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Center for the Study of Reading

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Abstract

This paper presents the results of a study examining effects of prior knowledge and explicitness of text connectivity on various measures of reading ability. The purpose of the study was to suggest some possible relationships, some alternative measures, and some new directions for research, particularly research that is designed to refine how we measure comprehension and make consequent judgments about students' abilities. The paper presents a glimpse of reading comprehension and its assessment from a schema-theoretic perspective. We contend that current assessment of reading comprehension is strongly biased by the extent of an individual's prior knowledge about the topic presented in the text to be read. Since this is a statement about the relationship between text and reader, it can (as in the study reported) be examined by manipulating such factors as text familiarity or by measuring the reader's prior knowledge. The study indicates that the sizable effects of prior knowledge on reading comprehension can be found by manipulating the text or by measuring the individual reader's prior knowledge. The value of direct measurement of prior knowledge is discussed.

Writers include explicit connectives in text as deemed appropriate for the intended audience. What audience characteristics interact with the connectivity of the text? This study suggests that ability may be a more important factor to consider than prior knowledge.

Prior Knowledge, Connectivity,

and the Assessment of Reading Comprehension

This study examined at least a few aspects of the recently popular point of view that comprehension involves a reader who constructs a model of the meaning of a text based upon cues provided by the text and the reader's existing knowledge structures. In particular we examined the effects of prior knowledge (a reader variable), the connectedness of ideas in the text (a text variable), and the types of question probes and processing indices used to assess comprehension (a measurement variable). Other variables, such as reading ability and reading speed, were employed to add precision to our estimate of the power and influence of the major variables of interest.

Prior Knowledge and Reading Comprehension

Recently, attention has focused on a schema-theoretic approach to reading comprehension. Schema theory proposes that knowledge is stored in schematic structures (Anderson, Spiro, & Anderson, 1977; Rumelhart & Ortony, 1977) and defines comprehending as the processes of forming, elaborating, modifying, or integrating these knowledge structures (Rumelhart, 1977). Reading comprehension is the process of using prior knowledge and the cues provided by the writer to construct a model of the meaning of the text, which, hopefully, bears some resemblance to the author's intended meaning. Such an act of construction involves a considerable amount of inferencing at all levels. If prior knowledge is strong, then one may construct a detailed model rapidly: Reading reduces largely to recognizing which text items fill

which slots in the schema one has invoked (e.g., which character is the heroine, what her goal is, how she achieves it, etc.), and to filling in otherwise uninstantiated slots (e.g., certain motives) with default (best guess) values. On the other hand, if background knowledge is weak, inferencing becomes increasingly difficult, possibly requiring more and more reasoning skill to tie the text together.

This theoretical perspective posits a major role for background knowledge in the reading process. It implies that the ease with which readers comprehend will be directly related to the extent of their prior knowledge. Indeed, if prior knowledge is considerable, then comprehending can amount to simple slot-filling activity, minimizing the amount of active text processing required for reading. Conversely, if background knowledge is weak, then more processing will be required to make sense of it. This should be even more apparent when relationships among text propositions in the text are less well cued, that is, when the writer has written poorly or made considerable and unwarranted assumptions about the background knowledge that the reader shares with the author. Tuinman (1979, p. 47) suggests that,

> Reading requires reasoning when either the linguistic code is complex or when the reader's schemata are inadequate to accommodate the text's information structure. When the message is coded in known linguistic structures (phonetic, syntactical, or semantic) and the text's information structure matches the reader's schemata, reading is merely recognition.

Pace (Note 1) has also pointed out that in familiar story situations there is a difference between "active" and "passive" inferencing. Passive inferencing is a matter of merely "recognizing" the appropriate schema and the text values that fill important slots, whereas active inferencing involves reasoning.

Given this perspective, it is no surprise that factor-analytic studies of reading comprehension have found a word knowledge factor on which comprehension tests load highly (e.g., Davis, 1968, 1972; Thurstone, 1946). In studies of readability, also, any index of vocabulary difficulty accounts for about 80% of the predicted variance in comprehensibility (Coleman, 1971; Klare, 1974-75).

Text Connectedness

While the relationship between the text content and relevant prior knowledge should affect readers' comprehension of the text, characteristics of the text itself, aside from the familiarity of its content, will also create problems for the readers.

There are cues to the organizational structures in text: for example, topic sentences, macro-connectors such as "but," "however," and "because," and discontinuities in time, location, actors, and content. Provided that a reader is aware of these cues and knows what to do with them, they should assist him in his cognitive modeling of the text. Stein and Nezworski (1978), for example, showed that fifth-grade students could recall structural disruptions of narrative at least as well as normal orderings if explicit markers were used. However, this was only partially helpful for

first graders. On the other hand, Neilsen (1977) found that with his narrative texts, removal of the connectives made no difference to readers' (fifth grade, ninth grade, and junior college) comprehension of the passages. It has also been shown that, in the case of expository text, some adult readers are less bound to be influenced by the text structure than are others (Marshall & Glock, 1978-79). More proficient adult readers are able to read text for their own purposes and to override such built-in emphases. With respect to readability formulae, these data are interesting. Even the Neilsen finding of no differences between connected and unconnected versions of a passage flies in the face of the simple extrapolation one would make from the fact that sentence complexity (alias sentence length) is the second most powerful predictor of comprehension difficulty (Klare, 1974-75): Connectives tend to produce longer and more complex sentences. However, it seems likely that some children will lack the background knowledge or ability to use it to overcome the lack of explicitness of text structure. That is, the extent to which information is represented in the text (and the reader does not have to infer it) has an effect on recall. McConkie (1978, p. 17) summarizes this point:

> In general, textual manipulations which reduce information useful to the reader in building a coherent representation of the content can be expected to reduce comprehension of the passage. In some cases, the reader's prior knowledge will compensate for loss of textual information or relations may be identified on a problem solving basis requiring greater reading time.

The feeling that removing the structural connectives from text will make it somewhat less comprehensible is an appealling one which research has both supported (Stein & Nezworski, 1978) and rejected (Neilsen, 1977). Of course, the explicit connectives are not the only connectives in the text. Connection is also often implied by sheer proximity. That is, two adjacent sentences tend to have an implicit link between them. The reader, invoking a Gricean-like (1975) principle, assumes that the writer put the sentences next to one another for a good reason. The argument so far presented in this paper and in the above statement by McConkie would contend that the extent of a reader's background knowledge may well moderate, or even overcome, the potential power of this effect. Walmsley (1977) in summarizing the connectivity literature, similarly suggests this possibility. It may be the case that greater background knowledge can overcome the absence of explicit connectives, and even order implicit connection of ideas in a text. However, the inferences required in such an endeavor may force a reader to spend more time processing the text. With respect to processing time, low prior knowledge should increase processing time regardless of connectivity; the effect should simply be more dramatic in low-connectivity conditions.

Question Classification

Apart from the obvious use of time as a dependent variable, how might we best measure the influence of these variables on reading? Perhaps we can profit from an analysis of their effects on different question types. Clasification of reading comprehension questions has progressed quite slowly

to the present versions such as that developed by Pearson and Johnson (1978).

These classification systems are a far cry from the earlier attempts at generative algorithms which were based more on surface syntactic manipulations (for example, Bormuth, 1970). They are now much more concerned with what is involved in answering the question and where the information came from than within the surface structure of the text.

Pearson and Johnson (1978) and Lucas and McConkie (1980) each have developed systems which make the same basic distinctions amongst questions. These distinctions are exemplified in Pearson and Johnson's system, which is really a classification of question-answer relationships. The distinctions relate to the location of the information required, and/or actually used, to answer the question. Textually explicit (TE) items have both the question information and the answer information stated in a single sentence in the text. Textually implicit (TI) items have the question information and response information stated in different parts of the text, requiring the reader to combine the separate pieces of information in order to produce or recognize an answer. In order to answer scriptally implicit (SI) questions, the reader must combine some information from the text and some from his relevant background knowledge (script).

Another item type is especially relevant to the present study, though it does not appear in Pearson and Johnson's classification system. It links the textually explicit and textually implicit items relating to sentences containing connectives and has import for the psychological reality of the

sentence as a unit in reading comprehension. When a connective is removed from a sentence, the sentence generally becomes two sentences. Thus, the same item addressing the same information could be either textually explicit or textually implicit, depending on the presence or absence of the connective. These additional items we will call "switch" (SW) items. They allow us to investigate an additional aspect of connectivity. We can hypothesize that switch items will exhibit a greater decrement in performance than other items as a function of decreased explicitness of connectives.

Passage Independence

The classification so far does not include items which simply require information from the reader's background knowledge. In other words, it does not classify topic related questions and answers if neither is explicitly mentioned in the text.

There are, of course, good reasons for this. Such items could hardly be considered to measure reading comprehension, since the requisite information is not even in the text. Indeed, these items would be more likely to show up as passage (or context) independent (Farr & Tuinman, 1972; Hanna & Oaster, 1978-79; Pyrczak, 1972, 1974, 1975-76; Tuinman, 1974). That is, reading the passage or not reading it before answering the question would make relatively little difference to a reader's ability to answer the question. Items which have been assessed as being passage independent have been frowned upon for some time. The idea is that these items are not really testing reading comprehension and should therefore be statistically

identified and then removed from the test (Pyrczak, 1972; Tuinman, 1974).

Elimination of these items is based on a desire to have a "pure test of reading comprehension skill" independent of content knowledge. A basic premise of our endeavor is that this objective is both impossible to attain and undesirable; while these passage-independent background knowledge items do not measure reading comprehension, they can, in fact, tell us something about the influence of background knowledge on the student's performance. In this study we propose that passage-independent background knowledge test items can make a valuable contribution to our reading comprehension assessment methodology. Such concurrent assessment of prior knowledge would give us a better context within which to interpret more passage-dependent items.

Recognizing that prior knowledge has a large effect on reading comprehension assessment, we contend that the correlations found between measures of general vocabulary, IQ and reading comprehension may stem from the nature of the reading comprehension tests, which consist of a number of brief passages each followed by several questions, and each relating to a different topic. The fact that the passages draw on widely different background knowledge ensures that the background knowledge involved in the total test represents general knowledge which is, of course, highly related to IQ. Within IQ tests, vocabulary or word knowledge subtests are, in fact, the strongest predictors of academic success (Glasser & Zimmerman, 1967).

However, suppose that the reading test passages were considered individually and related to relevant background knowledge. Schema theory

would contend that a measure of specific background knowledge should be even more predictive than the general measures. Indeed, one cause of reading failure is considered to be lack of appropriate background knowledge or "schema availability" (Spiro, 1980), and if that is what is causing a failure, it would be useful to know about it, since the remedy is somewhat different from that required when background knowledge is adequate. A further relevant cause of reading comprehension is "schema selection" (Spiro, 1980), i.e., having the appropriate background knowledge, but failing to use it when it is appropriate to do so.

In order to assess these possible causes of comprehension failure, it would be useful to have some measure of what background knowledge readers had before reading the text. Without such information it is difficult to determine whether an individual was failing to comprehend because of a knowledge deficit or, perhaps, some more pervasive processing deficit (e.g., decoding skill, fluency, or particular comprehension skills).

The problem of "schema selection" could be assessed by considering performance on items for which a reader must develop answers by combining information from the passage with information from the text (i.e., scriptally implicit items) in the context of the background knowledge items. These background knowledge items should, by virtue of their development, be more passage independent than, for example, text-explicit or text-implicit items. That is, reader's performance on them should be relatively unaffected by prior access to the text, though there may be some "priming" effect from other items allowing easier access to the requisite knowledge.

What is being proposed, then, requires an expansion of the concept of passage dependence from a purely statistical concept of item analysis to a more rational analysis of item development. Thus we could deliberately construct items which would very likely be less passage dependent. We could also statistically verify the relationship later.

More passage-independent items tap background knowledge, which can be of the content or of the skills required to take tests (test-wiseness). Studies done on test-wiseness indicate that the biasing effects can be reduced considerably by training testees in the necessary skills (Slakter, Koehler, & Hampton, 1970; Wahlstrom & Boersma, 1968). But what should be done about the content knowledge problem? Since our real interest lies in the degree of inferencing, and general integration of textual information with existing knowledge structures (i.e., building models of meaning), we contend that test makers should be examining background knowledge differences as sources of reading comprehension problems, rather than trying to avoid such items. Armed with such knowledge, we might be able to make certain inferences about the differential causes of reading comprehension failure for different individuals.

The first tasks, then, are to demonstrate the effects of prior knowledge on children's comprehending from text and to examine some of the properties of background knowledge test items.

Two important hypotheses, then, are that:

1. Readers' familiarity with the text topic will influence the outcome of the assessments of their reading comprehension.
2. Content-specific passage-independent background knowledge test items can be designed so as to account for a significant amount of variance in readers' performance on other test items, even after general reading ability has been statistically removed from readers' comprehension scores.

These hypotheses have implications for the validity of a schema-theoretic notion of reading comprehension, since schema theory predicts confirmation of both hypotheses. It also has implication for the practical matter of reading comprehension assessment. For example, if background knowledge items do predict test performance, perhaps we can use them to help diagnose certain causes of comprehension failure. Clearly, background knowledge should play a more direct part in answering scriptally implicit questions than in answering either textually explicit or textually implicit ones. Thus we hypothesized that content-specific passage-independent background knowledge test items, directed as they are at the background knowledge required to answer scriptally implicit items, would account for the variance in performance on textually explicit or textually implicit items as well as performance on scriptally implicit items. This hypothesis has implications for the viability of diagnosing schema selection problems. The relationship between the background knowledge and the scriptally implicit items should be quite strong, and should allow us to answer the questions "Did the reader have the requisite background knowledge?" and "Did he use it when required?"

Metacognitive Aspects

We have discussed the potential effects on aspects of reading comprehension, of differences in the familiarity and connectivity of the text. However, there are alternatives to explanations of failures to comprehend. For example, if readers are aware that the text is causing difficulty, they may change their reading strategy to accommodate the problem. This may mean that the effects of the difficulty of the text on comprehension are reduced, and may or may not require extra reading time. Alternatively, it may be that however the text is read, readers aware of the difficulty of the text simply realize that they should have less confidence in the information that they have gathered from the text. These possibilities require a certain metacognitive awareness on the part of the reader. That is, readers would need to be able to notice the difference between when they were and were not having difficulty comprehending. That readers can be aware that the situation requires reduced confidence in their acquired knowledge could possibly be assessed by having them rate the confidence they have in their answer to a given item.

This approach or modifications of it have been used for at least 50 years now (Greene, 1929) and is reviewed by Echternacht (1979. Generally the approach has been used in an effort to assess "partial knowledge" or to discourage guessing on multiple-choice items by attaching differential penalties to errors depending on the confidence rating given to them. These efforts seem to have had an inappropriate focus. It is not "partial knowledge" that is assessed by these items but "awareness of partial

knowledge," that is, a metacomprehension (knowing about knowing) component rather than a comprehension component. Furthermore, that a reader is guessing is important information, and, rather than discouraging it, perhaps we should try to record its occurrence so that we can modify our judgments and decisions about individuals accordingly.

Suppose that when answering multiple-choice reading comprehension items, readers are required to rate separately each alternative in terms of its likelihood of being correct, and then make a decision as to which alternative they would "put their money on." This would allow readers to rate two or more alternatives as equal in plausibility, and then choose between them. Thus, if the two most highly rated alternatives had equal ratings, this would indicate that the final selection was a "guess" (where a guess is defined as selecting one of two or more alternatives that have been rated as equally plausable). If this measure is viable, it may enable us to answer some further questions. For example, this argument predicts that if readers are aware of their difficulty with the text, they will indicate less confidence (i.e., exhibit more guesses) in their answers when the text possesses less connectivity, or when they are less familiar with the content. By way of summary then, the following hypotheses have been proposed:

1. Readers' familiarity with the text topic will predict a significant proportion of the variance in reading comprehension scores over and above that explained by standardized reading test scores.

2. Content-specific passage-independent background knowledge questions can be designed so as to predict a significant proportion of reader's reading comprehension scores over and above that predicted by their standardized reading comprehension test scores.
3. Content-specific passage-independent background knowledge test items will predict a greater proportion of the variance on related scriptally implicit items than on textually explicit or textually implicit items.
4. Switch items will exhibit a greater decrement in performance than other items when the connectives are removed from the text.
5. A greater background knowledge can overcome the absence of (a) explicit and (b) implicit connectives in text.
6. A decrease in the connectivity in a text will force readers to spend more time trying to comprehend it.
7. A greater content familiarity will enable readers to procede through the text more rapidly.
8. Readers will tend to guess more when the text exhibits less connectivity.
9. Readers will tend to guess more when the text content is less familiar.

A study was designed to address the hypotheses presented above. The next section of this paper will present the study and its findings. A subsequent section will discuss the issues which the study raises, and some implications for research and practice.

Method

Subjects

Subjects were 130 eighth-grade students in a semi-rural midwestern school. Reading comprehension scores on the Science Research Associates Reading Comprehension test in national percentiles were obtained for most children. The mean percentile rank was 67.4, with a standard deviation of 21.3, and a range of 1 through 99. The bulk of the scores, however, were in the upper percentiles; hence the relatively high mean.

Materials

Two sets of manipulations were performed on a 600-word piece of text taken from a sixth-grade social studies book. The passage related to the Battle of Antietam Creek during the Civil War and was chosen because of the likelihood of a good spread of relevant background knowledge in the sample of students used in the study. The passage was at seventh-grade readability as measured by the Fry readability formula. The first experimental manipulation involved removal of the connectives from the text. The removal of the explicit connectives had the effect of increasing the number of sentences, since the connectives were often replaced by periods. This changed the readability of the passages to the fifth-grade level.

Even when there are no explicit connectives in the text, there still persists a considerable amount of implicit connection. This is the result of certain Gricean-type (1975) rules of the author-reader interaction that suggest that an author usually places sentences adjacent to one another for a good reason, i.e., to imply connection. Removal of this implicit

connection was accomplished by separating sentences that by virtue of their adjacency implied connection. This manipulation was performed within the severe constraints that: (a) transformation could only occur within paragraphs, and (b) no anaphoric or other reference could be confounded. Without these constraints, the text would no longer resemble normal connected discourse since so many textual variables (particularly referential ties) would be disrupted that the manipulation would be meaningless. The constraints did, however, prevent many of the sentence separations, thus making the manipulation rather mild. Thus there were three levels of connectedness of the text (connected, explicit connectives removed, and implicit connectives removed).

Content familiarity was also experimentally manipulated. This manipulation was performed in order to ensure that the children read a text for which they had virtually no relevant background knowledge. It involved replacing all proper nouns with pronounceable synthetic ones. For example, "General Lee" became "Chief Togo," and "Antietam" became "Bindu." There were 12 different name changes of this type. Also, relevant terms were changed. For example, Civil War became Sacred War, and North and South became East and West. This effectively transported the whole setting to a foreign country. The materials and transformations are presented in Appendix A.

These two manipulations of connectivity and familiarity produced six passages from the original one.

Forty-one multiple choice test items were placed at the end of each

passage. An attempt was made to develop the alternatives for these items in such a way that they bore a relatively consistent relationship with one another from item to item. Alternatives tended to follow the pattern:

1. correct answer;
2. irrelevant correct statement maintaining surface characteristics of the text;
3. relevant incorrect statement maintaining surface characteristics of the text;
4. irrelevant incorrect statement maintaining surface characteristics of the text.

Subjects were required to rate each alternative on its probability of correctness on a six-point rating scale before selecting the correct alternative. This procedure had three main purposes:

1. to provide a measure of confidence in an answer;
2. to provide a measure of the extent to which guessing occurred; Whenever the student rated two or more alternatives as equally probably correct and they had the highest ratings of the four alternatives, it was assumed that the final choice between them was a guess.
3. to ensure that subjects read each alternative before selecting one of them.

Eight of these 41 items were designed to be passage independent and tested relevant background knowledge. Three of these background knowledge items tested knowledge of wars in general, e.g., "A group of troops on

horseback is called . . . ?" The other five background knowledge items tested knowledge of the Civil War specifically, for example, "Who was president of the Union?" These five items were only valid when used with the familiar passage since in the unfamiliar situation they referred to fictitious people, places, or events.

The remaining 33 items consisted of 10 textually explicit items, 7 textually implicit items, 6 scriptally implicit items, and 10 items of the type which we have called switch items. In the standard text the answer to each of these latter items was stated in a single sentence in the text. They were thus textually explicit. However, when the explicit connectives were removed, they became textually implicit by virtue of the fact that the requisite information was then in two sentences. These items were expected to be more sensitive to the effects of the connective manipulation.

The familiar questions were identical to the unfamiliar questions except for the substitution of all proper names and relevant terms for the synthetic, unfamiliar ones. This meant that the prior knowledge and scriptally implicit items associated with the unfamiliar passage were not genuine questions. The prior knowledge items were about a hypothetical situation, and the scriptally implicit items required information from this hypothetical prior knowledge also. Consequently, whenever the unfamiliar data was included in an analysis, both types of question were dropped from the analysis. The experimental manipulation of familiarity then became the measure of prior knowledge and the remaining 27 items the measure of comprehension.

For contrast and examination of items with respect to their passage independence, a further two groups of subjects were added. These groups did not read the passage but answered the questions as best they could. One group received familiar questions, the other unfamiliar.

Procedure

The materials were administered to the children in six different groups, the experimental session lasting about 45 minutes. The students were asked to record the time from a large digital clock when they had finished reading the passage. They were also given instructions on how to answer the multiple-choice items, and were instructed not to turn back to any page which they had already completed to look at the passage or previous questions.

Data Analysis

The children's answers were machine-scored and the data was analyzed using a hierarchical regression model. The two groups that did not read the passages before answering the questions were not included in the regressions since the "no text" condition could hardly be considered as a text manipulation in the same sense as the other manipulations. Data from the no-text condition was used to compute the context-dependence indices (Table 1), and for graphical presentation.

Data analyses were performed on both familiar and unfamiliar passages combined, using familiarity as a factor, and on the data from the familiar passages alone using the prior knowledge questions as a predictor. In the

analysis of the familiar data, when any three-way interaction occured that involved ability and prior knowledge, the interaction was not interpretted. This was because ability and prior knowledge were correlated, r = .56, and this, coupled with the fact that the number of subjects was already halved (due to selection of only the familiar passages), made for very uneven distributions across cells. Furthermore, no interpretation was placed on the data from the low-ability subjects on the unfamiliar passages, since they had reached a floor in performance.

The measures available on the students were:

1. Background knowledge--the sum of the eight passage-independent background knowledge items (five specific and three general);
2. Reading ability--SRA Reading Comprehension Test scores in national percentiles;
3. Test score--the sum of all test items excluding background knowledge ones;
4. Test scores by item type: textually explicit, textually implicit, scriptally implicit, and switch items;
5. Time taken to read the passage (in seconds);
6. Ratings for each alternative;
7. Number of guesses made.

Results

Data are summarized as they relate to each of the hypotheses raised in the introduction. All findings, however, are limited in that they are based on only one basic passage, and the ability distribution is skewed, with a greater proportion of students scoring above the national median.

The test items answered by the two no-text groups from the familiar and unfamiliar materials were analysed separately according to Hanna and Oaster's (1978-79) context-dependence system. This anaylsis was used because it provides the most integrated and complete approach to the dependence of test items on the accompanying text. For the prior knowledge items (in the familiar passages), it was found that the mean context-dependence index was .085, the mean context-independence index was .266, and the mean item difficulty (non-dependence) was .399 (see Table 1). These indicate that, overall, the items were of appropriate difficulty and were indeed context independent.

We shall now examine each of the hypotheses presented in the earlier sections of the text, beginning with those dealing with text familiarity.

1. Readers' familiarity with the text topic will predict a significant proportion of the variance in reading comprehension test scores over and above that explained by standardized reading test scores.

The experimental manipulation of text familiarity turned out to be a powerful determinant of reading comprehension, predicting 9.78% of the total variance, ($F[1,44] = 7.60$, $p < .01$) after a standardized measure of reading ability, accounting for 13.37% of the variance ($F[1,44] = 10.40$, $p < .005$),

had been partialled out of the comprehension scores (see Table 2). The mean proportion correct for the familiar texts was 54.8% and the mean for the unfamiliar text was 41.0. This is a very large effect for the relatively small manipulation of substituting unfamiliar names for all the familiar names.

2. Content-specific passage-independent background knowledge questions can be designed so as to predict a significant proportion of variance in readers' reading comprehension scores over and above that accounted for by their standardized reading comprehension test scores.

The prior knowledge questions in the familiar passage also turned out to be very powerful predictors of performance on the other questions. They accounted for 23.8% of the residual variance after the effects of reading ability had been statistically removed ($F[1,21] = 14.08$, $p < .005$) Reading ability accounted for 14.1% of the total variance ($F[1,21] = 8.32$, $p < .01$, Table 3).

Since there were three prior knowledge items which related to war in general, these were relevant to both familiar and unfamiliar passages. While only three multiple-choice questions makes for a very unreliable test, these items accounted for 3.65% of the total variance in comprehension scores after ability had been statistically removed.

3. Content-specific passage-independent background knowledge items will predict a greater proportion of the variance on related scriptally implicit items than on textually explicit or textually implicit items?

The source of information which can be used to answer this question is the proportion of variance explained by background knowledge when each question type is separately used as a dependent variable. Table 5 shows that the proportion of variance which could be attributed to background knowledge (in the data from the familiar passages) does indicate that background knowledge items are better predictors of performance on scriptally implicit questions than performance on any of the other questions types. This was the case in spite of the fact that there were less of these questions than of any other question type, thus making the subtest less reliable.

4. Switch items will exhibit a greater decrement in performance than other items when the connectives are removed from the text.

It is clear from Figure 1 that the switch items exhibited little, if any, extra sensitivity to the connectivity manipulations, behaving very much like the textually implicit items across conditions.

5. A greater background knowledge can overcome the absence of (a) explicit and (b) implicit connectives in text.

The connectivity manipulations were coded as orthogonal contrasts in the regression analysis. The first contrast (C1) represented a comparison of the standard text group with the mean of the other two groups (no

explicit connectives and no order-implicit connectives). The second contrast (C2) compared performance on the text containing order-implicit connection with that from which order-implicit connectivity had been removed. The data indicate that the perspective from which this question developed was possibly inappropriate, since content familiarity did not moderate the effects of the connectivity manipulation. However, combining the data from both familiar and unfamiliar passages shows the first contrast (i.e., the presence of explicit connectives) to be significant in interaction with ability, accounting for 7.36% of the total variance ($F[1,44] = 5.72$, $p < .05$, Table 2). This interaction is presented in Figure 2.

It is clear that the manipulation did affect the more able readers. The less able readers, however, were unaffected by the manipulation. On the unfamiliar passages, as stated before, this was caused by their reaching a floor in their performance. However, since it was clear that they were not at floor in the familiar material (see Figure 3), a further explanation seems necessary.

A possible explanation rests on the assumption that less able readers read and digest text in word or proposition units and expend little effort in integrating the units. This would produce the same pattern of results across connectivity conditions. Such a possibility has been previously suggested by Clay and Imlach (1971), Isaksen and Miller (1976), and Markman (1979). It is interesting to note that the effect is the reverse of predictions made by most readability formulae, which would indicate that

with shorter sentences, readability should improve. Indeed, in this study, removal of the connectives changed the readability level from seventh to fifth grade according to the Fry formula.

6. A decrease in the explicitness of the connectivity in text will force readers to spend more time to comprehend it.

The data indicate that there are no main effects of the connectivity manipulations on the time taken to read the passage. A more potent predictor of the time taken was reading comprehension ability as measured by the standardized reading comprehension test. On the combined passages in fact, it predicted 20.6% of the total variance ($F[1,54] = 21.16$, $p < .001$, Table 5). This is perhaps because standardized tests are timed. Given the same amount of time, faster students do better on standard tests, and spend less time on the task used in this study. The reverse would be true for slower students.

7. A greater content familiarity will enable readers to procede through the text more rapidly.

This hypothesis seems to be incorrect. Content familiarity does not directly affect the time taken to read the passage (see Tables 5 and 6). However, familiarity did influence reading time performance in combination with the lack of connectives (C1). The effect was such that the high-ability children took longer to read the familiar passage when connectives were removed, possibly because increased processing time was required. The reverse was true on the unfamiliar passage. That is, the high-ability children took less time to read the passage if the connectives

had been removed. This could have been caused by their deciding not to process the more awkward texts very deeply and/or by the fact that removal of the connectives shortened the text somewhat. The low-ability children, however, behaved as the high-ability children did on the unfamiliar passage, taking less time to read the passage if the connectives had been removed.

8. Readers will tend to guess more frequently when the text exhibits less connectivity.
9. Readers will tend to guess more often when the text topic is less familiar.

Neither the connectivity of the text nor its familiarity showed a statistically significant influence on the extent to which readers guessed (see Tables 7 and 8). In fact, the only variable which significantly predicted guessing performance was the time taken to read the passage. Time taken correlated negatively with the number of guesses made, indicating a tendency for students who took longer over reading to guess less often. However, the analysis is very weak. Consider Figures 4, 5, and 6. Figure 4 indicates a trend towards more able readers guessing more frequently when the material is less familiar. Figures 5 and 6, by including the no-text condition, show the similarity between more able readers' performance on post-test score and number of guesses made. This similarity was not apparent for the less able readers.

These figures suggest the possibility that guessing is, as claimed, a potential measure of metacomprehension, if one assumes that the more able readers will be more likely to know when they do not know. It is

particularly clear that the low-ability readers were less aware of when they were guessing, since those who had not even read the text indicated that they had guessed less often than those who had read the text. This did not appear to be due to a lack of understanding of the task, since other aspects of the ratings appeared in order, such as selecting the highest rated alternative as the correct answer. However, the low reliability of the measure suggests that it may not be immediately practical.

Discussion

There are several findings in this study which have implication for our understanding of reading comprehension and its assessment. The finding that the children had considerable difficulty with the passages containing unfamiliar names is interesting since a similar type of text does occur in school social studies texts, for example, Addison-Wesley's Taba series:

> Taiyewo and Kehinde had often walked on the street that goes by the palace walls. They had peered through the gates. But they had never seen the Oba.
>
> Of course, the twins knew all about the Obas. Yorubaland is divided into states. Each state has its own ruler--its Oba. He lives in the most important city of the state. Each Oba has a special title. The Oba of Ife is called His Highness, the Oni of Ife. Because Ife is known throughout Yorubaland as a holy city, the Oni of Ife is the greatest of all Obas.

There are a number of possible causes of the phenomenon. For example, it could be that the unfamiliar names and places simply prevented the children from selecting the appropriate schemata to deal with the text. On the other hand, it could have been simply a matter of the pronounceability of the words. Words difficult to pronounce may lead to subvocalizing, or some other sort of an increased processing load, leaving less processing space for integrating the text. Another possibility is that it is simply a word frequency problem--a problem of lexical access. Each of these possibilities is testable, and since the effect of the relatively minor manipulation is so dramatic, it certainly seems worth investigating in further research. The findings emphasize the fact that the familiarity of the content is an important variable to consider when studying children's comprehension. Furthermore, the experimental manipulation used in this study seemed very effective in making the text unfamiliar without affecting the structure of the text at all. What is not clear is the mechanism through which the manipulation had its effect.

Of greater importance, however, is the demonstration of the biasing effects of prior knowledge. This demonstration is different from other such demonstrations (e.g., Bartlett, 1932; Stephensen, Jogdeo, & Anderson, 1978) in two very important ways. First, the familiar text was basically lifted from a children's text book, and is not contrived. Second, multiple-choice questions were used, just as those found in reading comprehension tests, whereas other studies have used free (and sometimes probed) recall.

In terms of reading comprehension assessment, the finding that

background knowledge items are strong predictors of reading comprehension performance on a given passage is very important. It means that the effects of prior knowledge are assessable and they do bias our measurement considerably. From a schema-theoretic perspective, a lack of background knowledge means that the reader has to construct a mental model of the text's meaning almost from scratch, probably requiring a number of different reasoning strategies. A more substantial background knowledge would allow the reader to construct a framework with which to "anchor" further information. Some information would merely verify information already contained in the schematic structure. This would imply that low background knowledge would even produce a decrement in the performance on simple factual, textually explicit items--which was indeed the case.

There are also warnings here. Students with less prior knowledge performed worse than students with greater prior knowledge, on all question types. This points out the inadequacy of removing passage-independent items as a guard against bias from prior knowledge. The effects are too pervasive. In fact, even the children who did not read the passage prior to answering the questions had lower scores on unfamiliar questions than on the familiar ones. Thus it seems that a "correction for guessing" cannot be as simple as the assumed 25% chance score.

However, performance on scriptally implicit items was the most affected by text familiarity. This seems to be an important piece of information to have when deciding upon the causes and cures of a child's reading problem. Perhaps we should include combinations of these items in our assessment

procedures. Spiro (1980) claims that some children have reading problems not because of a lack of prior knowledge, but because they fail to use the prior knowlege which they have in the reading situation. He calls this a problem of schema access. It is possible that a prior knowledge subscore in combination with a scriptally implicit item subscore, would provide information appropriate for detecting children with such problems. Cognitive intervention strategies could perhaps be used to correct the problem.

It is clear however, that our current assessment procedures are not the same as the tasks used in this study. The passage used in this study contained about 600 words, whereas reading tests for a similar age group contain passages of only about 100 to 150 words. Other differences lie in the number of questions following the passage and the availability of the text when answering the questions. Nonetheless, it would be interesting to know the answer to the question "To what extent are background knowledge questions predictive of performance on a standardized reading comprehension test?" This has implications for describing what we are actually measuring when we assess reading comprehension.

We found that the criterion test scores of the more able readers appeared to exhibit more sensitivity to disruptions in the connectivity of the text than did the scores of the less able readers, and their sensitivity was evident in both familiar and unfamiliar texts. In terms of the extent to which readers indicated that they had guessed, here too, more able readers indicated a more consistent effect of text manipulations than did

the less able readers. The effects of the relatively simple text familiarity manipulation were evident in all readers' post-test scores. This effect was also reflected in the more able readers' comprehension and guessing (metacomprehension) behavior.

A possible interpretation of our findings is that the more able readers were sensitive to the fact that the text was more difficult than normal but either did not know how to or did not care to do anything about it. For whichever reason, they read in their normal manner but had less confidence in their answers to the subsequent questions.

Our data initially appear to conflict with Marshall and Glock's (1978-79) findings. They found that community college students were more sensitive to the removal of connectives than were Ivy League students. Apart from the age difference between the subjects, there is also the problem of text length, the present text being over twice as long as that used by Marshall and Glock. These differences notwithstanding, there may be an explanation. Consider the possibility that there are developmental differences in the sensitivity to, and use of, connective cues in text. Suppose younger and less able readers do not attend to the cues in the text and read in relatively small units as suggested earlier. The more able readers, however, read in larger units and do attend to the connective cuing in the text, indeed, relying upon it somewhat. Truly fluent adult readers, on the other hand, pass this stage and become relatively independent of such cuing as did Marshall and Glock's ivy-league students. Less fluent adults are still at the stage of more able younger readers, aware of the cues and able to use them, but not yet independent of them.

An implication, then, is that connectivity is indeed important in children's texts, though the developmental hypothesis must remain conjecture until an appropriate study is done. In terms of practice, it is clear that readability formulae are particularly handicapped when the material is not familiar, and when the connectivity of the text is not explicit.

The frequency with which students indicated that they had guessed seemed to exhibit potential as a measure of their knowledge of the extent of their comprehension, since the measure reflected test performance for the more able readers. That it did not do so for the less able readers could merely reflect what earlier studies have shown: that less able readers are also less metacognitively aware. This, too, deserves further study, perhaps in conjunction with think-aloud procedures.

This study investigated the extent to which prior knowledge can influence reading comprehension, and particularly our assessment of reading comprehension. It has important implications for our interpretation, and possibly development, of reading comprehension tests. Perhaps we can improve our tests by actually assessing the individual's prior knowledge relevant to the texts to be read. This could have far-reaching effects on our assessment techniques, as could the suggestion that aspects of metacognitive awareness may also be assessable. The study also suggests that for eighth-grade readers, ability may be a more important factor than prior knowledge in determining their use of text connective cues.

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Table 1

Mean Passage-Dependency Data by Item Type

Using Hanna and Oaster's (1978-79) Analysis

Item Type	$\bar{X}_c$ [a]	CII [b]	CDI [c]	$\bar{X}_{ND}$ [d]
Text explicit	.25	.157 (.063)	.217 (.196)	.416 (.494)
Switch	.25	.013 (.070)	.235 (.166)	.503 (.616)
Text implicit	.25	.072 (.264)	.237 (.002)	.441 (.686)
Script implicit	.25	.094 (.028)	.013 (-.106)	.644 (.828)
Background knowledge	.25	.266	.085	.399

[a] $\bar{X}_c$ = Chance score.

[b] CII = Context-independence index = mean text absent score minus chance score.

[c] CDI = Context-dependence index = mean with text present minus text absent score.

[d] $\bar{X}_{ND}$ = Non-dependence score = 1 minus text present score.

Note. Main figures are based on the familiar data only. Data from unfamiliar passages are in parentheses.

Table 2

Regression Summary Table for Data

from Both Familiar and Unfamiliar Passages

Variable	F	% Total Variance Accounted for
Ability	10.40***	13.37
Familiarity	7.60**	9.78
C1	1.42	1.83
C2	1	.35
Time	1	.16
Ability by Familiarity	1	.28
Ability by C1	5.72*	7.36
Ability by C2	1	.75
Familiarity by C1	1	.01
Familiarity by C2	1	.05
Time by Ability	2.03	2.62
Time by Familiarity	2.40	3.08
Time by C1	1	.20
Time by C2	1	.45
Ability by Familiarity by C1	1	.09
Ability by Familiarity by C2	1.45	1.86
Time by Familiarity by Ability	1	.00
Time by Ability by C1	1.19	1.53
Time by Ability by C2	1	.01
Time by Familiarity by C1	1	.41
Time by Familiarity by C2	1	.53

Note. Dependent variable = percentage of comprehension questions correct. $N = 66$. $R^2 = .437$.

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

* $p < .05$

** $p < .01$

*** $p < .005$

Table 3

Regression Summary Table for Data from Familiar Text Only

Variable	F	% Total Variance Accounted for
Ability	8.32*	14.12
Background Knowledge (BK)	14.04**	23.84
C1	2.60	4.41
C2	.27	.47
Time	.63	1.07
Ability by C1	.02	.04
Ability by C2	.09	.16
BK by C1	.00	.00
BK by C2	.25	.43
Ability by BK	.03	.05
Time by C1	.05	.08
Time by C2	.33	.57
Time by Ability	.82	1.39
Time by BK	.67	1.14
Ability by BK by C1	.97	1.64
Ability by BK by C2	9.80*	16.64

Note. Dependent Variable = Percent Correct. $N = 37$. $R^2 = .660$.

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

* $p < .01$

** $p < .005$

Table 4

Summary of the Proportion of Variance

Uniquely and Jointly Accounted for

by Prior Knowledge and Ability for Each Question Type Subscore

Variable	% Total Variance Accounted for
Textually Explicit Items	
Prior Knowledge	7.01
Ability	3.02
Common	11.47
Switch Items	
Prior Knowledge	11.49
Ability	1.55
Common	12.18
Textually Implicit Items	
Prior Knowledge	8.71
Ability	0.08
Common	5.02
Scriptally Implicit Items	
Prior Knowledge	26.96
Ability	.10
Common	9.04

Note. N = 43.

Table 5

Regression Summary Table for Data From Both Passages

Variable	F	% Total Variance Accounted for
Ability	21.16**	20.59
Familiarity	1.64	1.60
C1	<1	.77
C2	<1	.05
Ability by Familiarity	1.25	1.22
Ability by C1	<1	.69
Ability by C2	1.37	1.33
Familiarity by C1	1.23	1.20
Familiarity by C2	<1	.72
Ability by Familiarity by C1	4.84*	4.71
Ability by Familiarity by C2	<1	.00

Note. Dependent variable = time taken to read passage. N = 66. R^2 = .329.

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

* $p < .05$

** $p < .001$

Table 5

Regression Summary Table for the Familiar Passage Only

Variable	F	% Total Variance Accounted for
Ability	2.99	7.48
Prior Knowledge	.06	.14
C1	.03	.08
C2	.90	2.24
Ability by Prior Knowledge	.01	.01
Ability by C1	3.44	8.61
Ability by C2	.34	.85
Prior Knowledge by C1	.29	.73
Prior Knowledge by C2	2.36	5.90
Ability by Prior Knowledge by C1	.14	.34
Ability by Prior Knowledge by C2	4.44*	11.10

Note. Dependent variable = time taken to read passage. $N = 37$. $R^2 = .375$.

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

* $p < .05$

Table 7

Regression Summary Table for Data from Both Passages

Variable	F	% Total Variance Accounted for
Ability	2.31	2.55
Familiarity	2.60	2.86
C1	3.20	3.52
C2	1.26	1.39
Time	4.12*	4.54
Ability by Familiarity	1	.34
Ability by C1	2.98	3.28
Ability by C2	2.61	2.87
Familiarity by C1	2.17	2.39
Familiarity by C2	1.29	1.42
Time by Ability	1	.06
Time by Familiarity	1	.74
Time by C1	1.32	1.50
Time by C2	1	.37
Ability by Familiarity by C1	1	.05
Ability by Familiarity by C2	1	.01
Ability by Familiarity by Time	1	.02
Time by Ability by C1	1	.59
Time by Ability by C2	1.38	1.52
Time by Familiarity by C1	1	.72
Time by Familiarity by C2	1	.01

Note. Dependent variable = guesses. $N = 84$. $R^2 = .307$

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

* $p < .05$

Table 8

Regression Summary Table for Data from Familiar Text Only

Variable	F	% Total Variance Accounted for
Ability	1.89	5.19
Background Knowledge (BK)	.55	1.52
C1	.00	.01
C2	.20	.54
Time	.07	.20
Ability by C1	2.30	6.30
Ability by C2	.28	.78
BK by C1	.21	.59
BK by C2	.02	.05
Ability by BK	3.67	10.06
Time by C1	.12	.34
Time by C2	.01	.01
Time by Ability	.01	.03
Time by BK	2.59	7.11
Ability by BK by C1	.06	.16
Ability by BK by C2	.47	1.29

Note. Dependent Variable = Number of Guesses. $N = 41$. $R^2 = .342$.

All independent variables have one degree of freedom.

C1 = contrast between standard text and mean of the two no-connectives conditions.

C2 = contrast between text containing no explicit connectives and text containing no explicit or implicit connectives.

Figure Captions

Figure 1. Graph of percent correct by question type by connectivity. (Note: Data from both familiar and unfamiliar passages combined.)

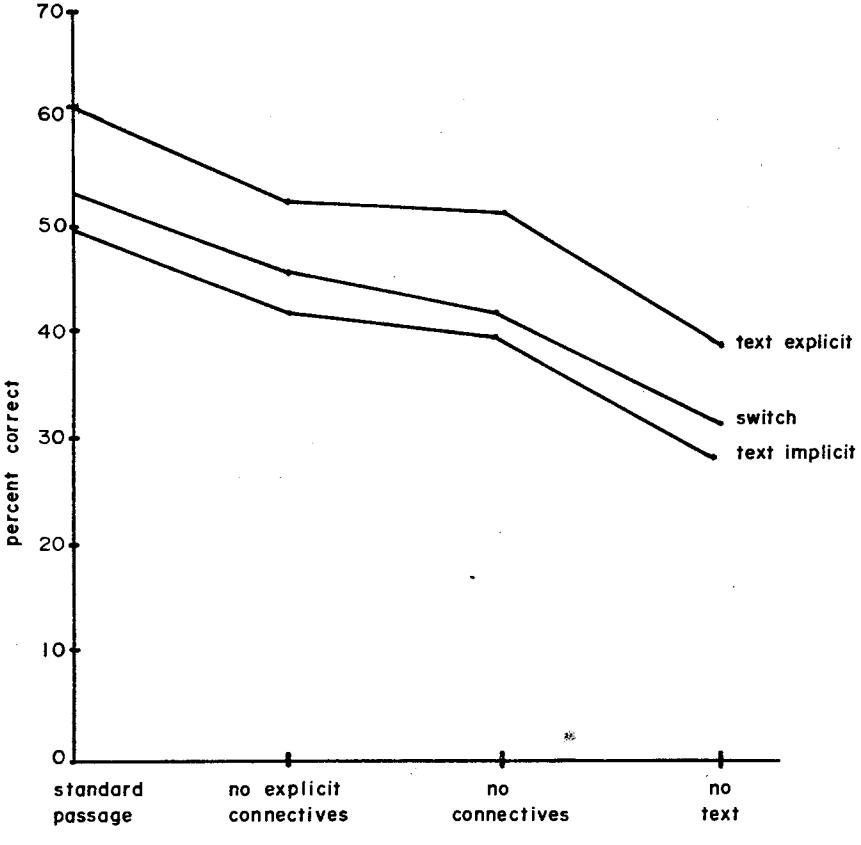
Figure 2. Mean number of questions (summed across question type) correct for standard passage and mean of the two manipulated passages by ability. (Note: Data from familiar and unfamiliar passages combined.)

Figure 3. Mean number correct on familiar and unfamiliar passages for high and low ability readers.

Figure 4. Mean number of guesses on familiar and unfamiliar passages for high and low ability readers.

Figure 5. Mean number correct for high and low ability readers across levels of connectivity and no text conditions. (Note: Data from familiar and unfamiliar texts combined.)

Figure 6. Mean number of guesses by high and low ability students across levels of connectivity and no text conditions.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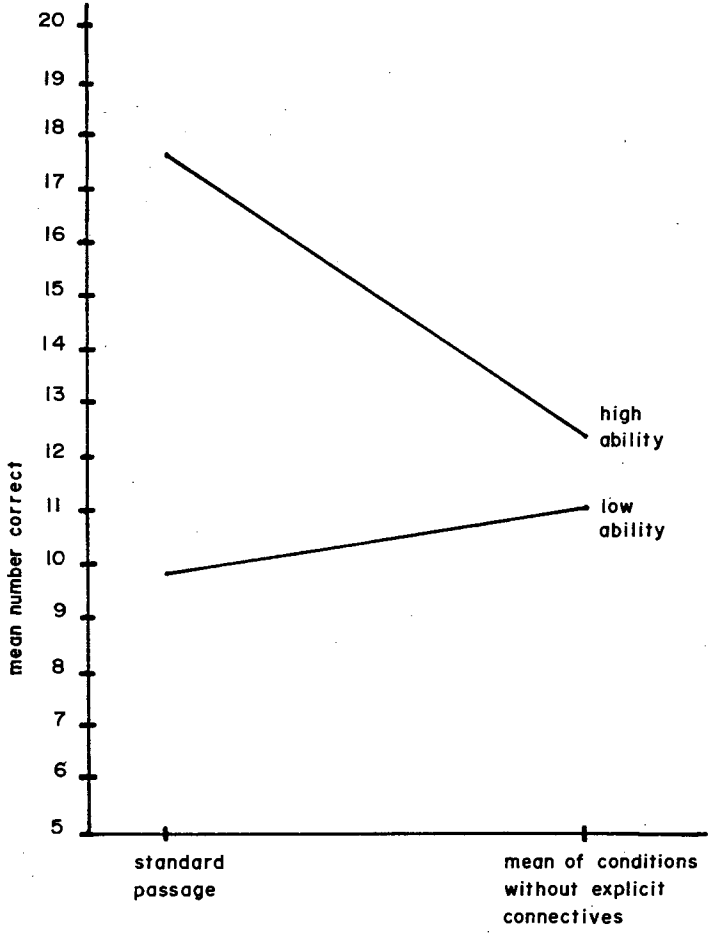
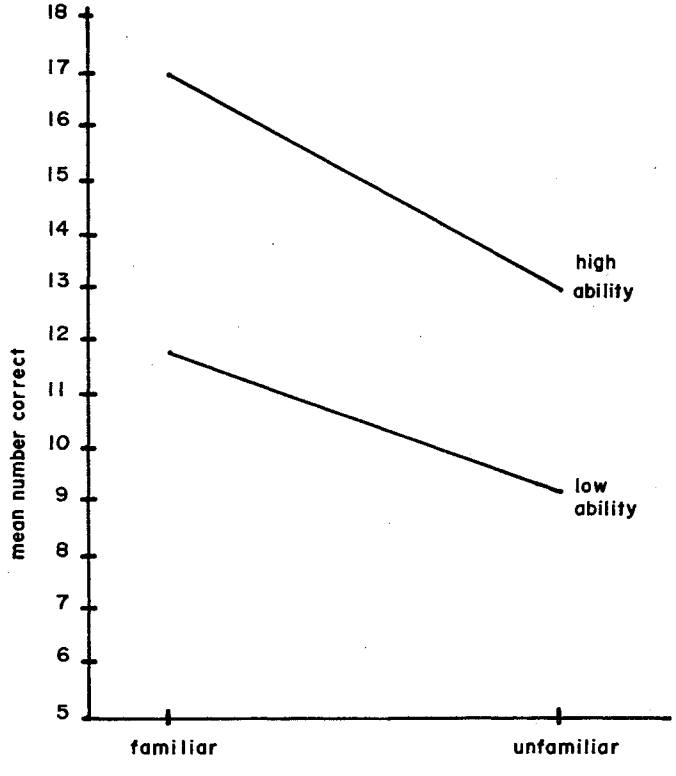
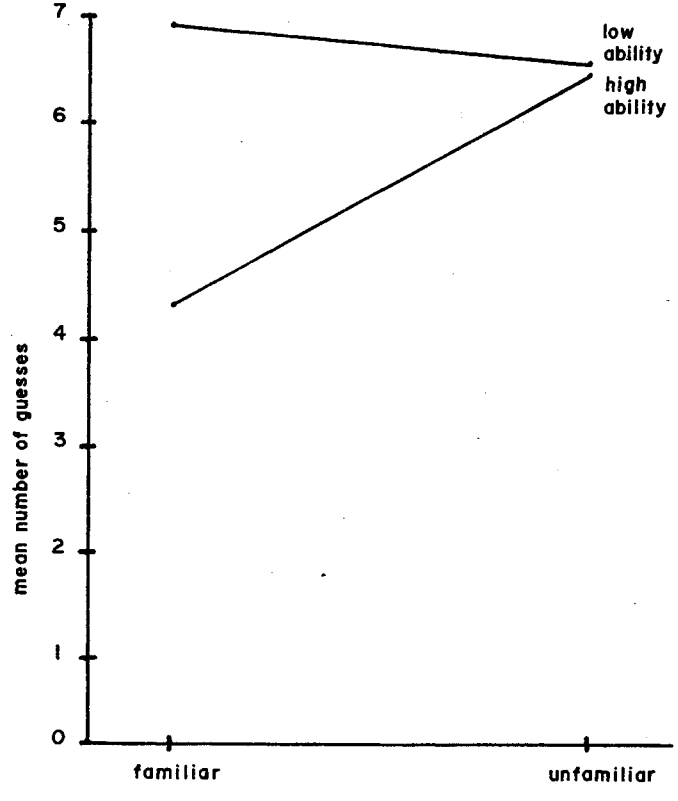
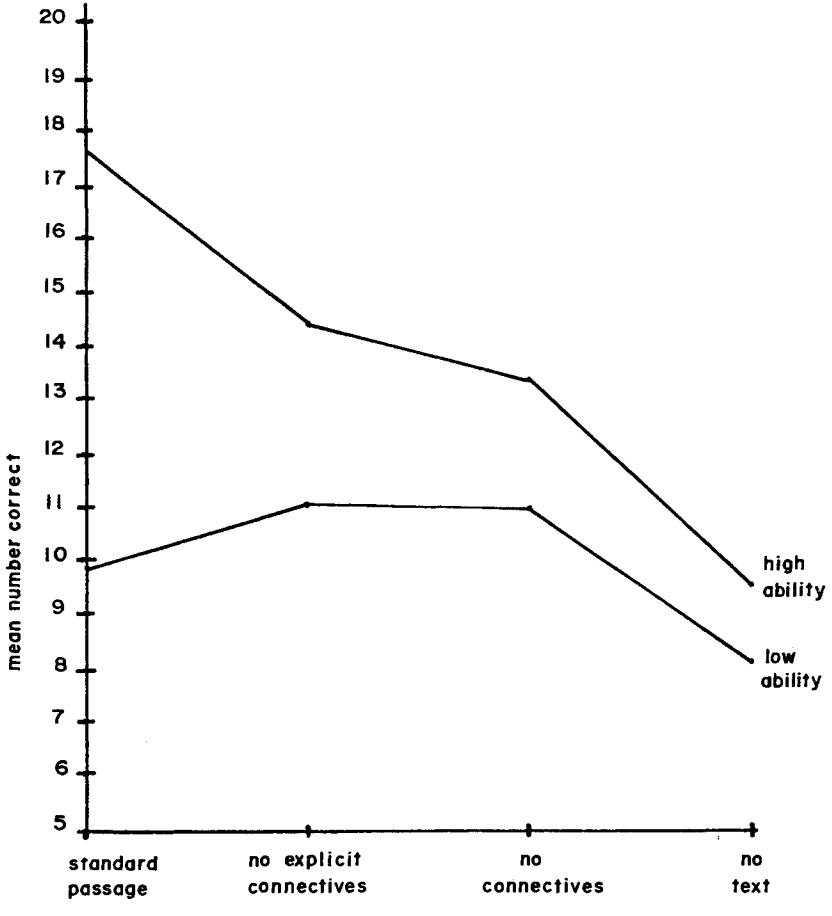
60
50
40
30
20
10
0
percent correct
text explicit
switch
text implicit
standard passage
no explicit connectives
no connectives
no text


20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
mean number correct
high ability
low ability
standard passage
mean of conditions without explicit connectives


mean number correct
18
17
16
15
14
13
12
11
10
9
8
7
6
5
high ability
low ability
familiar
unfamiliar


mean number of guesses
7
6
5
4
3
2
1
0
low ability
high ability
familiar
unfamiliar


mean number correct
20
19
18
17
16
15
14
13
12
11
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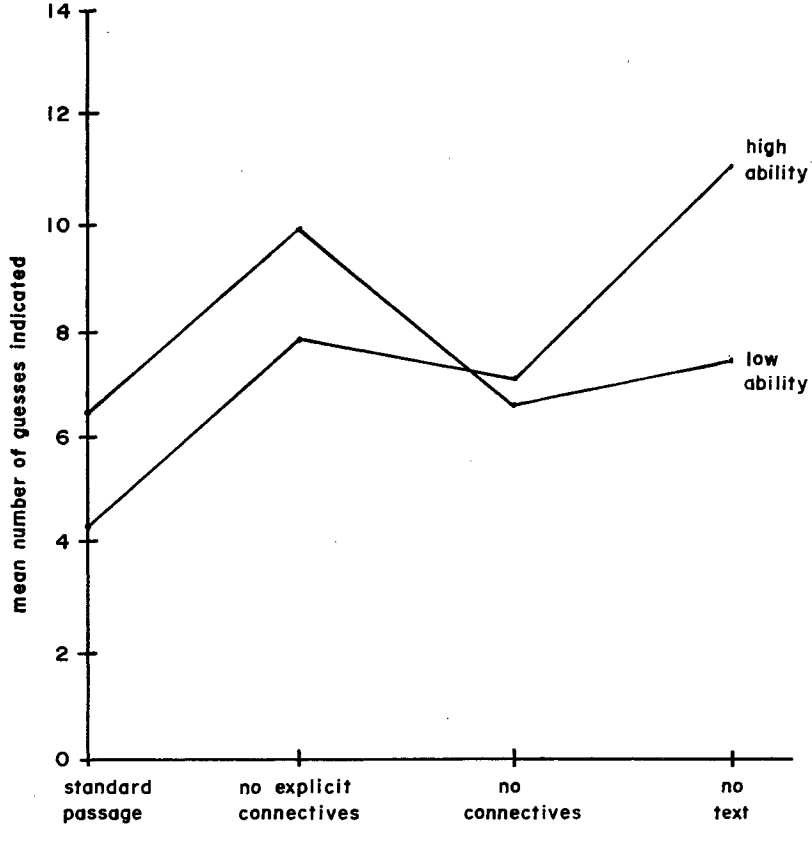
9
8
7
6
5
high ability
low ability
standard passage
no explicit connectives
no connectives
no text


mean number of guesses indicated
14
12
10
8
6
4
2
0
high ability
low ability
standard passage
no explicit connectives
no connectives
no text

APPENDIX

STANDARD PASSAGE FROM STUDY*

America was well into the Civil War, (2) and many battles had been fought between North and South (3). But no battle was bloodier nor more puzzling than the Battle of Antietam Creek (1). General George B. McClellan was the commander of the Union Army of the Potomac (4). He was chasing General Robert E. Lee's Confederate Army in Maryland (5). On September 13th, an odd thing happened (6). McClellan's army was near Frederick, Maryland (8) when one of his soldiers, Private Barton Mitchell, found three cigars wrapped in a piece of paper lying in a field (7). The paper turned out to be an order signed by General Lee entitled "Special Orders 191" (9). The orders instructed Lee's generals to split their army into four parts (11). Generals almost never split up their army in the face of the enemy (10) because each part is small and weak by itself (15). So the order must have seemed unusual to McClellan (16). McClellan was by nature a suspicious man (12). As a result he must have thought that Lee was trying to trick him by planting a fake order where Union soldiers would find it (14). If you look at McClellan's actions over the next few days, he certainly behaved as if he thought Lee was trying to trick him (13). Three days later, on September 16th, McClellan tracked down Lee's army at the town of Sharpsburg near Antietam Creek (17). By that time all but one of Lee's four units had rejoined him, (19) so he was nearly ready for battle. (21). Even so, Lee's forces were still badly outnumbered (20). But still McClellan did not attack (18). He waited one more day (22) on the excuse that there were so few troops facing him that he thought Lee had already retreated-.(24). Thus it was not until the morning of September 17th that he attacked Lee's Confederates in a large cornfield (23) By this time, of course, the confederates had set up many cannons (25) with which they killed thousands of McClellan's men (26). Halfway through the morning, the battle had reached an old roadway in the middle of the field (28). This road later became known as Bloody Lane (29) because so many soldiers were killed there (27). Meanwhile, another battle was beginning on the banks of the Antietam Creek (30). This creek had only a single-lane arched bridge for all the soldiers to get across (36). On the other hand, it was only about 50 feet wide and only waist deep (31). General Ambrose Burnside was on one side of the creek with 10,000 Union troops (32). On a hill on the other side of the creek were a mere 500 Confederate soldiers who were shooting down at Burnside's helpless men (33). Burnside was supposed to cross the creek in the morning and take the hill (34). He would then have been able to go to the aid of General McClellan's troops (37). If he had, it would probably have ended the battle and the Civil War as well (35). Instead, Burnside wasted hours wondering how his troops could get across the small bridge (38). He did not realize that they could have easily waded across the creek (39). By the time he managed to get enough men across the bridge to drive the Confederates from the hill, (41) General Lee's fourth group had arrived (42) and he had set up a strong battle line (45). So, by the end of the day, while very little ground had changed hands, (43) 25,000 Americans were dead (44). It was the bloodiest day of fighting in American history (40). The next day, there was no fighting (46) because both armies were exhausted (52). However, McClellan still had thousands of men in reserve who had not yet fought (47). Why did he not use them

against Lee's battered army (48)? Apparently he was still suspicious (50). Consequently, the Confederate army was able to slip away during the night (49) and the war continued for three more bloody years (51).

* The undelined words are the explicit connectives which were removed. The numbers enclosed in brackets indicate the ends of sentences and the order in which they occured in the passage with no implicit connectives. The following substitutions were made in the text to produce the unfamiliar passages:

Unfamiliar Words Substituted for Familiar Words.

Ambrose Burnside = Tombu Sandu

America = Punda

Antietam = Bindu

Barton Mitchell = Tita Mog

Confederate = Fuble

Frederick = Glod

George B. McClellan = Appit Obu

Maryland = Tan

Potomac = Isa

Robert E. Lee = Limpa Togo

Sharpsburg = Malu

Union = Semo

Other Substitutions

Army = Tribe

Civil War = Sacred War

Cornfield = Flaxfield

General = Chief

North = East

South = West

Question Classification

The questions on the following pages are classified according to Pearson and Johnson's (1978) classification system as follows:

Question Type	Question Number
Textually explicit	1 14 25 26 29 34 35 37 40
Textually implicit	2 6 7 9 12 16 20 21 27 32 39
Scriptally implicit	3 13 15 17 18 19
Switch*	4 5 8 10 11 31 36
Passage independent*	22 23 24 28 30 33 38 41

How likely is it that the answer is correct?

	very unlikely					very likely
1. On what date did McClellan's battle begin?						
1. 13th of September	1	2	3	4	5	6
2. 18th of September	1	2	3	4	5	6
3. 15th of September	1	2	3	4	5	6
4. 17th of September	1	2	3	4	5	6
2. McClellan did not use all of his army to attack because						
1. The confederate army slipped away during the night	1	2	3	4	5	6
2. He could not get all his men across the small bridge	1	2	3	4	5	6
3. He probably thought the enemy was trying to fool him	1	2	3	4	5	6
4. His men had all fought hard and were worn out	1	2	3	4	5	6
3. The soldiers shooting down from the hill probably fought for						
1. Lincoln	1	2	3	4	5	6
2. McClellan	1	2	3	4	5	6
3. Davis	1	2	3	4	5	6
4. Sherman	1	2	3	4	5	6
4. Because McClellan delayed his first attack for a day, the enemy						
1. killed many of his men with cannons	1	2	3	4	5	6
2. were able to escape	1	2	3	4	5	6
3. split their army into four groups	1	2	3	4	5	6
4. tried to trick McClellan	1	2	3	4	5	6
5. McClellan's troops did not get help because						
1. Burnside did not move fast enough	1	2	3	4	5	6
2. Lee's men outnumbered Burnside's	1	2	3	4	5	6
3. McClellan was a suspicious man	1	2	3	4	5	6
4. One of Burnside's men found Lee's "Special Orders 191"	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
6. Why did McClellan waste an extra day before attacking?						
1. Generals always split up their army in the face of the enemy	1	2	3	4	5	6
2. his army was outnumbered	1	2	3	4	5	6
3. his soldiers were exhausted	1	2	3	4	5	6
4. he thought Lee's men had run away	1	2	3	4	5	6
7. McClellan thought the "Special Orders 191" were fake because						
1. The orders were wrapped around three cigars and lying in a field	1	2	3	4	5	6
2. The strongest way to fight is to have all of your army together	1	2	3	4	5	6
3. The "Special Order 191" had not been signed by General Lee	1	2	3	4	5	6
4. He thought he was outnumbered by General Lee's army	1	2	3	4	5	6
8. Because McClellan thought that the enemy had already retreated,						
1. Lee was able to prepare his cannons	1	2	3	4	5	6
2. Burnside's men were unable to cross the bridge quickly	1	2	3	4	5	6
3. Lee tricked him by splitting up his army	1	2	3	4	5	6
4. McClellan was able to prevent much bloodshed	1	2	3	4	5	6
9. Burnside's battle began						
1. at the same time as McClellan's battle	1	2	3	4	5	6
2. before McClellan's battle	1	2	3	4	5	6
3. later on the same day as McClellan's battle	1	2	3	4	5	6
4. the day after McClellan's battle	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
10. Both McClellan and Burnside						
1. were suspicious men	1	2	3	4	5	6
2. supported secession	1	2	3	4	5	6
3. were outnumbered	1	2	3	4	5	6
4. waited too long before attacking	1	2	3	4	5	6
11. What probably would have happened if Burnside had done what he was supposed to?						
1. his men would have been killed by Lee's fourth group	1	2	3	4	5	6
2. they would not have found the "Special Orders 191"	1	2	3	4	5	6
3. the war would have finished	1	2	3	4	5	6
4. McClellan would still have been suspicious	1	2	3	4	5	6
12. Why would a general not want to divide his army? Because						
1. the enemy might find out	1	2	3	4	5	6
2. his soldiers might get confused	1	2	3	4	5	6
3. each part would be weak	1	2	3	4	5	6
4. they would not be able to set up their cannons	1	2	3	4	5	6
13. General McClellan was a commander in the army of						
1. Sharpsburg	1	2	3	4	5	6
2. Antietam	1	2	3	4	5	6
3. the North	1	2	3	4	5	6
4. Frederick	1	2	3	4	5	6
14. Burnside's battle began on the						
1. 18th of September	1	2	3	4	5	6
2. 13th of September	1	2	3	4	5	6
3. 17th of September	1	2	3	4	5	6
4. 15th of September	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
15. Some of the soldiers who were shooting down from the hill probably						
1. were Unionists	1	2	3	4	5	6
2. owned slaves	1	2	3	4	5	6
3. were slaves	1	2	3	4	5	6
4. were against secession	1	2	3	4	5	6
16. McClellan did not attack at first because he thought						
1. his army was outnumbered	1	2	3	4	5	6
2. the enemy had fled	1	2	3	4	5	6
3. the war would end with that battle	1	2	3	4	5	6
4. he should split up his army	1	2	3	4	5	6
17. McClellan was fighting						
1. against Sherman	1	2	3	4	5	6
2. for Lincoln	1	2	3	4	5	6
3. against Burnside	1	2	3	4	5	6
4. for Davis	1	2	3	4	5	6
18. McClellan probably						
1. was in favor of secession	1	2	3	4	5	6
2. was against secession	1	2	3	4	5	6
3. did not like cigars	1	2	3	4	5	6
4. supported Davis	1	2	3	4	5	6
19. The soldiers shooting down from the hill were						
1. Burnside's men	1	2	3	4	5	6
2. McClellan's men	1	2	3	4	5	6
3. confederates	1	2	3	4	5	6
4. Lee's fourth group	1	2	3	4	5	6
20. If Burnside had done what he was supposed to do he would have then						
1. Waited for his fourth group to rejoin him	1	2	3	4	5	6
2. Gone to help McClellan	1	2	3	4	5	6
3. Immediately set up camp	1	2	3	4	5	6
4. Spent hours wondering how to get his troops across the bridge	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
21. By the time McClellan attacked						
1. Burnside had tried to get his men across the bridge	1	2	3	4	5	6
2. the confederates had set up cannons	1	2	3	4	5	6
3. Lee's fourth group had arrived	1	2	3	4	5	6
4. the confederate army had been able to slip away during the night	1	2	3	4	5	6
22. The safest place to be in a battle is						
1. on top of a hill	1	2	3	4	5	6
2. in a valley	1	2	3	4	5	6
3. in a house	1	2	3	4	5	6
4. on a horse	1	2	3	4	5	6
23. The Union army is the same as the						
1. Northern Army	1	2	3	4	5	6
2. Southern Army	1	2	3	4	5	6
3. Maryland Army	1	2	3	4	5	6
4. Antietam Army	1	2	3	4	5	6
24. The South						
1. supported slavery	1	2	3	4	5	6
2. was against secession	1	2	3	4	5	6
3. was very powerful	1	2	3	4	5	6
4. had a weak leader	1	2	3	4	5	6
25. Who had lots of troops in reserve?						
1. Burnside	1	2	3	4	5	6
2. Lee	1	2	3	4	5	6
3. Mitchell	1	2	3	4	5	6
4. McClellan	1	2	3	4	5	6
26. Thousands of McClellan's men						
1. slipped away during the night	1	2	3	4	5	6
2. were killed with cannons	1	2	3	4	5	6
3. could not get across the single-lane bridge	1	2	3	4	5	6
4. supported secession	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
27. There was no fighting on the last day because						
1. the armies were tired out	1	2	3	4	5	6
2. McClellan didn't have enough men	1	2	3	4	5	6
3. the confederates couldn't get across a bridge	1	2	3	4	5	6
4. Lee's men were outnumbered	1	2	3	4	5	6
28. The President of the Confederacy was						
1. Sherman	1	2	3	4	5	6
2. Davis	1	2	3	4	5	6
3. Lee	1	2	3	4	5	6
4. McClellan	1	2	3	4	5	6
29. Burnside was supposed to						
1. Take over the hill in the morning	1	2	3	4	5	6
2. Swim the river	1	2	3	4	5	6
3. Split his army into four parts	1	2	3	4	5	6
4. Defeat Lee's army	1	2	3	4	5	6
30. The war was caused by						
1. The two generals having a disagreement	1	2	3	4	5	6
2. Secession of the Confederacy	1	2	3	4	5	6
3. General Lee's "Special Orders 191"	1	2	3	4	5	6
4. The South wanting to take over the North	1	2	3	4	5	6
31. "Special Orders 191" ordered						
1. Lee's army to divide itself	1	2	3	4	5	6
2. Burnside to cross the creek	1	2	3	4	5	6
3. McClellan to attack the enemy	1	2	3	4	5	6
4. Mitchell to take the hill in the morning	1	2	3	4	5	6

How likely is it that the answer is correct?

	very unlikely					very likely
32. In the day before McClellan's attack,						
1. Lee's fourth group arrived and set up a strong battle line	1	2	3	4	5	6
2. Burnside finally got the confederates off the hill	1	2	3	4	5	6
3. Lee hid his men in a cornfield	1	2	3	4	5	6
4. Lee prepared his cannons	1	2	3	4	5	6
33. Artillary includes						
1. any weapon used in war	1	2	3	4	5	6
2. troops and handweapons	1	2	3	4	5	6
3. only large guns	1	2	3	4	5	6
4. handgrenades and mines	1	2	3	4	5	6
34. Who was very suspicious?						
1. McClellan	1	2	3	4	5	6
2. Burnside	1	2	3	4	5	6
3. Lee	1	2	3	4	5	6
4. Mitchell	1	2	3	4	5	6
35. General George B. McClellan was a commander in the army of						
1. the Union	1	2	3	4	5	6
2. Maryland	1	2	3	4	5	6
3. Antietam	1	2	3	4	5	6
4. Sharpsburg	1	2	3	4	5	6
36. Who was supposed to help McClellan?						
1. his fourth group	1	2	3	4	5	6
2. his thousands of men in reserve	1	2	3	4	5	6
3. Lee's men	1	2	3	4	5	6
4. Burnside's men	1	2	3	4	5	6

	How likely is it that the answer is correct?					
	very unlikely					very likely
37. Generals hardly ever						
1. try to cross one-lane bridges	1	2	3	4	5	6
2. believe enemy orders which they find	1	2	3	4	5	6
3. divide their army in front of the enemy	1	2	3	4	5	6
4. try to wade through creeks	1	2	3	4	5	6
38. A body of troops on horseback is called						
1. a squadron	1	2	3	4	5	6
2. a battalion	1	2	3	4	5	6
3. an infantry	1	2	3	4	5	6
4. a cavalry	1	2	3	4	5	6
39. The war would have ended if						
1. Burnside had more troops	1	2	3	4	5	6
2. There were more than 500 troops fighting Burnside	1	2	3	4	5	6
3. Burnside had crossed the creek in the morning	1	2	3	4	5	6
4. The Confederates had set up many cannons	1	2	3	4	5	6
40. Burnside						
1. spent a lot of time getting his men across the bridge	1	2	3	4	5	6
2. had many of his men killed in a roadway	1	2	3	4	5	6
3. supported slavery	1	2	3	4	5	6
4. was a clever soldier	1	2	3	4	5	6
41. The President of the Union was						
1. Sherman	1	2	3	4	5	6
2. Davis	1	2	3	4	5	6
3. Lincoln	1	2	3	4	5	6
4. Washington	1	2	3	4	5	6