? Buswell (1937) was referring to this population when he wrote:

> Many readers at the college level who understand thoroughly what they read and whose critical reactions to the material are of a high order use cumbersone [reading] procedures which so restrict their choice and amount of reading that their entire fund of ideas remains limited.

What are the known psychological indicators of reading process, and may these indicators be considered as symptoms or as causes of process difficulties?

Psychological-Process Indicators

Buswell (1937) conducted a comparative study of psychological-process indicators. First he recorded the eye movements during oral and silent reading of 1,000 adults with varying reading abilities. Comparing the worst with the best 100 readers, Buswell found the best had: wider recognition span, fewer regressions per line, and a slightly shorter fixation duration. Mature silent-reading skills were psychologically different from oral-reading skills. The silent reading of the poorest readers (i.e., those with process difficulties) more nearly resembled oral reading than mature silent reading.

On each oral-reading film the subject's voice was also recorded, so that precise word-eye relationships could be determined. The eye-voice study showed that the best readers had a wider eye-voice span (EVS). Gibson and Levin (1975) compared readers, aged 7 through adult, and found that fast readers had a longer EVS than slow readers. Fast readers were more likely to end their EVS at phrase boundaries, showing a greater use of grammatical structure. However,

even the youngest and poorest readers made some use of sentence structure in reading. Buswell stressed that eye movements are symptoms of good or poor reading, not causes. They reflect what the person must do to read.

Last, Buswell (1937) examined vocalizations and lip movements made by his subjects when reading tongue twisters silently. He found that there was generally less vocalization and lip movement in better readers. Edfeldt (1960) monitored the mylohyoid muscle, which responds only to speech impulses. He found less silent speech in good readers than poor readers. Easy, clearly written texts showed less silent speech than hard or unclearly written ones. Even fast readers did not circumvent this motor-base of speech activity, although they displayed less silent speech than slow readers. Watkins (1979) effected a reduction in subvocalization levels of seventh graders, experimentally, but no transfer to rate of comprehension appeared to occur. In an earlier study, Buswell (1945) had shown that lip movement could be reduced by conscious teaching but that any such "improvements" would disappear over time. Subvocalization, said Edfeldt (1960), is not a cause of poor reading, but rather, a symptom; "silent speech does not occur until there is a need for extra aids in order that the text may be understood." Or, as Buswell observed (1937), one reverts to the more immature habits which accompany oral reading with particular textual difficulty or under emotional tension.

Huey (1908, 1968) found that auditory imagery (saying the words in one's head) characterized the silent reading of many graduate students. Since this inner speech of silent reading was faster

than the vocalized speech of oral reading, he deduced its nature to be simpler. Oral reading was an average of 56% to 66% slower than silent reading in one experiment. Huey calculated that at speeds above 300 to 400 words per minute it would be impossible to form auditory images of all words; persons reading at higher speeds would probably use auditory imagery in a more abbreviated manner. Persons reading at oral-speech levels are probably forming auditory images of the words in their head as they read. Inner speech may be classed with vocalization, lip movement, and mylohyoid-muscle movement as different aspects and degrees of auditory imagery processing.

While perceptual processing as indicated by eye movements seems at mature levels in fourth grade (Gibson & Levin, 1975), Samuels' study (1975-76) showed that rate of perception of words continues to improve into adulthood. In comparing good with poor fourth-grade readers, and in comparing college undergraduates with fourth-grade readers, using words known to all subjects, Samuels found the more mature groups to be better at generating words from word fragments, more aware of incorrect recognitions, faster at word recognition, and processing at a faster rate. Average rates of oral and silent reading also improve beyond the fourth grade. Edfeldt (1960) included a chart in his study of silent speech and silent reading which shows how oral- and silent-reading rates diverge in the primary grades. In grade 1, pupils read, orally and silently, at an average rate of 45 wpm. By fourth grade the respective rates were 135 and 156 wpm. In sixth grade, the rates were 170 and 210 wpm. (It appears that the oral- and silent-reading rates of some good readers do not increase

much beyond their sixth-grade levels, although cognitive strategies improve [Hafner, 1977]). Edfeldt's chart ends here, but other sources allow further approximations. The maximum adult oral-reading rate probably does not exceed 250 wpm, as it is practically impossible to be understood at rates above this level (Buswell, 1937). Since the average rate of adult speech is between 170 and 200 wpm (Gibson & Levin, 1975), actual average rates of adult oral reading probably would also be in this range. In fact, Buswell (1937) sets the average adult oral-reading rate at "below" 200 wpm. The average college student has a silent-reading rate of 280 wpm (Harris, 1968). Rapid silent reading, however, can commonly reach 600 wpm. The faster one reads silently, the less it is like oral reading, psychologically (Buswell, 1937).

Rate of Processing

While aspects of eye movements and silent speech have been shown to be symptoms of poor reading, rather than causes, some theorists are not ready to make the same statement for reading speed. The speed of input is thought by some to be not a symptom but a cause of comprehension difficulty. Gough (1972) referred to the poor comprehension associated with word-by-word reading to show that delays in input can affect comprehension. Gough felt this rate-comprehension effect can be explained by examining two characteristics of the primary memory (PM):

1. Seven entries must be held together in the PM (for processing) for sentence comprehension to occur, and

2. Items held in the PM decay rapidly if not processed.

Gibson and Levin (1975) said, "There is a minimal speed of reading below which the syntactical and meaningful relations within a sentence or a larger unit of discourse do not come through." This minimal speed would be that of word-by-word reading. Therefore, at low enough speeds, reading comprehension is adversely affected by rate (Cunningham, 1979; Rankin, 1963).

Fridal (1979) declared that for any given text there is a threshold reading speed above which the mind is occupied enough with information processing not to wander. Below this threshold, not enough stimulation of the brain occurs to keep it actively engaged in the reading task only. Thus, concentration is not as good at slow reading speeds. From his clinical experience with college students, Fridal stated that 200 to 350 wpm can be too slow to preserve concentration. (It sounds like the "concentration" thresholds he was advocating were those where auditory imagery has a lessening influence on processing.) The "slow" subjects of the present study were not word-by-word readers (a natural rate of less than 200 wpm does not indicate word-by-word reading). Their perceptual and cognitive maturity were at adult levels. Can such theory apply to them? Could the reading speed of slow-reading good-comprehenders be frustrating propositional memory and causing difficulty in grasping relationships?

Rothkopf (1979) paid high school, then college, volunteers to read for different specific learning goals (specific details). The control group was not given specific goals but was instructed to learn as much as they could about the text. When reading for specific goals, (1) goal-related material was inspected longer than incidental

material, and (2) more goal-related than incidental material was recalled. Eye movements were analyzed for 18 paid high school volunteers while they either read for different specific learning goals or to learn as much as they could. (Forward saccades, regressions, fixation durations, and return sweep time were recorded.) Experimental subjects seemed to make a judgment that a sentence was goal related after reading about two-thirds of it. They then displayed diverse styles of inspecting the material. Some gave added attention to goal-related material, employing some combination of rescanning lines, using more fixations, and/or using longer fixations; they spent longer on goal-related material than incidental material. Some experimental subjects continued inspecting goal-related material in the same manner as incidental material ($p < .05$); they spent the same amount of time on all material, regardless of goal-relatedness. Recall accuracy was essentially equivalent for these various styles displayed by the experimental group. (The control group spent as much time on each line as though it were goal-relevant. Recall was significantly better for the experimental group, in goal-related material, but significantly better for the control group in incidental material. As the number of specific goals was increased, in a separate trial, goal-related recall decreased.) As the experimental results are examined, at least three conclusions seem possible:

1. Extra processing time spent on goal-related material (details) is related to increased recall of these details.

2. Mere recognition that a text is goal related is sufficient to induce increased recall. Any extra time spent is relatively nonproductive in terms of recall of these details.

3. Extra processing time is required on goal-relevant material by some, but not all, subjects, to produce increased recall.

Since Rothkopf did not correlate inspection style with rate, we do not know whether a relationship existed between them. Fast readers are known to be more flexible readers, adjusting their rate to type of reading material (Robinson, 1941). If incidental knowledge were assessed, faster readers would probably get lower scores than slow readers (McConkie, 1973). Fast readers read for the central contents (Dee-Lucas, 1979). Perhaps slow readers do not vary their inspection style (eye-movement patterns) when encountering goal-relevant material, but fast readers do, displaying a range of eye-movement modifications. The slow reader's style may be expressed in #1, above, and the fast reader's style in #2, above.

Dee-Lucas (1979) studied what randomly assigned undergraduates do as they read faster. (Subjects were either rewarded for more thorough comprehension or for a higher speed of reading, producing two distinct rate groups.) She found that as students read faster (120 vs. 251 wpm), they selected material they judged to be of importance and focused on that. She thought that the group induced to read faster processed a smaller subset of material, but did so with thoroughness equal to the group induced to read slower. The slower group recalled 1.6 times as many propositions as the faster group (i.e., 37% vs. 23%); recall sentences of these two groups were

equally well structured. Thus the very slow speed of 120 wpm did not appear to frustrate the comprehension of these assigned slow readers, and relations within the text did come through. The faster readers picked up only half as many implications from the text as did slower readers. This may indicate that seeing implicit causal relations is facilitated in good readers by a slower reading speed. There was not as much memory return (immediate recall of propositions) for the time spent in reading at these lower rates, however. Students reading at about 120 wpm recalled about 10.7% of selection propositions for each minute of reading time. But students reading at about 251 wpm recalled about 13.9% of selection propositions for each minute of reading time. Perhaps faster subjects were recalling more propositions for each minute of reading time because their concentration was less impaired than slower subjects'. Perhaps slower subjects were recalling fewer propositions for each minute of reading time because they were dwelling more on implications. Perhaps in order to remember more details, more transformation of material (into implications) must occur.

Another aspect of seeing relationships is ambiguity resolution. If subjects are attempting to resolve text ambiguities, they will spend longer on the text. Resolving ambiguities takes time (Tanenhaus et al., 1979). In reading ambiguous words, there seem to be two processing stages: all meanings of the word are accessed, then meanings which do not fit the context are suppressed. Students reading more slowly make more inferences. Making correct inferences would require properly resolving ambiguities. No support has been

found for Fridal's contention that students reading slowly have greater concentration problems. Perhaps the types of relationships seen at slower speeds are of a different type than at faster speeds--detail relationship rather than main-idea relationship--and this difference has led to Fridal's assertion (i.e., perhaps he identified concentration with seeing main-idea relationships). Another interesting thought occurs at this juncture. Perhaps auditory-imagery usage in processing does more than thwart memory decay at slow speeds. Perhaps it facilitates the grasp of details and their relationship for the slowly reading good reader.

Kerr (1973) studied how processing demand is affected by various mental operations. She supported a hypothesis wherein a central processing mechanism of limited capacity would be necessary to some, but not all, mental operations. The degree of central processing required by different mental operations was studied by "comparing their degree of interference with a common secondary task." Using sentences and word lists, Kerr found that greater processing capacity was required:

1. when item difficulty was increased;
2. when list length was increased;
3. when subjects knew recall would be expected of them later;
4. when length of the retention period was increased;
5. when multiple input material (word lists, sentences) was presented more rapidly; and
6. when stimulus material was transformed into another form (as in computing answers or inferring).

Processing demands decreased over rehearsal time, perhaps because some items were committed to long-term memory, thus lightening the rehearsal load.

Let us assume that such results apply not only to processing word lists and sentences, but to reading extended discourse, as well. Combine the Dee-Lucas and Kerr results. Mature slower readers have to retain meanings of phrases, sentences, and paragraphs longer before synthesizing them for comprehension. They also appear to focus on a larger amount of material, make more inferences, and later recall a greater volume of material than faster readers. This increases the processing load on the limited central mechanism. Are mature slower readers trying to commit material to long-term memory as they go by incorporating more rehearsal time? This would lighten their processing load (as would their slower speed). Perhaps making inferences, discovering unstated causal relations, is part of the slower reader's rehearsal strategy. Some good readers read at habitually slow rates; do they adopt their slower rate due to bad habit and/or a preference for understanding detail and causal relations?

Mature fast readers would presumably be using more of their central processing capacity by increasing their speed of input. They appear to narrow their focus in reading, however, selecting material they consider important. They do not retain and recall as large a volume of material or make as many inferences (which cuts down on processing demands), but their time is more efficiently spent in terms of recall volume per unit of time on task. Perhaps, if mature fast readers could be evaluated, we would see that, while missing

some details and causal relations, they have a better view of overall topic organization and main-idea relationship. Since Dee-Lucas' subjects all were reading at induced rates below that of the average college student (i.e., below 280 wpm), we lack conclusive evidence on these points. Mature slow and fast readers do appear to spend their processing-capacity capital differently while engaged in the various mental operations of learning from reading, however. Processing style changes with the speed of reading (for assigned rates and natural rates) and with the goal relevance of a particular text.

Two seemingly counter theories to explain how mature readers process text are Gough's and Goodman's. Gough (1972) felt that all visual data from the text are processed and that meaning is constructed from this base. Goodman (1976) felt that "the least amount of information possible to make the best guess possible" is processed by the good reader. The intriguing thing about these theories is that Gough's sounds like possibly the mature slow reader's strategy, also resembling perhaps the inductive method of reasoning (forming conclusions from a body of one's own data). On the contrary, Goodman's sounds like possibly the mature fast reader's strategy, also resembling the deductive method of reasoning (synthesizing from clues). Gough's strategy seems best for gleaning details (something slow good readers excel at), and Goodman's strategy seems best for gleaning main ideas (something at which fast good readers appear to excel).

Postulation of "Structure" Hypotheses

To summarize the information-processing strategies hypothesized to be in use by natural slow and natural fast readers, the

building of details, inferences (microstructure), main ideas, and their relationship (macrostructure) will be likened to the building of a house. Slow readers build their home brick by brick. They work together all details of the first part of the substructure encountered, so that individual pieces are in proper relationship to each other. The various substructures are assembled in the order encountered until the whole text is assembled into substructures. Depending on the familiarity (Nicholson, 1978-79) of substructures encountered, substructure relationships are seen with varying degrees of clarity as he builds. Some substructures may be fitted together after initial construction (or the builder may be so exhausted from his effort that this final "fitting" will not occur). The builder could be left with a well-constructed house, or well-constructed components strewn haphazardly across the lawn, or anything in between. In other words, important relationships of main ideas may be overlooked by slow readers; this is the disadvantage of this strategy.

The fast reader stands a better chance of having at least his superstructure intact. He puts that up first. He only fills in those details considered to be of major importance to the house, as he puts up the superstructure. One can see what the finished house would look like. With this building technique, the house will take its form fairly rapidly. The builder might be very uncomfortable moving into this house, however. Unfinished details could make the house cold and uncomfortable. He has guessed about which parts of the house were necessary and which could be ignored, and has perhaps been wrong at times. He may miss details from which unique implications can be

built. Especially in the field of science, many new discoveries come from building up a compendium of details into unique configurations. Of course, each builder should be able to build a house according to the demands of the situation. Building a detailed house to sleep in one night would be wasteful of time. As we shall see (Review of Literature), mature slow readers prefer to build all their structures the same way, whereas mature fast readers show more ability to adapt to situation needs. No doubt, each is most comfortable with his own building style, however.

This experiment has been set up to test out aspects of this "building" hypothesis. Do mature slow readers excel at detail and inference comprehension, as research has indicated, and do mature fast readers excel at main idea and major relationship comprehension when allowed to read a text through once and answer questions from memory?

Research Questions

In the previous section, information processing was explored in an attempt to form a profile of the reader who reads slowly in spite of having good perceptual and cognitive development in reading-related tasks. A theory was formulated to predict differential types of comprehension to be expected from mature slow and fast readers on an initial read-through of extended discourse material. In this section, research questions are formulated to outline the correlational study that addresses this theory.

1.0 Will there be a relationship between standardized and academic performance data, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.1 Will there be a relationship between Nelson-Denny Reading Test Vocabulary scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.2 Will there be a relationship between Nelson-Denny Reading Test Comprehension scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.3 Will there be a relationship between Nelson-Denny Reading Test Total scores (Comprehension and Vocabulary combined), and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.4 Will there be a relationship between Nelson-Denny Reading Test Rate scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.5 Will there be a relationship between Scholastic Aptitude Verbal scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.6 Will there be a relationship between Scholastic Aptitude Math scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

1.7 Will there be a relationship between class rank, expressed as a percentile, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

2.0 Will there be a relationship between the number and type of questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

2.1 Will there be a relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

2.2 Will there be a relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

2.3 Will there be a relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

2.4 Will there be a relationship between the number of macro-structure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3.0 Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3.1 Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3.2 Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3.3 Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3.4 Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4.0 Will percentage rank in class have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4.1 Will percentage rank in class have an effect on the relationship between number of detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4.2 Will percentage rank in class have an effect on the relationship between number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4.3 Will percentage rank in class have an effect on the relationship between number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4.4 Will percentage rank in class have an effect on the relationship between number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

Limitations

It is possible that the format of this study may have disrupted the method whereby some subjects obtain meaning from print. At least some fast readers first survey an article to determine main ideas, then reread to fill in important related information. Such a preview was not permitted in this study. Students were allowed to read through the article only once.

Subjects who develop ideas as they read by looking back to check on an idea may likewise experience disruption of their method if the desired reference is located on a previous page. Comprehension responses only reflect information gleaned from an initial read-through, and they must be interpreted in this light.

Results of this study do not apply to 12th graders who may be excellent students, but whose Nelson-Denny Total Reading score falls below grade level.

Definition of Terms

Certain terms used in the research questions need further delineation.

Mature readers are defined as 12th-grade students who are in Regents or accelerated Regents classes and who score at or above the 12th-grade level on the Nelson-Denny Comprehension subtest, and who also score at or above their grade level on the Nelson-Denny Reading Test Total (a combination of Comprehension and Vocabulary subscores).

Piaget found that maturity in thinking, the formal operational stage, is generally reached by age 14 to 15 (Hafner, 1977). Sixteen- to 18-year-old 12th-grade students reading at or above grade level, and being mostly in the top quartile of their class, are therefore assumed to be at a psychologically mature level in perceptual and cognitive reading abilities.

Details are defined as particular actions, facts, or descriptive information that is located in one place in the text, generally a single sentence.

Microstructure is defined as the organization of details, based on stated and implied relationships. Such comprehension requires understanding the relationship of sentence details in one paragraph, or in neighboring paragraphs. Microstructures represent supporting ideas, rather than main ideas.

Main idea is defined as one of the major points of an extended discourse. To form the main idea, elements (microstructures, supporting ideas) must typically be gathered from several (noncontiguous) sectors of the text, weighed to determine their relative importance, and then synthesized. Main ideas in this study were not explicitly stated in the text.

Macrostructure is defined as the organization of main ideas and related concepts of an extended discourse. This structure of ideas must be inferred by the reader by assigning relative importance to various categories of information (main ideas), then inferring the proper relationship of these categories. Macrostructure may also be thought of as the relationship of major textual ideas to a unifying concept (Bader, 1980). A correct perception of macrostructure requires an understanding of the important textual ideas and their relationship; it also allows for application of those perceptions to new situations.

Discourse is defined as any stretch of structurally related language (Clark & Clark, 1977).

Extended discourse is defined as an extended stretch of structurally related language. For the purposes of this study, a passage 2,698 words (4,385 syllables) and 28 paragraphs in length is understood to represent extended discourse.

Percentage class rank is defined as that value which is obtained when class rank is converted into a percentage.

$$\text{percentage class rank} = \frac{(\text{class rank}) \times 100}{(\text{number of students in class})}$$

A percentage class rank of 15 means that a subject was in the top 15% of his class: 85% of the students performed at a lower academic level and 15% performed at the same level or higher. (This score was introduced as an approximate method of equating rank scores from eight different schools that had senior-class populations ranging from 39 to 250.)

Summary and Overview

The problem addressed in this study was introduced in this first chapter. Related theory was discussed in terms of the following topics: the psychology of reading, indicators of psychological process, and rate of processing discourse. Different information-processing strategies were hypothesized to be associated with naturally slow or fast reading rates. The chapter ended with a listing of research questions, study limitations, and definitions of terms.

A review of the literature related to the study problem is presented in Chapter II. The methodology used in conducting this study is described in Chapter III, together with a list of null and directional hypotheses. A statistical analysis of the data is presented in Chapter IV for each hypothesis.

In Chapter V, results of statistical tests are interpreted in light of related literature and theory. The chapter concludes with a post hoc analysis of data, discussion of implications, and recommendations for further research.

CHAPTER II

RELATED RESEARCH AND LITERATURE

Introduction

The purpose of this study was to attempt to discover whether mature readers with slow or fast reading rates differ in the types of information recalled after reading. Are different flexibility patterns associated with these differences? The review of literature presented here is organized under three major headings involving reading rate. These headings are: (1) reading rate as a correlate of comprehension, (2) factors upon which reading rate depends, and (3) reading rate as a factor in determining comprehension.

Reading Rate as a Correlate of Comprehension

Several early researchers operated from the premise that as one becomes a more proficient reader, one's rate increases. The faster reader was assumed to have a better understanding of what he read than the slower reader (King, 1916). However, when researchers have attempted to establish the correlation of reading rate and comprehension, widely divergent results have been obtained. King (1917) found a rate-comprehension correlation of -.47 in one study, and Eurich (1930) reported a relationship of +.67 in another. Most studies reported a low positive correlation, indicating very little comprehension advantage associated with a higher reading rate (Harris, 1968).

Researchers have attempted to identify the variables responsible for the wide correlational results. Results have been found to depend on testing procedures, nature of the material, and reader characteristics.

Standardized tests of rate and comprehension are generally composed of short unrelated paragraphs. One or more comprehension questions follow each reading selection. Testing procedures have varied widely, yielding different correlational results. Sometimes rate has been determined on different textual material than has comprehension; the presence of uncontrolled variables such as text difficulty and content render such correlations (which are generally low) invalid (Letson, 1958; Tinker, 1932). Robinson (1941) reported that rate and comprehension-accuracy scores vary between different subject areas, and between fiction and nonfiction. This effect was particularly pronounced for the rate scores of fast skilled readers. Tinker (1939) showed that when rate/comprehension correlations are calculated on separate materials they decline, even when the materials are judged comparable. Rate and comprehension should be measured on the same textual material.

Sometimes the rate determination included the time spent reading and answering questions. When such a procedure was combined with giving subjects a strict time limit to work in, inordinately high correlations resulted (Tinker, 1939). More recent group standardized tests use a longer beginning selection so that rate may be determined based on one minute of reading text only (Nelson, 1960).

Using Standardized Tests

When standardized tests are used with rate/comprehension studies, the correlations reported will be higher than if extended-discourse material had been used (Tinker, 1932). In studies employing standardized tests, correlations were also higher under the following conditions:

1. when strict time limits were imposed (Preston & Botel, 1951; Rankin, 1962),

2. when easily comprehended material was used (especially in combination with strict time limits) (Tinker, 1939),

3. when the rate score included time to read and answer comprehension questions (Rankin, 1962; Tinker, 1932),

4. when the rate of reading incorrectly answered paragraphs was excluded from the rate calculations (Blommers, 1944),

5. when the purpose for reading was general (Carlson, 1949),

6. when intelligence of sample subjects was higher (Carlson, 1949).

Using Extended Discourse

Some rate/comprehension correlational studies have used extended discourse rather than standardized test material in studying these relationships. One long reading selection is followed by several comprehension questions. Sometimes subjects read only for a specified time period, and other times they read until they complete a selection. Some studies have specified the nature of reading purposes and the types of comprehension questions, and others have not.

Occasionally, slow and fast readers have been compared (King, 1916, 1917; Robinson, 1941). Related studies have dealt with the ideal length of extended-discourse selections to yield reliable results (ideal length having been found to vary with school grade and reading skills of the sample population) (Chang, 1977; Robinson, 1941). As has already been mentioned, correlations in extended discourse are generally much lower than those obtained in unrelated-paragraph tests. In studies employing extended discourse, rate/comprehension correlations have been found to be higher under the following conditions:

1. when time limits were imposed and the total number of details remembered was compared (King, 1916, 1917);

2. when rate and comprehension were measured on easier material, under strict time limits (Letson, 1958),

3. when comprehension was measured as the number of correct responses, as opposed to the ratio of correct responses to items covered or tried (accuracy); this effect was especially pronounced when strict time limits were used (Letson, 1958; Robinson, 1941);

4. when social studies or literature reading material is used, as opposed to science and math material (Shores, 1951; Thurstone, 1944);

5. when fiction material is used, as opposed to nonfiction material (art, history, science) (Robinson, 1941); and

6. when critical thinking is not involved (Carlson, 1949).

Similarly, the rate/comprehension correlations in extended discourse have been found to be lower under the following conditions:

1. when science or math reading material is used (Shores, 1950),

2. when critical thinking is involved (i.e., questions requiring inferences) (Carlson, 1949),

3. when the volume of details recalled from a specific segment of text is considered (King, 1916, 1917),

4. when comprehension is measured as the ratio of correct answers to the number of questions attempted (Letson, 1958; Robinson, 1941), and

5. when comprehension is measured on difficult material with a strict time limit (Letson, 1958).

Summary

It may be seen from these studies that there is no general rate-comprehension correlation. Likewise, speed of reading does not appear to be a unitary concept, but it varies with intelligence, purpose, and difficulty of material (as well as artifacts of measurement and scoring procedures) (Carlson, 1949; Tinker, 1932).

Factors Upon Which Reading Rate Depends

As it became more and more obvious that reading speed was not a unitary concept, researchers began changing the focus of their studies. Instead of trying to demonstrate that fast readers are the best readers (Shores, 1950), researchers began searching more systematically for factors upon which reading rate depended. Reading rate was found to depend on the nature of the material, the purpose for reading, rate training, and reader characteristics.

Nature of the Material

Blommers (1944) found that good comprehenders slowed down as material became more difficult, whereas poor comprehenders continued reading at the same relative rate, from a nonstatistical comparison of data. Speed depended on an interaction of reading ability and material difficulty.

Rothkopf and Coatney (1974) reported that rate decreased in more difficult material, but the more difficult material used in their study appeared to be above the subjects' reading level. (It was rated as being on a college-graduate level, but was being read by college undergraduates.) Hoffman (1978) theorized that in material above a subject's reading level, a strategy of skimming, scanning, or study must be adopted. It appears that the average reader slows down as material becomes more difficult; however, if the material becomes so difficult that it exceeds his reading ability, the average reader will speed up.

Rothkopf and Coatney (1974), using average and very difficult material, varied the order of presentation of text. They found that the readability of a text interferes with the rate at which subjects begin reading subsequent material. This rate-distortion effect was especially pronounced when a more difficult passage preceded an easier passage. Blommers (1944), noting similar rate-interference effects, discounted the rate of reading the first paragraph in calculating reading rate for his study passages.

Robinson (1941), in a nonstatistical comparison of data, found that college students differentially adjusted their reading

rate to the type of subject matter being read. Fiction was read more rapidly than nonfiction (art, history, and geology). Among nonfiction selections, art was read fastest, followed by history, then geology. Robinson concluded that the rate divergence between fiction and nonfiction material was due to difference in the speed of assimilating the ideas expressed. Material with a higher concept density (e.g., science) was read more slowly. Two different history selections, dealing with Canadian and Russian history, were read at the same average rate and with the same general accuracy. Robinson felt that each subject might require a different set of reading skills, but that the skills within any one area (e.g., history) were probably constant. A related theoretical statement was made by Buswell (1937) when he stated that the ability to read in a familiar field is different from that of reading in an unfamiliar field.

Purpose for Reading

Yoakam (1928) maintained that every individual has more than one characteristic reading rate. He has at least four general rates, which vary with reader purpose: skimming, rapid reading, normal reading, and slow careful reading. Skimming is the most rapid rate and is used to obtain a quick survey or to locate a specific item. Rapid reading is used in reading for main ideas or in rereading; it is used with familiar or easy material. Normal reading occurs when reading to obtain both main ideas and details; it is that rate habitually used by a reader for most recreational and easy to moderately difficult factual reading. Careful reading, the slowest

rate, is used in difficult text, for high accuracy, or for critical evaluation; very little material is worthy of such detailed reflection (Adler & VanDoren, 1972). The skilled reader, then, is the efficient reader; he can vary his speed to suit his purpose. Buswell (1938) added that attention to detail is not always desirable; it slows down rate and accomplishes a purpose that may be much broader than necessary. Some readers need to be taught to vary speed to fit the purpose for reading.

McConkie (1973) demonstrated that speed of reading is influenced by the purpose for which subjects read. Subjects reading for multiple purposes read most slowly. Jensen (1978) verified that reading speed increases when one reads for the "central contents" only.

Subjects can change the type of information they receive from a text, depending on the purpose for which they are asked to read. McConkie (1973) asked college students in repeated trials to practice reading for a specific purpose. He then tested them with a variety of question types to see what type of additional information they picked up. There was no difference in test score totals between groups, but scores on different question types varied significantly. The groups picked up different patterns of information as they read, depending on their assigned purpose. Students reading for facts and students reading for inference adopted a similar strategy: they appeared to be reading for details and making inferences, based on the facts, at a later time. Students reading with the purpose of

answering any type of question could recognize if a phrase came from the reading material but did poorly answering factual questions.

Rate Training

Hill (1964) and Rankin (1970) stated that most readers, even good ones, display inflexible reading rates (they read different materials at the same general rate). McDonald (1960) tested 6,000 subjects of all ages in material of varying difficulty, style, content, and purpose. Most readers, regardless of age or text variables, maintained inflexible reading rates.

Inflexible reading may be learned through emphasis on oral reading. It may also be related to the type of professional reading one does; it can also reflect a lack of flexibility training (McDonald, 1965). Readers should vary their rate within selections and paragraphs (not only between material categories, and for different purposes) (McDonald, 1963).

Flexibility in adapting rate efficiently to content and purpose can be learned. Braam (1963) helped high school seniors differentially increase their rate in five types of content. Dee-Lucas (1979) showed that college students could adjust their rate of reading to different payoff conditions.

Reading rate seems to depend in part upon rate training. A common concern is that rate improvement, however, might negatively affect comprehension. Harris (1968) stated that normal reading speed can be increased 20% to 40% without adversely affecting comprehension.

McConkie (1973) found that reading speed could be increased without affecting the information for which one had been instructed to read; the amount of incidental information acquired, however, was reduced. Fridal (1979), in his work with Danish college students, found that concentration improves as a by-product of rate-improvement work (concentration is defined as being attained when the mind is so occupied with information processing that it does not wander). Two hundred to 350 wpm can be too slow for good concentration, he stated. Speed changes in his course were from 265 (± 70) wpm to 625 (± 235) wpm. Spache (1962) used the eye-movement camera to study the reading of college students who were graduates of commercial rate-improvement programs. They read study selections at 400-600 wpm with 70% comprehension, and books at 1,800-2,400 wpm with 50% comprehension. Harris felt these rates were poor for their purposes. So rate can, in general, be increased without disturbing comprehension of goal-related material. Excessive rate "increases" will probably impair comprehension of main ideas and details; these high rates probably reflect skimming strategies.

Pauk (1965) compared a short study-skills-only class with a longer class that covered study skills, rate training, and comprehension work. The study-skills-only class showed triple the grade point average improvement of the other group. Pauk was opposed to reading-pacer training, finding that it may interfere with the formation of more useful study skills (a statistically nonsignificant conclusion).

Rankin (1963) gave poorly comprehending college students sequential instruction in comprehension-vocabulary and rate. He

found that the order of instruction did not affect comprehension-vocabulary scores, but it did affect rate scores, with bigger increases when rate instruction came first. Students studying rate improvement first reported greater grade improvement and greater enjoyment for reading. Thus Rankin advised working on rate, before comprehension, if rate improvement is one of the goals for a student. Harris (1968) advised that rate improvement should be included in a study-skills course only for extremely slow readers or for those who must read volumes of material daily. There is a difference between rate training and flexibility training. Rate training works on improving reading speed within a given type of reading (generally within Yoakam's "normal reading" category); flexibility training teaches one to recognize the different reading purposes associated with various reading material and then to adopt a speed appropriate to those varying situations.

Reader Characteristics

The characteristics of the individual reader differ. Poor reading habits, which are reflections of psychological process, include: slow eye movements, many fixations per line, and lip movements (Jensen, 1978). These behaviors are not causes of poor reading speed but symptoms of a particular level of reading maturity (Buswell, 1937). Thus eye movements may be used to diagnose reading difficulties or to quantify improvement.

Buswell found that moving the lips in silent reading retarded the ability to rapidly fuse "words into ideas"; it coincided with

reading in a more word-by-word fashion. Lip movements were present in all educational levels of subjects, but to a lesser extent in the best readers. Subvocalization levels were altered through training, by Watkins (1979), but there was no apparent transfer to rate or comprehension.

Buswell (1951) found that the rate of reading may be related to the rate of thinking. Slow readers tended to be slow thinkers, whereas fast readers showed no tendency to be fast or slow thinkers, as a group. Fast thinkers tended to be fast readers, however, whereas slow thinkers tended to be low-average-rate readers. "To some extent, rate of reading is related to rate of thinking. It does no good to try to read faster than one can assimilate ideas" (Harris, 1970). Other possible causes of slow reading, besides rate of thinking, are learned inflexibility and habit carryover (Buswell, 1951).

Gibson and Levin (1975) quoted a study finding that what a person gains from an Evelyn Wood's speed reading course may be related to personality characteristics (using the Rokeach Dogmatism Scales and Shostrom Personal Orientation Survey). Holmes (1954) tested college psychology students and found that slow readers were slightly more impulsive. Maxwell (1978) found a somewhat opposite result; impulsivity was correlated with initial scanning time, $r = .65$. Thus faster scanners tended to be more impulsive. Slow scanners applied improvement strategies in a more rigid manner, more frequently persisting in their original strategy, and tending to look at each line (even when supposedly applying the "Z" strategy). No conclusions can be drawn about reading speed as it relates to personality variables.

Summary

From the studies reviewed in this section, reading rate is seen to depend on material difficulty; type of material being read (fiction vs. nonfiction and type of subject matter); readability of previously read text; purpose (however, with many readers being inflexible, instruction on reading for purpose may be needed); training; level of reading maturity, as reflected by psychological indicators of process; and rate of thinking, to some extent. There is some possibility that rate may also be related to personality factors, although this has not been demonstrated with any consistency.

Reading Rate as a Factor in Determining Comprehension

Studies in this section were divided into those assessing comprehension when subjects were reading at their natural rates and when subjects were reading at assigned rates. Reading rate and college achievement are then discussed.

Natural Rates

Natural rate has been defined as the rate at which one habitually reads textual information for understanding (King, 1916). A few studies have examined the differences between fast and slow readers reading at their natural rates.

Slow readers tend to be inflexible, whereas fast readers tend to be flexible in adjusting rate to varying reading material. Robinson (1941) compared the slowest 20% and the fastest 20% of a sample of college undergraduates with respect to their average

reading speeds in various material. The slowest 20% varied their rates very little between different types of material: geology--159 wpm, history--167 wpm, art--166 wpm, and easy fiction--175 wpm. Only the difference between science and fiction reading rates was statistically significant. The fastest 20% of readers, however, showed great variation in their rates: geology--294 wpm, history--312 wpm, art--335 wpm, and easy fiction--385 wpm. All differences were statistically significant. Fast readers seemed to be varying their reading strategy with textual factors; slow readers seemed not to be, in general.

Natural slow and fast readers also demonstrate different strategies in reading fiction and nonfiction materials. In easy fiction, slow readers increased their average rate by only two words per minute between the first and last third of a nine-minute reading period. Fast readers, however, increased their average rate by 28 words per minute. Having received a mind set for the story line early, fast readers perhaps read the rest of the story more selectively, attending more exclusively to central ideas. (Robinson tested "main meanings" rather than "unimportant detail.") In nonfiction material (geology, history, art), fast and slow readers both maintained their initial rates, with the fasts increasing their rate slightly and the slows decreasing their rate slightly. The major difference in rate patterns in nonfiction material was that the fastest readers adjusted their rate immediately to varying textual content, whereas the slowest readers used the same general rate

regardless of subject matter. Natural rate seems to affect reading-flexibility patterns.

Assigned Rates

As was suspected from Robinson's (1941) study, slow and fast reading speeds seem to interact with the type of information gleaned from the text. McConkie (1973) had students read for different purposes and rewarded them for doing this more rapidly or more slowly (for greater comprehension). No time limits were set. He found that increasing one's speed does not affect recall of purpose-related material. Increasing speed does lower the amount of incidental (non-purpose related) material recalled, however. Thus, when reading with no time limit, the average good reader would be expected to recall more from a slower reading than a faster reading of given material.

Randomly assigned college undergraduates read an article covering the same topic (Rothkopf, 1974). The second half of their articles was identical, but the first half differed in difficulty. In testing comprehension of the second half of the article, subjects who had read difficult material first read this second material more slowly (292 vs. 359 syllables per minute) but with greater comprehension (+4.1 vs. +3.5) than subjects reading easier material first. The higher comprehension may have been due, at least in part, to the slower reading rate. (Instructions were to read rapidly to learn "the essential elements of the content.")

Dee-Lucas (1979) wanted to know more specifically how a reader's comprehension would be affected if he were induced to read more rapidly or more slowly. She had randomly assigned college students to read history material under two reward conditions: (1) comprehend at greater speed or (2) comprehend well regardless of speed. Comprehension was measured by analyzing the propositional content of written recall. The readers rewarded more for speed read at the average rate of 251 wpm, recalling 23% of all propositions. The readers rewarded less for speed read at the average rate of 120 wpm, recalling 37% of all propositions. Slower readers recalled a greater volume of propositions. Specific propositions recalled at 120 wpm were most likely to be recalled at 251 wpm, whereas propositions poorly recalled at 120 wpm were even less likely to be recalled at 251 wpm. Slower readers recalled more incidental information than faster readers. Faster readers recalled a greater proportion of case propositions (i.e., those stating action), though not a greater amount of information central to the meaning of the passage. Both groups had the same proportion of accuracy in recall. Thus, Dee-Lucas surmised that the information each group chose to examine was processed with equal thoroughness. However, the fast group, having less time, had to select a "smaller subset of information" to process. The fast group most likely attempted to identify that information "most central" to the passage and most likely to be needed for the later test (i.e., the story line).

In this same study, subjects reading at the faster rate reported only half the implications of subjects reading at the slower

rate. However, the structure of recall (relatedness of recall sentences) was equally good for both groups. Slower readers, no doubt, had more time to reflect on the relationship of incidental ideas.

The earliest studies of rate, as it affects comprehension, were done by King (1916, 1917). He did not accept the then-current assumption that faster readers got more from their reading than slower readers. His research questions were ahead of their time and seemingly discounted (Eurich, 1930). King (1916) randomly assigned college students to slow and fast reading conditions. The fast group read about twice as fast as the slow group. In material read by both groups, the "slows" recalled 53.3% of requested details (facts, "specific points"), whereas the "fasts" recalled 45.7% of details. "Slow" and "fast" groups were next divided according to accuracy of recall, within each group. The segment of the "slow" group comprehending most poorly was still superior to the respective segment of the "fast" group (43.9% vs. 35%). The best-comprehending "slow" readers slightly outperformed the best "fast" readers (65% vs. 61.5%). King analyzed the data of a second similar set of experiments (1917) according to actual speeds achieved by his assigned-rate readers. Comprehension results were divided into quartiles according to rate. The lowest quartile of rate subjects recalled more details accurately than the highest quartile (67% vs. 60%). For the average reader, slower reading appeared to lead to greater recall of details. King (1916) identified those readers in the "fast" and "slow" groups who were reading at their natural rates and those who were forced to read at unnatural rates, in their assigned groups. When a naturally

slow reader was made to read fast, he was equally likely to recall more or fewer details. However, when a naturally fast reader was made to read slowly, he most generally remembered fewer details of the text. Interfering with the natural reading rate of college subjects was a greater handicap to fast readers than to slow readers. The reading strategy of fast and slow readers must be different. It would appear that the reading strategy of fast readers is more specifically oriented, King concluded.

Rate and College Achievement

In a study involving 68 pairs of Harvard freshman men, intelligence was controlled, and reading ability was compared with scholastic achievement in English, history, government, or economics courses. (Subjects were chosen in pairs so that IQ was equivalent, but one of the pair was scoring 2 grade points below the other in the given subject.) Overall, faster readers had slightly better achievement. Slower readers achieved slightly better in English and economics. (The economics professor in question stressed high accuracy in fine details; since detail comprehension has been said to be aided by slower reading, the slight advantage for slower readers is not surprising.) Faster readers achieved slightly better in history and significantly better in government. In general, rate of reading was not significantly associated with success in these high-density reading courses (Anderson, 1941).

Summary

Slow readers seem to have inflexible rates, whereas fast readers seem to have generally flexible rates. In easy fiction, fast readers have seemed to benefit from early knowledge of the story line, enabling them to increase their rate more as they read. Slow readers continue through the whole story at about the same rate.

Rate of reading seems to affect the quantity and quality of information obtained. Slower readers recall more of the text, both main information, details, and implications. This effect is especially apparent when detail and implication recall are considered. Slow readers have consistently shown an advantage when recall of details and knowledge of implications are evaluated. Fast readers (or those required to read rapidly) seem to zero in on items of central importance to the topic. This raises a question: do habitual rates of slow readers reflect a preference for knowing details and the inferences than can be built from them? All readers seem to structure their recall with equal effectiveness, regardless of rate. We do not know if there are differences in micro- and macrostructural recall, however.

If time spent on the task were compared with volume of recall attained (compare data in King, 1916, and Dee-Lucas, 1979), the fast reader is more efficient. He remembers a greater amount of information for each unit of time spent reading. If time limits are removed from consideration, then the slow reader has the comprehension advantage. Slow reading does not seem to have prevented college students

from making equally good grades as fast readers, though the effort to attain their goals may be greater (in terms of time on task).

Summary

If psychologically mature readers continue to read slowly in text written within their reading ability, it would seem the explanation must be elsewhere than with difficulty in processing. Slowness in silent reading, for a given individual, could be due to one or more of the following factors:

1. type of material generally read (large amounts of technical reading tend to induce a slower general rate);

2. bad habits stemming from inflexible training (excessive oral-reading training, lack of reading-flexibility training);

3. habitual use of auditory cues to aid comprehension and recall;

4. a slower rate of thinking (this is not well established, however); and

5. preferred style of thinking is applied to most reading situations (whether it is efficient of time or not). This could be explained by:

    a. a preference for knowing details and formulating inferences from them (building a structure detail by detail, inference by inference);

    b. a dissatisfaction with cursory knowledge of main ideas and their relationship (building a structure by first putting up the main-idea framework, then filling in major details).

CHAPTER III

METHODOLOGY

Introduction

This section contains a description of the methodology used in conducting the study. Chapter III is arranged in six main sections. The general population is first described. Next, study procedures are specified, including sample-selection procedures and vision-screening and task procedures. Third, the materials used are described, including development and validation of task questions. The fourth section outlines the study design. The fifth section presents data-analysis methods employed. The last section states the hypotheses formulated for this study. A summary of methods concludes the chapter.

Population

All subjects in this study were in their senior year in one of eight high schools or central schools. Six of these schools were located in a county in southwestern New York, the seventh was in a neighboring county in southwestern New York, and the eighth was in a neighboring county in Pennsylvania. All schools were within 80 miles of each other.

Included in the sample were rural consolidated schools, small village schools, a suburban school, and a city school. Senior-class enrollments at these schools, respectively, were 39, 73, 84, 86, 122,

134, 162, and 250. For government-funding purposes, all these areas sampled are classified as part of the Appalachian poverty region, though subjects did not necessarily come from impoverished backgrounds.

Although it is somewhat isolated, there is much vitality and opportunity in this region of the country. There are several cultural and educational advantages. The Chautauqua Institution, a summer music-arts-religion community of national renown, is located within the general area. An extensive two-county library system distributes learning materials by several methods. There is a Nature Center, patronized by a world-renowned ornithologist, which has an extensive environmental-education outreach in area schools; the center also offers free summer nature day-camp experiences to all area youngsters. A community college, a business college, practical and registered nurse programs, and two universities are also within this region.

Procedure

To obtain a testing sample for this study, superintendents of 12 area schools were telephoned, and the study was explained to them. Eight indicated willingness to have their schools participate, upon approval of the principals involved. Contact was then made by phone with the principals. All agreed to participate, and meetings were set up with relevant English and reading personnel from each school. Agreements reached by phone or in meetings were confirmed by follow-up letters to the persons who had been assigned to liaison duties.

To make participation more attractive, schools were offered the results of group screening data together with recommendations for their reading programs suggested by the data. Since most of the schools had no reading consultant and had not tested these students' reading since their ninth-grade competency test, this offer was well received.

After testing had been completed at a school, the group data were explained in formal meetings or informal gatherings, depending on the wishes of cooperating personnel. All administrators were assured that no comparisons would be made between specific schools or between individual students and that the names of participating schools, school personnel, and students would remain anonymous.

The testing program at each school involved two separate days per school, except for the smallest school, where all testing was completed in one day. One day of screening potential subjects was followed, within a week, by a day of individually testing all students selected as subjects. All data were collected in the first semester of the 1982-83 school year.

Sample-Selection Procedure

Participating schools were asked to make available for screening all seniors in the top quarter of their class, according to grade point average. If, due to scheduling considerations, this was not possible, they were requested to make available the seniors enrolled in 12th-grade English Regents classes. Potential subjects were then either brought together for screening in one large classroom or

screened during the time they were scheduled for 12th-grade English. The object of the screening procedure was to obtain subjects who were good readers for the research task. Asking for students in the highest quartile of their class was meant to give a higher return of acceptable subjects per individual screened and to have added indication of their maturity as readers by their level of scholastic achievement.

The Nelson-Denny Reading Test (NDRT), Form B, was administered as a screening device (Nelson, 1960). Vocabulary, Comprehension, and Rate subtests were given to all groups of potential subjects. The Rate score was based on the first minute of reading the first paragraph of the Comprehension subtest. Each screening required 45 minutes of administration time, including explanations to the group about the purposes of the study.

To enhance motivation for this testing, students were informed that they would each receive a complete set of their Nelson-Denny results, together with interpretation, at a later date. Since most subjects were planning to attend college, such feedback proved to be of substantial interest to most of them.

Students had been informed by school personnel beforehand that participation was voluntary, but the positive benefits to be obtained by participation were emphasized. Any student wishing to be excluded from this project, however, was scheduled into a study area during screening.

After the NDRT had been administered and scored, students were selected to be potential subjects in the study, based on their

results. To be selected, students had to achieve a minimum grade-level score of 12.0 on the Comprehension subtest, as well as a Total Reading score that was greater than or equal to their grade placement (i.e., 12.1 to 12.4, depending on month of testing). School personnel scheduled these students for individual visual testing and task participation on an ensuing day. Students were scheduled so as to appear one every 10 to 20 minutes.

Visual Testing and Task Procedure

Liaison personnel at each school had been asked to arrange a room for visual testing and task performance for this second and final phase of the study. They were asked to provide a quiet room (size unimportant), with a table and two chairs, and another table and four chairs. It was requested that the room have an electrical outlet for the vision machine. The table with two chairs was used for visually screening students, and the table with four chairs was used by students performing their reading and question-answering tasks.

Students who had passed the Nelson-Denny group screening and who had been scheduled for individual testing were responsible for keeping their appointments. Some schools reminded students who were late, whereas others did not. Only a few eligible students failed to be included in this second phase due to nonappearance.

Upon arriving in the testing room, students were asked whether they required corrective lenses for reading. If reading lenses were required, students were not permitted to continue without them. Some students who wore contact lenses mainly for distance vision, but kept

them in for near vision too, were permitted to wear them for this reading task as well, if they successfully passed the near-point screening.

Visual screening consisted of the following Keystone Telebinocular Near Point Tests: Fusion, Usable Vision--Right Eye, Usable Vision--Left Eye, and Usable Vision--Both Eyes. Students with acuity errors below the 80% level in Usable Vision--Both Eyes were dismissed from the population sample. (Only two students were thus excluded.) Students with underconvergence abounded. They were admitted into the study as long as they saw only one image at nearpoint in Usable Vision--Both Eyes.

After successfully concluding the visual screening, students were ushered to the other table in the room. There they were presented with a six-and-one-half-page typed article. They were instructed to read the article in the manner they normally read such material, but only to read through the article once. They were also asked not to look back at any page once they had passed it. They were told that their reading would be timed and that they would be asked a few questions afterward. (Appendix A lists the precise directions.)

Each student's reading was timed with a stop watch. After completing the article, having the time recorded, and returning the article, the subject was given a booklet containing 16 multiple-choice questions. (Appendix B contains a copy of the question booklet.) There was no time limit for answering the questions, just as there had been no time limit for reading the text. Both tasks were performed at a rate chosen by the student.

When the questions were answered, the student was given a pass to return to class. Frequently, there was time to discuss an individual's Nelson-Denny results at this point and to give some advice concerning preparing for the reading demands of college. However, whether or not this was possible, all students participating in any phase of the project were supplied through the school contact person with a printed report of Nelson-Denny results, together with a few specific suggestions for improving their vocabulary, comprehension, and/or rate.

The whole procedure was carefully prepared so that as one student began reading, another could be tested visually. The rooms were not always completely insulated from outside noise, but approximated the situation most students face when taking tests in a classroom setting.

Each subject who passed the NDRT screening and the visual screening was assigned a number. All data relating to each individual were then recorded by that number. School counselors provided rank-in-class data and available Scholastic Aptitude Test data by subject number. Counselors kept the list linking student names with their assigned numbers and destroyed the list when all data were collected. This procedure assured individual anonymity in the data-analysis phase of this study, as well as compliance with federal human-subjects requirements.

Materials

For the reading task, a well-written and -organized article of at least 1,500 words was sought. Several criteria were considered in selecting the article. It should be high-interest, general-study-type material that integrated concepts from several content areas. It should be written at a 12th-grade reading level and be unfamiliar, in terms of exact information, to the study population.

A Scientific American article entitled "The Black Death" was found in an auxiliary college text (Langer, 1968) that contained several Scientific American articles included for their high readability, good structure, and general interest. The article was too long at 3,498 words but with the deletion of some digressions was pared down to 2,698 words (4,385 syllables). "The Black Death" met all the desired criteria; it was selected as the textual material to be read by subjects in this study.

The article discussed the great plague years that began in Europe in 1348. After first reviewing medical/historical information, the discussion was divided into demographic, economic, psychological, moral, and religious effects of the plague, both from the standpoint of short-term effects and long-term effects. The authors hinted at an application to our present times when we are faced with the potential threat of mass death from atomic war. Readers are asked to consider the great plague as an example of human stress behavior in an atmosphere of all-encompassing disaster. (See Figure 1 for a diagram of the relationship of major textual organizing elements.)

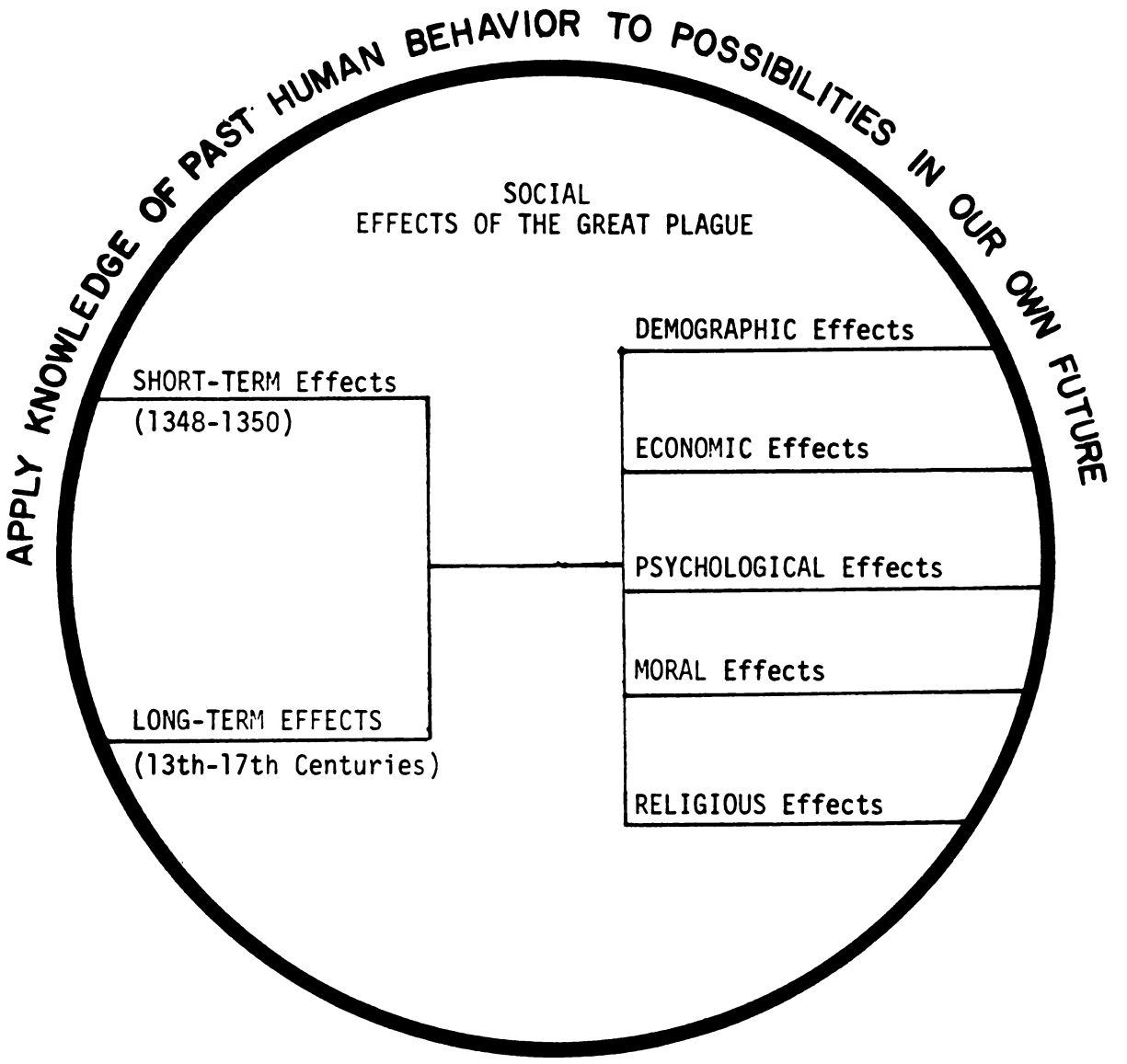

Figure 1.--A diagram showing the seven textual ideas ("effects") around which the major portion of Langer's "The Black Death" article is organized (1968). Included also is the global-application statement about which readers are instructed to think as they read. (In this thesis these elements were used to construct questions that would reflect knowledge of various levels of text relationship. Microstructure and main-idea questions variously fastened on aspects of one textual idea. Macro-structure questions required knowledge of and inference concerning interacting levels of different textual ideas.)

Developing Task Questions

Sample multiple-choice questions were constructed to accompany the article so as to test comprehension of various parts of text structure: detail, microstructure, main idea, and macrostructure. (See Chapter I for formal definitions of these terms.) All questions were written so that subjects could not merely record recognition of a phrase. Paraphrasing was used in every question to disguise actual text phrases that might have alerted readers to the correct answer without their actually having taken time to comprehend the matter during reading. It was desired to test for ideas, or comprehensions, that subjects had actually taken time to formulate during their reading and that they had at their disposal to think with when answering questions.

To construct questions that would truly represent the question categories set forth in this thesis, a structural diagram was made of the entire article. (See Appendix C for a reproduction of this structural diagram.) The diagram used structural elements identified by the writer. It was also constructed so that material located in one area in the text was in one area in the diagram.

When all ideas had been thus structurally arranged, showing their relationship, questions were constructed. Questions had to be text-dependent, unlikely to be guessed without having read the article. Great care was taken not to overlap questioning areas, so that the elements of one question would not tip off correct responses to other questions. The same general syntactical complexity of possible responses was sought, as well as a similar level of sophistication in

wording. Distractors were written so as to seem plausible; sometimes more than one distractor in a question was true, but only one response was true within the confines of that question. Random combinations of letters A, B, C, and D were generated to determine the placement of the correct answer among distractors for each question.

Detail questions were written about particular actions, facts, or descriptive information located in one sentence in the text. Paraphrase was used to disguise actual text wording. Appendix D lists the four detail questions and the textual sentences on which they were based.

Microstructure questions assessed knowledge of supporting, or secondary, ideas. These questions required an understanding of the relationship of several details located in the same area in the text. (All items in the question, including distractors, came from that one text area.) Appendix E lists the four microstructure questions together with paragraph location of answers.

Main-idea questions had points of similarity with microstructure questions, except for a few important points: (1) they represented main points of the author rather than supporting ideas; (2) they were gleaned from different areas in the text, or if the same area, then discussion occurred again in a diverse part of text, and distractors pulled on information from diverse parts of text; and (3) they required synthesis of ideas rather than an understanding of clearly stated textual ideas. Appendix F lists the main-idea questions, together with correct answers and remarks about item construction.

Macrostructure questions required a global understanding of the relationship of the seven major textual ideas, as well as being able to apply this knowledge to new situations. (See Figure 1.) Appendix G lists the macrostructure questions together with remarks about the construction of each item.

Validating the Questions

After the questions had been constructed, they were evaluated in an otherwise nonparticipating city high school. One class of senior English Regents students was asked to answer task questions without reading the article first. Two English Regents classes (containing mostly seniors, but with some juniors) were asked to time their reading of "The Black Death" and then to answer questions without referring back to the article. A fourth English Regents class (with a mix of juniors and seniors) read the article but, in answering questions, were allowed to refer back to the article. All students were asked to criticize question construction on an attached piece of paper after completing the task. They were particularly asked to note if the contents of any question gave clues to correct responses for other questions.

All questions that were correctly answered by more than chance would allow, without the text having been read, were revised. Percentage correct responses of all groups were compared for each question to make sure that reading the text actually gave an advantage in attaining the correct answer. Responses by the top-achieving half of these students was compared with responses of the bottom-achieving

half. Difficult questions were reexamined to make sure they were not misleading. One question was dropped, and six questions were partially reworded.

The result of the development process was a 16-question multiple-choice test containing four questions for each of the four structural questioning areas: detail, microstructure, main idea, and macrostructure. Each question presented four possible responses, excepting one that required selection of the proper combination of four possible responses (macrostructure question 12, Appendix B).

This test, together with the text and structural diagram of the text (Appendix C), was next submitted to a content-area reading specialist of national reputation for further evaluation and validation. No further question modifications were recommended.

Design

One hundred thirty-three high school seniors from eight schools in an 80-mile area of southwestern New York passed reading and visual screening and became subjects of this study. Each subject was judged to be comprehending and reading at least on grade level at the time of testing, according to the Nelson-Denny Reading Test. Visual competency in near-point testing had to register at a minimum of 80% acuity with both eyes functioning together. Students requiring reading glasses were not permitted to participate in the study unless they were wearing their corrective lenses.

The actual study task consisted in reading a 2,698-word (4,385 syllable) Scientific American article of nontechnical nature,

which was considered to be well-written and -organized (Langer, 1968). The article was condensed from 3,498 words. Each student was timed with a stop watch to obtain the number of minutes and seconds required to read through the article once. Students were asked to read at their own rates in order to answer a few questions. After reading, the student was asked to answer 16 multiple-choice questions, which represented different elements of text structure: detail, microstructure, main idea, and macrostructure. Each subject was individually tested and timed. There were no time limits in reading the article or answering the questions.

Scholastic Aptitude Test scores were collected, where available, for students by their assigned subject numbers. Also recorded were class-rank data for subjects by their research numbers.

Data Analysis

Up to 12 bits of information were tabulated for each of 133 subjects, by subject number. They were: Nelson-Denny Reading Test Vocabulary percentile score, Nelson-Denny Reading Test Comprehension percentile score, Nelson-Denny Reading Test Total Reading percentile score, Nelson-Denny Reading Test reading rate in words per minute, percentage rank in class, Scholastic Aptitude Test Verbal score, Scholastic Aptitude Test Math score, Detail Question accuracy, Microstructure Question accuracy, Main Idea Question accuracy, Macrostructure Question accuracy, and task rate in words per minute. (Appendix H lists data assembled for each subject, by subject number.)

Scholastic Aptitude Test data were available for 110 of the 133 subjects. Rank in class was available for all subjects.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), Version 8 (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975), through the computer facilities of Michigan State University. Pearson correlations were calculated for all combinations of the 12 variables and used to analyze Null Hypotheses 1 and 2. Zero-order partial correlations and partial coefficients were calculated to determine the relationship of the factors of interest when statistically adjusted for SAT Verbal scores or percentage rank-in-class data; the results of these analyses were used to address Null Hypotheses 3 and 4. Directional hypotheses were tested with Pearson and zero-order partial correlations.

Hypotheses

Null Hypotheses

1.0 There will be no relationship between standardized and academic performance data, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

- 1.1 There will be no relationship between Nelson-Denny Reading Test Vocabulary percentile scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.
- 1.2 There will be no relationship between Nelson-Denny Reading Test Comprehension percentile scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.
- 1.3 There will be no relationship between Nelson-Denny Reading Test Total percentile scores (Comprehension and Vocabulary combined), and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

1.4 There will be no relationship between Nelson-Denny Reading Test reading rate scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

1.5 There will be no relationship between Scholastic Aptitude Test Verbal scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

1.6 There will be no relationship between Scholastic Aptitude Test Math scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

1.7 There will be no relationship between percentage rank in class, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

2.0 There will be no relationship between the number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

2.1 There will be no relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

2.2 There will be no relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

2.3 There will be no relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

2.4 There will be no relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

3.0 Scholastic Aptitude Test Verbal scores will have no effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

3.1 Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

3.2 Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

3.3 Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

3.4 Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

4.0 Percentage rank in class will have no effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

4.1 Percentage rank in class will have no effect on the relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

4.2 Percentage rank in class will have no effect on the relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

4.3 Percentage rank in class will have no effect on the relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

4.4 Percentage rank in class will have no effect on the relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Directional Hypotheses

1.0 The direction of the relationships between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, can be correctly predicted for 12th-grade students who are mature readers.

1.1 There will be a negative relationship between the number of detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

1.2 There will be a negative relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

1.3 There will be a positive relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

1.4 There will be a positive relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Summary

The methodology used in conducting the study was presented in this chapter. The sample consisted of 133 12th-grade students who attended eight different schools in southwestern New York or northwestern Pennsylvania. All students were Regents students, and most were in the top 25% of their class. Each student selected as a subject had demonstrated competency in reading equal at least to his

grade-level placement. The population of inference would therefore be high school seniors who are good readers and, in general, good students.

The investigator explored the relationship between various rates of reading displayed by subjects in reading a 2,698-word (4,385 syllable) nontechnical Scientific American article written at the 12th-grade level, and apprehension of textual-structure factors, as measured by accuracy of response to a variety of question types: detail, microstructure, main idea, and macrostructure. The direction of these relationships was predicted, based on theory presented in Chapter I. Subjects were also characterized based on group-achievement data, and some of those achievement factors were partialed out of the correlations of comprehension type and rate to note the effect.

The types of data collected were delineated and data-analysis methods were explained. Last, the null and directional hypotheses were stated.

Chapter IV contains the hypotheses together with related statistical findings.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

A theory was formulated in Chapter I to predict differences in the types of information that would be best recalled by mature slow and fast readers after reading an extended discourse. This theory was tested using a population of high school seniors who were average to excellent readers and who were high-achieving students. A review of research showed that such readers could be assumed to be psychologically mature with respect to their reading abilities. The theory of differential retention at different reading rates by mature readers was addressed through four research questions:

1. Will there be a relationship between standardized and academic performance data, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

2. Will there be a relationship between the number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

3. Will Scholastic Aptitude Test Verbal scores have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

4. Will percentage rank in class have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

Four types of structurally related information were described and entered into the study as separate comprehension variables: detail, microstructure, main idea, and macrostructure. Standardized and academic-performance data were collected to characterize the populations. Data-collection methods were described in Chapter III, as were null and directional hypotheses and statistical-analysis methods.

An attempt was made to evaluate the data with multiple regression analysis, but no significance was attained by the main factors. Thus, correlation statistics were used in further analysis, and hypotheses were constructed to test the relationship of study variables.

Pearson or partial correlations were employed to test all hypotheses, using the SPSS statistical package, version 8 (Nie et al., 1975). All correlations were one-tailed since directionality in relationship was predicted. A probability level of .05 or less was established for correlations to be considered significant. The degree of statistically significant relationship is indicated by the following terms: "low" ($.15 < r < .3$), "moderate" ($.3 < r < .6$), "moderate to high" ($.6 < r < .75$), and "high" ($r \geq .75$). Lesser correlations were evaluated for directionality but considered statistically nonsignificant. Table 1 lists Pearson correlations between all study variables. Frequency data for all variables are given in Table 2.

Table 1.--Intercorrelations between standardized test results, achievement variables, four types of discourse comprehension variables, and discourse reading rate.

	ND-C	ND-T	ND-wpm	SAT-V	SAT-M	% Rank	D	Mic	MI	Mac	Discourse Reading Rate
ND Vocabulary[a] (ND-V)	.4476 ****	.8446 ****	.2629 ****	.6271 ****	.2499 ****	-.2296 ***	.1499 *	.1638 *	.1621 *	.1695 *	.2803 ****
ND Comprehension (ND-C)	--	.8476 ****	.1940 *	.6055 ****	.3300 ****	-.2464 ***	.2062 **	.1850 *	.1244 (.078)	.1318 (.066)	.3832 ****
ND Total Reading (ND-T)	.8476	--	.2723 ****	.7240 ****	.3312 ****	-.2853 ****	.2138 **	.2000 *	.1706 *	.1711 *	.3906 ****
ND Reading Rate (ND-wpm)	.1940	.2723	--	.2789 ***	.1649 *	-.1054 (.116)	.1817 *	.0490 (.289)	.1292 (.071)	.0217 (.403)	.4018 ****
SAT Verbal[b] (SAT-V)	.6055	.7240	.2789	--	.4532 ****	-.4274 ****	.2877 ****	.2518 ***	.1644 *	.2303 **	.3247 ****
SAT Math (SAT-M)	.3300	.3312	.1649	.4532	--	-.5942 ****	.1864 *	.2446 ***	.1313 (.086)	.1655 *	.1902 *
% Class Rank (% Rank)	-.2464	-.2853	-.1054	-.4274	-.5942	--	-.0831 (.172)	-.0699 (.213)	-.1125 (.099)	-.2211 ***	.0799 (.181)
Detail (D)	.2062	.2138	.1817	.2877	.1864	-.0831	--	.1465 *	.0339 (.350)	.1225 (.081)	-.0171 (.423)
Microstructure (Mic)	.1850	.2000	.0490	.2518	.2446	-.0699	.1465	--	.1021 (.122)	.1772 *	.1609 *
Main Idea (MI)	.1244	.1706	.1292	.1642	.1313	-.1125	.0339	.1021	--	.1726 *	.0896 (.154)
Macrostructure (Mac)	.1318	.1711	.0217	.2308	.1655	-.2211	.1225	.1773	.1726	--	.0165 (.426)

Note: In the raw data used for these correlations, higher numbers indicated higher achievement or faster reading, with the exception of percentage rank in class, where smaller numbers indicated higher-achieving students. Pearson correlations (SPSS Version 8) were used. Probabilities are listed under correlation values; the exact value is only given for nonsignificant relations. The left-hand side of the chart is completed, with correlations only, for reader convenience.

[a] ND indicates Nelson-Denny Reading Test.

[b] SAT indicates Scholastic Aptitude Test.

*$p \leq .05$.

**$p \leq .01$.

***$p \leq .005$

****$p \leq .001$.

Table 2.--Frequency data for population variables.

Variable	n[a]	Mean Value	Standard Deviation
NDRT Vocabulary	132	73.36	16.64
NDRT Comprehension	132	77.97	15.26
NDRT Total Reading	132	76.95	13.79
NDRT reading rate	131	272.17	86.19
SAT Verbal	110	491.91	77.58
SAT Math	110	557.55	92.94
Percentage Class Rank	132	15.63	11.67
Detail Questions	132	2.37	1.03
Microstructure Questions	132	1.98	0.95
Main Idea Questions	132	2.65	0.89
Macrostructure Questions	132	1.64	0.87
Task reading rate:			
words per minute	132	218.40	63.46
syllables per second	132	5.92	1.72

[a]Maximum number of subjects was 133. (See raw data note--Appendix H.)

Hypotheses and Statistical Tests

Null Hypotheses

Ho 1.1: There will be no relationship between Nelson-Denny Reading Test Vocabulary percentile scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation relating NDRT Vocabulary scores and the rate of reading an extended discourse was $r = .2803$, $p = .001$, based on 132 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between NDRT Vocabulary percentile scores, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was low and positive. The higher the NDRT Vocabulary percentile score of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.2: There will be no relationship between Nelson-Denny Reading Test Comprehension percentile scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation relating NDRT Comprehension scores and the rate of reading an extended discourse was $r = .3832$, $p = .001$, based on 132 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between NDRT Comprehension percentile scores, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was moderate and positive. The higher the NDRT Comprehension percentile scores of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.3: There will be no relationship between Nelson-Denny Reading Test Total percentile scores (Comprehension and Vocabulary combined), and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation relating NDRT Total Reading scores and the rate of reading an extended discourse was $r = .3906$, $p = .001$, based on 132 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between NDRT Total Reading percentile scores, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was moderate and positive. The higher the NDRT Total Reading percentile scores of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.4: There will be no relationship between Nelson-Denny Reading Test reading rate scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating NDRT reading rate scores and the rate of reading an extended discourse were $r = .4018$, $p = .001$, based on 131 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between NDRT reading rate scores, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was moderate and positive. The higher the NDRT reading rate of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.5: There will be no relationship between Scholastic Aptitude Test Verbal scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating SAT Verbal scores and the rate of reading an extended discourse were $r = .3247$, $p = .001$, based on 110 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between SAT Verbal scores, and the rate at

which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was moderate and positive. The higher the SAT Verbal scores of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.6: There will be no relationship between Scholastic Aptitude Test Math scores, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating SAT Math scores and the rate of reading an extended discourse were $r = .1902$, $p = .023$, based on 110 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between SAT Math scores, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. The relationship was low and positive. The higher the SAT Math scores of 12th-grade students who were mature readers, the faster those students tended to read extended discourse.

Ho 1.7: There will be no relationship between percentage rank in class, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating percentage rank in class and the rate of reading an extended discourse were $r = .0799$, $p = .181$, based on 132 students.

The null hypothesis was not rejected. There was no statistically significant relationship between percentage rank in class, and the rate at which an extended discourse was read, for 12th-grade students who were mature readers. There was a statistically nonsignificant

trend for students who ranked higher in the class to be somewhat slower readers. (See note on Table 1.)

Ho 2.1: There will be no relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating number of detail questions correctly answered and the rate of reading an extended discourse were $r = -.0171$, $p = .423$, based on 132 subjects.

The null hypothesis was not rejected. There was no statistically significant relationship between number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Ho 2.2: There will be no relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating the number of microstructure questions correctly answered and the rate of reading an extended discourse were $r = .1609$, $p = .033$, based on 132 subjects.

The null hypothesis was rejected. There was a statistically significant relationship between number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. The relationship was low and positive. The faster extended discourse was read by 12th-grade students who were mature readers, the more microstructure questions those students tended to answer correctly.

Ho 2.3: There will be no relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation data relating the number of main-idea questions correctly answered and the rate of reading an extended discourse were $r = .0896$, $p = .154$, based on 132 subjects.

The null hypothesis was not rejected. There was no statistically significant relationship between number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Ho 2.4: There will be no relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation relating the number of macrostructure questions correctly answered and the rate of reading an extended discourse was $r = .0165$, $p = .426$, based on 132 subjects.

The null hypothesis was not rejected. There was no statistically significant relationship between number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Ho 3.1: Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the Pearson and partial correlations between paraphrased detail comprehension and reading rate. The zero-order

partial correlation between detail and rate was .0591. The partial correlation controlled for SAT Verbal scores was -.0160. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. SAT Verbal scores had no significant effect upon the statistically nonsignificant relationship between number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. (Nie et al., 1975, p. 304, explained the rationale for this test.) Although not significant, partialing out SAT Verbal scores appeared to have the effect of nullifying any positive relationship of detail-rate correlations in this sample. (Note Pearson correlation in Table 3.)

Ho 3.2: Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the Pearson and partial correlations between microstructure and reading rate. The zero-order partial correlation between microstructure and rate was .1811, $p < .05$. The partial correlation controlled for SAT Verbal scores was .1278, $p = .114$. Only the first of these two correlations was statistically significant.

The null hypothesis was rejected. SAT Verbal scores had an effect upon the statistically significant relationship between number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. When the

Table 3.--Correlations between four types of discourse comprehension and discourse reading rate, assessed with different statistical procedures, and including variance for statistically significant factors.

Correlation Method	Types of Comprehension				Variance
	Details r	Micro-structure r	Main Idea r	Macro-structure r	Micro-structure r^2
Pearson[a]	-.0171	.1609*	.0896	.0165	.0259
Zero-order partials[b]	.0591	.1811*	.0590	-.0180	.0328
Partials controlling for SAT Verbal scores[c]	-.0160	.1278 (p=.114)	.0045	-.0900 (p=.198)	.0163
Partials controlling for percentage rank in class[c]	.0629	.1843*	.0659	-.0112	.0340

Note. Pearson correlations are presented only for comparison with zero-order (simple) partial correlations. Partial correlations were based on zero-partials, not Pearson correlations.

[a]Based on 132 subjects.

[b]Based on 121 subjects.

[c]Based on 89 subjects.

*$p < .05$.

microstructure/rate relationship was controlled for variance in SAT scores, the formerly significant relationship became nonsignificant. Partialing out SAT scores reduced the percentage of variance explained by microstructure/rate relationship by one-half (see microstructure r^2 column in Table 3).

Ho 3.3: Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of paraphrased main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the Pearson and partial correlations between main-idea comprehension and reading rate. The zero-order partial correlation between main idea and rate was .0590. The partial correlation controlled for SAT Verbal scores was .0045. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. SAT Verbal scores had no significant effect upon the statistically nonsignificant relationship between number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. Although not significant, partialing out SAT Verbal scores appeared to have the effect of decreasing the main-idea/rate correlation in this sample.

Ho 3.4: Scholastic Aptitude Test Verbal scores will have no effect on the relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the Pearson and partial correlations between macrostructure and reading rate, for 12th-grade students who were mature readers. The zero-order partial correlation between

macrostructure and rate was -.0180. The partial correlation controlled for SAT Verbal scores was -.0900, p = .198. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. SAT Verbal scores had no significant effect on the statistically nonsignificant relationship between number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. Although not significant, partialing out SAT Verbal scores appeared to have the effect of decreasing the macrostructure-rate correlation in this sample; the partialed negative relation began to approach significance.

Ho 4.1: Percentage rank in class will have no effect on the relationship between the number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the partial correlations between detail and reading rate. The zero-order partial correlation between detail and rate was .0591. The partial correlation controlled for percentage rank in class was .0629. These correlations were of approximately the same magnitude. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. Percentage rank in class had no significant effect on the statistically nonsignificant relationship between number of paraphrased detail questions correctly answered after reading an extended discourse, and the rate at which

that discourse was read, for 12th-grade students who were mature readers.

Ho 4.2: Percentage rank in class will have no effect on the relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the partial correlations between microstructure and reading rate. The zero-order partial correlation between microstructure and rate was .1811, $p < .05$. The partial correlation controlled for percentage rank in class was .1843, $p < .05$. These correlations were of approximately the same magnitude. Both of these correlations were statistically significant.

The null hypothesis was not rejected. Percentage rank in class had no significant effect on the statistically significant relationship between number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Ho 4.3: Percentage rank in class will have no effect on the relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the partial correlations between main idea and reading rate. The zero-order partial correlation between main idea and rate was .0590. The partial correlation controlled for percentage rank in class was .0659. These correlations were of approximately the same magnitude. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. Percentage rank in class had no effect on the statistically nonsignificant relationship between number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Ho 4.4: Percentage rank in class will have no effect on the relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

Table 3 reports the partial correlations between macrostructure and reading rate. The zero-order partial correlation between macrostructure and rate was -.0180. The partial correlation controlled for percentage rank in class was -.0112. These correlations were of approximately the same magnitude. Neither of these correlations was statistically significant.

The null hypothesis was not rejected. Percentage rank in class had no effect on the statistically nonsignificant relationship between number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. It was interesting, however, that while partialing out percentage rank slightly increased the rate relationship with detail, microstructure, and main idea, it had the effect of slightly decreasing the rate/macrostructure relationship. (Referring to Table 1, it can be seen that slower readers were nonsignificantly higher in their class rank, and persons higher in their class rank got nonsignificantly more macrostructure questions correct.)

Directional Hypotheses

Hd 1.1: There will be a negative relationship between the number of detail questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation between detail recall and reading rate in extended discourse was $r = -.0171$, $p = .423$, $n = 132$. The zero-order partial correlation between detail recall and reading rate was $r = .0591$, $p = .258$, $n = 121$.

The directional hypothesis inconsistently predicted the direction of the correlation, and the relationships were not statistically significant. There was not a statistically significant negative relationship between the number of detail questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Hd 1.2: There will be a negative relationship between the number of microstructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation between microstructure recall and reading rate in extended discourse was $r = .1609$, $p = .033$, $n = 132$. The zero-order partial correlation between microstructure recall and reading rate was $r = .1811$, $p = .022$, $n = .121$.

The directional hypothesis incorrectly predicted the direction of the correlation; the correlations were consistently positive and statistically significant. There is a statistically significant low positive relationship between number of microstructure questions

correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers. The faster extended discourse was read by 12th-grade students who were mature readers, the more microstructure questions those students tended to answer correctly.

Hd 1.3: There will be a positive relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation between main-idea recall and reading rate in extended discourse was $r = .0896$, $p = .154$, $n = 132$. The zero-order partial correlation between main idea and rate was $r = .0590$, $p = .258$, $n = 121$.

The directional hypothesis correctly and consistently predicted the direction of the correlation, but the relationships were not statistically significant. There was not a statistically significant positive relationship between the number of main-idea questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Hd 1.4: There will be a positive relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers.

The Pearson correlation between macrostructure recall and reading rate in extended discourse was $r = .0165$, $p = .426$, $n = 132$. The zero-order partial correlation between macrostructure and rate was $r = -.0180$, $p = .422$, $n = 121$.

The directional hypothesis inconsistently predicted the direction of the correlation, and the relationships were not statistically significant. There was not a statistically significant positive relationship between the number of macrostructure questions correctly answered after reading an extended discourse, and the rate at which that discourse was read, for 12th-grade students who were mature readers.

Summary

The null and directional hypotheses described in Chapter III were tested in Chapter IV. The following null hypotheses were not rejected: 1.7; 2.1, 2.3, 2.4; 3.1, 3.3, 3.4; 4.1, 4.2, 4.3, and 4.4. The following null hypotheses were rejected: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6; 2.2; and 3.2. One directional hypothesis correctly and consistently predicted the direction of the relationship--that of main idea (1.3). However, the positive relationship was not statistically significant. Two directional hypotheses inconsistently predicted the direction of the relationship, with one calculation method producing a negative correlation and the other method producing a positive correlation. These two directional hypotheses pertained to detail (1.1) and macrostructure (1.4); neither method of calculation produced statistical significance. One directional hypothesis failed to predict correctly the direction of relationship; however, that relationship was statistically significant--that of microstructure (1.2).

In Chapter V, the results of this study are discussed and interpreted in the context of related literature and theory. A post hoc data analysis is included, informally comparing the sample means of the 30 slowest and 30 fastest discourse readers for implications.

CHAPTER V

SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine whether mature readers vary in the type of information they recall after reading extended discourse at slow or fast rates. The study population was composed of 133 seniors from a variety of high schools. All subjects had at least 12th-grade-level reading skills, and most were in the top quarter of their class, based on grade point average.

The study population was described based on mean performances on various standardized and achievement measures (Table 2), and then the relationship of these measures to the discourse reading rate was explored (Table 1). Accuracy in recall of each of four types of information was correlated with discourse reading rate to see whether any relationships existed. Then, zero-partial correlations between rate and type of comprehension were tested, controlling for Scholastic Aptitude Test (SAT) Verbal scores, or percentage class rank scores, to see whether these achievement variables had any effect on existing relationships (Table 3). Finally, hypotheses predicting the direction of comprehension-rate relationships were examined. Table 4 summarizes the research findings for Null Hypotheses 1 and 2, Table 5 summarizes the research findings for Null Hypotheses 3 and 4, and Table 6 summarizes the research findings for the directional hypotheses.

Table 4.--Summary of results of statistical tests of Null Hypotheses 1 and 2.

Hypothesis Number	Variable Correlated With Discourse Reading Rate	Findings	Interpretation: "Faster readers have..."
Ho 1.1	NDRT Vocabulary	Rejected, p = .001	...higher scores
Ho 1.2	NDRT Comprehension	Rejected, p = .001	...higher scores
Ho 1.3	NDRT Total Reading	Rejected, p = .001	...higher scores
Ho 1.4	NDRT Reading Rate	Rejected, p = .001	...higher scores
Ho 1.5	SAT Verbal	Rejected, p = .001	...higher scores
Ho 1.6	SAT Math	Rejected, p = .023	...higher scores
Ho 1.7	% Class Rank	Not rejected	(...lower rank)
Ho 2.1	Detail	Not rejected	---
Ho 2.2	Microstructure	Rejected, p = .033	...higher recall
Ho 2.3	Main idea	Not rejected	(...higher recall)
Ho 2.4	Macrostructure	Not rejected	---

Note. Interpretations in parentheses are not statistically significant.

Table 5.--Summary of results of variance comparisons of null hypotheses controlled for certain factors.

Hypothesis Number	Variable Correlated With Discourse Reading Rate	Correlation Controlled For...	Findings	Effect of Control on Correlation
Ho 3.1	Detail	SAT Verbal	Not rejected	(reduction)
Ho 3.2	Microstructure	SAT Verbal	Rejected	reduces correlation to nonsignificance
Ho 3.3	Main idea	SAT Verbal	Not rejected	(reduction)
Ho 3.4	Macrostructure	SAT Verbal	Not rejected	(reduction)
Ho 4.1	Detail	% Rank	Not rejected	(slight increase)
Ho 4.2	Microstructure	% Rank	Not rejected	(slight increase)
Ho 4.3	Main idea	% Rank	Not rejected	(slight increase)
Ho 4.4	Macrostructure	% Rank	Not rejected	(slight reduction)

Note. Effects in parentheses refer to correlation (variance) comparisons that did not change statistical significance of findings.

Table 6.--Summary of results of directional hypotheses.

Directional Hypothesis Number	Predicted Direction of Relationship With Discourse Reading Rate	Findings	Actual Direction of Relationship With Discourse Rate
H_d 1.1	Detail--negative	Not supported	(Inconsistent direction)
H_d 1.2	Microstructure--negative	Not supported	Positive direction
H_d 1.3	Main idea--positive	Not supported	(Positive direction)
H_d 1.4	Macrostructure--positive	Not supported	(Inconsistent direction)

Note. When the "actual direction" is reported to have been of "inconsistent direction," this indicates that one of two calculated correlations was positive and the other was negative, based on Pearson correlations (n = 132) and zero-order partial correlations (n = 121). Results in parentheses are not statistically significant.

Discussion

Research Questions

1.0: Will there be a relationship between standardized and academic performance data, and the rate at which an extended discourse is read, for 12th-grade students who are mature readers?

The relationship between speed and comprehension in timed material has been found to be moderate to high when comprehension is measured as the number of correct responses; however, the relationship between speed and comprehension has been found to be negative and low when comprehension is measured as the number of right responses compared to the number of items attempted (Letson, 1958; Rankin, 1962). Thus, timed tests contain an inherent bias against the slower reader. For this reason it was expected that Nelson-Denny Reading Test (NDRT) and SAT correlations with discourse rate would be of some positive magnitude. This proved to be the case.

NDRT Vocabulary scores and SAT Math scores showed a low statistically significant relationship to discourse reading rate. NDRT Comprehension, NDRT Total Reading, NDRT reading rate, and SAT Verbal scores all showed moderate statistically significant relationships to discourse reading rate. (See Table 1.)

Anderson (1941) found slightly better achievement, overall, from faster-reading than from slower-reading Harvard freshman men. In general, however, rate of reading was not associated with success in high-density reading courses. For this reason, it was expected that percentage rank in class would be nonsignificantly related to discourse reading rate, but that faster readers might tend to be

ranked higher in their class. This projection was partly borne out; the rank/rate relationship was nonsignificant. However, there was a slight tendency for slower readers to rank higher in their class ($r = .0799$, $p = .181$), as reported in Table 1. The tendency for this relationship to be negative or positive might well be a function of subject selection. In this study, only good readers and higher achievers were selected as subjects. One would assume that Harvard freshman men also tended to be good readers and high achievers in their high school days, but no such controls were introduced into that experiment. In any case, rate of reading appeared to be unrelated to achievement for either of these populations.

The study population was characterized using frequency data from NDRT, SAT, and rank scores (Table 2). The average subject scored between the 63rd and 91st percentile on NDRT Total Reading (or between grade-level equivalents of 13.0 and > 14.0). The average subject also scored between 414 and 569 on SAT Verbal and between 465 and 650 on SAT Math. The average subject's rank in class was in the top 4 to 27%. (These figures were obtained by subtracting, then adding, 1 SD to the mean population figures in Table 2.)

2.0: Will there be a relationship between the number and type of questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

Scattered research in this century has begun to produce a pattern of comprehension-type/rate results that appear to allow for prediction of subject recall based on relative speed of reading. King (1916) found that any person reading more slowly (reading at

assigned rates) can expect to recall a greater number of details. In timed material, the faster (assigned rate) reader got a greater total volume of details through reading more material, but slower readers got more details per unit of text read. When college upperclassmen and upperclasswomen were requested to read at their natural rates, slower readers recalled a significantly greater number of details than faster readers (showing a moderate negative relationship).

Dee-Lucas (1979) found greater recall of action-related information (case propositions) by Cornell undergraduate psychology students when they read at fast assigned rates. Subjects assigned to read slowly, however, recalled a greater total number of propositions and twice as many inferences (implied causal relations) as fast readers. Dee-Lucas ascribed this result to the greater time available to slow readers for reflection. She hypothesized that slow readers probably "processed all of the information that they considered relevant very thoroughly prior to the recall task," whereas faster readers were more selective in processing and chose "a smaller subset of information" to process. Dee-Lucas felt that faster readers ($\bar{X}$ = 250 wpm) probably processed information of central importance to the passage equally as carefully as did the slower readers ($\bar{X}$ = 120 wpm).

Shores and Husbands (1950) found that fast readers were not the best comprehenders when reading-related problems had to be solved using critical thinking. Carlson (1949) noted that slow-reader performance was better on questions requiring inference.

McConkie (1973) found that reading rate depended on the purpose for which one read, using college undergraduates reading Scientific American articles. Having multiple purposes reduced reading rate the most, whereas reading only for the central contents increased the reading rate. Jensen (1978) verified that reading speed increases when one reads for only central contents.

McConkie (1973) also found that students gathered different patterns of information from their reading, depending on their assigned purpose. Both students reading for facts and those reading for inference appeared to read for details initially and to make inferences based on facts at a later time. Students reading to answer any future type of question appeared able to recognize phrases from their reading, but they were poor at answering factual questions.

The pattern that appeared to emerge from these studies was one wherein mature slow readers would be expected to read information in greater depth and to recall more details and more information requiring inference and critical thinking. Mature fast readers, on the other hand, would be expected to process a smaller subset of material, involving main ideas and "central contents."

From this perceived pattern, hypotheses were constructed predicting differential rate relationships with various types of comprehension. Detail and detail-relationship (microstructure) were predicted to be negatively associated with rate for mature good readers, and main idea and main-idea relationship were predicted to be positively associated with rate. The slower readers were hypothesized to be using inductive reasoning to a greater extent, wherein

textual ideas were integrated into one's own idea structure, and recall conclusions were formed from a body of one's own data. The faster readers were hypothesized to be using deductive reasoning to a greater extent, wherein main ideas were recognized and processed and served as clues from which to synthesize recall conclusions.

In comparing total discourse comprehension with discourse reading rate, no significant difference was found for the whole population ($r = .1044$, $p = .117$). No significant relationship was found for detail, main idea, or macrostructure and rate (although the main-idea relationship was consistently positive). However, a statistically significant low positive relationship existed between microstructure (detail-relationship) and discourse rate (Table 1). None of the projected directional hypotheses was supported at a statistically significant level. Main idea behaved more as predicted than did the other three comprehension variables.

Obviously, much remains to be discovered about rate/comprehension-type relationships. The exact nature of comprehension requirements must be stated in future studies, to allow for proper inference and study reproduction. In addition, populations must be defined with relation to reading ability and possibly achievement level, as well. An example of the difficulties involved is seen with detail questions. This study employed detail questions which required that subjects had understood what they read; this was accomplished by using paraphrase in recall questions. Other studies reporting "detail recall" may have used questions of a much simpler nature, allowing for mere recognition of text phrases.

3.0: Will SAT Verbal scores have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

Since SAT Verbal scores were derived from timed tests, it was assumed that a score bias would exist in favor of faster readers. This result has already been substantiated and reported. It was assumed, then, that partialing out the effect of SAT Verbal scores would have the effect of lowering rate/comprehension-type correlations. As reported in Tables 3 and 6, this assumption was substantiated. When partial correlations were calculated for these mature readers, controlling for SAT Verbal scores, all correlations between rate and detail, microstructure, main idea, or macrostructure decreased by .05 to .07. The only modification that affected statistical significance, however, occurred with the microstructure/rate relationship, which declined to a nonsignificant level from a previous statistically significant low positive relationship. (It is interesting that macrostructure/rate was affected so that it approached significance in a negative direction.)

4.0: Will percentage rank in class have an effect on the relationship between number and type of comprehension questions correctly answered after reading an extended discourse, and the rate at which that discourse is read, for 12th-grade students who are mature readers?

In the research examined, grade point average was not significantly associated with reading rate (Anderson, 1941). This result was replicated in the present study, as has already been reported. It was assumed, then, that partialing out the effect of percentage rank in class would have little if any effect on rate/comprehension-type

relationships. In fact, detail, microstructure, and main-idea correlations with rate increased slightly when partial correlations were calculated controlling for percentage rank in class, whereas macrostructure correlations with rate decreased slightly. Significance of simple correlations was not affected by controlling for grade point average. (See Tables 3 and 6.) There were obviously high-achieving students among all segments of this population with respect to rate.

General Comparisons With Background Studies

Much has been written on the topic of rate and comprehension. Early researchers attempted to identify fast readers as the best readers through rate/comprehension-correlation studies. When divergent results were consistently obtained, the focus of the studies gradually changed; researchers began looking for the factors affecting data variability. They found that reading rate depended on many factors, such as the nature of the reading material and the level of reading maturity of subjects. Some studies have investigated differences in comprehension when reading purpose or rate was varied, comparing readers who were assigned to read at various rates or comparing slow and fast readers reading at natural rates. Conclusions of such research were presented in Chapter II. Some of these conclusions are briefly reviewed in the following pages so that they may be examined with reference to data from the present study.

In the present research, rate and type of comprehension were compared using one extended-discourse selection. The material was

lengthy (2,698 words or 4,385 syllables), general-study-type material, of appropriate difficulty for the study population. Rate was calculated based only on time spent reading the discourse passage. It has long been established that such procedures produce the most reliable rate/comprehension relationships (Tinker, 1939).

Several conditions that tend to lower rate/comprehension correlations were intentionally incorporated into the extended-discourse-material selection so that any relationships found would more accurately reflect true population differences: nonfiction material was used (Robinson, 1941), and critical thinking was involved in answering microstructure, main-idea, and macrostructure questions (Carlson, 1949).

Tinker (1932) and Rankin (1962) showed that rate/comprehension correlations produced with standardized test material were higher than when such correlations were calculated from extended-discourse material. The data from this study confirmed this long-standing conclusion. The Pearson correlation of NDRT reading rate and Total Reading was $r = .2723$, $p = .001$ (131 subjects). The Pearson correlation of extended-discourse reading rate and total comprehension was $r = .1044$, $p = .117$ (132 subjects). The NDRT correlation was statistically significant, displaying a low positive relationship, but the extended-discourse correlation was not.

The only type of comprehension found to be significantly related to rate in the extended-discourse task was microstructure: $r = .1609$, $p = .033$ (132 subjects). The magnitude of that relationship was still below that of NDRT rate/comprehension. In contrast

to extended-discourse material, NDRT paragraphs employed strict time limits and more easily comprehended material; both these factors have been shown to increase the rate/comprehension relationship (Preston & Botel, 1951; Rankin, 1962; Tinker, 1939).

Rothkopf and Coatney (1974) found that rate decreased in more difficult material. Robinson (1941) reported that material with a higher concept density is read more slowly due to the difference in speed with which the ideas can be assimilated. The average rate of reading the easier NDRT passage (based on the first minute of reading) was 272 wpm, with a standard deviation of 86 wpm (Table 2). The average rate of reading the more difficult extended-discourse material (based on total discourse reading time) was 218 wpm, with a standard deviation of 63 wpm (Table 2). The relationship between these two rate measures for the study population was $r = .4018$, $p = .001$ (131 subjects). This relationship is illustrated in Figure 2, using a scattergram. This study, then, supported the findings that rate decreases in material that is more difficult or that has a higher concept density.

Hill (1964) and Rankin (1970) stated that even most good readers showed inflexible rates, reading all material at the same rate. When measured in words per minute, inflexible rates were not displayed by the present population as a whole; the standardized NDRT material was read more rapidly than the extended-discourse material. Table 7 compares data from the present study on the 31 subjects who most consistently read slowly on both NDRT and extended discourse; this group, called the slow-slow group, read below 226 wpm on NDRT

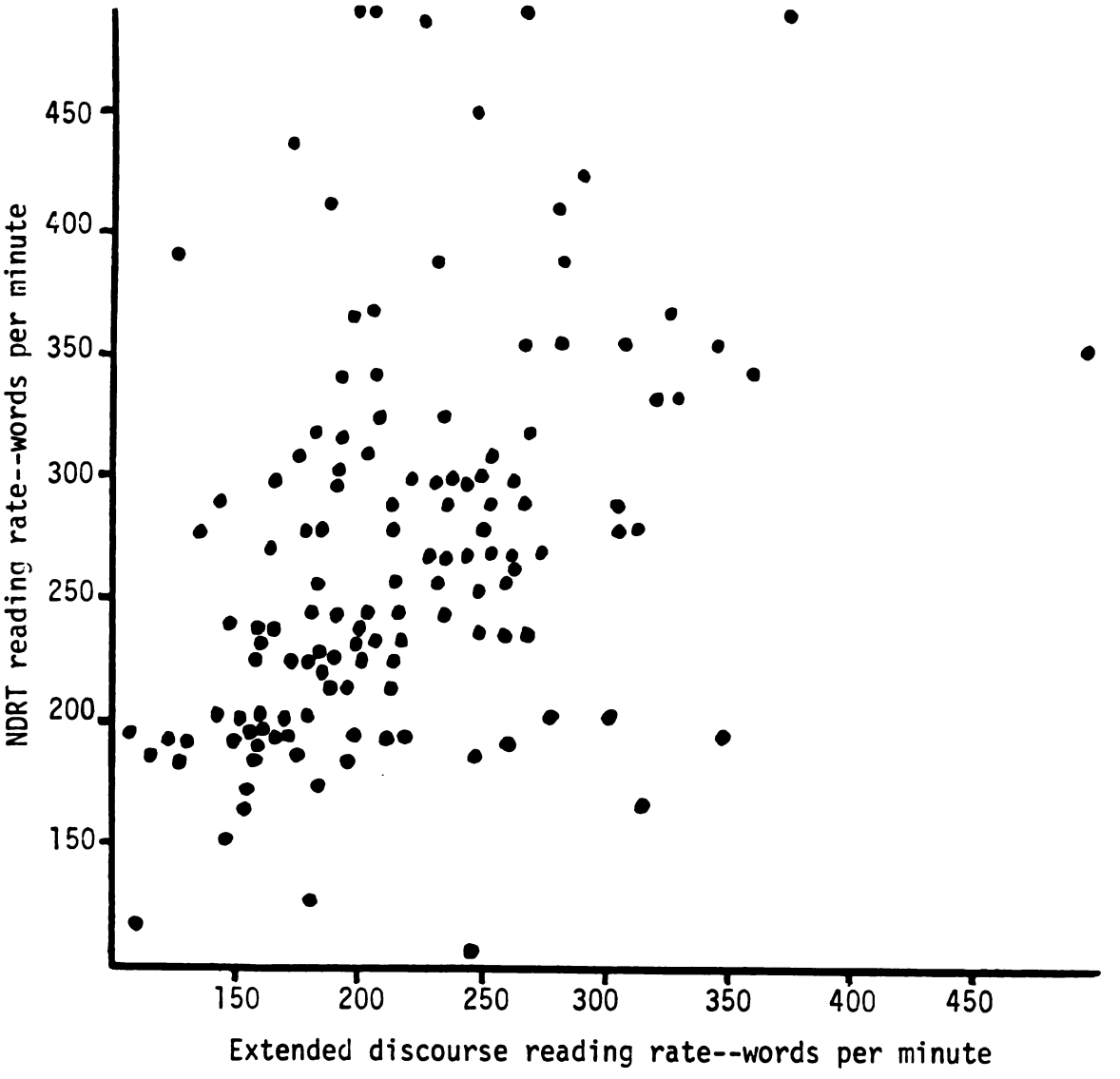

Figure 2.--Nelson-Denny (NDRT) reading rate for each student as a function of his/her reading rate on the study material (N = 133). (Note: Subjects with rates at the extremes were reading at faster rates than could be shown in this graph.)

Table 7.--A comparison of mean reading-rate changes between the slow-slow[a] and fast-fast[b] subjects in Nelson-Denny and extended-discourse task material, in words per minute and syllables per second.

Group	Reading Rates	
	Measured in wpm[c]	Measured in sps[d]
Slow-slow		
Nelson-Denny mean rate	194 ± 26	4.77 ± 0.62
Discourse task mean rate	159 ± 24	4.27 ± 0.64
(Percentage rate drop)[e]	(18.6%)	(10.5%)
Fast-fast		
Nelson-Denny mean rate	331 ± 75	8.30 ± 1.70
Discourse task mean rate	295 ± 59	7.98 ± 1.59
(Percentage rate drop)	(10.9%)	(3.9%)

[a]Slow-slow subjects read NDRT at less than 226 wpm, and the discourse at a rate less than or equal to 190 wpm (n = 31).

[b]Fast-fast subjects read NDRT at more than 226 wpm, and the discourse at a rate greater than or equal to 250 wpm (n = 32).

[c]wpm = words per minute.

[d]sps = syllables per second.

[e]Percentage rate drop was calculated by comparing the rate difference in each category with the NDRT rate, to show how much group rate decreased when task material was read. (Wpm and sps rate drops are not proportional between groups due to a peculiarity of the NDRT rate task. In the NDRT reading, multisyllabic words became more frequent the further one read. Thus, a person reading to NDRT word 331, in the one-minute time limit, read disproportionately more syllables than persons reading to word 194. This difficulty was not encountered in the discourse task as all subjects were timed reading all words.)

and ≤ 190 wpm on the discourse task. The 31 slow-slow subjects were compared with 32 fast-fast subjects, who most consistently read rapidly on both NDRT and extended discourse; the fast-fast group read above 226 wpm on NDRT and ≥ 250 wpm on the discourse task.

Both words-per-minute and syllables-per-second rates were calculated and appear in Table 7 to informally test the idea that an individual's reading rate remains the same between different reading tasks when measured in syllables per second (Hoffman, 1978; Ritty, 1979). In this study, both those who tended to read consistently slowly and those who tended to read consistently rapidly reduced their reading rates for the discourse material, with the slow-slow group showing the greatest average drop in rate (Table 7). This difference was evident whether measured in words per minute or syllables per second. When the percentage rate drop was calculated, greater variability in rate adjustment was produced by measuring in words per minute than in syllables per second: slow-slow displayed an 18.6% vs. 10.5% rate drop; fast-fast displayed a 10.9% vs. 3.9% rate drop. In spite of this observation of measuring-system differences, rate of reading was still varied by the individual, using either method of calculation (Table 7). Rothkopf and Coatney (1974) reached this same general conclusion.

Subjects in this study were instructed to read at a rate natural for them in such extended-discourse material. King (1916) found slow readers reading at natural rates to be less flexible in adjusting their rate to varying materials than fast readers. This conclusion was not supported by data from the present study. Table 7

shows that the slow-slow group displayed a greater percentage of rate change between NDRT and task material than did the fast-fast group (18.6% vs. 10.9%), both groups being good readers and tending to be high achievers. Thus the slow-slow group displayed more flexibility in rate between NDRT and discourse tasks than did the fast-fast group.

As has been mentioned, the rates would be expected to vary between NDRT and the discourse task because of the differences associated with them. NDRT had a strict time limit, consisted of short unrelated paragraphs, and was somewhat less difficult; questions were on the same page as the text. In contrast, the discourse material had no time limit, consisted of 28 conceptually related paragraphs, and was more difficult; questions were not presented until all discourse had been read. King's conclusions on rate/flexibility relationships were based on various types of study materials with subjects reading at natural rates, without time limits. Although he used college students as subjects, one cannot be sure that they were all good readers (Marshall & Glock, 1978). Within the confines of King's study methods, his conclusions may still be valid.

Informal Post Hoc Analysis

In this study, subjects were asked to read "The Black Death," a somewhat condensed Scientific American general-study-type article. They were instructed to "read at the rate they normally read such material," in order to answer "a few questions." It is assumed that subjects then chose their own purposes and read at a variety of rates

in order to satisfy the objectives they generally set for themselves in such study-type material.

The investigator hypothesized that different general styles of reading (patterns of selective attention to information) would be displayed by the population extremes, with respect to rate. This hypothesized phenomenon was tested using Pearson correlations; statistical significance was found only for microstructure questions. It was found that faster readers tended to answer significantly more of those questions that involved detail relationship. There was, however, no statistically significant relationship between rate and the following types of comprehension: detail (paraphrased), main idea (synthesized from diverse sectors of the text), or macrostructure (which required inferring major textual ideas and their relationship and interpreting these ideas in the context of unifying concepts.

From the results of Dee-Lucas' (1979) and King's (1916, 1917) research, it was anticipated that slow readers would be better at all types of detail comprehension. The present study showed no statistically significant rate relationship for details, however, and a rate relationship that favored faster readers for the microstructure material. The scattergrams shown in Figure 3 depict each individual's accuracy in answering each type of question, as a function of his/her extended-discourse reading rate.

To formulate theoretical implications and suggestions for further research, the study population was subdivided for analysis. A slow-discourse group was established, containing the 30 slowest readers of extended discourse in the research population; all 30 of

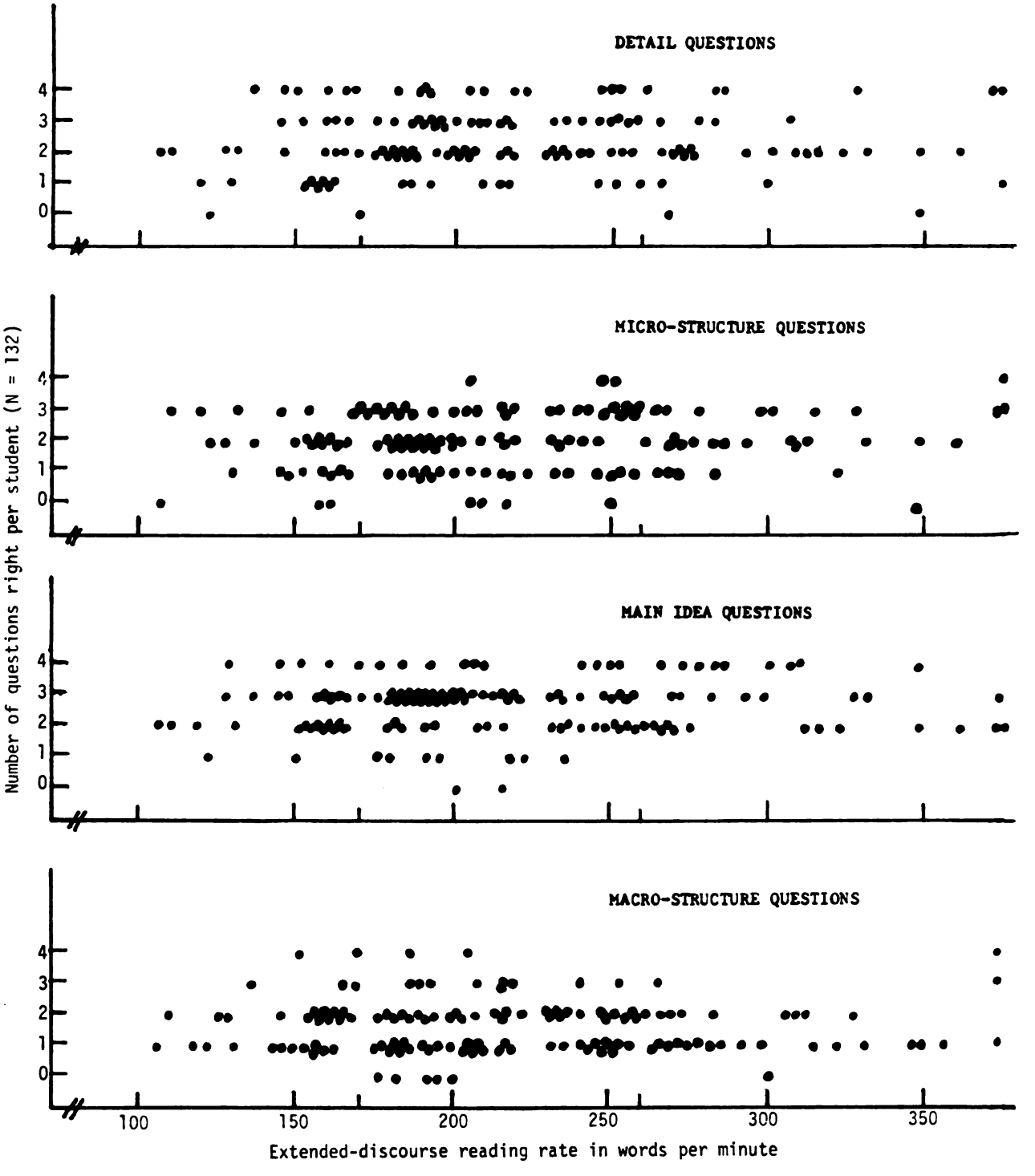

Figure 3.--Number of questions per comprehension category answered correctly by each student as a function of his/her rate of reading the extended-discourse material.

these subjects read the task at or below 170 words per minute. (In Figure 3, this level is indicated with a small mark on the rate scale just to the right of the 150 wpm mark.) A fast-discourse group was also established, containing the 30 fastest readers of extended discourse in the research population; all 30 of these individuals read the task at or above 260 words per minute. (In Figure 3, this level is indicated with a small mark on the rate scale just to the right of the 250 wpm mark.) Means for these two groups, and the 73 subjects who fell in between them, based on task rate, are reported in Table 8 for all study variables. (NDRT reading rates were disregarded in defining these groups.)

Edfeldt (1960) found the average rate of adult speech to be between 170 and 200 wpm and the maximum rate of adult oral reading to be about 250 wpm. Harris (1968) found the average rate of silent reading by college students to be about 280 wpm. Comparing the slow-discourse and fast-discourse groups to these levels produced some clear distinctions. The slow-discourse group was not only reading below the average silent-reading rate of college students, it was also reading at a rate below the average level of adult oral speech--170 words per minute, or less, with an average reading rate of 148.3 wpm. The fast-discourse group, in contrast, was reading above the maximum rate for understandable oral speech, and its average silent-reading rate was above that of college students--260 words per minute, or more, with an average reading rate of 323.5 wpm. There should therefore be a psychological difference between these groups, in terms of the manner in which they were processing the information

Table 8.--Subpopulation means for post hoc comparison of the 30 slowest and the 30 fastest readers of extended discourse, for all study variables.

Study Variables	Rate Groups Based on Reading Rate of Discourse Task		
	Slow-Discourse[a]	Middle[b]	Fast-Discourse[c]
NDRT Vocabulary[d]	66.97	73.51	79.77
NDRT Comprehension[d]	71.30	76.86	86.70
NDRT Total Reading[d]	70.30	76.42	84.97
NDRT wpm rate	213.9	277.1	314.6
SAT Verbal	473.6[e]	484.1[f]	526.9[g]
SAT Math	526.4[e]	563.1[f]	572.3[g]
% Class Rank	16.22	15.43	15.68
Detail	2.17	2.51	2.30
Microstructure	1.77	2.03	2.13
Main idea	2.60	2.62	2.80
Macrostructure	1.83	1.63	1.47
Total discourse comprehension	8.37	8.79	8.70
Task wpm rate	148.3	212.1	323.5

Note. Underlining emphasizes post hoc group comprehension means.

[a] $n = 30$; these subjects all read the discourse $\leq$ 170 wpm.

[b] $n = 73$; these subjects all read the discourse between 171 and 259 wpm.

[c] $n = 30$; these subjects all read the discourse $\geq$ 260 wpm.

[d] These scores were all expressed as percentiles.

[e] $n = 25$.

[f] $n = 59$.

[g] $n = 26$.

they read (Chapter I; Buswell, 1937; Edfeldt, 1960; Gibson & Levin, 1972; Huey, 1968 [1908]).

Findings of post hoc analysis. The smallest unit of discourse structure measured in this study was recall of paraphrased details. As shown in Table 8, the slow-discourse group remembered an average of 0.13 fewer detail questions than the fast group. Memory for detail relationship, called microstructure, showed an even wider gap between groups; the fast-discourse group remembered an average of 0.36 more microstructure questions than did the slow-discourse group. Microstructure, it may be remembered, was the only comprehension variable among the discourse questions that showed a significant relationship to rate: $r = .160$, $p = .033$. Thus the slow-discourse readers appeared to be at a disadvantage in recalling detail and relationship (microstructure), in comparison with fast-discourse readers.

The fast-discourse group also appeared to be superior when recalling main ideas; the average fast-discourse reader had .20 more main ideas correct than did the average slow-discourse reader. An interesting change occurred with macrostructure, however; the average fast-discourse reader no longer appeared to be superior. The average slow-discourse reader answered 0.36 more macrostructure questions correctly than did the average fast-discourse reader. This difference was of the same magnitude as the microstructure group mean difference, only the difference was in the opposite direction. There appeared to be an interaction (not statistically demonstrated) between slow- and fast-discourse groups and microstructure and

macrostructure question accuracy. Figure 4 graphically depicts this informal interaction of means.

Macrostructure accuracy for all subjects was depicted in Figure 3. The distribution of macrostructure/rate results looked as if these results should have been significant; the upper margin formed a skewed normal curve, appearing to favor slower readers. That no statistically significant relationship was found between rate and macrostructure accuracy was probably a function of population variability in the middle rate range.

Macrostructure questions represented the most complex type of comprehension tested in this study; accuracy required synthesis of all levels of information, as well as inference, critical thinking, and determining the relationship of major textual ideas to a unifying concept. It would appear that mature slow readers were occupied with a more complex type of information processing during reading than were mature fast readers. The slow-discourse group was not reading at slower rates due to difficulty with reading (Table 8), thinking (note macrostructure group means), or achievement abilities (note percentile group means). The slow-discourse group must have been using processing time differently from the fast-discourse group.

Figure 5 duplicates Figure 4 and also depicts mean performance of the highly variable middle-rate readers. As shown in Figure 5, the middle-rate readers appeared to be superior to both other rate groups in mean detail accuracy: 0.21 greater than fast-discourse group means and 0.34 greater than slow-discourse group means. In

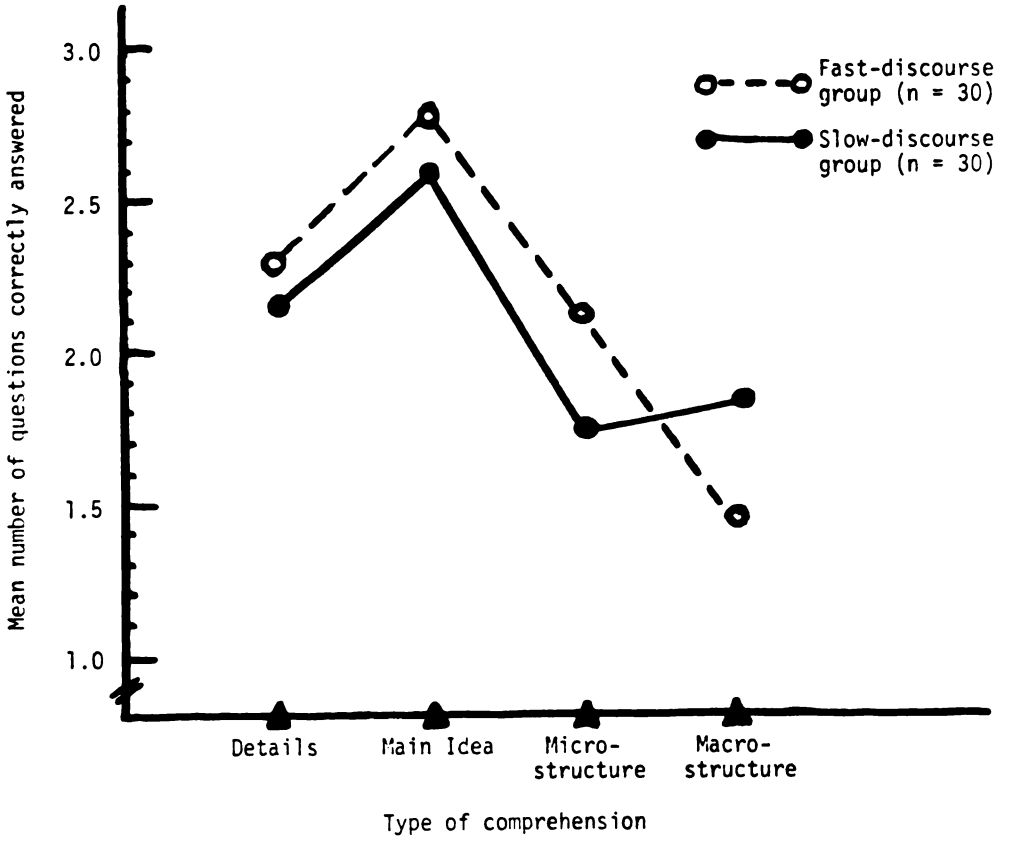

Figure 4.--Mean group accuracy for slowest and fastest readers on four types of comprehension. (Slow-discourse readers were reading extended discourse at rates ≤ 170 wpm; fast-discourse readers were reading extended discourse at rates ≥ 260 wpm.)

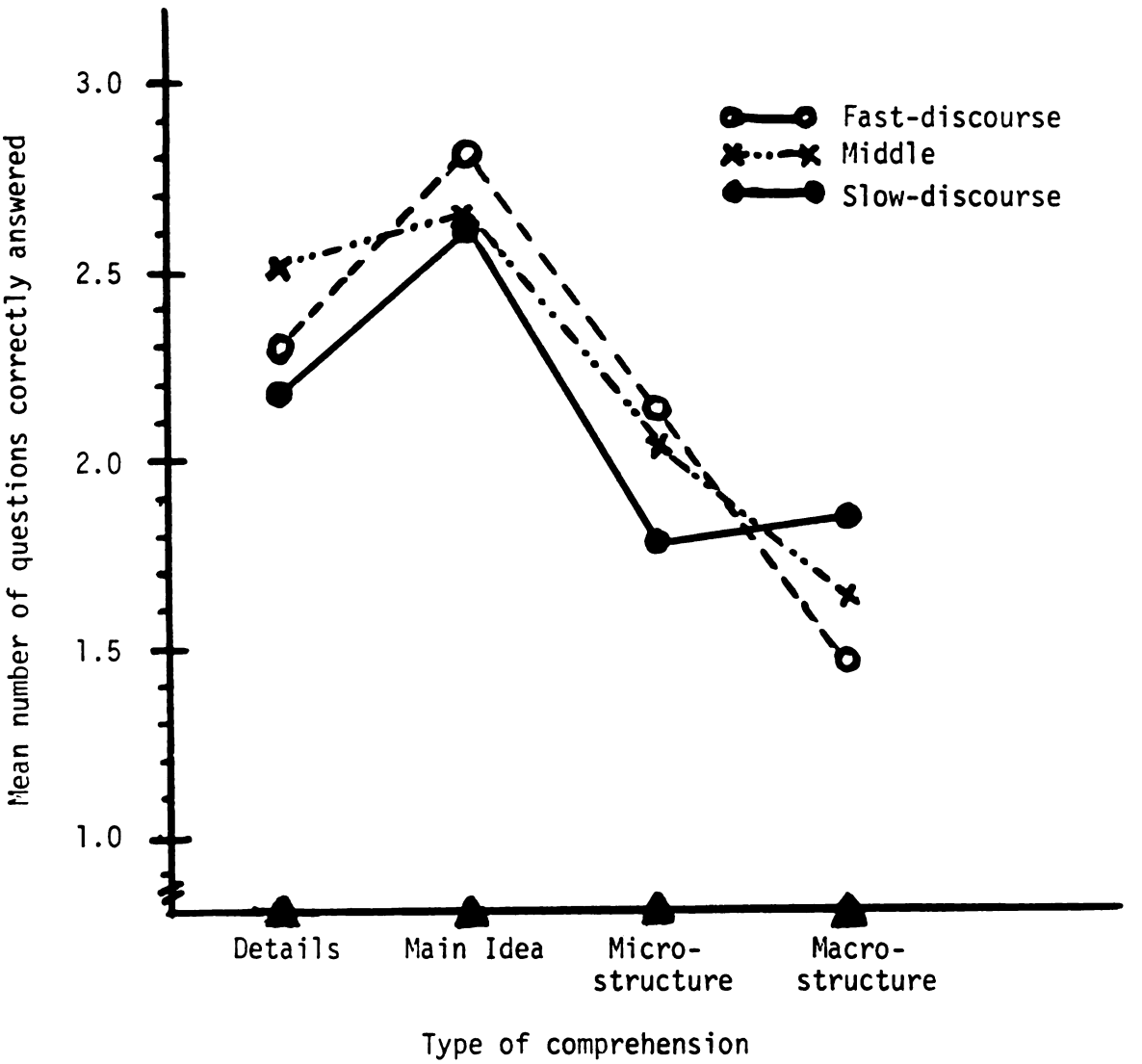

Figure 5.--Mean group accuracy for slow-discourse, middle group, and fast-discourse readers on four types of comprehension questions. (Slow-discourse readers (n = 30) were reading ≤ 170 wpm; middle readers (n = 73) were reading between 171 and 259 wpm; fast-discourse readers (n = 30) were reading at rates ≥ 260 wpm.)

all other question categories, their mean performance fell between slow and fast mean scores.

Comparison of study and post hoc findings with comprehension literature. Auditory imagery (saying the words in one's head) probably occurs with greater frequency among slower readers than among faster readers (Huey, 1908). It appears to be partially a mechanism to overcome the forgetting of idea traces in a sentence, which slow reading can produce (Gough, 1972). Perhaps auditory imaging serves an important function in macrostructure comprehension.

This researcher hypothesized that the mature slow readers actually were reading with the intention of evaluating and incorporating new information into idea chunks already categorized and stored in their memory. Thus, not only must the new information be understood and related to itself, it must also be related to information already "on file."

Miller's (1956) 7 ± 2 hypothesis stated that an individual seems capable of holding only five to nine pieces of information in his immediate memory at one time. To hold more information in memory, relationships must be formed among the items so that they are grouped into fewer categories. Thus, selective integration of information, either into existing mental categories or into new groupings, must occur for new information to be retained. Reading at a slower rate puts a greater strain on the central processing mechanism. Kerr (1973) found that transforming information into another form, such as inference, requires a greater processing

capacity, as does a more rapid input. Slow readers could be rehearsing, committing some items to long-term memory, to lighten the short-term memory load (Chapter I, p. 11).

Slow readers may also be resolving more ambiguities that are presented by the interaction of text and previously held assumptions. Ambiguity resolution takes time (Tanenhaus, 1979).

Shores (1950) found that fast readers perform better on short-paragraph standardized tests but do not comprehend better when tested using science material. The time-limit element of short-paragraph tests is one biasing factor in favor of higher comprehension by faster readers. Also, however, short paragraphs are essentially microstructures; detail relationship is the highest level of thought required in such short text (considering the types of comprehension defined in this study). Thus, Shores' findings are not inconsistent with findings of the present study. Microstructure (detail relationship) comprehension may actually be facilitated at higher rates.

Dee-Lucas (1979) maintained that fast readers read for central contents. This conclusion received some support from the present study; a comparison of main-idea means in Figures 4 and 5 revealed that more questions were correctly answered in the main-idea category than in any other by the fast-discourse readers. Dee-Lucas also found that the slower readers remembered twice as many inferences as the fast group. If this statement is judged on the least complicated structural level, microstructure, the fast readers were best. (Little inference was required for microstructure accuracy.) If this statement is judged on the middle level of inference difficulty, main idea, fast

readers still had an advantage. But if one considers the most complicated understanding of test structure in this study, macrostructure, the slow readers appeared to have an advantage. Thus, mature slow readers may be tentatively judged to have been making more inferences than mature fast readers.

Failure of Directional Hypotheses

In Chapter I, it was stated that slower readers would produce the most successfully completed information structures if their strategies worked; evidence for successfully completed structures was best judged in this study by superiority in macrostructure comprehension. Failure to link different substructures successfully into macrostructures would have resulted, nevertheless, in superior microstructure performance by the slower readers, according to the original theory. That slower readers were predicted to excel in micro- rather than macrostructure comprehension was assumed to be a failure for the slower readers' supposed reading strategies. It would have been consistent with the original theory to predict higher accuracy for mature slow readers in macrostructure recall.

The fast readers were projected to be building an information superstructure, only ascertaining the identity of main ideas and their relationship. Three factors were overlooked, two regarding the nature of the questions and one regarding the nature of the subjects. Microstructure questions, in this lengthy study discourse at least, represented important supporting ideas and thus could have been considered important by these superior students. Macrostructure comprehension

required careful in-depth reading, which was less likely to occur at higher reading rates. Last, the subjects were not only good readers, they were also high achievers and thus more intelligent than an average high school student. With these factors operating, it is not impossible to conceive that fast readers were building more complete information superstructures.

Superiority in macrostructure comprehension by mature slow readers who were excellent students should have been predicted. This conclusion fits the original slow readers' "structure" hypothesis for cases in which the text was conceptually accessible (i.e., not too difficult). Post hoc findings (not statistically tested) that slow readers exceed fast readers in macrostructure comprehension can thus be explained by the original "structure" hypotheses presented in Chapter I. Even if fast readers who were superior students attended to the supporting ideas presented by microstructure, it was thought that the more meticulous processing by slower readers would result in greater recall. Either speed really does facilitate making connections between neighboring details, or else, perhaps, slower readers integrate microstructures into existing conceptual frameworks so that the microstructures are not as recognizable in their original form. Future researchers may find both of these projections to have a measure of accuracy.

Revised "Structure" Hypotheses

The slow-discourse group's slower average discourse rate of 148 wpm was not an indication of decoding or comprehension difficulty

or of word-by-word reading. These subjects were shown to be highly competent in the reading process and were also among the best students in their schools. The average slow-discourse reader scored in the 70th percentile on NDRT Total Reading; this equates with a grade-level reading score of 13.4. The average NDRT Vocabulary subscore was slightly lower, and the average NDRT comprehension score was slightly higher. The extended-discourse material read for this study was of appropriate difficulty, with a readability score of the 12th-grade level. Why, then, were these good students, who were mature readers, reading so slowly? The theoretical explanation given in Chapter I will be revised in light of study and informal post hoc study findings.

Miller (1956) demonstrated that the span of immediate memory is severely limited, as is the span of perceptual judgments that can be made at any given time. People are restricted in the amount of information they can "receive, process, and remember" to about 7 ± 2 bits of data. An article like "The Black Death" (Langer, 1968) obviously contains a multitude of information, much of which is new information. (Appendix C presents a structural diagram of text ideas.) Miller hypothesized kinds of linguistic recoding that allow such a multitude of thoughts to be dealt with. Most commonly, people translate new ideas they wish to remember into their own words, and in recall remember verbalizations and elaborate on them. People may attempt to combine the information into "chunks" of related ideas, thereby reducing the memory load. They may also attempt to memorize

the ideas by integrating them into already existing chunks of related ideas in long-term memory.

According to the Given-New strategy explained by Haviland and Clark (1974), "the listener takes in a sentence, breaks it into its syntactically defined Given and New information, and then attempts to add the New information to memory." The Given information functions as a memory address, showing the reader where similar information is stored. When this "address" is located, the new information is incorporated into the already existing "file." In cases in which no file (Antecedent information) yet exists, the reader has the choices of (1) modifying a related existing category, (2) establishing a new category and building a relational bridge to some existing category, or (3) deciding it is not worth the processing effort and continuing to scan for ideas considered important. It will take more time to integrate the new information than simply to ignore it and to read for only more important ideas. The more inferences an individual attempts to draw, the more time, relatively speaking, the task will assume (Dee-Lucas, 1979; Kerr, 1973).

This researcher theorized that the slow reader's tendency is to attempt to integrate all the ideas encountered into existing memory chunks and networks, building bridges from ideas that are read to existing schemata by extensive use of inference. This chunking or integration process follows the Given-New strategy. The mature slow reader tends not to make the decision that an idea is unworthy of this integration effort. He processes all details, examining relationships, making judgments about importance and agreement and fit

with respect to existing memory networks, and continues reading and incorporating, adjusting perceptions. This occurs in a fashion similar to that hypothesized by Gough (1972) in that all text is processed; Gough's theory must be viewed in light of Thorndike's (1917) and Huey's (1908) statements about information processing. Decisions on the lowest levels of relationship (words, syntax) are likely made without conscious awareness (Graesser, 1980; Kerr, 1973).

Graesser showed that when readers attempt to form "a cohesive, well-organized, and recallable representation" of the discourse, mere resources are allocated to macrostructure analysis, or text relationships, than if they merely wished to comprehend the contents of the discourse. The slow-discourse reading style is comparable to the careful-reading rate for critical evaluation described by Yoakam (1928).

Mature slow readers thus spend their extra time in a deeper and more extensive analysis of the text, attempting more recoding and integration of article ideas into conceptual chunks and carefully examining relationships as they occur. These slow readers use a form of inductive reasoning in comprehension/question-answering activities, making the data their own, then answering later discourse questions by drawing conclusions based on the chunked, related, integrated data. The slow readers are better thought of, not as building an isolated house, as postulated in Chapter I, but as building a structure that must be tailored to fit the contours of existing related idea chunks, fitting the structure being erected but also fitting the structures that already exist.

Whereas mature slow readers process essentially all material they encounter, constructing their comprehension from the entire body of data, mature fast readers are more selective. They select information they feel is worth in-depth processing, attending more to main ideas and supporting ideas. They construct a framework of this information, which allows a good understanding of general information structure to emerge. They use a more deductive-reasoning style in comprehension/question-answering activities; the ideas they have selectively attended to become, for them, clues from which the correct answer may be synthesized. Goodman's information-processing theory most nearly reflects their strategy (1976)--processing the least information possible to make the best guess possible.

Implications for Education

Few implications for education can be drawn at this stage of theory development. However, it appears likely that mature readers who read slowly in all printed material may be wasting precious time resources. It is unlikely that the heavier reading load imposed by a college schedule would allow the time for such a consistent in-depth approach. One is also mindful of Adler and Van Doren's (1972) opinion that very little writing is worthy of such an in-depth treatment. It would therefore seem useful to teach mature slow readers how to vary their reading strategy to fit course requirements, teacher expectations, and their own purposes. They need to learn that every word is not necessarily golden.

Mature faster readers would seem better prepared than slower readers to cope with the vast reading expectations of typical college courses. Their method of reading does not appear as "scientific," however; they are apparently not as thoroughly testing ideas before incorporating them into memory structures. It would seem that they need to learn to use a more rigorous reading style in scientific topics, especially if they become more involved with use of the scientific method; one must know as certainly as possible what is "given" and what is "new" and untested, to operate successfully within a scientific framework. For nonscientific purposes, however, their reading strategy seems superior. No doubt, all mature readers, whatever their reading strategies, could benefit from study-skills instruction that teaches them to recognize more efficiently the idea framework of any extended discourse.

Conclusions

In Chapter I of this dissertation, the writer discussed theory related to information processing and formulated conclusions from the literature concerning how mature fast and slow readers might differentially process extended discourse. Reading was defined as a self-directed, active process that goes beyond symbol-sound matching into complex thought processes requiring evaluation and organization of ideas encountered. Maturity in perception and cognition was defined, and by applying the definition to selection of the study population, it was possible to say that all study subjects were "mature" readers, having reached perceptual and cognitive maturity.

Reading-rate theories were divided into two groups, one hypothesizing that slow reading speed may be a cause of poor comprehension and the other hypothesizing that the type of comprehension that occurs varies with the rate at which a text is read. A structural hypothesis was formulated to account for the reading strategies of mature slow and fast readers, to predict the types of information that would best be recalled at slow and fast rates, and to test the two general theory divisions. Four types of structurally related comprehension were described: detail, microstructure, main idea, and macrostructure.

In Chapter IV, the results of hypotheses testing were discussed. No statistically significant relationship was found between the total number of extended-discourse questions correctly answered and the rate of discourse reading for the population. Also, no statistically significant relationship existed between detail, main-idea, or macrostructure comprehension and extended-discourse reading rate, for the population. The only statistically significant comprehension/rate relationship was between microstructure and discourse rate; the relationship was low and positive.

In Chapter V, the population was subdivided for further trend analysis. The 31 subjects who most consistently read Nelson-Denny material and extended discourse slowly (slow-slow group) did not differ significantly from the 32 subjects who most consistently read both these measures rapidly (fast-fast group): $F = .5280$, $p = .591$. These two groups also did not differ significantly on any of the four types of comprehension.

It appears that the first group of reading-rate theories--those stating that slow reading might cause poor comprehension--were not generally applicable to this study population. With the exception of microstructure (detail relationship), rate did not appear to be related to comprehension. No data supported a causative rate-comprehension statement. The microstructure data supported a limited rate-relationship statement.

In a post hoc study, the slowest 30 discourse readers ($\overline{X}$ = 148 wpm) were informally compared with the fastest 30 discourse readers ($\overline{X}$ = 324 wpm). Although no significance tests were performed, patterns of comprehension were suggested by the mean sample comprehension data. Fast-discourse readers achieved slightly higher mean scores than slow discourse readers in detail and main-idea comprehension. Whereas fast-discourse readers appeared superior in microstructure comprehension, slow-discourse readers appeared to be superior in macrostructure comprehension. The middle group of readers ($\overline{X}$ = 212 wpm) displayed great score variability; their group means showed them to be superior to both slow and fast readers in detail comprehension. This middle group attained mean accuracy scores on the other three types of comprehension that fell in between slow- and fast-discourse readers' mean scores.

The seeming superiority of slow readers in macrostructure comprehension was explained by their detailed method of processing essentially all ideas encountered in the data. Incorporating these ideas into existing memory structure required some idea transformation, which may have hindered detail, microstructure and main-idea recall.

Fast readers were pictured as processing a smaller subset of data--the central contents. Macrostructure was not as well understood by fast readers because less inference and information integration had occurred, but microstructure and main-idea comprehension were facilitated. Microstructure recall seemed to increase significantly with increased speed of reading. A middle rate of reading extended discourse appeared best for detail comprehension. Further investigation concerning comprehension/rate patterns is recommended.

Recommendations for Further Research

Research regarding how the brain processes, chunks, and remembers ideas is in its infancy. Resolution of these ideas will undoubtedly involve more than psychological research; biochemical research will eventually assume the greater significance. This study offered a general overview of how comprehension and rate may differentially interact in mature readers. Speculations are made about some of the general factors that may underlie the surface observations.

A further study is suggested to test for the hypothesized presence of a rate interaction with micro- and macrostructure comprehension. It is suggested that subjects be selected who have at least grade-level scores in NDRT Total Reading and that the same material and questions be used as in the present study. Two randomly assigned groups would be constructed and would be assigned different purposes for reading. One group would be asked to read for an understanding of detail relationships (microstructures), and the other group would be asked to read in order to understand the interrelationship

of ideas of the entire text (macrostructure). What patterns of information recall are exhibited in these circumstances? Are fast readers still best at microstructure and slow readers at macrostructure? If it seemed likely to yield additional data of worth, a third group could be added to read for just the main ideas or central contents.

Many of the subjects from the present study are accessible for further research. (Most indicated in writing their willingness to be subjects on a continuing basis.) It would be interesting to have all available original subjects engage in free written recall, writing everything they remember about the article one year after initially reading it. Any conclusions they came to, or any changes in the way they viewed things, formed from the reading, would be included. Is there a difference in the types of recall based on previous discourse rate?

In examining the profiles of subjects in this population, it was noted that they seemed to have higher SAT Math than SAT Verbal scores. It would be interesting to perform this study with mature readers whose SAT scores varied, so that some were substantially better in Math and some in Verbal. SAT Math scores were more highly related to achievement than were SAT Verbal scores; thus it would be predicted that such groups would have group mean achievement differences. Would they also differ in patterns of information recalled at various rates?

As shown in Table 8, the highly variable middle group had SAT Verbal mean scores that resembled slow-discourse group means and SAT Math mean scores that resembled fast-discourse group means.

This middle group had the highest group means in percentage class rank, detail comprehension, and total discourse comprehension. Further investigation into the relationship of these variables to each other is recommended.

At this point, it appears likely that rate differences in mature readers reflect different information-processing strategies and that different rates are more appropriate for recall of different types of information. It does not appear that rates below oral-speech levels are hindering comprehension of these mature slow readers, with the possible exception of microstructure comprehension. There is much room for further research on these questions, however.

APPENDICES

APPENDIX A

VERBAL DIRECTIONS GIVEN TO EACH STUDENT BEFORE THEY READ THE TASK ARTICLE

Verbal Directions Given to Each Student Before They Read the Task Article

I have here a copy of a Scientific American article called "The Black Death." I want you to read this article in the manner that you would normally read such material upon seeing it for the first time. (Pause) Read through the article just once. After you have passed a page, you are not to return to it. Tell me when you have finished because I will be timing you. (Show the stopwatch for emphasis on the rate factor.) You will be asked a few questions afterward. Do you have any questions?

(If there are questions about rate, say: "If you generally read fast the first time through an article, do so now; if you generally read at a slower pace the first time through an article, do so now.")

Begin.

APPENDIX B

QUESTIONS FOR BLACK DEATH ARTICLE

Questions for Black Death Article

For each question, print your answer in the blank provided.
(Please make sure your printing is legible. Thanks.)

____ 1. The Black Death was so named because

A. it was carried mainly by black rats.
B. it was transmitted from ports in the Black Sea.
C. Black Magic was thought to be responsible for the plague.
D. black spots appeared on plague-stricken persons.

____ 2. People had different theories for what caused the plague; a common belief of the time was that

A. fleas, carried by rats, were transmitting the disease.
B. Satan had sent the plague thru witches and/or Jews.
C. physicians were spreading the plague by poisoning wells.
D. Death would overtake them unless they fled.

____ 3. During the plague years of the 14th century, the loss of population

A. exceeded thirty percent, but rose above sixty percent in some areas.
B. approached twenty percent, with England especially hard hit.
C. was greatly increased because many countries were at war.
D. was so great that Europe did not recover until the 18th century.

____ 4. The fear and despair gripping Europe during the plague did not directly influence

A. the moral outlook.
B. the art and literature.
C. the economic changes.
D. the demographic changes.

____ 5. The 1348-1350 plagues claimed the most victims each year during

A. January-March.
B. April-June
C. July-September.
D. October-December.

____ 6. The attitude of most people during the plagues may be summarized as follows:

A. Take whatever you want; we won't live to pay the price for our deeds.
B. Seek God; we are being punished for our sins.
C. Eat, drink, and be merry for tomorrow we may die.
D. Suicide is preferable to enduring the agony of the plague.

____ 7. What was the financial situation of the people immediately after the 1348-1350 plague years?

A. Rural areas were in a desperate financial situation but towns and cities were not as there were fewer people to share wealth.
B. Towns and cities were in a desperate financial situation but rural areas were not because of their food reserves.
C. Towns, cities and rural areas were in a desperate financial situation because the social-economic structures collapsed.
D. Towns, cities and rural areas were not immediately in desperate financial situations because there were fewer people to share food and wealth.

____ 8. Pretend you are on a task force to plan for civilian needs in the event of a disaster in this country. You must consider how people would react to a nuclear bombardment which kills a huge segment of the population. From your study of human behavior during the European plague years, which response would you consider to be least likely after a nuclear disaster?

A. There would be a significant increase in criminal behavior.
B. People would attempt to atone for their sins.
C. There would be a resurgence in witchcraft and superstition.
D. There would be a great concern for helping survivors.

____ 9. Flagellation cults of the time were concerned with people

A. purifying themselves of evil.
B. making extravagant vows to God about the future.
C. praying that the end of the world might not come.
D. whipping themselves to stop the advance of the plague.

____10. These several hundred years of plagues in Europe may have produced the Reformation because

A. constant mental pain and the nearness of death led people to reconsider their relationship to God.
B. people discarded their belief in God when prayer had failed to protect them from the plague.
C. people were upset with clergy who had turned to superstition and hedonistic behavior.
D. Calvin, Wycliffe and other church leaders had fled each plague outbreak, abandoning the common people.

____11. The term pandemic refers to

A. all the outbreaks of plague occurring between 1348 and the late 17th century in Europe.
B. the final large outbreak of plague in 1665 in Europe.
C. all the outbreaks of plague occurring between 1348 and 1350 in Europe.
D. all the outbreaks of plague occurring after 1350 all over Europe.

____ 12. During the European plague years, major shifts in population occurred as

A. people fled to the towns and cities during the few years of continuous plague.
B. people fled to the towns and cities during the years of intermittent plague.
C. people fled to the country during the few years of continuous plague.
D. people fled to the country during the years of intermittent plague.
E. A and B
F. A and C
G. A and D
H. B and C
I. B and D
J. C and D

____ 13. Which segment of society made a lot of money immediately after the 1348-1350 plagues?

A. the clergy, because they were profiting from the labor of the poor.
B. the landowners, because they sold farmland for a great profit.
C. the survivors, because they stole what they wanted from deserted houses.
D. the craftsmen, because there was a demand for their work.

____ 14. Why did people behave as they did as the plague approached?

A. Since they had no way of preventing the plague from reaching them, hastening death by entering quarantined areas seemed reasonable.
B. They were terrified because there was no known cure for the plague.
C. The psychological shock caused by so many persons dying led to feelings of omnipotence.
D. The Bacillus pestis organism affected not only the lungs, lymph glands, or blood, but also the emotions and mental attitude of people.

____ 15. Why were sick and dying people frequently dumped in burial pits with persons already dead? This was done

A. because loved ones had abandoned them and there was no one to care for them.
B. in a desperate attempt to keep the plague from spreading.
C. because sick people were considered to be as good as dead; people who contracted plague invariably died in a few days.
D. because burial crews were mostly composed of hardened men who were more interested in body fees than human suffering.

____ 16. This article has presented a variety of responses which people had to the plague, discussing certain individuals for illustration. What generality concerning human behavior during major catastrophe can most logically be made?

A. People can generally choose how they will respond to major catastrophe.
B. A person can never be sure how he/she will respond to major catastrophe.
C. A person's environmental background will determine how he/she will respond.
D. A person's economic status will determine how he/she will respond.

Discussing any part of this experiment might influence the results obtained. People tend to respond in relationship to their expectations. Therefore, I earnestly request you not to discuss any phase of this experiment with anyone until all persons at your school are finished with it. Thank you very much for your participation. I would be happy to make results and conclusions known to you, upon your request, at a later date. Results of the Nelson-Denny Reading Test will be returned to you in the next few days. Thank you.

Note. These questions may be used only with the written permission of S. M. Hice, and with the condition that the source is properly acknowledged.

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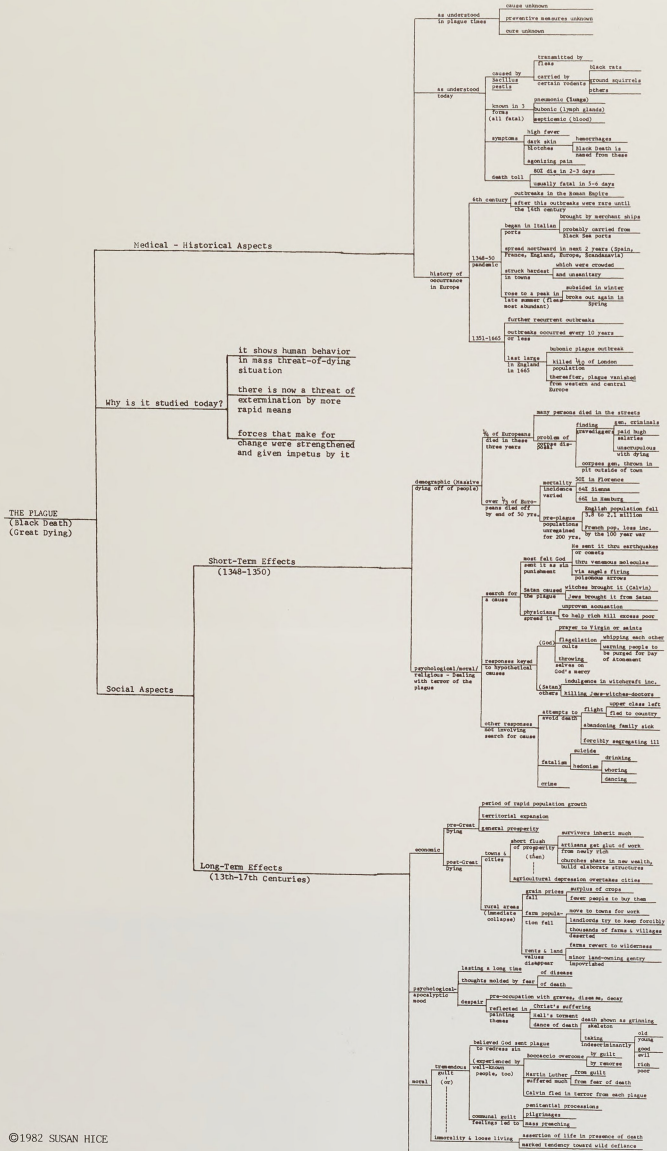
APPENDIX C

STRUCTURAL DIAGRAM OF LANGER'S (1968)

"THE BLACK DEATH"

Note: Diagram refers to the condensed version of this article prepared by S. M. Hice.



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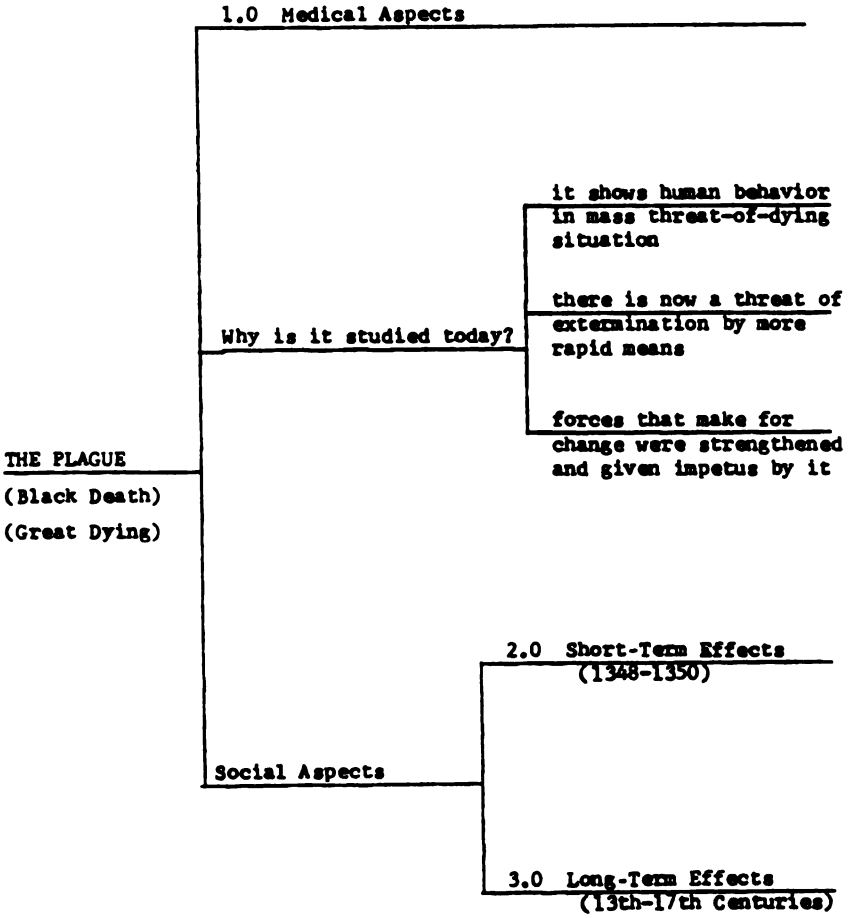
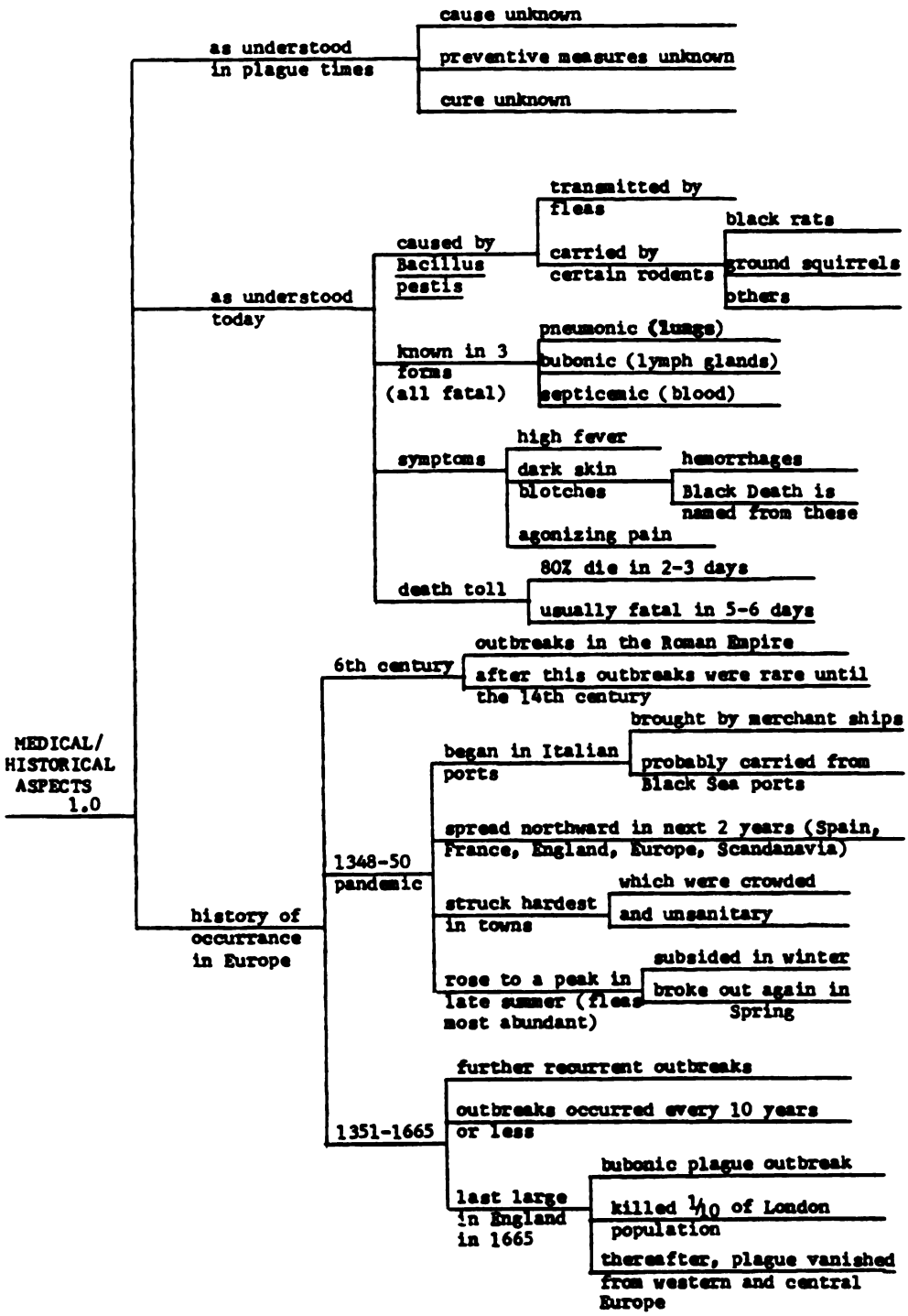
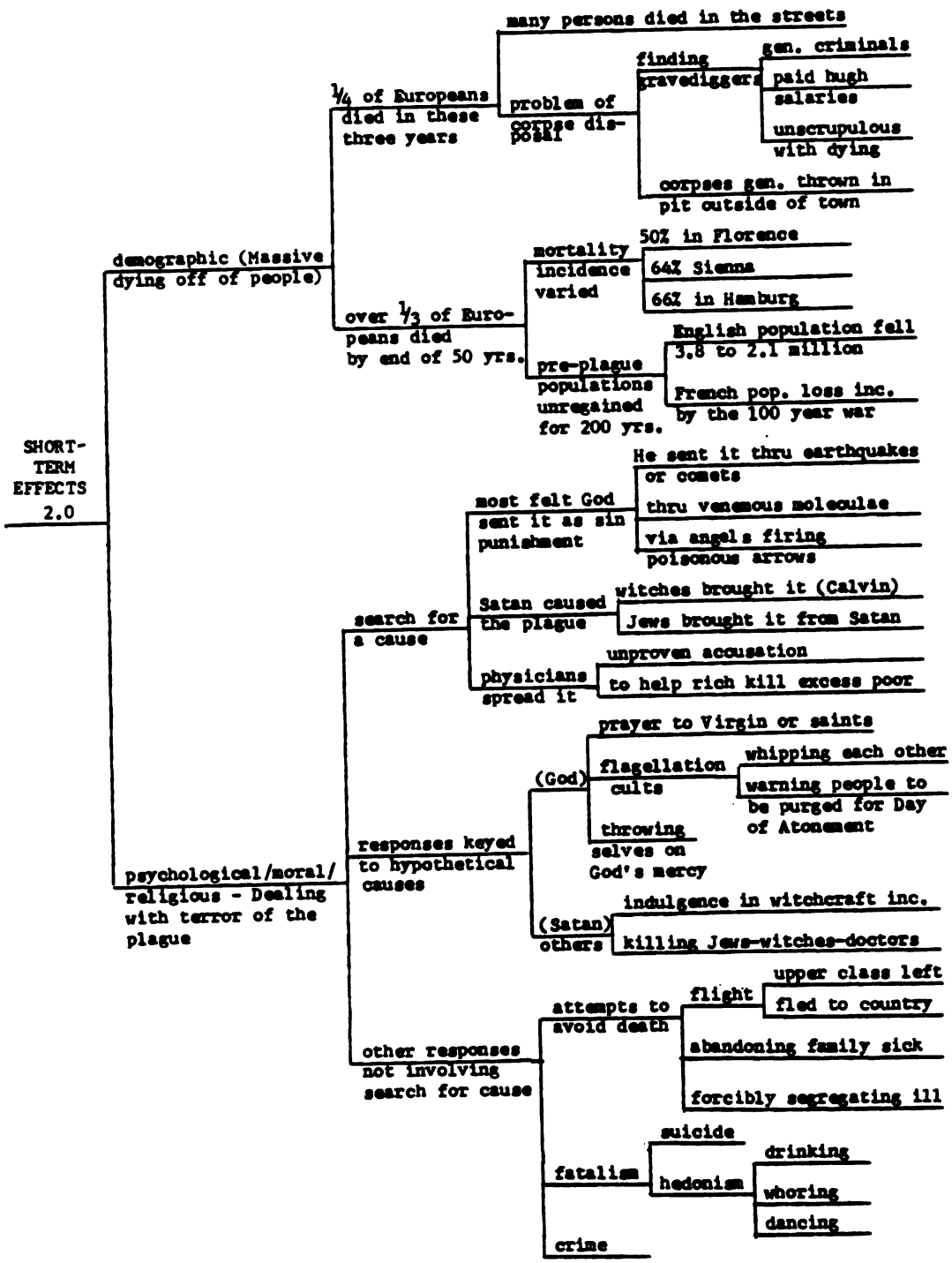
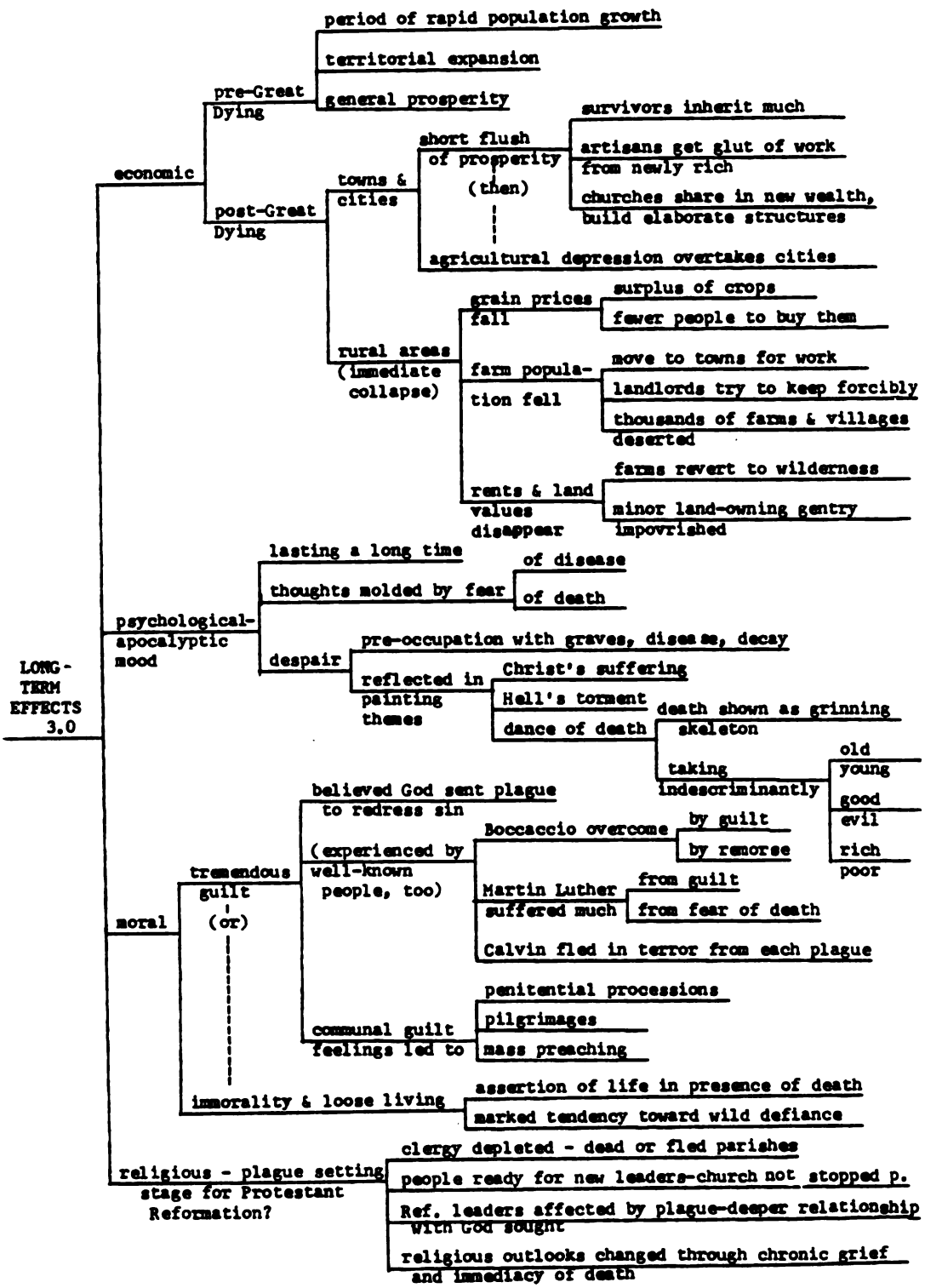
Structural Diagram of Langer's (1968) "The Black Death"




MEDICAL/ HISTORICAL ASPECTS 1.0
as understood in plague times
cause unknown
preventive measures unknown
cure unknown
as understood today
caused by Bacillus pestis
transmitted by fleas
carried by certain rodents
black rats
ground squirrels
others
known in 3 forms (all fatal)
pneumonic (lungs)
bubonic (lymph glands)
septicemic (blood)
symptoms
high fever
dark skin blotches
hemorrhages
Black Death is named from these
agonizing pain
death toll
80% die in 2-3 days
usually fatal in 5-6 days
history of occurrance in Europe
6th century
outbreaks in the Roman Empire
after this outbreaks were rare until the 14th century
1348-50 pandemic
began in Italian ports
brought by merchant ships
probably carried from Black Sea ports
spread northward in next 2 years (Spain, France, England, Europe, Scandanavia)
struck hardest in towns
which were crowded and unsanitary
rose to a peak in late summer (fleas most abundant)
subsided in winter
broke out again in Spring
1351-1665
further recurrent outbreaks
outbreaks occurred every 10 years or less
last large in England in 1665
bubonic plague outbreak
killed 1/10 of London population
thereafter, plague vanished from western and central Europe


SHORT-TERM EFFECTS 2.0
demographic (Massive dying off of people)
1/4 of Europeans died in these three years
many persons died in the streets
problem of corpse disposal
finding gravediggers
gen. criminals
paid high salaries
unscrupulous with dying
corpses gen. thrown in pit outside of town
over 1/3 of Europeans died by end of 50 yrs.
mortality incidence varied
50% in Florence
64% Sienna
66% in Hamburg
pre-plague populations unregained for 200 yrs.
English population fell 3.8 to 2.1 million
French pop. loss inc. by the 100 year war
psychological/moral/religious - Dealing with terror of the plague
search for a cause
most felt God sent it as sin punishment
He sent it thru earthquakes or comets
thru venemous moleculae
via angels firing poisonous arrows
Satan caused the plague
witches brought it (Calvin)
Jews brought it from Satan
physicians spread it
unproven accusation
to help rich kill excess poor
responses keyed to hypothetical causes
(God)
prayer to Virgin or saints
flagellation
whipping each other
cults
warning people to be purged for Day of Atonement
throwing selves on God's mercy
(Satan) others
indulgence in witchcraft inc.
killing Jews-witches-doctors
other responses not involving search for cause
attempts to avoid death
flight
upper class left
fled to country
abandoning family sick
forcibly segregating ill
fatalism
suicide
hedonism
drinking
whoring
dancing
crime



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APPENDIX D

DETAIL QUESTIONS, SHOWING CORRECT ANSWER, AND TEXT DERIVATION OF ANSWER

Detail Questions, Showing Correct Answer, and Text Derivation of Answer

1. The Black Death was so named because black spots appeared on plague-stricken persons.

   From paragraph 2, last sentence: "The Black Death got its name from dark blotches produced by hemorrhages in the skin." (Langer, 1968)

2. The 1348-1350 plagues claimed the most victims each year during July-September.

   From paragraph 4, last sentence: "Each year the epidemic rose to a peak in the late summer, when the fleas were most abundant, and subsided during the winter, only to break out anew in the spring." (Langer, 1968)

3. Flagellation cults of the time were concerned with people purifying themselves of evil.

   From paragraph 10, last sentence: "In the streets half-naked flagellants, members of the century-old cult of flagellantism, marched in processions whipping each other and warning the people to purge themselves of their sins before the coming day of atonement." (Langer, 1968.

4. Which segment of society made a lot of money immediately after the 1348-1350 plagues? --the craftsmen, because there was a demand for their work.

   From paragraph 21, middle sentence: "They built elegant houses and went on a buying spree that made work (and high prices) for the manufacturing artisans." (Langer, 1968)

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APPENDIX E

MICROSTRUCTURE QUESTIONS, CONSTRUCTED FROM NEIGHBORING DETAILS, AND REPRESENTING SUPPORTING IDEAS

Microstructure Questions, Constructed From Neighboring Details, and Representing Supporting Ideas

1. During the plague years of the 14th century, the loss of population exceeded thirty percent, but rose above sixty percent in some areas.

   From paragraph 7 (8). Requires recognizing that "more than 1/3" is compatible with over thirty percent, and "more than 2/3" is compatible with above sixty percent. (Text from Langer, 1968) Is essentially memory of Details. (All distractors based on paragraphs 7 and 8.)

2. What was the financial situation of the people immediately after the 1348-1350 plague years? Rural areas were in a desperate financial situation but towns and cities were not as there were fewer people to share wealth.

   From paragraphs (20), 21, 22. Requires understanding and remembering a clear comparison made in the text. No inference is required, just syntactic and semantic understanding. (All distractors found in paragraphs 20, 21, 22.)

3. The term "pandemic" refers to all the outbreaks of plague occurring between 1348 and 1350 in Europe.

   From paragraphs 4 and 5. This is a vocabulary question and requires noting the usage of "pandemic" in the sentences in which it occurs. Some inference is required. (All distractors are composed of other date possibilities.)

4. Why were sick and dying people frequently dumped in burial pits with persons already dead? This was done because burial crews were mostly composed of hardened men who were more interested in body fees than human suffering.

   From paragraphs (12) and 13. Requires understanding the relationship of sentence details in one complete paragraph. No special inference is required, just implications from word usage. (All distractors came from paragraph 12, except one that was invented.)

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APPENDIX F

MAIN-IDEA QUESTIONS, SHOWING CORRECT ANSWERS AND DIVERSE ELEMENTS OF TEXT THAT THE ANSWER AND/OR THE DISTRACTORS ARE DRAWN FROM

Main-Idea Questions, Showing Correct Answers and Diverse Elements of Text That the Answer and/or the Distractors Are Drawn From

1. People had different theories for what caused the plague; a common belief of the time was that Satan had sent the plague thru witches and/or Jews.

   Requires putting together elements of text from paragraphs 10 and 17. Distractors came from paragraphs 2 and 9, among others. Thus the main idea is pieced from several microstructures throughout the text. The question must also be closely read, to remember that "belief" refers to belief about the cause of the plague. Summarizing, this answer required synthesizing of related information in different paragraphs and referred to one of the main ideas in the text.

2. The attitude of most people during the plagues may be summarized as follows: Seek God; we are being punished for our sins.

   The answer occurs in paragraph 10; half the answer appears again in paragraph 17, and half in paragraph 22. Distractors came from paragraphs 12, 14, and 15. This main-idea question was very like microstructure, except for its repetition in diverse areas of text, its being a main idea, and the distractors coming from diverse areas of text. Some inference was required to produce the correct answer.

3. These several hundred years of plagues in Europe may have produced the Reformation because constant mental pain and the nearness of death led people to reconsider their relationship to God.

   Requires synthesis of information from paragraphs 27 and 28. Paragraphs 11 and 14 give clues that the distractors are wrong. This main-idea question differs from microstructure in the importance of the idea, the synthesis required, and the location of distractor information in diverse sections of the text.

4. Why did people behave as they did as the plague approached? They were terrified because there was no known cure for the plague.

   Required synthesizing information presented in one paragraph of text, paragraph 9. Behavior was gleaned from paragraphs 10, 11, 14, 15, and 16. Distractors were located in paragraph 12, or fabricated based on paragraph 2. This main-idea question differs from microstructure in the importance of the idea, the synthesis required, and the necessity of knowing that the diversely located distractor material was incorrect.

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APPENDIX G

MACROSTRUCTURE QUESTIONS, RELATING MAJOR TEXTUAL IDEAS AND SOMETIMES ALSO GLOBAL APPLICATIONS

Macrostructure Questions, Relating Major Textual Ideas and Sometimes Also Global Applications (See Figure 1)

1. The fear and despair gripping Europe during the plague did not directly influence the economic changes.

   Requires an understanding of the whole article. The four possible pairings must be weighed, with an understanding of each necessary to answer correctly. This question concerns the interaction of psychological effects with other societal effects.

2. Pretend you are on a task force to plan for civilian needs in the event of a disaster in this country. You must consider how people would react to a nuclear bombardment which kills a huge segment of the population. From your study of human behavior during the European plague years, which response would you consider to be least likely after a nuclear disaster: there would be a great concern for helping survivors.

   Requires an understanding of human behaviors presented in the article. These must be weighed for which was least present during the plague, then applied to the situation proposed.

3. During the European plague years, major shifts in population occurred as people fled to the towns and cities during the years of intermittent plague and people fled to the country during the few years of continuous plague.

   Requires an understanding of short-term demographic effects and long-term demographic effects. The answer may be gleaned from paragraphs 11, 19, and 22, which makes it a bit like main idea. However, the idea interaction is on a more complex basis.

4. This article has presented a variety of responses which people had to the plague, discussing certain individuals for illustration. What generality concerning human behavior during major catastrophe can most logically be made? A person can never be sure how he/she will respond to major catastrophe.

   Requires inference from statements made of behavior patterns during the article to know that this is the most appropriate answer. Also requires a global generalized understanding of the article.

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APPENDIX H

RAW DATA

Raw Data

Data for 133 subjects. Percentile rank has been converted from rank, task wpm has been converted from task time, and D, Mic, MI, and Mac have been tabulated from scoring each individuals test by these categories.

Subject Number	ND-V	ND-C	ND-T	ND wpm	SAT-V	SAT-M	%age Rank	D	Mic	MI	Mac	Task wpm
001	77	99	94	333	650	560	2.8	2	3	2	1	330
002	98	98	98	344	630	570	4.8	2	2	2	1	360
004	75	84	81	269	540	510	17.6	3	2	3	3	239
005	71	90	83	333	460	400	22.0	2	2	1	1	322
006	89	84	88	195	640	650	8.0	4	1	3	3	218
007	66	84	77	226	430	620	6.8	2	3	2	2	200
008	81	81	82	356	550	710	1.6	2	4	2	1	347
011	99	93	99	561	700	690	0.8	4	3	4	1	204
012	95	93	94	586	560	530	12.8	2	3	2	2	231
013	83	74	79	226	460	550	10.0	3	3	2	2	186
014	56	59	58	425	530	630	6.0	2	3	2	1	292
016	32	74	55	203	470	660	6.4	2	2	3	2	179
015	69	74	71	245	490	530	20.4	2	3	2	0	182
017	64	59	62	235	380	460	4.8	2	0	3	0	200
018	73	69	71	235	410	640	14.4	2	3	2	2	200
019	93	90	92	299	550	560	4.4	3	3	3	3	264
020	44	69	58	235	390	550	25.2	1	2	2	2	161
021	73	93	85	245	460	340	22.4	2	4	3	4	203
023	69	78	73	226	410	650	11.6	2	1	2	1	194
028	87	84	87	226	580	460	14.8	4	3	2	3	188
029	95	69	88	368	450	540	16.0	3	3	2	1	199
031	50	59	55	195	460	630	18.0	2	2	2	2	158
032	89	97	97	203	550	690	7.2	3	4	3	1	277
033	50	74	63	195	430	520	18.8	2	2	3	1	130
034	61	54	58	235	340	540	23.6	2	3	2	1	162
035	81	97	91	279	530	740	2.4	3	3	1	2	216
036	53	87	73	309	460	550	5.6	3	3	1	2	256
037	64	54	59	299	390	590	13.6	2	3	3	2	232
039	71	64	68	475	450	680	16.0	3	3	0	1	205
040	69	64	67	309	470	530	10.8	2	1	1	0	178
041	59	49	54	309	410	450	14.0	2	4	1	1	204
043	95	90	94	391	570	640	7.2	2	2	2	2	232
044	53	81	69	203	440	580	13.2	3	4	3	1	144
046	66	49	58	159	450	480	12.0	1	4	2	2	159
047	75	74	75	226	510	620	16.0	3	3	0	2	158
048	66	98	88	195	640	670	0.4	4	2	2	2	165
050	73	97	88	257	580	640	5.2	1	2	1	1	215
051	38	81	63	226	370	550	20.0	3	2	2	1	180
052	64	74	69	165	550	730	3.6	3	4	1	4	152
053	38	69	55	269	410	580	8.4	3	2	1	2	231

055	66	90	81	290	520	540	9.6	2	3	2	1	269
056	81	78	80	188	500	690	9.2	3	3	3	1	175
057	69	78	73	344	420	560	2.0	3	2	1	3	192
058	35	69	54	195	430	480	22.8	1	3	1	1	158
059	53	64	59	188	390	370	24.4	1	2	2	1	118
060	95	97	96	450	660	660	2.8	4	4	4	2	250
062	90	95	93	177	500	580	8.8	2	4	1	1	183
064	69	90	82	195	510	670	12.4	4	2	3	2	167
066	38	74	58	344	410	350	23.2	1	2	0	1	208
071	69	49	59	214	390	530	26.0	1	3	3	2	215
072	61	49	55	203	440	390	27.4	4	2	0	1	159
073	95	98	97	195	550	630	1.4	2	3	1	2	199
074	87	87	88	153	-	-	9.6	2	3	1	2	145
075	90	84	88	327	560	620	19.2	3	1	2	1	234
076	50	78	65	177	410	560	20.5	1	2	2	1	156
077	61	64	63	257	380	520	24.7	2	2	0	1	249
078	61	84	75	299	440	550	6.9	3	2	1	1	250
079	94	98	96	356	550	660	5.5	2	3	2	2	269
080	89	49	72	195	510	510	12.3	3	3	1	2	161
081	77	81	80	488	410	560	32.9	2	4	2	2	272
082	77	84	82	226	550	590	45.2	3	3	2	2	215
083	92	95	94	235	480	640	2.7	4	4	2	3	208
084	96	69	89	356	530	660	8.2	1	3	3	1	298
085	97	74	91	290	410	390	34.3	2	3	2	2	239
091	38	64	53	188	380	550	12.8	2	3	2	2	127
092	79	84	83	195	490	520	15.4	0	2	0	1	347
093	86	69	79	214	-	-	18.0	3	3	3	2	193
094	59	84	73	279	400	480	25.6	2	2	2	2	311
095	91	99	96	203	530	690	2.6	2	4	3	0	300
096	59	78	69	188	480	540	23.1	3	3	3	1	249
097	71	69	70	203	480	570	5.1	1	2	2	2	154
098	71	87	81	235	480	550	7.7	0	2	1	2	267
099	75	81	79	245	520	540	10.3	3	1	2	1	191
100	73	93	85	269	-	-	20.5	3	2	3	1	255
101	50	74	63	257	420	500	28.2	2	3	3	1	184
111	92	98	95	413	600	600	4.8	4	4	1	2	283
112	86	99	94	561	560	690	1.2	4	2	4	4	378
113	47	93	76	188	440	530	16.7	3	3	1	0	194
114	71	49	60	-	-	-	11.0	4	1	2	1	149
115	77	87	84	299	-	-	14.3	4	2	2	0	192
116	90	99	96	279	-	-	6.0	2	3	3	3	253
117	79	93	88	269	540	620	7.1	3	3	3	2	207
118	73	74	73	195	-	-	16.7	0	1	2	1	122
119	56	90	77	391	440	320	22.6	1	4	1	2	128
120	79	97	90	319	530	620	15.5	2	2	1	1	269
121	83	99	94	368	610	630	3.6	4	3	3	2	327
122	87	54	73	226	-	-	8.3	2	3	1	4	186
123	50	64	58	299	-	-	20.2	4	1	1	2	222

125	71	54	63	413	-	-	23.8	3	3	1	2	189
126	91	84	89	203	630	720	9.5	0	3	3	4	170
127	56	54	55	269	-	-	2.4	3	3	1	3	165
128	64	74	69	245	-	-	19.1	2	3	2	1	217
129	64	97	85	279	-	-	13.1	2	4	2	2	308
130	71	49	60	279	-	-	29.8	1	3	2	1	184
131	77	69	73	299	-	-	36.9	1	3	1	1	192
141	59	59	59	165	450	400	20.5	2	2	3	1	314
142	95	95	95	356	600	600	21.3	1	3	3	3	559
143	66	74	70	290	540	520	7.4	3	4	2	2	306
144	91	74	85	299	570	530	4.1	2	4	3	3	169
145	66	69	68	129	-	-	4.9	2	2	2	2	180
146	69	93	84	235	-	-	34.4	2	2	3	1	265
147	73	74	73	257	460	540	18.0	2	3	3	1	231
148	71	59	65	438	490	650	1.6	2	1	3	1	176
149	64	49	57	195	440	420	17.2	1	2	3	1	153
151	83	74	79	195	470	390	40.7	2	2	0	1	106
152	84	59	73	226	540	480	16.3	2	4	2	0	176
153	91	97	94	319	-	-	12.8	1	3	3	2	184
154	56	44	50	379	-	-	30.2	1	4	1	1	245
155	93	93	93	356	470	500	9.3	3	3	2	0	282
156	93	90	92	299	450	550	14.0	2	4	3	1	240
157	96	99	98	290	620	630	8.1	2	3	3	2	254
158	95	98	96	290	440	420	38.4	4	3	1	1	146
159	59	69	64	269	-	-	62.8	2	2	2	1	274
160	83	59	72	214	-	-	26.7	4	2	3	1	809[a]
161	95	81	91	391	470	530	32.6	4	3	2	1	284
171	84	87	87	245	-	-	8.6	2	2	1	2	235
172	97	99	98	279	670	480	11.1	4	3	2	3	136
181	81	81	82	269	500	700	23.1	4	3	4	2	247
182	84	54	71	214	450	460	17.2	3	3	2	3	188
183	53	54	54	327	390	420	29.1	3	2	1	1	209
184	73	59	67	117	420	460	31.3	2	2	3	2	109
185	86	69	79	290	420	530	18.7	2	0	0	1	215
186	97	95	97	257	510	450	40.3	4	2	2	2	260
187	90	84	88	195	510	470	44.8	1	2	3	2	258
188	44	69	58	195	360	440	17.9	3	3	3	3	215
189	87	87	88	319	550	630	2.2	4	4	2	2	192
191	75	87	83	269	530	560	20.9	1	2	1	1	264
192	32	69	53	279	-	-	61.9	4	3	3	1	182
193	83	95	90	299	590	610	14.9	4	2	3	2	248
194	83	84	85	106	570	510	12.7	3	2	2	1	244
195	77	84	82	235	-	-	2.4	2	2	1	2	163
196	84	69	78	235	510	590	7.5	1	4	1	1	250
197	64	69	67	235	400	630	3.0	2	3	2	3	217
124	50	39	44	195	-	-	10.7	1	4	1	2	146[b]

Note. This table is a data summarization. Comprehension accuracy was actually entered as individual question responses, then corrected and tabulated into categories by computer. Task wpm rate was entered as time units and converted by computer into wpm and sps by appropriate formulas. Percentage rank was also calculated by computer from class rank and school senior population.

[a]This subject's speed was known to have probable error; speed could have been any value between 324 and 809 wpm on task. Deleted for Pearson r.

[b]This subject was not included in study due to low NDRT Total score.

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