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ABSTRACT

Poor readers and reading age level controls performed a primed picture naming task and a lexical decision task. Additionally, vocabulary performance was assessed for both groups. Subjects were 42 Dutch children--mean age for the poor readers was 145 months and for controls was 117 months. In the picture naming task there were three priming conditions: repeated, semantically related, and unrelated. Picture items represented early acquired and late acquired words. In the lexical decision task the same items were represented, now as printed words. In addition to words, pseudoword and nonword items were used. Picture naming data showed that poor readers were slower in the repeated prime condition only. This effect could not be explained by differences in vocabulary. Semantically related primes were ineffective, in comparison to the repeated prime condition. Lexical decision data replicated the poor readers' nonword reading deficit: poor readers were slower, especially on the nonwords. A separately conducted analysis of the real word data showed strong effects of acquisition age in addition to between reader group differences. Late-acquired words took longer reaction times. Vocabulary performance as covariate could explain the between group effects in this task. Findings suggest that semantic and phonological processing independently contribute to reading deficits. (Contains 10 references and 2 figures of data.) (Author/RS)

Phonological and Semantic Processing in Reading Disabled Children

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Paper presented at the 1997 Annual meeting of the American Educational Research Association

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Running head: SEMANTIC AND PHONOLOGICAL FACTORS

Abstract

In this study poor readers and reading age level matched controls performed a primed picture naming task and a lexical decision task. Additionally, vocabulary performance was assessed for both groups. In the picture naming task there were three priming conditions: (a) repeated (b) semantically related and (c) unrelated. Picture items represented early acquired and late acquired words. In the lexical decision task the same items were presented, now as printed words. In addition to words, pseudoword and nonword items were used. Picture naming data showed that poor readers were slower in the repeated prime condition only. This effect could not be explained by differences in vocabulary. Semantically related primes were ineffective, in comparison to the repeated prime condition. The negative priming results found in the semantically related picture condition are discussed. Lexical decision data replicated the poor readers' nonword reading deficit: poor readers were slower, especially on the nonwords. A separately conducted analysis of the real word data showed strong effects of acquisition age in addition to between reader group differences. Late--acquired words took longer reaction times. Vocabulary performance as covariate could explain the between group effects on this task. In the discussion it is argued that semantic and phonological processing independently contribute to reading deficits.

There is abundant evidence that poor readers are deficient in phonological skills, such as mapping alphabetic symbols, segmenting phonemes and encoding speech sounds (Bryant & Bradley, 1983; Shankweiler & Liberman, 1989). There is only scattered evidence that poor readers are also deficient in semantically based skills, such as acquiring a vocabulary and retrieving spoken and written words from the mental lexicon. A problem which dominates studies focusing on semantic processing in poor readers is that the experimental tasks used confound semantic and phonological coding ability. Several longitudinal studies report that measures of expressive and receptive vocabulary, administered to kindergarten children, were significantly correlated with measures of reading ability administered to these same children in the first or second grade (e.g. Vellutino & Scanlon, 1987). If vocabulary knowledge predicts achievement in beginning reading, than it might well be a vital prerequisite for successful acquisition of this skill. The question is how poor vocabulary performance in early childhood originates. This may originate from (a) poor access to semantic codes, independent of phonological coding skills, or (b) by poor semantic coding as the result of a deficit in deficient phonological processing. The present study aimed to collect evidence which of both possibilities is best in accordance with the facts.

The finding that poor vocabulary in early childhood correlates with poor reading later on raises the question about the relationship between phonological and semantic coding in reading development. No doubt poor reading is at least partially dependent on semantic access. Two hypotheses for poor semantic processing have been suggested by Perfetti (1986). The *code quality* hypothesis assumes an asynchrony between semantic and phonetic codes, causing poorer access to the semantic

system. The second hypothesis assumes that poor readers are deficient in their access to *orthographic structure*, causing impaired semantic processing in visual word recognition. The present study tried to further specify the relationship between these two possible factors involved in the development of reading problems.

Poor readers and controls, matched for reading age level, were presented a "pure" semantic processing task and a visual word discrimination task. In the semantic processing task subjects were asked to name pictures presented on a computer screen. The target pictures were always preceded by a picture prime. The relationship between prime and target picture was manipulated. There were three priming conditions, identical prime, semantically related, and unrelated. In the visual word discrimination task subjects had to decide if letter strings presented on the screen were real words or not. The letter strings were real words, orthographically legal pseudo words or random letter strings. The word items in the set coincided with the names of the pictures presented in the semantic processing task. Poor readers were expected to perform worse on the visual word discrimination task. The question of interest was to what extent there were also differences on the semantic priming task.

Method

Subjects

Participants were two matched groups of normal and poor readers. Poor readers were subjects scoring at least 2 years below the age norm, as measured by a standard Dutch reading ability test (Brus & Voeten, 1972). These subjects (n=21; mean age: 145 months, range 131-157) were matched on reading level on this test with a group of normal readers (n=21; mean age: 117 months, range 100-136). Both groups had been taught

reading with comparable instruction materials. Both groups were matched on Brus reading score (mean 59.3, range 41-76). There were no differences in teaching methods employed or differences in ethnic background.

Materials

Materials for the picture naming task were taken from the Boston Naming Task (Kaplan et al., 1978) and Snodgrass et al. (1980). The stimulus set consisted of 90 pictures. 50% of the items represented concepts acquired early in language development (i.e. before the fifth age), the other 50% represented late-acquired concepts (Van Loon-Vervoorn, 1989). Sample items are presented in Figure 1.

(insert Figure 1 here)

The lexical decision used sets of these same concepts, now presented as printed words. In addition to the Brus reading test a standard vocabulary test was used Stijnen (1978), a 4-alternative standardized multiple choice test.

Procedure and design

Picture naming task. Ss. were tested individually. Immediately prior to the experimental session each subject learned the appropriate picture labels. Ss. were told to name the picture as rapidly as possible. The prime picture was shown on the centre of the screen for 3 seconds, followed by a 1-s pattern mask. Then the target picture appeared. If no response was given within 3 seconds the target disappeared. There were three priming conditions: (a) identical prime (e.g. prime: "apple"- target: "apple"); (b) same semantic category (e.g.

"pear"-"apple"); and (c) unrelated prime (e.g. "chair"- "apple"). 10 test trials preceded the experimental session.

Lexical decision task: Word items were 30 words (15 early concepts, 15 late concepts) randomly selected from the picture naming task items. These words were also used to create 30 pseudo and 30 nonwords items by way of letter transposition. This resulted in a total of 90 items. Test items (letter height 5 mm, width 4mm) were presented on the monitor screen, and subjects responded by pressing a "no" (red) button or "yes" (green) button. Items disappeared by pressing one of these buttons or after a 5-s period. The experimental session was preceded by 10 practice items.

Results

Vocabulary performance. The vocabulary test showed large differences (mean score: 56% correct for the poor readers versus 78% correct for controls). *Picture naming task*. A 2 (group) x 2 (early/late concepts) x 3 (prime condition) analysis of variance showed main effects of prime condition and acquisition age. There were 1-st order interactions of prime by condition and a group by prime. Priming was strongest in the repeated condition. The group by prime effect showed that in the repeated condition poor readers were significantly (200 ms) slower. See Figure 2.

(insert Figure 2 here)

This effect remained highly significant after including vocabulary performance as a covariate.

Lexical decision. A 2 (group) x 3 (word/pseudo/nonword) analysis of variance showed main effects of group and type. As expected, poor

readers were slower and less accurate. There was also a group by type interaction showing that the largest between group differences were found on the pseudo and nonword items. This interaction remained significant after inclusion of vocabulary as covariate. A separately conducted 2 (group) x 2 (early/late concepts) analysis on the word items showed a main effect for group only and no interaction. This effect remained no longer significant after inclusion of vocabulary as a covariate. A regression analysis with word decision latency as dependent and vocabulary performance and picture naming as predictors showed that vocabulary performance was the best predictor (27% explained variance).

Discussion

The most important conclusion from the present experiments is that most probably poor reading originates from two sources, one phonologically rooted, the other one semantically based. This implies that we have two relatively independent sources of reading problems. This conclusion is based on the finding that although vocabulary performance appeared to be strongly related to word recognition skills, it could not explain the differential semantic priming effects for the reader groups in the picture naming experiment.

A second argument for the conclusion of two relatively independent sources of problems in reading acquisition is the finding that vocabulary turned out to be strongly related to word decoding, but that vocabulary level as a factor could not explain the strong between group differences found in the pseudo and nonword conditions in the lexical decision task.

Priming with a semantically related picture prime turned out to be relatively ineffective for both reader groups. This outcome was contrary to our expectations. In a related study by Biggs & Marmurek (1990)

positive priming effects in the semantically related condition were found. A major difference, however, is that these investigators used adult readers as subjects, which suggests that the semantic processing system in children may not yet be fully developed. This interesting point certainly deserves further exploration.

One of the most noticeable results in the present study is that age of concept acquisition did not appear to be a discriminating factor between the two reader groups. Moreover, the acquisition factor in the picture naming tasks turned out to be only moderately related to vocabulary performance. The fact that there were strong acquisition age effects in both groups, leads us to conclude that acquisition age affects word access but this effect is a general trend in word decoding tasks. The present data suggest that semantic access and phonological coding are probably two relatively independent sources of problems in decoding skill.

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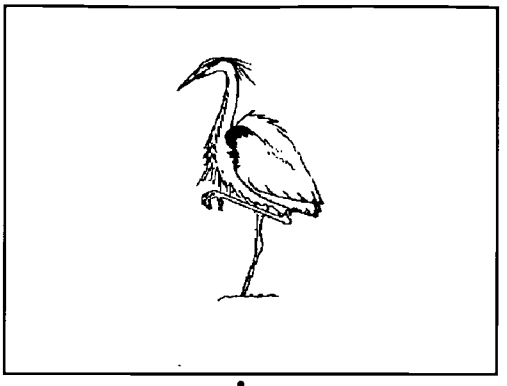
Figure captions

Fig. 1 Sample picture items

Fig. 2 Group x Prime interaction



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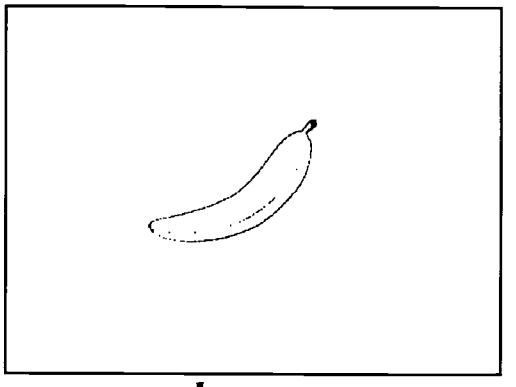

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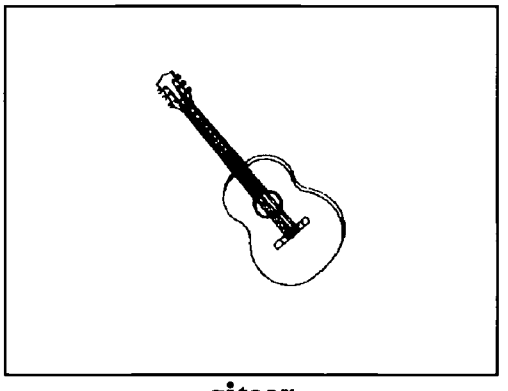

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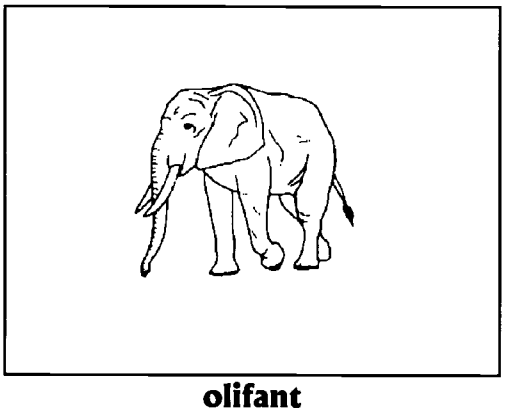

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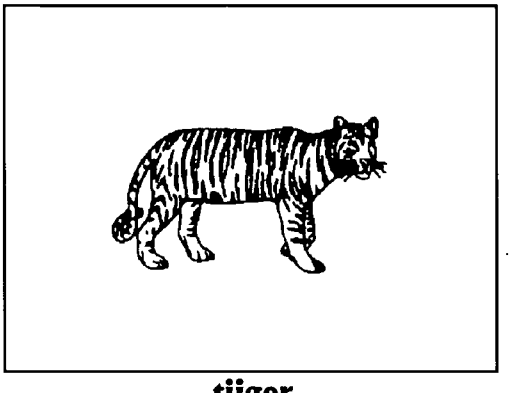

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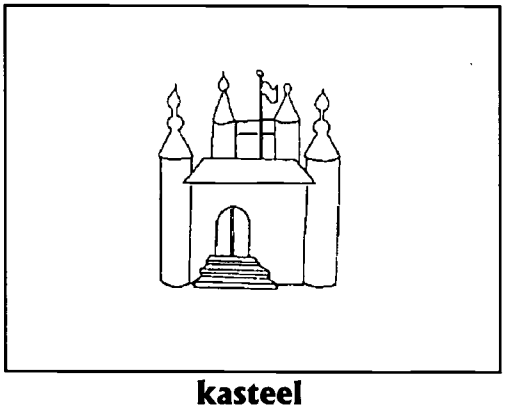

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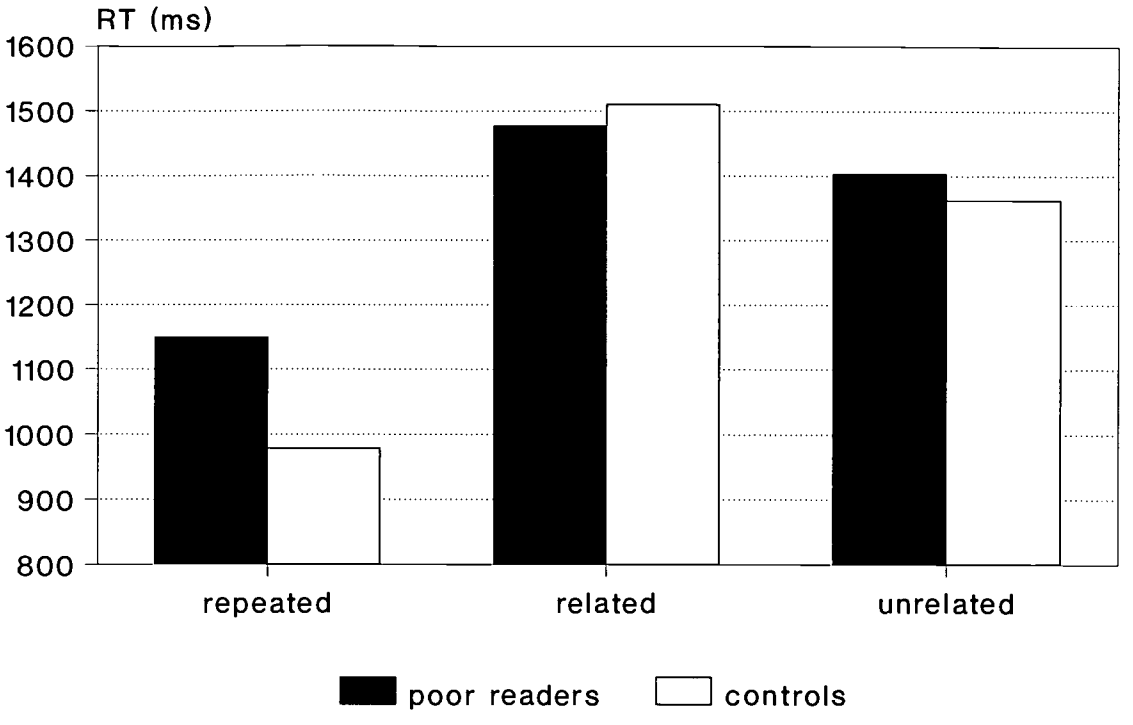
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