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ABSTRACT

Two studies investigated the use of graphic and contextual information in word recognition, and the extent to which good and poor fourth grade readers were flexible in their ability to trade off one type of information for another as situations warranted. The subjects orally read stories containing ten altered words, with a single letter substituted so that another word was formed that was anomalous within the sentence. The first study used different orienting instructions to manipulate subjects' response sets and measured awareness of the passage modifications. Results indicated that variations in responding to the altered words were not related to ability or instructional orientation. The variations were related to subjects' self-reports of strategies adopted to deal with anomalies and their ability to identify the altered words. In the second experiment the task demands were made explicit in order to examine the relationship of information processing demands and reading ability. Good and poor readers were equally able to conform to demands for contextually appropriate reading responses, but poor readers were less able to suppress contextual information when accurate reading was required. The results of this research run counter to the conception of poor readers as insensitive to contextual information. (Author/RL)

Strategy Availability and Use By Good and Poor Readers

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Strategy Availability and Use

By Good and Poor Readers

Abstract

Two studies are reported that investigate the use of graphic and contextual information in word recognition, and the extent to which good and poor fourth grade readers are flexible in their ability to trade off one type of information for another when the situation warrants. Subjects orally read stories containing ten altered words, with a single letter substituted so that another word was formed that was anomalous within the sentence. The first study uses different orienting instruction to manipulate subjects' response set and measures awareness of the passage modifications. Results indicate that variations in responding to the altered words are not related to ability or instructional orientation, but are related to subjects' self-report of strategies adopted to deal with anomalies and their ability to identify the altered words. In the second experiment task demands are made explicit in order to examine the relationship of information processing demands and reading ability. Good and poor readers are equally able to conform to demands for contextually appropriate reading responses, but poor readers are less able to suppress contextual information when accurate reading was required. These results are discussed in terms of the word recognition task and processing demands in normal reading situations.

Contextual and graphic cues represent two different types of information that a reader might draw on to recognize words during reading. Reliance on one type of information to some extent obviates the necessity of using information of the other type. For example, if a reader is trying to determine the final word to follow the sentence context, "I like cream and sugar in my," the reader could collect extensive visual information about features and letters in order to recognize the word. In this case the word could be identified without the aid of any information in the prior sentence context. Alternatively, one could use semantic knowledge about the preceding sentence context to generate expectations about possible word candidates--coffee, cereal, tea, etc.--and then minimally sample the available visual information to confirm one of the candidates. The research presented in this paper investigates the use of graphic and contextual information in word recognition, and the extent to which good and poor readers are flexible in their ability to trade off one type of information for another when the situation warrants.

Of course, these information processing procedures can only be considered strategic to the extent that word recognition is the focus of attention, the desired goal. If passage comprehension is the desired outcome, then word recognition may be a conscious sub-goal, or information processing may be completely reorganized to achieve new this goal (Schwartz, 1980; Stanovich, 1980). In the latter case, word recognition processes could function automatically and simultaneously with other informational sources in determining thematic level decisions (Rumelhart, 1977).

This distinction between processing at a word level and processing at an idea or thematic level is useful in the interpretation of experimental research on the reading process and may bear directly on the analysis of individual differences in reading ability. (Schwartz, 1980; Stanovich, 1980). For example, Allington and Strange (1977) had both good and poor fourth-grade readers respond to passages where a letter was changed in five percent of the words so that the letter string was transformed into a different word that made the sentence anomalous. Examples of such sentences are, "He leaned too fan over the edge of the wall," and "Bill jumped off the bus and ram to the river." Thus, the words fan and ram have been substituted for far and ran. The focus of this study was on whether the subject would read the actual stimulus word (e.g., fan) or the word that would make the sentence meaningful (e.g., far). Reading the actual word would be an indication of reliance on graphic cues, whereas substituting the meaningful word would indicate reliance on contextual information. Allington and Strange (1977) found that both good and poor readers responded with the contextually appropriate original word rather than the actual word 56% of the time. However, there was a tendency ($p < .08$) for good readers to respond with the actual word more often than the poor readers (40% versus 27%, respectively). These results are interpreted as indicating that while both groups utilize context, good readers pay greater attention to graphic information in their normal processing of text. This conclusion, however, may reflect task demands within the testing situation rather than normal processing procedures. If the children remain unaware of the passage alternations, then responses can be assumed

to reflect a natural processing strategy. However, should they become conscious of what appear to be typographical errors in the text, then readers might shift attention from making thematic decisions to a focus on word level processing. Whether the actual or contextually appropriate word response is given may then depend on differences in readers' awareness of the experimental manipulation and perception of the implicit task demands. But, given Allington and Strange's (1977) neutral request to simply read orally into a recorder, subjects are likely to choose somewhat randomly between the possible response sets. Finally, given that subjects do adopt a response set, they may still differ in the ability to recognize sites where grapheme substitutions have been made.

Two studies were conducted to further elaborate on the issues raised by Allington and Strange (1977). The first study attempts to manipulate subjects' response set and measure awareness of the passage modifications. The second study makes task demands explicit in order to examine the relationship of processing mode and reading ability.

Experiment I

Method

Subjects. Twenty-one good and twenty-one poor readers completing the final weeks of the 3rd grade participated in the study. The designation of good or poor reading ability was made on the basis of teachers' ratings of each student's progress in learning to read. Subjects were randomly selected from the high and low ability divisions of four third grade classrooms, from one suburban school.

Materials. Two of the grapheme substitutions stories developed by Allington and Strange (1977) were used in this experiment. Each story contained ten altered words, with a single letter substituted such that another word was formed which was anomalous within the sentence. Each story was approximately 200 words long.

Design and Procedure. The design is a 2x3 factorial, with two levels of reading ability and three attention orienting instructional sets. Neutral oral reading instructions serve as a control condition and replication of the Allington and Strange (1977) procedure. Two other instructional sets specified both a purpose and strategy for reading. A meaning orientation stressed understanding the passage, suggested imagery as an appropriate strategy to heighten understanding, and provided a story continuation task as the purpose for reading. A word orientation set stressed accurate reading, suggested looking at each word carefully as a useful strategy, and provided a cover purpose of making a tape for younger children to read along with as the reason for accurate reading.

Subjects were tested individually in small rooms within the school. The entire session was recorded so as not to draw undue attention to the taping of the subjects' oral reading. Following the orienting instructions, subjects read the two passages. After completing each passage, children in the meaning set were asked what they thought might happen next in the story. Children experiencing difficulty in reading the passages were encouraged to read the story as best they could. Occasional help was given with identification of non-altered words.

After reading the two stories, a series of eight probe questions were asked to assess the subject's awareness of the grapheme substitutions. These questions increased in specificity from, "What did you think of the story?" to "Did you have problems with any of the words?" If at any point subjects indicated awareness of word substitutions, they were asked, "What did you do when you came to one of these words?" These responses were followed up to determine whether a decision had been made to read the words as printed or as they would fit the context.

Following these questions, subjects were informed that indeed some words had been changed so they looked like the right words, but that they were actually other words. The children were asked to silently read through the stories again and underline the words that had been changed. The experimenter then pointed to each underlined word and asked the child what the word should have been. These responses were written above the underlined words.

Results and Discussion

The study is analyzed in terms of total reading time, the number of contextually-appropriate original words substituted for altered words, and the number of altered sites identified on direct inspection of both passages. The analysis of reading time indicates a strong main effect of ability level,

F (1,36) = 29.7, $p < .01$, with no significant treatment or interaction effects. Although this finding is of little theoretical interest, it does provide some validation of the teachers' rating procedure for group assignment.

There were no significant main effects or interaction in the analysis of contextual substitutions. The orienting instructional treatments did produce some variation in the number of changes, with mean values of 9.6, 6.7, and 10.1 for the meaning, word, and control orientations, respectively. However, this effect did not approach statistically significant levels due to wide variations in response patterns.

There was a significant difference between good and poor readers in their ability to identify sites where grapheme substitutions had been made: F (1,36) = 22.7, $p < .01$. Good readers identified an average of 14.7 of the 20 sites, while poor readers indicated only 9.4 sites.

The most striking result of this study is that all but one subject reported some awareness of the grapheme substitutions in response to the probe questions. In fact, for most subjects, resolution of the unexpected complication appeared to be the major concern in the testing situation. While reading ability, orientation instructions, and reading rates do not predict the number of contextual substitutions made while reading, a dichotomous variable created from the subjects' self-reports of what they did when encountering grapheme substitutions and the ability to identify altered sites does predict a significant amount of variation in response patterns: $R^2 = .34$.

The results of this study are consistent with the findings reported by Allington and Strange (1977). However, these results cannot be generalized to information processing in normal reading since subjects show a high degree of awareness of task demands and therefore must be viewed as functioning under word

recognition rather than thematic decision strategies. Of course, third grade readers may have difficulty focusing and maintaining attentional processing at the thematic level under any circumstances (Schwartz, 1980). Thus, an important difference between good and poor readers at this level might rest in the flexibility with which they can coordinate different sources of information during reading. That is, do they have available strategies for highlighting either contextual or orthographic information in their word recognition decisions as the situation demands? The second experiment investigates this type of strategic flexibility by making subjects explicitly aware of the grapheme substitution procedure and varying task demands to require either accurate reading or meaningful substitutions.

Experiment II

Method

Subjects. Twenty good and twenty poor readers in the first half of the fourth grade participated in the study. As in the previous study, the good versus poor reader designation was made on the basis of teacher ratings. Subjects were randomly selected from the high and low ability divisions of four fourth grade classrooms from a different school in the same suburban district.

Materials. The same two stories employed in Experiment I served as stimulus material, except that only one of the stories was presented in the grapheme alteration form; the other was used in its normal format.

Design and Procedure. The design was a 2x2 factorial, with two levels of reading ability, two sets of treatment instructions, and a covariate measure of reading time on the normal passage. This latter measure was used to

reduce the variation in the altered passage reading times due to individual differences in reading rates. Children were again tested individually in small rooms within the school with the entire session recorded so as not to focus attention on the taping of the final passage reading and possibly distract from the treatment task.

Subjects first read the normal passage orally. They were simply told that the experimenter wanted to make a recording of their reading to listen to later. After completing this passage, subjects were informed that the second story had been changed a bit. The grapheme alteration procedure was explained, using the altered version of the story the child had just read to illustrate what this type of change might look like, and to give the children a chance to identify where changes had been made. The treatment instructions then request subjects to read the new, altered story orally, either exactly as printed or so that it would make sense.

Results

The experimental results are analyzed in terms of reading times on the normal and grapheme substitution passages, and subjects' responses to the altered words in the second story.

The analysis of reading time on the normal text shows a strong main effect of reading ability, F (1,36) = 10.6, $p < .01$, but no significant effect of treatment or the treatment × ability interaction. The mean reading time for the high ability group is 96.8 seconds, as compared to 135.9 seconds for the poor readers. This analysis provides additional validation of the classification method.

The analysis of reading times on the grapheme substitution passage yields the same pattern of results, mean reading times of 105.3 and 142.3

seconds for good and poor readers, respectively, F (1,36) = 9.04, p < .01. The new reading times for each group and treatment are listed in Table 1. A further analysis of covariance, using reading time on the normal story as the covariate, was conducted to reduce the large amount of variation in reading times due to individual differences. This analysis indicates a marginally significant treatment effect (p < .09) with the accurate reading set resulting in times of 118.5 seconds compared to 129.0 seconds in the meaning change condition. The main effect of reading ability and the interaction of ability x treatment are not significant in this analysis.

Analysis of subjects' responses to the grapheme-altered words can be conducted in terms of the number of exact responses to the print or the number of contextually expected substitutions generated by subjects. These two measures are highly related but not identical. Subjects occasionally omit an altered word or respond with an unexpected substitution or modification of the sentence. Since the pattern of results is the same in both analyses, only the exact response scoring will be presented.

Treatment instructions produce a strong main effect, F (1,36) = 280.0, p < .01, with a mean number of exact responses of 7.5 and 1.1 words for the accurate reading and meaning change conditions, respectively. There is a trend in the data toward a main effect of ability and an ability x treatment interaction (p < .10) primarily due to response differences between good and poor readers in the accurate reading condition (see Figure #1). In the accurate reading condition, high ability subjects give exact responses to an average of 8.2 words as opposed to 6.8 words by the low ability readers. A simple main effect analysis of this data supports the trend in the overall analysis: F (1,18) = 7.6, p < .05.

Discussion

The hypothesis that good and poor readers differ in the flexibility with which they can coordinate information to make word recognition decisions is only partially supported in this study. The lack of a treatment x ability level interaction in the covariance analysis of reading time fails to suggest differing degrees of compatibility between processing demands and subjects' normal processing strategies. If good readers regularly use context to generate predictions and then minimally sample the print to confirm these predictions, they should be able to function normally in the meaning change treatment but not in the accuracy condition. In contrast, if poor readers fail to optimally use contextual information, then the opposite pattern might be predicted for these readers. In short, if good readers are more conceptually driven than poor readers, then a reading time interaction would be predicted. However, as previously mentioned, the treatment x ability level interaction was not significant. It should also be noted that the interaction suggested by the pattern of times in Table #1 is the direction opposite to the above prediction.

The hypothesis that word recognition decisions are more conceptually driven in the normal processing of good readers than poor readers is further mitigated by a variance analysis of reading times under the different treatment conditions. As indicated in Table #1, the variability of reading times for the poor reading group in both treatment conditions is statistically equivalent: F (9,9) = 1.80, $p > .05$. The good readers, however, show greater variability in reading time under the meaning change condition than under accurate reading instructions: F (9,9) = 3.94, $p < .05$. While various

interpretations of this post hoc analysis are possible, the result may reflect the good readers' attempt to adopt conceptually driven processing strategies that differ from their normal processing mode.

The responses of children to the grapheme-altered sites in both experiments are consistent with the findings reported by Allington and Strange (1977), but more clearly reflect the use of conscious word recognition strategies. The availability of strategies for analyzing word recognition decisions in terms of contextual information is demonstrated in the meaning change condition. Both good and poor readers transform approximately 9 of the 10 target words. Furthermore, when only expected substitutions are scored, both groups average 8.1 appropriate responses.

The difference in performance under the accurate reading set may indicate that poor readers are less flexible in their use of the contextual analysis component of their word recognition strategies. The grapheme-altered words in isolation should not present a recognition problem for fourth-grade students. Given this assumption, the performance of poor readers cannot be attributed a lack of knowledge about word constituent codes such as letters and spelling patterns, but rather to difficulties in coordinating this information with contextual cues. While good readers seem able to suspend the contribution of contextual information in their target word responses, poor readers are less able to do so. This lack of flexibility may also be responsible for the difference between good and poor readers in their ability to identify sites where grapheme alterations had been made in Experiment 1.

The results of this research run counter to the conception of poor readers as insensitive to contextual information. The poor readers' responses to the inserted anamolies reflect the relative potency of contextual cues in their word recognition processing. Normal reading may seldom require children to suspend contextual analysis; however, flexibility in coordinating information sources may be a critical component of fluent reading. The use of contextual information to make word recognition versus thematic decisions requires competing processes (Schwartz 1980, 1980a; Stanovich, 1980). Further research is needed to investigate the flexibility of children in coordinating these goals.

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Table 1

Mean Reading Times on Grapheme Substitution Passage by Reading Ability and Treatment Condition (Experiment II)

	Treatment Condition			
	Meaning Change		Accurate Reading	
	$\bar{X}$	SD	$\bar{X}$	SD
Good Readers	116.6	(27.4)	94.0	(13.8)
Poor Readers	137.5	(57.3)	147.0	(42.7)

Figure 1

Mean number of exact readings of altered words by good and poor readers in the meaning change and accurate reading treatment conditions.