The Effect of Semantic Context on Children's Word Recognition

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SCHVANEVELDT, ROGER; ACKERMAN, BRIAN P.; and SEMLEAR, TEDDY. *The Effect of Semantic Context on Children's Word Recognition.* CHILD DEVELOPMENT, 1977, **48**, 612–616. This study employs a lexical-decision task to investigate children's use of semantic context in word recognition. Previous studies have shown that young children do not use contextual factors in word recognition as much as older children do. However, these studies do not distinguish between knowledge of contextual structure (syntactic and semantic) and the use of contextual information. In this study, second- and fourth-grade children made decisions about words in semantically related or unrelated contexts. By presenting common words and their associates, childrens' knowledge of the contextual information was assured, and a more accurate assessment of their use of context could be made. Younger and poorer readers benefit at least as much from semantic context in word recognition as do older and better readers.

Recognition of visually presented words is influenced by several kinds of information available to a reader. One source of information is the visual form of a word. The various encoding and recoding operations performed on this kind of visual information produce internal representations that provide access to stored information about words (Baron 1973; Meyer, Schvaneveldt, & Ruddy 1974; Rubenstein, Richter, & Kay 1975; Spoehr & Smith 1975). A second source of information is the syntactic and semantic context accompanying words. Contextual information also affects word-recognition processes (Meyer & Schvaneveldt 1971; Meyer, Schvaneveldt, & Ruddy 1975; Tulving & Gold 1963).

Both of these sources of information are important in the child's development of word-recognition skills. The child must master a variety of perceptual and contextual discriminations to become a skilled reader (Gibson & Levin 1975; Rayner 1975; Rayner & Hagelberg 1975). However, while there have been many investigations into the child's developing skill in analyzing sensory information in reading (see Gibson & Levin 1975), there has been relatively little research on the effects of the information provided by context. In this paper, we present some new findings on the effects of semantic context on children's word recognition.

There are reasons for entertaining various hypotheses about the development of context effects. If a reader is not skilled at encoding visual information, the graphemic properties of the input could consume most of his attention, leaving little capacity for attending to semantic context (see LaBerge & Samuels 1974; Willows 1974). As readers develop fluency, encoding processes become "automatic," and more attention can be devoted to the semantic properties of the text. Thus, on this view, context effects should increase as reading skill develops.

This argument receives some support from a few studies of context effects in children's word recognition (Klein, Klein, & Bertino 1974; Steiner, Wiener, & Cromer 1971; Weinstein & Rabinovitch 1971). The contexts used in these studies contained both syntactic and semantic information. For example, Klein et al. required children to identify the word boundaries in a long, unbroken sequence of letters. The sequence was either a random ordering of words or an ordering that composed a coherent sentence. The superiority of the coherent material over the random ordering increased with both developmental level and reading skill. Similarly, Steiner et al. found that good readers in the fifth grade showed larger context effects than poor readers.

While these studies have demonstrated larger effects of context for older and better readers, it is unclear whether these differences

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reflect children's level of knowledge about linguistic structures or level of skill in using whatever knowledge is available at a particular developmental level. Clearly a child's knowledge about semantic or syntactic structures will place an upper limit on the possible effects of context. In terms of syntactic structures, there is recent evidence (Bohannon 1976) of a dramatic development over ages 5–8 years in the child's ability to discriminate syntactically well-formed sentences from sentences whose words have been randomly reordered and of a parallel development in the effect of syntactic structure on immediate memory span and on comprehension. Thus at least part of the developmental increase in the effect of sentence context on word recognition might reflect increased knowledge about the structure of sentences. In terms of semantic structure, however, recent findings show that the child's semantic knowledge is well developed for many common words (nouns and simple verbs) when formal schooling begins (Nelson & Kosslyn 1975; Steinberg & Anderson 1975). This is true for second-grade children for both associative and categorial relationships among words (McCauley, Weil, & Sperber 1976). The use of a task manipulating semantic context independently of syntactic context might yield a better estimate of children's level of skill in using context in word recognition.

When their knowledge of contextual information is assured, younger and poorer readers might rely as heavily on contextual information in recognizing words as do readers with greater skill. Because a child has semantic knowledge of words before he can read them, the semantic organization of memory is initially independent of the graphemic properties of words. In this sense, the use of semantic context in word recognition by younger and poorer readers should not be inferior to that of older and better readers.

The lexical-decision task.—The present study used a lexical-decision task (Meyer & Schvaneveldt 1971) to determine how much beginning readers (second and fourth graders) benefit from semantic context in word recognition. In the lexical-decision task, people judge whether various strings of letters are words or nonwords. By encouraging quick and accurate responses indicating such decisions, the effect of semantic context is assessed from the speed and accuracy of responses to a word when it follows a related or an unrelated word. For example, a word like "nurse" is classified faster following a related word like "doctor" than following an unrelated word like "lamp."

The evidence suggests that the facilitative effect of an appropriate semantic context in the lexical-decision task results from increased efficiency in encoding processes. Processes involved in selecting and executing responses are not speeded by presenting material in an appropriate semantic context (Meyer et al. 1975; Schvaneveldt & Meyer 1973). Alterations in the form of the visual stimulus do, however, affect the magnitude of context effects. Visual degradation retards the recognition of words in an inappropriate semantic context by approximately 120 msec while retarding recognition of words in an appropriate semantic context by 90 msec (Meyer et al. 1975). Apparently the deleterious effects of the visual degradation on encoding the stimulus are partially offset by an appropriate semantic context.

Degrading the stimulus display has the direct effect of decreasing the automaticity of graphemic encoding. Since changes in the automaticity of encoding are probably involved in learning to read (LaBerge & Samuels 1974), those subjects for whom there is less automaticity (younger and poorer readers) should, by analogy, show greater context effects.

In the present experiment, we asked children to make lexical decisions about common words that are paired in accordance with the word associations of 7-year-olds. Since we can be reasonably certain that these associations (e.g., "king-queen") reflect the semantic knowledge of these and older children, we are able to focus on the child's use of contextual knowledge in word recognition.

Method

Subjects.—The subjects were 24 second-grade children (mean age 7.6 years) and 24 fourth-grade children (mean age 9.5 years) attending school in Easthampton, New York. The children came from middle-class backgrounds and were evenly divided by sex.

Materials.—Two Kodak Ektographic projectors, each with a tachistoscopic shutter, were used to rear-project slides onto a small screen placed directly in front of the child. Timers were activated by either of two response keys situated in a response panel attached to the bottom of the projection screen.

The stimuli were slides of letter sequences forming words or nonwords. The words were

taken from the subjects' first- and second-grade readers and from the teachers' verbal reports of recognizable vocabulary. The words were paired, where possible, according to Palermo and Jenkins (1964) lists of highly associated words for first- and second-grade children. There were two lists presented: the pairs in List I were unpaired in List II and vice versa. Each individual was shown either List I or List II. Examples of highly associated and unassociated word pairs and the pairs containing nonwords can be seen in table 1.

Procedure.—Each subject was tested individually. During a practice session that lasted several minutes, the subject was instructed to push the "yes" button (on the child's right) if the letter sequence was a word and the "no" button (on the left) if the sequence was not a word. The child was instructed to be as fast and as accurate as possible. To demonstrate this procedure, the child was shown both a word and a nonword and asked to respond.

When the subject responded to the first letter sequence, the key press terminated the presentation of the first slide and initiated the onset of the second slide of the pair. Reaction time was measured from the onset of the second letter sequence to the key-press response. Between each stimulus pair there was an intertrial interval of 2 sec. After the thirty-sixth and seventy-second pairs were presented, the subject had a rest period lasting several minutes. At random intervals the subject was given positive feedback and reminded to respond as quickly and as accurately as possible.

Results

An initial analysis determined that the list factor had no effect, so further analyses ignored this factor. The reaction-time data were analyzed by means of a 2 (second and fourth graders) × 2 (associated vs. unassociated word pairs) analysis of variance. Significant effects were found for grade, $F(1,46) = 32.94$, $p < .01$, and context, $F(1,46) = 34.57$, $p < .01$; but only a marginal effect was found in the grade × context interaction, $F(1,46) = 3.41$, $p < .10$. Both the absolute reaction times and the magnitude of the association effect appear to decrease with increasing grade. Reaction times by age and presentation conditions can be seen in table 2. Semantic context also facilitates accuracy as well as speed of response, suggesting that the reaction-time effects are not due to a speed-accuracy tradeoff.

The relationship between reading ability and performance in the lexical-decision task was examined by correlating scores from the Iowa Basic Skills Achievement Test with mean recognition times (word-word plus word–associated word times) and with the mean context effect (word-word reaction time minus word–associated word reaction time). Only those tests common to both second and fourth grades (vocabulary, spelling, and reading) were used. The correlations can be seen in table 3. An inverse relationship exists between recognition times for words and test scores. For both second- and fourth-grade children, reaction times decrease as test scores increase. Good readers identify words faster than do poor readers. Of more interest is the relationship between the context effect and test scores. For both second- and fourth-grade children,

TABLE 1

EXAMPLES OF WORD AND NONWORD STIMULUS PAIRS

Condition	Example	% Pairs
Associated words	King-queen, bread-butter	22.2
Unassociated words	King-butter, bread-queen	22.2
Word-nonword	Here-qmsr	22.2
Nonword-word	Ptrl-home	22.2
Nonwords	Wrdt-lsmn	11.1

TABLE 2

MEAN REACTION TIME (msec) FOR WORD AND NONWORD PRESENTATION CONDITIONS

Grade	Word-Word	Word–Associated Word	Context Effect (Difference)
Second	1,211 ± 41 (6.4)	1,117 ± 34 (3.5)	94 ± 19 (2.9)
Fourth	940 ± 25 (1.4)	891 ± 24 (1.1)	49 ± 16 (0.3)
	Word-Nonword	Nonword-Word	Nonword-Nonword
Second	1,421 ± 58 (4.4)	1,192 ± 65 (6.8)	1,375 ± 59 (5.5)
Fourth	1,090 ± 37 (1)	938 ± 28 (1)	1,085 ± 54 (1)

NOTE.—Figures in parentheses are % error.

TABLE 3

CORRELATIONS OF LEXICAL-DECISION DATA WITH IOWA BASIC SKILLS SCORES

	IOWA SCORES		
	Vocabulary	Spelling	Reading
Second grade:			
Recognition time[a]	−.58**	−.47*	−.66**
Context effect[b]	−.43*	−.43*	−.26
Fourth grade:			
Recognition time[a]	−.27	−.30	−.30
Context effect[b]	−.11	−.31	−.13

NOTE.—Two-tailed.

[a] Decision time for word-word plus word-associated word.

[b] Decision time for word-word minus word-associated word.

* $p < .05$, $r = .404$.

** $p < .01$, $r = .515$.

all the correlations are negative, and most are well below zero. For the second-grade children, two correlations are significantly different from chance at a $p < .05$ level (vocabulary and spelling). These results suggest that poorer readers use semantic context at least as much as better readers do.

Discussion

The findings presented here support the distinction we have made between knowledge of contextual structure and use of contextual information. When the child's knowledge is assured by using simple semantic relations known by even the youngest children, the effect of semantic context on word recognition for younger and poorer readers is at least as large as it is for older and better readers.

Work with adults on lexical-decision tasks and naming (or pronunciation) tasks suggests that semantic context influences the process of encoding visual information. Our findings now with children suggest the same conclusion. Even the poorest readers in our study apparently have some knowledge about the appearance of common words, and with effort they can recognize such words without context. We might suppose that contextual information facilitates accessing the knowledge people have about the appearance of related words (see Schvaneveldt, Meyer, & Becker 1976). This knowledge may then be used to interpret the visual information present. Of course visual information may also provide access to memorial representations of words, but this route depends on skills which are developed in learning to read. Until these skills are mastered, the reader may depend heavily on extraliteral information, the experience of contextual constraints that occur in speaking and listening.

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