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CONJOINT SYNTACTIC AND SEMANTIC CONTEXT EFFECTS:
TASKS AND REPRESENTATIONS

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Abstract

Syntactic and semantic relatedness were orthogonally varied in a series of experiments by presenting semantically related and unrelated noun and verb targets in phrasal contexts syntactically disposing to nouns or verbs. In addition, the subjects' task, naming or lexical decision on the target, was varied across experiments. In lexical decision, semantic facilitation and inhibition effects depended on context-target match, especially for noun targets. In several experiments, naming data showed only weak semantic effects, which were not modulated by context-target match. However, there was clear evidence of syntactic inhibition in these experiments. Finally, robust semantic facilitation was observed in a naming experiment where contexts and targets were always syntactically matched. Thus, although in some experiments lexical decision appeared to reflect additional text-level integration processes to which naming was immune, the naming task was less consistent across experiments. This contradiction may be resolved if a distinction is introduced between situations where lexical targets are part of the sequence being tested and situations where they are external probes.

When a sentence-final content word is presented in a speeded response task, it may vary in semantic and syntactic congruity with the context. In the case of syntactic congruity, several recent studies show that, when a sentence-final target is syntactically anomalous, latencies are slowed (Wright & Garrett, 1984; West & Stanovich, 1986). But most of the research in this area has been concerned with semantic effects, assessed on a goodness-of-completion continuum (e.g., Fischler & Bloom, 1979; Stanovich & West, 1983). In recent work (O'Seaghdha, 1986, in press) I have shown semantic effects in simple phrases where relatedness is defined by a single contextual content word (see Table 1). Just as with more complex contexts, lexical decision responses to related targets were fast relative to the neutral condition, and responses to unrelated targets were slow. However, the effect of the context was virtually eliminated when the function words between the contextual content word and the target were incoherent (e.g. with tea the and COFFEE). This result argues against an important role of lexically mediated facilitation in natural language processing. That is, the mere occurrence of a lexical relative of the target is not sufficient to produce an effect. Rather, it appears that a sequence must be syntactically coherent up to the point of target presentation.

In the experiments reported here, this work was extended by marking both syntactic and semantic appropriateness on phrase-terminal targets (see Table 1). In these experiments, related or unrelated noun or verb targets were presented in noun contexts (contexts in which noun but not verb completions were grammatical), or in the reciprocal verb contexts. The targets were also tested in neutral contexts which lacked close lexical relatives. The sequences were always grammatical up to the

TABLE 1
Examples of Materials Used in the Experiments

Context Words				Related/Unrelated Target		
1	2 ¹	3	4	Noun	Verb	
<u>Noun context</u>						
with	tea	/dessert	or	with	COFFEE/ BONE	STIR/ RELAX
<u>Verb context</u>						
the	tea	/dessert	that	you	COFFEE/ BONE	STIR/ RELAX

1 The related(e.g. tea) or neutral(e.g. dessert) context is defined in Position 2. Nominally related targets were always presented in the neutral contexts.

point of target presentation. This procedure provides a stronger test of lexical mediation than the earlier work where the sequences were asyntactic before the targets were presented. In addition, it allows for examination of the conjoint effects of syntactic coherence and semantic relatedness. At least three processes could influence performance under these conditions:

1) Binding of syntactic categories to positional slots. In each case, a strong preference exists for a noun or verb ending. Presenting a member of the wrong syntactic category violates syntax and should slow latencies.

2) Semantic facilitation independent of syntactic binding. This could be mediated by intralexical facilitation (Forster, 1979) or by conceptual-lexical priming (Tanenhaus, Dell, & Carlson, 1987). However, if sentence-context effects depend on syntactic coherence (O'Seaghdha, in press) these effects should be weak.

3) Processes operating after syntactic binding of a target. Such processes would be conditional on the syntactic appropriateness of the target and would reflect success or failure at integrating new words with higher-level contextual representations. Such effects are likely to influence a binary decision task more than the univocal naming task (see Seidenberg, Waters, Sanders, & Langer, 1984; Lucas, Tanenhaus, & Carlson, 1987).

Method

The general procedure in all of the experiments was the same. Eighty related noun-noun pairs used in previous research (O'Seaghdha, 1986, in press) were embedded in simple noun-expectancy phrases (see examples in Table 1). In the neutral condition, a noun unrelated to the target was substituted in each context. To produce the unrelated conditions, noun targets were reassigned to unrelated contexts. Next, a related verb was found for each context, and unrelated verb conditions were generated in the same way as for the nouns. Finally, a set of verb-expectancy phrases was written to provide a symmetrical set of verb context conditions.

Thus, on a particular trial, a subject could read a priming or neutral, noun or verb context. In priming contexts, a related or unrelated, noun or verb target was presented. In neutral contexts, the target was by definition not strongly related, but the corresponding nominally related noun or verb was presented.

On each trial, the four context words were presented serially at a fixed 400 msec rate at a center screen location. In the lexical decision experiments, there were eighty word and forty nonword targets, balanced over conditions. In the naming experiments, the conditions were interleaved in such a way that 120 word targets could be presented without repetition of items.

Summary of Experiments

Table 2 summarises data from seven naming and lexical decision experiments. The conditions map onto experiments, indexed by numbers in the table, as follows:

Experiments 1 and 2 (Lexical Decision, Separate): Noun and verb targets were presented in noun contexts (Experiment 1) and verb contexts (Experiment 2).

Experiment 3 (Lexical Decision, Matched): Contexts and targets were matched: Noun targets were presented in noun contexts. The data are extracted from a larger experiment (O'Seaghdha, in press, Experiment 5).

Experiment 4 (Naming, Mixed): Noun and verb targets were presented in noun and verb contexts.

Experiments 5 and 6 (Naming, Separate): Same as Experiments 1 and 2 except for task.

Experiment 7 (Naming, matched): Nouns in noun contexts, verbs in verb contexts within the experiment.

The Table shows data from all of these experiments organised by type of context and type of target. Sixteen subjects served in Experiment 3, twenty-eight subjects in Experiments 6 and 7, and thirty-two subjects in each of Experiments 1, 2, 4, and 5. The overall relatedness effect is the difference between unrelated and related conditions. The facilitation effect is the difference between neutral and related contexts.

Results

Relatedness The main effect of Relatedness was significant in all experiments except Experiment 4 (Naming, Mixed contexts). Experiment 1 replicates the strong syntactic dependency observed in the previous lexical decision research (O'Seaghdha, 1986, in press). This conclusion holds whether the priming of nouns in noun contexts is compared to the 2 msec priming of verbs in the same contexts within the experiment, or to the 14 msec priming of the noun targets in the verb contexts of Experiment 2. However, the relatedness effects in Experiment 2 are weaker than in Experiment 1 and do not show syntactic dependency. It appears that the verb targets are less strongly related to the contexts than the nouns, so that in Experiment 2 the modest semantic effect of asyntactic nouns is comparable to the modest integration observed for the syntactically congruent but semantically weak verbs.

TABLE 2
Means of Response Latencies with Estimates of Overall Relatedness
and Facilitation Summarised from Seven Experiments

Task and Contexts	Target	R	U	N	Relatedness	Facilitation ¹
<u>Noun Contexts</u>						
Lexical Decision, Separate (1) ²	Noun	498	541	527	43	29
	Verb	590	592	598	2	8
Lexical Decision, Matched (3)	Noun	491	530	519	39	28
	Verb	-	-	-	-	-
Naming, Mixed (4)	Noun	471	479	474	8	3
	Verb	497	504	508	11	7
Naming, Separate (5)	Noun	450	458	456	8	6
	Verb	468	480	480	12	12
Naming, Matched (7)	Noun	450	469	467	19	17
	Verb	-	-	-	-	-
<u>Verb Contexts</u>						
Lexical Decision, Separate (2)	Noun	512	526	524	14	12
	Verb	525	543	532	18	11
Lexical Decision, Matched	No data					
Naming, Mixed (4)	Noun	491	498	501	7	10
	Verb	493	497	491	4	-2
Naming, Separate (6)	Noun	471	481	476	10	5
	Verb	466	481	476	15	10
Naming, Matched (7)	Noun	-	-	-	-	-
	Verb	469	487	480	18	11

¹ R = Related; U = Unrelated; N = Neutral; Relatedness = (U - R);
Facilitation = (N - R).

² Numbers in parentheses index Experiments (see text).

The virtual absence of any relatedness effect in Experiment 4 was unexpected. The naming task is considered to be a relatively direct measure of context effects (e.g., Seidenberg et al., 1984). Effects of the kind usually observed in sentence-context studies (e.g., Stanovich & West, 1983) were therefore expected. That is, the effects should resemble those with lexical decision though they might be a little smaller, especially on the inhibitory side. In Experiments 5 and 6, when the contexts were either all noun or all verb, the relatedness effects were stronger, but did not discriminate between syntactically

congruent and syntactically incongruent conditions. This outcome makes sense for Experiment 6 which compares directly to Experiment 2. However, a stronger effect of nouns in noun contexts was expected in Experiment 5. Only in Experiment 7, where contexts and targets were always matched, was the expected large facilitation effect for congruent nouns observed.

Syntactic inhibition Although semantic effects were virtually absent in Experiment 4, robust syntactic inhibition was observed, at least for noun contexts. This result is important for the practical reason that it provides assurance that subjects did not merely fail to register the contexts in this multi-condition experiment, and for the substantive reason that it shows an independence of semantic and syntactic effects. Independence of semantic relatedness and syntactic congruity was also observed in Experiments 2, 5 and 6. In the case of Experiments 2 and 6, this may be attributed to semantic effects for nouns balancing syntactic integration for verbs. But in Experiment 5, the same discrimination between nouns and verbs that was observed in Experiment 1 was expected.

Nouns and verbs The data show several contrasts between noun and verb contexts and targets. First, leaving aside Experiment 4, the verb context data appear relatively consistent across tasks and experiments. Second, there is an asymmetry in syntactic inhibition across contexts: In Experiment 4, where they can be directly compared, nouns are more inhibited in verb contexts than verbs are in noun contexts. These considerations together suggest that, for the kinds of constructions used, verb contexts are syntactically stronger. On the other hand, the noun contexts are semantically stronger (see the large facilitation effects in Experiments 1, 3, and 7). Several factors may contribute here. Referential noun-concepts may be more strongly linked together than they are linked to possible predicates. Verbs may be more constraining in predicate-object constructions (She drove the car) than they are constrained in relative clauses (The car that she...).

Tasks and Representations A widely expressed view is that, in contrast to lexical decision, the naming task is a relatively unbiased measure of lexical access (e.g., Balota & Lorch, 1986). Seidenberg et al. (1984) showed that lexical decision is biased by a number of factors, including syntactic congruence between a single-word prime and a target, by which naming is not influenced. However, using more constraining sentence-frame contexts, West and Stanovich (1986) found that naming latency was affected by the syntactic congruity of contexts and targets. It appears that speakers involuntarily delay the articulation of a word when it is syntactically incongruent with its context. In fact, roughly equivalent effects have been observed in the two tasks in most of the sentence-frame context literature, except that lexical decision tends to show larger overall effects and especially more inhibition of unrelated targets (see Stanovich & West, 1983).

Recently, Lucas, Tanenhaus, and Carlson (1987) have successfully used the lexical decision-naming task contrast to show that instrument inferences are coded in constructed text-level representations. The present data could be interpreted in terms of the same contrast if Experiment 7 were disregarded. That is, it could be claimed that the strong facilitation effects for nouns in noun contexts in the lexical

decision task reflect text-level integration (O'Seaghdha, in press), while the naming data reflect largely lexical influences. However, the statistical weakness of the relatedness effect in Experiment 4 suggested that this conclusion might be premature. Why should the frequently observed robust facilitation of semantically related congruent sentence completions not be replicated here? It turned out that the relatedness effect was nonsignificant in Experiment 4, significant but syntax insensitive in Experiment 5, and of the expected magnitude only in Experiment 7.

Resolution of the status of the naming task may be at hand if a contrast between sentence intrinsic and sentence external targets is taken into account. The lexical decision and naming tasks may validly be used to index different representations when, as in the Lucas et al. study, the probes are not continuations or completions of the sentences being indexed. However, the syntactically sensitive naming task may be a mercurial index when it is used to tap sentence intrinsic effects. This suggestion is supported both by the present results and by previous evidence that relatively minor changes in procedure can dramatically influence naming latency to sentence-completions. For example, slightly different procedures in Stanovich & West's (1979) Experiments 1 and 2 produced a jump from 15 to 111 msec of facilitation.

Conclusions In addition to the foregoing methodological considerations, several substantive conclusions can be drawn from the present data. First, although the nature of these processes requires further study, it appears that relatedness effects in both lexical decision (Experiments 1 to 3) and naming (Experiment 7) on sentence-completion targets can reflect processes of text integration. The mapping between performance on the tasks and on-line reading remains indeterminate. However, the fact that syntactic inhibition was observed in Experiment 4 when relatedness effects were virtually eliminated, suggests that syntactic assignment may be an obligatory process of a kind that syntactic-semantic integration is not.

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O' SEAGHDHA

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