

Saliency and Awareness in the Jacoby-Whitehouse Effect

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L. L. Jacoby and K. Whitehouse (1989) observed that false recognition of new test words was biased by the nature and duration of preceding context words. With very brief exposures to context words, participants were more likely to call a test item "old" when the prior context word was identical than when there was a mismatch. At longer durations, the reverse pattern was obtained. In the present experiment, test items were preceded by the rapid visual presentation of 7 supraliminal context items, 1 of which might or might not match the test item. Participants either looked for matches (high salience) or tried to remember the context items (low salience). The results closely resemble those for long and short exposure durations, suggesting that the crucial variable is the saliency of matches rather than perceptual subliminality of context items.

Jacoby and Whitehouse (1989) reported two experiments that each consisted of three phases. In Phase 1 participants saw a list of words, presented at one per second, which they were instructed to study in preparation for a recognition test. On every trial of the recognition test given in Phase 2, a sequence of four events took place: visual mask, context item, visual mask, and recognition test word. There were three conditions, such that the relation of the context item to the recognition item was a *match* (they were the same word), a *nonmatch* (they were different words), or a *control* (the context item was a string of letters). Lastly, in Phase 3 of the experiment, participants faced a second, and straightforward, recognition test for their memory of match and nonmatch context words from Phase 2.

Two groups of participants took part in the experiment. For the unaware group, context items in Phase 2 were presented very briefly (50 and 16 ms, respectively, in the two experiments) and participants were not informed that the appearance of the mask would be interrupted by this presentation. For the aware group, context items were presented for a much longer period (200 and 600 ms, respectively, in the two experiments) and participants were not only informed of this presentation but were instructed to read silently (Experiment 1) or read aloud (Experiment 2) the context words they saw prior to the recognition test words and to expect a subsequent recognition test for these context words.

Jacoby and Whitehouse (1989) found that, with one exception, participants in the short-presentation unaware condition were more likely to judge a recognition test item as "old" if it had been preceded by a matching context word than if it had been preceded by a nonmatching context word.¹ The relevant results are shown in Table 1. It can be seen that in both experiments, false recognitions of new items are higher in the match than in the nonmatch condition. Additionally, in Experiment 1, correct recognition of old items was also higher in the

match condition, but for some reason this result could not be replicated in Experiment 2, in which context items were more briefly presented. It can also be seen from Table 1 that an exactly opposite pattern of results was obtained from the long-presentation aware condition in both experiments. Participants who had been made aware of context items were less likely to judge test items as old in the match as compared with the nonmatch condition, and this held consistently for both old and new test words across both experiments.

To explain these contrasting patterns of results for the long- and short-presentation groups, Jacoby and Whitehouse (1989) proposed that the processing of test words in a match condition is facilitated by immediately prior processing of the same item and that this is experienced as enhanced fluency of perception. They suggested that participants in the unaware, short-presentation condition were prone to misattribute this fluency in terms of familiarity, and so were more willing to respond "old." Those participants in the aware, long-presentation condition, however, were thought to have the reverse bias, being more inclined to attribute enhanced fluency to repetition than to familiarity and, consequently, generating a reversed pattern of data. Jacoby and Whitehouse argued in their article that because of the "finding of opposite effects, one can be certain that effects observed in a supposedly unaware condition were not actually due to subjects being aware of the presentation of an item without the experimenter's detecting that awareness" (pp. 126-127). What they were doing was to appeal to a frequently invoked criterion for distinguishing "subliminal" from "supraliminal" presentations; namely, that the two conditions should, in some circumstances at least, generate qualitatively different data (Cheesman & Merikle, 1986; Dixon, 1971, 1981; Kelley & Jacoby, 1990; Marcel, 1983; Merikle & Reingold, 1990; Reingold & Merikle, 1990; Shevrin & Dickman, 1980). They buttressed their claim by showing that, in the third phase of their experiments, recognition of unmatched context words was

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¹ Because, for our purposes, the most important finding concerns the comparison between match and nonmatch conditions, we will not discuss any further in this paper data for the control condition, in which context items were letter strings.

Table 1
Proportion of Old Recognition Memory Judgments as a Function of Test Stimulus, Context Stimulus, and Condition in the Experiments by Jacoby and Whitehouse (1989) and in the Present Study

Study	Condition	Old test stimulus by context		New test stimulus by context	
		Match	Mismatch	Match	Mismatch
J & W I	Short	0.69	0.63	0.36	0.19
J & W II	Short	0.61	0.63	0.26	0.17
G, B, & W	Low salience	0.70	0.61	0.37	0.21
J & W I	Long	0.62	0.69	0.24	0.29
J & W II	Long	0.59	0.68	0.21	0.36
G, B, & W	High salience	0.62 (0.61)	0.65 (0.67)	0.34 (0.31)	0.40 (0.40)

Note. J & W I and J & W II refer to the two experiments by Jacoby and Whitehouse (1989); G, B, & W refers to the present study. Figures in parentheses are corrected proportions.

significantly above chance for the aware group but not for the unaware group. This might seem to have established that the two groups really did differ in that the long-presentation participants had been aware of the context items while the short-presentation participants had not. It is evident, however, that matters were less clear-cut than this. Every one of the supposedly unaware participants in Experiment 1 reported some consciousness of context words sometimes being presented, as did half of the corresponding participants in Experiment 2, although all of them reported paying little heed to these fleetingly glimpsed stimuli. The role of awareness of context items in the generation of the basic effect remains, therefore, contentious at the least.

Reactions to the Jacoby-Whitehouse Effect

Two prior articles (Bernstein & Welch, 1991; Joordens & Merikle, 1992) have concentrated on the issue of whether context items in the supposedly unaware condition really were presented below some threshold of awareness.² Bernstein and Welch acknowledged the overall importance of the Jacoby-Whitehouse effect but doubted whether subliminal processes needed to be invoked to explain it. They replicated the conditions of Jacoby and Whitehouse's (1989) Experiment 2 in what they termed their memory conditions, but rather than talking of aware and unaware groups they simply referred to long (600 ms) and short (16 ms) presentations of context words. One departure from the original study was that their control condition employed nonword context items in place of a letter string. In addition, they added two further conditions to the original ones, both employing short presentations of context items. In the perception condition, participants had only to judge whether the context item was the same word as the test word, a different word, or a nonword. In the dual condition, participants first made the usual old-new recognition decision and then the same tripartite match-mismatch judgment as required in the perception condition.

The results from the memory conditions closely resembled those obtained by Jacoby and Whitehouse (1989), as did the recognition decisions of participants in the dual condition. Bernstein and Welch (1991) demonstrated, therefore, that the basic effect is readily reproducible. However, they also reported that the match-mismatch judgments in both their

perception and dual conditions were made at a level better than chance. On this basis they concluded that generation of the Jacoby-Whitehouse effect does not require that context stimuli in the short-presentation condition be truly "subliminal or even unconscious in other senses" (p. 326).

We do not think that Bernstein and Welch's (1991) results count in any way against Jacoby and Whitehouse's (1989) original explanation of the effect. However, we do have a query regarding Bernstein and Welch's interpretation of their findings. Specifically, if presentation of context items can facilitate or interfere with subsequent processing of test items, yielding a subjective sense of greater perceptual fluency on match than on nonmatch trials, then it seems unsurprising that the same subjective sense might provide a basis for making at least same-different decisions. Admittedly, a simple fluency judgment would not allow participants to distinguish between trials on which the context item was a nonmatch word and those on which it was an actual nonword. However, the finding that under some conditions participants can distinguish words from nonwords at durations that do not allow identification is not novel (Bradshaw, Hicks, & Rose, 1979). Furthermore, the overall departure from chance in Bernstein and Welch's data was due very much more to correct responding on match and nonmatch word trials than to correct identification of nonword context items, a finding consistent with the notion that participants were responding primarily in terms of perceptual fluency.

In the long, drawn out, and complicated debate over subliminal perception (Dixon, 1971, 1981; Holender, 1986), it has become common to draw distinctions between the thresholds of, on the one hand, detection and identification, and, on the other hand, subjective and objective detection (Cheesman & Merikle, 1986). The first of these distinctions is self-explanatory. The second distinguishes between the energy level below which individuals report themselves unable to detect the target stimulus (subjective detection) and the, usually lower, level below which some forced-choice discrimination drops to chance (objective threshold). The Jacoby-Whitehouse effect is necessarily dependent on context items in

² However, see also Debner and Jacoby (1994) and Whittlesea (1993) for recent investigations of closely related issues.

the unaware condition being above objective threshold, because the Phase 2 recognition judgment is precisely a forced-choice discrimination of the sort just described. Given also the verbal reports of some subjective detection, Jacoby and Whitehouse's (1989) original claim presumably was that context items in the short presentation condition were below threshold for identification, not below threshold for detection. Bernstein and Welch's (1991) results do not conflict with this conclusion; they demonstrate that above-chance performance can also be obtained on the forced-choice discrimination of matches.

The first experiment in Joordens and Merikle's (1992) study was a close replication of Jacoby and Whitehouse's (1989) Experiment 1, and produced very similar results. They then conducted a second experiment in which two groups of participants were tested under the short-presentation (57 ms) condition, with only one group being made aware that context items would be presented. Both groups showed the pattern of "old" responses typical of short presentation. However, both groups also showed slightly better than chance discrimination of context words in the subsequent Phase 3 recognition test, as did participants in a third experiment—with exposure duration as a within-subjects variable (57 ms vs. 229 ms) and aware instructions—that yielded the usual crossover pattern of results: Joordens and Merikle concluded, first, that contrasting patterns of responses for short- and long-presentation context items are not caused by different response strategies induced by the different instructions for aware and unaware groups and, second, that they need not be "associated with null and greater than null recognition" of context words. Further, above-chance recognition of short-presentation items need not imply that those items were initially above their identification threshold. It could be that the priming effect of the context presentation lasts sufficiently long that enhanced fluency could underlie recognition decisions in the Phase 3 test exactly as it was thought to do in the Phase 2 test. No direct measure of the duration of priming under exactly this type of condition has, to our knowledge, been made; but priming effects persisting over many hours and days have been reported in the literature on implicit memory (Jacoby, 1983; Sloman, Hayman, Ohta, Law, & Tulving, 1988), so the idea is not an implausible one.

Given the difficulty of establishing exactly what degree of context word awareness was achieved by participants in different experiments, we believe that the really important question to ask is whether presentation of items below identification threshold is necessary for obtaining the Jacoby-Whitehouse effect. To establish the matter beyond doubt, primes must be presented at a duration that is unambiguously above identification threshold and yet still be able to produce the pattern of "old" responses usually associated with short presentations. A technique that might possibly achieve this result is rapid, serial visual presentation of several context words, one of which may (or may not) match the immediately following recognition test word. Under these conditions very rapid forgetting of context words can be expected (Potter, 1984) so that, although having been consciously perceived and identified, the majority of context words will quickly be lost from mind. Under these circumstances, will participants tend to attribute enhanced

fluency to the item having been presented in the Phase 1 study list, and so respond "old," or will they attribute it to repetition of matching items and so favor a response of "new"?

The answer may well depend on how salient repetitions seem to the participants. Our hypothesis is that when repetitions are made salient, by requiring participants to judge their occurrence, then there will be a tendency to respond "new" on match trials. This has been the finding in all the previously cited experiments when single context items have been presented for an extended duration, so that participants could scarcely fail to notice the occurrence of matches and mismatches. When, on the other hand, instructions make no mention of repetitions, and presentation conditions are such as to favor fleeting attention to and rapid forgetting of context items, then it is likely that enhanced perceptual fluency may be misattributed to recognition of the test item from the Phase 1 study list, so that "old" becomes the prevailing response on match trials. Our experiment was designed to test this possibility.

Method

Participants

Thirty eight psychology students at the University of Keele participated, some as volunteers, others in partial fulfillment of course requirements. They all were native English speakers with normal or corrected-to-normal vision. Six participants served as controls to establish the identifiability of context words presented in the experiment proper. The remaining 32 participants were evenly assigned to each of two experimental conditions, designated as high salience and low salience.

Stimuli

Sixty low-to-medium frequency (5–49 per million) five-letter nouns were selected from the Thorndike and Lorge (1944) word book to be used as recognition test words. These were randomly divided into two sets, A and B, of 30 words each, one set being used as old items for half of the participants in each experimental condition and as new items (distractors) for the other half, and vice versa for the other set. A further 420 words of four to six letters were also selected for use as context words by sampling from all 56 categories of the norms of Battig and Montague (1969). Each of the 60 items in sets A and B was then assigned seven context words, care being taken to avoid as far as possible semantic links between any of the eight words. In this way 60 sequences of seven context items preceding a recognition test item were produced, all in the nonmatching condition. To arrive at sequences for the matching condition, the middle context word in each sequence was replaced by that sequence's test word. Two recognition tests were then formed. Test 1 consisted of half of the nonmatching sequences for set A and set B, combined with the noncorresponding half of match sequences for each set. Test 2 was the complement of Test 1. Participants could, therefore, be presented in Phase 1 of the experiment with either set A or set B to memorize. Then, in Phase 2, they saw either Recognition Test 1 or Recognition Test 2. Hence, each recognition test item was seen by an equal number of participants in each of the four types of trials: old match, old nonmatch, new match, and new nonmatch. In addition, a further five practice sequences, using words selected in the same manner as the experimental items,

were added at the start of each recognition test. Three of these were match sequences and two were nonmatch sequences.

Procedure and Apparatus

The experiment was conducted in an otherwise empty and quiet computer laboratory. Participants were tested either individually or in groups of no more than five, all of whom were in the same experimental condition. Each participant sat 65–75 cm from the screen of an Amstrad color monitor driven by an Amstrad PC 2286/40. Brightness and contrast levels were set to maximum and room lights were on. Stimulus characters were in lower case (3 mm × 5 mm) and appeared as white on black. Hand-held buttons were provided for use when responding in the Phase 2 recognition test, each participant choosing which button to use for "old" and which for "new," in accord with their own hand preference.

In Phase 1, participants were presented with a list of 33 words (3 practice and 30 experimental), each of which appeared for 500 ms and was followed by a 500-ms blank screen. They were instructed to repeat each word silently in order to memorize the words for a subsequent recognition test. In Phase 2, participants saw either Recognition Test 1 or Recognition Test 2, consisting of 65 sequences of seven context words followed by a recognition test word which was presented in green to distinguish it from the context items. Each trial began with the appearance on the screen of five asterisks, which acted to warn the participant of the start of the trial and also to indicate the position of the following words. The asterisks disappeared at one per half second, to be followed by a half second blank screen and then the first context word. Context words were displayed for 200 ms and were separated by a 50-ms blank screen. The test item then came on, in green, and remained until the participant pressed one of the two response buttons. There followed a random delay of between 1,500 and 2,500 ms before the next trial was initiated.

Participants in the low-salience condition were instructed to attend to all the context items and then to respond to the green test item by pressing either their "old" or their "new" response button, depending on whether they thought the test item had been part of the original study list.³ Participants in the high-salience condition received similar instructions but with the additional requirement to decide whether the test item matched any preceding context word. They were instructed to give priority to the memory judgment and to decide whether they wanted to respond "new" or "old," but that before pressing the relevant button they were to circle either Y (match) or N (nonmatch) on a numbered response sheet.

Following completion of the 65 recognition trials, participants in the low-salience condition were asked to comment on anything they had noticed about the word sequences. Eleven spontaneously reported noticing that test items on some trials had matched an earlier context item. When the remaining five were specifically asked if they had noticed any repetition of words in the sequences, all commented that they had noticed these on some occasions.

Control participants did not go through Phase 1 of the experiment. They were simply told that they would be shown sequences of briefly-presented words and that their task was to write down immediately, on the sheet of paper provided, as many of the words as they could recall in any order (free recall). After 10 practice trials, which they were allowed to repeat as often as they wished, they completed 10 experimental trials. For the following 20 trials they were asked to make a special effort to report words from the middle of the sequences, giving these priority over early and late occurring words (constrained recall). Then, for a final 10 trials, they were told to revert to their original instructions. At the conclusion of their session all participants were debriefed as to the true purpose of the experiment.

Table 2

Proportion of Items Recalled From Each Serial Position by Control Participants Under Conditions of Free Recall (FR) and Constrained Recall (CR)

Condition	Serial position							M
	1	2	3	4	5	6	7	
FR	.70	.62	.57	.50	.43	.34	.46	.52
CR	.48	.58	.63	.63	.48	.51	.37	.53

Results

Table 2 shows the data of the control participants as percentages of items from each serial position correctly reported under free and constrained recall instructions. Mean number of items recalled was similar with both instruction sets, but it is evident that with free recall there were strong primacy and recency effects for first and last items. The poorer performance with middle items was due to rapid forgetting, rather than to failure of initial perception, because under the constrained recall instructions, middle order items were recalled best. A two-way, repeated measures analysis of variance (ANOVA) yielded no main effect of instruction type, $F(1, 5) < 1$, $MSE = 0.543$, but a significant effect of serial position, $F(1, 30) = 2.96$, $MSE = 11.26$, $p < .03$, and a significant interaction, $F(1, 30) = 3.67$, $MSE = 6.09$, $p < .01$. That participants in both experimental conditions must have been able to perceive items occurring in the middle positions was further demonstrated by the ability of those in the high-salience condition to discriminate nonmatch from match trials. Mean correct responses were 93% for the former and 81% for the latter, indicating that context words were sufficiently well perceived and retained over the short term for four out of five matches to be detected.

Table 1 contains the results of the present study as well as those of both the Jacoby and Whitehouse (1989) experiments. It can be seen that participants in our low-salience condition produced data very similar to the unaware, short-presentation condition in the two earlier studies: "Old" responses were more common in the match than in the nonmatch condition for both new and old items. By contrast, in our high-salience condition the pattern of results was reversed, with "old" responses more frequently given on nonmatch than on match trials. This mimics the pattern obtained by Jacoby and Whitehouse for the long-presentation condition, although in our experiment the differences are somewhat smaller. It must be remembered, however, that participants in this condition reported matches on 7% of nonmatch trials and nonmatches on 19% of match trials. Because on such error trials participants would have been biased against showing the predicted pattern of results, a clearer picture should emerge if the data of such trials are deleted. The figures in parentheses in Table 1 indicate that when this was done, the obtained pattern of data did, indeed, more strongly comply with the prediction. Conse-

³ They were informed that they would later be given a recognition test for context items, but they were not.

quently, these corrected proportions were employed in all subsequent analyses.⁴

Data for old and new items were entered into separate two-way ANOVAs with match–nonmatch as a within-subjects variable and low–high salience as a between-subjects variable. For old items, neither main effect achieved significance, $F_s(1, 30) < 1$ in both cases, but there was a significant interaction between them, $F(1, 30) = 5.98$, $MSE = 152.9$, $p < .01$; in the low-salience condition, the response “old” was significantly more frequent on match than on nonmatch trials, $t(15) = 2.23$, $SE = 15.8$, $p < .025$, whereas in the high-salience condition, the difference in the opposite condition was marginally significant, $t(15) = 1.37$, $SE = 18.5$, $p < .1$. For new items again, neither main effect achieved significance, $F_s(1, 30) = 1.03$ and 0.81 , but there was a significant interaction between them, $F(1, 30) = 13.92$, $MSE = 177.7$, $p < .001$; in the low-salience condition, the response “old” was significantly more frequent on match trials, $t(15) = 3.13$, $SE = 20.2$, $p < .005$, whereas in the high-salience condition it was significantly more frequent on nonmatch trials, $t(15) = 2.08$, $SE = 17.4$, $p < .025$.

Discussion

The results of the experiment were largely in line with our predictions. Participants who on each trial merely viewed seven successive context words presented at a rate of four per second produced the same pattern of biased responses on match and nonmatch trials as had previously been obtained with single, very brief context words, even though the control data established that the context words were above identification threshold and that items in all serial positions were potentially recallable. By contrast, when matches between context and target words were made more salient for participants by having them make repetition judgments, the bias towards giving “old” responses on match trials was reversed, a pattern previously observed under aware, long-presentation conditions. The data thus resemble those obtained by Jacoby and Whitehouse (1989), even down to the level of showing somewhat stronger effects for new items as compared with old.

For present purposes, the important finding was that the bias on recognition obtained by Jacoby and Whitehouse (1989) with short-presentation context words could be mimicked with context words clearly above identification threshold, provided that the salience of repetitions is kept low. In our experiment, this was achieved by overt instruction. Our results are consistent with recent reports that the Jacoby–Whitehouse effect can be obtained with primes that, rather than being presented for longer or shorter exposures, are either attended or unattended (Debner & Jacoby, 1994; Joordens & Merikle, 1991, 1994). The difference is that, in our study, primes in the low-salience condition were not so much unattended as only fleetingly

attended, with rapid forgetting preventing awareness of more than a small percentage of matches. We suggest that manipulations of exposure duration and of attention to context items—as well as appropriate use of rapid serial visual presentation—serve as methods for implicitly varying the salience of repetitions, whereas instructions can provide an overt manipulation. Of course, overt and implicit manipulations of salience may not be wholly independent of one another, as suggested by the previously mentioned finding by Joordens and Merikle (1992). They reported that with sufficiently short or long exposure of primes, overt instructions which did or did not alert participants to their presence had no influence on the pattern of results. Reasonably enough, if participants are rarely, if ever, able to consciously identify primes, they are unlikely to notice many repetitions, and these will consequently be of low salience for them.

To put this another way, it matters little whether Jacoby and Whitehouse’s (1989) context stimuli really were subliminal (by whatever criterion). As their own interpretation of the effect implied, what really counts in generating the effect is not awareness of context items per se, but rather the participant’s awareness of matches between context and target items. It is this latter awareness, which is open to manipulation in a variety of ways, that would seem to determine the attributional biases operating on Phase 2 recognition decisions. The question of whether, or to what extent, participants themselves may be aware of their biases, and of whether such awareness itself affects those biases, adds a further layer of complexity to the issue.

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⁴ It should also be noted that because, when asked during debriefing, all participants in the low-salience group reported having noticed the occurrence of matches on a few trials, their data also could be assumed to underestimate the full effect of unnoticed repetitions; but in this case correction was not possible because the relevant trials could not be identified.

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Received July 19, 1994

Revision received September 19, 1994

Accepted October 7, 1994 ■