Fluent Identification of Repeated Words

Michael E. J. Masson
University of Victoria
Victoria, British Columbia, Canada

Lawrence Freedman
Department of Psychology
Mississauga Hospital
Mississauga, Ontario, Canada

We propose that fluent identification of a repeated word is based on a form of episodic memory for the context-specific interpretation applied during the word’s initial processing episode. In a lexical decision paradigm, fluent responses to repeated words were associated with a change in decision bias rather than perceptual sensitivity. Repetition effects were reduced or eliminated when the context word accompanying a repeated homograph was changed so that a different meaning was implied. A context-sensitive repetition effect was also obtained when repeated homographs served as context words for nonrepeated targets, suggesting a role for integral processing of context and target. In a word naming paradigm, repetition effects showed a weaker and different form of context sensitivity and were obtained even when the initial presentation was auditory, did not require articulation, or involved a visually dissimilar letter string (e.g., krooze for cruise). These results are taken as support for an account of long-term repetition effects that emphasizes episodic memory for context-specific interpretations of a word.

Despite the high level of word identification skill possessed by literate adults, a single presentation of a familiar word is capable of significantly enhancing the fluency with which that word is identified on a second presentation occurring seconds or minutes later. This word repetition effect has been demonstrated using a number of classic word identification procedures including lexical decision (Forbach, Stanners, & Hochhaus, 1974; Scarborough, Cortese, & Scarborough, 1977), word naming (Scarborough et al., 1977), and perceptual identification (Jacoby & Dallas, 1981; Winnick & Daniel, 1970). Moreover, the influence of a word’s presentation is maintained over hours or days (Jacoby, 1983a; Jacoby & Dallas, 1981; Scarborough et al., 1977). Enhanced fluency produced by a single presentation is surprising from the perspective of theories of lexical access in which it is assumed that lexical entries are stable and not lastingly influenced by single episodes (e.g., Morton, 1969). Neither is the effect expected by theories of skill development in which high level of skill is characterized by very slight changes in performance due to additional experience (Anderson, 1982; Crossman, 1959; Logan, 1988).

One theoretical account of the word repetition effect is based on the assumption that presentation of a word is capable of inducing activation of its lexical representation and that this activation is more persistent than previously envisioned (Forbach et al., 1974; Monsell, 1985; Morton, 1979). Increased activation of a lexical entry makes it more accessible when the corresponding word is repeated, but this does not constitute a permanent change in the lexicon. This view has encouraged use of the word repetition paradigm as a tool in studying the morphological organization of the lexicon (Fowler, Napps, & Feldman, 1985; Stanners, Neiser, Hernon, & Hall, 1979).

An alternative view is that enhanced fluency through repetition is produced partly (Feustel, Shiffrin, & Salasoo, 1985; Salasoo, Shiffrin, & Feustel, 1985) or completely (Jacoby, 1983a; Jacoby & Brooks, 1984; Jacoby & Dallas, 1981) as a result of a newly created episodic representation of a word’s occurrence. In sharp contrast with the activation view, this perspective treats paradigms that yield repetition effects as methods of exploring the nature of episodic memory, particularly memory for operations applied during word identification (Jacoby, 1983b; Jacoby & Hayman, 1987).

There is a body of evidence to suggest that the activation view has merit, at least with respect to its emphasis on the lexical interpretation of a repeated word. It has been shown that in lexical decision and perceptual identification, presentation of a word will facilitate later identification of morphologically but not orthographically related words (Fowler et al., 1985; Kirsner, Dunn, & Standen, 1987; Murrell & Morton, 1974; Stanners et al., 1979). Further, in a study involving the two visually distinct Serbo-Croatian alphabets, Feldman and Moskovljevic (1987) demonstrated that changing the alphabet across a word’s two presentations did not influence the repetition effect. In their review of a number of studies of repetition effects in visual lexical decision and perceptual identification, Kirsner and Dunn (1985) concluded that an initial auditory (as opposed to visual) presentation of a word typically attenuated but did not eliminate repetition effects. These results are consistent with an account of repetition effects in lexical decision and perceptual identification that includes sustained activation of the lexical referent of a visual pattern.

Some of the basic assumptions of the activation view, however, have been called into question. First, activation of a lexical unit, either by word repetition or by semantic priming, should be fundamentally the same process. The difficulty...
is that a number of clear dissimilarities have emerged between these two mechanisms of activation: (a) Semantic priming effects are short-lived (Dannenbring & Briand, 1982; Foss, 1982; Gough, Alford, & Holley-Wilcox, 1981), whereas repetition effects are persistent (Jacoby & Dallas, 1981; Scarborough et al., 1977); (b) in lexical decision and word naming tasks, the effects of word repetition and semantic priming are additive, rather than underadditive as would be expected if both procedures involve activation of the same lexical representation (den Heyer, 1986; den Heyer & Benson, 1988; den Heyer, Goring, & Dannenbring, 1985; Durgunoglu, 1988; Simpson & Kellas, 1989: Wilding, 1986); and (c) different patterns of event-related potentials are associated with semantic priming and word repetition (Rugg, 1987).

Second, a number of theories of lexical access assume a stable, frequency-sensitive search order of the lexicon, with high-frequency words accessed first (Becker, 1979; Forster, 1976). Word repetition appears to undermine this system because word frequency effects are attenuated when items are repeated (Jacoby, 1983a; Jacoby & Dallas, 1981; Scarborough et al., 1977). Consequently, Forster and Davis (1984) have claimed that the long-term word repetition effect is a product of episodic memory, rather than lexical activation. To support this contention, they showed that the word frequency effect was maintained when a word was masked on its first presentation to minimize the formation or accessibility of an episodic representation.

The ascription of repetition effects to episodic memory does not resolve the issue of which aspects of a processing episode contribute to enhanced fluency. Jacoby and his colleagues (Jacoby, 1983b; Jacoby & Dallas, 1981; Jacoby & Hayman, 1987) have obtained convincing evidence that specific visual experience with an item improves later identification. But it appears that processes operating across various physical manifestations of a word also make a contribution, as indicated by the repetition effects produced with morphologically related items, visually dissimilar alphabets, and cross-modal presentations discussed earlier. In addition, the joint effects of word frequency and input modality on repetition effects suggest a role for modality-independent processes. Using lexical decision and perceptual identification paradigms, Kirsner and his colleagues (Kirsner, Milech, & Standen, 1983; Kirsner, Milech, & Stumpfel, 1986) found that attenuation of the word frequency effect was observed only in the modality-independent component of the repetition effect—that is, when comparing new items to old items previously experienced in a different modality. The modality-specific component, assessed by comparing old items previously experienced in the same versus different modality, did not involve alteration of the word frequency effect.

Although available evidence supports the view that one component of long-term repetition effects is based on modality-independent processes, the nature of this component remains unclear. For example, it may be the case that cross-modal repetition effects emerge as a result of forming an image of a printed word in response to its auditory presentation (Jacoby & Witherspoon, 1982). This kind of explanation, however, is not plausible for morphological and cross-alphabet repetition effects. Alternatively, the modality-independent component may involve sustained activation of a generic lexical entry, as advocated by Fowler et al. (1985), Stanners et al. (1979), and others. As noted earlier, however, there are significant problems with this view. In addition, this approach requires postulation of two qualitatively different memory systems to account for the modality-dependent episodic memory and independent (semantic memory) components of repetition effects.

We prefer a view, similar to that expressed by Jacoby and his colleagues (Hayman & Jacoby, 1989; Jacoby, Baker, & Brooks, 1989; Jacoby & Brooks, 1984), that emphasizes memory for specific processing episodes as the basis for repetition effects. We propose that fluent reprocessing of a stimulus is a result of recruitment and reapplication of procedures applied to identical or similar stimuli in the past (Kolers, 1979; Kolers & Roediger, 1984). Recruitment does not always take the form of conscious and individuated recollection of episodes but may occur automatically through interaction with a stimulus and may be applied without awareness during stimulus processing. Memory for a prior episode is content-addressable in the sense that it can be engaged simply by exposure to relevant stimuli and tasks. Related claims about the recruitment of memory for specific episodes have been made in theories of categorization (Medin, 1986), comparative judgments (Kahneman & Miller, 1986), and automaticity (Logan, 1988).

An important issue from our perspective is the nature of the recruited operations that contribute to fluent identification in the word repetition paradigm. Our view is that aspects of word identification that are supported by many prior experiences will be executed with a high level of skill and will not be susceptible to significant improvement when a word is repeated. The vast experience normal readers have with identification of words in a variety of alphabetic styles suggests that the source of repetition effects probably does not lie with visual analysis of the word. Therefore, it is not surprising that repetition effects are sustained across changes in type case or script (Feustel et al., 1983; Levy, Newell, Snyder, & Timmins, 1986) and alphabetic system (Feldman & Moskovitch, 1987). On the other hand, the use of unfamiliar type fonts produces repetition effects that are highly sensitive to changes in a word's visual pattern (Jacoby & Hayman, 1987; Kolers, 1975; Masson, 1986).

We claim that operations responsible for developing a conceptual interpretation of a word are critically implicated in word repetition effects found in paradigms involving normally printed, whole words. Contrary to the view that repetition effects arise from sustained activation of a stable lexical entry, however, we argue that a word's interpretation varies significantly across contexts and that repetition effects depend on reestablishing a word's original encoding context. Rather

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1 With respect to the issue of context-dependent interpretations of words, we have in mind something like Kintsch's (1988) construction-integration model of text comprehension, in which a word's interpretation is determined by the surrounding text. This is assumed even for words with single dictionary definitions and supposedly single lexical entries.
than producing sustained activation of a logogen, the initial encoding of a word creates an episodic memory of the encoding operations, and memory for those operations will be invoked on a later presentation only if a similar context and, therefore, a similar interpretation is established. By this view, repetition effects will be reduced or disappear if a word's encoding context is significantly varied across presentations. Jacoby (1983a, 1983b) has obtained two results by using a perceptual identification task that can be interpreted from this perspective. First, repetition effects were reduced when the proportion of repeated items in a test list was 10% rather than 90%. By including a greater proportion of old words in the test list, the original encoding context was more faithfully reconstructed. Second, repetition effects were not observed for items that were generated in the context of their antonyms and later tested in isolation. Rather than taking this result as evidence for the contribution of data-driven operations to enhanced perceptual identification, we view it as a signature of the context-dependent recruitment of memory for operations.

We report two sets of experiments designed to provide support for the ideas advanced here. We chose to study the lexical decision and word naming tasks, primarily because of the rich knowledge base available concerning the influence of context on word identification in these tasks and concerning the differences between the tasks regarding constituent processing operations.

Experiments 1-3: Lexical Decision

In the first three experiments our goal was to establish the critical contribution of conceptual processing operations to repetition effects observed in the lexical decision task. In Experiment 1 a signal detection analysis was applied to separate the possible influence of enhanced perceptual sensitivity to the visual features of previously presented words from the contribution of interpretive operations applied to the perceptual evidence derived from visual analysis. In Experiments 2 and 3 the powerful effects of manipulating context to change a word's interpretation were explored by using homographs.

Experiment 1

The purpose of Experiment 1 was to establish that repetition effects in the lexical decision task are not based on operations responsible for low-level visual analysis (e.g., feature extraction and identification), but rather can be attributed to processes responsible for constructing a conceptual interpretation of a word. The strategy, similar to that used by Ratcliff, McKoon, and Verwey (1989), was to frame the effect of repetition on lexical decision in terms of signal detection theory. This approach allows independent assessment of the influence of prior exposure on sensitivity and bias. Changes in sensitivity resulting from prior exposure would imply improvement of visual analysis.

A modified lexical decision task was used in which targets appeared briefly and were masked to reduce lexical decision accuracy. In the first phase of the experiment a duration threshold was set for each subject whereby performance on the masked lexical decision task was approximately 70% correct. In the second phase, subjects performed a standard lexical decision task. Words from this phase were then used in the masked lexical decision task, either in identical form or with one letter changed to produce a nonword foil (e.g., table was changed to tube). A set of new words and nonwords was included in the masked lexical decision task as well. If repetition effects are produced by improved visual analysis, they should be expressed as increased perceptual discrimination between a repeated word and a visually similar foil. On the other hand, if prior exposure influences processes that interpret the results of visual analysis, repetition effects should appear as a shift in decision bias.

Method

Subjects. The subjects were 24 University of Victoria students who were native speakers of English and who volunteered to participate in the experiment. Volunteers were informed of their rights as participants (e.g., the right to withdraw from the experiment at any time) and at the end of the session were shown a summary of their performance and given an explanation of the purpose of the experiment.

Materials. A set of 48 words and 48 pronounceable nonwords was selected for use in determining each subject's 70% threshold duration for the masked lexical decision task. Two additional items of each type were selected for use as practice items at the beginning of the second phase of the experiment. In addition, 120 words were selected for use as critical items in the second and third phases. The critical items ranged in frequency from 83 to 247 per million with a mean of 129.1, according to the Kucera and Francis (1967) norms. A pronounceable nonword was derived from each critical word by changing one interior letter. These word–nonword pairs were grouped into four lists of 30 to allow counterbalanced assignment to conditions, as discussed below. Finally, 60 pronounceable nonwords were produced for use as filler items in the second phase of the experiment. All items were five or six characters in length.

Procedure. Subjects were tested individually, and instructions and stimuli were presented via an Apple II+ microcomputer equipped with a green video monitor. When viewed from a distance of 40 cm a four-letter word on the monitor subtended a visual angle of 1.2°. The computer was modified to synchronize presentation of stimuli with the raster scan cycle on the monitor. This allowed presentation durations to be set as multiples of 16.7 ms, the length of a raster scan cycle. Stimulus durations will be reported here to the nearest millisecond.

In the first phase of the experiment, subjects were presented with a series of 96 trials in which a briefly presented letter string was followed by a mask, and the task was to determine whether the string was a word. Each trial began with the word READY printed in the middle of the screen. The subject pressed one of three horizontally arrayed buttons on a button box to erase the warning signal. After a 500-ms pause, a letter string briefly appeared at the center of the screen, then was replaced by a mask consisting of random pattern of dots that occupied 10 character positions. The subject pressed one of two buttons, labeled YES and NO, to indicate his or her decision. After the response, the READY signal for the next trial appeared. The 96 trials consisted of four blocks of 24 trials each. Within each block 12 words and 12 nonwords, randomly chosen without replacement from the pool of items assigned to this phase of the experiment, were presented in random order. The duration of the letter string was 83 ms during the first block and was reduced by one raster scan cycle.
after each block. The duration for the final block was 33 ms. On the basis of accuracy in each of these blocks of trials, a duration was chosen for use in the third phase of the experiment that most closely approximated 70% correct.

In the second phase of the experiment, subjects were given a standard lexical decision task consisting of four practice trials (two words and two nonwords) followed by a randomly ordered sequence of the 60 filler nonwords and 60 of the critical words. The set of critical words consisted of two of the 40-item sets of critical words. On each trial a warning signal consisting of a set of four plus signs appeared in the center of the screen for 500 ms, followed by a 250-ms blank interval. A letter string then appeared in the center of the screen and remained until the subject pressed one of the response buttons. A button press caused the letter string to be erased, and the next trial started automatically.

In the final phase of the experiment there were 120 trials conducted in the same manner as the first phase, except that the duration selected for an individual subject was used on all trials. Subjects were instructed to decide whether each letter string was a word and to press the appropriate button as soon as a decision had been made. The items used in this phase were (a) the words from one of the lists shown in Phase Two, (b) the nonwords associated with the words from the other list used in Phase Two, (c) the words from one of the remaining lists, and (d) the nonwords from the other remaining list. This set of four items constituted a factorial combination of two variables: prior or no prior experience, and word or nonword. Of course the nonwords with prior experience had not actually been seen in Phase Two, but their visually similar word counterparts had been. Assignment of the four lists of critical items to these four conditions was counterbalanced across subjects. A summary of the procedure is shown in Table 1.

Results

On the basis of performance in the first phase of the experiment, subjects were assigned a duration of either 33, 50, or 67 ms (ns = 7, 11, and 6, respectively) for exposure of letter strings in the masked lexical decision task. Mean response times on the standard lexical decision task in the second phase of the experiment were consistent with typical findings (616 ms for words and 779 ms for nonwords). Two aspects of the data from the masked lexical decision task in the third phase of the experiment were important: response time and accuracy.

The mean time taken to make correct responses is shown in Table 2. The means for repeated items were based only on items to which correct responses were made in the second phase of the experiment (97.3% of the items). Across the entire set of 24 subjects, an additional six trials (0.2%) were excluded because response time exceeded a criterion of 5,000 ms. The remaining data were submitted to an analysis of variance with lexical status (word, nonword) and repetition (repeated, nonrepeated) as factors. Type I error rate was set at .05, as in all other analyses reported here. For the sake of brevity, nonwords in the repeated condition will be referred to as repeated nonwords, although it was actually a visually similar word that appeared in the second phase. Words were responded to more quickly than nonwords, F(1, 23) = 57.77, MS\text{e} = 32,233, and there was a significant interaction, F(1, 23) = 5.17, MS\text{e} = 16,090, although the main effect of repetition was not reliable. A simple effects analysis of the interaction indicated that repeated words were identified faster than new words, F(1, 23) = 20.44, MS\text{e} = 4,225, but there was no repetition effect for nonwords (F < 1).

The error rates from the masked lexical decision task are also shown in Table 2. Although subjects were more accurate on repeated than on nonrepeated words, they were less accurate in their responses to nonwords when an item was repeated. This trade-off was examined by using a nonparametric signal detection analysis (Grier, 1971; Pastore & Scheirer, 1974), which does not assume that signal and noise distributions are normally shaped and of equal variance. The measure of sensitivity, A', takes a value of .5 when hit and false alarm rates are equal (chance performance) and 1.0 when performance is perfect. The decision criterion measure, B*, is larger when a higher criterion is in effect and ranges from −1.0 to 1.0. This analysis was applied separately to data from repeated and nonrepeated items. Hits were defined as correctly identifying a word as such, and false alarms were defined as incorrectly claiming that a nonword was a word.

The mean A' and B* values obtained in the repeated and nonrepeated conditions are shown in Table 2. Separate analyses of variance with repetition as the only factor were applied to the accuracy and the decision criterion scores. There was no effect of repetition in the accuracy data (F < 1), but the mean decision criterion was significantly lower among repeated items, F(1, 23) = 7.75, MS\text{e} = 0.025.

The results presented here showed that subjects had access to a long-term memory system which mediated lexical decisions...
Discussion

The reaction time data in the masked lexical decision task replicated the usual word repetition effect (Forbach et al., 1974; Scarborough et al., 1977), but the signal detection analysis clearly indicated the observed enhancement was not attributable to changes in perceptual sensitivity. Initial exposure to a word instead served to reduce the amount of evidence needed to claim the item was a word when it reappeared under visually degraded conditions. This result is consistent with the findings reported by Jacoby (1983a) for a perceptual identification task and by Ratcliff et al. (1989) for a forced-choice word identification task. In Jacoby’s case, a signal detection analysis was not applied, but enhanced perceptual identification performance was ascribed to a bias to give old words as a response. The strength of this bias shifted as conditions governing the retrieval of prior encoding episodes changed (e.g., the percentage of old items in the test list). In the Ratcliff et al. experiments, the first exposure to repeated items occurred in the context of a sentence. It might be argued that their failure to find a repetition effect on sensitivity was due to the lack of data-driven processing applied to words appearing in context (Jacoby, 1983b). In the present experiment, words appeared in isolation, but still the influence of prior occurrence was expressed as a change in decision criterion rather than perceptual sensitivity, as indicated by formal application of signal detection theory.

These results support the conclusion that repetition effects in the lexical decision task are not based on perceptual operations such as feature extraction and identification. A viable alternative is that enhanced lexical decision speed is a consequence of conceptual processes. For example, the change in decision criterion might be caused by a lowered threshold for activation of the logogen representing the repeated word (Morton, 1969). Alternatively, an episodic memory of the word’s initial occurrence might be brought forward by either a repetition of the word or the presentation of a visually similar nonword (Jacoby, 1983a). The selected episodic memory, although not necessarily available to consciousness, might enhance the fluency of processing the repeated item in the sense that the operations included in the retrieved memory might be reapplied in the current context.

It could be argued that conclusions drawn from the data-limited version of the lexical decision task used in Experiment 1 may not apply to the standard lexical decision task in which targets are clearly visible. For example, when faced with degraded word displays, subjects might rely on some form of guessing strategy to guide their responses, and this would tend to emphasize response biases rather than perceptual sensitivity. There are a number of counterarguments in favor of the view that changes in perceptual sensitivity had a fair chance to be expressed and that the obtained results may be generalized to standard lexical decision tasks. First, subjects were not merely guessing, because their accuracy levels were clearly above chance. Second, even when performance is so near chance that subjects believe they are guessing, their responses are significantly influenced by the results of perceptual processing (Cheesman & Merikle, 1984; Greenwald, Klinger, & Liu, 1989). Third, the rationale behind signal detection analysis is to provide independent assessment of sensitivity and bias, so that wide variations in response criterion have no influence on sensitivity. Finally, the pattern of response time data from the data-limited lexical decision task are strikingly similar to the pattern observed in the standard task, including the observation of greater reduction in response time to repeated words than to repeated nonwords (Forbach et al., 1974; Scarborough et al., 1977). Nevertheless, part of the goal of Experiment 2 was to provide converging evidence for the claim that fluent lexical decisions about repeated words arise from processes that interpret perceptual evidence rather than from improved visual analysis.

Experiment 2

Our view of long-term repetition effects emphasizes the contribution of conceptual processes responsible for interpreting visual patterns. We do not, however, embrace the notion that activation of invariant lexical representations produces long-lasting fluency effects. Our objective is to find evidence for the role of context-dependent episodic memory for particular experiences in producing repetition effects. If the long-term repetition effect in the lexical decision task is based on a form of episodic memory, it should, like other expressions of episodic memory, be sensitive to changes in context. In fact, repetition effects have been shown to be sensitive to at least five kinds of context. Long-term repetition effects in lexical decision are reduced or eliminated if the initial task performed with an item involves a recognition decision or simply reading it (Forster & Davis, 1984; Ratcliff, Hockley, & McKoon, 1985). Repetition effects in lexical decisions with prime–target pairs are reduced when elements of the pairs are reassigned (den Heyer, 1986). When words initially appear in the context of a sentence or text and then are tested with lexical decision, perceptual identification, or fragment completion, repetition effects are eliminated or significantly attenuated (Levy & Kirnser, 1989; MacLeod, 1989; Oliphant, 1983). The repetition effect in perceptual identification is enhanced if a large proportion of items in the test list consists of previously presented words (Jacoby, 1983a) or if the perceptual context in which an item appears is repeated (Whittlesea & Brooks, 1988).

In Experiment 2 we tested the hypothesis that the repetition effect in lexical decision depends on repetition of the contextually determined interpretation applied to a word. This claim

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implies that a repeated visual pattern may or may not produce enhancement, depending on the interpretation applied at each presentation. In order to induce very different interpretations of a single visual pattern, we used homographs and presented them with a single context word that was intended to bias the interpretation of the homograph toward one of its meanings. When a homograph was repeated, it appeared with either (a) the original context word, (b) a new context word that biased the same meaning of the homograph as on its first presentation, or (c) a new context word that biased a different meaning of the homograph. If repetition effects are based on a form of episodic memory for the homograph's initial occurrence, they should be stronger when the original context is repeated than when a new context word consistent with the same meaning of the homograph is used. Even though context words would induce the same general meaning of the homograph, we contend that the specific interpretation of the target would differ. Consequently, repetition effects will be stronger when the original encoding context is more accurately reproduced.

Consequently, repetition effects will be stronger when the original context word, (b) a new context word that biased the same meaning of the homograph as on its first presentation. In order to induce very different interpretations of a single visual pattern, we used homographs and presented them with a single context word that was intended to bias the interpretation of the homograph toward one of its meanings. When a homograph was repeated, it appeared with either (a) the original context word, (b) a new context word that biased the same meaning of the homograph as on its first presentation, or (c) a new context word that biased a different meaning of the homograph. If repetition effects are based on a form of episodic memory for the homograph's initial occurrence, they should be stronger when the original context is repeated than when a new context word consistent with the same meaning of the homograph is used. Even though context words would induce the same general meaning of the homograph, we contend that the specific interpretation of the target would differ. Consequently, repetition effects will be stronger when the original encoding context is more accurately reproduced. In addition, using a new context word that biased a completely different meaning of the homograph was expected to produce little or no enhancement.

With respect to predictions regarding the different-meaning condition, we were sensitive to the distinction between dominant and subordinate meanings of homographs. This distinction was important because our goal was to induce clearly different interpretations of a visual pattern across its two presentations. We expected that when the context word biases the subordinate meaning of a homograph, subjects might independently generate the dominant meaning as well. When the item is repeated with a context word that biases the dominant meaning, some enhancement might be generated because of this extracurricular activity. Generation of the alternative meaning of a homograph seemed less likely when the context word biased the dominant meaning. Therefore, the most powerful test of the claim that enhancement depends on a repeated conceptual interpretation was the condition in which homographs first appeared in a context that biased the dominant meaning, then were repeated in a context that biased the subordinate meaning. We predicted that this condition would yield the smallest, and possibly a nonsignificant, repetition effect.

Method

Subjects. The subjects were 24 university students drawn from the same population as in Experiment 1, and they were informed and debriefed as in that study. None had participated in the earlier experiment.

Materials. A set of 60 homographs, each with at least two meanings classified as nouns, was selected from various sources (Gorfein, Viviani, & Liddo, 1982; Holley-Wilcox & Blank, 1980; Nelson, McEvoy, Walling, & Wheeler, 1980; Schvaneveldt, Meyer, & Becker, 1976; Wollen, Cox, Cochran, Shea, & Kirby, 1980; Yates, 1978). Homographs with two noun interpretations were selected because evidence suggests that for such homographs one meaning is selectively accessed when the item is preceded by a word lexically related to that meaning (Seidenberg, Tanenhaus, Leiman, & Blienkowski, 1982). The mean frequency of the homographs was 60.7 per million, with a range of 1–311 (Kucera & Francis, 1967). The dominant and subordinate meanings of 49 of the homographs were determined from ratings provided by published norms. For the remainder, a local sample of subjects similar to those tested in the experiment provided ratings by following the procedure described by Gorfein et al. (1982). For the items with published norms, the mean percentage of respondents giving the dominant or the subordinate interpretation as their first response to the homograph was 66.6 and 25.4, respectively. For each homograph two pairs of context words were selected. One pair of words was semantically related to the dominant meaning of the homograph (e.g., organ piano/music), and the other pair was related to the subordinate meaning (e.g., organ transplant/heart). The 60 sets of homographs and context words were arranged as three lists of 20 for purposes of counterbalancing.

In addition to the homographs and context words, a set of five related word pairs and five word–nonword pairs was selected for use as practice items, and three sets of filler items were constructed. One filler set consisted of 60 pairs of semantically related words, and another contained 60 word–nonword pairs. The first member of each pair of these items served as a context word, and the second was the target letter string. In the case of nonword targets, the string was pronounceable. The third set of filler items consisted of an additional 60 pronounceable nonword targets. These fillers were presented twice each during the experiment. For 20 of these items, one context word each was selected, and for the remaining 40, two different context words were chosen for each target.

Procedure. Subjects were tested individually with the same equipment as in Experiment 1. They were given a lexical decision task that began with a randomly ordered presentation of the 10 practice items followed by 360 filler- and critical trials presented in a pseudorandom order. The critical trials consisted of two presentations of each of the 60 homograph target items. A list of 60 pairs of positions, each separated by 15 trials, was established for the critical items in the 360-trial sequence. An independent random assignment of critical items to these positions was established for each subject. Filler items were used to help produce the lag between presentations of a critical item, although the two presentations of many critical items were interleaved. Among the filler items, 120 appeared once each and 60, with nonword targets, appeared twice each. The 60 repeated filler items were separated by a variable lag, ranging from 1 to 300 items, and 40 of them used a different context word on each presentation.

One list of 20 critical items was tested in each context repetition condition. In the identical condition, the identical context word was used on both presentations. In the same-meaning condition, a new context word was used on the second presentation of a homograph, but it was consistent with the meaning implied by the context word used on the first presentation. In the different-meaning condition, context words associated with two different meanings of a homograph were used on the two presentations. Half of the items in each condition were initially tested with a context word associated with the dominant meaning of the homograph, and the other half were initially tested by using a context word associated with the subordinate meaning. Selection of one member of the pair of available context words was counterbalanced across subjects. Assignment of critical items to these conditions was counterbalanced so that each list appeared equally often in each condition. The number of filler trials of each type was selected so that across the entire set of critical and filler trials an equal number used word or nonword targets. Also, there were equal numbers of trials with each target type (word or nonword) that used an identical or changed context word on the second presentation.

Subjects were instructed to make a word/nonword decision regarding the letter string that appeared in lower case on each trial. They were told to make their response as soon as a decision was made. Each trial began with a warning signal composed of a row of six plus signs presented at the center of the screen. When the subject pressed
one of the response buttons, the display was erased and remained blank for 500 ms. Then the context word appeared in upper case at the center of the screen for 1,000 ms. The screen was then erased, and 100 ms later the target word appeared in lower case at the center of the screen and remained there until the subject made a response. After the response, the screen was erased and remained blank for 250 ms; then the next trial began. A rest period was provided after the first 180 trials. The trial sequence was arranged so that no critical item had its two presentations straddling the boundary between the two blocks of 180 trials. A summary of the procedure is shown in Table 1.

Results

Our major interest was in response times to critical items on their first and second presentations. Of the 2,880 critical trials obtained across the entire sample of subjects, 2 were eliminated from the analyses because response times exceeded 2,000 ms. In addition, our analysis of responses to the second presentation of a critical item included only those items to which a correct response had been made on the first presentation. The mean correct response time and error rate for each context repetition condition are shown in Table 3.

An analysis of variance was applied to the response time data. The two factors were presentation (first, second with an identical context word, second with context biased toward the same meaning as the first presentation, and second with context biased toward a different meaning) and homograph meaning induced by the context word (dominant and subordinate). The effect of presentation was highly reliable, $F(3, 69) = 45.66, MS_e = 3.132$. Homographs tested by using a context word associated with the dominant meaning were responded to more quickly than when the subordinate context word was used, $F(1, 23) = 5.33, MS_e = 2.299$. The interaction between presentation and type of context word was not significant.

The effect of presentation was further examined with two sets of planned comparisons. For each set the family-wise error rate was held to a maximum of .05 by using the Bonferroni procedure. Each comparison in a set was made with a Type I error probability of .05/c, where c is the number of comparisons in the set. The first set consisted of two comparisons that explored the effects of changing the context word when a homograph was repeated. In both comparisons scores were averaged across the two levels of dominance. First, the mean of the identical and same-meaning conditions (525 ms) was compared with the mean of the different-meaning condition (590 ms). This contrast was significant, $F(1, 23) = 29.94, MS_e = 1,696$. Second, the identical (492 ms) and same-meaning conditions (558 ms) were compared, and this difference was significant as well, $F(1, 23) = 30.12, MS_e = 1,716$.

There were three contrasts in the second set, and these were used to establish the conditions under which reliable repetition effects occurred. In the first comparison, scores were averaged across dominance, and mean response time on the first presentation (619 ms) was compared with the mean for the identical and same-meaning conditions (525 ms), producing a significant difference, $F(1, 23) = 15.75, MS_e = 687$. The remaining two contrasts tested the repetition effect for the different-meaning condition, separately for each level of dominance. When the context word biased the dominant meaning of the homograph, the repetition effect (608 vs. 569 ms) was significant, $F(1, 23) = 6.76, MS_e = 2,772$. But when the context word biased the subordinate meaning, the repetition effect (630 vs. 611 ms) did not approach significance ($F = 1.27$). The power of the latter test to detect an effect equal to that obtained in the dominant meaning condition, assuming a Type I error probability of .05, was estimated to be .66.

An analysis of variance based on the error rates shown in Table 3 did not produce any significant effects.

Discussion

Experiment 2 provided a clear demonstration that repetition effects in the lexical decision task are sensitive to contextual changes. When it was most likely that different interpretations of the target word were applied on its two presentations (dominant then subordinate meanings were implied by context), no reliable repetition effect was observed. But even when the same general meaning of a homograph was implied during its two presentations, enhancement was greater if the context word was repeated rather than replaced by a compatible alternative. This finding suggests that the repetition effect is sensitive to changes not just in the general meaning of a homograph but also to more subtle differences in contextually determined interpretations. In our view, the more faithfully a test context reconstructs the original encoding context, the more likely it is that the previously applied encoding procedures will be recruited and efficiently reapplied during the test. The pattern of results obtained here is very similar to that obtained with recognition memory tasks, in which encoding and testing a word in different contexts (e.g., safe cracker followed by soda cracker, or even green cheese followed by green grass) greatly reduces recognition performance (Light & Carter-Sobell, 1970; Thomson, 1972). The similarity

### Table 3

<table>
<thead>
<tr>
<th>Homograph meaninga</th>
<th>Context conditionb</th>
<th>RT (ms)</th>
<th>PE (in %)</th>
<th>RE (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominant</td>
<td>First presentation</td>
<td>608</td>
<td>6.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second presentation</td>
<td>569</td>
<td>7.1</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Identical context</td>
<td>497</td>
<td>6.7</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>Same meaning</td>
<td>554</td>
<td>5.0</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Different meaning</td>
<td>569</td>
<td>7.1</td>
<td>39</td>
</tr>
</tbody>
</table>

a Refers to the meaning implied by the context word appearing on the indicated presentation.
b Refers to the nature of the context word relative to the context word used on the first presentation.

The repetition effect was computed by subtracting second presentation response time from first presentation response time.
in these two patterns of results is consistent with the view that repetition effects are mediated by a form of episodic memory.

We are confident in ruling out enhanced visual analysis as the primary source of the repetition effects observed here because repeating a word's visual pattern was not sufficient to enhance the fluency of a lexical decision. It cannot be argued that repetition effects were disrupted by changing to a visually different context word because fluency depended on whether such a change preserved the target's general meaning. These results converge with the evidence obtained in Experiment 1 to argue strongly against a perceptual sensitivity explanation of repetition effects in lexical decision tasks.

It must be conceded that these results do not render the activation hypothesis completely implausible. It could be argued that the different-meaning condition failed to produce strong repetition effects because the inappropriate lexical entry for a homograph was activated on its first presentation. The difference between the identical and same-meaning context conditions is more difficult to handle from this perspective, however, because the same lexical entry should have been activated in both cases. The differential repetition effect might be attributed to sustained activation of the context word in the identical condition, allowing it to be more readily identified when repeated and to initiate activation in related concepts, including the target. But with a stimulus onset asynchrony (SOA) of 1,100 ms it seems implausible that optimal activation of associates would not be achieved by the time of the target's onset, regardless of the context word's prior presentation. On the other hand, the long SOA may have encouraged a form of cued recall strategy in which subjects attempted to predict the upcoming target when a context word was repeated. This strategy could be successful only in the identical context condition because context words were not repeated in the same-meaning condition. Although this appeal to a form of episodic memory is plausible, it seems unlikely that subjects would have developed the strategy because fewer than 6% of the trials involved a repeated context-target word pair.

Experiment 3

A third experiment was conducted to provide more convincing evidence in favor of the view that episodic memory for encoding operations was responsible for repetition effects in lexical decision. Our goal was to demonstrate that a specific process associated with the lexical decision task plays a key role in enhancing the fluency of responses to repeated words. Strong evidence has been provided for the idea that the lexical decision task involves a postlexical process that checks the consistency or relation between the target and context words (Balota & Chumbley, 1984; Forster, 1981; Seidenberg, Waters, Sanders, & Langer, 1984). If a relation between the target and context items can readily be found, an immediate positive lexical decision is warranted. The characterization of this relational processing as occurring after lexical access is the product of a view that emphasizes the role of stable lexical entries. Although we prefer to avoid making appeals to such a lexical organization, we do wish to emphasize the notion of integral processing of the context and target words. Our concept of integral processing is intended to reflect context-dependent interpretive processes involved in identifying and classifying visual patterns rather than elaborate encoding processes responsible for levels of processing effects (e.g., Craik & Tulving, 1975). Further, we subscribe to the view that integral processing should be more efficient or successful if the two elements have previously occurred together. Our claim is that responding to a repeated context-target pair is enhanced by episodic memory for prior instances of relational processing, although it is not necessary that the subject be aware of the retrieval and application of this memory.

By this view it should be possible to enhance the fluency of lexical decisions to novel targets, as long as the relational processing is similar to that applied on a previous occasion. A situation of this type was created by initially presenting a homograph target word in the context of a word that biased one of its meanings. When the homograph was repeated, however, it served as a context word, not a target. The target word appearing with the homograph had not been seen before and was related either to the meaning of the homograph that was implied on its first presentation or to the other meaning. It was expected that faster lexical decisions would be made in the former case because relational processes would be facilitated by memory for the earlier experience with the homograph. Moreover, items tested in the latter condition should show no repetition effect because a completely different meaning of the homograph would be involved in relational processing.

Method

Subjects. The subjects were 24 university students selected from the same pool as in the earlier experiments, and none had taken part in those experiments.

Materials and design. A set of 96 critical homographs with two distinct noun interpretations were obtained from the same sources used for Experiment 2 and from Cramer (1970) and Onifer and Swinney (1981). According to published norms, the mean percentage of subjects who selected the dominant meaning of the critical homographs was 69.3%, and the mean percentage who selected the subordinate meaning was 22.9%. The mean frequency of occurrence for the homographs was 64.6 per million (Kucera & Francis, 1967). For each of the homographs, two pairs of unambiguous words were selected, one pair related to each meaning of the homograph. The mean frequency of occurrence for the words associated with the dominant or subordinate homograph meanings was 56.5 and 49.5 per million, respectively.

The critical homographs were assigned to six lists of 16 items each. Each list was assigned to one of six conditions in the experiment, and assignment was counterbalanced across subjects so that each list appeared equally often in each condition. In four of the conditions, the homograph was presented twice, and in the other two it was presented once. For homographs that appeared twice, the homograph was the target on the first presentation, and one of its associates was the context word. On the second presentation the homograph served as the context word, and one of its other associates was the target. For two of the conditions, the words appearing with the homograph were associated with the same meaning (e.g., HAY–STRAW, STRAW–barn), and for the other two conditions the words were associated with different meanings (e.g., MONEY–bank, BANK–river). The two conditions within each of these pairs were distinguished by whether the word used on the first presentation was associated with the
dominant or subordinate meaning of the homograph. In the once-presented conditions, homographs appeared as context words, and one of their associates was used as the target. In one condition the target was related to the dominant meaning of the homograph, and in the other it was related to the subordinate meaning.

In addition to the critical homographs and context words, two sets of filler items were developed. One set consisted of 40 triples of items. Each triple contained a homograph, a word associated with one of its meanings, and a pronounceable nonword. The homographs in this set were presented twice each. On their first occurrence they appeared as targets with the related word as context, and the corresponding nonword was the target. The other set of filler items was composed of 60 pairs of words and pronounceable nonwords. The words in 16 of the pairs were homographs. When items in this set were presented, the word in each pair was the context item, and the nonword was the target. This arrangement of filler items produced ratios of word to nonword targets of 2.4:1, 2:1, and 1.6:1 for the three types of context: unambiguous word, homograph appearing for the first time, and homograph appearing for the second time, respectively.

Procedure. Subjects were tested on a lexical decision task as in Experiment 2. A series of 300 filler and critical trials was presented in a pseudorandom order following the conventions described for Experiment 2. The critical trials consisted of two presentations involving 64 of the critical homographs and one presentation of the remaining 32 homographs. The position of the critical items within the trial sequence was determined as in Experiment 2, with 15 trials separating repeated presentations of critical homographs. In addition, the sequence was arranged so that the positions occupied by critical homographs presented only once were distributed in a manner similar to the positions occupied by the second presentation of the other critical homographs. The two presentations of each of the 40 repeated filler items were separated by 15 trials.

Each trial was conducted as in Experiment 2 with the following exceptions. The warning signal was displayed for 250 ms, then was erased automatically, and 750 ms later the context word appeared. After 250 ms the target was presented below the context word, and both items remained on the screen until the subject responded. After the response was made, the screen was erased, and the next trial began 200 ms later. A rest period was provided after each block of 100 trials. A summary of the procedure is shown in Table 1.

Results

Data from the critical trials were analyzed by computing the mean response time in each condition for each subject. Only response times from trials on which a correct response was made in less than 1,500 ms were included. This criterion excluded 1.0% of the trials because response time was too long. The mean response times and error rates for the critical trials on which a homograph served as the context word and an unambiguous word was the target are shown in Table 4. For items presented twice, data were excluded if a response error was made on the first presentation (2.6%).

An analysis of variance with presentation (nonrepeated, repeated with same meaning, and repeated with different meaning) and homograph meaning (dominant and subordinate) found a significant main effect of presentation, $F(2, 46) = 5.94, MS_e = 2.951$. In addition, trials on which the dominant meaning of the homographs was implied led to faster responses than trials involving the subordinate meaning, $F(1,$

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Homograph meaning</th>
<th>RT</th>
<th>PE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dominant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same meaning</td>
<td>639</td>
<td>4.5</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Different meaning</td>
<td>663</td>
<td>4.5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subordinate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same meaning</td>
<td>654</td>
<td>5.0</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Different meaning</td>
<td>692</td>
<td>4.8</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>Nonrepeated items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>673</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4
Mean Lexical Decision Time (RT, in Milliseconds), Error Rate (PE, in Percent), and Repetition Effect (RE) in Experiment 3

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Homograph meaning</th>
<th>RT</th>
<th>PE</th>
<th>RE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dominant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same meaning</td>
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</tr>
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<td>Different meaning</td>
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<td>10</td>
<td></td>
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<tr>
<td></td>
<td>Subordinate</td>
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<td></td>
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<tr>
<td>Repeated items</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Same meaning</td>
<td>654</td>
<td>5.0</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Different meaning</td>
<td>692</td>
<td>4.8</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>Nonrepeated items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>673</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$Refers to the nature of the context word relative to the context word on the first presentation.

Replication effect was computed by subtracting response time on repeated items from response time on nonrepeated items.

Data are from the second presentation.

$^{23} = 7.18, MS_e = 2.144$. The interaction was not reliable ($F < 1$). The effect of presentation was explored with two comparisons that averaged across homograph meaning and were carried out by using the Bonferroni correction for family-wise Type I error, which was set at .05. In the first contrast it was found that items in the same-meaning condition produced faster response times (647 ms) than items in the nonrepeated condition (682 ms), $F(1, 23) = 11.55, MS_e = 1,269$, constituting a form of repetition effect. The second comparison showed that responses in the different-meaning condition (677 ms) were not significantly faster than responses in the nonrepeated condition ($F < 1$). The power of the letter comparison to detect a repetition effect of the magnitude observed in the same-meaning condition, with Type I error at .05, was estimated at .94. We used the effect size from the same-meaning condition to provide an estimate of the upper bound on the power of this test.

For items in the repeated conditions, the mean response times on their first presentation were 643 ms and 668 ms for items in the dominant and subordinate meaning conditions, respectively. This effect of homograph meaning was reliable, $F(1, 23) = 5.54, MS_e = 1,284$. An analysis of the error rates in the nonrepeated and repeated conditions revealed no significant effects.

Discussion

Fluency of lexical decisions was enhanced among targets that had not been seen previously but whose ambiguous context word had appeared earlier. This effect, however, depended on the sequence of interpretations applied to the ambiguous context word. If the same interpretation was maintained across the homograph's appearance as a target and a context word, enhancement was found. But if different meanings were implied on the homograph's two presentations, no reliable enhancement was observed. Clearly, repetition of a visual pattern played little or no part in generating the en-
hancement effects obtained here because response time to targets depended on having the appropriate conceptual experience with the context word. On the other hand, these results are consistent with the predictions we made from the view that the repetition effects were due to a process that constructs a conceptual relation between the context and target. The efficiency of this construction process is increased, leading to a faster lexical decision, when one of the words has recently been involved in similar activity with another partner.

Alternatively, it could be argued that enhancement was brought about by increased activation of the lexical representation for the appropriate meaning of the homograph. One means by which such a process might generate the results in Experiment 3 is the spread of activation to concepts associated with the activated meaning of the homograph. When one of these concepts later appears as a target, faster identification is possible because of the sustained increase in its activation level. This explanation is probably incorrect, however, because earlier work has shown that exposure to a word does not produce long-term enhancement of the identification of semantically related items (Dannenbring & Briand, 1982; Foss, 1982; Gough et al., 1981). Another possible mechanism is increased efficiency in the repeated context word's priming of the target. When an ambiguous context word is repeated, the heightened activation of one of its meanings, produced by the initial presentation, may result in more or faster priming of a related target. In this account, postlexical checking processes are not assumed to contribute to repetition effects. Enhancement is the product of a long-term increase in activation rather than episodic memory for the decision making processes applied on a word's first presentation.

Experiments 4–6: Word Naming

Although the evidence from Experiments 1–3 was consistent with the episodic view we have advocated, it was not adequate to clearly distinguish between that view and an activation view of repetition effects. Therefore, a further attempt to test the differences between these two views was made in a series of experiments using a word naming task. In these studies our objectives were (a) to use the task to provide converging evidence for our claims about the source of repetition effects observed in Experiment 3, (b) to provide additional evidence that is more naturally accounted for by the episodic view than by the activation view, and (c) to demonstrate that repetition effects in word naming are primarily a consequence of interpretive processes applied to a word rather than visual analysis.

Experiment 4

To provide a direct test of the claim that repetition effects found in Experiment 3 were a result of relational processing of the context and target words, Experiment 4 was conducted by using the word naming task. A number of studies have shown that postlexical processes (what we refer to as relational processing) have little or no influence on word naming time (Forster, 1981; Lorch, Balota, & Stamm, 1986; Seidenberg et al., 1984). Experiment 4 was a replication of Experiment 3, in that on its first appearance a homograph was a target word, and on its second presentation it was a context word; the target word appearing with a repeated homograph had not appeared earlier. Because relational processes should not influence word naming time, the repetition effect found in Experiment 3 should not be replicated if it depends on these processes. On the other hand, if the enhancement observed in Experiment 3 were a result of heightened activation of the repeated context word and its increased efficiency in priming the target, the repetition effect should be replicated.

Method

Subjects. The subjects were 24 new students drawn from the same source as in the earlier studies.

Materials and Procedure. The materials and procedure were the same as in Experiment 3, with the following exceptions. The nonword filler items were replaced with words that were semantically related to the partner with which they were presented. On each trial, subjects responded by naming aloud the target word rather than making a lexical decision. Vocal responses were detected by a microphone and triggered a Grass Stradley voice-activated relay that was interfaced with the microcomputer. Detection of vocal response was signaled to the subject by printing a row of asterisks below the target word. This display remained on the screen for 1,000 ms during which time the experimenter, who viewed another screen that displayed the target word on each trial, could press a button to record response errors. Then the display was erased, and the next trial began after a 200-ms delay. A summary of the procedure is shown in Table 5.

Results and Discussion

The mean response time in each condition was computed for each subject, excluding trials on which a response error was made (0.3% of the trials) and trials on which response

Table 5

Summary of Procedures for Experiments 4–6

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment 4</td>
<td>Word naming task with context–target pairs. Critical trials involved homographs repeated after 15 intervening trials. Homographs appeared as targets on their first presentation and as context words on their second presentation as in Experiment 3. One set of homographs was not repeated, and these appeared as context words. Context conditions and sample items: same meaning (light–beam, beam–laser), different meaning (steel–bar, bar–laveret), and nonrepeated (bank–money).</td>
</tr>
<tr>
<td>Experiment 5</td>
<td>Similar to Experiment 4 except homographs always appeared as target items (e.g., light–beam, laser–beam). The context–target SOA was 250 ms in Experiment 5a and 1,000 ms in Experiment 5b.</td>
</tr>
<tr>
<td>Experiment 6</td>
<td>Targets were not homographs and were presented in isolation. Phase 1: One block of word and pseudohomophone naming trials and one block of lexical decision trials (visual in Experiment 6a and auditory in Experiment 6b). Phase 2: Word naming including targets from Phase 1 and new items. Pseudohomophones from Phase 1 appeared as real words.</td>
</tr>
</tbody>
</table>
time exceeded 1,000 ms (0.8% of the trials). Data from trials involving repeated items were excluded if an incorrect vocal response was made on the item's first presentation (0.4%). The mean response time for each condition is shown in Table 6. An analysis of variance of these data with presentation (nonrepeated, repeated with same meaning, and repeated with different meaning) and homograph meaning (dominant and subordinate) as factors revealed no significant effects (Fs < 1.31). Planned comparisons that averaged across homograph meaning and contrasted the nonrepeated condition with each of the other two conditions were nonsignificant as well. The power of the planned comparison to detect a repetition effect of 13 ms in the same-meaning condition with a Type I error rate of .05 was estimated to be .84. An effect of 13 ms was chosen because that was the size of the word naming repetition effect observed in the same-meaning condition in Experiment 5a (see below). The mean response times to homographs on their first presentation were 552 ms and 549 ms for items presented with a context word that biased the dominant and the subordinate meanings, respectively. This difference was not statistically significant. No analysis of error rates was done because there were so few errors.

Naming a novel target word did not reliably benefit from prior exposure to the context word that accompanied it. The failure to find a repetition effect in Experiment 4 is in direct contrast with the outcome of Experiment 3, in which a lexical decision task was used. It cannot be argued that word naming tasks generally do not produce repetition effects because such effects have been reported before (e.g., Scarborough et al., 1977). A critical issue is the source of this repetition effect. One possibility is that enhancement in this task depends on the repetition of a specific visual pattern. Although this explanation now seems to be implausible for the lexical decision task, it still is a viable account of word-naming repetition effects. In fact, Durso and his colleagues (Durso & Johnson, 1979; Durso & O'Sullivan, 1983) failed to obtain repetition effects in the word naming task when common nouns initially appeared as pictures rather than printed words. The importance of repeating a visual pattern may be associated either with visual processing operations or with generation of an articulatory code from a particular letter string. Alternatively, repetition effects may be based on a repeated conceptual interpretation of the target. The latter view was advanced by Durso and O'Sullivan (1983), who found that naming a picture of a famous person reduced naming latency when that name later appeared in print. They claimed that a picture of a familiar person and the person's printed name both invoke the same semantic information, but pictures of common nouns activate more specific information than do their corresponding printed words. For common nouns the discrepancy in the semantic information activated by pictures and words precluded a repetition effect in word naming.

Although the Durso and O'Sullivan (1983) results are consistent with the semantic interpretation view, they are based on an evaluation of repetition effects for items initially presented in a physical format very different from the one used to measure repetition effects. By contrast, the purpose of Experiment 5 was to demonstrate that fluent identification produced by repetition of a specific visual pattern depends on the contextually determined interpretation of that pattern. There were two versions of Experiment 5, differing only in the SOA between the context and target words. The procedure was the same as that used in Experiment 4, with the exception that homographs always appeared as targets and never as context words. A different context word was used on each presentation, and the one used on the second presentation either preserved the original meaning of the target homograph or implied the alternative meaning. It was expected that repetition effects would be observed because homograph tar-

### Table 6

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Mean Word Naming Time (RT, in Milliseconds) and Repetition Effect (RE) in Experiment 4</th>
<th>Homograph meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Subordinate</td>
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<tr>
<td>Different meaning</td>
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<td>3</td>
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<tr>
<td>Nonrepeated items</td>
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<td>559</td>
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</tbody>
</table>

a. Refers to the nature of the context word relative to the context word on the first presentation.

Repetition effect was computed by subtracting response time on repeated items from response time on nonrepeated items.

Data are from the second presentation.
Results and Discussion

The mean response time in each condition was computed excluding trials on which a response error occurred (0.1% and 1.1% of the trials in Experiments 5a and 5b, respectively) or on which response time exceeded a criterion of 1,000 ms in Experiment 5a or 800 ms in Experiment 5b (0.4% and 0.9% of the trials in Experiments 5a and 5b, respectively). Trials involving repeated presentation of a homograph were eliminated if a response error had been made on its initial presentation (0.2% and 1.2% for Experiments 5a and 5b, respectively). This analysis of variance with presentation (nonrepeated, repeated with same meaning, and repeated with different meaning) and homograph meaning (dominant and subordinate) as factors was applied to the data from Experiment 5a. Only the presentation effect was significant, $F(2, 46) = 10.81$, $MS_e = 306.4$. Two planned contrasts, averaging across homograph meaning, were conducted by using the Bonferroni procedure. The mean of the repeated-with-same-meaning condition (547 ms) was found to be significantly less than the mean of the nonrepeated condition (560 ms), $F(1, 23) = 9.37$, $MS_e = 221.2$, and the two repeated conditions (same vs. different meaning) did not reliably differ ($F < 1$). In addition, the mean response time to the first presentation of repeated items was 559 ms and 558 ms for homographs appearing with a context word that biased the dominant or subordinate meaning, respectively. These means were not significantly different ($F < 1$).

The pattern of results in Experiment 5a was different from that obtained in Experiment 2 with a lexical decision task. Although a reliable repetition effect was found, it was not influenced by the consistency of the context in which the target appeared. The pattern of means did, however, suggest that an unanticipated form of contextual influence was operating. There was a slight advantage among repeated items when the context word was associated with the target's dominant meaning. This observation suggested the hypothesis that on its first appearance subjects generally constructed an interpretation of a homograph that emphasized its dominant meaning, regardless of the context word. This notion is consistent with the conclusion from Experiment 4 that generation of a naming response does not heavily rely on relational processing of the context and target. When a homograph was repeated with a context word consistent with its dominant meaning, however, the combination of context and target would constitute a more powerful retrieval cue for the original encoding episode. This hypothesis was tested in Experiment 5b by using a longer SOA to enable the context word to exert a stronger influence on target naming times. In Experiment 5b the planned comparisons emphasized differences between dominant and subordinate meanings rather than same versus different meanings.

The response times from Experiment 5b were analyzed in an analysis of variance as in Experiment 5a. Once again, only the effect of presentation was significant, $F(2, 46) = 15.63$, $MS_e = 221.2$, and the two repeated conditions (same vs. different meaning) did not reliably differ ($F < 1$). In addition, the mean response time to the first presentation of repeated items was 559 ms and 558 ms for homographs appearing with a context word that biased the dominant or subordinate meaning, respectively. These means were not significantly different ($F < 1$).

The pattern of results in Experiment 5a was different from that obtained in Experiment 2 with a lexical decision task. Although a reliable repetition effect was found, it was not influenced by the consistency of the context in which the target appeared. The pattern of means did, however, suggest that an unanticipated form of contextual influence was operating. There was a slight advantage among repeated items when the context word was associated with the target's dominant meaning. This observation suggested the hypothesis that on its first appearance subjects generally constructed an interpretation of a homograph that emphasized its dominant meaning, regardless of the context word. This notion is consistent with the conclusion from Experiment 4 that generation of a naming response does not heavily rely on relational processing of the context and target. When a homograph was repeated with a context word consistent with its dominant meaning, however, the combination of context and target would constitute a more powerful retrieval cue for the original encoding episode. This hypothesis was tested in Experiment 5b by using a longer SOA to enable the context word to exert a stronger influence on target naming times. In Experiment 5b the planned comparisons emphasized differences between dominant and subordinate meanings rather than same versus different meanings.

The response times from Experiment 5b were analyzed in an analysis of variance as in Experiment 5a. Once again, only the effect of presentation was significant, $F(2, 46) = 15.63$, $MS_e = 338.6$. Two planned comparisons, averaging across same versus different meaning, were carried out with the

Table 7

<table>
<thead>
<tr>
<th>Context condition</th>
<th>Homograph meaning</th>
<th>Experiment 5a</th>
<th>Experiment 5b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dominant</td>
<td>Subordinate</td>
<td>Dominant</td>
</tr>
<tr>
<td></td>
<td>RT</td>
<td>RE</td>
<td>RT</td>
</tr>
<tr>
<td>Repeated items</td>
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</tr>
<tr>
<td>Same meaning</td>
<td>544</td>
<td>17</td>
<td>550</td>
</tr>
<tr>
<td>Different meaning</td>
<td>543</td>
<td>18</td>
<td>547</td>
</tr>
<tr>
<td>Nonrepeated items</td>
<td>561</td>
<td></td>
<td>560</td>
</tr>
</tbody>
</table>

a Refers to the nature of the context word relative to the context word on the first presentation.
b Repetition effect was computed by subtracting response time on repeated items from response time on nonrepeated items.
c Data are from the second presentation.
Bonferroni procedure. It was found that repeated homographs tested with a subordinate context word ($M = 504$ ms) were named more quickly than nonrepeated homographs tested in that context ($M = 516$ ms), $F(1, 23) = 7.80$, $MS_e = 245.9$, but more slowly than repeated homographs tested with a dominant context word ($M = 496$ ms), $F(1, 23) = 9.66$, $MS_e = 75.4$. As in Experiment 5a, the mean response time for the first presentation of repeated homographs was not significantly influenced by type of context word ($M = 515$ ms and $M = 518$ ms for dominant and subordinate contexts, respectively; $F < 1$).

The results of Experiment 5b strongly suggested that sensitivity to the type of context word changed when homographs were repeated, but the critical interaction between presentation and homograph meaning was not significant either in Experiment 5a or 5b. In order to enhance the power of the test of this effect, data from both experiments were pooled. Data from the first presentation of repeated homographs were included with the response times for nonrepeated items, and response times for repeated items were averaged across same- and different-meaning conditions. An analysis of variance with presentation (first and second) and homograph meaning (dominant and subordinate) found a significant effect of repetition ($M = 538$ ms and $M = 523$ ms for first and second presentation, respectively), $F(1, 47) = 88.45$, $MS_e = 124.9$, and even the 3-ms main effect of homograph meaning was reliable ($M = 529$ ms and $M = 532$ ms for dominant and subordinate, respectively), $F(1, 47) = 4.55$, $MS_e = 100.0$. The interaction was also significant, $F(1, 47) = 6.02$, $MS_e = 81.8$, indicating that naming time was influenced by type of context word only on the second presentation of a homograph. The mean response time for first presentation of targets that appeared with a dominant or a subordinate context word was 538 ms in each condition, but for second presentation the means for dominant and subordinate conditions were 520 ms and 526 ms, respectively. Although the advantage among repeated homographs for those items that appeared with a dominant rather than a subordinate context word was very small, it was reliable and represented one third of the overall repetition effect found in Experiments 5a and 5b.

The results of Experiment 5 did not produce the same kind of contextual sensitivity in repetition effects as that observed in Experiments 2 and 3, but there was convincing evidence of a form of contextual influence that was generated as a result of prior exposure to a target. The contextual sensitivity found in Experiment 5 consisted of additional fluency observed among repeated homographs tested with context words that biased the dominant meaning. The degree of contextual sensitivity was also much less in the word naming task than in lexical decision.

In comparing the results of Experiments 2 and 5, it should be noted that both the initial encoding and test tasks were different. It could be that had we used the same initial episodic experience as in Experiment 2, a lexical decision task, context effects similar to those found in Experiment 2 would have appeared even with a word naming task. In fact, we did just that in two other experiments not fully described here. The first presentation of homographs involved a lexical decision, and the second presentation required a word naming response. As in Experiments 2 and 5 repetitions were embedded in a continuous series of trials, which meant that subjects frequently changed tasks from trial to trial. In these experiments response time patterns in the naming task were very much like the lexical decision task in that naming times were longer than in pure naming tasks, a much larger repetition effect was found, and the repetition effect was highly context sensitive as in Experiment 2. These results indicate that with either lexical decision or naming as the initial task, the word naming task produces a context-sensitive repetition effect.

In Experiment 5 context sensitivity took the form of enhanced repetition effects when the context word biased the dominant meaning of the homograph target. Dominant and subordinate context words did not differentially influence word naming times on the first presentation of a homograph, indicating that the advantage for dominant context words during repetition of the target could be attributed to memory for the target's initial encoding episode. In particular, our suggestion is that subjects tended to adopt the dominant interpretation of a homograph on its first presentation, independent of the context word (Simpson & Burgess, 1985). Preference for the dominant meaning of homographs was not found with the lexical decision task, probably because in that task generating a response involves integrative processing of the context and target words (Forster, 1981; Seidenberg et al., 1984), thereby endowing the context word with significant power over the interpretation of the homograph. On the second presentation of a homograph a context word related to its dominant meaning would serve as a more effective retrieval cue for the prior encoding of the homograph than would a subordinate context word. On the first presentation of a homograph, however, there would be no recent episode to be retrieved.

Once again, one could attempt to produce an explanation of these results from an activation viewpoint. Perhaps the repetition effect resulted from sustained activation of the dominant meaning of the homograph. But there is no means to explain the differential influence of dominant and subordinate context words produced by an earlier episode involving the target homograph. For the activation view to be viable, it must be assumed that the influence of context on lexical access depends on the degree of activation of the target lexical entry. Specifically, it must be assumed that context effects are more powerful when a target is already active. This explanation seems inconsistent with the typical finding that identification of high-frequency words, which could be considered generally more active or to have a lower activation threshold than low-frequency words, are less influenced by context than low-frequency words (Becker, 1979; Stanovich & West, 1983).

Experiment 6

The weak influence of context on the word naming repetition effect observed in Experiment 5 suggests that the effect might depend significantly on visual analysis as opposed to interpretive processes. Alternatively, enhancement might be a result of improved efficiency at assembling or executing a pronunciation. Fluent generation of a pronunciation may even be tied to a specific letter string. Two versions of Exper-
iment 6 were designed to assess the importance of visual processing and pronunciation in generating a repetition effect for the word naming task. In Experiment 6a targets were initially presented for naming in their normal visual form or as pseudohomophones (nonwords with the same phonetic pattern as real words; e.g., \textit{rale}), or they were presented in a lexical decision task in which no vocal response was required. Targets were presented a second time as normal words in a naming task. The two types of formats in the initial naming task provided subjects with experience in enunciating each target, although the pseudohomophone format involved a letter string that was visually different from the target that would later be used to generate the same pronunciation. The lexical decision task provided visual experience with the target but did not require its pronunciation. Experiment 6b was identical to Experiment 6a except that an auditory version of the lexical decision task was used.

A number of hypotheses were tested in Experiment 6. First, it was expected that if visual experience with the target is critical to enhanced fluency in naming words, only word naming and visual lexical decision should produce significant repetition effects. Second, if generation of a pronunciation is the critical factor, only word and pseudohomophone naming should lead to increased fluency. Third, if assembly of a pronunciation from a specific letter string is responsible for fluency in repeated word naming, only word naming should produce a repetition effect. Finally, if invoking a conceptual interpretation of the letter string is the primary basis for the word naming repetition effect, evidence for enhanced fluency should be observed in all tasks, with the possible exception of naming pseudohomophones. In that case subjects generate a pronunciation from a nonword. McCann and Besner (1987) have shown that subjects name pseudohomophones faster than nonword control items, but the pseudohomophones do not produce the frequency effect found among their real word counterparts. They concluded that pronouncing a pseudohomophone involves access to a whole-word phonological code, but did not suggest that the conceptual system was involved. Even if pseudohomophone naming does not depend on deriving a conceptual interpretation that is consistent with the base word, it seems likely that an interpretation would be constructed as a result of enunciating the pseudohomophone. In fact, because all nonwords in the pronunciation task were pseudohomophones, successful generation of a corresponding real word after naming could serve as verification that a correct pronunciation had been produced. According to the conceptual interpretation view of word-naming repetition effects, then, whether pseudohomophone naming produces enhanced fluency depends on whether it engenders retrieval of the relevant real word concept.

A number of methodological changes, relative to the earlier experiments, were made in designing Experiment 6. First, no context word appeared with the target items because the goal was to maximize the contribution of visual analysis in the naming task. Second, the targets were not homographs because we were not interested in producing changes in interpretation. Instead, targets were selected so that a visually dissimilar pseudohomophone could be generated from each one. Finally, rather than mixing initial and repeated trials as in the earlier experiments, the naming and lexical decision tasks were presented in two separate blocks, with a final block of word naming trials involving repeated and new target words. The motivation for this change came from the results of the experiments briefly described in the discussion of Experiment 5, in which word naming and lexical decision tasks were mixed together. The result was that the naming task behaved much like the lexical decision task. In Experiment 6 our aim was to study the word naming task in its more usual form.

Method

Subjects. The subjects were two new groups of volunteers drawn from the source used in the earlier experiments. There were 24 subjects in Experiment 6a and 32 in Experiment 6b.

Materials. A set of 80 critical words, many taken from the McCann and Besner (1987) study, were selected. The words were chosen so that it was possible to derive from each one a visually dissimilar nonword that shared the same pronunciation (e.g., \textit{cruise}, \textit{krooze}). The mean frequency of the words used in Experiment 6a was 94.0 per million, with a range of 0–2,439 (Kucera & Francis, 1967). In producing the materials for Experiment 6b, five substitutions were made to increase the degree of visual dissimilarity between words and their pseudohomophone counterparts. The mean frequency for those items was 95.2. The 80 word–pseudohomophone pairs were arranged as four lists of 20 for purposes of counterbalancing. One set of items was assigned to each condition in the experiment, as defined by type of initial experience with the items: word naming, pseudohomophone naming, lexical decision, or no initial experience. Assignment of items to these four conditions was counterbalanced across subjects. In addition, a set of 20 pronounceable nonwords that were not pseudohomophones was selected for use in the lexical decision task, and a set of 28 words, six nonwords, and six pseudohomophones was selected for use as practice items.

Procedure. Subjects were tested individually with the same equipment as in the other experiments. They were given three blocks of trials, each preceded by a set of instructions that explained the task that was in effect during that block. In each block the subject then was given two practice trials including feedback concerning the correctness of his or her response for each trial. Then another set of 10 practice trials was given, followed by the critical trials, all without feedback. One block of trials consisted of naming aloud words and pseudohomophones, another involved a lexical decision task, and the last block of trials always involved a word naming task. The first two blocks were used to provide subjects an initial experience with the critical items, and the order of presentation of these two blocks was counterbalanced across subjects. The first block of naming trials consisted of 20 critical words and 20 critical pseudohomophones, along with six practice items of each type. The block of lexical decision trials was similarly structured except that the nonwords were filler items. In Experiment 6a the lexical decision task was visual, whereas in Experiment 6b the items were read aloud by the experimenter and not seen by the subject. In the last block of trials, subjects were required to name aloud all 80 critical words. A brief rest period was allowed during this block after 40 of the critical items had been presented. After the rest period, four practice items and the remaining 40 critical items were presented.

In each of the blocks, a trial began with a warning signal (a single plus sign) at the center of the screen for 250 ms, followed by a blank screen for 500 ms. The target then appeared in lower case at the center of the screen and was erased when the subject responded, either by naming the item or by pressing a button to indicate a lexical
decision. The next trial started automatically after a pause of 750 ms. In Experiment 6b the screen was blank during the lexical decision block, and no response times were recorded during that block. In all other respects, the procedure for the naming and lexical decision tasks was the same as in earlier experiments. A summary of the procedure is shown in Table 5.

Results and Discussion

Data from the last block of word naming trials were analyzed by computing the mean response time in each condition for each subject, after excluding trials on which times exceeded a criterion of 1,500 ms in Experiment 6a or 2,000 ms in Experiment 6b. As a result, 0.6% and 1.2% of the trials were eliminated from Experiments 6a and 6b, respectively. In addition, response time for a trial was excluded if an error was committed, and response time for any item in the repeated presentation conditions was eliminated if an error had been committed on either of its presentations. The mean response times and error rates, averaging over subjects, are shown in Table 8. Error rates were not analyzed because they were so low. Table 8 also includes mean response times and error rates for the first naming and lexical decision blocks, although these data were not submitted to analyses of variance.

Separate analyses of variance for Experiments 6a and 6b were applied to subjects' mean response times in the final word naming block. Type of initial experience (none, word naming, pseudohomophone naming, and lexical decision) was a within-subjects factor. In Experiment 6a there was a significant difference among the condition means, $F(3, 69) = 3.67$, $MS_e = 217.9$, indicating that a reliable repetition effect had occurred. Two planned comparisons were then done by using the Bonferroni procedure to determine whether significant repetition effects were produced by the pseudohomophone naming and lexical decision tasks. The difference between nonrepeated items and items that had originally appeared in the pseudohomophone naming task was not reliable by this test, $F(1, 23) = 2.50$, $MS_e = 295.5$, $p > .10$. On the other hand, the mean naming latency for items that originally appeared in the lexical decision task was significantly lower than the mean for nonrepeated items, $F(1, 23) = 16.08$, $MS_e = 98.0$.

In Experiment 6b the overall analysis of variance showed there was a significant difference among the conditions, $F(3, 93) = 4.62$, $MS_e = 313.8$. Two planned comparisons were conducted as in Experiment 6a, and they showed that appearance in the pseudohomophone task reliably reduced later naming latency, relative to nonrepeated items, $F(1, 31) = 8.75$, $MS_e = 234.0$. Auditory presentation in a lexical decision task produced marginally reliable enhancement, $F(1, 31) = 5.52$, $MS_e = 254.6$, $p < .026$. The reliable repetition effect produced by the pseudohomophone task of Experiment 6b is convincing because it was highly reliable ($p < .006$), and the estimated power of Experiment 6a to detect an effect of a similar size was only .50.

The patterns of results from Experiment 6 support the view that enhanced fluency in naming repeated words depends neither on a recent explicit articulation of the word nor on direct visual experience with it. Both auditory and visual lexical decision tasks, which did not involve overt pronunciation, produced later fluency in naming target words. Further, the pseudohomophone task yielded convincing enhancement in Experiment 6b even though initial experience with the targets consisted of visually dissimilar letter strings. It appears that a modality-independent process common to all four tasks used here, such as construction of a conceptual interpretation of the target, makes an essential contribution to the repetition effect in the word naming task. In both versions of Experiment 6, however, the repetition effect produced by an initial word naming task was larger than the effects obtained with any other initial task. If this pattern is a reliable one, it would

<table>
<thead>
<tr>
<th>Task in Trial Block 1 or 2</th>
<th>Experiment 6a</th>
<th>Experiment 6b</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>RT</td>
<td>PE</td>
</tr>
<tr>
<td>Repeated items</td>
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<td></td>
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<tr>
<td>Word naming</td>
<td>494</td>
<td>1.2</td>
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<tr>
<td>Pseudohomophone naming</td>
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<td>11.5</td>
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<tr>
<td>Lexical decision</td>
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<tr>
<td>Nonrepeated items</td>
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<tr>
<td>Word naming</td>
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<td>Pseudohomophone naming</td>
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<td>Lexical decision</td>
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</table>

* Repetition effect was computed by subtracting response time on second presentation of repeated items from response time on nonrepeated items.
* Response times were not collected for the auditory lexical decision task used in Experiment 6b.
* The task in Trial Block 3 was always word naming.
support the hypothesis that fluent word naming is additionally inspired by recent prior experience involving processes such as visual analysis, assembly of a phonological code from a letter string, or articulation of that code.

General Discussion

The purpose of the experiments reported here was to test the claim that repetition effects in the lexical decision and word naming tasks are primarily the result of increased fluency in developing a conceptual interpretation of a target word. Our view is that repeated presentation of a word recruits episodic memories of recent experiences with that word. This recruitment is highly context sensitive and includes operations associated with generating a context-dependent interpretation of the word. Our characterization of repetition effects contrasts with a view that emphasizes improved visual analysis of repeated patterns and with a lexical activation view that denies contextual sensitivity.

The present experiments yielded six results that are particularly relevant to the views of repetition effects under consideration here. (a) Fluent lexical decisions about repeated targets presented in isolation were due to a reduction in the amount of perceptual information used to make a response, rather than to improved perceptual analysis. (b) Repetition effects in the lexical decision task were reduced or eliminated when a change in the context word appeared with an ambiguous target induced a change in the target's semantic interpretation across its two presentations. (c) Increased fluency in lexical decisions about a novel target word was found when the target appeared with a repeated, ambiguous context word and was compatible with the interpretation that had been applied on the context word's first presentation. (d) The repetition effect with novel targets and repeated context words failed to replicate when a word naming task was used, suggesting that the effect is dependent on processes specific to lexical decision or absent in word naming. (e) In contrast to the lexical decision task, context effects in fluent naming of repeated homograph targets were weak and consisted of increased sensitivity to the distinction between dominant and subordinate context words, with the former producing faster naming responses to the targets. (f) Reliable repetition effects in naming isolated target words were found even when the initial experience with a target was auditory, did not involve articulation, or consisted of a visually different stimulus (a pseudohomophone).

The high degree of contextual sensitivity observed in the lexical decision task constitutes support for the view that repetition effects in that task are based on a form of episodic memory for processes that construct a conceptual interpretation of the target. In the word naming task, context effects were not as strong, but it is clear that modality-independent processes were essential to repetition effects in this task as well. Our view is that encoding activities such as establishing an interpretation of the target through integral processing with its context contribute to the resulting episodic memory. When a word is repeated in an identification task such as lexical decision, episodic memory for aspects of the earlier encoding experience will be recruited and will contribute to more fluent execution of encoding operations. We assume that episodic memories can be recruited automatically, in parallel as a result of interaction with a stimulus and can be applied to current processing without entering awareness.

It is important to distinguish between initial encoding operations responsible for stimulus identification and elaborative processes associated with deliberate manipulation of concepts. Elaborative processes contribute strongly to performance on direct memory tests such as recall and recognition but have little impact on the degree of fluency in stimulus identification (Jacoby & Dallas, 1981; Kirsner et al., 1983). We claim that basic stimulus identification operations, on the other hand, are responsible for enhanced fluency in making the initial identification of a repeated item. Both identification and elaborative processes, however, are viewed as adhering to a similar set of principles. One essential principle is that recruitment of episodic memory for these operations is context dependent. This principle has been clearly demonstrated for elaborative processes (e.g., Watkins & Tulving, 1975). The results reported here for word naming, and especially lexical decision, indicate that the same is true for stimulus identification operations. The reduction or loss of repetition effects brought about by an inappropriate context is comparable to the effects found when repeated target words were initially presented in isolation or as part of a text (Levy & Kirsner, 1989; MacLeod, 1989; Oliphant, 1983). Our view is that reading a word embedded in text may produce a very different interpretation and certainly incorporates different processes in generating the interpretation, relative to what is involved in the identification of an isolated target word.

Jacoby (1983b) has made a strong case for the view that data-driven aspects of encoding episodes are primarily responsible for producing repetition effects when words are presented in isolation and under data-limited conditions. We believe that the critical feature of Jacoby's and similar results are the data-limited conditions, including tasks such as perceptual identification and word fragment completion (Jacoby 1983b; Roediger & Blaxton, 1987) and the use of unusual typography (Jacoby & Hayman, 1987; Jacoby & Dallas, 1981; Kirsner, 1986). Under conditions where data-driven processes are highly practiced, however, as with clearly printed words in lexical decision or word naming tasks, operations aimed at producing conceptual interpretations appear to make the most powerful contribution to the fluent identification of repeated stimuli, even when targets are presented in isolation (Experiments 1 and 6). From this perspective, each occurrence of a word and the interpretation applied to it are contextually bound, even if the context is no more immediate than other targets in the list. Therefore, developing an interpretation for a repeated word benefits significantly from recent experience with that word in the appropriate context.

Although our approach can claim support from the results reported here, we have not been able to rule out an alternative account that emphasizes sustained activation of stable, lexical entries. A critical difference between the activation view and the proposal we have offered is our emphasis on the contextually controlled volatility of word meaning and the consequent importance of episodic representations of context-specific occurrences of words. Our strategy in designing the
experiments reported here has not been to achieve the difficult task of clearly deciding between the the episodic and activation views. Rather, we have attempted to conduct experiments for which we could derive clear predictions from the episodic view.

In addition, we have pointed out aspects of the results that are consistent with the episodic view but difficult to account for with a simple lexical activation account. In Experiment 2 changing context words without changing the interpretation of a homograph target should not have altered the repetition effect because the appropriate lexical entry would have been accessed on both presentations. No repetition effect should have been observed in Experiment 3 because the target words had not been seen earlier and so should not have received long-lasting activation. A lexical activation account of Experiment 3 that emphasized sustained activation of repeated context words was rendered implausible by Experiment 4. Although it is not strong, a case against the activation view can also be made for the word naming task. In Experiment 5 differential response times associated with dominant and subordinate context words emerged only on a homograph target's second presentation. This result is difficult to explain from an activation point of view. If the nature of the context word had little influence on the time taken to name a homograph on its first presentation, why should heightened activation of the homograph make its later identification more sensitive to the nature of the context word? When combined with the arguments against the activation view summarized at the beginning of this article, the current results pose a significant set of problems for the proposal that fluent identification of repeated words is a product of sustained activation of a lexical node.

In summary, we have argued for the view that repetition effects in word identification are based on a form of episodic memory for the construction of a context-dependent interpretation of a target word. The present experiments provided evidence that fluent identification of a repeated item in lexical decision and word naming tasks does not depend primarily on enhanced perceptual processing, but rather on the generation of a consistent semantic interpretation. As in the case of episodic memory for elaborative processes, recruitment of memory for stimulus identification episodes can be highly context dependent.

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Received June 23, 1989
Revision received September 12, 1989
Accepted September 13, 1989