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ANATOMISING LEXICAL DECISION IN PHRASAL CONTEXTS:  
WHEN DOES TRUCK NOT PRIME CAR?

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ABSTRACT

Context effects on lexical decisions were anatomised by manipulating lexical relatedness in syntactic and asyntactic sequences. In a Syntactic condition, related or unrelated word-pairs were embedded in simple sequences (e.g., a truck or a CAR/FLOOR). In a Scrambled condition, two inapposite function words were substituted between the related and unrelated nouns (e.g., the truck that before CAR/FLOOR). The phrases were presented serially and subjects made lexical decisions to their terminal elements. Substantial relatedness effects were found only in syntactic sequences, whether presentation rate was slow or whether it exceeded the rate of normal reading. The syntactic relatedness effect was shown to consist, in equal proportions, of facilitation of related words and inhibition of unrelated words. These results argue against a role for intralexical priming in on-line reading. They point up the roles of syntactic connectedness and of the current interpretation even in very rudimentary contexts.

INTRODUCTION

The phenomenon of lexical priming -- facilitation of the perception of one word in the context of another -- has been extensively studied in the past 15 years (e.g., Fischler & Goodman, 1978; Meyer & Schvaneveldt, 1971; Neely, 1977). More recently, researchers have examined how responses in lexical tasks, primarily lexical decision and naming, are modulated in sentence contexts (e.g., She cleaned the dirt from her SHOES/HANDS/TERMS). These studies show facilitation of congruent completions (SHOES) and inhibition of incongruent completions (TERMS), relative to appropriate but unlikely completions (HANDS) or other control conditions. Larger inhibition effects have usually been observed in the lexical decision than in the naming task (see Fischler & Bloom, 1979, 1980; Stanovich & West, 1979, 1983).

The main theoretical interest of these studies lies in the facilitation effects. Do they represent a genuine influence on lexical access of the kind that is thought to occur in single-word contexts (e.g., truck-CAR)? One recent view, motivated by a conception of the lexicon as an encapsulated system or module (Forster, 1979; Stanovich & West, 1983), is that genuine facilitation effects depend on the presence of lexically related words in the contexts. For example, mailed and letter might prime STAMP in the sentence He mailed the letter without a STAMP.

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TABLE 1  
EXAMPLES OF COUNTERBALANCED MATERIALS

Context Words				Related/Unrelated Target
1	2	3	4	
<u>Syntactic (All Experiments)</u>				
the	author/owner	of	this	BOOK/FLOOR
the	ceiling/circle	and	the	FLOOR/BOOK
<u>Scrambled (Experiments 1 and 2)</u>				
the	author	the	and	BOOK/FLOOR
the	ceiling	this	of	FLOOR/BOOK

On this view, activation in the lexicon occurs independently of concurrent interpretive processes. That is, facilitation effects resulting from such activation are intralexical. Such a process would not account for facilitation in contexts that lack lexical associates (e.g., She cleaned the dirt from her SHOES). This kind of facilitation is ascribed by Forster (1979, 1981) and others to a positive response bias following the occurrence of a predictable target. Thus two sources of facilitation are identified -- priming in a lexical store, and a response bias determined by predictability.

Because semantically related words are rarely adjacent in connected text, and because the process of reading is probably too fast to allow the development of predictions, some authors (e.g., Mitchell, 1982) have concluded that contextual facilitation plays little or no role in normal skilled reading. This conclusion may be premature, however. First, the proximity of related words may not be critical. Foss (1982) showed that phoneme monitoring latencies were facilitated in contexts containing related words, but not when the same related words were presented in randomised texts. Further, when the contexts were coherent, facilitation was not affected by the distance separating the priming and target words. He interpreted this as evidence that latencies were not determined by intralexical priming but by the facility with which new material was integrated in a text-level representation.

Secondly, although explicit expectancies would take time to develop, it is not clear that facilitation in sentence contexts requires such specificity. Although some researchers have argued that it does not occur at rapid rates, Fischler and Bloom (1980) observed facilitation when contexts were read at rates well in excess of normal reading speed. Also, Fischler and Bloom (1979) found no cost to less likely completions in highly constraining contexts. Such costs should be incurred if the benefits to the most likely completions depended on explicit prediction.

However, if facilitation reflects the more efficient integration of new material into a sentence or text-level representation, the cost-free outcome makes sense.

Control of materials is a problem in assessing lexical and nonlexical contributions to facilitation effects in sentence frame contexts. In particular, some sentences contain lexical relatives of the targets, but others do not. In the experiments reported here, this problem was addressed by defining relatedness in terms of a single content word in each context (e.g., a truck or a CAR; see other examples in Table 1). Thus, an equivalent level of control to the simple one-word context case was achieved. With these materials it was possible first to address the intralexical issue, and then to reassess the nature of the facilitation effect.

#### EXPERIMENTS 1 AND 2: ARE THERE INTRALEXICAL EFFECTS?

A series of lexical decision experiments where lexical relatedness and syntactic connectedness were independently manipulated was conducted. That is, related and unrelated noun pairs were embedded in syntactic or scrambled sequences. The scrambling consisted in substituting anomalous function words between the nouns (see examples in Table 1).

The sequences were presented serially, word by word, at a fixed location in the center of a CRT. Subjects made lexical decisions to the last word in each sequence which was printed in uppercase letters. There were eighty word and forty nonword filler trials in an experiment.

Experiments 1 and 2 were designed to assess the extent of relatedness effects in the syntactic and scrambled sequences. In Experiment 1, the contexts were presented at a slow, 800 msec per word, rate. Under these conditions, deliberate prediction and exploitation of lexical relatedness might occur in both kinds of context. In Experiment 2, the 200 msec rate exceeded that of normal reading, thus giving intralexical activation a better chance to show, and at the same time addressing the concern with the relevance of lexical priming at reading speed.

The results of both experiments are summarised in Table 2. In the case of Experiment 1, the responses of forty-eight subjects to ten targets are represented in each estimate. (These subjects also served in a second block involving an additional manipulation not reported here. See O'Seaghdha (1986) for details). In Experiment 2, twenty-four subjects responded to twenty targets in each subcondition.

Both experiments show a clear relatedness effect in the syntactic contexts, but little or no effect in the scrambled condition. There is a nonsignificant 13 msec effect in the scrambled condition at the 200 msec rate, but the contrast between this effect and that in the syntactic condition leads to the conclusion that the relatedness effects in the latter cannot be attributed to intralexical priming among related words.

Of course the relatedness effect in the syntactic condition

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TABLE 2  
 EXPERIMENTS 1 AND 2: MEANS OF BIWEIGHT ESTIMATED REACTION  
 TIMES WITH STANDARD ERRORS AND PERCENTAGE ERRORS  
 AS A FUNCTION OF CONTEXT CONDITION AND RATE

<u>Experiment 1: 800 msec rate</u>					
	Syntactic		Scrambled		
	<u>Related</u>	<u>Unrelated</u>	<u>Related</u>	<u>Unrelated</u>	
	512	561	532	534	
	9.1	12.2	10.5	8.3	
Error%	1.7	4.6	1.3	2.9	
<u>Experiment 2: 200 msec rate</u>					
	Syntactic		Scrambled		
	<u>Related</u>	<u>Unrelated</u>	<u>Related</u>	<u>Unrelated</u>	
	495	537	512	525	
	11.8	16.6	12.3	11.6	
Error%	1.5	4.2	2.0	3.1	

must be partly inhibitory. Substantial inhibition of anomalous targets is reliably obtained in lexical decision experiments. An informal comparison of latencies in the related and unrelated syntactic contexts to latencies in the nonpriming scrambled condition indicates that the overall effect divides equally into facilitation and inhibition components. A more direct evaluation of these components is provided in Experiment 3.

## EXPERIMENT 3: FACILITATION AND INHIBITION

In Experiment 3, the relatedness effect in syntactic sequences was partitioned into facilitation and inhibition components. For this purpose, a neutral condition containing unrelated context nouns was developed (see Table 1). In this condition, the phrases made sense (e.g., the owner of the BOOK), but there was no lexical relation between the contextual content word (owner) and the target (BOOK). The related and unrelated conditions were the same as in Experiments 1 and 2, and the procedure was identical. Three presentation rates -- 200, 400, and 800 msec -- were tested, and sixteen subjects were run at each rate. The questions in Experiment 3 were whether facilitation occurred, relative to the neutral context, and whether the division into facilitation and inhibition varied with rate of presentation.

The evidence shown in Table 3 confirms that the relatedness effect consists, in approximately equal proportions, of facilitation and inhibition. The inhibition of anomalous targets

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TABLE 3  
 EXPERIMENT 6: MEANS OF BIWEIGHT ESTIMATED REACTION TIMES  
 WITH STANDARD ERRORS AND PERCENTAGE ERRORS AS A FUNCTION OF  
 CONTEXT CONDITION AND RATE

<u>Rate</u>	<u>Context Condition</u>		
	<u>Related</u>	<u>Neutral</u>	<u>Unrelated</u>
<u>200 msec</u>	495	512	534
	10.7	10.4	6.9
Error%	0.9	1.9	5.6
<u>400 msec</u>	491	519	530
	15.9	13.2	17.6
Error%	0.9	2.5	3.1
<u>800 msec</u>	476	503	526
	15.3	17.4	20.2
Error%	1.6	1.2	3.8

replicates previous findings in the literature, and was expected. However, contrary to what previous readings of the literature (e.g., Mitchell, 1982) would suggest, facilitation did not vary substantially with rate of presentation. If there were little facilitation at the 200 msec rate, but increasing facilitation at slower rates, the interpretation of this experiment would be straightforward. Facilitation would then be attributable to a postlexical response bias. Because this outcome was not obtained, it appears that the emphasis in the literature on slow-acting predictive processes as the source of facilitation may be misplaced.

## DISCUSSION

Neither intralexical priming (e.g., Stanovich & West, 1983), nor a response bias favouring predictable targets (Forster, 1979, 1981), accounts for the facilitation effects in these experiments. An alternative account of facilitation effects in phrasal or sentence contexts is therefore required.

One candidate is Foss's (1982) proposal that facilitation in his phoneme monitoring experiments reflected the speed of integration of new material with a discourse level representation of the texts. This idea seems compatible with the present data. In addition, it is consonant with the notion of a positive response bias with appropriate sentence completions in a lexical decision task (see Forster, 1981), but this bias is characterised as a byproduct of integration, not as a consequence of explicit

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prediction of targets. Further, the invariance of performance with rate of presentation suggests that it reflects normal processes of comprehension and not merely the special requirements of the lexical decision task.

The main point demonstrated in these experiments is that syntactic connectedness is prerequisite for the occurrence of relatedness effects. It might be urged that lexical priming is somehow "transmitted" in syntactic sequences. This must be true, at least in a metaphorical sense. However, such a view would still require a revision of the view of facilitation as the product of a blind process of spreading activation. Perhaps the most important implication of the research is that, if relatedness effects are as sensitive to syntactic coherence as these data indicate, the interdependence of parsing and interpretive operations requires further detailed analysis. We know one circumstance where truck does not prime car. The adequacy of our understanding of the cases where priming does occur is therefore brought into question.

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