

Research in Brief: Printed Intonation Cues and Reading in Children

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Eighty third- and fourth-graders read one of four types of printed texts: standard print; print in which word size was varied to reflect aspects of speech intonation (three stress-pitch levels); print in which word size reflected differences in the grammatical form class of words; and print in which word size was varied randomly. Reading speed and comprehension with standard print were compared to performances with each of the other texts. Results revealed that the intoned text was read faster than the standard text by third-graders but not by fourth-graders. No other major effects were observed. Findings though preliminary are consistent with the view that less experienced readers transform graphic to aural input before deriving a semantic interpretation.

Design of the present study investigating the effect of print manipulations on the reading process was guided by two lines of thought, the first focusing upon the relationship between printed language and reading, and the second centering on the relationship between speech and reading. Hochberg (1970) has described reading as a process in which peripheral search guides (i.e., printed cues registered in the periphery of the eyes) are used to obtain advance information about the structure of a text. Detection and use of the blanks between words, the first letters and lengths of words, the location of capital letters, and punctuation marks all serve to maintain a good reader's speed, organization, and comprehension of a passage. There have been a few investigations undertaken to assess the effects of manipulating the form of such printed cues upon reading behavior. Hochberg, Levin, and Frail (described in Hochberg, 1970) presented children with texts in which the spaces between words were filled with a consistent but meaningless symbol. Reading speeds on this text were substantially below those with unadulterated text, especially among older subjects who were presumably more experienced in the use of printed cues to guide their reading. Cromer (1970) studied the

effects of grouping printed words within sentences into constituent phrases. He did this by extending the amount of blank space at phrase boundaries. In presenting this text as well as regular text to adults thought to be deficient in reading organizational skills, he found that comprehension with the phrase structured text was superior to comprehension with the unaltered text. This effect was thought to result from the advantage provided by text cues which assisted these readers in grouping words into meaningful units. These studies suggest that manipulation of printed cues can either facilitate or impede aspects of the reading process depending upon whether the cues hinder or aid the reader in structuring a text.

Not only characteristics of printed language but also aspects of spoken language are thought to be involved in reading. Although much disagreement pervades discussions of the role of articulation or acoustic representation in the reading process (McGuigan, 1970), most studies suggest that silent reading is accompanied by some phonological imagery or activity (Conrad, 1972). Although it is unclear whether such phonological information actually contributes to the process of mature reading, for children who are still mastering the skill and who must transform print to speech before they can achieve an interpretation, it may be that phonological information is essential for helping them recognize words and organize them into meaningful units. Goodman (1968) suggests the importance of recoding from print to speech in his psycholinguistic model of beginning reading. One acoustic component of speech which aids the listener in segmenting the flow of sound is intonation, made up of variations in pitch and stress. Cues in printed text provide little information about this aspect of speech, and it may be that as a consequence, children's reading is slow because they must identify the appropriate intonation pattern for each sentence before they can make sense of it. Lefevre (1964) and also Fries (1963) have emphasized the role of intonation in their discussions of factors involved in learning to read. This view of beginning reading suggests that if aids enabling children to identify the spoken correlates of printed language were provided, their reading might be improved substantially. The investigation described below constitutes the first of a number of studies directed at obtaining evidence for this possibility and sorting out the various factors responsible for any observed facilitation.

The present study was designed to examine the effects of printed intonation cues on reading in children and to contrast the effects of these cues with two other sorts of cues. In order to build information about intonation into printed language, the letter size of words was varied to reflect levels of pitch and stress. Three word sizes were utilized. In addition, texts containing two other word size treatments were created. In one case, the grammatical form class of words was used as the basis for assigning word sizes. Levin and Kaplan (1970), Mehler, Bever, and Carey (1967) as well as Cromer (1970) present evidence suggesting that phrases are the units used to read. It was reasoned that cues reflecting the form class of words might convey structural consistencies useful for organizing sentences into phrase units. In the second type of text, word sizes were assigned randomly. This condition was included in order to verify that any facilitative effects resulting from systematic word size variations could be attributed to these variations, not to the mere presence of word size differences. Reading performance with each of the three text treatments was compared to a control condition in which word size was uniform. It was expected that young readers would find intonation cues more useful than the other sorts of cues.

Goodman (1968) and Weiner and Cromer (1967), among others, assert that as readers gain in experience and proficiency, they learn the regularities of printed language. As a consequence their dependency upon speech during reading diminishes and they become able to decode meaning directly from print. It was reasoned that if this is true, then younger *Ss* should benefit more from intonation cues than older *Ss*. In order to examine this possibility, third- and fourth-grade readers were selected. Since a substantial portion of the classroom learning experiences of fourth-graders, in contrast to third-graders, entails reading, it was thought that by the end of the school year, these two groups should be quite different in their reading experience and in their use of speech to derive meaning. Hence, in the present study, the reading of third-graders was expected to be facilitated more by the presence of intonation cues than the reading of fourth-graders.

When this mammoth was found, it was sitting on its back legs. One of its front legs was raised. Except for parts of the head, which had been eaten by wolves, the animal was perfectly preserved. It was so fresh that the meat could even be eaten - if anyone cared to eat "elephant" meat. Most amazing of all, there were buttercups on its tongue!

Figure 1. Sample page from the intoned text.

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Figure 2. Sample page from the form class text.

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Figure 3. Sample page from the random text.

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Figure 4. Sample page from the standard text.

Method

Materials. Two stories, one about growing oranges and another about the discovery of a frozen mammoth, were used. There were 453 words organized into five paragraphs in the orange story, and 510 words comprising eight paragraphs in the mammoth passage. Each paragraph was printed on a separate page. Four printed versions of each text were created: (1) an intoned text in which each word was printed in one of three sizes to reflect levels of pitch and stress which might be assigned by a person reading the story aloud; (2) a form class text in which words in noun phrases and pronouns were printed in the largest type, verb contentives, predicate adjectives, and adverbs in the middle-size type, and prepositions, auxiliary verbs, conjunctions, and relative pronouns in the smallest type; (3) a random text in which the three word sizes were assigned randomly, with the number of words of each of the three sizes identical to that in the intoned text; and (4) a standard text in which word size was equivalent to the middle of the three word sizes and constant throughout the story. Examples of text types are presented in Figures 1 through 4. A computer-graphics computer editing program developed at Bell Laboratories, Murray Hill, New Jersey, was used to generate all of the texts.

Subjects. Five sets of 4 males and five sets of 4 females were selected from the third- and fourth grades of an upper-middle class elementary school in Davis, California ($N=80$). Members of each set were matched in reading ability based on standardized scores on the E.T.S. Co-operative Primary Test, administered in May of the preceding year. All children fell above the 50th percentile on this text. Set members were assigned randomly to the four text conditions. Children were tested in the spring. The mean age of third-graders was 8 years 10 months, and of fourth-graders was 9 years 11 months.

Procedures. Children were examined individually by a female adult. The orange grove story was read first for the purpose of introducing the child to the text type. The child and experimenter took turns reading the first four pages aloud, and the child read the final page silently. After each page was completed, the examiner presented comprehension questions to the child to insure that he paid attention to the story's meaning. Following this passage, the mammoth text

was presented. The child was told to read this story to himself, and he was warned that afterward he would be asked some questions about it. The examiner timed the subject's completion of each page with a stopwatch. When finished, the child was asked to retell the story to the examiner, and then his memory for specific parts was elicited with 21 short-answer questions.

Design. A randomized blocks design was utilized. There were five blocks at each sex and grade level. Within each of the blocks, subjects were assigned randomly to one of the four text treatments. In the analysis, the treatment factor was nested within each of the two grade levels.

Results

Analyses of variance were performed on three dependent measures taken on subjects' silent reading of the mammoth story: reading time, number of correct facts recalled freely, and number of facts elicited by the question prompts. Mean values are presented in Table I. Main effects of grade emerged in the two recall analyses, with $F(1,4) = 28.11, p < .01$, for free recall, and $F(1,4) = 13.42, p < .025$, for prompted recall. Not surprisingly, fourth-graders remembered more of the passage than third-graders. Dunnett's test (Winer, 1962) was used to assess the effects of the text treatments within each grade level. Comparison of performances with each of the three varied texts against performance with the standard text revealed one difference. Third-graders given the intoned passage took significantly less time,

Table I. Mean Time in Seconds and Mean Recall Scores as a Function of Grade Level and Text Treatment

Grade	Measure	Text Treatment			Form Class	Mean
		Standard	Intoned	Random		
3rd	Time*	253.5	179.7	213.8	242.3	222.3
	Free	14.15	14.50	12.35	13.65	13.66
	Prompted	14.95	14.05	13.30	14.05	14.08
4th	Time*	196.4	182.7	168.9	195.3	185.8
	Free	21.10	21.10	22.25	19.55	21.00
	Prompted	19.30	21.00	21.05	19.50	20.01

*MSE (24) = 3460.9

in fact, more than one minute less reading time than third-graders given the standard text, $t(24) = 2.81, p < .025$. None of the other main effects or interactions in these analyses was significant save for one. In the prompted recall analysis, a sex by treatment interaction nested within grade level emerged, $F(6,24) = 2.72, p < .05$. Inspection of cell values revealed that in the random condition scores of third-grade boys were depressed relative to the other conditions whereas scores of third-grade girls were heightened. Causes of this interaction are unknown.

In hopes of gaining additional insight into the performances of third-graders, since this was where the intoned text exerted some effect, various aspects of their oral reading behavior on pages 2 and 4 of the orange grove story were examined. Inspection of the mean number of word repetitions revealed slightly more in the random group than in the standard group, $\bar{X} = 8$ vs. 5, matched pair difference test $t(9) = 1.69, p < .10$. However, differences in reading errors between the standard text and each of the other groups were minimal. Despite the absence of error differences, there did occur a difference in reading speed. Subjects given the intoned text were observed to read the final page of the passage faster than standard text subjects. In fact, 9 out of 10 paired values favored the intoned text: $\bar{X}_I = 60.7$ vs. $\bar{X}_S = 78.3$ seconds, matched-pair difference test $t(9) = 2.34, p < .025$. It is interesting to note that such a difference was not evident earlier in the story, when readers possessed less experience with the text cues. On page 2, only half of intoned text subjects read the passage faster than their matched standard-text mates.

Discussion

Results of the present study yielded preliminary confirmation of some of the hypotheses proposed regarding effects of word size variations on reading in children. The silent reading speed of third-graders given intoned text was greater than that of third-graders given standard text. Such facilitation was also observed in the oral reading times of third-graders and it appeared to result not from a reduction in number of reading errors but from an increase in the rate of reading once these readers had acquired some experience with this cuing system. However, intonation cues did not boost the reading comprehension (as measured by recall) of subjects above that occurring with

standard print. Comprehension was found to be substantial and equivalent among all the groups. Perhaps this occurred because adjunct questions were presented during the reading of the first story and so served to insure that all subjects processed the meaning of the passages. The research of Rothkopf (1970) supports this possibility. Furthermore, because all subjects were reading at or above grade level, and no poor readers were included in the sample, it may be that extracting meaning from the story was not a problem for any of these children.

It is thought that intonation cues boosted the reading speed of third-graders because the cues assisted these readers in transforming print to speech. However, there are alternative ways of explaining these results. Perhaps the cues provided structurally relevant eye fixation points. Or perhaps they distinguished the most from the least semantically salient words. Or perhaps such acoustic information aided subjects who were having difficulty comprehending the material being read. It is known that articulatory activity during reading becomes more pronounced when readers encounter difficult material (Edfeldt, 1960). These uncertainties remain to be clarified by additional research.

The finding that, unlike its effects on third-graders, intonation cues failed to improve the reading speed of fourth-graders is also consistent with expectations that fourth-graders, being more experienced readers, have learned to decode meaning directly from print and so they have little use for speech cues in their reading. Cromer (1970) has obtained findings parallel to these. In comparing the effects of a text cued for phrase structure to a standard text, he found that good adult readers did not profit from the cued text while poor readers did. This occurred presumably because it was the good readers who were skilled in using cues present in standard print to organize the text and and so needed little additional assistance.

One inadequacy of the present study must be mentioned. It is possible that effects of printed text cues on reading were limited because the treatments were only weakly administered. No attempt was made to direct readers' attention to or to force them to use these cues in their reading. Furthermore, subjects were provided with only limited exposure to these cues (i.e., only two stories were read). In order to ascertain whether reading comprehension as well as speed

might be boosted, whether facilitation might occur in older as well as younger subjects, and whether form class cues as well as intonation cues might enhance some aspect of reading, more explicit instruction and practice in the use of these cue systems need to be provided. Exploration of these possibilities constitutes the next step in this line of research.

In conclusion, it must be noted that the present study was a first attempt to explore effects of printed text cues on reading in children. Findings are useful mainly as a basis for the design of other studies verifying that intonation cues facilitate reading and exploring various factors which might account for such effects. Additional work of this sort is in progress.

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