American Psychological Association

Journal of Experimental Psychology: Learning, Memory, and Cognition

© 2018 American Psychological Association
0278-7393/19/$12.00

2019, Vol. 45, No. 9, 1683–1702
http://dx.doi.org/10.1037/xlm0000666

Can Response Congruency Effects Be Obtained in Masked Priming Lexical Decision?

María Fernández-López, Ana Marcet, and Manuel Perea
Universitat de València

In past decades, researchers have conducted a myriad of masked priming lexical decision experiments aimed at unveiling the early processes underlying lexical access. A relatively overlooked question is whether a masked unrelated wordlike/unwordlike prime influences the processing of the target stimuli. If participants apply to the primes the same instructions as to the targets, one would predict a response congruency effect (e.g., *book-TRUE* faster than *fiok-TRUE*). Critically, the Bayesian Reader model predicts that there should be no effects of response congruency in masked priming lexical decision, whereas interactive-activation models offer more flexible predictions. We conducted 3 masked priming lexical decision experiments with 4 unrelated priming conditions differing in lexical status and wordlikeness (high-frequency word, low-frequency word, orthographically legal pseudoword, consonant string). Experiment 1 used wordlike nonwords as foils, Experiment 2 used illegal nonwords as foils, and Experiment 3 used orthographically legal hermit nonwords as foils. When the foils were orthographically legal (Experiments 1 and 3; i.e., a standard lexical decision scenario), lexical decision responses were not affected by the lexical status or wordlikeness of the unrelated primes, as predicted by the Bayesian Reader model and the selective inhibition hypothesis in interactive-activation models. When the foils were illegal (Experiment 2), consonant-string primes produced the slowest responses for word targets and the fastest responses for nonword targets. The Bayesian Reader model can capture this pattern, assuming that participants in Experiment 2 were making an orthographic legality decision (i.e., anything legal must be a word) rather than a lexical decision.

Keywords: lexical decision, masked priming, word recognition

Supplemental materials: http://dx.doi.org/10.1037/xlm0000666.supp

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Since its inception in 1984, Forster and Davis's masked priming technique (Forster & Davis, 1984) has become a fundamental tool for examining the initial moments of letter and word recognition in cognitive psychology (see Forster, 2013; Grainger, 2008) and cognitive neuroscience (e.g., Event Related Potentials [ERPs]: Grainger & Holcomb, 2009; Magnetoencephalography: Lehtonen, Monahan, & Poeppel, 2011; functional Magnetic Resonance Imaging [fMRI]: Dehaene et al., 2001). In the standard setup, a briefly presented lowercase prime is preceded by a pattern mask and followed by an uppercase target stimulus until the participant's response so that readers are not usually aware of the prime. This allows researchers to examine various types of prime-target relationships (e.g., identity priming: *steal-STEAL* vs. *horse-STEAL*; orthographic priming: *steam-STEAL* vs. *green-STEAL*; phonological priming: *steel-STEAL* vs. *shell-STEAL*; morphological priming: *stole-STEAL* vs. *brink-STEAL*; associative/semantic priming: *thief-STEAL* vs. *nurse-STEAL*; translation priming: *robar-STEAL* vs. *venir-STEAL*). Importantly, this technique minimizes the strategic processes that may occur with visible, unmasked primes (for fMRI evidence, see Dehaene et al., 2001; for modeling evidence, see Gomez, Perea, & Ratcliff, 2013).

Although the masked priming paradigm has been employed with a number of laboratory word identification tasks (e.g., lexical decision, naming, semantic categorization, same-different), most masked priming experiments have used the lexical decision task. Indeed, researchers have compiled large masked priming data sets with this task (see Adelman et al., 2014, for a megastudy of masked priming lexical decision using 27 form-related priming conditions), and most contemporary models of visual word recognition offer quantitative predictions at the behavioral level (i.e., response times [RTs] and accuracy) of masked priming effects in the lexical decision task (e.g., dual-route cascaded model: Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; spatial coding model [SCM]: Davis, 2010; multiple read-out model [MROM]: Grainger & Jacobs, 1996; Bayesian Reader model [BR model]: Norris & Kinoshita, 2008).

In the present article, we focus on a relatively neglected phenomenon in masked priming lexical decision that may allow us to test the predictions of leading models of visual word recognition: the response congruency effect with unrelated primes. The response congruency effect in lexical decision can be defined as the difference in RTs between a congruent trial (i.e., when the prime elicits the same response as the target; e.g., *bright-WINDOW* or *geuzel-POLCIR*) and an incongruent trial (e.g., *geuzel-WINDOW* or *bright-POLCIR*). The idea is that participants may apply the

This article was published Online First October 25, 2018.

María Fernández-López, Ana Marcet, and Manuel Perea, Departamento de Metodología and ERI Lectura, Universitat de València.

Correspondence concerning this article should be addressed to Manuel Perea, Departamento de Metodología and ERI Lectura, Universitat de València, Avenida Blasco Ibáñez, 21, 46010-Valencia, Spain. E-mail: mperea@uv.es

task instructions (e.g., an implicit categorization of the "yes" vs. "no" decision) not just to the targets but also to the masked primes. As Loth and Davis (2010b) indicated, the examination of response congruency effects in masked priming lexical decision allows us to scrutinize "the state of the lexicon after the prime stimulus has been processed up to an early stage" (p. 174). Thus, this effect may allow us to elucidate the processes underlying masked priming lexical decision.

Response congruency effects have been reported in other masked priming tasks. For instance, Naccache and Dehaene (2001; see also Dehaene et al., 1998) found faster responses in a numerical categorization task ("Is the number higher than 5?") when the masked prime is from the same category as the target (e.g., prime = 7; target = 9) than when it is not (e.g., prime = 2; target = 9). Importantly, Dehaene et al. (1998) found evidence of a differential effect on motor preparation for congruent and incongruent trials using the lateralized readiness potential as a marker, thus favoring the idea that participants make implicit decisions to the prime stimuli. Similarly, Forster (2004) found a response congruency effect in a masked semantic categorization task for narrow categories (e.g., *answer-WINDOW* faster than *collie-WINDOW* for the category "type of dog"). To explain this response congruency effect, Forster stated, "An implicit decision about the category membership of the prime is reached before an explicit decision about the target is reached" (p. 283). If this implicit decision also takes place in masked priming lexical decision, one would expect faster "yes" responses to words after an unrelated word prime than after an unrelated nonword prime—and conversely, one would expect faster "no" responses to nonwords after an unrelated nonword prime than after an unrelated word prime. Critically, a leading computational model of visual word recognition, namely, the BR model (Norris, 2006; see also Norris & Kinoshita, 2008), makes a straight prediction: There should be no effects of response congruency in masked priming lexical decision. The predictions from interactive activation models are less straightforward, although the presence–absence of a response congruency effect may be informative in deciding whether there is homogeneous or selective inhibition at the lexical level.

The BR model (Norris, 2006) assumes that words are represented in an orthographic and lexical perceptual space. Lexical decisions are based on the comparison of the evidence that the visual input is produced—or not—by a word. Information that increases the odds that the stimulus is a word will decrease the odds that the stimulus is a nonword until a criterion is achieved and a response is triggered. To simulate masked priming lexical decision, the BR model assumes that "evidence from both the prime and targets are integrated in reaching a decision" (Kinoshita & Norris, 2012, p. 3). The masked prime generates evidence that the target is in a particular area of the perceptual space, thus predicting faster lexical decision responses to orthographically related pairs (e.g., *trie-TRUE*) than to control pairs (*fiok-TRUE*). Critically, if prime and target do not share any orthographic features, the prime will not alter the evidence for the target in lexical decision—note that in Norris and Kinoshita's (2008) account of masked priming lexical decision, the information from the prime is not sufficient to provide specific evidence that the target is a word or not. That is, neither the masked word prime *food* nor the masked pseudoword prime *fiok* would have an effect on the responses to the target word *TRUE* because they are far apart in perceptual space. As Norris and Kinoshita claimed, "there should be no response-congruence effects in lexical decision" (p. 442). What we should also note, however, is that the BR model assumes that priming effects depend on the decision required by the task, thus not precluding an effect of response congruence in other tasks. For instance, the BR model can capture an effect of response congruence in masked priming semantic categorization tasks (e.g., "Is the word an animal name?"). In a semantic categorization task, "the evidence consists of distributed semantic features that are diagnostic of category membership" (de Wit & Kinoshita, 2014, p. 1738). Specifically, semantic features like <builds nests> in the masked prime *eagle* would constitute evidence toward a "yes" decision, whereas semantic features like <made of metal> in the masked prime *stapler* would provide evidence toward a "no" decision, thus producing a response congruency effect.

Alternatively, the IA model (McClelland & Rumelhart, 1981) and its successors (multiple read-out model: Grainger & Jacobs, 1996; dual route cascade model: Coltheart, et al., 2001; spatial coding model: Davis, 2010) assume that all units at the word level receive activation from the letter and visual feature levels. When the activation level of a word unit exceeds its resting level—which is a function of word frequency—it sends inhibition to all other word units. In the IA model, a "yes" response in lexical decision occurs when the activation level of a word unit exceeds some asymptotic activation threshold (see Jacobs & Grainger, 1992, for the first implementation of the IA model to lexical decision), whereas a "no" response would be produced when none of the word units exceeds threshold after a certain processing duration (see Coltheart, Davelaar, Jonasson, & Besner, 1977). The IA model can easily capture masked orthographic priming effects: The processing of a prime (e.g., the pseudoword *trie*) would partially activate similarly spelled word units (e.g., *true*, *tree*, and *trip*), thus predicting faster lexical decision times to *trie-TRUE* than to *fiok-TRUE* (see Perea & Rosa, 2000, for simulations). Using the original setting of the IA model, the activated word units inhibit all other word units regardless of whether they are orthographically similar or not (i.e., homogeneous lateral inhibition). That is, upon presentation of the masked prime *food*, its corresponding word unit would send inhibitory signals to other word units (e.g., *TRUE*). This inhibition would occur to a lesser degree when the prime is not a word (e.g., the prime *fiok* would produce less inhibition on the word unit *TRUE* than the prime *food*). This specification of the IA model predicts slower "yes" lexical decision times for those target words preceded by an unrelated word prime than when preceded by an unrelated pseudoword prime (e.g., *food-TRUE* slower than *fiok-TRUE*). More generally, the model predicts that "yes" lexical decision times for those target words preceded by an unrelated prime should be a direct function of the lexical activation generated by the prime: high-frequency word prime (*food-TRUE*) > low-frequency word prime (*glop-TRUE*) > pseudoword prime (*fiok-TRUE*) > consonant-string prime (*ghdk-TRUE*; see Bayliss, Davis, Brysbaert, Luyten, & Rastle, 2009, for simulations showing this exact pattern). Thus, the original IA model predicts a response congruency effect—or, rather, an effect of the wordlikeness of the unrelated primes—for "yes" responses.

Importantly, the predictions in the IA model are dependent on the nature of the parameter settings. Davis and Lupker (2006) proposed a selective inhibition mechanism in which the activated

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

word units would only inhibit those word units that are close in lexical space (i.e., similarly spelled word units; e.g., *tree*, *tire*, *tore*, *free* for the word unit *true* but not for unrelated word units like *food*). In this scenario, neither the presentation of the high-frequency word prime *food* nor the presentation of the consonant-string prime *ghdk* would modify the activation level of the target word *TRUE*. Therefore, the selective inhibition hypothesis in the IA model would predict a null effect of response congruency for "yes" responses (see Bayliss et al., 2009, for simulations).

Finally, the predictions on "no" responses in lexical decision in the IA model may depend on how these responses are performed. If the temporal deadline for "no" responses is adjusted after an unrelated prime, as suggested by Forster (1998), one would not expect any response congruency effects for nonwords. That is, the temporal deadline for the pseudoword *UFEZ* would be the same regardless of whether the unrelated prime is a word (e.g., *true*) or not (e.g., *tybe*).

The empirical evidence of an effect of response congruency—or, more generally, an effect of the wordlikeness of the unrelated prime—in masked priming lexical decision is scarce and nonconclusive (see Table 1 for a summary). Although most experiments have failed to obtain an effect of the unrelated primes (Bayliss et al., 2009; Loth & Davis, 2010a, Experiment 4; Norris & Kinoshita, 2008; Perea, Fernández, & Rosa, 1998; Perea, Gómez, & Fraga, 2010; Perea, Jiménez, & Gómez, 2014, Experiment 1; Sereno, 1991), several experiments did find an effect (e.g., Jacobs, Grainger, & Ferrand, 1995; Loth & Davis, 2010a, Experiments 1, 2, and 3; Perea et al., 2014, Experiment 2). There are two procedural differences between these two types of outcomes. The null findings occurred when the target stimuli were presented once and the foils were orthographically legal (i.e., the most usual scenario in word recognition experiments). In contrast, the experiments that reported an effect from the unrelated primes either repeated the target stimuli several times (Jacobs et al., 1995; Perea et al., 2014, Experiment 2) or the foils were orthographically illegal (e.g., *SYKDD*; Loth & Davis, 2010a). To reexamine this issue in depth, we focused on the response congruency effect when the target stimuli are presented only once (i.e., the most common setting in word recognition experiments), and we varied the wordlikeness of the nonword targets: orthographically legal nonwords matched in sublexical characteristics with the words in in Experiment 1, orthographically illegal nonwords in Experiment 2, and orthographically legal nonwords with no close neighbors in Experiment 3.

The main goal of the present study was to examine in detail under which conditions the effect of response congruency could

Table 1
Summary of Masked Priming Lexical Decision Experiments With Different Types of Unrelated Primes

		Mean RT (in ms) Prime type					
Research article	Target type	HFW	H/LFW	LFW	PW	NW	
Sereno (1991)	HFW	621			623		
	LFW			694	702		
	PW		689		678		
Perea, Fernández, & Rosa (1998)	HFW	676		681	679		
	PW	810		811	810		
Norris & Kinoshita (2008, Exp. 1)	HFW	561			561		
	LFW			634	621		
	PW		672		682		
Bayliss et al. (2009, Exp. 1)	HFW	597		600	602	615	
	LFW	688		669	679	686	
Bayliss et al. (2009, Exp. 2)	HFW	581		584			
	LFW	668		666			
Loth & Davis (2010a, Exp. 4)	MFW		636		638		
	PW		794		793		
Perea, Gómez, & Fraga (2010)	W		635		641		
	PW		697		695		
Perea, Jiménez, & Gómez (2014, Exp. 1)	HFW/LFW		678		682		
	PW		727		726		
Jacobs, Grainger, & Ferrand (1995, Exp. 2)	HFW	493			513		[a]
(Items repeated several times)	PW	515			498		[a]
Loth & Davis (2010a, Exp. 1)	HFW	475				498	[a]
	NW	520				497	[a]
Loth & Davis (2010a, Exp. 2)	HFW	531				539	[a]
	PW	586				576	[a]
Loth & Davis (2010a, Exp. 3)	HFW	588				601	[a]
	PW	713				721	
Perea et al. (2014, Exp. 2) (Items repeated several times)	HFW	590			601		[a]
	PW	668			665		

Note. Wordlikeness of nonwords targets from Loth and Davis (2010a): Experiment 4 > Experiment 3 > Experiment 2. RT = Reaction Time; W = word; HFW = high-frequency word; H/LFW = high/low-frequency word; LFW = low-frequency word; MF = medium frequency; NW = illegal nonword; PW = pseudoword; Exp. = Experiment.
[a] Significant effect from unrelated primes.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

occur in masked priming lexical decision. Unlike previous published experiments, which focused exclusively on very few types of orthographically legal primes or on a single comparison of orthographically legal versus orthographically illegal primes, we chose four types of unrelated primes that differed in wordlikeness (60 items per condition): (a) a high-frequency word (e.g., *línea-JAULA*, *coche-GAULO* [in English: *line-CAGE*, *car-GAULO*]), (b) a low-frequency word (e.g., *censo-JAULA*, *boina-GAULO* [*census-CAGE*, *beret-GAULO*]), (c) an orthographically legal pseudoword (e.g., *bunte-JAULA*, *vomon-GAULO* [*bunte-CAGE*, *vomon-GAULO*]), and (d) a consonant string (e.g., *pdtnr-JAULA*, *lbctr-GAULO* [*pdtnr-CAGE*, *lbctr-GAULO*]). Thus, there were two unrelated word priming conditions and two unrelated nonword priming conditions. This allowed us to examine not only the overall response congruency effect but also the effect of the frequency of the word primes (high-frequency vs. low-frequency) and the effect of legality of the nonword primes (orthographically legal pseudowords vs. consonant strings).

Importantly, we also examined whether the difficulty of the word–nonword decision could modulate the response congruency effect in masked priming lexical decision. The rationale here is that the processes underlying lexical decision move faster toward the "yes" or "no" boundaries (i.e., evidence for one response or the other is accumulated faster) when words and nonwords are easily discriminable (e.g., using orthographically illegal nonwords as foils; see Ratcliff, Gomez, & McKoon, 2004, for empirical and modeling evidence). This may maximize the chances to observe an effect because of an implicit decision on the primes. For instance, the high-frequency prime *world* might be implicitly categorized as "yes," and this would speed up the responses to the target word *CHAIR* relative to the consonant-string prime *wtsbn*. However, this prime-induced congruency effect may be more difficult to detect when the nonword foils are orthographically legal (see Loth & Davis, 2010b, for a similar reasoning). (One might argue that the size of effects is usually diminished when RTs are faster, but masked priming effects tend to be similar in magnitude for fast and slow responses; see Gomez et al., 2013). In Experiment 1, the foils were orthographically legal nonwords matched in subsyllabic elements with the target words (e.g., *RERTA*). This is the typical scenario in word recognition experiments. In Experiment 2, the word–nonword discrimination was made substantially easier by having orthographically illegal nonwords (*DPTME*) as foils, and hence maximizing the chances of a prime-induced congruency effect on target stimuli from an implicit "yes" or "no" decision to the prime. To anticipate the results, we found no signs of an effect from the unrelated primes in Experiment 1, whereas in Experiment 2, we found an effect of the unrelated primes on target performance, but only for consonant-string primes. Thus, one could argue that this latter finding may have been driven by a legality judgment decision ("If the target is orthographically legal, say yes") rather than by lexical decision. To examine whether the effects found in Experiment 2 occurred because of a change in the nature of the task (i.e., orthographic legality rather than lexical decision) or because the words and nonwords were easily discriminable, we designed a third experiment. In Experiment 3, the foils had no close neighbors (e.g., *GAZUR*), but they were always orthographically legal. Therefore, although the word–nonword discrimination in Experiment 3 was easier than in Experiment 1, lexical decisions needed to be made in terms of lexical activation rather than orthographic legality.

According to the BR model (Norris & Kinoshita, 2008), one would expect no effects of the lexicality or frequency of the unrelated primes in masked priming lexical decision for word and nonword targets. Therefore, the presence of an effect from the unrelated primes would pose some problems for Norris and Kinoshita's (2008) account of masked priming lexical decision—a similar null effect is predicted by Forster's (2004) account of masked priming lexical decision, in which lexical decisions cannot be generated by masked primes. The predictions from the original IA model hinge on whether they assume selective inhibition or not; in the former case, the model predicts no effects from the different types of unrelated primes, whereas in the latter, the model predicts a direct relation between the lexical decision times and the wordlikeness of the unrelated primes (see Bayliss et al., 2009, for simulations). We defer a thorough description of more sophisticated mechanisms for lexical decision responses in other IA models (i.e., MROM and SCM).

Experiment 1

Method

Participants. Twenty-four students from the Universitat de València (València, Spain), all native speakers of Spanish with normal or corrected to normal vision and no history of reading disorders, voluntarily took part in the experiment. This study was approved by the Experimental Research Ethics Committee of the Universitat de València. Before starting the experiment, all participants signed an informed consent form.

Materials. We selected 240 five-letter target words from the Spanish subtitle database (Duchon, Perea, Sebastián-Gallés, Martí, & Carreiras, 2013). The mean frequency was 16 occurrences per million (range = 5–40)—this corresponded to an average Zipf frequency of 4.15 (range = 3.74–4.61; see van Heuven, Mandera, Keuleers, & Brysbaert, 2014, for the advantages of using Zipf frequencies when describing word information). The mean orthographic Levenshtein distance 20 (Yarkoni, Balota, & Yap, 2008) was 1.41 (range = 1.00–2.65). We also created a set of 240 nonwords to act as foils. These nonwords were created from the target words using Wuggy (Keuleers & Brysbaert, 2010). To act as unrelated primes, we selected 120 high-frequency words (*M* = 201 occurrences per million, range = 49–1304; mean Zipf frequency = 5.14, range = 4.69–6.11) and 120 low-frequency words (*M* = two occurrences per million, range = 0–5; mean Zipf frequency = 3.26, range = 2.17–3.70)—all of them of five letters. Each target stimulus, presented in uppercase, was preceded by a lowercase prime that could be (a) an unrelated high-frequency word, (b) an unrelated low-frequency word, (c) a pseudoword (obtained using Wuggy [50% from high-frequency words and 50% from low-frequency words]), or (d) a five-letter consonant string. The complete list of prime-target pairs is available in Appendix A. To rotate the four priming conditions across all target words, we created four counterbalanced lists following a Latin square design. To familiarize the participants with the task, the 480-trial experimental phase (i.e., 60 items per condition) was preceded by a short practice phase composed of 16 trials (eight word trials and eight nonword trials) with the same characteristics as the experimental trials—these practice trials were not included in the analyses.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Procedure. Each participant was tested alone in a quiet room. DMDX software (Forster & Forster, 2003) was used to display the sequence of stimuli and to register the timing and the accuracy of the responses. In each trial, a pattern mask (i.e., a series of five numbers) was displayed for 500 ms in the center of a computer screen. The mask was replaced by a lowercase prime stimulus for 50 ms, and then the prime was replaced by an uppercase target stimulus. The target stimulus was displayed on the screen until the participant responded or 2 s had passed. All stimuli were presented in black (Courier New 14-pt font) on a white background. Participants were instructed to decide whether the target stimulus was a Spanish word or not by pressing the "yes" or the "no" key. Both speed and precision were stressed in the instructions. Instructions did not mention the existence of any lowercase stimuli. Sixteen practice trials preceded the 480 experimental trials. Participants did not receive feedback on RTs or error rates during the experiment. The session lasted for approximately 18 to 22 min. The raw data of the experiments are provided as online supplemental materials.

Results and Discussion

Error responses and extremely short RTs (less than 250 ms: four responses) were omitted from the latency analyses—note that the deadline to respond was set to 2 s. The mean RTs for the correct responses and the accuracy in each experimental condition are presented in Table 2.

To examine the influence of unrelated primes on the processing of word–nonword targets, we employed linear mixed effects (LME) models in R (R Core Team, 2017) using the *lme4* (Bates, Mächler, Bolker, & Walker, 2015) and *lmerTest* packages (Kuznetsova, Brockhoff, & Christensen, 2016), with two fixed factors: Target Lexicality (word, nonword) and Prime Type (high frequency word, low frequency word, pseudoword, consonant string). For type of prime, we created three orthogonal contrasts following the three research questions: (1) the effect of prime lexicality (word prime [high frequency word, low frequency word] vs. nonword [pseudoword, consonant string]), (2) the effect of prime word-frequency (high frequency word-prime vs. low frequency word-prime), and (3) the effect of the wordlikeness of the nonword primes (pseudoword vs. consonant string). Because of the normality assumption required by LME analyses, the raw RTs were inverse-transformed (−1,000/reaction time [RT]). There were 10,957 observations in the latency analyses. We chose the maximal random effects model whose structure converged. (Using untransformed RTs in the LMEs or using ANOVAs produced exactly the same pattern of results as that reported here). For the accuracy analyses, the responses were coded as binary values (1 = correct, 0 = incorrect), and we used the *glmer* function in the *lme4* package.

Latency analyses. RTs were faster for word targets than for nonword targets (640 vs. 741 ms, respectively; $t = 9.128$, $p < .001$). None of the planned contrasts approached significance: prime lexicality ($t = .004$, $p = .997$), word-prime frequency ($t = .454$, $p = .65$), and nonword-prime wordlikeness ($t = 1.291$, $p = .209$)—none of the interactions between target lexicality and prime type approached significance (all ts < 1.485, ps $> .137$).

Accuracy analyses. Accuracy was higher for word targets than for nonword targets (93.8 vs. 96.5, respectively; $z = 6.949$, $p < .001$). Neither the effect of prime lexicality ($z = 1.778$, $p = .075$) nor the effect of prime word-frequency ($z = .634$, $p = .526$) was significant—the interactions with target lexicality were not significant either (all ps $> .524$). The effect of nonword-prime wordlikeness was significant ($z = 2.896$, $p = .003$): Participants were more accurate when the prime was a pseudoword than when the prime was a consonant string (95.6 vs. 94.0, respectively)—this effect occurred similarly for word and nonword targets, as can be deduced from the lack of interaction between the two factors ($z = .808$, $p = .419$).

RT distributions. To further examine whether the LME analyses missed some subtle effects (e.g., a facilitative effect in the leading edge of the RT distributions that could have been canceled by an inhibitory effect in the higher quantiles), we computed the .1, .2, .3, .4, .5, .6, .7, .8, and .9 quantiles for each participant and condition, and then calculated the values for each quantile across participants (i.e., vincentiled averages). As can be seen in the vincentile plots of the RT distributions shown in Figure 1, all priming conditions behaved similarly, thus corroborating the LME analyses.

In sum, the present experiment, using orthographically legal nonwords as foils and a moderately large number of pairs in each condition (60 items per condition), showed that decision times to "yes" and "no" responses were not modulated by the wordlikeness of the unrelated primes, thus replicating previous experiments with wordlike nonword foils (Bayliss et al., 2009; Loth & Davis, 2010a, Experiment 4; Norris & Kinoshita, 2008; Perea et al., 1998, 2010, 2014, Experiment 1; Sereno, 1991). The only effect from the unrelated primes occurred in the accuracy data: Accuracy was higher when the target stimulus was preceded by a pseudoword prime than when preceded by a prime composed of random consonants—note, however, that the size of the effect (although significant) was very small (95.6 vs. 94.0, respectively).

The BR model and IA model—under the selective inhibition hypothesis—can easily capture this pattern of findings. The question now is whether we could find an effect of the unrelated primes in masked priming lexical decision in an extreme scenario in which the word–nonword discrimination is very easy. Experiment 2 was parallel to Experiment 1, except that we employed illegal nonwords as foils. As the rate of evidence accumulation for a "yes" or "no" response with illegal nonwords will be substantially higher than with wordlike nonwords, there is more room for a response congruency effect to appear. The idea is that participants are more likely to make an implicit decision based on the prime when the lexical status of prime and target is easily discriminable (e.g., the prime *gktbc* would produce evidence toward a "no" decision, whereas a prime like *house* would produce evidence toward a "yes" decision). Indeed, in a series of unpublished experiments, Loth and Davis (2010a) reported a response congruency effect in masked priming lexical decision when using

Table 2
Mean Correct Response Times (in ms) and Accuracy (in Parentheses) for Words and Pseudowords in Experiment 1

Target lexicality	Prime type: High-frequency word	Low-frequency word	Pseudoword	Consonant string
Word	635 (96.7)	641 (97.1)	633 (96.9)	637 (95.3)
Pseudoword	734 (94.0)	730 (94.2)	733 (94.2)	735 (92.7)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

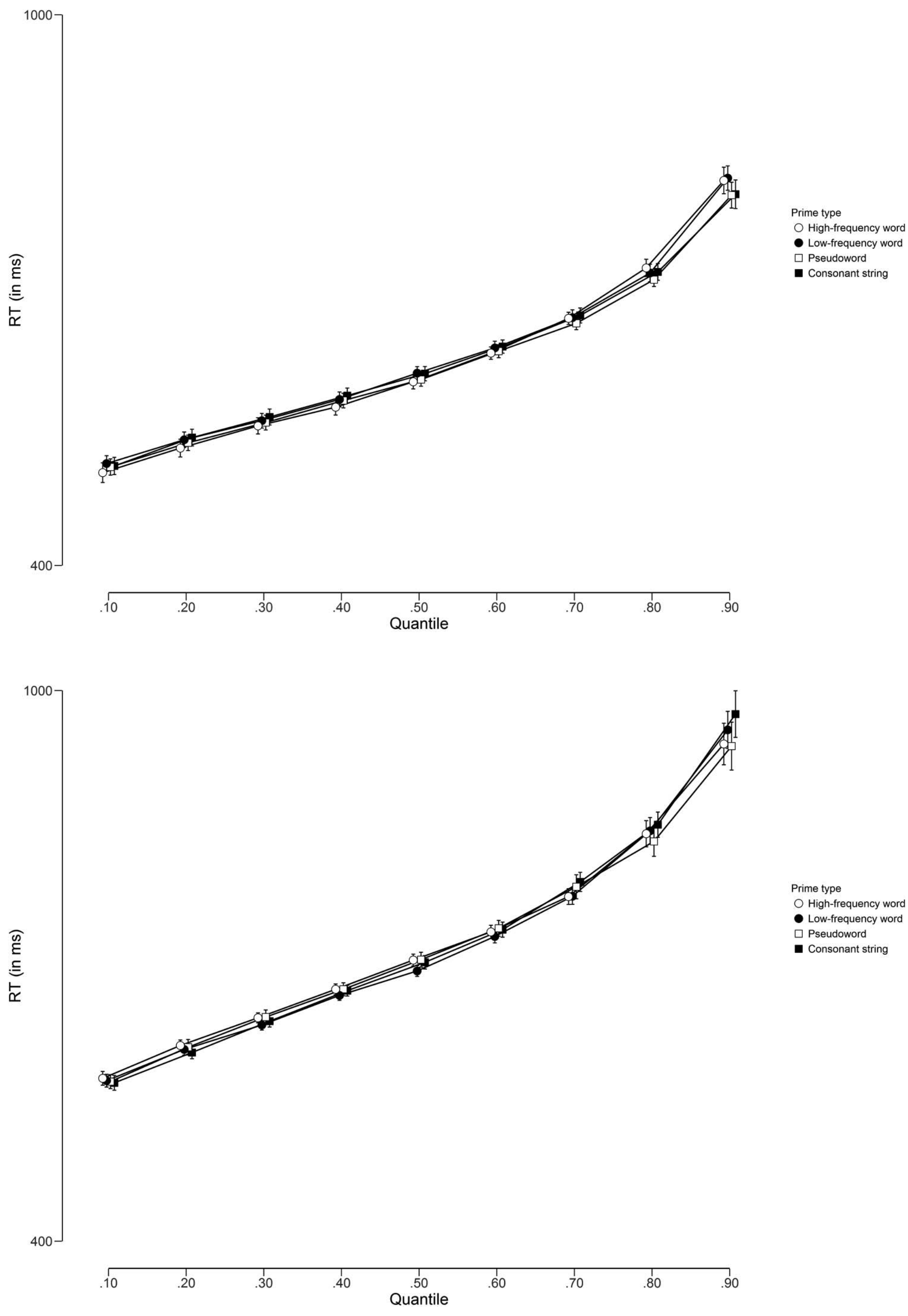

Figure 1. Group reaction time (RT) distributions for the four experimental conditions in Experiment 1 (upper panel: words; lower panel: nonwords) across quantiles (.1 to .9).

unwordlike nonword targets (e.g., faster "yes" responses for *order-CATCH* than for *dqrki-CATCH*; faster "no" responses for *dqrki-SYKDD* than for *order-SYKDD*). A limitation of Loth and Davis's experiments, however, is that the two unrelated priming conditions (i.e., word primes vs. illegal primes) differed not only on lexical status (i.e., word vs. nonword) but also on their orthographic legality (legal vs. illegal).

Experiment 2

Method

Participants. Twenty-four new students from the same subject pool as in Experiment 1 participated in the experiment.

Materials. The set of stimuli was exactly the same as in Experiment 1 except for the nonword targets. Unlike Experiment

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

1, in which the foils were orthographically legal nonwords, in Experiment 2, all foils were illegal nonwords. All of the five-letter nonword foils contained an illegal trigram and a single vowel (e.g., *BEFRM*, *TCFRO*) so that they were hardly pronounceable—in a few cases (less than 9%), these nonwords had an orthographic neighbor (e.g., the nonword *chpja* has the very low-frequency word *chajá* [a Uruguayan dessert] as a neighbor). The complete list of nonword foils is available in Appendix B.

Procedure. The procedure was the same as in Experiment 1.

Results and Discussion

As in Experiment 1, error responses and very short RTs (less than 250 ms: one response) were excluded from the latency analyses. The mean correct RTs and the accuracy in each condition are presented in Table 3. The statistical analyses were parallel to those reported in Experiment 1. There were 11,215 observations in the RT analyses.

Latency analyses. RTs were faster for word targets than for nonword foils (546 vs. 576 ms, respectively; $t = 11.513$, $p < .001$).

Prime lexicality. Although the effect of prime lexicality was not significant ($t = .758$, $p = .449$), we found a significant interaction of prime lexicality and target lexicality ($t = 6.585$, $p < .001$): Lexical decision times on the target words were, on average, 10 ms faster when these were preceded by a word prime than when preceded by a nonword (pseudoword and consonant string) prime (541 vs. 551 ms, respectively; $t = 5.036$, $p < .001$), whereas lexical decision times on target nonwords were, on average, 7 ms faster when preceded by a nonword prime than when preceded by a word prime (573 vs. 580 ms, respectively; $t = 4.175$, $p < .001$).

Prime word-frequency. Neither the effect of the prime word-frequency ($t = .342$, $p = .732$) nor its interaction with target lexicality was significant ($t = 1.482$, $p = .138$).

Prime nonword-wordlikeness. The effect of prime nonword-wordlikeness was significant ($t = 3.573$, $p < .001$): RTs were faster when the prime was a pseudoword than when the prime was a consonant string (556 vs. 568 ms, respectively). This effect interacted with target lexicality ($t = 8.229$, $p < .001$): Lexical decision times on the target words were, on average, 28 ms faster when they were preceded by a pseudoword prime than when preceded by a consonant string (537 vs. 565 ms, respectively; $t = 7.704$, $p < .001$). In contrast, lexical decision times to target nonwords were, on average, 2 ms faster when the prime was a consonant string in comparison with pseudowords (572 vs. 574 ms, respectively; $t = 3.353$, $p < .001$). This latter difference, which was significant using inverse-transformed RT data, vanished when the analyses were conducted on the raw RT data ($t < 1$). As can be seen in the vincentile plot for nonword targets in Figure 2, there was a substantial advantage of the consonant string condition over the pseudoword condition in the leading edge of the RT distribution that vanished in the higher quantiles—note that inverse transformations put more weight in the short than in the long RTs. To examine this issue in greater depth, we conducted a 9 (quantile) $\times$ 2 (prime nonword-wordlikeness: pseudoword vs. consonant string) analysis of variance. The main effect of prime nonword-wordlikeness did not approach significance ($F < 1$), but critically, prime nonword-wordlikeness interacted with quantile, $F(8, 184) = 17.706$, $p < .001$: There was a substantial advantage of the consonant-string condition over the pseudoword condition in the leading edge of the RT distribution (29 ms in the .1 quantile, $p < .001$; 23 ms in the .2 quantile, $p < .001$; and 16 ms in the .3 quantile, $p = .009$), whereas the difference was (if anything) in the opposite direction at the highest quantile (-35 ms in the .9 quantile, $p = .108$)—we applied a Bonferroni correction in these simple effects tests. The nature of this interaction is discussed in the RT distributions section. (Note that the parallel analyses with word targets revealed a prime nonword-wordlikeness effect, $F[1, 23] = 59.83$, $p < .001$, that was approximately the same size across the quantiles [interaction, $F(8, 184) = 1.03$, $p = .41$])

Accuracy analyses. We did not find any differences in accuracy between the words and nonwords ($z = .09$, $p = .926$).

Prime lexicality. The prime lexicality effect was significant ($z = 2.800$, $p = .005$): Participants were more accurate when the prime was a word than when the prime was a nonword (97.8 vs. 96.8, respectively). This effect interacted with target lexicality ($z = 2.450$, $p = .014$): For word targets, responses were more accurate when the unrelated prime was a word than when it was not a word (98.1 vs. 96.4; $z = 3.678$, $p < .001$), whereas this effect did not occur for nonword targets ($z = .236$, $p = .813$).

Prime word-frequency. Neither the effect of prime word-frequency ($z = .5$, $p = .619$) nor its interaction with target lexicality approached significance ($z = .34$, $p = .735$).

Prime nonword-wordlikeness. The effect of prime nonword-wordlikeness approximated significance ($z = 1.95$, $p = .052$). This effect interacted with target lexicality ($z = 2.660$, $p = .007$): For word targets, participants were more accurate when the prime was a pseudoword than when it was consonant string (97.6 vs. 95.1; $z = 3.482$, $p < .001$), but this difference did not approach significance for nonword targets ($z = .508$, $p = .611$).

RT distributions. As shown in the vincentile plot displayed in Figure 2 (top panel), the RT distributions for the word targets were remarkably similar when preceded by an unrelated high-frequency word prime, an unrelated low-frequency word prime, or a pseudoword prime (i.e., the orthographically legal primes), whereas the RT distribution for the word targets preceded by a consonant-string prime showed a location shift to the right. Thus, the effect from consonant-string primes is not a simple response congruency effect (i.e., both consonant-strings primes and pseudoword primes presumably provide evidence for "no" responses in lexical decision, but the pseudoword primes behaved similarly to the word primes). Instead, what this pattern of data suggests is that participants took into account the orthographic characteristics of the primes regardless of their lexical status. This occurred fast enough so that an orthographically illegal prime produced evidence toward a "no" decision, whereas an orthographically legal prime produced

Table 3
Mean Correct Response Times (in ms) and Accuracy (in Parentheses) for Words and Nonwords in Experiment 2

	Prime type			
Target lexicality	High-frequency word	Low-frequency word	Pseudoword	Consonant string
Word	542 (98.2)	539 (97.9)	537 (97.5)	565 (95.1)
Nonword	577 (97.5)	583 (97.5)	574 (97.2)	572 (97.5)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

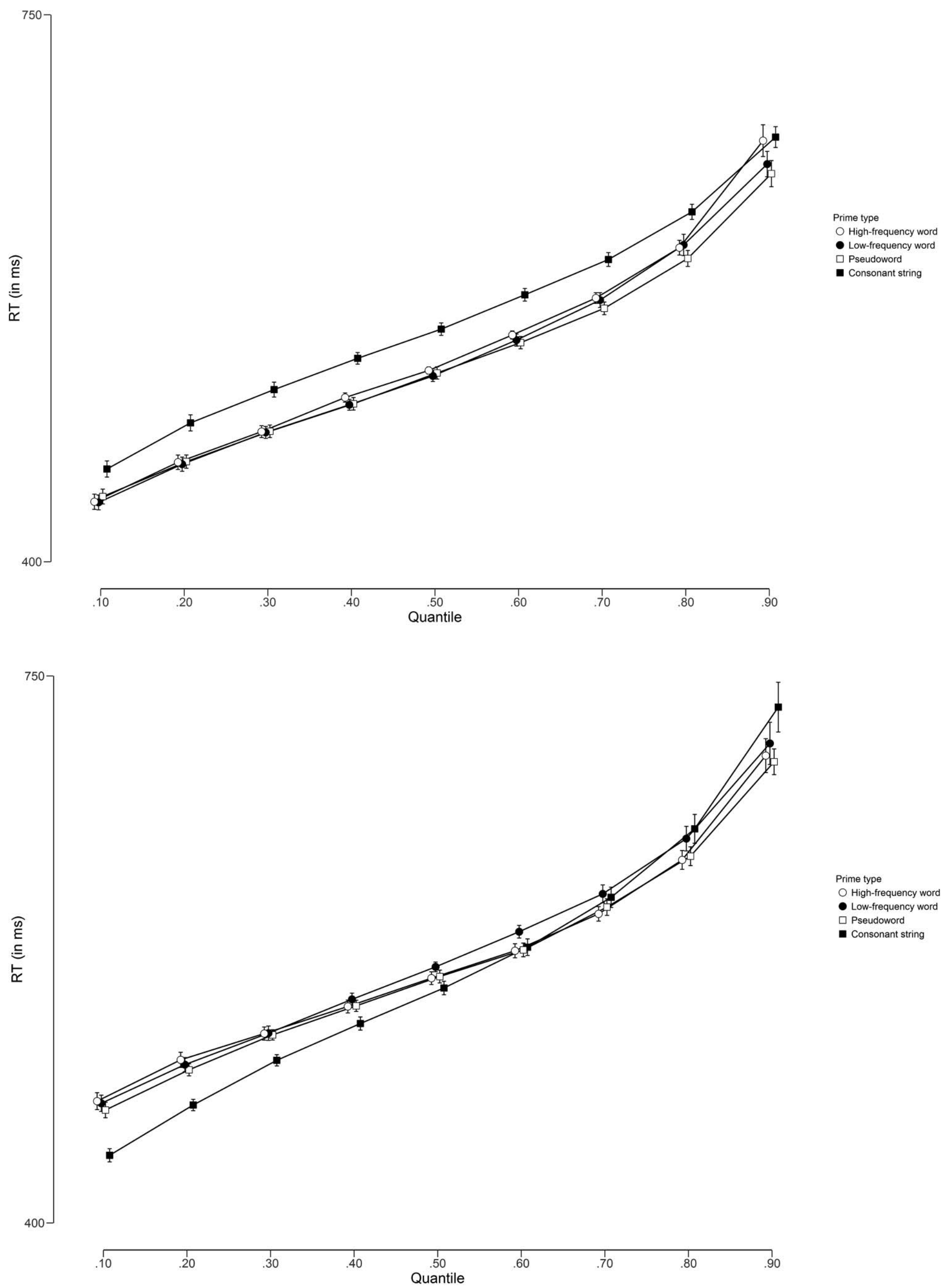

Figure 2. Group reaction time (RT) distributions for the four experimental conditions in Experiment 2 (upper panel: words; lower panel: nonwords) across quantiles (.1 to .9).

evidence toward a "yes" decision.[1] This reinforces the view that the participants in the Experiment 2 could have evaluated the legality of the stimuli rather than accessing the mental lexicon (i.e., a judgment legality task). Indeed, Forster, Mohan, and Hector (2003) showed that word-frequency effects (i.e., a marker of lexical access) are dramatically diminished in lexical decision experiments with illegal nonword foils—consistent with this view, the lexicality effect in the current experiment was dramatically smaller than in Experiment 1 (31 vs. 97 ms, respectively).

For the nonword targets, the RT distributions were again very similar when preceded by a high-frequency unrelated prime, a low-frequency unrelated prime, or a pseudoword prime (i.e., the orthographic legal primes). There is, however, a somewhat unusual pattern in the RT distribution of the consonant string condition: We found a large legality congruency effect in the initial quantiles

[1] We thank the reviewers and the editor for suggesting this explanation.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

of the RT distribution (i.e., shorter "no" RTs to nonword targets when the prime was orthographically illegal than when the prime was orthographically legal) that vanished in the higher quantiles. This pattern is puzzling, as one would expect an effect to increase its size across quantiles (e.g., word-frequency effect; Ratcliff et al., 2004) or to be approximately the same size across quantiles (e.g., masked identity priming; Gomez et al., 2013). The existence of a large effect in the leading edge of the RT distribution that disappears in the higher quantiles has been documented in a numerical categorization task ("Is the digit higher than 5?") with masked primes (e.g., prime = 7, target = 9 vs. prime = 3, target = 9; see Kinoshita & Hunt, 2008). Kinoshita and Hunt (2008) posited the existence of an "inhibitory control mechanism" that rejects an activated response when the cognitive system detects that "the (supraliminal) target is not the source of the response" (pp. 1331–1332). However, it is unclear how a prime can be discounted when it is not visible—the theories on prime discounting originated from studies using visible primes (e.g., see Huber & O'Reilly, 2003). Indeed, de Wit and Kinoshita (2014) acknowledged that "in masked priming, no prime discounting occurs because the prime is masked and hence the participants are unaware that the evidence accumulated from the prime comes from a difference source" (p. 1739). Clearly, the disappearance of the legality congruency effect in the higher quantiles for the nonword targets grants some explanation. The following is an admittedly ad hoc account that should be explored in more targeted studies.

Here, we propose a plausible mechanism within the structure of evidence accumulation modeling.[2] We term it the "probabilistic use of the prime" (PUP) hypothesis. The intuition is straightforward: Suppose that the observer does not use the information provided by the prime in every trial. Instead, the prime-target relationship is utilized in a proportion of trials (i.e., there is a probability greater than 0 and less than 1 that, in a given trial, the information provided by the prime is used). This hypothesis can be implemented in many different ways. However, given prior research on masked priming effects, we believe that assuming that prime-target congruency affects the Time of Encoding + Response (T_{er} parameter) is reasonable (see Gomez et al., 2013, for discussion). (Note that the diffusion model cannot disentangle the time of encoding from the time of response.) If the probability of using the prime-target relationship were 1 (PUP = 1), then the priming effect would produce a location shift in the RT distribution. Critically, as this probability goes down, the effect on the tail is progressively reduced (see Figure 3). Note that at relatively high PUPs (.85 in Panels C and D of Figure 3), there seems to be a location shift in the RT distributions. This matches the results with word targets in the current experiment and also the masked identity priming effects reported by Gomez et al. (2013; see also Perea, Marcet, Lozano, & Gomez, 2018). Importantly, when the PUP is low (.15 in Panels A and B of Figure 3), we can observe a pattern very similar to that found with nonword targets. That is, if prime-target legality congruency affects the T_{er} parameter in a relatively small proportion of trials (e.g., via an implicit decision to the prime stimulus), the model predicts an advantage of the congruent condition in the leading edge of the RT distribution that vanishes in higher quantiles. Why does the pattern of effects differ for word and nonword targets? We could speculate that the PUP might be related to the usefulness of the prime. If we assume that participants were basing their implicit decision on prime legality rather than prime lexicality, three of the four priming conditions were congruent (i.e., high-frequency words, low-frequency words, orthographically legal pseudowords). Thus, in a large majority of trials, the orthographic legality of the primes would be helpful in reaching a "yes" decision (i.e., the implicit decision to the prime matches the decision to the target). If we assume that this affects mainly the T_{er} parameter of the model, one would obtain a legality congruency effect of similar size across the quantiles, as actually occurred. In contrast, for nonword targets, only one of four priming conditions was congruent. In this scenario, prime-target congruency would be substantially less helpful in reaching a "no" decision, and it may have used in only a limited proportion of trials. Although admittedly ad hoc, the PUP hypothesis offers a reasonable account of the RT distributions for word and nonword targets in the present experiment (i.e., compare Figures 2 and 3). Importantly, the diminishing masked priming effect in the higher quantiles obtained by Kinoshita and Hunt (2008, Experiment 1) in a numerical categorization task can also be accommodated by the PUP hypothesis: In their experiment, only one of four priming conditions were congruent with the response.

Summary. In sum, the present experiment represents a demonstration of a response congruency effect in masked priming when the participants' task requires the discrimination of words and illegal nonwords (e.g., *bunte-JAULA* [in English: *funt-CAGE*] produced faster "yes" responses than *pdtrv-JAULA* [*pdtr-CAGE*]; *ghdk-BEFRM* produced faster "no" responses than *fiok-BEFRM*). Importantly, these differences were completely absent with orthographically legal primes (i.e., high-frequency words, low-frequency words, and pseudowords behaved similarly; see Figure 2) and only occurred for consonant-string primes. This finding replicates and extends Loth and Davis's (2010a) Experiment 1. In Loth and Davis's Experiment 1, participants responses were 23 ms faster when the target word were preceded by a congruent prime (i.e., a high-frequency word; 475 ms) than when preceded by an incongruent prime (i.e., an illegal nonword; 498 ms)—we also found a 23-ms difference when comparing these two conditions.

What are the implications of this congruency effect for models of visual word recognition? Although computational models of visual word recognition have been used to simulate lexical decision experiments with illegal nonwords as foils (e.g., Loth & Davis, 2010b; Norris, 2009; Ratcliff et al., 2004), one might argue that under these circumstances, the participants' task is not lexical decision per se, but rather an orthographic legality task (see Forster et al., 2003, for discussion)—note that we did not find a simple response congruency effect (i.e., unrelated pseudoword primes behaved just is unrelated word primes) but a legality congruency effect. To examine the involvement of lexical processing in Experiment 2, we calculated the Pearson correlation between the mean RT of each word and its Zipf frequency. The idea is that if participants are treating the task as an orthographic legality task, frequency effects should be very small. This analysis showed a negligible correlation between

[2] We are indebted to Pablo Gomez for suggesting this explanation. Although we use terms of the diffusion model account of lexical decision (Gomez et al., 2013; Ratcliff et al., 2004), Norris (2009) showed that this model can be subsumed within the BR model.

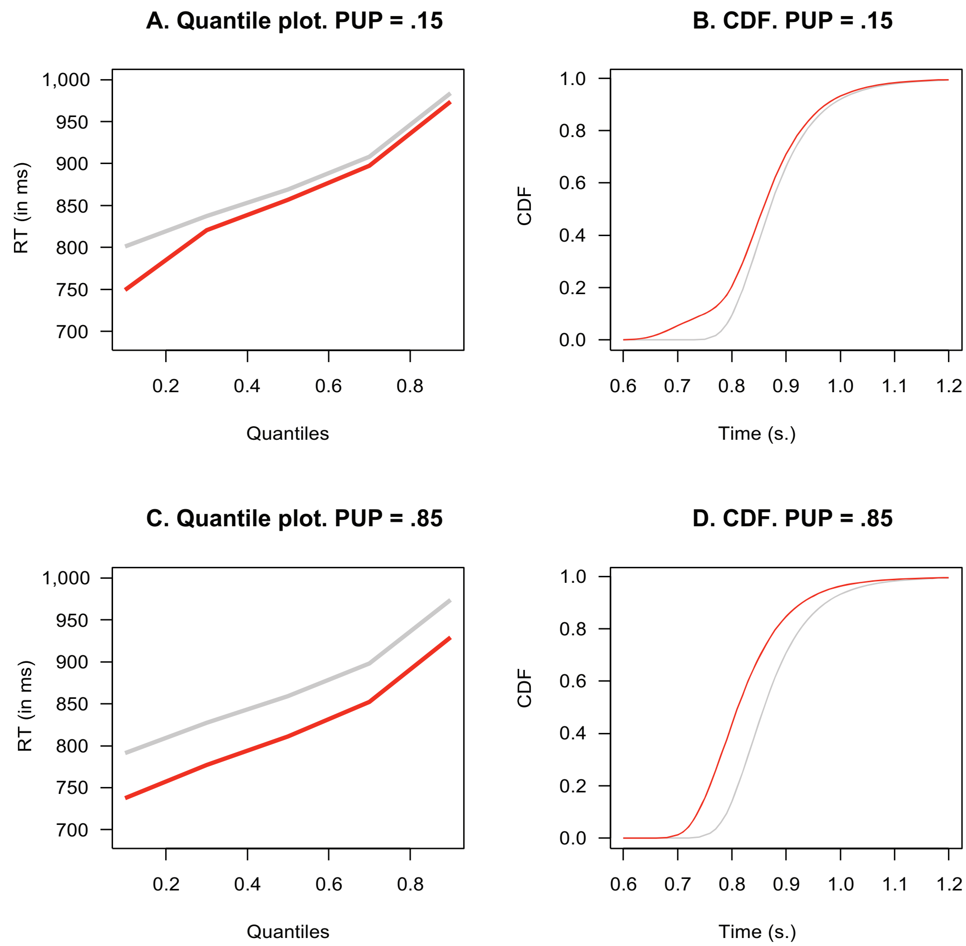

Figure 3. Quantile plots (left) and cumulative density functions (CDFs; right) for two conditions that differ in the probabilistic use of the prime (PUP): low proportion of trials (PUP = .15; top panels) versus low proportion of trials (PUP = .85, bottom panels). Prime-target relationship is assumed to affect the Time of Encoding + Response (T_{er} parameter) of the target. RT = Reaction Time. See the online article for the color version of this figure.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

these two variables ($r = -0.04$, $p = .55$), thus supporting the view that the word–nonword task in the current experiment did not involve lexical access. (The parallel correlation coefficient in Experiment 1 was $r = -0.27$, $p < .001$.) Thus, we believe that it would be premature to make claims on whether the legality congruency effect in the current experiment poses serious problems for the masked priming account of the BR model or the selective inhibition hypothesis of the IA model in a standard lexical decision task—note that these two accounts would predict similar RTs for all priming conditions.

To create a more constraining scenario for the BR and IA models in an easy-to-perform lexical decision task without the risk of altering its lexical nature, we designed Experiment 3. Experiment 3 was similar to Experiment 2, in which the word–nonword discrimination was easy: The nonword foils did not have any close neighbors. Critically, all nonword foils were orthographically legal (*GAZUR*). In this scenario, lexical decisions need to be made in terms of lexical activation rather than on orthographic legality, so that the BR and the IA model—under the selective inhibition hypothesis—would predict a null effect of response congruency.

Experiment 3

Method

Participants. Twenty-four new students from the same subject pool as in Experiments 1 and 2 participated in the experiment.

Materials. The set of stimuli was exactly the same as in Experiments 1 and 2 except for the nonword targets. Unlike Experiment 2—in which foils were illegal nonwords—in Experiment 3, all foils were orthographically legal nonwords. We created the foils by changing two letters from Spanish words using Pseudo software (van Heuven, 2002). Then, we filtered the output by extracting only those nonwords with no close lexical neighbors (i.e., no one-letter substitution-letter neighbors, no transposed-letter neighbors, no addition-letter neighbors, and no deletion-letter neighbors). This produced a list of more than 300 orthographically legal hermit nonwords (e.g., *LEDUL*, *RUPUO*), and we randomly selected 240 nonwords from this set. The complete list of legal nonword foils is available in Appendix C.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Procedure. The procedure was the same as in Experiments 1 and 2.

Results and Discussion

As in Experiments 1 and 2, error responses and very short RTs (less than 250 ms: one response) were omitted from the latency analyses. The mean correct RTs and the accuracy in each experimental condition are presented in Table 4. The statistical analyses were parallel to those reported in the previous experiments. There were 11,167 observations in the RT analyses.

Latency analyses. RTs were, on average, 60 ms faster for word targets than for nonword targets (644 vs. 704 ms, respectively; $t = 5.775$, $p < .001$).

Prime lexicality. Neither the effect of prime lexicality nor its interaction with target type was significant (both ts < 1.26, ps $>$ .21). Indeed, lexical decision times were only 1 ms faster when the prime was a word than when the prime was a nonword (673 vs. 674 ms, respectively).

Prime word-frequency. Neither the effect of word-prime frequency nor its interaction with target type approached significant (both ts < 1, ps $> .65$). Participants' responses were 1 ms faster when the target was preceded by a high-frequency word than when preceded by a low-frequency word (673 vs. 674 ms, respectively).

Prime nonword-wordlikeness. Neither the effect of prime nonword-wordlikeness ($t = 1.941$, $p = .065$) nor its interaction with target type was significant ($t = .403$, $p = .687$)—note that, for word targets, the difference between the pseudoword and consonant string conditions was only 4 ms (643 vs. 647 ms, respectively; $t = 1.275$, $p = .208$).

Accuracy analyses. Accuracy was higher for nonword targets than for word targets (97.7 vs. 96.2, respectively; $z = 4.44$, $p < .001$).

Prime lexicality. The effect of prime lexicality was significant ($z = 2.264$, $p = .02$): Participants were more accurate when the prime was a word than when the prime was a nonword (97.3 vs. 96.5, respectively)—this effect occurred similarly for word and nonword targets, as can be deduced from the lack of interaction between prime and target lexicality ($z = .789$, $p = .429$).

Prime word-frequency. Neither the effect of word prime frequency nor its interaction with target lexicality was significant (both zs < 1, both ps $> .42$). Subjects were only 0.5% more accurate when the prime was a low-frequency word than when the prime was a high-frequency word (97.6 vs. 97.1, respectively).

Prime nonword-wordlikeness. Neither the effect of prime nonword-wordlikeness nor its interaction with target type approached significance (both zs < 1.24, ps $> .21$). The difference in accuracy between pseudoword and consonant string primes is only of 0.5% (96.8 vs. 96.3, respectively).

Table 4
Mean Correct Response Times (in ms) and Accuracy (in Parentheses) for Words and Nonwords in Experiment 3

	Prime type			
Target lexicality	High-frequency word	Low-frequency word	Pseudoword	Consonant string
Word	644 (96.7)	640 (96.9)	643 (95.6)	647 (95.6)
Pseudoword	701 (97.5)	708 (98.2)	698 (97.9)	709 (97.0)

RT distributions. As can be seen in the vincentile plots for both the word and nonword targets displayed in Figure 4, all priming conditions behaved similarly, thus corroborating the LME analyses.

Therefore, the present experiment showed that, when using orthographically legal hermit nonwords as foils, lexical decision times on the target stimuli were similar regardless of the characteristics of the unrelated primes. This pattern of data is similar to that found in Experiment 1, which employed orthographically legal nonwords matched with words in sublexical characteristics. Furthermore, the Pearson correlation between the mean RT of each word and its Zipf frequency in the current experiment was similar to that found in Experiment 1 ($r = -0.28$, $p < .001$ and $r = -0.27$, $p < .001$, respectively), thus showing that the two experiments involve lexical access. The only effect from unrelated primes occurred in the accuracy data: Accuracy was 0.8% higher when the target stimuli were preceded by a word prime than when preceded by a nonword prime (97.3 vs. 96.5, respectively).

The null finding in the latency data may be in contrast to Loth and Davis's (2010a) Experiment 2, which found that lexical decision times for word targets were faster when preceded by a high-frequency word prime than when preceded by an illegal nonword prime when the foils were pronounceable nonwords with no neighbors (e.g., *TEIR*, *DULEW*). However, the effect size in Loth and Davis's Experiment 2 was only 8 ms—the parallel difference in the current experiment was 3 ms (see Table 4). Thus, we prefer to remain cautious about this small effect.

General Discussion

The present experiments were designed to examine in detail whether the lexical status and wordlikeness of unrelated primes (high-frequency words, low-frequency words, orthographically legal pseudowords, and random consonant strings) could affect target processing in masked priming lexical decision. We did so in three different scenarios that varied in the difficulty of the word–nonword discrimination: orthographically legal nonwords matched in subsyllabic elements with the target words (Experiment 1), orthographically illegal nonword foils (Experiment 2), and orthographically legal nonwords with no neighbors (Experiment 3). When using orthographically legal nonwords, RTs to words and nonwords did not differ as a function of the wordlikeness of the prime stimuli (Experiments 1 and 3; see Figures 1 and 4), thus extending previous research with orthographically legal foils (see Table 1 for a summary) with a more thorough set of conditions. We only found an effect of the unrelated primes when the nonwords were orthographically illegal (Experiment 2) and restricted to the primes composed of consonant strings (see Figure 2). We now discuss the implications of these findings for leading models of visual word recognition.

The BR model predicts similar RTs for words preceded by an unrelated prime regardless of its wordlikeness in lexical decision (see Loth & Davis, 2010b, and Norris & Kinoshita, 2008, for simulations). Consistent with the BR model, all unrelated priming conditions behaved similarly in standard word recognition scenarios (i.e., when the foils were orthographically legal, as in Exper-

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

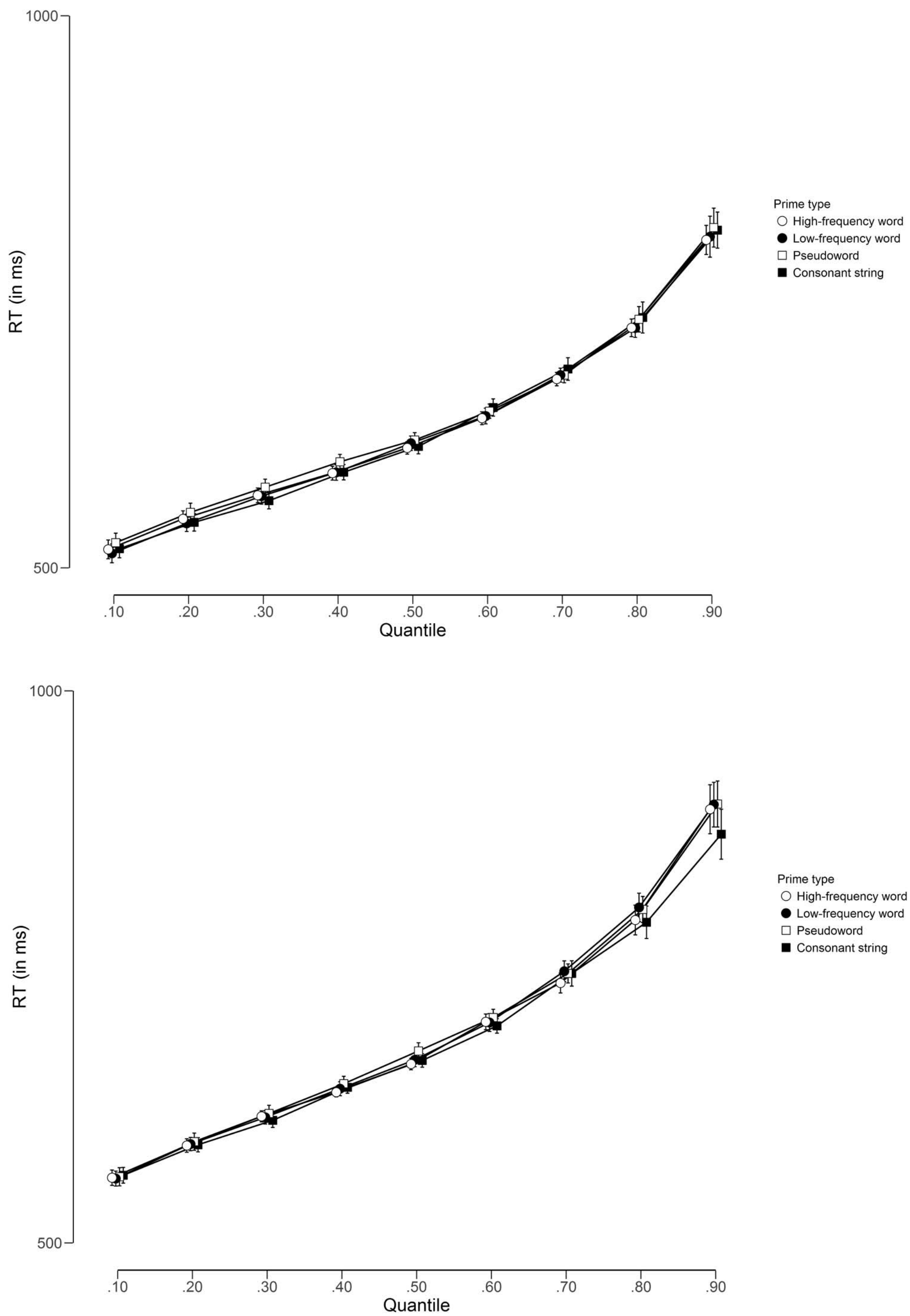

Figure 4. Group reaction time (RT) distributions for the four experimental conditions in Experiment 3 (upper panel: words; lower panel: nonwords) across quantiles (.1 to .9).

iments 1 and 3).[3] However, when the word–nonword discrimination was much easier (i.e., using illegal nonwords as foils [e.g., *BEFRM*, *TCFRO*] instead of orthographically legal nonwords), we found an effect from the unrelated primes: Word RTs were longer when the masked prime was a consonant string than when the masked prime was an orthographically legal nonword (*ghdk-TRUE*

[3] The only minor differences across conditions were in the accuracy analysis. In Experiment 1, there was a 1.6% increase in the error rates when the primes were composed of random consonants relative to pseudoword primes. In Experiment 3, accuracy was 0.8% higher when the target stimuli were preceded by a word prime than when preceded by a nonword prime.

produced longer response times than *fiok-TRUE*; see Figure 2), and nonword responses were faster when preceded by a consonant-string prime than when preceded by a orthographically legal prime, but only in the initial quantiles of RT distributions (*ghdk-BEFRM* produced faster responses than *fiok-BEFRM*; see Figure 2). The question now is whether this latter finding poses some problems for the BR account of masked priming lexical decision. One might argue that the task in Experiment 2 may have switched from lexical decision to an orthographic legality decision. In an orthographic legality decision task, the BR model could quickly accumulate evidence for "yes" or "no" responses from the masked primes: As all the nonword foils violated the orthographic constraints, then anything legal must be a word. That is, participants could carry over from prime to target the estimate of the probability that the visual input is orthographically well formed, not the lexical status. As a result, the BR model could predict slower "yes" responses when the prime is composed of random consonants than when the prime is an orthographically legal stimulus (e.g., a pseudoword or a word), as actually occurred in Experiment 2. Conversely, the model could predict faster "no" responses when the prime is a consonant string than when the prime is an orthographically legal stimulus (e.g., a pseudoword or a word). Indeed, as indicated in the introduction, the BR model can readily accommodate response congruency effects in two-choice tasks other than lexical decision (e.g., semantic categorization; see de Wit & Kinoshita, 2014). Thus, the present findings offer some empirical support to the BR account of masked priming in standard lexical decision experiments—they are also a demonstration of how the nature of the decision required by the task modulates masked priming effects.

The IA model (McClelland & Rumelhart, 1981) offers different predictions depending on whether there is homogeneous or selective lateral inhibition (see Bayliss et al., 2009, for simulations). Clearly, the homogeneous lateral inhibition hypothesis cannot capture the pattern of effects in any of the three experiments (i.e., this hypothesis wrongly predicts longer "yes" decisions in the high-frequency word priming condition than in the nonword priming conditions). Instead, the pattern of the data with orthographically legal nonwords (Experiments 1 and 3) favors Davis and Lupker's (2006) selective lateral inhibition hypothesis: The processing of the word *TRUE* is not modified by the wordlikeness of the unrelated prime, whether it is a high-frequency word like *food* or a consonant string like *ghdk*. The only potential drawback is that response times are faster for *food-TRUE* than for *ghdk-TRUE* when the foils were orthographically illegal (Experiment 2). Although the original IA model under the selective lateral inhibition hypothesis cannot predict this difference, one might argue that participants in Experiment 2 were making an orthographic legality judgment rather than a lexical decision. This orthographic legality judgment task would be beyond the scope of the IA model. A somewhat crude approximation would be to use "overall lexical activity" as a source of evidence to speed up responses in this scenario, as in the "fast-guess" criterion proposed by the MROM (Grainger & Jacobs, 1996) or the SCM (see Davis, 2010). If the fast-guess criterion were set low when the nonword foils did not generate practically any lexical activity, those words whose primes produce some lexical activation would enjoy some advantage relative to those words whose primes barely produced any lexical activation. Indeed, Loth and Davis (2010b) conducted simulations that showed that, depending on the value of the parameters, the SCM could predict an effect of response congruency (e.g., *fiok-TRUE* faster than *ghdk-TRUE*) when the nonword foils are unwordlike and orthographically illegal. However, it is unclear to us how this fast-guess mechanism can accommodate the findings of Experiment 3 with hermit nonwords as foils—note that these stimuli also generate a very low level of activation in the lexicon. Further empirical and computational work is necessary to examine the similarities and differences on word versus nonword responses in lexical decision versus orthographic judgment tasks.

In summary, the present experiments were designed to examine whether response congruency effects with wordlike and unwordlike unrelated primes could be found in lexical decision. When the foils were orthographically legal nonwords, both wordlike and unwordlike priming conditions behaved similarly (Experiments 1 and 3). These findings suggest that participants were unable to establish the lexical status of the masked prime or even to determine the likelihood of its being a word in a standard lexical decision task, thus providing empirical support to the BR model and the selective inhibition hypothesis of the IA model. Furthermore, our findings are a demonstration that detecting invariances (i.e., the null effect of lexical status of unrelated primes on target processing in masked priming lexical decision) is important to progress in science (see Rouder, Speckman, Sun, Morey, & Iverson, 2009). Thus, at a methodological level, the current experiments are useful for choosing the appropriate baseline in masked priming lexical decision experiments. We only found an effect of the unrelated primes on target processing when the foils were orthographically illegal and the primes were composed of consonant strings. However, in this scenario, one might argue that the participants' responses could have been driven by orthographic properties rather than lexical access. Further experimentation using measures with a better temporal resolution (e.g., ERPs) may offer important insights on the time course of the effects of response congruency across tasks.

References

Adelman, J. S., Johnson, R. L., McCormick, S. F., McKague, M., Kinoshita, S., Bowers, J. S., . . . Davis, C. J. (2014). A behavioral database for masked form priming. *Behavior Research Methods, 46,* 1052–1067. http://dx.doi.org/10.3758/s13428-013-0442-y

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67,* 1–48. http://dx.doi.org/10.18637/jss.v067.i01

Bayliss, L., Davis, C. J., Brysbaert, M., Luyten, S., & Rastle, K. (2009). *How are lexical decisions to word targets influenced by unrelated masked primes?* Unpublished manuscript. Retrieved from http://crr.ugent.be/papers/Bayliss%20et%20al.%202008.pdf

Coltheart, M., Davelaar, E., Jonasson, J. T., & Besner, D. (1977). Access to the internal lexicon. In S. Dornic (Ed.), *Attention and performance VI* (pp. 535–555). Hillsdale, NJ: Erlbaum.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108,* 204–256. http://dx.doi.org/10.1037/0033-295X.108.1.204

Davis, C. J. (2010). The spatial coding model of visual word identification. *Psychological Review, 117,* 713–758. http://dx.doi.org/10.1037/a0019738

Davis, C. J., & Lupker, S. J. (2006). Masked inhibitory priming in English: Evidence for lexical inhibition. *Journal of Experimental Psychology: Human Perception and Performance, 32,* 668–687. http://dx.doi.org/10.1037/0096-1523.32.3.668

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Dehaene, S., Naccache, L., Cohen, L., Bihan, D. L., Mangin, J. F., Poline, J. B., & Rivière, D. (2001). Cerebral mechanisms of word masking and unconscious repetition priming. *Nature Neuroscience, 4,* 752–758. http://dx.doi.org/10.1038/89551

Dehaene, S., Naccache, L., Le Clec'H, G., Koechlin, E., Mueller, M., Dehaene-Lambertz, G., . . . Le Bihan, D. (1998). Imaging unconscious semantic priming. *Nature, 395,* 597–600. http://dx.doi.org/10.1038/26967

de Wit, B., & Kinoshita, S. (2014). Relatedness proportion effects in semantic categorization: Reconsidering the automatic spreading activation process. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 40,* 1733–1744. http://dx.doi.org/10.1037/xlm0000004

Duchon, A., Perea, M., Sebastián-Gallés, N., Martí, A., & Carreiras, M. (2013). EsPal: One-stop shopping for Spanish word properties. *Behavior Research Methods, 45,* 1246–1258. http://dx.doi.org/10.3758/s13428-013-0326-1

Forster, K. I. (1998). The pros and cons of masked priming. *Journal of Psycholinguistic Research, 27,* 203–233. http://dx.doi.org/10.1023/A:1023202116609

Forster, K. I. (2004). Category size effects revisited: Frequency and masked priming effects in semantic categorization. *Brain and Language, 90,* 276–286. http://dx.doi.org/10.1016/S0093-934X(03)00440-1

Forster, K. I. (2013). How many words can we read at once? More intervenor effects in masked priming. *Journal of Memory and Language, 69,* 563–573. http://dx.doi.org/10.1016/j.jml.2013.07.004

Forster, K. I., & Davis, C. (1984). Repetition priming and frequency attenuation in lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 10,* 680–698. http://dx.doi.org/10.1037/0278-7393.10.4.680

Forster, K. I., & Forster, J. C. (2003). DMDX: A windows display program with millisecond accuracy. *Behavior Research Methods, Instruments & Computers, 35,* 116–124. http://dx.doi.org/10.3758/BF03195503

Forster, K. I., Mohan, K., & Hector, J. (2003). The mechanics of masked priming. In S. Kinoshita & S. Lupker (Eds.), *Masked priming: The state of the art* (pp. 3–37). New York, NY: Psychology Press.

Gomez, P., Perea, M., & Ratcliff, R. (2013). A diffusion model account of masked versus unmasked priming: Are they qualitatively different? *Journal of Experimental Psychology: Human Perception and Performance, 39,* 1731–1740. http://dx.doi.org/10.1037/a0032333

Grainger, J. (2008). Cracking the orthographic code: An introduction. *Language and Cognitive Processes, 23,* 1–35. http://dx.doi.org/10.1080/01690960701578013

Grainger, J., & Holcomb, P. J. (2009). Watching the word go by: On the time-course of component processes in visual word recognition. *Language and Linguistics Compass, 3,* 128–156. http://dx.doi.org/10.1111/j.1749-818X.2008.00121.x

Grainger, J., & Jacobs, A. M. (1996). Orthographic processing in visual word recognition: A multiple read-out model. *Psychological Review, 103,* 518–565. http://dx.doi.org/10.1037/0033-295X.103.3.518

Huber, D. E., & O'Reilly, R. C. (2003). Persistence and accommodation in short-term priming and other perceptual paradigms: Temporal segregation through synaptic depression. *Cognitive Science, 27,* 403–430. http://dx.doi.org/10.1207/s15516709cog2703_4

Jacobs, A. M., & Grainger, J. (1992). Testing a semistochastic variant of the interactive activation model in different word recognition experiments. *Journal of Experimental Psychology: Human Perception and Performance, 18,* 1174–1188. http://dx.doi.org/10.1037/0096-1523.18.4.1174

Jacobs, A. M., Grainger, J., & Ferrand, L. (1995). The incremental priming technique: A method for determining within-condition priming effects. *Perception & Psychophysics, 57,* 1101–1110. http://dx.doi.org/10.3758/BF03208367

Keuleers, E., & Brysbaert, M. (2010). Wuggy: A multilingual pseudoword generator. *Behavior Research Methods, 42,* 627–633. http://dx.doi.org/10.3758/BRM.42.3.627

Kinoshita, S., & Hunt, L. (2008). RT distribution analysis of category congruence effects with masked primes. *Memory & Cognition, 36,* 1324–1334. http://dx.doi.org/10.3758/MC.36.7.1324

Kinoshita, S., & Norris, D. (2012). Task-dependent masked priming effects in visual word recognition. *Frontiers in Psychology, 3,* 178. http://dx.doi.org/10.3389/fpsyg.2012.00178

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2016). *lmerTest: Tests for random and fixed effects for linear mixed effect models (lmer objects of lme4 package).* R package Version 2. 0–33. Retrieved from http://CRAN.Rproject.org/packagelmerTest

Lehtonen, M., Monahan, P. J., & Poeppel, D. (2011). Evidence for early morphological decomposition: Combining masked priming with magnetoencephalography. *Journal of Cognitive Neuroscience, 23,* 3366–3379. http://dx.doi.org/10.1162/jocn_a_00035

Loth, S., & Davis, C. J. (2010a, January). *Response congruency effects in masked primed lexical decision*. Poster presented at the Experimental Psychology Society, London Meeting, London, UK.

Loth, S., & Davis, C. J. (2010b). Testing computational accounts of response congruency in lexical decision. In E. J. Davelaar (Ed.), *Connectionist models of neurocognition and emergent behavior: From theory to applications* (pp. 173–189). Singapore: World Scientific Publishing. http://dx.doi.org/10.1142/9789814340359_0012

McClelland, J. L., & Rumelhart, D. E. (1981). An interactive activation model of context effects in letter perception: I. An account of basic findings. *Psychological Review, 88,* 375–407. http://dx.doi.org/10.1037/0033-295X.88.5.375

Naccache, L., & Dehaene, S. (2001). Unconscious semantic priming extends to novel unseen stimuli. *Cognition, 80,* 215–229. http://dx.doi.org/10.1016/S0010-0277(00)00139-6

Norris, D. (2006). The Bayesian reader: Explaining word recognition as an optimal Bayesian decision process. *Psychological Review, 113,* 327–357. http://dx.doi.org/10.1037/0033-295X.113.2.327

Norris, D. (2009). Putting it all together: A unified account of word recognition and reaction-time distributions. *Psychological Review, 116,* 207–219. http://dx.doi.org/10.1037/a0014259

Norris, D., & Kinoshita, S. (2008). Perception as evidence accumulation and Bayesian inference: Insights from masked priming. *Journal of Experimental Psychology: General, 137,* 434–455. http://dx.doi.org/10.1037/a0012799

Perea, M., Fernández, L., & Rosa, E. (1998). El papel del status léxico y de la frecuencia del estímulo-señal en la condición no relacionada con la técnica de presentación enmascarada del estímulo-señal [The role of the lexical status and word-frequency of the unrelated primes in the masked priming technique]. *Psicológica, 19,* 311–319.

Perea, M., Gómez, P., & Fraga, I. (2010). Masked nonword repetition effects in yes/no and go/no-go lexical decision: A test of the evidence accumulation and deadline accounts. *Psychonomic Bulletin & Review, 17,* 369–374. http://dx.doi.org/10.3758/PBR.17.3.369

Perea, M., Jiménez, M., & Gómez, P. (2014). A challenging dissociation in masked identity priming with the lexical decision task. *Acta Psychologica, 148,* 130–135. http://dx.doi.org/10.1016/j.actpsy.2014.01.014

Perea, M., Marcet, A., Lozano, M., & Gomez, P. (2018). Is masked priming modulated by memory load? A test of the automaticity of masked identity priming in lexical decision. *Memory & Cognition*. Advance online publication. http://dx.doi.org/10.3758/s13421-018-0825-5

Perea, M., & Rosa, E. (2000). Repetition and form priming interact with neighborhood density at a brief stimulus onset asynchrony. *Psychonomic Bulletin & Review, 7,* 668–677. http://dx.doi.org/10.3758/BF03213005

Ratcliff, R., Gomez, P., & McKoon, G. (2004). A diffusion model account of the lexical decision task. *Psychological Review, 111,* 159–182. http://dx.doi.org/10.1037/0033-295X.111.1.159

R Core Team. (2017). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from http://www.R-project.org/

Rouder, J. N., Speckman, P. L., Sun, D., Morey, R. D., & Iverson, G. (2009). Bayesian t tests for accepting and rejecting the null hypothesis. *Psychonomic Bulletin & Review, 16,* 225–237. http://dx.doi.org/10.3758/PBR.16.2.225

Sereno, J. A. (1991). Graphemic, associative, and syntactic priming effects at a brief stimulus onset asynchrony in lexical decision and naming. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17,* 459–477. http://dx.doi.org/10.1037/0278-7393.17.3.459

van Heuven, W. J. (2002). Pseudo (2.07) [Computer software]. Retrieved from http://www.psychology.nottingham.ac.uk/staff/wvh/internal/research/pseudo/index.html

van Heuven, W. J., Mandera, P., Keuleers, E., & Brysbaert, M. (2014). SUBTLEX-U. K.: A new and improved word frequency database for British English. *The Quarterly Journal of Experimental Psychology: Human Experimental Psychology, 67,* 1176–1190. http://dx.doi.org/10.1080/17470218.2013.850521

Yarkoni, T., Balota, D., & Yap, M. (2008). Moving beyond Coltheart's N: A new measure of orthographic similarity. *Psychonomic Bulletin & Review, 15,* 971–979. http://dx.doi.org/10.3758/PBR.15.5.971

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Appendix A

List of Words and Pseudowords in Experiment 1

The stimuli are presented as quintuples: high-frequency word prime, low-frequency word prime, pseudoword prime, consonant string prime, and TARGET.

Word Targets

común, parra, ácofa, bzjms, DISCO; libre, malla, mulmo, lrjrg, NIEVE; serio, labio, gorpo, zglnc, ÁLBUM; gente, diván, ancor, rsmcb, NIETO; ruido, telón, selor, dqplz, ÁNIMO; largo, tenor, nocho, qdfcn, PLAGA; miedo, copla, salla, prdzt, VAGÓN; pobre, huida, lausa, qfnrt, TRIGO; norte, tapiz, mopén, mlztj, RUMBO; dolor, verso, eblas, qftzn, RUBIO; perro, fusil, gipán, zjtfq, FIRMA; carta, rapaz, patuz, crgqz, MONJA; calma, coral, molpa, cjfpm, FRUTA; dulce, beata, becha, mtdbg, LUNAR; deseo, caldo, ralco, cjqfg, CIFRA; tonto, brujo, cueme, sqlnz, FECHA; árbol, polen, ragoz, jfgrd, FERIA; amigo, felpa, sildo, clrbg, MAREA; viejo, tesis, miaje, bsrdm, FALDA; error, nuera, guemo, zfpnj, PLAZO; línea, censo, bunte, pdtrr, COBRE; forma, yegua, llica, rtjzl, GUIÓN; verde, soplo, acube, gsnqm, TEXTO; padre, surco, puaca, rrncg, BOTÓN; trato, sauna, roine, tcbzf, METAL; bella, pinar, émper, btdjp, GLOBO; héroe, tapón, mejar, snjgz, RANGO; culpa, toldo, leana, npgzf, MONTE; broma, dorso, bádor, bjdrm, SONDA; calor, tramo, lobio, stqrl, RABIA; vuelo, flora, retio, mbfjz, VACÍO; viaje, olivo, plado, psfdj, ASILO; playa, tinte, farmo, nrrls, METRO; mando, atlas, goror, cdbzt, CICLO; poder, vicio, murco, mrsbc, PACTO; igual, matiz, diepo, psrmf, DEUDA; hotel, galán, ibuaz, lbrnt, PATIO; mitad, busto, anazo, dsglb, CONDE; éxito, forro, nurto, lrdfm, ALTAR; lucha, cesta, jeglo, rbcnq, ABEJA; radio, senda, nunto, dptcq, GORRA; listo, prado, menia, gdtlb, COBRA; suelo, ardor, nitar, sflng, PASTA; justo, nogal, zosto, crgbp, POLLO; ayuda, roble, ellir, dpnlz, MARCO; fondo, tacto, cueno, zcrjd, CHINO; chica, guiño, fidro, msqzb, TRONO; mejor, manía, pagle, rnmqb, ACOSO; avión, átomo, golle, gfpnz, LATÍN; mundo, azote, rusar, dzrjf, ARROZ; bomba, torso, muste, rsbjf, DIOSA; nariz, coste, sabón, fzdmj, LUNES; pared, pajar, zosel, tldgm, GRASA; libro, mango, nagar, qgjdr, RUMOR; nivel, brasa, guepo, lgfmd, RENTA; salud, rasgo, larta, cnzmd, PLAZA; lugar, élite, cadmo, jlngp, SUDOR; juego, bulto, aolta, lgsrm, BALÓN; carne, legua, miega, mncgq, CLIMA; mente, chapa, zueno, dfsct, ZORRO; común, parra, ácofa, bzjms, FRENO; libre, malla, mulmo, lrjrg, SUAVE; serio, labio, gorpo, zglnc, OREJA; gente, diván, ancor, rsmcb, DANZA; ruido, telón, selor, dqplz, TRUCO; largo, tenor, nocho, qdfcn, NOBLE; miedo, copla, salla, prdzt, DROGA; pobre, huida, lausa, qfnrt, PLATO; norte, tapiz, mopén, mlztj, BOLSO; dolor, verso, eblas, qftzn, CUEVA; perro, fusil, gipán, zjtfq, PRESO; carta, rapaz, patuz, crgqz, SIGLO; calma, coral, molpa, cjfpm, CURVA; dulce, beata, becha, mtdbg, COPIA; deseo, caldo, ralco, cjqfg, SUCIO; tonto, brujo, cueme, sqlnz, GRADO; árbol, polen, ragoz, jfgrd, BAHÍA; amigo, felpa, sildo, clrbg, INDIO; viejo, tesis, miaje, bsrdm, JAMÓN; error, nuera, guemo, zfpnj, HUECO; línea, censo, bunte, pdtrr, TIGRE; forma, yegua, llica, rtjzl, BRISA; verde, soplo, acube, gsnqm, LÁSER; padre, surco, puaca, rrncg, RIÑÓN; trato, sauna, roine, tcbzf, ESPÍA; bella, pinar, émper, btdjp, TURCO; héroe, tapón, mejar, snjgz, GALLO; culpa, toldo, leana, npgzf, MAFIA; broma, dorso, bádor, bjdrm, ORINA; calor, tramo, lobio, stqrl, QUEJA; vuelo, flora, retio, mbfjz, TROZO; viaje, olivo, plado, psfdj, PLENO; playa, tinte, farmo, nrrls, SOLAR; mando, atlas, goror, cdbzt, MÓVIL; poder, vicio, murco, mrsbc, TEMOR; igual, matiz, diepo, psrmf, DUCHA; hotel, galán, ibuaz, lbrnt, MANGA; mitad, busto, anazo, dsglb, BRUJA; éxito, forro, nurto, lrdfm, BARRO; lucha, cesta, jeglo, rbcnq, DIETA; radio, senda, nunto, dptcq, CIVIL; listo, prado, menia, gdtlb, FICHA; suelo, ardor, nitar, sflng, MUSEO; justo, nogal, zosto, crgbp, RUEDA; ayuda, roble, ellir, dpnlz, PIANO; fondo, tacto, cueno, zcrjd, TORRE; chica, guiño, fidro, msqzb, CANTO; mejor, manía, pagle, rnmqb, VILLA; avión, átomo, golle, gfpnz, CAÑÓN; mundo, azote, rusar, dzrjf, GRANO; bomba, torso, muste, rsbjf, LOCAL; nariz, coste, sabón, fzdmj, BORDE; pared, pajar, zosel, tldgm, CUERO; libro, mango, nagar, qgjdr, AGUJA; nivel, brasa, guepo, lgfmd, SUSTO; salud, rasgo, larta, cnzmd, FURIA; lugar, élite, cadmo, jlngp, QUESO; juego, bulto, aolta, lgsrm, JUDÍO; carne, legua, miega, mncgq, CULTO; mente, chapa, zueno, dfsct, ÓPERA; común, parra, ácofa, bzjms, BINGO; libre, malla, mulmo, lrjrg, TIMÓN; serio, labio, gorpo, zglnc, TARTA;

(*Appendices continue*)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

gente, diván, ancor, rsmcb, FRASE; ruido, telón, selor, dqplz, RUINA; largo, tenor, nocho, qdfcn, FLUJO; miedo, copla, salla, prdzt, BARRA; pobre, huida, lausa, qfnrt, CARRO; norte, tapiz, mopén, mlztj, RATÓN; dolor, verso, eblas, qftzn, ÁCIDO; perro, fusil, gipán, zjtfq, TECHO; carta, rapaz, patuz, crgqz, BURRO; calma, coral, molpa, cjfpm, IDEAL; dulce, beata, becha, mtdbg, OTOÑO; deseo, caldo, ralco, cjqfg, SELVA; tonto, brujo, cueme, sqlnz, PRESA; árbol, polen, ragoz, jfgrd, PRIMA; amigo, felpa, sildo, clrbg, SELLO; viejo, tesis, miaje, bsrdm, AROMA; error, nuera, guemo, zfpnj, CRUCE; línea, censo, bunte, pdtrr, SORDO; forma, yegua, llica, rtjzl, HUESO; verde, soplo, acube, gsnqm, PUNTA; padre, surco, puaca, rrncg, CALVO; trato, sauna, roine, tcbzf, AUTOR; bella, pinar, émper, btdjp, CORTO; héroe, tapón, mejar, snjgz, MOTOR; culpa, toldo, leana, npgzf, FALLO; broma, dorso, bádor, bjdrm, SALTO; calor, tramo, lobio, stqrl, BARCA; vuelo, flora, retio, mbfjz, TENIS; viaje, olivo, plado, psfdj, HACHA; playa, tinte, farmo, nrrls, ATAJO; mando, atlas, goror, cdbzt, UNIÓN; poder, vicio, murco, mrsbc, ENANO; igual, matiz, diepo, psrmf, PLACA; hotel, galán, ibuaz, lbrnt, SOCIO; mitad, busto, anazo, dsglb, GESTO; éxito, forro, nurto, lrdfm, TABLA; lucha, cesta, jeglo, rbcnq, NIÑEZ; radio, senda, nunto, dptcq, SABOR; listo, prado, menia, gdtlb, ALDEA; suelo, ardor, nitar, sflng, ARAÑA; justo, nogal, zosto, crgbp, APODO; ayuda, roble, ellir, dpnlz, VALLE; fondo, tacto, cueno, zcrjd, ACTOR; chica, guiño, fidro, msqzb, VIUDA; mejor, manía, pagle, rnmqb, ÁRABE; avión, átomo, golle, gfpnz, MANTA; mundo, azote, rusar, dzrjf, CREMA; bomba, torso, muste, rsbjf, GUAPA; nariz, coste, sabón, fzdmj, NORMA; pared, pajar, zosel, tldgm, CLAVO; libro, mango, nagar, qgjdr, ACERO; nivel, brasa, guepo, lgfmd, DOSIS; salud, rasgo, larta, cnzmd, CIRCO; lugar, élite, cadmo, jlngp, SUERO; juego, bulto, aolta, lgsrm, POEMA; carne, legua, miega, mncgq, LETRA; mente, chapa, zueno, dfsct, VAPOR; común, parra, ácofa, bzjms, GRITO; libre, malla, mulmo, lrjrg, PLOMO; serio, labio, gorpo, zglnc, RITMO; gente, diván, ancor, rsmcb, PESCA; ruido, telón, selor, dqplz, HORNO; largo, tenor, nocho, qdfcn, BARBA; miedo, copla, salla, prdzt, ETAPA; pobre, huida, lausa, qfnrt, GRIPE; norte, tapiz, mopén, mlztj, SABIO; dolor, verso, eblas, qftzn, JABÓN; perro, fusil, gipán, zjtfq, ACERA; carta, rapaz, patuz, crgqz, SALSA; calma, coral, molpa, cjfpm, LÁPIZ; dulce, beata, becha, mtdbg, CABLE; deseo, caldo, ralco, cjqfg, TRIBU; tonto, brujo, cueme, sqlnz, ÉTICA; árbol, polen, ragoz, jfgrd, CASCO; amigo, felpa, sildo, clrbg, TINTA; viejo, tesis, miaje, bsrdm, CABRA; error, nuera, guemo, zfpnj, TANGO; línea, censo, bunte, pdtnr, JAULA; forma, yegua, llica, rtjzl, BLUSA; verde, soplo, acube, gsnqm, CURSO; padre, surco, puaca, rrncg, LABOR; trato, sauna, roine, tcbzf, SIGNO; bella, pinar, émper, btdjp, RECTA; héroe, tapón, mejar, snjgz, CELDA; culpa, toldo, leana, npgzf, BOTÍN; broma, dorso, bádor, bjdrm, VÍDEO; calor, tramo, lobio, stqrl, LICOR; vuelo, flora, retio, mbfjz, GAFAS; viaje, olivo, plado, psfdj, DUELO; playa, tinte, farmo, nrrls, TÚNEL; mando, atlas, goror, cdbzt, DUEÑA; poder, vicio, murco, mrsbc, OVEJA; igual, matiz, diepo, psrmf, BUZÓN; hotel, galán, ibuaz, lbrnt, CRUEL; mitad, busto, anazo, dsglb, MORAL; éxito, forro, nurto, lrdfm, PLANO; lucha, cesta, jeglo, rbcnq, ROBOT; radio, senda, nunto, dptcq, VARÓN; listo, prado, menia, gdtlb, VENTA; suelo, ardor, nitar, sflng, BICHO; justo, nogal, zosto, crgbp, TROPA; ayuda, roble, ellir, dpnlz, AVISO; fondo, tacto, cueno, zcrjd, MOSCA; chica, guiño, fidro, msqzb, CAJÓN; mejor, manía, pagle, rnmqb, TAREA; avión, átomo, golle, gfpnz, TORTA; mundo, azote, rusar, dzrjf, PLUMA; bomba, torso, muste, rsbjf, DRAMA; nariz, coste, sabón, fzdmj, RIVAL; pared, pajar, zosel, tldgm, VALLA; libro, mango, nagar, qgjdr, PARTO; nivel, brasa, guepo, lgfmd, PULSO; salud, rasgo, larta, cnzmd, DUQUE; lugar, élite, cadmo, jlngp, DÉBIL; juego, bulto, aolta, lgsrm, BANDO; carne, legua, miega, mncgq, HUEVO; mente, chapa, zueno, dfsct, TALLA.

Pseudoword Targets

clase, suela, firia, bzrnd, CUODA; coche, boina, vomón, lbctr, BREMO; santo, casta, mucor, nbmlf, AGACO; joven, gasto, ruena, nzftr, BLIGA; prisa, saldo, drolo, grjds, TUCOR; medio, secta, fluja, lsgfd, SASGA; buena, jarra, pasno, jdgfz, SECIS; fuego, farol, goren, gfrdm, MAPTO; grupo, verbo, badón, fnbgs, FLERO; llave, andén, bejua, mgqbn, RUPTA; sitio, cauce, arnia, rlfnd, DIRSA; falta, faena, fazón, dpqtm, URIÁN; noche, grifo, legor, mrbtf, SIFLE; feliz, gruta, tabez, tzpgl, CASPO; mujer, limbo, gosal, tfcrr, OCEGO; calle, aleta, maver, rbltj, ÉCITO; golpe, peine, pudes, sfbrn, TABIA; único, fobia, filza, scrzg, AVURO; pelea, útero, bomal, rgncd, RALTA; brazo, manto, cergo, ldgrc, BANJA; razón, cojín, broga, mrbnr, SOEGO; cielo, cisne, mepla, mnrbj, PLARO; negro, mareo, ralmo, zlngt, PRACO; reloj, cloro, runco, crrzf, ACUFO; barco, pavor, orazo, rbsdl, SUSNE; color, ancla, valbo, fgrrd, RULLO; final, muslo, prana, tnbms, HUIBO; vista, tacón, lorio, srfnm, DITAL; mayor, mueca, baero, qpnjf, DRAÑO; sueño, ámbar, croja, cmrdt, SOLLA; fácil, cuota, delle, zqbmc, BRANA; orden, sodio, muvor, dcpng, NURJA; causa, fogón, plame, drcpf, LLUPO; hielo, trama, mocer, dmqbp, TARBO; oeste, fiera, prujo, dslmn, COSCE; trago, rigor, ficle, lfrqs, SUCEA; traje, cutis, pusto, trfbd, CHIGU; baile, vejez, mante, stldb, SUNOR; señal, pudor, faubo, lfrnt, MOPRA; total, pompa, rargo, gzdrn, MENZA; señor, musgo, vimal, dngtc, CRENO; novia, tripa, carre, qrcmg, SENCO; punto, fauna, mobun, mgcjt, NIJÓN; nuevo, pasto, relio, rnlmf, MATRA; honor, fibra, zuche, qdjpz, PURCA; banda, prosa, fánel, tqjdc, FÁMER; doble, folio, erdin, sqcfm, ÁLFEM; gusto, miope, mogre, fpzrj, RAPIO; lleno, momia, gopia, tpbqg, GRUBA; parte, vigor, miaco, jslrf, VIASA; madre, tórax, cunra, rbnjg, CEGRO; hogar, lirio, mapre, nzrsf, RUJÓN; valor, rosal, lorna, mrbqt, DIEME; capaz, bambú, vaipe, drnzj, BIFÓN; banco, ansia, úmaso, brqmt, NACEO; corte, dardo, trida, nlrqt, ROTÚN; campo, trapo, ruezo, lgcrd, JARSA; reina, palmo, meper, sldfp, ASENA; leche, funda, nonte, mdtbj, AIDOR; papel, fresa, leluz, lrsqg, NUEJO; clase, suela, firia, bzrnd, REULA; coche, boina, vomón, lbctr, HERRU; santo, casta, mucor, nbmlf, PURTA; joven, gasto, ruena, nzftr, IBEOL; prisa, saldo, drolo, grjds, RULGO; medio, secta, fluja, lsgfd, LUTIA;

(*Appendices continue*)

buena, jarra, pasno, jdgfz, RAPOR; fuego, farol, goren, gfrdm, HAUSO; grupo, verbo, badón, fnbgs, SIZAL; llave, andén, bejua, mgqbn, DONTA; sitio, cauce, arnia, rlfnd, ROBUC; falta, faena, fazón, dpqtm, ÁVADA; noche, grifo, legor, mrbtf, LLITO; feliz, gruta, tabez, tzpgl, CRUSA; mujer, limbo, gosal, tfcrr, VECHA; calle, aleta, maver, rbltj, FLENA; golpe, peine, pudes, sfbrn, MABÓN; único, fobia, filza, scrzg, DARJA; pelea, útero, bomal, rgncd, LANCA; brazo, manto, cergo, ldgrc, COVIO; razón, cojín, broga, mrbnr, DURCO; cielo, cisne, mepla, mnrbj, GAPÓN; negro, mareo, ralmo, zlngt, FLADO; reloj, cloro, runco, crrzf, CURNO; barco, pavor, orazo, rbsdl, GODIS; color, ancla, valbo, fgrrd, VAHÚA; final, muslo, prana, tnbms, QUIÓS; vista, tacón, lorio, srfnm, BONTA; mayor, mueca, baero, qpnjf, SUCNO; sueño, ámbar, croja, cmrdt, PUSGO; fácil, cuota, delle, zqbmc, RIERO; orden, sodio, muvor, dcpng, GOGRE; causa, fogón, plame, drcpf, BEDRA; hielo, trama, mocer, dmqbp, BURSO; oeste, fiera, prujo, dslmn, DACHO; trago, rigor, ficle, lfrqs, TIFRO; traje, cutis, pusto, trfbd, PEISO; baile, vejez, mante, stldb, FIDOR; señal, pudor, faubo, lfrnt, GUEVA; total, pompa, rargo, gzdrn, ECIÑA; señor, musgo, vimal, dngtc, DOCHO; novia, tripa, carre, qrcmg, ACOFO; punto, fauna, mobun, mgcjt, SÚNIL; nuevo, pasto, relio, rnlmf, GIJEZ; honor, fibra, zuche, qdjpz, TELZA; banda, prosa, fánel, tqjdc, DUVIO; doble, folio, erdin, sqcfm, CHOGO; gusto, miope, mogre, fpzrj, GERTA; lleno, momia, gopia, tpbqg, BARGO; parte, vigor, miaco, jslrf, GAULO; madre, tórax, cunra, rbnjg, GULLA; hogar, lirio, mapre, nzrsf, TRUMO; valor, rosal, lorna, mrbqt, BRADA; capaz, bambú, vaipe, drnzj, PUCES; banco, ansia, úmaso, brqmt, RERTA; corte, dardo, trida, nlrqt, OCATA; campo, trapo, ruezo, lgcrd, PRAMA; reina, palmo, meper, sldfp, RAUGA; leche, funda, nonte, mdtbj, MAFLE; papel, fresa, leluz, lrsqg, DARRO; clase, suela, firia, bzrnd, GAÑOS; coche, boina, vomón, lbctr, BRIME; santo, casta, mucor, nbmlf, ONRÍO; joven, gasto, ruena, nzftr, CODOR; prisa, saldo, drolo, grjds, ANCEO; medio, secta, fluja, lsgfd, ÁMAJO; buena, jarra, pasno, jdgfz, PLAJO; fuego, farol, goren, gfrdm, CHUDO; grupo, verbo, badón, fnbgs, BACHA; llave, andén, bejua, mgqbn, FOSTO; sitio, cauce, arnia, rlfnd, FÁJIZ; falta, faena, fazón, dpqtm, ACHAZ; noche, grifo, legor, mrbtf, CAUPA; feliz, gruta, tabez, tzpgl, PLUNE; mujer, limbo, gosal, tfcrr, CALSO; calle, aleta, maver, rbltj, ADETO; golpe, peine, pudes, sfbrn, MOTRE; único, fobia, filza, scrzg, CISÓN; pelea, útero, bomal, rgncd, LANGO; brazo, manto, cergo, ldgrc, RINTA; razón, cojín, broga, mrbnr, ECIRO; cielo, cisne, mepla, mnrbj, TAPTO; negro, mareo, ralmo, zlngt, LEBRA; reloj, cloro, runco, crrzf, ERTAR; barco, pavor, orazo, rbsdl, GADÓN; color, ancla, valbo, fgrrd, RABRA; final, muslo, prana, tnbms, LARÓN; vista, tacón, lorio, srfnm, CLASA; mayor, mueca, baero, qpnjf, ACIZA; sueño, ámbar, croja, cmrdt, CIPEL; fácil, cuota, delle, zqbmc, MESTE; orden, sodio, muvor, dcpng, CHEGO; causa, fogón, plame, drcpf, LICHA; hielo, trama, mocer, dmqbp, ACIGO; oeste, fiera, prujo, dslmn, CHOJA; trago, rigor, ficle, lfrqs, CRIAL; traje, cutis, pusto, trfbd, FLUCA; baile, vejez, mante, stldb, BACHO; señal, pudor, faubo, lfrnt, FLOGO; total, pompa, rargo, gzdrn, OCOZA; señor, musgo, vimal, dngtc, GAUTO; novia, tripa, carre, qrcmg, BRIJE; punto, fauna, mobun, mgcjt, QUIVO; nuevo, pasto, relio, rnlmf, PREMA; honor, fibra, zuche, qdjpz, JANCO; banda, prosa, fánel, tqjdc, SACEO; doble, folio, erdin, sqcfm, TEDER; gusto, miope, mogre, fpzrj, ENDIA; lleno, momia, gopia, tpbqg, CUNZA; parte, vigor, miaco, jslrf, FARRE; madre, tórax, cunra, rbnjg, FADÍO; hogar, lirio, mapre, nzrsf, DRAJA; valor, rosal, lorna, mrbqt, GONTO; capaz, bambú, vaipe, drnzj, BONCE; banco, ansia, úmaso, brqmt, ÓCENO; corte, dardo, trida, nlrqt, DEMIO; campo, trapo, ruezo, lgcrd, ÁCIÑE; reina, palmo, meper, sldfp, DUNTO; leche, funda, nonte, mdtbj, NULCA; papel, fresa, leluz, lrsqg, SATRA; clase, suela, firia, bzrnd, LIRRO; coche, boina, vomón, lbctr, ACEFO; santo, casta, mucor, nbmlf, RINCO; joven, gasto, ruena, nzftr, PAMIA; prisa, saldo, drolo, grjds, GODÓN; medio, secta, fluja, lsgfd, TORAR; buena, jarra, pasno, jdgfz, NÍCEA; fuego, farol, goren, gfrdm, JUIRA; grupo, verbo, badón, fnbgs, BAGOR; llave, andén, bejua, mgqbn, GUCHE; sitio, cauce, arnia, rlfnd, ADOCA; falta, faena, fazón, dpqtm, GRESO; noche, grifo, legor, mrbtf, GORNA; feliz, gruta, tabez, tzpgl, RARTO; mujer, limbo, gosal, tfcrr, DABOR; calle, aleta, maver, rbltj, PEGRO; golpe, peine, pudes, sfbrn, SUAJA; único, fobia, filza, scrzg, LLASO; pelea, útero, bomal, rgncd, VALTO; brazo, manto, cergo, ldgrc, ERTOR; razón, cojín, broga, mrbnr, CÉTOL; cielo, cisne, mepla, mnrbj, OCEZO; negro, mareo, ralmo, zlngt, JOLLO; reloj, cloro, runco, crrzf, POMAL; barco, pavor, orazo, rbsdl, SASIO; color, ancla, valbo, fgrrd, GACÓN; final, muslo, prana, tnbms, RUZMO; vista, tacón, lorio, srfnm, FESDA; mayor, mueca, baero, qpnjf, CEGLA; sueño, ámbar, croja, cmrdt, CEPTO; fácil, cuota, delle, zqbmc, OMIZA; orden, sodio, muvor, dcpng, PUCAL; causa, fogón, plame, drcpf, NURDO; hielo, trama, mocer, dmqbp, HOMBO; oeste, fiera, prujo, dslmn, DRUMA; trago, rigor, ficle, lfrqs, VELDA; traje, cutis, pusto, trfbd, BLETO; baile, vejez, mante, stldb, CHODO; señal, pudor, faubo, lfrnt, LENIA; total, pompa, rargo, gzdrn, VUNDA; señor, musgo, vimal, dngtc, GAUTA; novia, tripa, carre, qrcmg, BROPO; punto, fauna, mobun, mgcjt, MUSTO; nuevo, pasto, relio, rnlmf, RORGO; honor, fibra, zuche, qdjpz, MÓPEL; banda, prosa, fánel, tqjdc, LARÍN; doble, folio, erdin, sqcfm, NULLO; gusto, miope, mogre, fpzrj, GUBIO; lleno, momia, gopia, tpbqg, DABÓN; parte, vigor, miaco, jslrf, LAFIO; madre, tórax, cunra, rbnjg, RECHO; hogar, lirio, mapre, nzrsf, BOMPA; valor, rosal, lorna, mrbqt, ZUBÍO; capaz, bambú, vaipe, drnzj, VABRO; banco, ansia, úmaso, brqmt, CAINO; corte, dardo, trida, nlrqt, NANÓN; campo, trapo, ruezo, lgcrd, FRIMA; reina, palmo, meper, sldfp, DARRA; leche, funda, nonte, mdtbj, BURAR; papel, fresa, leluz, lrsqg, CLIGA

(*Appendices continue*)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Appendix B

List of Nonword Targets In Experiment 2

The stimuli are presented as quintuples: high-frequency word prime, low-frequency word prime, pseudoword prime, consonant string prime, and TARGET. (The word trials are the same as in Experiment 1).

Nonword Targets

clase, suela, firia, bzrnd, CBFDA; coche, boina, vomón, lbctr, BEDMT; santo, casta, mucor, nbmlf, AGBCO; joven, gasto, ruena, nzftr, BLIGC; prisa, saldo, drolo, grjds, TKCOR; medio, secta, fluja, lsgfd, SASGP; buena, jarra, pasno, jdgfz, SDCIS; fuego, farol, goren, gfrdm, MAPLR; grupo, verbo, badón, fnbgs, FLBTO; llave, andén, bejua, mgqbn, RUPTP; sitio, cauce, arnia, rlfnd, DMRSA; falta, faena, fazón, dpqtm, URDCN; noche, grifo, legor, mrbtf, SGFTE; feliz, gruta, tabez, tzpgl, CATPB; mujer, limbo, gosal, tfcrr, PCTGO; calle, aleta, maver, rbltj, ÉCSCP; golpe, peine, pudes, sfbrn, TPBIA; único, fobia, filza, scrzg, ALNDT; pelea, útero, bomal, rgncd, RJLTA; brazo, manto, cergo, ldgrc, BANJZ; razón, cojín, broga, mrbnr, SGPGO; cielo, cisne, mepla, mnrbj, PLARDP; negro, mareo, ralmo, zlngt, PRBCO; reloj, cloro, runco, crrzf, ACRFD; barco, pavor, orazo, rbsdl, SDTNE; color, ancla, valbo, fgrrd, RUBPC; final, muslo, prana, tnbms, HJPBO; vista, tacón, lorio, srfnm, DITRL; mayor, mueca, baero, qpnjf, DRTÑO; sueño, ámbar, croja, cmrdt, SOLBF; fácil, cuota, delle, zqbmc, TNRGA; orden, sodio, muvor, dcpng, NURKJ; causa, fogón, plame, drcpf, LLPMO; hielo, trama, mocer, dmqbp, TABRZ; oeste, fiera, prujo, dslmn, CFSCE; trago, rigor, ficle, lfrqs, SUCMR; traje, cutis, pusto, trfbd, CHJGU; baile, vejez, mante, stldb, DUBMR; señal, pudor, faubo, lfrnt, MGPRA; total, pompa, rargo, gzdrn, METSL; señor, musgo, vimal, dngtc, CRPNO; novia, tripa, carre, qrcmg, SENTB; punto, fauna, mobun, mgcjt, NMJÓN; nuevo, pasto, relio, rnlmf, MASRP; honor, fibra, zuche, qdjpz, PBTCA; banda, prosa, fánel, tqjdc, FAPMT; doble, folio, erdin, sqcfm, DBTEM; gusto, miope, mogre, fpzrj, RAPGC; lleno, momia, gopia, tpbqg, GRTBA; parte, vigor, miaco, jslrf, VIMTF; madre, tórax, cunra, rbnjg, CJGRO; hogar, lirio, mapre, nzrsf, RULJM; valor, rosal, lorna, mrbqt, DTPME; capaz, bambú, vaipe, drnzj, BIFCN; banco, ansia, úmaso, brqmt, NMCUO; corte, dardo, trida, nlrqt, ROTNL; campo, trapo, ruezo, lgcrd, JTRSA; reina, palmo, meper, sldfp, ASPGT; leche, funda, nonte, mdtbj, DLTOR; papel, fresa, leluz, lrsqg, MUDLD; clase, suela, firia, bzrnd, RTHLA; coche, boina, vomón, lbctr, HEFNR; santo, casta, mucor, nbmlf, TMSRA; joven, gasto, ruena, nzftr, IBSTP; prisa, saldo, drolo, grjds, RBLGO; medio, secta, fluja, lsgfd, LUTGF; buena, jarra, pasno, jdgfz, RTBOR; fuego, farol, goren, gfrdm, HASFZ; grupo, verbo, badón, fnbgs, SBZAL; llave, andén, bejua, mgqbn, DOBTC; sitio, cauce, arnia, rlfnd, RTBUB; falta, faena, fazón, dpqtm, ÁVNTP; noche, grifo, legor, mrbtf, LCBTO; feliz, gruta, tabez, tzpgl, CUBBJ; mujer, limbo, gosal, tfcrr, TMHCA; calle, aleta, maver, rbltj, FLGEM; golpe, peine, pudes, sfbrn, MGVÓN; único, fobia, filza, scrzg, DARJC; pelea, útero, bomal, rgncd, LBNTA; brazo, manto, cergo, ldgrc, COVBP; razón, cojín, broga, mrbnr, DTRCO; cielo, cisne, mepla, mnrbj, GAPBN; negro, mareo, ralmo, zlngt, FBPDO; reloj, cloro, runco, crrzf, CUBNM; barco, pavor, orazo, rbsdl, GLDIT; color, ancla, valbo, fgrrd, VAHPT; final, muslo, prana, tnbms, QBJÓS; vista, tacón, lorio, srfnm, BOGTC; mayor, mueca, baero, qpnjf, SDCNO; sueño, ámbar, croja, cmrdt, PUSGF; fácil, cuota, delle, zqbmc, RITRB; orden, sodio, muvor, dcpng, GCTRE; causa, fogón, plame, drcpf, BEFRM; hielo, trama, mocer, dmqbp, PMRSO; oeste, fiera, prujo, dslmn, DACHG; trago, rigor, ficle, lfrqs, TCFRO; traje, cutis, pusto, trfbd, PEDSC; baile, vejez, mante, stldb, FBDOR; señal, pudor, faubo, lfrnt, GUBCF; total, pompa, rargo, gzdrn, TCSÑA; señor, musgo, vimal, dngtc, DOCGP; novia, tripa, carre, qrcmg, GCPFO; punto, fauna, mobun, mgcjt, SÚCBL; nuevo, pasto, relio, rnlmf, GCJEZ; honor, fibra, zuche, qdjpz, TELZP; banda, prosa, fánel, tqjdc, GLVIO; doble, folio, erdin, sqcfm, CORGC; gusto, miope, mogre, fpzrj, GCRTA; lleno, momia, gopia, tpbqg, BARGP; parte, vigor, miaco, jslrf, GFTLO; madre, tórax, cunra, rbnjg, GULBZ; hogar, lirio, mapre, nzrsf, TRBMO; valor, rosal, lorna, mrbqt, BAPDP; capaz, bambú, vaipe, drnzj, PCMES; banco, ansia, úmaso, brqmt, RERTG; corte, dardo, trida, nlrqt, PCBTA; campo, trapo, ruezo, lgcrd, PGAMF; reina, palmo, meper, sldfp, RADGB; leche, funda, nonte, mdtbj, MCFTE; papel, fresa, leluz, lrsqg, DATRD; clase, suela, firia, bzrnd, GFCUN; coche, boina, vomón, lbctr, BIRTR; santo, casta, mucor, nbmlf, LPTÍO; joven, gasto, ruena, nzftr, CODMR; prisa, saldo, drolo, grjds, ZNPEO; medio, secta, fluja, lsgfd, ÁMKJP; buena, jarra, pasno, jdgfz, CLTJO; fuego, farol, goren, gfrdm, CUFSL; grupo, verbo, badón, fnbgs, TKCHA; llave, andén, bejua, mgqbn, FUSTM; sitio, cauce, arnia, rlfnd, FKJIZ; falta, faena, fazón, dpqtm, ACHBT; noche, grifo, legor, mrbtf, CLTPA; feliz, gruta, tabez, tzpgl, PUCLM; mujer, limbo, gosal, tfcrr, SCLSO; calle, aleta, maver, rbltj, AEDTB; golpe, peine, pudes, sfbrn, MPTBE; único, fobia, filza, scrzg, CITFN; pelea, útero, bomal, rgncd, NLPSO; brazo, manto, cergo, ldgrc, RITNF; razón, cojín, broga, mrbnr, PBTRO; cielo, cisne, mepla, mnrbj, TAPTL; negro, mareo, ralmo, zlngt, LSRGA; reloj, cloro, runco, crrzf, ERTGR; barco, pavor, orazo, rbsdl, GCDÓN; color, ancla, valbo, fgrrd, MUBTL; final, muslo, prana, tnbms, ZLRÓN; vista, tacón, lorio, srfnm, CETLR; mayor, mueca, baero, qpnjf, GCTZA; sueño, ámbar, croja, cmrdt, CIPBL; fácil, cuota, delle, zqbmc, MFSTE; orden, sodio, muvor, dcpng, CEHPG; causa, fogón, plame, drcpf, LZHCA; hielo, trama, mocer, dmqbp, AIBGZ; oeste, fiera, prujo, dslmn, CHPJA; trago, rigor, ficle, lfrqs, CIRLB; traje, cutis, pusto, trfbd, FLTCA; baile, vejez, mante, stldb, BACDP; señal, pudor, faubo, lfrnt, FLCGO; total, pompa, rargo, gzdrn, OCPZT; señor, musgo, vimal, dngtc, TLGTO; novia, tripa, carre, qrcmg, BILJP; punto, fauna, mobun, mgcjt, TPMVO; nuevo, pasto, relio, rnlmf, PECCG; honor, fibra, zuche, qdjpz, JTNCO; banda, prosa, fánel, tqjdc, SAFDV; doble, folio,

(*Appendices continue*)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

erdin, sqcfm, LMTER; gusto, miope, mogre, fpzrj, EDNPM; lleno, momia, gopia, tpbqg, RNZPA; parte, vigor, miaco, jslrf, FABST; madre, tórax, cunra, rbnjg, FGDÍO; hogar, lirio, mapre, nzrsf, DABMG; valor, rosal, lorna, mrbqt, PGNTO; capaz, bambú, vaipe, drnzj, BODCT; banco, ansia, úmaso, brqmt, RTCNO; corte, dardo, trida, nlrqt, DEMPL; campo, trapo, ruezo, lgcrd, PCLÑE; reina, palmo, meper, sldfp, DUNTÑ; leche, funda, nonte, mdtbj, NLGCA; papel, fresa, leluz, lrsqg, SAPGC; clase, suela, firia, bzrnd, LPSRO; coche, boina, vomón, lbctr, AEDFP; santo, casta, mucor, nbmlf, RMNCO; joven, gasto, ruena, nzftr, PAMGB; prisa, saldo, drolo, grjds, GBDÓN; medio, secta, fluja, lsgfd, TODPC; buena, jarra, pasno, jdgfz, CPCEA; fuego, farol, goren, gfrdm, JUCBT; grupo, verbo, badón, fnbgs, BTVOR; llave, andén, bejua, mgqbn, GUCPL; sitio, cauce, arnia, rlfnd, SRDCA; falta, faena, fazón, dpqtm, GEDSP; noche, grifo, legor, mrbtf, GTRNA; feliz, gruta, tabez, tzpgl, RARST; mujer, limbo, gosal, tfcrr, DSVOR; calle, aleta, maver, rbltj, PEGRD; golpe, peine, pudes, sfbrn, SBTJÁ; único, fobia, filza, scrzg, LAVZS; pelea, útero, bomal, rgncd, BTLTO; brazo, manto, cergo, ldgrc, ERTBR; razón, cojín, broga, mrbnr, CPTOL; cielo, cisne, mepla, mnrbj, OECZP; negro, mareo, ralmo, zlngt, JCLPO; reloj, cloro, runco, crrzf, POMCL; barco, pavor, orazo, rbsdl, SGSIO; color, ancla, valbo, fgrrd, GÁCTN; final, muslo, prana, tnbms, RBZMO; vista, tacón, lorio, srfnm, FESDC; mayor, mueca, baero, qpnjf, CJGLA; sueño, ámbar, croja, cmrdt, CEPTZ; fácil, cuota, delle, zqbmc, JMRZA; orden, sodio, muvor, dcpng, PUVRL; causa, fogón, plame, drcpf, NJRDO; hielo, trama, mocer, dmqbp, HOBTC; oeste, fiera, prujo, dslmn, DPTMA; trago, rigor, ficle, lfrqs, VEPTD; traje, cutis, pusto, trfbd, BLCTO; baile, vejez, mante, stldb, COFDD; señal, pudor, faubo, lfrnt, LPNIA; total, pompa, rargo, gzdrn, VUNLR; señor, musgo, vimal, dngtc, GDHTA; novia, tripa, carre, qrcmg, BOFBG; punto, fauna, mobun, mgcjt, MGRTO; nuevo, pasto, relio, rnlmf, ROFBT; honor, fibra, zuche, qdjpz, MTPEL; banda, prosa, fánel, tqjdc, LACLN; doble, folio, erdin, sqcfm, NPLBO; gusto, miope, mogre, fpzrj, BUBPC; lleno, momia, gopia, tpbqg, TFBÓZ; parte, vigor, miaco, jslrf, SAFLR; madre, tórax, cunra, rbnjg, RMCHO; hogar, lirio, mapre, nzrsf, BOGPC; valor, rosal, lorna, mrbqt, ZRBÍO; capaz, bambú, vaipe, drnzj, ZANBL; banco, ansia, úmaso, brqmt, CPCNO; corte, dardo, trida, nlrqt, NANLR; campo, trapo, ruezo, lgcrd, FPÑMA; reina, palmo, meper, sldfp, DAGLP; leche, funda, nonte, mdtbj, BDTER; papel, fresa, leluz, lrsqg, CILGD

Appendix C

List of Nonword Targets in Experiment 3

The stimuli are presented as quintuples: high-frequency word prime, low-frequency word prime, pseudoword prime, consonant string prime, and TARGET. (The word trials are the same as in Experiments 1 and 2).

Nonword Targets

clase, suela, firia, bzrnd, ÁCILI; coche, boina, vomón, lbctr, ADUBA; santo, casta, mucor, nbmlf, AECAZ; joven, gasto, ruena, nzftr, AGESO; prisa, saldo, drolo, grjds, ÁGEZO; medio, secta, fluja, lsgfd, AHEVA; buena, jarra, pasno, jdgfz, ALOVO; fuego, farol, goren, gfrdm, APANÚ; grupo, verbo, badón, fnbgs, ASNIP; llave, andén, bejua, mgqbn, ÁVECO; sitio, cauce, arnia, rlfnd, AYEHO; falta, faena, fazón, dpqtm, AZANI; noche, grifo, legor, mrbtf, AZOXA; feliz, gruta, tabez, tzpgl, AZUGO; mujer, limbo, gosal, tfcrr, BAPEI; calle, aleta, maver, rbltj, BESCE; golpe, peine, pudes, sfbrn, BIAPA; único, fobia, filza, scrzg, BIFRE; pelea, útero, bomal, rgncd, BIRFO; brazo, manto, cergo, ldgrc, BILTA; razón, cojín, broga, mrbnr, BIODI; cielo, cisne, mepla, mnrbj, BISNA; negro, mareo, ralmo, zlngt, BITIL; reloj, cloro, runco, crrzf, BOGÚN; barco, pavor, orazo, rbsdl, BÓPAZ; color, ancla, valbo, fgrrd, BREMI; final, muslo, prana, tnbms, BRUPE; vista, tacón, lorio, srfnm, BUMIL; mayor, mueca, baero, qpnjf, BUNTE; sueño, ámbar, croja, cmrdt, BUPOE; fácil, cuota, delle, zqbmc, CAXIL; orden, sodio, muvor, dcpng, CECÓN; causa, fogón, plame, drcpf, CEFRI; hielo, trama, mocer, dmqbp, CELUR; oeste, fiera, prujo, dslmn, CILBE; trago, rigor, ficle, lfrqs, CLELE; traje, cutis, pusto, trfbd, CLUFE; baile, vejez, mante, stldb, COLCI; señal, pudor, faubo, lfrnt, CRAMS; total, pompa, rargo, gzdrn, CUFER; señor, musgo, vimal, dngtc, CUPAC; novia, tripa, carre, qrcmg, DAENO; punto, fauna, mobun, mgcjt, DIBEO; nuevo, pasto, relio, rnlmf, DILCI; honor, fibra, zuche, qdjpz, DOBUR; banda, prosa, fánel, tqjdc, DOCHI; doble, folio, erdin, sqcfm, DRUFI; gusto, miope, mogre, fpzrj, DUIPÁ; lleno, momia, gopia, tpbqg, DUSPE; parte, vigor, miaco, jslrf, ECAZO; madre, tórax, cunra, rbnjg, ÉGACA; hogar, lirio, mapre, nzrsf, ELGÓN; valor, rosal, lorna, mrbqt, EÑEBA; capaz, bambú, vaipe, drnzj, EÑOZO; banco, ansia, úmaso, brqmt, EPEJA; corte, dardo, trida, nlrqt, ERTOL; campo, trapo, ruezo, lgcrd, ÉSOCO; reina, palmo, meper, sldfp, ÉTOXA; leche, funda, nonte, mdtbj, ETUMA; papel, fresa, leluz, lrsqg, EUCOR; clase, suela, firia, bzrnd, EVEÓN; coche, boina, vomón, lbctr, EVUMA; santo, casta, mucor, nbmlf, FAIBA; joven, gasto, ruena, nzftr, FALGI; prisa, saldo, drolo, grjds, FAGPE; medio, secta, fluja, lsgfd, FANIR; buena, jarra, pasno, jdgfz, FÉFAR; fuego, farol, goren, gfrdm, FEGUZ; grupo, verbo, badón, fnbgs, FESMA; llave, andén, bejua, mgqbn, FLAFE; sitio, cauce, arnia, rlfnd, FLEFI; falta, faena, fazón, dpqtm, FLONI; noche, grifo, legor, mrbtf, FOLFE; feliz, gruta, tabez, tzpgl, FOLMU; mujer, limbo, gosal, tfcrr, FOLUZ; calle, aleta, maver, rbltj, FOMOR; golpe, peine, pudes, sfbrn, FOSDI; único, fobia, filza, scrzg, FROXA; pelea, útero, bomal, rgncd, FUEVI; brazo, manto, cergo, ldgrc, FULPI; razón, cojín, broga, mrbnr, GALSÍ; cielo, cisne, mepla, mnrbj, GAZUR; negro, mareo, ralmo,

(*Appendices continue*)

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

zlngt, GEAJA; reloj, cloro, runco, crrzf, GEFÚN; barco, pavor, orazo, rbsdl, GERFO; color, ancla, valbo, fgrrd, GILZO; final, muslo, prana, tnbms, GLEME; vista, tacón, lorio, srfnm, GOPIS; mayor, mueca, baero, qpnjf, GUGOZ; sueño, ámbar, croja, cmrdt, GUNGO; fácil, cuota, delle, zqbmc, GUNTI; orden, sodio, muvor, dcpng, GUPÉN; causa, fogón, plame, drcpf, GUSNA; hielo, trama, mocer, dmqbp, HANAC; oeste, fiera, prujo, dslmn, HARUR; trago, rigor, ficle, lfrqs, HECRE; traje, cutis, pusto, trfbd, HESNE; baile, vejez, mante, stldb, HESUR; señal, pudor, faubo, lfrnt, HIBUR; total, pompa, rargo, gzdrn, HOLTO; señor, musgo, vimal, dngtc, HUOTE; novia, tripa, carre, qrcmg, HUSCE; punto, fauna, mobun, mgcjt, IBAFE; nuevo, pasto, relio, rnlmf, ILAPÚ; honor, fibra, zuche, qdjpz, ILASI; banda, prosa, fánel, tqjdc, INENO; doble, folio, erdin, sqcfm, ISGER; gusto, miope, mogre, fpzrj, ITOBO; lleno, momia, gopia, tpbqg, IXTAR; parte, vigor, miaco, jslrf, JAESO; madre, tórax, cunra, rbnjg, JEGER; hogar, lirio, mapre, nzrsf, JELUA; valor, rosal, lorna, mrbqt, JIDUO; capaz, bambú, vaipe, drnzj, JILPE; banco, ansia, úmaso, brqmt, JIUTA; corte, dardo, trida, nlrqt, JOMBE; campo, trapo, ruezo, lgcrd, JOSMO; reina, palmo, meper, sldfp, JUALE; leche, funda, nonte, mdtbj, JUCIL; papel, fresa, leluz, lrsqg, JUFÚS; clase, suela, firia, bzrnd, LAFLA; coche, boina, vomón, lbctr, LÁVOX; santo, casta, mucor, nbmlf, LEDUL; joven, gasto, ruena, nzftr, LEPAZ; prisa, saldo, drolo, grjds, LIRGI; medio, secta, fluja, lsgfd, LITÉN; buena, jarra, pasno, jdgfz, LOAJO; fuego, farol, goren, gfrdm, LOPIL; grupo, verbo, badón, fnbgs, LORME; llave, andén, bejua, mgqbn, LUATE; sitio, cauce, arnia, rlfnd, LUSUR; falta, faena, fazón, dpqtm, MEIPE; noche, grifo, legor, mrbtf, MILGE; feliz, gruta, tabez, tzpgl, MIVOR; mujer, limbo, gosal, tfcrr, MOFUL; calle, aleta, maver, rbltj, MONIZ; golpe, peine, pudes, sfbrn, MOSPE; único, fobia, filza, scrzg, MOZUR; pelea, útero, bomal, rgncd, MUMET; brazo, manto, cergo, ldgrc, NAOCE; razón, cojín, broga, mrbnr, NESAX; cielo, cisne, mepla, mnrbj, NIPLO; negro, mareo, ralmo, zlngt, NOROL; reloj, cloro, runco, crrzf, NORZI; barco, pavor, orazo, rbsdl, NOVOD; color, ancla, valbo, fgrrd, NÚGUL; final, muslo, prana, tnbms, NULGE; vista, tacón, lorio, srfnm, OBUAL; mayor, mueca, baero, qpnjf, OCOBO; sueño, ámbar, croja, cmrdt, ODUER; fácil, cuota, delle, zqbmc, OGEFA; orden, sodio, muvor, dcpng, OJUBÁ; causa, fogón, plame, drcpf, OLZIO; hielo, trama, mocer, dmqbp, ATECE; oeste, fiera, prujo, dslmn, ORSIN; trago, rigor, ficle, lfrqs, ORZUN; traje, cutis, pusto, trfbd, OSIZO; baile, vejez, mante, stldb, OTURI; señal, pudor, faubo, lfrnt, ÓVAZU; total, pompa, rargo, gzdrn, OZABO; señor, musgo, vimal, dngtc, OZIAL; novia, tripa, carre, qrcmg, PAFIE; punto, fauna, mobun, mgcjt, PEBIO; nuevo, pasto, relio, rnlmf, PECRE; honor, fibra, zuche, qdjpz, PIEMO; banda, prosa, fánel, tqjdc, CILEA; doble, folio, erdin, sqcfm, PIMUA; gusto, miope, mogre, fpzrj, PLIJE; lleno, momia, gopia, tpbqg, PLIME; parte, vigor, miaco, jslrf, PÓPOZ; madre, tórax, cunra, rbnjg, PUCIZ; hogar, lirio, mapre, nzrsf, PUMUR; valor, rosal, lorna, mrbqt, PURVI; capaz, bambú, vaipe, drnzj, REBAZ; banco, ansia, úmaso, brqmt, REBUR; corte, dardo, trida, nlrqt, REMPE; campo, trapo, ruezo, lgcrd, REMÚN; reina, palmo, meper, sldfp, RIJUR; leche, funda, nonte, mdtbj, ROESO; papel, fresa, leluz, lrsqg, RUFUR; clase, suela, firia, bzrnd, RUPAE; coche, boina, vomón, lbctr, RUPUO; santo, casta, mucor, nbmlf, RURME; joven, gasto, ruena, nzftr, SASIL; prisa, saldo, drolo, grjds, SAZUO; medio, secta, fluja, lsgfd, SECRI; buena, jarra, pasno, jdgfz, SEPUE; fuego, farol, goren, gfrdm, SEUNE; grupo, verbo, badón, fnbgs, SIBÚN; llave, andén, bejua, mgqbn, SICIR; sitio, cauce, arnia, rlfnd, SILUR; falta, faena, fazón, dpqtm, SOBLI; noche, grifo, legor, mrbtf, TAJUR; feliz, gruta, tabez, tzpgl, TELMÚ; mujer, limbo, gosal, tfcrr, LEFUR; calle, aleta, maver, rbltj, TIBUI; golpe, peine, pudes, sfbrn, TISCE; único, fobia, filza, scrzg, TISDO; pelea, útero, bomal, rgncd, TUGER; brazo, manto, cergo, ldgrc, TULME; razón, cojín, broga, mrbnr, TULZA; cielo, cisne, mepla, mnrbj, TURVI; negro, mareo, ralmo, zlngt, TUSGA; reloj, cloro, runco, crrzf, UCOBO; barco, pavor, orazo, rbsdl, UDAFE; color, ancla, valbo, fgrrd, UFAVI; final, muslo, prana, tnbms, UFUTA; vista, tacón, lorio, srfnm, UGABO; mayor, mueca, baero, qpnjf, ÚGEHO; sueño, ámbar, croja, cmrdt, ULFIR; fácil, cuota, delle, zqbmc, ULGER; orden, sodio, muvor, dcpng, ULINA; causa, fogón, plame, drcpf, ÚMIVO; hielo, trama, mocer, dmqbp, UPACI; oeste, fiera, prujo, dslmn, URRIZ; trago, rigor, ficle, lfrqs, UTRÁN; traje, cutis, pusto, trfbd, UZIJO; baile, vejez, mante, stldb, VADAZ; señal, pudor, faubo, lfrnt, VÁVIL; total, pompa, rargo, gzdrn, VÍDOY; señor, musgo, vimal, dngtc, VIRMI; novia, tripa, carre, qrcmg, VOFUR; punto, fauna, mobun, mgcjt, VOHÓN; nuevo, pasto, relio, rnlmf, VORRI; honor, fibra, zuche, qdjpz, VOSÍA; banda, prosa, fánel, tqjdc, VUCEL; doble, folio, erdin, sqcfm, VUGEO; gusto, miope, mogre, fpzrj, VUJÓN; lleno, momia, gopia, tpbqg, VUOBA; parte, vigor, miaco, jslrf, VUOJA; madre, tórax, cunra, rbnjg, TLUPO; hogar, lirio, mapre, nzrsf, XACOA; valor, rosal, lorna, mrbqt, YORPO; capaz, bambú, vaipe, drnzj, ZACUO; banco, ansia, úmaso, brqmt, ZADAO; corte, dardo, trida, nlrqt, ZIECA; campo, trapo, ruezo, lgcrd, ZIOVE; reina, palmo, meper, sldfp, ZOLIL; leche, funda, nonte, mdtbj, ZOROL; papel, fresa, leluz, lrsqg, FENDU

Received January 16, 2018
Revision received August 20, 2018
Accepted August 21, 2018 ■

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.