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A challenging dissociation in masked identity priming with the lexical decision task☆

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ABSTRACT

The masked priming technique has been used extensively to explore the early stages of visual-word recognition. One key phenomenon in masked priming lexical decision is that identity priming is robust for words, whereas it is small/unreliable for nonwords. This dissociation has usually been explained on the basis that masked priming effects are lexical in nature, and hence there should not be an identity prime facilitation for nonwords. We present two experiments whose results are at odds with the assumption made by models that postulate that identity priming is purely lexical, and also challenge the assumption that word and nonword responses are based on the same information. Our experiments revealed that for nonwords, but not for words, matched-case identity PRIME–TARGET pairs were responded to faster than mismatched-case identity prime–TARGET pairs, and this phenomenon was not modulated by the lowercase/uppercase feature similarity of the stimuli.

1. Introduction

For the past decades, the masked priming technique (Forster & Davis, 1984) has been one of the most prolific tools in the study of the underpinnings of the earliest stages in visual-word identification (see Grainger, 2008, for review). Although the basic setup of masked priming (i.e., a forward pattern mask, a briefly presented lowercase prime [around 30–60 ms], and an uppercase TARGET) can be applied to a number of paradigms, the majority of the published experiments have employed the lexical decision task (i.e., "is the target stimulus a word or not?"). A fundamental finding obtained with masked priming lexical decision is the dissociation between the large identity priming for word targets and the small (or even negligible) identity priming for nonword targets (i.e., *house–HOUSE* yields shorter responses times than *plant–HOUSE*, but *bleeky–BLEEKY* does not always produce shorter responses times than *mornet–BLEEKY*; see Forster, 1998, for a review). This has been taken to suggest that masked priming effects in lexical decision originate from a lexical level of processing (Forster & Davis, 1984; see also Kanwisher, 1987; Norris & Kinoshita, 2008).

In terms of formal modeling, one approach has generated comprehensive accounts of many aspects of the latency and accuracy in the lexical decision task: the "evidence accumulation" approach (diffusion model: Ratcliff, Gomez, & McKoon, 2004; Bayesian Reader model: Norris, 2006). In these models, the evidence for/against the two alternatives (word vs. nonword) is noisy and responses are made when the evidence reaches one of the two decision boundaries (i.e., "word" and "nonword" boundaries). While the diffusion model is agnostic as to the specific intricacies of masked priming (i.e., it is a model of the decision process, not of orthographic/lexical access; but see Gomez, Perea, & Ratcliff, 2013), the Bayesian Reader model has been extended to provide a full account of masked priming (see Norris & Kinoshita, 2008). When applied to masked priming lexical decision, this model assumes that primes and targets are processed as a single stimulus at the lexical level (see also Kanwisher, 1987). For word targets, the evidence from the primes accumulates at the lexical level so that an identity prime "will cause the prior of the target to be revised upward" (Norris & Kinoshita, 2008, p. 440) and the net effect is that responses are faster after an identity prime than after an unrelated prime. For nonword targets, "there is no specific representation that accumulates evidence that the input is a nonword, therefore there is no facilitatory priming for nonwords" (p. 441; see also Kanwisher, 1987, for a similar claim).

Leaving aside the contentious issue of masked identity priming (relative to an unrelated priming condition) in nonword targets, there is one empirical finding that poses problems for the Bayesian Reader account of masked priming. Jacobs, Grainger, and Ferrand (1995) compared the magnitude of masked identity priming effects for matched-case *PRIME–TARGET* pairs versus mismatched-case *prime–TARGET* pairs (e.g., *YEUX–YEUX* vs. *yeux–YEUX*) for word and

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nonword targets in a lexical decision task in French. To avoid visual continuity, they added a 16-ms mask between the prime and the target (i.e., 500-ms forward mask, 33-ms prime, 16-ms backward mask, target item until response). For word targets, responses were equally fast regardless of the case of the prime, which is consistent with the idea that word representations in masked priming are based on the activation of abstract word-level representations (Norris & Kinoshita, 2008; see also Bowers, Vigliocco, & Haan, 1998, for early evidence). In contrast, for nonword targets, there was a latency advantage of the matched-case identical pairs (uppercase PRIME–uppercase TARGET) over the mismatched-case identical pairs (lowercase prime–uppercase TARGET). Given that Norris and Kinoshita (2008) indicated that "it does not matter whether the nonwords presented as the prime or the target are the same or different" (pp. 440–441), the Bayesian Reader may need additional assumptions to explain the advantage of matched-case identity primes for nonword stimuli reported by Jacobs et al. (1995).

It is important to note that Jacobs et al. (1995) did not control for two factors that might have modulated the magnitude of masked priming effects: (1) the distribution of letters in the words and the nonwords, and (2) the physical features of the letters in the word and nonword targets. That is, one might argue that, in the Jacobs et al. (1995) experiment, the letters in the words could have been more visually similar in lowercase/uppercase (e.g., "k" or "c") than in the nonwords. Here we addressed these issues in two experiments. In Experiment 1, we controlled for the letter distribution across word and nonword targets to ensure that the dissociation between words and nonwords was not a by-product of letter discriminability; then, in Experiment 2 we directly manipulated the physical similarity/dissimilarity of features for both word pairs and nonword pairs: *ciky–CIKY* vs. *CIKY–CIKY* (i.e., items composed of letters that are visually similar in lowercase and uppercase) and *edel–EDEL* vs. *EDEL–EDEL* (i.e., items composed of letters that are visually different in lowercase and uppercase). The manipulation in Experiment 2 is relevant because even though masked priming lexical decision is allegedly based on abstract representations (particularly for words), feature similarity between prime and target letters might play a role in the obtained priming effects for nonwords.

The central focus of the present experiments was on the comparison of two types of identity trials: matched PRIME–TARGET pairs vs. mismatched prime–TARGET pairs. However, for consistency with previous research (e.g., Jacobs et al., 1995), we also included unrelated words and nonwords as primes—half of the unrelated primes in lowercase and the other half in uppercase.

2. Experiment 1

2.1. Method

2.1.1. Participants

Twenty-four students at the Universitat de València took part in the experiment and received extra course credit. All of them were native speakers of Spanish and had normal (or corrected-to-normal) vision.

2.1.2. Materials

The target stimuli were 240 words and 240 orthographically legal nonwords, all of them of five letters. The words were extracted from the Spanish B-Pal database (Davis & Perea, 2005): 120 words were of high-frequency (mean word frequency: 69 per million words, range 25–268; mean number of orthographic neighbors: 1.6, range: 0–4) and the other 120 words were of low-frequency (mean word frequency: 6.9 per million words, range 3.6–10.5; mean number of orthographic neighbors: 1.5, range: 0–3). The nonwords were created by replacing one vowel from a Spanish word (e.g., *étuca* [the base word is *ética*], *drega* [the base word is *droga*], etc.). The base words from which the nonwords were derived were not in the experimental set (for the nonwords: mean number of orthographic neighbors: 2.1, range: 1–4). The proportion of each letter (e.g., *a*'s, *b*'s, etc.) was similar for low-frequency words, high-frequency words, and nonwords. The set of stimuli (both word and nonword targets) is available at http://www.uv.es/mperea/identity_priming_lists.pdf. The uppercase target stimulus was preceded by a prime that was: i) the same as the target and in matched-case (e.g., *METRO–METRO*); ii) the same as the target except that it was in mismatched-case (*metro–METRO*); iii) an unrelated word (half in lowercase, half in uppercase); or iv) an unrelated nonword (half in lowercase, half in uppercase). Four lists of stimuli were created in a Latin square design to counterbalance the experimental materials.

2.1.3. Procedure

The experiment was conducted in groups of four participants in a quiet room. DMDX software (Forster & Forster, 2003) was employed to present the stimuli and record the responses. On each trial, a forward pattern mask (i.e., a series of #'s) was presented for 500 ms preceded the prime stimulus, which was shown by 33 ms (i.e., two refresh cycles at 60 Hz), which in turn was replaced by a 16-ms pattern mask (i.e., one refresh cycle). Then, the target stimulus was presented in the same spatial location as the prime until the participant responded—or 2 s had elapsed. Participants were instructed to press the "sí" (yes) key if the uppercase letter string was a Spanish word and to press the "no" key if the uppercase letter string was not a word. Both speed and accuracy were stressed in the instructions. Eighteen practice trials preceded the experimental phase (480 trials) and there were short self-paced breaks every 120 trials. The whole session lasted approximately 16 min.

3. Results and discussion

Error responses (6.7% for word targets and 6.1% for nonword targets) and lexical decision times less than 250 and greater than 1800 ms (0.3% for word targets and 0.8% for nonword targets) were excluded from the RT analyses. The mean RTs and the error rate per condition are displayed in Table 1. As is customary, responses to words and nonword targets were analyzed separately. As stated in the Introduction, the main empirical goal was to examine whether there were differences of case in the targets preceded by an identity prime (matched-case identity PRIME–TARGET pairs vs. mismatched-case identity prime–TARGET pairs). Word-frequency was included as a factor in the statistical analysis on word targets, and List was included in all analyses to extract the error variance due to the counterbalancing lists. These analyses were conducted over subjects (F_1) and over items (F_2). For the interested reader, we also conducted statistical analyses of the effect of repetition priming (i.e., comparing the identity condition vs. unrelated conditions) and the effect of the lexical status of the prime (i.e., comparing the unrelated word condition vs. unrelated nonword condition)—these are reported in Appendix A (see also Table 1). To summarize these findings, we found the typical pattern of masked repetition priming effects, and (as in prior experiments) failed to find any clear evidence of an effect of the lexical status of the unrelated primes (e.g., see Perea, Fernández, & Rosa, 1998).

Table 1
Mean lexical decision times (RTs, in milliseconds) and percentages of errors (ERs) for word and nonword targets in Experiment 1.

	Words				Nonwords	
	Low frequency		High frequency			
	RT	ER	RT	ER	RT	ER
Matched-case ID	644	7.8	584	2.6	687	6.0
Mismatched case ID	644	11.0	581	2.8	701	5.4
Unrelated_word	678	11.1	619	3.3	726	6.5
Unrelated_nonword	682	12.1	624	2.8	727	6.6
Mismatched–Matched	0	3.2	−3	0.2	14	−0.6

3.1. Analyses on word targets

Response times on word targets were virtually the same when preceded by a matched-case identity prime and when preceded by a mismatched-case identity prime (i.e., less than a 2-m difference), both *F*s < 1. Although the analyses on the error rates did not reveal a significant overall difference for target words as a function of matched/mismatched-case of the identity primes, $F_1(1,20) = 2.03$, $MSE = 27.5$, $p = .16$; $F_2(1,232) = 3.66$, $MSE = 76.6$, $p = .057$, the interaction of this factor and word-frequency approached significance, $F_1(1,20) = 3.90$, $MSE = 17.0$, $p = .062$; $F_2(1,232) = 4.35$, $MSE = 76.6$, $p = .038$, reflecting the fact that for low frequency words, participants committed more errors on mismatched-case identity targets than on the matched-case identity targets (11.0 vs. 7.8%, respectively; $F_1(1,20) = 3.92$, $MSE = 31.2$, $p = .062$; $F_2(1,116) = 5.56$, $MSE = 109.0$, $p = .020$), whereas there were no trends of a parallel difference for high-frequency words (2.6% vs. 2.8%, respectively; both *F*s < 1).

3.2. Analyses on nonword targets

Response times were, on average, 14 ms shorter on the matched-case identity targets than the mismatched-case identity targets, $F_1(1,20) = 9.56$, $MSE = 240$, $p = .006$; $F_2(1,236) = 5.04$, $MSE = 4043$, $p = .026$. The analyses on the error rates did not reveal any differences in the accuracy of responses as a function of the type of identity prime (matched-case vs. mismatched-case; both *F*s < 1).

The results of the experiment are clear. While for word targets, there were no signs of a difference between pairs like *metro–METRO* and *METRO–METRO* in the RT analyses, for nonword targets, response times were significantly faster for matched-case identity pairs than for mismatched-case identity pairs (i.e., *LECHA–LECHA* faster than *lecha–LECHA*). Therefore, Experiment 1 successfully extended the findings reported by Jacobs et al. (1995) with a controlled set of stimuli in which letter similarity (i.e., number of *a*'s, *b*'s, etc. in the stimuli) was similar for word and nonword targets, and established the phenomenon in a different language: Spanish. As a reviewer pointed out, the previous statistical analyses were based on the assumption that the upper and lower case unrelated primes (e.g., *dosis–METRO* vs. *DOSIS–METRO*) do not have different effects on the response times (RTs). To substantiate this assumption, we examined the latencies of the unrelated conditions when the prime was in lowercase vs. uppercase. For word targets, the mean RTs were 650.3 vs. 653.7 ms, respectively; and for nonword targets, the mean RTs were 725.4 and 729.7 ms, respectively (all *F*s < 1).

The dissociation between word and nonword targets found in this experiment seems inconsistent with models of the lexical decision task that posit that word and nonword responses are carried out via the same mechanism and using the same information (e.g., "accumulation of evidence" models). Furthermore, as can be seen in Table 1 (see Appendix A), the priming effect for nonwords was sizeable: 26 ms when using the standard lowercase identity prime–TARGET pairs and 40 ms when using the matched-case identity PRIME–TARGET pairs (see also Jacobs et al., 1995, for a similar finding), which also seems to be at odds with the predictions of the Bayesian Reader model.

Before examining how the Bayesian Reader model should be amended to accommodate the empirical findings reported here, it is critical to test the role of the physical similarity of the letters in the obtained effects. In Experiment 1, we did not manipulate the similarity between the lowercase/uppercase features of the words' and nonwords' constituent letters—i.e., we only controlled the distribution of the letters for words and nonwords. In Experiment 2, we created two types of identity pairs: those in which (most of) the letters had similar features in lowercase and uppercase: *kiss–KISS* and *KISS–KISS* (word targets) and *ciky–CIKY* and *CIKY–CIKY* (nonword targets); and those in which (most of) the letters had dissimilar features in lowercase and uppercase: *edge–EDGE* and *EDGE–EDGE* (word targets), and *edel–EDEL* and *EDEL–EDEL* (nonword targets). Given the difficulties in finding a large set of items, participants were presented with each target word/nonword four times, one in each priming condition (see Bowers et al., 1998, for a parallel strategy).

4. Experiment 2

4.1. Method

4.1.1. Participants

The participants were 38 undergraduate students at DePaul University (Chicago) who participated to obtain course credit. All of them were native speakers of American English and had normal (or corrected-to-normal) vision.

4.1.2. Materials

We selected a set of 80 English words of four letters from the N-Watch database (Davis, 2005). Forty of these words were composed of at least three dissimilar cross-case letters in the similarity matrix of Boles and Clifford (1989) (a/A, b/B, d/D, e/E, l/L, g/G, h/H, and r/R; word-frequency per million: 117, range: 6.7–632.4; number of orthographic neighbors: 2.7, range: 0–6; number of similar letters: 3.2, range: 3–4) and the remaining forty words were composed of at least three similar letters in lowercase and uppercase (c/C, i/I, k/K, m/M, n/N, s/S, t/T, u/U, v/V, and w/W; word–frequency: 110, range: 6.9–1360; number of orthographic neighbors: 3.9, range: 1–6; number of similar letters: 3.1, range: 3–4). We also created a set of 80 orthographically legal nonwords of four letters. Forty of these nonwords were composed of at least three dissimilar letters in lowercase and uppercase (e.g., *prae–PRAE*; mean number of orthographic neighbors: 2.9; range 0–6) and the other forty nonwords were composed of at least three similar letters in lowercase and uppercase (e.g., *cilt–CILT*; number of orthographic neighbors: 3.1, range: 0–7). The set of stimuli (both word and nonword targets) is available at http://www.uv.es/mperea/identity_priming_lists.pdf. Given the (relatively) small number of stimuli in the experiment, all participants were presented with each target word/nonword four times, one in each priming condition (see Bowers et al., 1998): uppercase identity prime, lowercase identity prime, unrelated word prime (half in lowercase, half in uppercase) and unrelated nonword prime (half in lowercase, half in uppercase).

4.1.3. Procedure

The procedure was the same as in Experiment 1—except that the experiment was conducted in English.

5. Results and discussion

Incorrect responses (4.6% for word targets and 8.3% for nonword targets) and lexical decision times less than 250 and greater than 1800 ms (0.1% for word targets and 0.2% for nonword targets) were excluded from the latency analyses. The mean RTs and error percent per condition are displayed in Table 2. Words and nonword targets were analyzed separately. The ANOVAs on the latency/error data employed a 2 (type of stimulus: physically similar letters in lowercase/uppercase vs. physically dissimilar letters in lowercase/uppercase) × 2 (prime case: lowercase vs. uppercase) design. As in Experiment 1, the statistical analyses of the repetition priming effect and the effect of the lexical status of the prime are reported in Appendix A.

5.1. Analyses on word targets

Response times on word targets were virtually the same when preceded by a matched-case and a mismatched-case identity prime, both *F*s < 1—this difference was similar for the two types of targets

Table 2
Mean lexical decision times (RTs, in milliseconds) and percentages of errors (ERs) for word and nonword targets in Experiment 2.

	Words				Nonwords			
	Similar letters		Dissimilar letters		Similar letters		Dissimilar letters	
	RT	ER	RT	ER	RT	ER	RT	ER
Matched-case ID	556	3.6	552	5.5	640	7.8	645	8.7
Mismatched case ID	558	3.4	549	4.3	651	8.2	658	10.5
Unrelated_word	588	4.7	590	5.8	664	6.7	668	8.4
Unrelated_nonword	594	4.0	601	5.3	666	7.7	665	8.6
Mismatched–Matched	2	−0.2	−3	−1.2	11	0.4	13	1.8

(interaction: both *F*s < 1). The ANOVA on the error rates failed to reveal a difference between matched and mismatched-case identity priming conditions, $F_1(1,37) = 1.44$, MSE = 11.5, p = .24; $F_2(1,78) = 2.75$, $MSE = 6.3$, $p = .10$—the interaction between the two factors was not significant (both *ps* > .18).

5.2. Analyses on nonword targets

The ANOVA on the latency data revealed a 12-ms advantage of the matched-case identity over the mismatched-case identity priming condition, $F_1(1,37) = 8.46$, $MSE = 657$, $p = .006$; $F_2(1,78) = 12.26$, $MSE = 572$, $p = .001$. This difference occurred to the same degree regardless of the type of lowercase prime (i.e., *edel*- and *ciky*-like nonwords), as deduced from the lack of interaction between the two factors, both *F*s < 1. The ANOVA on the error rate data did not reveal any differences between matched and mismatched-case identity priming conditions, $F_1(1,37) = 1.38$, $MSE = 14.4$, $p = .25$; $F_2(1,78) = 1.13$, $MSE = 18.7$, $p = .29$ (interaction: $F_1(1,37) = 3.13$, $MSE = 15.2$, $p = .085$; $F_2(1,78) = 18.7$, $MSE = 19.8$, $p = .11$).

Thus, for nonword targets, we found an advantage of the matched-case identity pairs over the mismatched-case identity pairs in the latency data (i.e., as in Experiment 1), and this occurred regardless of the feature similarity between lowercase/uppercase pairs (*CIKY–CIKY* faster than *ciky–CIKY* and *EDEL–EDEL* faster than *edel–EDEL*). For word targets, this difference was absent—again, as in Experiment 1. Finally, as can be seen in Table 2, masked identity priming with the mismatched-case prime–TARGET identity pairs (relative to the appropriate priming condition; see Appendix A) also occurred for the nonword targets (11.5 ms)—as usual, it was smaller than the priming effect for word targets (34.5 ms).

In sum, this experiment extends the findings from Experiment 1—and the Jacobs et al. (1995) experiment—by showing that feature similarity does not play a role in the dissociation effect of matched and mismatched-case pairs in masked identity priming for words and nonwords. In addition, it establishes the phenomenon in yet another language: English. Furthermore, Experiment 2 involved a number of repetitions of each target (i.e., some underlying "long term" priming) and the outcome was still the same.

6. General discussion

The three main findings of the present masked priming lexical decision experiments are the following. First, lexical decision times for uppercase nonword targets were faster when preceded by a matched-case identity prime than when preceded by a mismatched-case identity prime (Experiments 1 and 2), thus replicating Jacobs et al. (1995). Second, the previous phenomenon was not modulated by the lowercase/uppercase feature similarity of stimuli (Experiment 2). Third, lowercase/uppercase differences in masked identity priming are absent in responses to words (i.e., both *edge–EDGE* and *EDGE–EDGE* or *city–CITY* and *CITY–CITY* produced similar identification times (Experiments 1 and 2). Taken together, these findings imply that the differences between words and nonwords do *not* occur at a retinotopic (or semi-retinotopic) level of processing, but rather at an abstract level of processing.

The dissociation in the RT data for word targets and nonword targets with respect to the matched-case and mismatched-case identity pairs is a reliable finding that has been found consistently in three different laboratories and languages (Jacobs et al., 1995: *French*; Experiment 1: *Spanish*; and Experiment 2: *English*). Thus, the question becomes now what mechanism gives rise to the differential word/nonword effects in masked identity priming. An *ad hoc* explanation for the present pattern of results is necessary to account for the data within an accumulation of evidence framework. One possibility is that, for words, there is some feedback from word-level representations into the letter detection system, and hence there is an abstract, case-independent encoding of the prime—note that this is consistent with neural models of visual-word recognition (e.g., see Dehaene, Cohen, Sigman, & Vinckier, 2005; see also Molinaro, Duñabeitia, Marín-Gutiérrez, & Carreiras, 2010, for ERP evidence of feedback from the lexical level to the letter level in masked priming). For nonword targets, there is no such feedback because nonwords do not have lexical representations (see Kanwisher, 1987, for a similar reasoning), and hence the encoding of the identity prime does not receive input from the lexical level and it is more likely to be case-specific. However, this explanation might be at odds with the spirit of the Bayesian Reader model—which is a purely feedforward account, and its consequences and feasibility are unclear. An alternative explanation for the word/nonword dissociation would be in terms of flexible deadlines to say "nonword". That is, one could argue that "nonword" responses in the lexical decision task are based on a temporal deadline. This temporal deadline could be set at on the onset of the prime or on the onset of the target, depending on whether the system detects two different events (see Forster, 1998). If one assumes that the matched identity PRIME–TARGET pairs (e.g., *EDEL–####–EDEL*) are more likely perceived as a single event than the mismatched identity prime–TARGET pairs (e.g., *edel–####–EDEL*), the deadline for "nonword" responses would be more likely to be set at the onset of the prime in the matched than in the mismatched prime–target pairs. This can easily explain why "no" responses to *edel–EDEL* are slower than the responses to *EDEL–EDEL*. However, Wagenmakers, Ratcliff, Gómez, and McKoon (2008) provided modeling evidence that posed some problems for "deadline" models in the lexical decision task, as they could not account for data from experiments in which the proportion of words/nonwords and the instructions [emphasis in speed vs. accuracy] were manipulated. One strategy to disentangle these two alternative explanations of the present dissociation (i.e., feedback from the word level vs. deadline account for "no" responses) would be to examine the time course of the matched/mismatched identity priming conditions for word targets vs. nonword targets by using electrophysiological measures (ERPs)—note that, unlike ERPs, behavioral experiments only give us one data time at the end of the processing.

Although the focus of the present article was not the presence/absence of an identity priming effect with nonwords (with mismatched-case) relative to the unrelated condition, it is worth mentioning that we obtained sizeable effects with nonword targets in the two experiments (see Table 1 and Appendix A). As indicated in the Introduction, the Bayesian Reader model would have predicted a null effect of repetition priming for nonwords. We acknowledge that the presence/absence of this effect has been a source of contention in the literature (see Forster, 1998; Perea, Gomez, & Fraga, 2010). Gomez et al. (2013) suggested that this may be the case because the masked priming effect for nonwords may depend on the interplay between different factors (e.g., an advantage at encoding vs. a disadvantage at classifying the repeated stimulus as a nonword). Clearly, more research should be devoted to explore the underpinnings of masked repetition priming with nonwords—and how it may differ across types of nonword foils.

To sum up, the modulation of masked identity priming effects for nonwords—but not for words—as a function of case provides, at the empirical level, a relevant piece of information to solve the intricacies of the dissociating effects of words and nonwords in masked priming lexical decision. Furthermore, at the theoretical level, the current data, which extend the data from Jacobs et al. (1995), pose some problems for successful "evidence accumulator" models of lexical decision and masked priming.

Appendix A. Effects of repetition priming and lexical status of unrelated prime

Experiment 1. Results

Repetition priming (identity vs. unrelated pairs)

In the two experiments, we employed the unrelated items that correspond to the same lexical category as that of the targets (i.e., word primes for word targets, and nonword primes for nonword targets). Response times to target words were about 40 ms shorter when preceded by a mismatched-case identity prime than when preceded by an unrelated word prime, $F_1(1,20) = 47.98$, $MSE = 678$, $p < .001$; $F_2(1,236) = 75.45$, $MSE = 2274$, $p < .001$—note that the magnitude of masked identity priming was similar for high- and low-frequency words (interaction: both $Fs < 1$). The error rates did not reveal a difference between the mismatched-case identity priming condition relative to the unrelated word priming condition, both $Fs < 1$.

Response times to target nonwords were, on average, 26 ms shorter when preceded by a mismatched-case identity prime than when preceded by an unrelated nonword prime, $F_1(1,20) = 26.41$, $MSE = 294$, $p < .001$; $F_2(1,236) = 57.77$, $MSE = 3457$, $p < .001$. ANOVAs on error rates did not reveal a difference between the mismatched-case identity priming condition relative to the unrelated priming condition, both $Fs < 1$.

Effect of lexical status of the unrelated prime (unrelated word prime vs. unrelated nonword prime)

For word targets, there was a 4.5 ms advantage of the unrelated word prime condition relative to the unrelated nonword prime condition, but it was not significant (both $Fs < 1$). In addition, there were no signs on the difference between the lexical statuses of the unrelated priming conditions for nonword targets, both $Fs < 1$. Thus, these data successfully replicated Perea, Fernández, and Rosa (1998); see also Norris & Kinoshita (2008).

Experiment 2. Results

Repetition priming (identity vs. unrelated pairs)

Response times to target words were, on average, 34.5 ms shorter when preceded by a mismatched-case identity prime than when preceded by an unrelated word prime, $F_1(1,37) = 126.2$, $MSE = 365$, $p < .001$; $F_2(1,78) = 122.0$, $MSE = 417$, $p < .001$—note that the masked identity priming effect was similar for the two types of targets (interaction: $F_1(1,37) = 2.23$, $MSE = 526$, $p = .14$; $F_2(1,78) = 2.78$, $MSE = 419$, $p = .10$). The error data revealed that mismatched-case identity primes led to fewer errors on the target words than the unrelated word primes, $F_1(1,37) = 7.19$, $MSE = 10.6$, $p = .011$; $F_2(1,78) = 7.71$, $MSE = 10.4$, $p = .007$—this effect was similar in size for the two types of targets (interaction: both $Fs < 1$).

Response times to target nonwords were, on average, 11.5 ms shorter when preceded by a mismatched-case identity prime than when preceded by an unrelated nonword prime, $F_1(1,37) = 7.70$, $MSE = 576$, $p = .009$; $F_2(1,78) = 8.59$, $MSE = 571$, $p = .004$—this effect was similar in magnitude for *edel*- and *ciky*-like nonwords, as deduced from the lack of interaction between the two factors, both $ps > .24$. In addition, there were, on average, 1.4% more errors on the unrelated priming nonword condition than on the mismatched-case identity priming condition in the analysis by participants, $F_1(1,37) = 3.87$, $MSE = 10.2$, $p = .057$; $F_2(1,78) = 2.18$, $MSE = 19.1$, $p = .14$—the interaction between type of target and identity priming approached significance in the analysis by participants ($F_1(1,37) = 4.08$, $MSE = 8.5$, $p = .051$; $(1,78) = 1.91$, $MSE = 19.1$, $p = .17$).

Effect of lexical status of the unrelated prime (unrelated word prime vs. unrelated nonword prime)

For word targets, there was a small, but significant, 9-ms advantage of the unrelated word priming condition over the unrelated nonword priming condition ($F_1(1,37) = 9.38$, $MSE = 304.0$, $p = .004$; $F_2(1,78) = 8.17$, $MSE = 388.7$, $p = .005$). This difference, which was similar in magnitude for the two types of targets (interaction: both $Fs < 1$), suggests response congruence may play a (small) role in "word" responses—note that in Experiment 1, there was a nonsignificant 4.5-ms difference in the same direction. This difference was completely absent for nonword targets, both $Fs < 1$—as also occurred in Experiment 1. Clearly, an in-depth examination of the effects of response congruency effect for unrelated primes in lexical decision is a relevant issue for further research.

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