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Contextual priming effects in perceptual identification

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The proportion of contextually related priming pairs was manipulated in a perceptual identification task to determine the relative contributions of automatic and controlled processes to performance. Subjects studied a set of sentences and then identified prime-target pairs consisting of (1) two words from the same studied sentence (related context), (2) two words from different studied sentences (unrelated context), or (3) a nonword prime and a word from a studied sentence (neutral context). When the identification test list included a high proportion of contextually related pairs, facilitation for related-context pairs and inhibition for unrelated-context pairs were observed relative to comparable nonstudied pairs. In the low-proportion condition, performance was unaffected by the proportion manipulation. Based on these results, we argue that contextual effects in perceptual identification reflect the operation of controlled processes.

There is substantial evidence that prior experimental presentation of words can promote better perceptual identification of those words in a subsequent test (e.g., Jacoby, 1983; Jacoby & Dallas, 1981; Jacoby & Witherspoon, 1982). Jacoby and colleagues argued that this facilitation in performance is largely due to enhanced perceptual fluency for the previously experienced items, with perceptual fluency being essentially related to the sensory properties of the words. Sensory-based perceptual fluency appears to be the major process underlying perceptual identification performance when the situation involves relatively unorganized lists of independent words during initial exposure and later test. However, Jacoby also speculated that semantic processes can contribute to perceptual identification performance in cases in which contextual factors are available to support such meaning-related processes. For example, Jacoby (1983, Experiment 1) demonstrated that perceptual identification varies as a function of the proportion of old words in the test list. In addition, Franks, Plybon, and Auble (1982) found that identification is enhanced by sentential contexts. These are two cases in which contextual, semantic processes contributed to overall performance.

Jacoby (1983) alluded to possible relationships between the distinction of perceptual fluency and contextual processes and the popular distinction of automatic versus controlled processes (see Posner & Snyder, 1975), but preferred to develop a different theoretical approach. In the present study, we examined perceptual identification from the perspective of automatic versus controlled processes. The question was how contextual, semantic factors contribute to perceptual identification performance. Appropriate contextual relations could invoke automatic or controlled processes, or both, either of which could facilitate identification. The procedures for this experiment were adapted from Ratcliff and McKoon (1978). In their work, subjects were presented with a set of sentences and were subsequently given a recognition reaction-time test for a list of words, some of which were old words that had appeared in the sentences, whereas others were new words. Reaction times were faster for old words that followed other old words from the same clause or sentence. On the basis of subsequent experiments, Ratcliff and McKoon (1981) concluded that these priming effects are due to automatic processes.

A method that is typically used to differentially manipulate automatic versus controlled processes involves varying the proportion of target items that instantiate the relation that is of central interest. For example, Ratcliff and McKoon (1981, Experiment 1) varied the proportion of appropriate priming pairs in the recognition test. The degree of priming observed should be affected by this proportion manipulation if priming is at least partially a function of controlled processes. Automatic processes should not be affected by this manipulation. Ratcliff and McKoon found that the latter was the case. On the other hand, as previously mentioned, Jacoby (1983) varied the proportion of old words in a perceptual identification test and found a trade-off in identification of old versus new words as a function of this manipulation, that is, evidence for controlled processes. In the present study, we employed a variation of the Ratcliff and McKoon paradigm with a perceptual identification test. We manipulated the proportion of contextually appropriate priming pairs in order to assess the relative contributions of automatic and controlled processes to perceptual identification.

METHOD

Design

For the study, a 2 (proportion of related test pairs: high/low) × 2 (type of target word: old/new) × 3 (type of prime: related/unrelated/neutral) × 2 (experimental phase: one/two) design was used. High versus

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low proportion of related contexts is a between-subjects factor that varies the proportion of cases in which the words in a prime-target pair occurred in the same acquisition sentence. Old versus new target is a within-subjects factor referring to whether or not a target word actually appeared in a prior acquisition sentence. Type of prime is a within-subjects factor in which a prime is a word that occurred in the same sentence as its target, a word that occurred in a different sentence from its target, or a nonword letter string that is neutral in its relation to the target. Phase 1 versus Phase 2 is a within-subjects factor that refers to the fact that the experiment is conducted as two replications differing only in details of the instructions.

Subjects

Subjects were 48 undergraduates enrolled in introductory psychology courses at Vanderbilt University, with 24 subjects each assigned to the high- and low-related conditions.

Materials

The experimental session was conducted in two phases. Each phase consisted of a presentation of 12 acquisition sentences followed by a perceptual identification test that contained both old and new words. The sentences were obtained from a pool of 255 sentences used by Ratcliff and McKoon (1978). All sentences were of the following form: Noun1 Verb1 Noun2 Conjunction Noun3 Verb2 Noun4. An example sentence is "When the pioneer felled the oak the branch crushed the wagon." Overall, 48 sentences were used in the experiment, with sentences and test words counterbalanced across all four experimental factors.

Perceptual identification test lists were constructed from the pool of 192 nouns appearing in the 48 sentences (4 nouns per sentence). Each test list contained 48 pairs of words, divided among six different types of prime-target pairings. Three types of pairs consisted of old prime and target words: related context (RC), unrelated context (UC), and neutral context (NC) pairs. Primes and targets of RC pairs were taken from the same proposition of an acquisition sentence (e.g., *pioneer* and *oak*). In contrast, UC pairs were composed of a prime from one acquisition sentence and a target from a different acquisition sentence (e.g., *pioneer* and *charity*). The prime of an NC pair consisted of a string of random letters, eight characters in length; the second member of the pair was an old word. Three comparable types of new word pairs (RC new, UC new, and NC new) were generated by counterbalancing old and new items across subjects. Note that the labels RC, UC, and NC for new items refer only to what these items would have been if their corresponding sentences had been presented during acquisition. Pairs were pseudorandomly ordered so that all pair types were evenly distributed throughout the list.

In the high-related context condition, the frequencies of old word pair types were as follows: RC = 12, UC = 4, and NC = 8. The frequencies of old pair types in the low-related context condition were as follows: RC = 4, UC = 12, and NC = 8.

In addition to the test pairs, there were 6 practice pairs and 48 new, nonexperimental word pairs that were used for determining subjects' baseline identification performance rates and for providing subjects with practice on the task. For each subject, 16 of the practice pairs had random letter primes.

Procedure

The sequence of procedures was as follows: perceptual identification familiarization trials, Phase 1 acquisition and identification test, and Phase 2 acquisition and identification test. Each subject was tested individually in a 1-h session.

All stimuli were presented on a Zenith PC-150 monitor. Six practice trials were presented, followed by the 48 familiarization trials. The familiarization and test trials were initiated by the experimenter. For each trial, the experimenter said "Ready" to inform the subject that the trial was about to begin. A fixation point (asterisk) appeared on the screen for 150 msec. Next, the asterisk was replaced by the prime for 1,000 msec. Then a brief blank interval of 20 msec occurred, followed by presentation of the target word for approximately 50 msec. Finally, a pattern mask replaced the target word for 200 msec. The screen was then cleared, and the subject attempted to identify each member of the pair in order of appearance.

Following the familiarization trials, Phase 1 of the experiment was administered. Twelve sentences were presented individually for 20 sec each during acquisition. The subject was asked to rate the sentences for comprehensibility and to study them for later recall. A perceptual identification test followed acquisition. Prior to these test trials, the subject was told that some of the words to be presented would be words that had appeared in the acquisition sentences. He/she was instructed to use the acquisition information to help identify the words. No additional information about the test list was provided. Following these instructions, a test list of 48 prime-target pairs was presented.

Phase 2 of the experiment was very similar to Phase 1 except for differences in instructions. Depending on the proportion condition to which a subject had been assigned, the respective proportions of RC old and UC old pairs were described to the subject prior to the identification test trials. For example, subjects in the high RC group were told that (1) if the prime word was from an acquisition sentence, most of the time the target would be from the same sentence, and (2) in the few cases where the target word was not from the same sentence, it would be an old word from a different sentence. All subjects were told that if the first word was a new word, the second word would also be a new word. Finally, in the case of a random letter string prime, subjects were told that the target would be either an old word or a new word with equal probability. Subjects were encouraged to use any strategies that they thought would be helpful, given this additional information about the test list.

RESULTS AND DISCUSSION

The primary data of interest are the mean proportions of correctly identified target words, conditionalized on correct identification of the prime. The prime was misidentified in only a very small percentage (<1%) of all test trials. The data were analyzed in a 2 (high-related context/low-related context) × 2 (old/new) × 3 (RC/UC/NC pair types) × 2 (Phase 1/Phase 2) mixed ANOVA. The means for the first three factors collapsed across phases are presented in Table 1. Also presented are the adjusted means that result when performance on the initial familiarization trials is taken out as a covariate. Performance of the low-related context group was superior to that of the high-related context group on these trials, possibly reflecting preexperimental differences in base rates for identification performance. The essential pattern of results can be seen more clearly in these adjusted means.

There was strong evidence for enhanced perceptual identification of previously presented words with a highly significant main effect for old versus new words [$F(1,46) = 89.95$, $p < .001$]. The main effect of pair type was significant [$F(2,92) = 6.08$, $p < .01$], but, more important, this variable interacted with both the old versus new factor [$F(2,92) = 4.38$, $p < .02$] and the high- versus low-related context factor [$F(2,92) = 5.98$, $p < .01$]. Also, the three-way interaction among these factors approached significance [$F(2,92) = 2.72$, $p = .07$]. The remaining main effects and interactions involving these factors were nonsignificant at the .10 level. Overall, the pattern of results is clear and verified by particular comparisons.

In the high-related context condition, old RC targets were identified better than were old NC targets, which were in turn identified better than old UC targets. That is, when a high proportion of the old pairs were from the

Table 1
Mean Proportion of Words Correctly Identified as a Function of the Proportion of Related Context Pairs in the Test List

Proportion Condition	Context and Pair Type											
	RC-Old		UC-Old		NC-Old		RC-New		UC-New		NC-New	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
High RC	.67	.19	.42	.32	.50	.25	.38	.17	.33	.29	.37	.26
Adjusted Mean	.71		.46		.53		.42		.37		.41	
Low RC	.61	.30	.59	.24	.63	.24	.40	.31	.42	.22	.42	.23
Adjusted Mean	.57		.55		.59		.36		.38		.38	

Note—RC = related context; UC = unrelated context; NC = neutral context. Adjusted means are derived by taking out identification performance on familiarization trials as a covariate.

same sentence, identification of targets following related primes was facilitated, whereas identification of targets following unrelated primes was inhibited [$t(92) = 2.88$, $p < .01$, and $t(92) = 1.67$, $p < .05$, respectively]. This combination of facilitation and inhibition indicates that semantic contexts can influence perceptual identification and suggests that this influence is due to controlled, rather than automatic, processes. This conclusion is supported by the results for the low-related context condition. In this case, performance did not differ among the old RC, UC, and NC pairs. If automatic processes based on semantic contexts were affecting perceptual identification, RC pairs should have shown facilitation relative to the UC and NC pairs. Since this was not the case, it appears that context effects in perceptual identification rely on controlled processes. As would be expected, there were no significant differences in performance among the new pairs.

The main effect of experimental phase was significant [$F(1,46) = 6.17$, $p < .02$], as was the phase × high- versus low-related context interaction [$F(1,46) = 5.16$, $p < .03$]. Means from this interaction indicate that there was a decline in identification rates from Phase 1 to Phase 2, which appeared primarily in the low-related context condition. It may be that the additional instructions presented prior to Phase 2 negatively affected overall performance in this condition. If so, the processes underlying this effect are not clear since phase (and, by implication, the instructional manipulation) did not interact with the old versus new and the pair type variables. More important, since the latter interactions were not significant, this decrement in the low-related context condition does not equivocate the previous conclusions regarding controlled processes.

Overall, we suggest the following account of the present findings. In agreement with Jacoby (1983), we suggest that perceptual fluency based on sensory information can enhance perceptual identification of words. In addition, contextual relations established during acquisition can influence perceptual identification performance if reinstated at the time of test. These contextual effects seem to be the result of controlled processes applied to the products of the prior perceptual processes.

Finally, our results do not coincide with those obtained by Ratcliff and McKoon (1981), who manipulated the proportion of related context items in a recognition reaction-time task. A context facilitation effect was obtained across variations in the proportion manipulation, the size of the effect remained unchanged as the proportion of related context items increased, and the facilitation was not accompanied by inhibition. Ratcliff and McKoon (1981) concluded that contextual priming effects are based on automatic processes. There are numerous methodological differences between the two studies that might have contributed to these contrasting results. Two differences seem especially salient. For each acquisition-test trial, we presented substantially larger sets of acquisition sentences and longer test lists, and, of course, used a perceptual identification test. Ratcliff and McKoon presented smaller acquisition and test sets and used a recognition reaction-time test. In comparison to our procedures, their acquisition/test conditions may have allowed more active maintenance of information in working memory, with the demonstrated automatic processing effects being contingent on such activation. An alternative possibility is that identification and recognition require quite different judgments involving different processes, with contextual relations having different functional properties in the two cases. Such speculations await resolution in future research.

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