DOCUMENT RESUME

ED 098 514 CS 001 424

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TITLE	Memory-Scanning Differences and Picture Versus Word Encoding for Good and Poor Readers.
PUB DATE	Aug 73
NOTE	7p.; Paper presented at the Annual Meeting of the American Psychological Association (Montreal, Quebec, August 1973)
EDRS PRICE	MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS	Decoding (Reading); Elementary Education; Grade 4; Grade 6; *Memory; Reading; *Reading Ability; *Reading Research; Reading Skills; *Word Recognition

ABSTRACT

The purpose of this experiment was to replicate and extend previous work which showed substantial differences between good readers (GR) and poor readers (PR) in the time taken to encode single words. The technique used was based on the memory-scanning and visual-scanning procedure first used by Sternberg. The subjects for the study consisted of 30 fourth graders and 30 sixth graders. Of these, 15 subjects were selected for being the poorest readers in their class, and the other 15 were selected as being the best readers in their class on the basis of their scores on the Wide Range Achievement Test. Stimuli were 10 picutres of common objects chosen from the Stanford-Binet picture vocabulary test and their printed word equivalents. For half of the subjects, all of memory set (MS) size two (two items in memory) was run before MS size four; for the other half, this was reversed. The subjects viewed slides of the pictures or words and indicated whether the slides were the same or different. The results showed no differences between GRs and PRs or between grades in preference or in pictorial versus word mode of encoding. However, the substantial reading ability and grade differences found in this and previous studies indicate reader ability difference in the facility to encode single words. (WR)

MEMORY-SCANNING DIFFERENCES AND PICTURE VERSUS WORD ENCODING FOR GOOD AND POOR READERS

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Presented at American Psychological Association Meetings, August 1973, Montreal. Session on "Correlates of Reading Proficiency."

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The present experiment was an attempt to replicate and extend previous work which showed substantial differences between good readers (GRs) and poor readers (PRs) in the time taken to encode single words. The technique used was based on the memory-scanning and visual-scanning procedure first used by Sternberg.

In the present experiment, we explored the possibility that GRs and PRs were, to some degree, utilizing different modes of encoding the key word. Specifically, it was possible that PRs, more than GRs, tended to prefer simple visual imagery over a more complex phonological transform of the key word (which was always presented visually). By phonological information is meant information produced by transformation of the visual pattern of print into familiar spelling patterns and/or into phonemic equivalents. A preference for simple visual imagery would slow the learning of reading.

In the present study, memory search sets were composed of either all pictures (P) or all words (W) and these were varied factorially with key words, i.e., probes, which were either pictures or words. The Ss were required to respond "same" when the probe item had also been a member, in name, of the memory set. If differential encoding preferences exist, we would expect different reaction time (RT) patterns for GRs and PRs. For example, if PRs prefer visual encoding, they might be faster on trials on which picture memory sets were followed by picture probes than on trials in which word memory sets were followed by word probes.

Method

Stimuli were 10 pictures of common objects chosen from the Stanford-Binet picture vocabulary test and their printed word equivalents. Two slides were made for each of the 32 trials: one slide was the memory set (MS) and the other the probe. Each MS was composed of either two or four items; each probe slide contained one item. On half of the trials, the probe item was either identical to, or had the same name as, one item in MS: for these conditions, S had been instructed to respond, "same." The size of MS, the type of MS (i.e., picture or word), the type of probe, and the presence of probe in MS (same vs. different) were varied factorially along with school grade (fourth vs. sixth) and reader ability (RA: poor vs. good). Children were assessed for RA by means of the Wide Range Achievement Test, word recognition section. Good readers were all above 50% norm and poor readers below 50% norm. The N's were as follows. The Ss were 30 children in Grade 4 and 30 children in Grade 6. Of these, 15 Ss were selected for being the poorest readers in their class and the other 15 were selected as the best readers in their class. Selection was on the basis of the WRAT.

The Ss were familiarized with the words and pictures and a few practice trials were run. For half of the Ss, all of MS Size 2 (two items in memory) was run before MS Size 4; for the other half, this was reversed. In each MS size condition, there were four blocks of eight trials each, each block containing all eight combinations of: MS type, (i.e., word or picture), probe type, (word or picture), and "same" vs. "different." Each trial was initiated by E, who said, "Ready." The MS slide remained on for 2 sec. for the Size 2 condition and 4 sec. for the 4 item condition. After a blank interval of 940 msec. the probe slide came on.

The Ss viewed the slides while seated at a table. Each hand rested on a telegraph key, one labeled "same" and the other, "different." Light bulbs indicated S's response to E. A Hunter Model 1520 clock displayed the latency between probe onset and S's response.

Results

Errors were few and unsystematic. For each S, the median latency was obtained for each combination of MS type, probe, presence of probe, and MS size. The first slide [SLIDE 1] presents mean RT averaged across Ss and set size for the four combinations of MS type and probe type within each combination of RA and grade. The columns are headed with the MS type followed by probe type; e.g., "P-W" represents picture memory sets followed by word probes. Inspection of the figure indicates a general decrease of RT with increases in RA and grade. Both RA and grade were significant ($F = 7.4$, $df = 1/56$, $p < .01$; $F = 9.4$, $df = 1/56$, $p < .005$, respectively). Memory set type was not significant but probe type was ($F = 9.8$, $df = 1/56$, $p < .005$). More importantly, the interaction of MS Type x Probe Type was very strong ($F = 52.8$, $df = 1/56$, $p < .001$). Thus, for all RA and grade combinations, W-W was the fastest condition and P-P next fastest. Except for Grade 6 PRs, P-W appears to be faster than W-P. However, the interaction of MS type x Probe type x Grade x RA did not approach significance, nor did MS type x Probe type x Grade, or MS type x Probe type x RA. Thus, the results seem to indicate no major encoding preference differences among grades or PRs and GRs. None of the higher order interactions countered this interpretation.

The scanning rates of GR and PR in each grade were examined. SLIDE 2 presents mean RT for same and different responses (labeled "+" and "-", respectively) as a function of MS size for each grade and RA combination. The left-hand graph represents responses occurring on trials where MS was composed of pictures. For each graph, it is clear that RT increases from MS Size 2 to 4 and this is confirmed by the analysis of variance (for MS set size, $\underline{F} = 178$, $\underline{df} = 1/56$, $\underline{p} < .001$). There were no significant effects involving MS size and either RA or grade except for the interaction of Grade x RA x MS Size x MS type x Same-Different. But that was only marginally significant at $\underline{p} < .05$ ($\underline{F} = 4.7$, $\underline{df} = 1/56$, $\underline{p} < .05$). The nature of that effect does not affect our interpretation and is not central to the concerns of this paper. Thus, only the overall effects of RA and grade appear to be important. These data suggest that, at all levels of RA and grade, memory was scanned at the same rate of items/sec.: Within each MS type, the slopes of the RT functions of "same" responses do not differ among levels of RA and grade. All of the "same" (+) lines have the same slope. Likewise, the slopes of negative responses do not differ.

Discussion

The present results show no differences between GRs and PRs or between grades in preference for pictorial vs. word mode of encoding. However, the substantial RA and grade differences that were found in this and in previous studies seem to indicate an RA difference in the facility to encode single words. Of course, it is not newsworthy to say that GRs and PRs differ in their abilities to read words. However, the present study together with previous work can exclude some factors from consideration as causes of the RT difference. They suggest that the RA difference is not due to differences in (a) visual perceptual processing of unrelated letters, (b) at least one aspect of memory retrieval, namely, the scanning of short-term memory, (c) knowledge of grammar, and (d) the preferred mode of encoding.

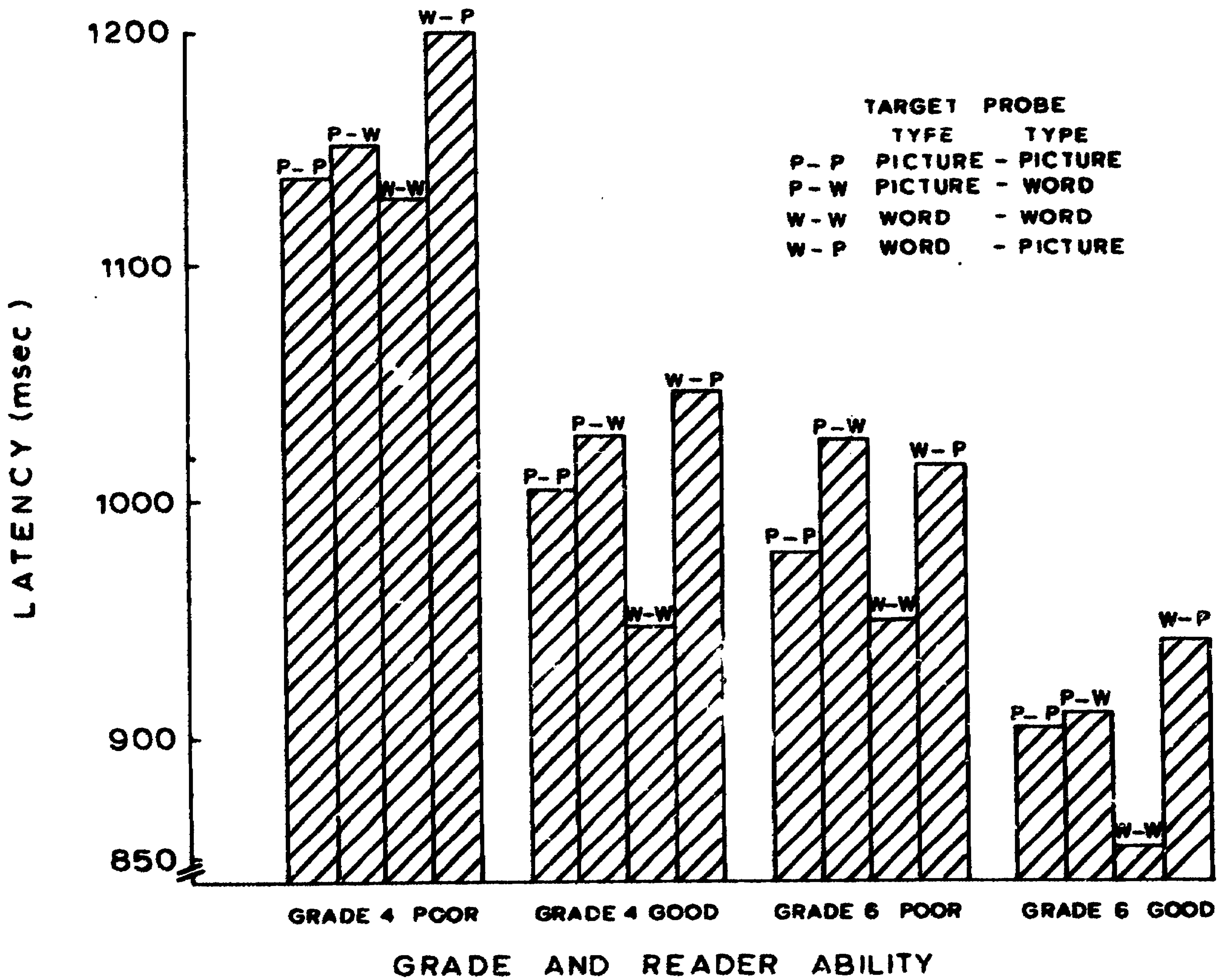
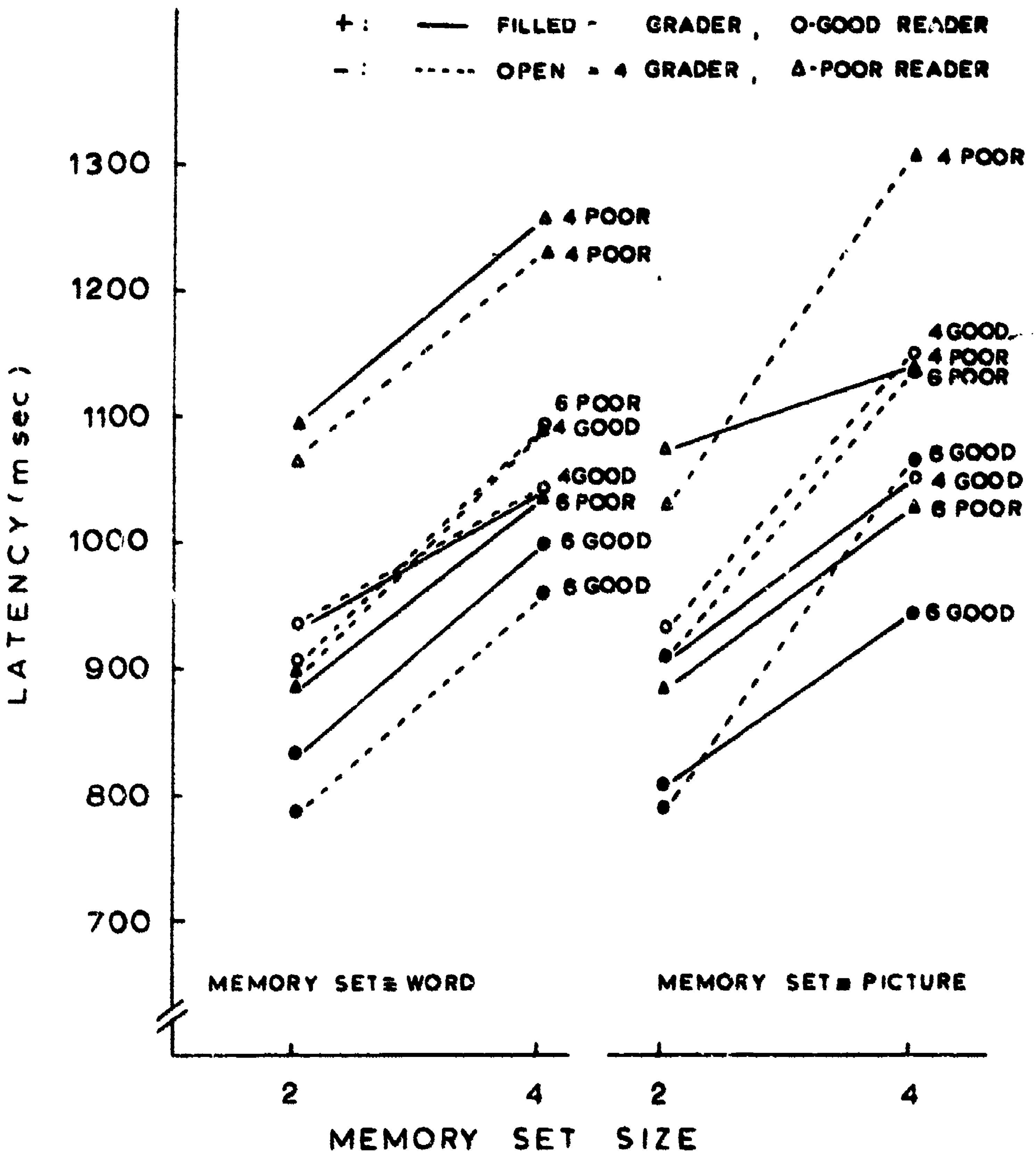

LATENCY (msec)
1200
1100
1000
900
850
TARGET PROBE
TYFE TYPE
P– P PICTURE - PICTURE
P – W PICTURE - WORD
W - W WORD - WORD
W - P WORD - PICTURE
P– P
P – W
W–W
W – P
GRADE 4 POOR
GRADE 4 GOOD
GRADE 6 POOR
GRADE 6 GOOD
GRADE AND READER ABILITY

Figure 1.



+ : —— FILLED = GRADER , O-GOOD READER
− : ----- OPEN = 4 GRADER , Δ-POOR READER
LATENCY (m sec)
1300
1200
1100
1000
900
800
700
4 POOR
4 POOR
6 POOR
4 GOOD
4GOOD
6 POOR
6 GOOD
6 GOOD
4 POOR
4 GOOD
4 POOR
6 POOR
6 GOOD
4 GOOD
6 POOR
6 GOOD
MEMORY SET = WORD
MEMORY SET = PICTURE
2
4
2
4
MEMORY SET SIZE