Department of Psychology

Massachusetts Institute of Technology

Cambridge, Massachusetts 02139

Mary C. Potter

and

Judith F. Kroll

I. LEXICAL AND OBJECT DECISIONS
II. SYNTACTIC DISAMBIGUATION OF HOMOGRAPHS

Technical Report No. 10

January, 1979

Contract MDA 903-76-C-0441

Prepared for

Advanced Research Projects Agency
1400 Wilson Blvd.
Arlington, Virginia 22209

ARPA Order No. 3281
Amd. 1 and 2

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNCLASSIFIED

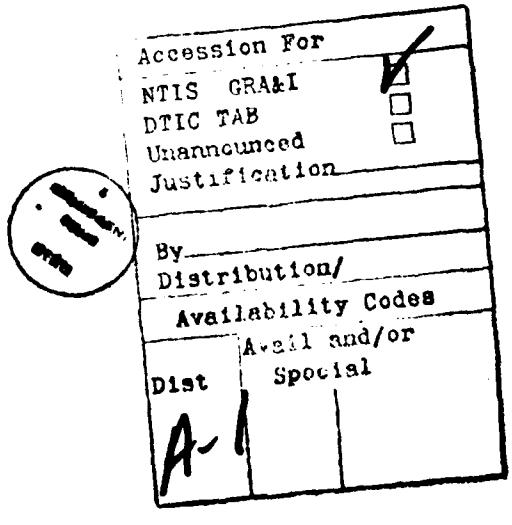
REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 10	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) I. LEXICAL AND OBJECT DECISIONS II. SYNTACTIC DISAMBIGUATION OF HOMOGRAPHS		5. TYPE OF REPORT & PERIOD COVERED Scientific Interim Report Oct. 1 - Dec. 31, 1978 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Mary C. Potter and Judith F. Kroll		8. CONTRACT OR GRANT NUMBER(s) MDA 903-76 C 0441
9. PERFORMING ORGANIZATION NAME AND ADDRESS Massachusetts Institute of Technology 77 Massachusetts Ave. Cambridge, MA 02139		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 3281 Amendments 1 and 2
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Supply Service - Washington Room 1D245, The Pentagon Washington, D.C. 20310		12. REPORT DATE January, 1979 13. NUMBER OF PAGES 33
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Information processing, verbal processing, pictorial processing, lexical retieval, priming, picture-word interaction, reading, perception.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Two sets of experiments are reported. In Part I, tests of speed of identification indicated that pictures and words can be identified equally fast, but a mixture of the two increases the difficulty of responding, especially to pictures. In Part II, the speeded selection of one pronunciation of an ambiguous word was influenced by a brief priming word that indicated the syntax (noun or verb) of the target word. The effectiveness of the selective prime was reduced when it was sometimes misleading, showing that its influence was not wholly automatic.		

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Table of Contents

Shorter versions of Parts I and II were presented as papers at the annual meeting of the Psychonomic Society, San Antonio, Texas. Part II was co-authored by Janell M. Schweickert. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the United States Government.



Report Summary

Objectives. The goal of the research program is to investigate speeded reading, speeded picture-recognition, and the interaction between pictures and words, both in immediate response to stimuli and in later recall or recognition.

Methods and Results. Part I reports the results of four experiments in which viewers made speeded decisions as to whether a picture represented a real object or a nonsense object, and whether a string of letters (such as heng) was a word or a pseudoword. The object decision task, first developed in our laboratory, permits a comparison of the speed of identification of words versus objects, and also allows an assessment of modality-specific versus modality-independent factors in identification. The results showed that object and word decisions are similar in the time they take and in the difference between more versus less frequent items. Both pictures and words show similar positive effects of semantic relatedness: two items from the same category (e.g., car and truck) are identified more rapidly than two items from different categories. When the viewer sees a mixed series of pictures and words, however, the "reality decision" is slowed down and errors increase, showing that the decision is not modality-independent. Consistent with that observation, repeating an item was more helpful when the modality did not change.

In Part II, the influence of minimal syntactic context on word identification was investigated. We measured time to begin to pronounce homographs - words that are spelled identically but have two or more distinct meanings. The class of homographs studied have one pronunciation when used as a verb (to wind) and another pronunciation when used as a noun (the wind). Presenting the word to or the 200 msec in advance of the target word strongly influenced which pronunciation subjects chose, without significantly changing response time. A second experiment showed that the biasing effect of the prime was greatly reduced when the syntactic prime produced an anomaly (the enter) on some trials. This result shows that viewers could ignore the prime when it was unreliable.

Conclusions and Implications for Further Research. The results of the experiments in Part I extend our earlier evidence for similarities in the immediate pro-

cessing of pictured objects and written names, but show that in some tasks a mixing of the two modalities may produce interference. Further research will be required to clarify the conditions under which interference occurs. The studies in Part II show that a minimal syntactic cue or prime presented a fraction of a second in advance of a word can exert a substantial influence on its interpretation. This result adds to current evidence that context may have an extremely rapid selective effect on subsequent identificaiton and response. Further work will attempt to uncover the processing stage or stages affected by a syntactic prime.

Part I

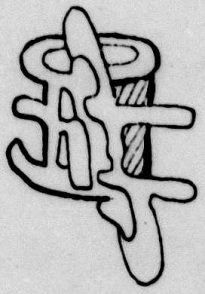
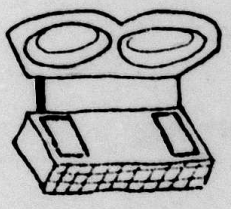
Lexical and Object Decisions: Accessing Memory for Words and Things

Mary C. Potter and Judith F. Kroll

In the lexical decision task subjects decide whether a string of letters forms a real word. This task has been used to indicate how words are read and lexical knowledge is stored (e.g., Coltheart, Davelaar, Jonnasson, & Besner, 1977; Forster & Chambers, 1973; Frederiksen & Kroll, 1976; Rubenstein, Lewis, & Rubenstein, 1971). We have devised a similar task to explore the way in which an object is recognized, which we have called the object decision task. In the object decision task subjects decide whether a line drawing depicts a real object. An example of the stimulus materials is shown in Figure 1.

We will describe a set of experiments in which performance in the object decision task was compared with performance in the lexical decision task. The goal of these experiments was to explore the relationship between modality-specific lexical and imagistic representations and amodal conceptual representations. Although lexical decisions presumably can be made without reference to conceptual memory, a substantial body of evidence suggests that the semantic properties of words are important in lexical decision (e.g., James, 1975; Meyer & Schvaneveldt, 1971) and that access to semantically related concepts proceeds automatically (Fischler, 1977; Marcel & Patterson, 1978). In lexical decision, this semantic component might reflect semantic knowledge stored in a word's lexical entry. Another possibility,

Figure 1. An example of stimulus materials for object and lexical decision tasks.

OBJECT DECISION	LEXICAL DECISION
	heng
	coat
	geison
	cat

however, is that the semantic component is contributed by a non-lexical conceptual system, a system that represents knowledge independent of input format. Pictures of objects, for example, activate conceptual knowledge as rapidly as words do, although pictures are notoriously slow to activate lexical entries, i.e., their names (Potter & Faulconer, 1975).

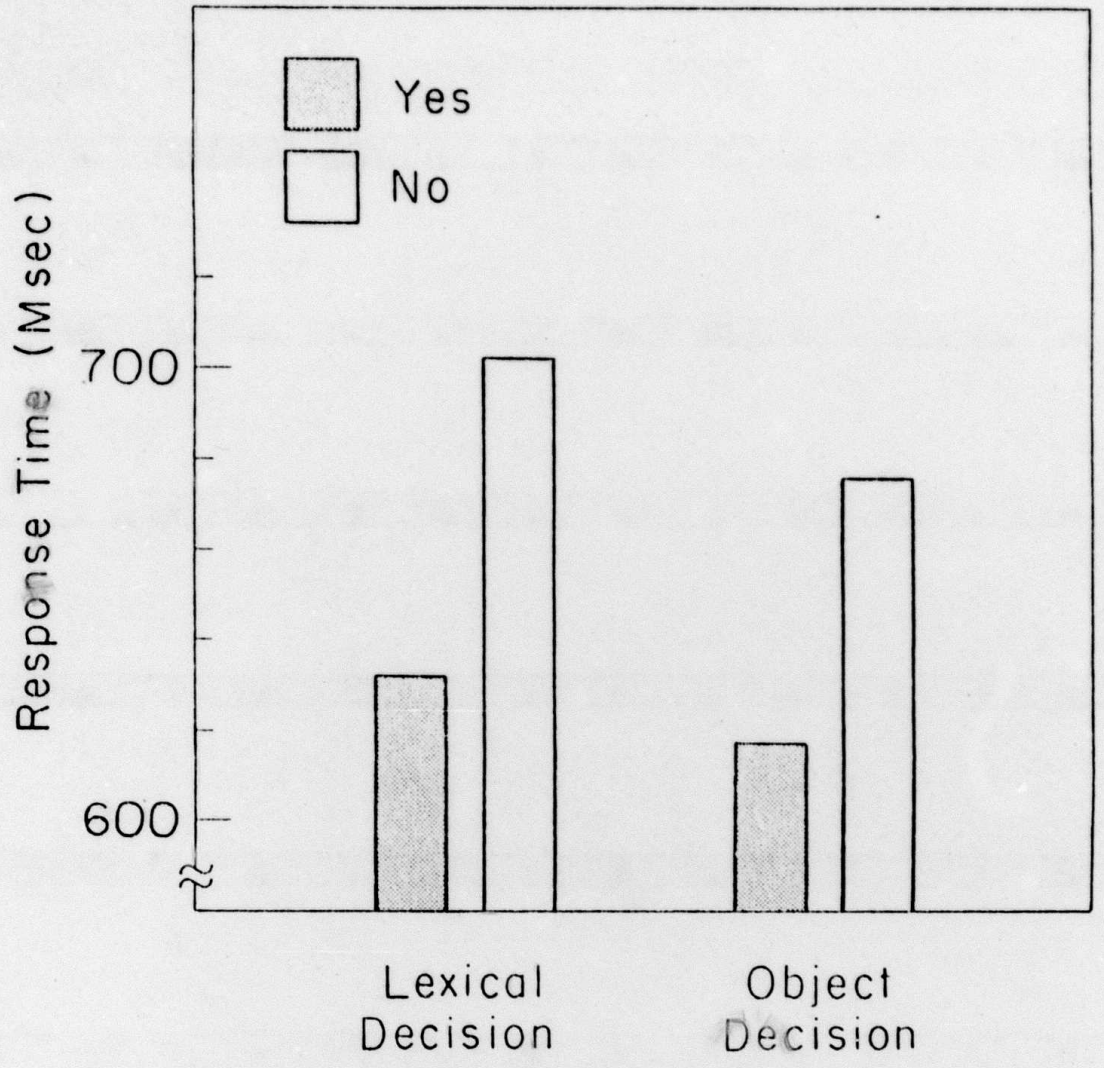
Before we explore these issues directly, we will describe a preliminary experiment in which separate groups of subjects performed the lexical and object decision tasks. These pure conditions were included as a baseline for later comparisons and as a measure of the overall difficulty of the picture task. The words used in the lexical decision task were the names of the objects pictured in the object decision task.

The materials in object decision were line drawings of 60 objects and 60 pseudo-objects similar to the set shown in Figure 1. The materials in lexical decision were the 60 words that named the objects and 60 pseudowords. The words ranged from three to eight letters in length. The words and pictures were chosen to represent a large number of different semantic categories.

In each task the items were presented for 500 msec. The subject responded by depressing one of two buttons to indicate "yes" or "no". Twenty practice trials were given prior to the experimental set. Twelve subjects performed the lexical decision task and twelve different subjects performed the object decision task.

Mean decision latencies for lexical and object decisions are shown in Figure 2. An overall analysis of variance showed that "yes" responses were faster than "no" responses in both tasks, but there was no interaction

Figure 2. Mean decision latencies (msec) for the lexical and object decision tasks.



between the modality of the task and the response. The error rate for each task fell below 5% and an analysis of variance performed on the few errors made supported the latency results.

The similarity of the reaction times (RTs) in the lexical and object decision tasks may, of course, be simply a coincidence since there is no a **priori** way of equating the peripheral difficulty of processing the pictures and words, or the difficulty in rejecting the distractors. To increase our confidence in the comparability of the tasks, we looked at the influence of word frequency on each decision. Comparing the 30 less frequent and the 30 more frequent words in lexical decision, there was a significant 35 msec advantage for the more frequent words. In object decision, the frequency effect, as indexed by the frequency of the object names, was a significant 24 msec for the same two groups of items. An analysis of variance indicated that the two frequency effects did not differ significantly.

The similar RTs, error rates, and frequency effects in the first experiment do not necessarily imply that lexical and object decisions are made on the basis of a common amodal representation. Each type of decision could be made on the basis of a modality-specific lexical or imagistic representation which reflects the overall familiarity of the stimulus word or object.

One way to discover whether a single conceptual representation is implicated in both lexical and object decisions is to see whether object decisions benefit from semantic facilitation. If the semantic facilitation

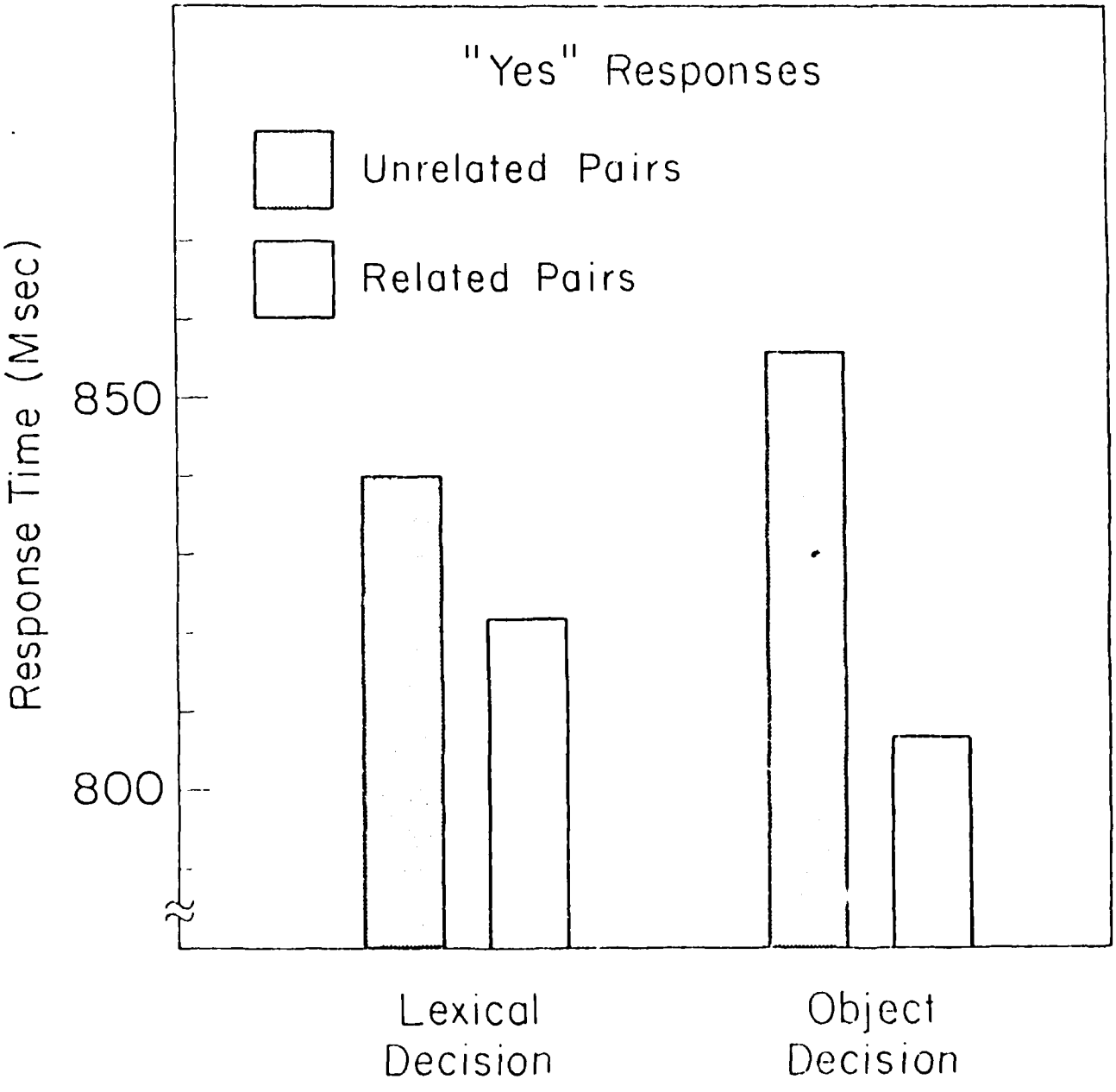
effect discovered by Meyer and Schvaneveldt (1971) in the lexical decision task is due to lexical organization and associations (i.e., associations specific to the lexicon), then we would not expect equivalent facilitation for related objects. In Experiment 2 we replicated the Meyer and Schvaneveldt semantic facilitation paradigm with both lexical and object decision.

The materials in Experiment 2 were similar to those previously described except that two items were presented simultaneously on each trial, one above the other. In the lexical decision task the subject decided whether both of the items were real words. If both were words the subject responded "yes"; if one was a word and the other a pseudoword, or if both were pseudowords, the subject responded "no". In the object decision task the subject decided whether both of the pictured items depicted real objects and responded "yes" if they did, and "no" if one was a real object and the other a pseudo-object, or if they were both pseudo-objects. Half of the positive items in each task consisted of semantically related items from the same superordinate category, and half of semantically unrelated items.

Sixteen subjects performed the lexical decision task and sixteen different subjects performed the object decision task. The only other change in procedure from Experiment 1 was that subjects responded by saying "yes" and "no" and the onset of their articulation was recorded.

Decision latencies for "yes" responses are shown in Figure 3 for unrelated and related stimulus pairs. The overall pattern of results is quite similar for lexical and object decisions; related pairs were judged to be real words or real objects faster than unrelated pairs.

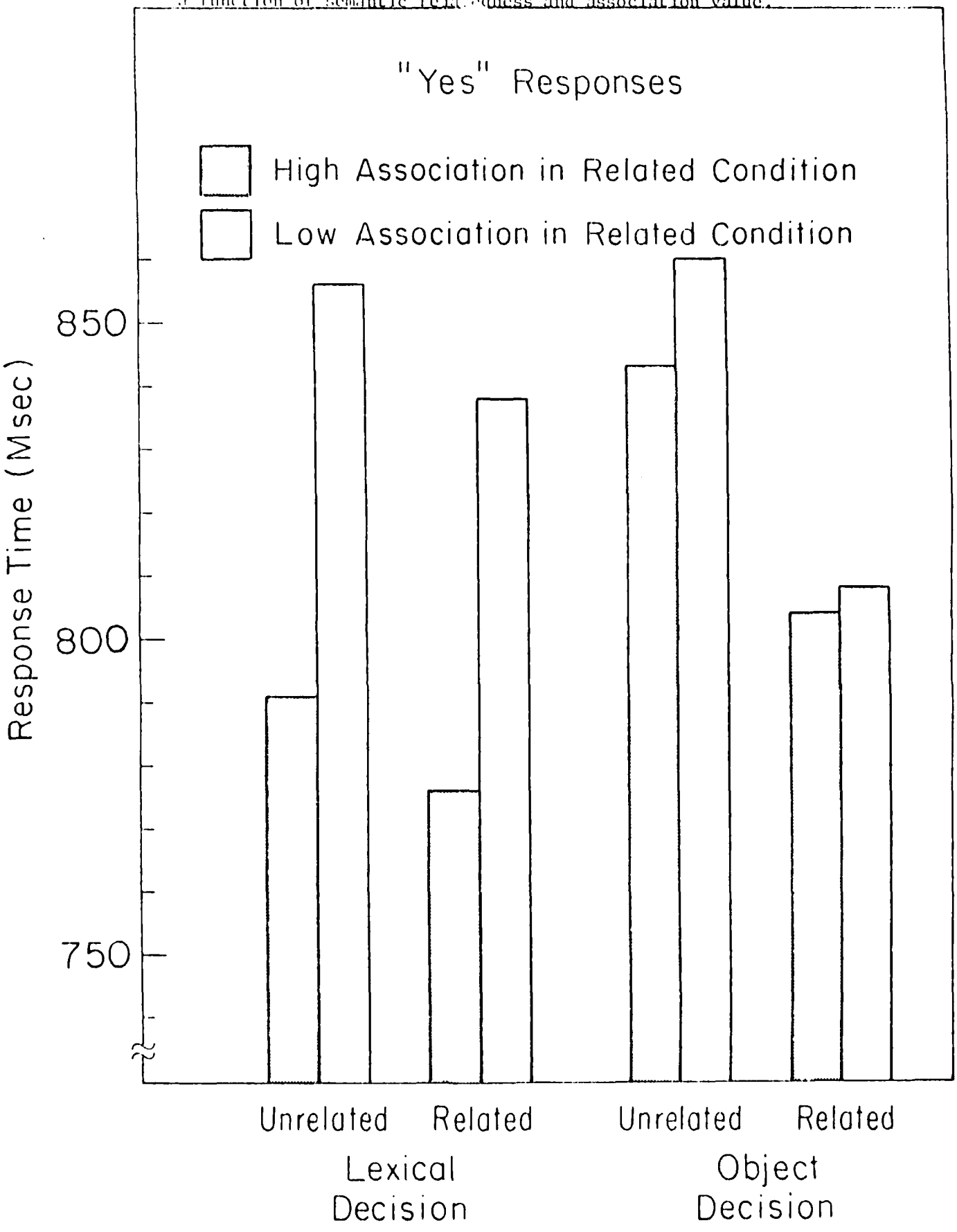
Figure 3. Mean decision latencies (msec) for lexical and object decisions as a function of semantic relatedness.



The magnitude of the relatedness effect, however, was larger for pictures (49 msec) than for words (18 msec). The fact that semantic facilitation occurs in object decision suggests that the source of semantic facilitation is not in the lexicon, but in an amodal conceptual system.

All of the related items in Experiment 2 were members of the same semantic category. A subset of those items, however, were also highly associated. A separate analysis was conducted to see whether the highly associated pairs produced more facilitation than pairs related only by same category membership. Since many of the highly associated pairs were also more frequent than the remaining related pairs, it was necessary to control for frequency effects by comparing the highly associated pairs with unrelated pairs drawn from the same pool of frequent words. The results of this analysis are shown in Figure 4 where latencies for lexical and object decisions are shown as a function of degree of association and relatedness. Note that in the unrelated condition, high and low association refer not to the relationsip between the unrelated words or pictures but to the set of words used to construct unrelated pairs. In lexical decision the highly associated pairs were accepted as real more rapidly than the semantically related but unassociated pairs. Notice, however, that the magnitude of facilitation for the highly associated pairs was the same for both related and unrelated condition. Thus, the apparent facilitation must be attributable to some characteristic of the highly associated words, probably their high frequency, rather than association value. The same result held for the object decision task except that

Figure 4. Mean decision latencies (msec) for lexical and object decisions as a function of semantic relatedness and association value.



the highly associated pairs were only slightly faster than the unassociated pairs. The failure to find associative facilitation replicates a previous finding by Fischler (1977) for the lexical decision task and further supports the idea that the source of semantic facilitation is not in a lexicon, sensitive to word-specific associations, but in an amodal conceptual system. Is it possible that lexical and object decisions are based entirely on output from the conceptual system?

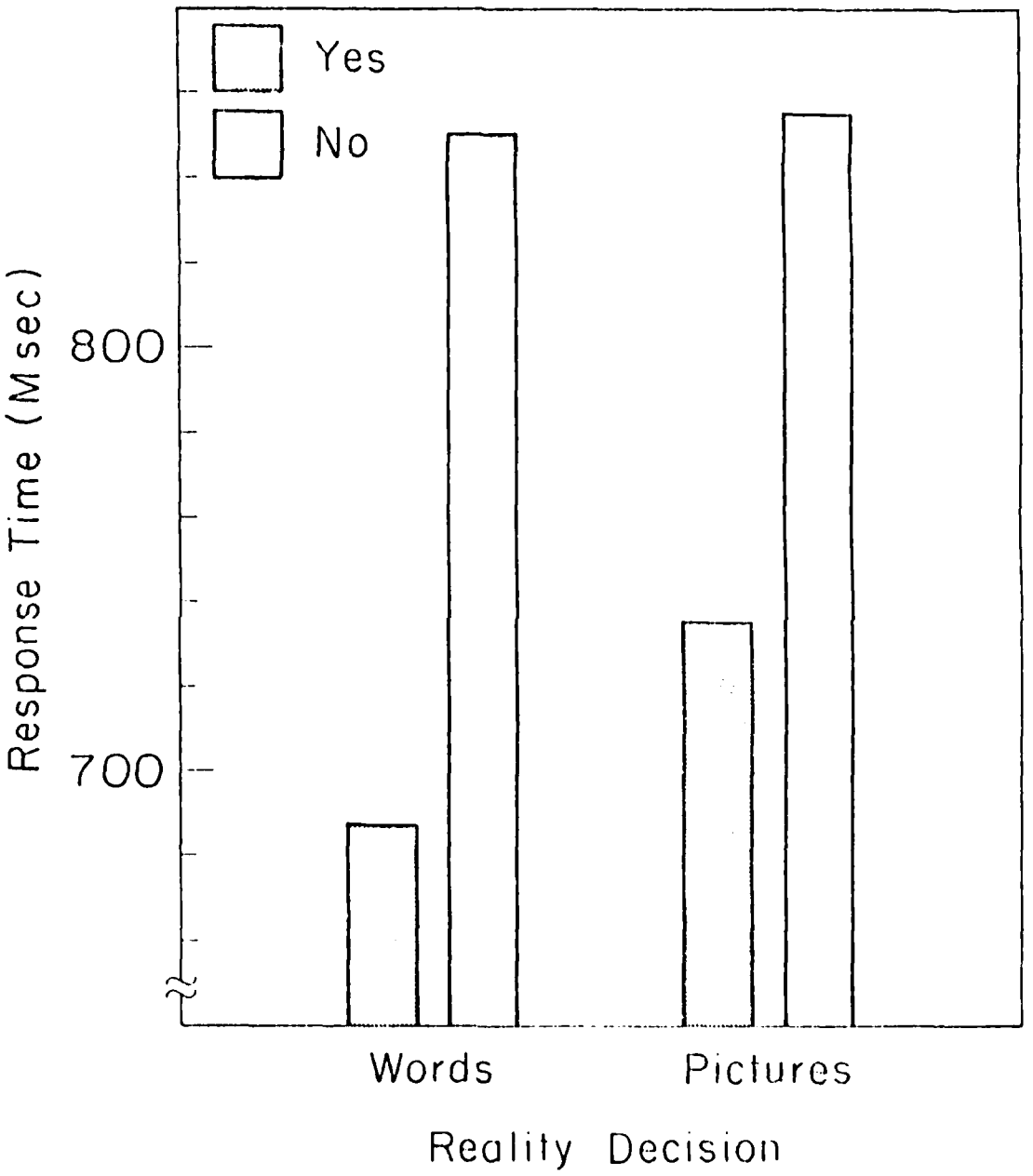
One way to test the degree to which lexical and object decisions rely on access to a common conceptual memory is to ask subjects to make reality decisions about mixed sequences of words and pictures. In the reality decision task subjects decide whether a given item is real, independent of its modality. If, in the previous conditions in which separate lexical and object decisions were required, the decisions about each modality depended on a common conceptual representation, then the time and accuracy needed to make mixed reality decisions should resemble the previous results.

Twenty four subjects performed the reality decision task. Except for the new instructions and mixed sequence of materials, the experiment was identical to the first experiment we described. Each subject received any given item in one modality only.

Figure 5 shows mean decision latencies for "yes" and "no" responses in reality decision as a function of the stimulus format. Compared with the tasks carried out separately, the reality decision task was markedly slower: 86 msec slower for the "yes" responses and 163 msec longer for the "no" responses. Moreover, the slowing effect was somewhat greater for pictures than for words.

The reality decision results make it clear that pure lexical and object decisions are not based solely on an amodal conceptual representation. If

Figure 5. Mean decision latencies (msec) for reality decisions about words and pictures.



they were based on a common representation such as the idea of the object, mixing pictures and words should have presented no difficulties. Recall that mixing words and pictures in other tasks that are clearly conceptual does not produce this sort of interference.

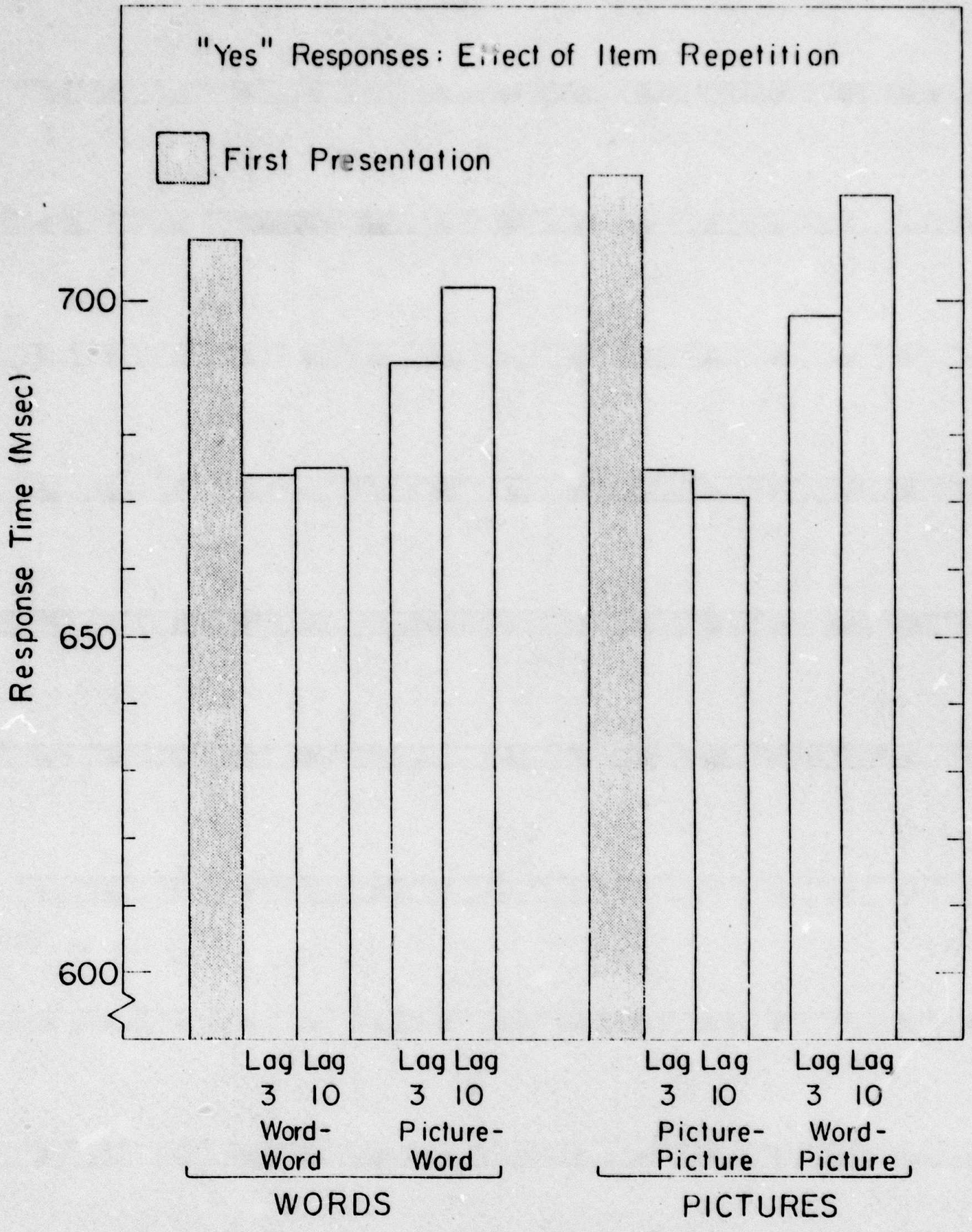
Should one conclude that a lexical decision is exactly what its name implies, a decision that a particular word exists in memory, and that an object decision is a decision that a particular visual shape exists in object-memory? If so, why did both types of decision show similar semantic or conceptual facilitation in Experiment 2?

The final experiment we will report more directly assessed the existence of a modality-independent component in lexical and object decisions. We used the repetition procedure of Kirsner and Smith (1974) and Scarborough, Cortese, and Scarborough (1977). Those investigators observed that lexical decision is faster the second time a given word is presented. If reality decision make use of conceptual representations, then we might expect some facilitation from repeating items across as well as within modality.

Subjects in Experiment 3 were again given reality decision instructions; they were told to expect a mixture of pictures, words, pseudowords, and pseudoobjects. Each item was repeated once during the course of the experiment. The repetitions occurred after three or ten intervening trials and were either in the same or in a different format as the initial presentation. There were 32 subjects.

Figure 6 shows decision latencies for repetitions of pictures and words in reality decision for "yes" responses. The shaded bars represent the time to respond "yes" to words and pictures on the first presentation. The unfilled bars represent the repeated presentations as a function of lag and

Figure 6. [illegible] decision latencies (msec) for reality decisions about words and pictures as a function of number of repetitions, modality of the repeated item, and lag between the first and repeated presentation.



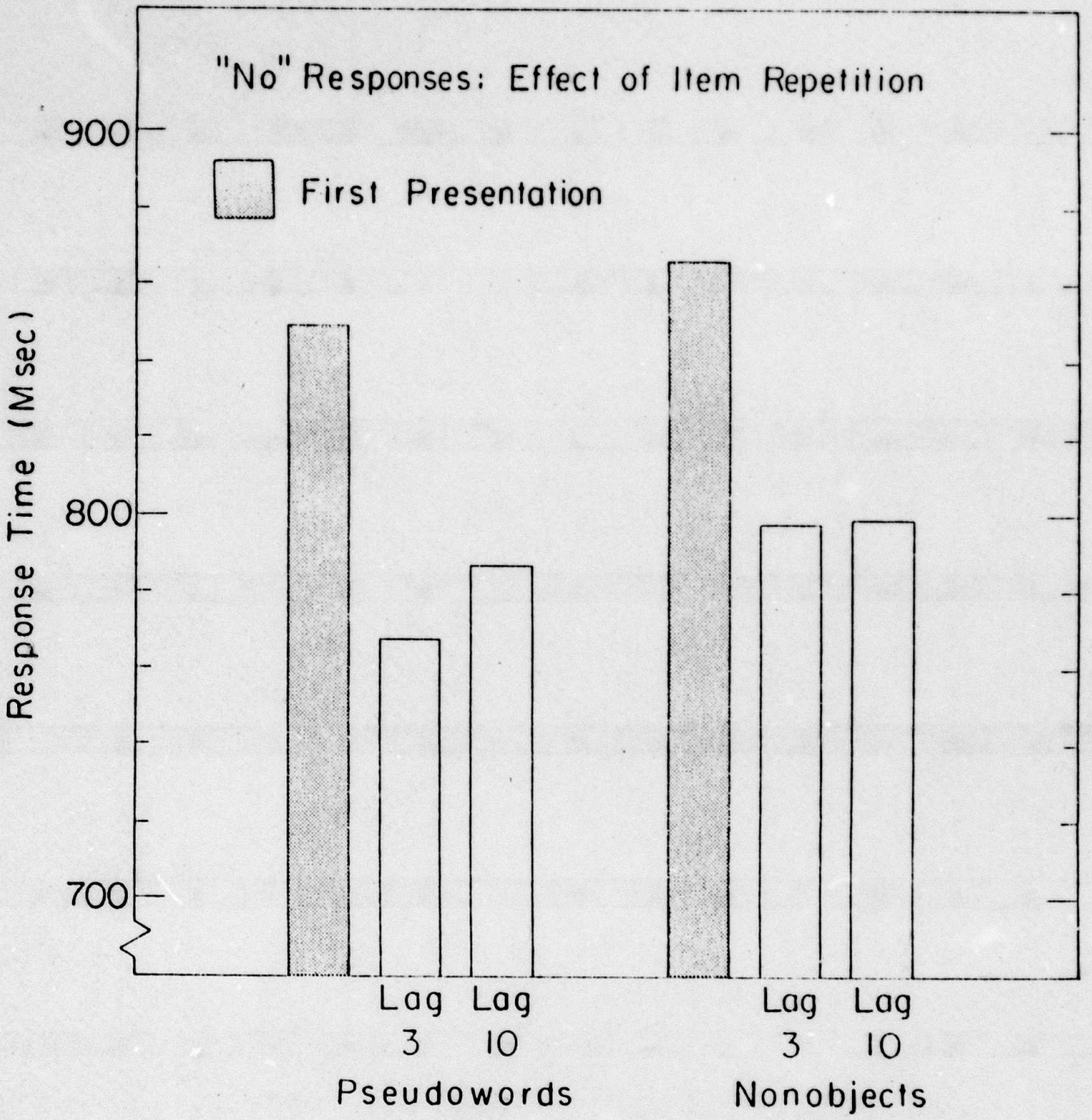
modality of the first and repeated presentations. There was a marked reduction of 40 msec in decision time on the second presentation when the same modality was repeated. The facilitation on cross modality repetitions was much smaller, approximately 20 msec with a lag of three items, and it virtually disappeared with a lag of ten items.

Scarborough etal. (1977) found that the repetition effect in lexical decision was almost as great when the case of a word was different on the second presentation, showing that the modality-specific facilitation is not just at the level of shape recognition. On the other hand, Kirsner and Smith (1974) found that changing from spoken to written words, or vice versa, reduced the repetition effect considerably. So it is not too surprising that a change from words to pictures (or the reverse) diminishes the repetition effect.

The repetition effect for negative trials is shown in Figure 7. Again, the shaded bars represent the first presentation of pseudowords and nonobjects. The size of the repetition effect was much larger for the "no" responses (approximately 60 - 70 msec) than it had been for the "yes" responses. There was a small effect of lag for the pseudowords with a bit more facilitation on second presentations after three trials than after ten trials. There was no effect of lag on the size of the repetition effect for nonobjects.

Altogether, these experiments show that the major component in a lexical or object decision is a modality-specific memory representation of the word or visual object, although a small amodal component probably exists. Whether it is this amodal conceptual component that is responsible for the semantic facilitation observed in Experiment 2 remains to be seen. An experiment now under way, in which semantic facilitation between words and pictures is measured, may answer that question.

Figure 7. Mean decision latencies (msec) for negative responses to pseudowords and nonobjects as a function of repetition and lag.



References

Coltheart, M., Davelaar, E., Jonnason, J.T., & Besner, D. Access to the internal lexicon. In S. Dornic & P.M.A. Rabbitt (Eds.), Attention and Performance VI. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Fischler, I. Associative facilitation without expectancy in a lexical decision task. Journal of Experimental Psychology: Human Perception and Performance, 1977, 3, 18-26. (a)

Fischler, I. Semantic facilitation without association in a lexical decision task. Memory & Cognition, 1977, 5, 335-339. (b)

Forster, K.I., & Chambers, S.M. Lexical access and naming time. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 627-635.

Frederiksen, J.R., & Kroll, J.F. Spelling and sound: Approaches to the internal lexicon. Journal of Experimental Psychology: Human Perception and Performance, 1976, 2, 361-379.

James, C. The role of semantic information in lexical decisions. Journal of Experimental Psychology: Human Perception and Performance, 1975, 104, 130-136.

Kirsner, K., & Smith, M.C. Modality effects in word identification. Memory & Cognition, 1974, 2, 637-640.

Marcel, A.J., & Patternson, K.E. Word recognition and production: Reciprocity in clinical and normal studies. In J. Requin (Ed.), Attention and Performance VII. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.

Meyer, D.E., & Schvaneveldt, R.W. Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of Experimental Psychology, 1971, 90, 227-234.

Potter, M.C., & Faulconer, B.A. Time to understand pictures and words. Nature, 1975, 253, 437-438.

Rubenstein, H., Lewis, S.S., & Rubenstein, M.A. Evidence for phonemic recoding in visual word recognition. Journal of Verbal Learning and Verbal Behavior, 1971, 10, 645-657.

Scarborough, D.L., Cortese, C., & Scarborough, H.S. Frequency and repetition effects in lexical memory. Journal of Experimental Psychology: Human Perception and Performance, 1977, 3, 1-17.

Part II

Syntactic Disambiguation of Homographs

Judith F. Kroll and Janell M. Schweickert

Understanding a written sentence involves at least three levels of analysis: (1) a lexical level where individual word meanings are accessed; (2) a syntactic level where relationships between the parts of the sentence established; and (3) a semantic level where a global meaning for the sentence is constructed. The study we will describe is concerned with interactions between the lexical and syntactic components of sentence processing. It tests the hypothesis that syntactic context may selectively bias the course of lexical access for individual words.

Recently, a great deal of attention has been paid to the effect of semantic context in biasing lexical access (e.g., Fischler, 1977; Neely, 1977; Meyer & Schvaneveldt, 1971). Minimal semantic contexts, in the form of single word primes, have been shown to influence lexical access even when subjects cannot report the context (Fischler & Goodman, 1978; Marcel & Patterson, 1978). Although some have argued that semantic facilitation effects in lexical access represent the operation of deliberate attentional strategies (e.g., Tweedy, Lapinski, & Schvaneveldt, 1976), others have shown that at least part of the facilitation can be attributed to the operation of automatic attentional mechanisms (e.g., Fischler, 1977; Neely, 1977). In light of the finding of semantic facilitation in lexical access, it seemed reasonable to ask whether similar effects could be obtained with minimal syntactic contexts.

It is difficult to isolate syntactic context effects in sentence processing; most sentences provide rich semantic as well as syntactic context. For this reason we decided to study lexical access for single words which were preceded by minimal syntactic contexts. If the time course of syntactic biasing resembles that for semantic biasing, then a briefly presented syntactic prime should be sufficient to direct access to lexical memory.

We asked subjects to name four types of words. Examples of each type are shown in Figure 1. Half of the words were ambiguous and half were unambiguous. The unambiguous words were either nouns or verbs. The ambiguous words were homographs which had one or two pronunciations. The homographs were syntactically and semantically ambiguous since they had different meanings in noun and verb forms. For one class of homographs the noun and verb forms were pronounced the same way (e.g., FALL). For the other class of homographs, the nouns and verbs were pronounced differently (e.g., WIND or WIND).

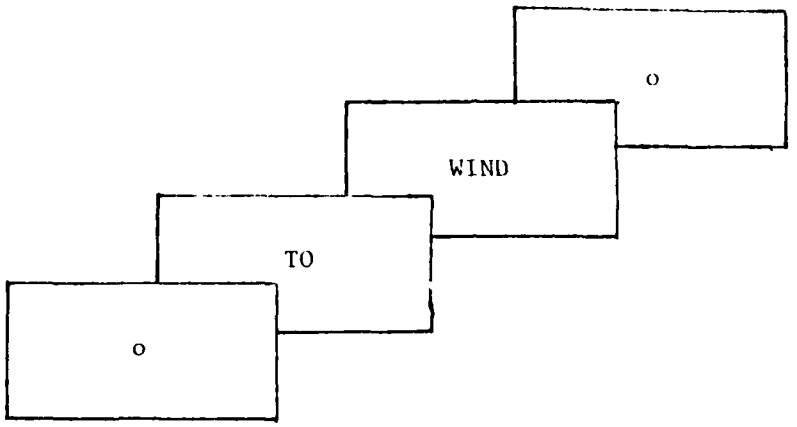
Each type of target word was presented tachistoscopically for 200 msec. Prior to the presentation of the target, a word priming the syntactic category of the target was presented. The duration of the priming word was also 200 msec and the target immediately followed the offset of the prime. The sequence of events as they appeared to a subject are shown in Figure 2. The word TO was used to prime verb targets and the word THE was used to prime noun targets. For the unambiguous targets, the prime was always reliable; the subject might see THE MAGNET or TO ENTER but never TO MAGNET or THE ENTER. For the ambiguous words the prime was

FIGURE 1: EXAMPLE OF STIMULUS MATERIALS

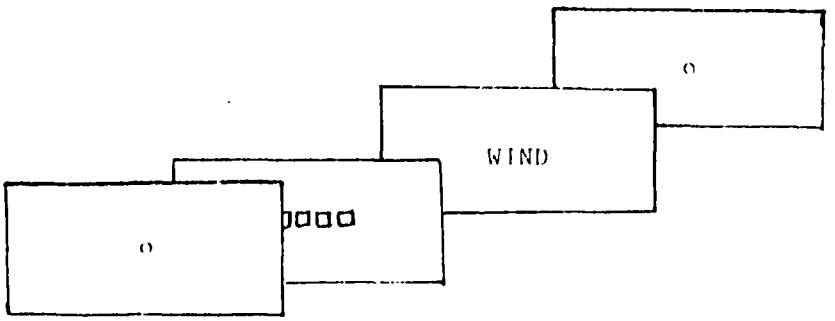
	UNAMBIGUOUS	AMBIGUOUS	
		NUMBER OF PRONUNCIATIONS	
		ONE	TWO
NOUN	MAGNET	FALL (THE SEASON)	WIND (A BREEZE)
VERB	ENTER	FALL (TO DROP)	WIND (TO TWIST)

FIGURE 2: SEQUENCE OF STIMULUS PRESENTATION

Prime Condition:



Noprime Condition:



also reliable 100% of the time since each prime correctly corresponded to one of the meanings of the homographs. Thus, TO FALL corresponds to the "to drop" meaning of fall, while THE FALL refers to the "season" meaning of fall. In the case of homographs with more than a single pronunciation, the choice of a prime becomes a bit more interesting since the syntactic category of the word determines its pronunciation. TO WIND meaning "to twist" has a distinct pronunciation from THE WIND meaning "a breeze." If subjects can make use of the syntactic context in the brief presentations of the words TO or THE, then we can use the disambiguation of pronunciations of words like WIND or WIND as an index of syntactic bias. If the primes cannot be used, then the pronunciation of these ambiguous words should following the underlying dominance. The relative dominance of different meanings had been previously determined for each target word.

Figure 2 also shows a control condition in which target words were preceded by neutral primes consisting of four empty squares. The control primes were presented in a single block of trials and the TO and THE primes were presented, randomly intermixed, in a different block of trials. Each target word was presented only once for each subject and the order of conditions and assignment of primes to ambiguous targets was counterbalanced across subjects. Twenty target words of each of the four types were presented. The four classes of words (unambiguous verb, unabiguous noun, ambiguous with one pronunciation, ambiguous with two pronunciations) were equated for overall word frequency and length as closely as possible.

Thirty two subjects performed the naming task. Each subject viewed half of the targets in the prime condition and half in the no prime control

condition. The subjects were instructed to name the target words as quickly as possible. The subjects were told that they should not pronounce the primes. Mean naming latencies to begin to articulate the target were recorded. All subjects' responses were tape recorded so that pronunciations could be accurately checked.

Mean naming latencies for each type of target word are shown in Table 1. An overall analysis of variance showed no main effect of priming and no interactions between priming and target condition. Thus, we will consider the naming times collapsed over the prime and no prime conditions. For the ambiguous words with two pronunciations note that two reaction times (RTs) are given: one for the time to pronounce the word as a noun and the other for the time to pronounce the word as a verb. There are three important points to be made about these data. First, for all of the four word types there were no significant RT differences between the priming and no priming conditions. This absence of an interaction means either that the primes did not influence processing, or, that the primes were used, but did not influence the time to begin an articulation. Second, the latencies to begin to pronounce words with multiple pronunciations were significantly longer than latencies to pronounce any other class of words. This difference cannot be attributed to ambiguity of meaning since naming times were as fast for homographs with single pronunciations as they were for the unambiguous words. Finally, unambiguous nouns were named a bit more rapidly than unambiguous verbs. The noun advantage also held for the homographs with two pronunciations in which case pronunciations of the noun form were faster than pronunciations of the verb form. Superficially, this result replicates a previous finding by Scarborough and Springer (1973) in which

TABLE 1: MEAN NAMING LATENCIES, EXPERIMENT 1

Primes 100% Reliable

	NO PRIME	PRIME		$\bar{X}$
		Verb pr.	Noun pr.	
UNAMBIGUOUS				
Noun (e.g. magnet)	626	---	632	629
Verb (e.g. enter)	637	645	---	641
AMBIGUOUS				
One Pronunciation (e.g. fall)	615	631	629	623
Two Pronunciations				
Noun (e.g. wind)	645	674	663	656
Verb (e.g. wind)	667	685	682	675

lexical decisions were reported to be approximately 30 msec faster for nouns than for verbs. A careful examination of the particular nouns and verbs used in the present study, however, indicated that different stress patterns may account for the apparent syntactic class difference. Nouns tended to be stressed on the first syllable more often than verbs.

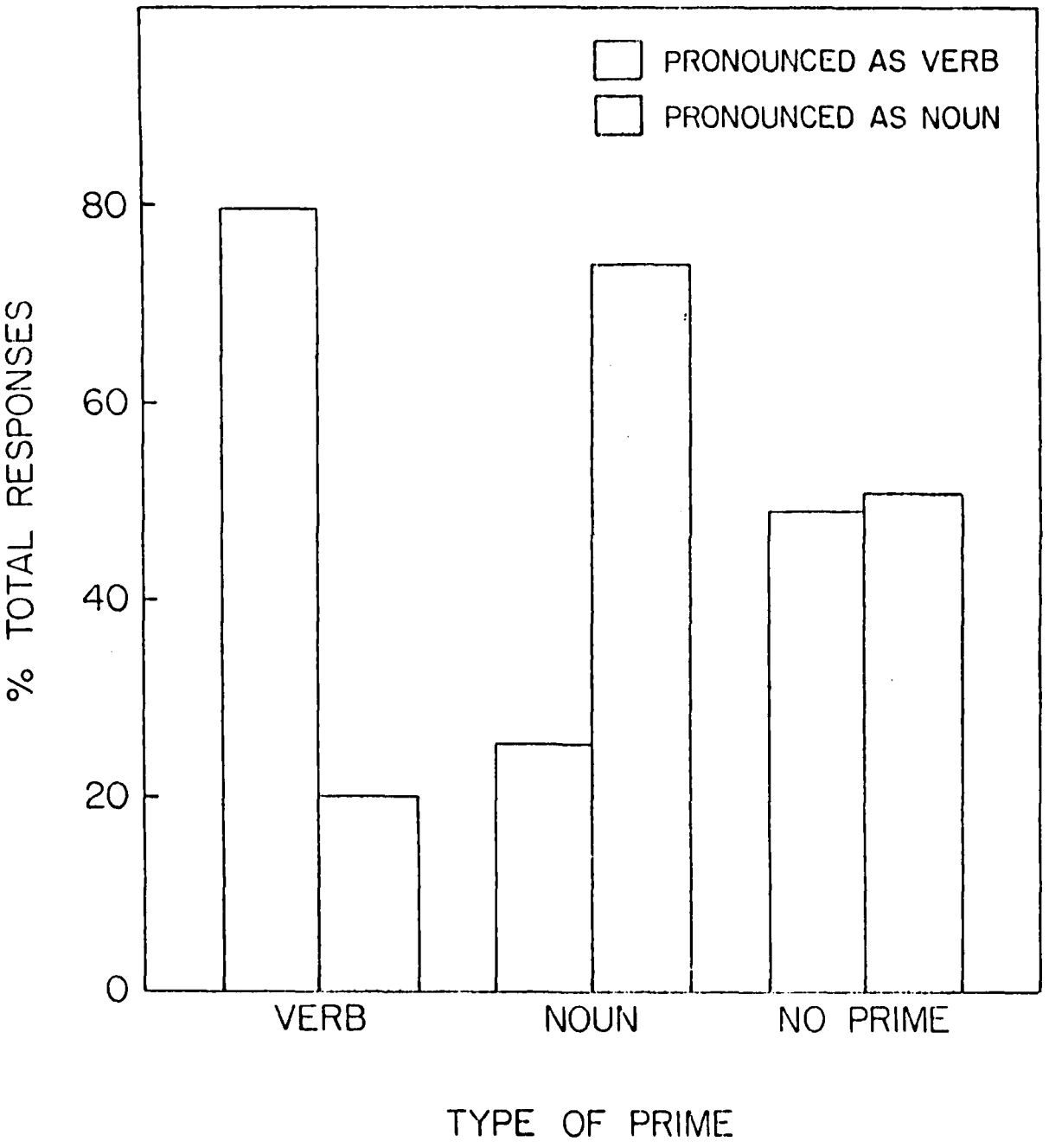
The latency data show no differences between the prime and no prime conditions. However, it would be premature to conclude that the primes had no effect on processing. We can also look at the pronunciations of the ambiguous words in the various priming conditions. We had tape recorded subjects' responses and independent judges decided whether individual responses to homographs with two pronunciations were pronounced as nouns or verbs. Figure 3 shows the distribution of responses for homographs with two pronunciations. The total responses were separated into the proportion pronounced as verbs and nouns for each priming condition. These data exclude errors which occurred on fewer than 6% of the trials. Although the previous analysis of reaction times indicated no overall effect of priming, the influence of syntactic primes is quite clear from the distribution of responses within each priming condition. When the verb prime TO was presented, the homographs were pronounced as verbs 80% of the time, and as nouns 20% of the time. When the noun prime THE was presented, the homographs were pronounced as nouns 75% of the time, and as verbs 25% of the time. When no prime was presented, they were pronounced as nouns and verbs equally often.

The main result of this experiment was that syntactic primes did not influence naming latencies but did influence pronunciations. At least two questions arise from these findings. First, did the syntactic primes affect lexical access or later decision making about pronunciations? Second,

FIGURE 3: EXPERIMENT 1

PERCENT OF TOTAL RESPONSES PRONOUNCED AS VERBS OR NOUNS AS A FUNCTION OF THE TYPE OF PRIME

(HOMOGRAPHS WITH TWO PRONUNCIATIONS)



was the priming effect we obtained mediated by automatic or deliberate attentional mechanisms? In the next experiment we attempted to address these questions by manipulating the reliability of the prime as a cue to the syntactic category of the target word. If the syntactic priming effect is under the control of deliberate attentional strategies, then a change in the reliability of the primes should produce a corresponding change in the magnitude of the syntactic biasing.

The second experiment was identical to the first with a single exception. Unambiguous nouns and verbs were preceded by an appropriate syntactic prime 50% of the time (e.g., THE MAGNET, TO ENTER) and by an inappropriate prime the remaining 50% of the time (e.g., TO MAGNET, THE ENTER). In all other respects the experiment was identical to the one just described. Sixteen subjects performed the naming task.

The mean naming latencies for the four types of target words in the prime and no prime conditions are shown in *Table 2*. Although the naming latencies are longer than those obtained in Experiment 1, the pattern of results is essentially the same. If we now examine the effect of priming with an inappropriate prime (e.g., THE ENTER or TO MAGNET) we see that there was no consistent cost when the syntactic information in the prime mismatched the syntactic class of an unambiguous noun or verb. This suggests that the use of the prime was indeed under the subject's voluntary control. When the information in the prime failed to signal the appropriate syntactic class the subject ignored it. If this account of the results in terms of deliberate attentional strategies is correct, then we might further expect that the ambiguous words with more than a single pronunciation would be pronounced according to the dominant meaning rather than the syntactic category suggested by the prime. *Figure 4* shows the distribution of

TABLE 2: MEAN NAMING LATENCIES, EXPERIMENT 2

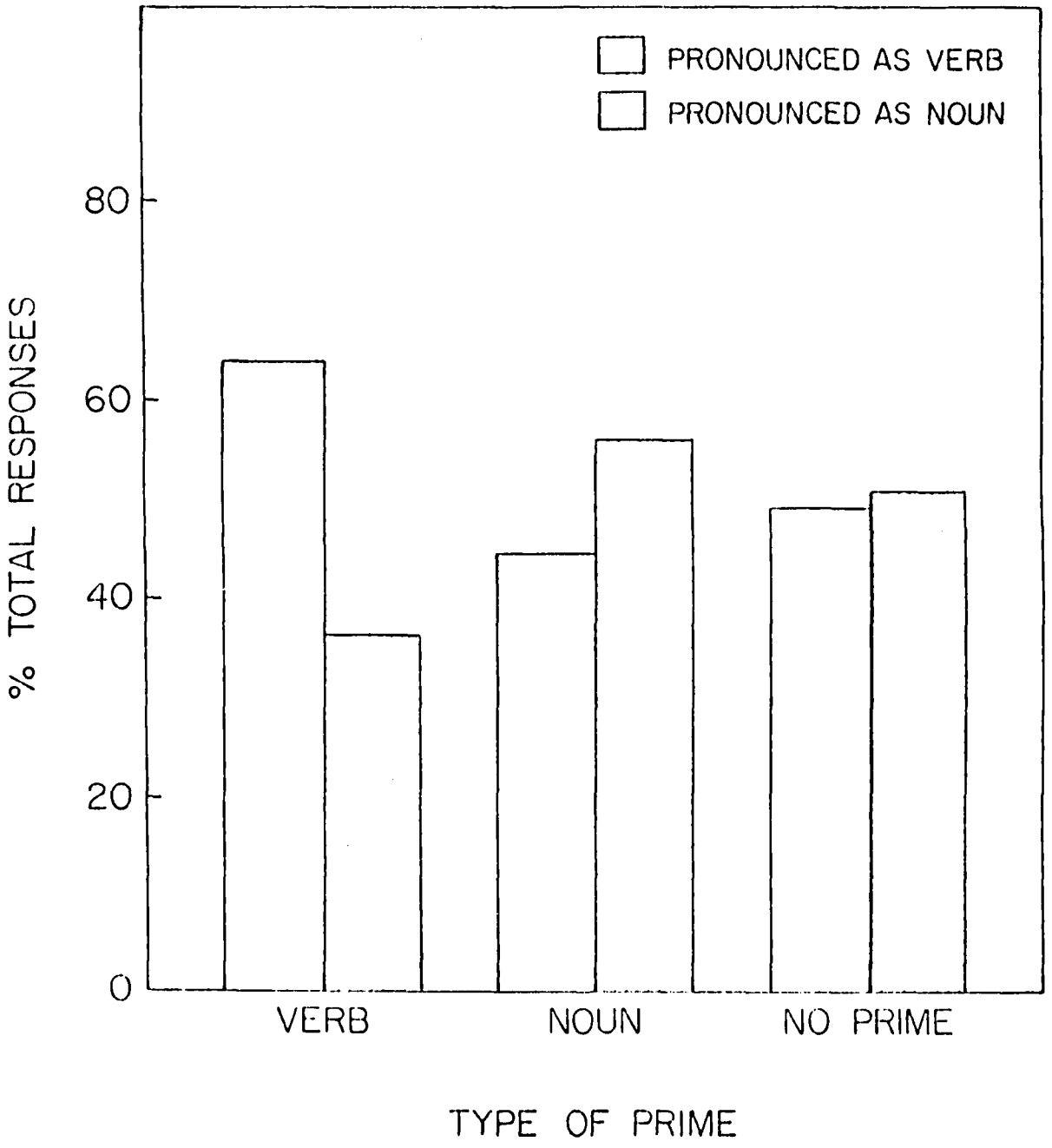
Primes 75% Reliable

	NO PRIME	PRIME		$\bar{X}$
		Verb pr.	Noun pr.	
UNAMBIGUOUS				
Noun (e.g. magnet)	678	701	691	687
Verb (e.g. enter)	686	719	737	707
AMBIGUOUS				
One pronunciation (e.g. fall)	646	685	681	665
Two pronunciations				
Noun (e.g. wind)	681	718	742	706
Verb (e.g. wind)	673	731	742	705

FIGURE 4: EXPERIMENT 2

PERCENT OF TOTAL RESPONSES PRONOUNCED AS VERBS OR NOUNS AS A FUNCTION OF THE TYPE OF PRIME

(HOMOGRAPHS WITH TWO PRONUNCIATIONS)



responses for homographs with two pronounciations. Again, the total responses were separated into the proportion pronounced as nouns and verbs for each priming condition. Although an analysis of variance indicated a significant interaction between pronounciations and the type of prime, it is clear that this effect is greatly reduced from the one obtained in Experiment 1 (see Figure 3). Recall that the primes in Experiment 2 were unreliable for 50% of the unambiguous words. Thus, subjects may have attended to the primes on some small proportion of trials.

The preliminary results of the two experiments we have described suggest that syntactic context biases decisions about pronunciations rather than lexical access, and is under the control of deliberate rather than automatic attentional mechanisms. Further experiments we have planned will explore the implications of these results for understanding words in richer sentence contexts.

References

Fischler, I. Associative facilitation without expectancy in a lexical decision task. Journal of Experimental Psychology: Human Perception and Performance, 1977, 3, 18-26.

Fischler, I., & Goodman, G.O. Latency of associative activation in memory. Journal of Experimental Psychology: Human Perception and Performance, 1978, 4, 455-470.

Marcel, A.J. & Patterson, K.E. Word recognition and production: Reciprocity in clinical and normal studies. In J. Requin (Ed.), Attention and Performance VII. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.

Meyer, D.E., & Schvaneveldt, R.W. Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of Experimental Psychology, 1971, 90, 227-234.

Neely, J.H. Semantic priming and retrieval from semantic memory: Roles of inhibitionless spreading activation and limited-capacity attention. Journal of Experimental Psychology: General, 1977, 106, 226-254.

Scarborough, D. & Springer, L. Noun-verb differences in word recognition. Paper presented at the 14th annual meeting of the Psychonomic Society in St. Louis, November, 1973.

Tweedy, J.R., Lapinski, R.H., & Schvaneveldt, R.W. Semantic-context effects on word recognition: Influence of varying the proportion of items presented in an appropriate context. Memory & Cognition, 1977, 5, 84-89.