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On the nature of consonant/vowel differences in letter position coding: Evidence from developing and adult readers

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Abstract

In skilled adult readers, transposed-letter effects (jugde-JUDGE) are greater for consonant than for vowel transpositions. These differences are often attributed to phonological rather than orthographic processing. To examine this issue, we employed a scenario in which phonological involvement varies as a function of reading experience: a masked priming lexical decision task with 50-ms primes in adult and developing readers. Indeed, masked phonological priming at this prime duration has been consistently reported in adults, but not in developing readers (Davis, Castles, & Iakovidis, 1998). Thus, if consonant/vowel asymmetries in letter position coding with adults are due to phonological influences, transposed-letter priming should occur for both consonant and vowel transpositions in developing readers. Results with adults (Experiment 1) replicated the usual consonant/vowel asymmetry in transposed-letter priming. In contrast, no signs of an asymmetry were found with developing readers (Experiments 2-3). However, Experiments 1-3 did not directly test the existence of phonological involvement. To study this question, Experiment 4 manipulated the phonological prime-target relationship in developing readers. As expected, we found no signs of masked phonological priming. Thus, the present data favour an interpretation of the consonant/vowel dissociation in letter position coding as due to phonological rather than orthographic processing.

Key words: masked priming, lexical access, lexical decision, letter position coding

A robust phenomenon in the areas of visual-word recognition and reading is that a jumbled word (e.g., jugde, caniso) can be easily confounded with its base word (judge, casino; i.e., the transposed-letter similarity/confusability effect). This effect, which has been obtained in different languages/scripts (Roman, Kana, Thai, Chinese, Korean, Hebrew, Arabic, Devanagari), populations (developing readers, adult readers) and task procedures (behavioural, electrophysiological, eye movements) has been used to rule out the position-specific orthographic input coding scheme employed by the interactive activation model (McClelland & Rumelhart, 1981). Indeed, current models of visual-word recognition employ more flexible orthographic input coding schemes. For instance, in the overlap model of letter position coding (Gomez, Ratcliff, & Perea, 2008) there is position uncertainty at assigning positions to letters in a letter string (see also LTRS model, Adelman, 2011; spatial coding model, Davis, 2010; noisy Bayesian reader model, Norris, Kinoshita, & van Casteren, 2011, for a similar assumption). This way, the letter "D" in JUGDE is associated with position 4 but also, to a lesser degree, with positions 3 and 5. As a result, JUDGE and JUGDE are more confusable than JUDGE and a replacement-letter control such as JUPTE. Another family of models of visual-word recognition make similar predictions by assuming that there is a layer of "open bigrams" between the letter and word levels. For instance, JUDGE and JUGDE would share all the open bigrams (e.g., JU, JD, JG…) except DG/GD, and hence, they are perceptually very similar (open-bigram model, Grainger & van Heuven, 2003; multiple-route model, Grainger, Lété, Bertrand, Dufau, & Ziegler, 2012; SERIOL model, Whitney, 2001).

These models can capture most of the empirical findings on letter position coding except for a subtle manipulation: transposed-letter effects are greater for consonant transpositions than for vowel transpositions. In particular, nonwords created by transposing two consonants (e.g., CHOLOCATE) are highly confusable with their base words (e.g., CHOCOLATE): lexical decision and naming times are substantially longer and more error-prone to the transposed-letter nonword CHOLOCATE than to a replacement-letter control (e.g., CHOTONATE). In contrast, the parallel effect with vowel transpositions (CHOCALOTE vs. CHOCULITE) is noticeably smaller (e.g., see Perea & Lupker, 2004; see also Lupker et al., 2008). More importantly, this consonant/vowel asymmetry also appears when using a technique that taps the earliest stages of visual-word recognition, namely, Forster and Davis' (1984) masked priming technique. In this technique, a target stimulus is preceded by a briefly presented, forwardly masked prime stimulus for around 30-50 ms (see Grainger, 2008, for review). Under these circumstances, the masked prime is not perceived consciously and the obtained effects are assumed to be due to early automatic processes (e.g., see Gomez, Perea, & Ratcliff, 2013, for qualitative differences between masked and unmasked priming)—note that this technique has been qualified as "the major methodological innovation of the last two decades" to study orthographic processing (Grainger, 2008, p. 8). A number of lexical decision experiments have shown a consonant/vowel asymmetry in transposed-letter priming (see Lupker, Perea, & Davis, 2008; Perea & Lupker, 2004; Perea & Acha, 2009; see also Carreiras, Vergara, & Perea, 2009, for converging electrophysiological evidence): 1) target words are recognized more rapidly when preceded by a transposed-letter prime created by switching two consonants (C-C) than when preceded by a control, replacement-letter prime in which two consonants have been replaced (e.g., caniso-CASINO < caviro-CASINO; around 18-21 ms in the Perea & Lupker, 2004, experiments); and 2) response times to target words are similar when preceded by a transposed-letter prime created by switching two vowels (V-V) and when preceded by an orthographic control in which two vowels have been replaced (anamil-ANIMAL = anomel-ANIMAL).

The orthographic input coding schemes of the above-cited models of visual-word recognition assume that consonants and vowels are processed in the same manner. Therefore, these models would (wrongly) predict masked transposed-letter priming effects of *similar* magnitude for consonant transpositions (caniso-CASINO < caviro-CASINO) and for vowel transpositions (anamil-ANIMAL < anomel-ANIMAL). Before amending the orthographic input coding schemes of these models, it is important to consider an alternative explanation. In the initial demonstration of the consonant/vowel asymmetry in letter position coding, Perea and Lupker (2004) indicated: "it would be possible to propose a locus of the consonant/vowel differences observed here which is entirely outside of the architecture of the models under consideration. For example, one could propose that those differences arise at the sub-lexical phonological level." (p. 242) Keep in mind that the implemented architecture of current models of visual-word recognition includes an orthographic layer and a lexical layer, but not a phonological layer (e.g., see Davis, 2010). That is, one might argue that the processing differences between consonants and vowels do *not* arise at the very earliest stages of orthographic processing, but rather slightly later, when the letters are mapped onto phonological codes (i.e., at a phonological level of processing). If this were the case, the orthographic input coding scheme of current models of visual-word recognition would not need to be amended.

Empirical support for the "phonological" interpretation of the consonant/vowel asymmetries in letter position coding comes from a series of experiments conducted by Perea and Acha (2009) with adult skilled readers. They found a significant masked transposed-letter priming effect for C-C transpositions but not for V-V transpositions in a lexical decision task, as in the original Perea and Lupker (2004) experiments. But the key finding was that when these same stimuli were used in a variety of the masked priming paradigm that allegedly taps orthographic rather than phonological processes (i.e., the masked prime same-different matching task; see Norris & Kinoshita, 2008; but see Lupker, Nakayama, & Perea, 2015), the transposed-letter priming effect was sizable and similar in magnitude for C-C transpositions and for V-V transpositions. Perea and Acha (2009) concluded: "letter position coding takes place very early in processing, before the distinction between vowels and consonants starts to matter" (p. 136). Although the findings of Perea and Acha are compelling, more conclusive evidence would be obtained if the consonant/vowel asymmetry were observed in the *same* task, in particular in the most popular word identification task (i.e., lexical decision).

To examine whether or not consonant/vowel asymmetries in letter position coding are due to phonological processes, we conducted a series of masked priming lexical decision experiments in a scenario in which phonological involvement varies as a function of reading experience, being minimal in developing readers. Specifically, we employed a 50-ms prime exposure duration (i.e., the most usual setup in masked priming experiments) with developing readers—Grade 4 children. The rationale is the following. With skilled adult readers, masked phonological priming at a 50-ms prime exposure duration has been repeatedly reported in the lexical decision task in different labs and languages (e.g., Dutch: Driegue & Brysbaert, 2002; English: Berent, 1997; Bowers, Vigliocco, & Haan, 1998; French: Grainger & Ferrand, 1996; Greek: Dimitripoulou, Duñabeitia, & Carreiras, 2011; Spanish: Perea & Carreiras, 2006; Pollatsek, Perea, & Carreiras, 2005). Hence, all the resulting masked transposed-letter priming effects with that prime duration could (potentially) originate from a mixture of orthographic and phonological processes. The key point here is that, unlike adult readers, masked phonological priming is *absent* in developing readers. Davis, Castles, and Iakovidis (1998) found no evidence of masked phonological priming with at 50-ms prime exposure duration in fourth graders (e.g., witch–WHICH produced the same response times as the control wirch-WHICH). Davis et al. (1998) concluded that "by the age of 9 years, the primary process used by most children in lexical access is an orthographic one" (p.643). That is, masked priming effects with developing readers are due to orthographic rather than phonological processes. Therefore, if consonant/vowel asymmetries in letter position coding are due to phonological influences, developing readers should show masked transposed-letter priming effects similar in size for C-C and for V-V transpositions. (footnote 1)

In Experiment 1, we employed a masked priming lexical decision task with adult skilled readers (i.e., college students) using a 50-ms prime exposure duration. In each trial, a target stimulus (e.g., CAMISETA [the Spanish for t-shirt]) was preceded by a brief presentation of a masked nonword prime (50 ms) that would be a C-C prime (the transposed-letter nonword ca**s**i**m**eta or its replacement-letter control ca**n**i**v**eta) or a V-V prime (the transposed-letter nonword cam**e**s**i**ta or its replacement-letter control cam**a**s**u**ta). The goal was to replicate the typical finding from previous research (i.e., a masked transposed-letter priming effect for C-C transpositions, but not for V-V transpositions; see Perea & Lupker, 2004). Experiment 2 was parallel to Experiment 1, except that the participants were developing readers (Grade 4 children, around 9-10 years). While masked transposed-letter priming has been previously reported with developing readers (e.g., Acha & Perea, 2008; Castles, Davis, Cavalot, & Forster, 2007; Ziegler et al., 2012), none of these experiments manipulated the consonant/vowel status of the transposed/replaced letters (e.g., Acha & Perea, 2008, only employed C-C transpositions in their experiment). Experiment 3 was a replication of Experiment 2, except that we employed a more sensitive variety of the masked priming technique, the sandwich technique (Lupker & Davis, 2009). In this technique, the target word is presented not only after the prime, but it is also briefly presented between the pattern mask and the prime. As Lupker and Davis (2009) demonstrated with modelling and experimentation, this procedure magnifies the magnitude of masked priming effects by providing an initial boost to the activation of target words (see Perea, Abu Mallouh, & Carreiras, 2014; Stinchcombe, Lupker, & Davis, 2012; see also Ktori, Grainger, Dufou, & Holcomb, 2012, for converging evidence using ERPs), and hence it may provide a better window of opportunity to detect an interaction between transposed-letter priming and consonant/vowel status—keep in mind that masked priming effects tend to be small in magnitude. In all experiments, we employed a go/no-go procedure rather than a yes/no procedure in the lexical decision task (i.e., respond to words and refrain responding to nonwords), as the go/no-go procedure produces faster response times, less noisy latency data, and higher accuracy than the yes/no procedure in developing readers (see Perea, Soares, & Comesaña, 2013, for discussion).

The predictions of the experiments are straightforward. On the one hand, if consonant/vowel asymmetries in letter position coding with adult readers are due to phonological influences, as Perea and Lupker (2004) suggested, they should be absent in a scenario in which phonological involvement is minimal—this minimal scenario was a masked priming lexical decision task with developing readers. That is, for developing readers, masked transposed-letter priming effects would be of similar magnitude for C-C transpositions (e.g., ca**sim**eta-CAMISETA < ca**niv**eta-CAMISETA) and for V-V transpositions (e.g., cam**esi**ta-CAMISETA < cam**asu**ta-CAMISETA). This outcome would not require making changes in the orthographic input coding schemes of the models of visual-word recognition. Nonetheless, to explain the consonant/vowel asymmetries in letter position coding with adult skilled readers, these models would need to implement a phonological layer in their future versions. On the other hand, if the consonants and vowels are processed differently at the earliest phases of orthographic processing, regardless of reading expertise, then C-C transpositions should produce greater transposed-letter priming effects than V-V transpositions not only with adult readers but also with developing readers. This latter outcome would pose problems for current models of visual-word recognition, as these models assume that the orthographic input coding scheme is *not* sensitive to consonant/vowel status.

One premise in Experiments 2-3 was that masked priming effects with developing readers at the 50-ms prime exposure duration are orthographic rather than phonological in nature. However, one might argue that previous demonstrations of a null effect of masked phonological priming with developing readers occurred in opaque orthographies (e.g., English; see Davis et al., 1998) and that the mapping of print to sound may be more useful for lexical access in alphabetically transparent orthographies (e.g., Spanish) than in more opaque orthographies (see Jiménez & Guzmán, 2003). To directly test this question in the language of the experiment (i.e., Spanish), Experiment 4 examined the presence of masked phonological priming in a masked priming lexical decision task with Spanish developing readers. Specifically, we compared targets preceded by a pseudohomophone prime vs. an orthographic control prime.

Experiment 1

Method

Participants. Sixteen psychology students (11 female; mean age =19.9 years, *SD* = 1.3) from a Spanish university, took part in the experiment to earn extra course credit. All of them were native speakers of Spanish and had normal (or corrected-to-normal) vision.

Materials. A set of 120 Spanish words was selected from the LEXIN database (Corral et al., 2009), which is a database of Spanish words in preschool and school children. These words were nouns or adjectives. The mean word-frequency was 6.83 (1-160), the mean length was 9.38 (range: 7-12) and the mean number of orthographic neighbors (Coltheart's N) was 0.44 (range: 0-5). Orthographic neighborhood values were taken from the ESPAL database (Duchon, Perea, Sebastián-Gallés, Martí, & Carreiras, 2013). The mean of word frequency per million in the ESPAL database was of 21.15 (range: 0.02 - 321.12). For the purposes of the lexical decision task, a set of 120 orthographically legal pseudowords was created with Wuggy (Keuleers & Brysbaert, 2010). For each target stimulus, we created four nonword primes: 1) a transposed letter nonword created by transposing two nonadjacent consonants (ca**s**i**m**eta- CAMISETA; 2) a replacement-letter nonwords created by replacing the critical nonadjacent letters (ca**n**i**v**eta-CAMISETA); 3) a transposed letter nonword created by transposing two nonadjacent vowels (cam**e**s**i**ta-CAMISETA; and 4) a replacement-letter nonwords created by replacing the critical nonadjacent letters (cam**a**s**u**ta-CAMISETA). The replaced letters maintained the ascending or descending letter-shape of the transposed letter words. All the experimental stimuli are given in Appendix A. The position of transposed (or replaced) consonant vs. vowel was matched across conditions ($p > .13$; i.e., in the above example the position for the consonants transposed or replaced was 3-5 and 4-6 for the vowels, in other words the position was 3-5 for vowels and 4-6 for consonants).

Procedure. The experiment took place individually in a quiet room. DMDX software (Forster & Forster, 2003) was used to present the stimuli and collect the responses. In each trial, a pattern mask (a series of #'s) was presented in the center of the screen for 500 ms. Then a lowercase prime was presented in 12-pt Courier New for 50 ms (3 ticks in the 60-Hz CRT monitor) and was immediately replaced by an uppercase target item (either a word or a pseudoword presented in 12-pt Courier New), which remained on the screen until the participant responded –or 2,500 ms had elapsed. The inter-trial interval was 1,133 ms (68 ticks). Participants were asked to decide as fast as possible while trying not to make too many errors if the target stimulus was a real Spanish word and refrain from responding if the stimulus was not a word (i.e., a go/no-go lexical decision task). Four different lists were created to ensure that each target was presented across all priming conditions. The order of stimuli presentation from each list was randomized for each participant. The whole session lasted approximately 15 min.

Results and Discussion

Error responses (0.9% of trials) and lexical decision times smaller than 250 ms or greater than 2000 ms were excluded from the latency analyses. The mean lexical decision and percent error per condition are displayed in Table 1. We conducted separate ANOVAs on the latency and error data for word targets in a Prime type (transposition, replacement [i.e., orthographic control]) x Letter type (consonant, vowel) x List (list 1, list 2, list 3, list 4) design. List was included as a dummy factor in the ANOVAs to extract the error variance due to the counterbalancing lists. In the ANOVA conducted by subjects (F_1) and by items (F_2), the factors Prime type and Letter type were treated as repeated measures factors, whereas the factor List was treated as between-subject variable.

The ANOVA on the latency data did not reveal a significant effect of Prime type or Letter type (all *p*s > .10). More important, the interaction between Prime type and Letter type was significant, $F_1(1, 12) = 10.08$, $MSE = 239.4$, $\eta^2_p = .46$, $p = .008$; F_2(1,

115) = 5.53, MSE = 6808.7, η^2_p = .39, p = .020. This reflected a transposed-letter priming effect of 21 ms in the C-C condition, $F_1(1, 12) = 39.98$, MSE = 116.0, η^2_p = .72, $p < .001$; $F_2(1, 115) = 7.52$, MSE = 9673.9, η^2_p = .06, p = .007, while there were no signs of a transposed-letter priming effect in the V-V condition (-3 ms), both $F_s < 1$. The ANOVA on the error data failed to reveal any significant effects, all $p_s > .20$.

As expected, results revealed a masked transposed-letter priming effect for C-C (21 ms), but not for the V-V transpositions (-3 ms). Thus, the present experiment replicates earlier research with adult readers (Perea & Lupker, 2004; see also Acha & Perea, 2009; Lupker et al., 2008).

In Experiment 2, we employed exactly the same setup as in Experiment 1, except that the participants were developing readers. As indicated in the Introduction, masked priming effects with developing readers are supposed to reflect orthographic rather than phonological processes (Davis et al., 1998). The predictions are clear-cut. If developing readers show the same consonant/vowel asymmetry in letter position coding as adult skilled readers, this would strongly suggest that the orthographic input coding scheme of models of visual-word recognition needs to be amended (i.e., consonants and vowels would be processed differently at an orthographic level of processing). Alternatively, if developing readers show transposed-letter priming effects of similar magnitude for C-C and V-V transpositions, this would mean that the consonant/vowel asymmetry in letter position coding does not have its origin at the earliest stages of orthographic processing (i.e., the orthographic input coding scheme of the models would not need to be amended), but rather at a later stage, presumably phonological in nature.

Experiment 2

Method

Participants. Twenty 4th grade children (12 female; mean age = 9.94 years; *SD* = 0.41) participated voluntarily in the experiment after we obtained written consent form from their parents. The children came from average socioeconomic backgrounds in a public school located in Galicia, Spain. All participants had normal (or corrected-to-normal) vision and were native speakers of Spanish. None of them had any sensory, neurological, or learning disabilities. The experiment was run at the middle of the school year.

Materials and Procedure. The materials were the same as in the Experiment 1. The procedure was also the same, with the exception that data were collected in groups of two rather than individually in a quiet room provided by the school.

Results and Discussion

Error responses (10.5% of trials) and lexical decision times smaller than 250 ms or greater than 2000 ms were removed from the latency data. Four participants were replaced because they committed more than 30% of errors. Mean lexical decision times and percent error per condition are displayed in Table 1. The statistical analyses were parallel to those in Experiment 1.

The ANOVA on the latency data revealed a significant effect of Prime type in the analysis by subjects, $F_1(1, 16) = 5.2$, $MSE = 2219.91$, $\eta^2_p = .25$, $p = .037$; $F_2(1, 113) = .80$, $MSE = 41773.35$, $\eta^2_p = .01$, $p = .37$. Neither the main effect of Letter type nor the interaction between Prime type and Letter type reached significance, all $F_s < .47$. The ANOVA on the error data failed to reveal any significant effects, all $p_s > .69$.

In the current experiment with developing readers (4th Graders), we found faster response times on a target word when it was preceded by a transposed-letter prime than when it was preceded by a replacement-letter prime. Unlike Experiment 1 (adult skilled readers), the transposed-letter priming effect was not affected by the consonant/vowel status of the transposed/replaced letters: the magnitude of the masked transposed-letter priming effect was 23 ms for C-C transpositions and 21 ms for V-V transpositions. That is, developing readers did not show any signs of a consonant/vowel asymmetry in letter position coding in a masked priming lexical decision task. This strongly suggests that the origin of the consonant/vowel asymmetries in letter position coding is *not* at an early orthographic stage common to all readers. It is worth noting here that Experiment 4 corroborated that developing readers showed no signs of masked phonological priming at the standard prime exposure duration (50 ms) in Spanish. That is, the obtained transposed-letter priming effects in the present experiment can be characterized as orthographic rather than phonological in nature.

As indicated in the Introduction, current models of visual-word recognition do not make any explicit distinction between consonants and vowels in their orthographic input coding schemes. As the implemented version of these models only includes an orthographic layer and a lexical layer, these models predict a similar transposed-letter priming effect for consonant and vowel transpositions. To substantiate this claim, we conducted simulations on a leading computational model of visual-word recognition, namely, the spatial coding model (Davis, 2011), with the present set of stimuli. Using the default set of parameters (prime exposure duration = 50 ms), results showed a masked transposed-letter priming effect of similar magnitude for C-C and V-V transpositions. Specifically, for consonant transpositions, the transposed-letter priming effect was 13 processing cycles (the averages were 83 and 96 cycles for the word targets preceded by a transposed-letter prime and a replacement-letter prime, respectively). For vowel transpositions, the transposed-letter priming effect was also 13 processing cycles (the averages were 84 and 97 cycles for the word targets preceded by a transposed-letter prime and a replacement-letter prime, respectively). In sum, the spatial coding model (Davis, 2011) predicts that the transposed-letter priming effect should be similar in size for C-C and V-V transpositions, as actually occurred in developing readers—bear in mind that this model does not have an implemented phonological layer (i.e., the predicted transposed-letter priming effects are orthographic in nature).

One potential limitation of the present experiment is that the main effect of transposed-letter priming failed to reach significance in the analysis by items, possibly because the response time data from developing readers are substantially noisier than the data from adult readers. Rather than conducting an exact replication of the experiment, we opted for running Experiment 3 with a masked priming procedure that magnifies the size of the priming effects by providing an initial boost to the activation of the target word: the sandwich technique (e.g., see Lupker & Davis, 2009; Perea et al., 2014; see also Ktori et al., 2012). In this technique, the target stimulus is presented briefly just after the forward mask and preceding the nonword prime. Thus, in Experiment 3 we expect to obtain the same pattern as in the current experiment, with the difference that the masked priming effects will be numerically greater and statistically more robust.

Experiment 3

Method

Participants. Twenty 4th grade children (10 female; mean age = 9.54 years; *SD* = 0.48) participated voluntarily in the experiment after we obtained written consent form from their parents. The children came from the same schools as in Experiment 2. The experiment was run at the middle of the school year, and none of these participants had taken part in Experiment 2. All participants had normal (or corrected-to-normal) vision and were native speakers of Spanish. None of them had any sensory, neurological, or learning disabilities.

Materials. The materials were the same as those used in the Experiment 1.

Procedure. The only difference regarding the procedure used in Experiments 1 and 2 was the inclusion of a lowercase target stimulus (8-pt Courier New font) for 33.3 ms just before the presentation of the prime (see Lupker & Davis, 2009, for a similar procedure).

Results and Discussion

Error responses (8.2% of trials) and lexical decision times smaller than 250 ms or greater than 2000 ms were excluded from the latency analyses. Three participants who made more than 30% of errors were replaced. Mean lexical decision times and percent error per condition are displayed in Table 1. The statistical analyses were parallel to those in Experiments 1 and 2.

The ANOVA on the latency data revealed a significant effect of Prime type, $F_1(1, 16) = 13.33$, $MSE = 2280.32$, $\eta^2_p = .45$, $p = .002$; $F_2(1, 113) = 5.59$, $MSE = 21134.56$, $\eta^2_p = .05$, $p = .020$. Neither the main effect of Letter type nor the interaction between Prime type and Letter type reached significance, all $F_s < 0.4$. The ANOVA on the error data failed to reveal any significant effects, all $p_s > .19$.

In the current sandwich priming experiment with developing readers, we found a masked transposed-letter priming effect that was independent of consonant/vowel status (47 ms for C-C transpositions, 40 ms for V-V transpositions). That is, we replicated the pattern of data observed in Experiment 2. The basic difference is that, as expected, the magnitude of the transposed-letter priming effects with the sandwich technique (current experiment) was numerically larger and more robust in the by-items analyses than with the standard masked priming setup (Experiment 2).

In the Introduction, we indicated that the consonant/vowel asymmetry in letter position coding could originate: i) from differences in sublexical phonology (i.e., the orthographic input scheme of models of visual-word recognition would not need to be amended), or ii) from a modulation of consonant/vowel status in letter position coding at an early orthographic stage common to developing and adult readers (i.e., the orthographic input scheme of models of visual-word recognition should be amended). The findings from Experiments 1-3 offer evidence in favour of the first option.

There is a potential caveat, though. A basic premise in our reasoning was that while adult readers are sensitive to masked phonological priming with brief prime exposure durations (i.e., 50 ms), developing readers are not sensitive to masked phonological priming (see Davis et al., 1998). The Davis et al. (1998) experiment was conducted in English. To obtain firmer conclusions, it is important to examine whether masked phonological priming can be obtained in Spanish with developing readers. Keep in mind that Spanish has a more transparent orthography than English (i.e., there is a direct correspondence between written symbols and phonemes with a very few exceptions) and one could argue that Spanish could more be sensitive to early phonological effects (as captured by masked priming) than English. Previous research with adult readers in Spanish has shown masked phonological priming effects with the masked priming lexical decision task with a 50-ms prime exposure duration (e.g., Perea & Carreiras, 2006, 2008; Pollatsek et al., 2005). Then, the question is whether masked phonological priming can also be obtained with developing readers in Spanish with a 50-ms prime exposure duration. Experiment 4 was designed to answer this question by using word pairs that sounded the same but differed in the initial orthographic syllable (see Pollatsek, Perea, & Carreiras, 2005, for a similar strategy with adult skilled readers in Spanish). This manipulation optimizes the chances to detect a masked phonological priming effect, because phonological codes are serial in nature (e.g., masked phonological priming in adult skilled readers are greater when primes and target share the first phonological syllable than when they share the second phonological syllable; see Carreiras, Ferrand, Grainger, & Perea, 2005). In the present experiment, the critical comparison was between a pseudophomone priming condition (e.g., vocina-BOCINA, note that "v" and "b" are pronounced as /b/ in Spanish; i.e., vocina is a pseudohomophone of bocina) and its appropriate orthographic control (nocina-BOCINA). The critical letters in the pseudohomophone priming condition and in the orthographic control condition (e.g., "v" in vocina-VOCINA vs. "n" in nocina-BOCINA) were matched in terms of ascending, descending, or neutral letters. We also included an identity condition and an unrelated condition as further controls. (footnote 2)

The predictions of Experiment 4 are clear-cut. If response times to a target word such as BOCINA are similar when preceded by the pseudohomophone prime vocina and when preceded by the control prime nocina, this would mean that the information extracted from the briefly presented prime is orthographic rather than phonological. Alternatively, if response times are faster to vocina-BOCINA (phonological condition) than to nocina-BOCINA (control condition) that would mean that masked phonological priming effects do exist in Spanish with developing readers, and this would require a thorough re-interpretation of the findings in Experiments 1-3. To maximize the magnitude of masked priming effects, the experiment was conducted with the sandwich technique.

Experiment 4

Method

Participants. Twenty-one 4th grade children (9 female; mean age = 9.4 years; *SD* = 0.59) participated voluntarily in the experiment after we obtained written consent form from their parents. The children came from average socioeconomic backgrounds in a public school located in Val Miñor, Galicia. All participants had normal (or corrected-to-normal) vision and were native speakers of Spanish. None of them had any sensory, neurological, or learning disabilities. The experiment was run at the middle of the academic year.

Materials. One hundred and sixty Spanish words of four to seven letters (148 nouns and 12 adjectives) were selected from the LEXIN database (Corral et al., 2009). All these words were composed of differing syllable structures (e.g., CVCCV, CVCVCV, CVCCVCV), and had frequency values that ranged from 6 to 472 (*M* = 37.01). The mean of word frequency per million in the ESPAL database (Duchon et al., 2013) was of 48.30 (range: 0.38 - 727). Besides, orthographic neighbourhood values ranged from 0 to 35 (*M* = 10.01), and phonological neighbourhood values ranged from 0 to 81 (*M* = 21.01). The values of neighbourhood were also taken from the ESPAL database. The uppercase targets were preceded by lowercase primes that were: a) the same as the target (bocina-BOCINA, identity condition); b) the same as the target except that first letter represented the same sound with another letter (vocina-BOCINA, preserving phonology; "v" and "b" sound exactly the same in Spanish), c) the same as the target except for a change of the first letter with a different sound (nocina-BOCINA, orthographic control)—this letter was matched in terms of being ascending, descending, or neutral with the replaced letter in the pseudohomophone priming condition; and d) an unrelated prime (sinoza-BOCINA, unrelated). For the purposes of the lexical decision task, 160 orthographically legal pseudowords were created with Wuggy (Keuleers & Brysbaert, 2010). The complete list of words and pseudowords is presented in Appendix B. The priming manipulation for the pseudoword targets was the same as that for words. Four lists of materials were constructed so that each target appeared once in each list. For instance, if a word was preceded by an identity primes in List 1, it would be preceded by a preserving phonology prime in List 2, by an orthographic control prime in List 3, and by an unrelated prime in List 4.

Procedure. The procedure was the same as in Experiment 3. We used the sandwich technique because it is more sensitive to masked priming effects than the standard procedure (Lupker & Davis, 2009). The whole session lasted about 20 minutes.

Results and Discussion

Error responses (4.8% of trials) and lexical decision times smaller than 250 ms or greater than 2000 ms were excluded from the latency analyses. Data from one participant who made more than 30% of errors were not included in the analysis (i.e., N=20 participants). The mean lexical decision times and percent error per condition are displayed in Table 2. Rather than conducting an unfocused, omnibus ANOVA with the four priming conditions, we conducted three planned comparisons. The first comparison was to examine whether or not there was a masked phonological priming effect (i.e., phonological condition vs. orthographic control condition), which is the critical issue at stake in the experiment. In addition, and to discard floor/ground effects, we also tested the identity priming effect (i.e. identity condition vs. one-letter different conditions); and the form-priming effect (i.e., one-letter different conditions vs. unrelated condition). As in Experiments 1-3, List (list 1, list 2, list 3, list 4) was included as a dummy factor in the analyses to extract the error variance due to the counterbalancing lists. The statistical analyses were conducted by subjects (F_1) and by items (F_2).

Masked phonological priming. There were no signs of a difference between the phonological and orthographic control conditions in the RTs (829 vs. 826 ms, respectively, both Fs < 1) or the error rates (2.6 vs. 2.8%, respectively, both Fs < 1).
Identity priming. There was an advantage of the identity condition over the one-letter different conditions in the RTs (802 vs. 828.5 ms, $F_1(1, 16) = 7.56$, $MSE = 786$, $\eta^2_p = .32$, $p = .014$; $F_2(1, 156) = 6.56$, $MSE = 5771$, $\eta^2_p = .04$, $p = .011$. The error rates showed the same trend (1.9 vs. 2.7% of errors), but the difference was not significant, both ps > .20.
Form priming. There was an advantage of the one-letter different conditions over the unrelated condition in the RTs, $F_1(1, 16) = 42.63$, $MSE = 1118$, $\eta^2_p = .73$, $p < .001$; $F_2(1, 156) = 41.04$, $MSE = 11307$, $\eta^2_p = .2$, $p < .001$, and in the by-subjects analyses of the error data, $F_1(1,16) = 5.47$, $MSE = 2.86$, $\eta^2_p = .26$, $p = .033$; $F_2(1,156) = 2.30$, $MSE = 55.8$, $\eta^2_p = .02$, $p = .13$.

Results showed that masked priming effects at a 50-ms prime exposure duration with developing readers (4th Graders) were orthographic rather than phonological in nature, as response times were similar for target words preceded by a phonologically related prime (vocina-BOCINA) or a one-letter different orthographic prime (nocina-BOCINA) (829 vs. 826 ms, respectively). Importantly, this was not due to a floor or a ground effect, since the identity priming condition (bocina-BOCINA) yielded, as expected, faster responses than the form-related (one-letter different) conditions, and in turn, the form-related (one-letter different) primes were more effective than the unrelated primes. Therefore, the present experiment extended the null masked phonological priming effect reported by Davis et al. (1998) in English to a transparent phonology, Spanish. Hence, a longer prime duration would be necessary to obtain reliable phonological priming effects with developing readers (e.g., above 67 ms), as Chetail and Mathew (2012) and Grainger et al. (2012; see also Ziegler et al., 2013) have shown in French.

General Discussion

A particularly puzzling (and unexplained) phenomenon for current models of visual-word recognition is that, for adult skilled readers, transposed-letter effects are greater for consonant transpositions than for vowel transpositions. To explain this consonant/vowel asymmetry, one option is to modify the orthographic input coding schemes of models of visual-word recognition. A less drastic option, suggested by Perea and Lupker (2004), is to assume that the consonant/vowel differences in letter position coding found in adult skilled readers are due to phonological influences that would be "entirely outside of the architecture of the models" (p. 242). Keep in mind that the implemented version of these models includes an orthographic layer and a lexical layer, but not a phonological layer (e.g., see Davis, 2010). To test the "phonological" hypothesis of the consonant/vowel dissociation in letter position coding, we employed a scenario in which phonological involvement is presumably minimal: a masked priming lexical decision task with primes presented for 50 ms with developing readers—Grade 4 children.

Data from adult skilled readers in Experiment 1 showed a masked transposed-letter priming effect for C-C transpositions (casimeta-CAMISETA < caniveta-CAMISETA), but not for V-V transpositions (camesita-CAMISETA = camasuta-CAMISETA), thus replicating earlier research (e.g., Lupker et al., 2008; Perea & Acha, 2009; Perea & Lupker, 2004). More importantly, data from developing readers (Grade 4 children) with the same materials showed a masked transposed-letter priming effect of similar magnitude for C-C and V-V transpositions, both when using the standard setup (Experiment 2) and when using a technique that enhances the priming effects (i.e., sandwich technique; Experiment 3). This is exactly the pattern of data predicted by computational models of visual-word recognition on the basis of orthographic processes alone (e.g., see the simulations on the spatial coding model reported in the Discussion section of Experiment 2). Finally, Experiment 4 showed that that there were no signs of a masked phonological priming effect with Spanish developing readers (i.e., we found similar response times for target words when preceded by a pseudohomophone and when preceded by an orthographic control), thus replicating earlier research in English (e.g., Davis et al., 1998). That is, the obtained transposed-letter priming effects in Experiments 2 and 3 with developing readers can be characterized as orthographic rather than phonological in nature.

The implications of the present data are straightforward. The data from Experiments 2 and 3 with developing readers favour the "phonological" interpretation of consonant/vowel asymmetries in letter position coding suggested by Perea and Lupker (2004): in a scenario in which masked phonological priming is essentially absent, C-C and V-V transposed-letter nonwords are equally effective at activating the targets' lexical representations. It is important to stress that this was not due to any particularities of these words, as these same stimuli produced the typical pattern of data when the experiment was conducted with adult skilled readers (Experiment 1; i.e., a sizeable transposed-letter priming effect for C-C transpositions but not for V-V transpositions). Indeed, on the basis of orthographic processes alone, the spatial coding model (Davis, 2011) predicts that both consonant and vowel transpositions should produce masked transposed-letter priming effects of similar magnitude. Taken together, these data suggest that consonant/vowel differences in letter position coding do not originate at the earliest stages of orthographic processing, but instead they originate from phonological processing (see Perea & Lupker, 2004).

Our interpretation of the present data is consistent with recent eye movements and electrophysiological studies. With respect to eye-tracking studies during sentence reading, Johnson (2007) using parafoveal previews in English reported a sizeable transposed-letter priming relative to the orthographic control for C-C transpositions, but not for V-V transpositions (17 vs. 9 ms, respectively) when measuring the gaze durations on the target word (i.e., an index that correlates highly with lexical decision times; see Schilling, Rayner, & Chumbley, 1998). Importantly, Johnson (2007) found no signs of a consonant/vowel interaction with the transposed/replaced previews when measuring an eye movement measure that taps the earliest stages of word processing, namely, the first-fixation duration on the target word. More recently, Winskel and Perea (2013) replicated this pattern in Thai: transposed-letter priming occurred for C-C transpositions (30 ms) but not for V-V transpositions (1 ms) when measuring the gaze durations on the target word, whereas this interaction did not occur in the first-fixation durations on the target word. Regarding electrophysiological studies, in an unprimed lexical decision experiment, Carreiras, Vergara, and Perea (2007) found very similar event-related potential (ERPs) waves to transposed-letter consonant (re**lov**ution; the base word is RE**VOL**UTION) and vowel (rev**ulo**tion) nonwords at early time windows

(300-500 ms). Indeed, the differences between transposed-letter C-C pseudowords and transposed-letter V-V pseudowords only occurred in later time windows (500-600 ms) as well as in reaction times and error rates. Taken together, these experiments strongly suggest that consonant/vowel differences in letter position coding do not arise at the very early stages of orthographic processing.

In sum, the current masked priming lexical decision experiments showed that consonant/vowel status does not play a role at encoding letter position when phonological involvement is minimal. Therefore, current models of visual-word recognition do not need to be amended to include consonant/vowel status in their orthographic input coding schemes. Instead, the processing differences between consonants and vowels can be better explained by phonological processes that are beyond the current (implemented) architecture of these models. Clearly, a challenge for future implementations of computational models of visual-word recognition is the addition of a phonological layer that adequately accounts for the interplay between orthographic and phonological representations during the course of lexical access (see Carreiras, Armstrong, Perea, & Frost, 2014, for review).

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Footnotes

Footnote 1. This does not mean that we are denying an involvement of phonology during the course of lexical access in developing readers, but rather that a 50-ms prime exposure duration is not enough to activate phonological codes. Indeed, significant phonological priming effects have been reported with developing readers when using prime durations longer than 65 ms (67 ms: Chetail & Mathew, 2012; 150 ms: Goikoetxea, 2005; 70 ms: Grainger, Lété, Bertrand, Dufau, & Ziegler, 2012; Ziegler, Bertrand, Lété, & Grainger, 2014). This is consistent with the idea that processing speed is slower in children than in adults (see Ratcliff, Love, Thompson, & Opfer, 2012, for empirical/modelling evidence) and that (unsurprisingly) phonological effects in alphabetic languages arise more slowly than orthographic effects (see Ferrand & Grainger, 1992, for an examination of the time course of masked orthographic vs. phonological priming in adult readers).

Footnote 2. In Experiment 4, the critical letter in the pseudohomophone priming condition was physically different (e.g., in terms of ascenders/descenders) from the original letter (e.g., “v” vs. “b”) and thus one could argue that any differences obtained between these two conditions could be due to a low-level visual effect rather than to orthography. However, there is empirical evidence that shows that these visual cues do not play a relevant role in visual-word recognition experiments with adult or developing readers. For instance, in a lexical decision experiment with Grade 4 children, Perea and Panadero (2014) found similar response times (and error rates) for nonwords that kept the visual form from the baseword such as viotin (i.e., visually similar to violin) and for control nonwords such as viocin. Furthermore, in a masked priming lexical decision experiment with Grade 5 children, Perea, Jiménez, and Gomez (2015) found similar response times to nominally/physically identical pairs such as EDGE-EDGE and for nominally (but not physically identical pairs) such as edge-EDGE. Taken together, these findings are consistent with the idea that masked priming effects in lexical decision are independent of visual similarity between prime and target (see Perea, Vergara-Martínez, & Gomez, 2015, for discussion; see also Kinoshita & Kaplan, 2008, for similar evidence using isolated letters).

Table 1. *Mean lexical decision times (RTs; in Milliseconds) and Percentage of Errors (% E) in the different experimental conditions in Experiment 1 (adults), Experiment 2 (4th Grade children; standard masked priming) and Experiment 3 (4th Grade children; sandwich priming). Standard errors are presented between brackets.*

	Adults				**Children (standard procedure)**				**Children (sandwich priming)**			
	Consonants		Vowels		Consonants		Vowels		Consonants		Vowels	
Priming conditions	RT	% E	RT	% E	RT	% E	RT	% E	RT	% E	RT	% E
Transposed Letters (TL)	621 (26.9)	0.6 (0.3)	638 (27.0)	1.0 (0.7)	1,132 (44.6)	11.8 (1.9)	1,148 (38.7)	11.7 (1.7)	1,061 (54.9)	6.8 (1.9)	1,058 (56.9)	7.5 (1.6)
Replaced Letters (RL)	642 (27.7)	0.4 (0.3)	635 (25.6)	1.5 (0.6)	1,155 (40.3)	12.5 (1.9)	1,169 (44.9)	11.5 (2.1)	1,108 (58.9)	8.0 (1.9)	1,098 (58.9)	8.5 (1.9)
RL-TL	21	-0.2	-3	0.5	23	0.7	21	-0.2	47	1.2	40	1

Table 2. *Mean lexical decision times (RTs; in Milliseconds) and Percentage of Errors (% E) for Identical, Preserving Phonology, Orthographic control and Unrelated priming conditions in Experiment 4 (4th Grade children). Standard errors are presented between brackets.*

	Identity	**Preserving Phonology**	**Orthographic Control**	**Unrelated**
RTs	802 (29)	829 (30)	826 (31)	898 (27)
% E	1.9 (0.6)	2.6 (0.6)	2.8 (0.7)	3.6 (0.9)

Appendix A. Stimuli in Experiments 1-3

Uppercase targets are followed by the four priming conditions used: TL-consonants, RL-consonants, TL-vowel, RL-Vowel

Word targets: INCUBADORA, incudabora, inculatora, incabudora, incobedora; INTELIGENTE, inletigente, indebigente, intilegente, intolagente; CADUCIDAD, cacudidad, canubidad, cadicudad, cadecodad; REMOLACHA, relomacha, retozacha, remalocha, remilucha; FORTALEZA, forlateza, forbadeza, fortelaza, fortuloza; SOLIDARIDAD, soliradidad, solinatidad, soladiridad, soleduridad; PERSONAJE, pernosaje, pervomaje, persanoje, persuneje; TARTAMUDO, tarmatudo, tarzaludo, tartumado, tartimedo; DESAYUNO, deyasuno, degavuno, desuyano, desiyeno; MACEDONIA, madeconia, mabezonia, macodenia, macudinia; ZANAHORIA, zahanoria, zafasoria, zanoharia, zanehuria; CONGELADO, conlegado, conbepado, congoledo, congalido; DESPEDIDA, desdepida, deslegida, despideda, despoduda; CONVOCATORIA, convotacoria, convolazoria, convacotoria, convecutoria; TOBOGANES, togobanes, topolanes, tobagones, tobigunes; DECORADO, derocado, denozado, decarodo, decurido; ORDENADORES, ordedanores, ordezatores, ordanedores, ordinudores; MARINERO, manirero, masivero, mareniro, marunaro; CAMISETA, casimeta, caniveta, camesita, camasuta; LABORATORIO, labotarorio, labofanorio, labarotorio, laberitorio; COMUNICACIÓN, comucinación, comuviración, cominucación, comenocación; CONTAMINADO, contanimado, contavinado, contimanado, contemonado; ALBARICOQUE, albaciroque, albanivoque, albiracoque, alberucoque; AMANECER, anamecer, asavecer, amenacer, aminocer; RESUCITADO, resuticado, resufinado, resicutado, resecatado; ESCALERILLA, escarelilla, escanetilla, escelarilla, escilorilla; PRIMAVERA, privamera, prisarera, primevara, primovura; FREGADERO, fredagero, frelapero, fregedaro, fregiduro; FAVORECIDA, favocerida, favosenida, faverocido, favirucido; EVAPORADO, evaropado, evanogado, evoparado, evuperado; ALAMEDA, amaleda, anateda, alemada, alimuda; FENOMENAL, femonemal, fecoremal, fenemonal, fenimanal; MALHUMORADO, malhuromado, malhusozado, malhomurado, malhemarado; TIRABUZÓN, tirazubón, tiranulón, tirubazón, tirebozón; GENEROSIDAD, genesoridad, genevonidad, genoresidad, genurasidad; UNIDADES, udinades, utisades, unadides, unedodes; TOSTADORA, tosdatora, toslafora, tostodara, tostudera; ABSOLUTO, ablosuto, abconuto, absuloto, abselato; NATURALEZA, natulareza, natufaveza, nataruleza, naterileza; PODEROSO, poredoso, pometoso, podoreso, podiraso; ESPINACAS, esnipacas, esvigacas, espanicas, esponecas; ROTULADORES, rotudalores, rotufatores, rotaludores, rotelidores; ITINERARIO, itirenario, itisevario, itenirario, itunorario; AMARILLO, aramillo, asavillo, amirallo, amorullo; COLORADO, corolado, covotado, colarodo, colerido; HELADERÍA, hedalería, hetabería, heledaría, heludoría; FOGONAZO, fonogazo, fovojazo, foganozo, fogunizo; COMISARÍA, cosimaría, covinaría, comasiría, comusoría; COLABORACIÓN, colarobación, colanofación, colobaración, coluberación; PREFERIDO, prerefido, presetido, prefiredo, prefurodo; ACANTILADO, acanlitado, acanbifado, acantalido, acantuledo; MARAVILLA, mavarilla, mazasilla, marivalla, marevolla; LITERATURA, litetarura, litebanura, litaretura, litorutura; CACEROLA, carecola, casevola, carocela, caracila; FINALIZAR, filanizar, fitacizar, finilazar, finelozar; TULIPANES, tupilanes, tugifanes, tulapines, tulepunes; ABOGADO, agobado, apotado, abagodo, abegudo; MALEDUCADA, malecudada, malevutada, maudecada, malidocada; COMPETIDORES, compeditores, compelibores, compitedores, computodores; CHOCOLATERA, chocotalera, chocofabera, chocalotera, choculetera; GELATINA, getalina, gebafina, gelitana, gelutona; FEMENINO, fenemino, fesecino, femineno, femanuno; CRISTALINA, crislatina, crisbafina, cristilana, cristeluna; INVITACIÓN, intivación, indisación, invatición, invetoción; CORONILLA, conorilla, covocilla, corinolla, corenalla; ORGANIZADO, orgazinado, orgasirado, orginazado, orgenuzado; TELEDIRIGIDO, teledigirido, teledijinido, telidergido, teludarigido; APARECIDO, apacerido, apanesido, aperacido, apirucido; ENAMORADO, enaromado, enasozado, enomarado, enumirado; TELEVISIÓN, tevelisión, teredisión, telivesión, telavusión; ASPIRADORAS, aspidaroras, aspilanodas, asparidoras, asporedoras; FAROLILLO, falorillo, fabonillo, farilollo, farelallo; EXPOSICIÓN, exsopición, exnogición, expisoción, expesución; ILUMINADO, ilunimado, ilucirado, ilimunado, ilemanado; VELOCIDAD, vecolidad, venotidad, velicodad, velacedad; PARALIZADOS, parazilados, paranifados, parilazados, parelozados; GOLOSINA, gosolina, gocofina, golisona, golesuna; DELICADEZA, delidaceza, delibaneza, delacideza, delocedeza; INVITADO, intivado, inlizado, invatido, invutedo; PATINADORA, patidanora, patilasora, patanidora, patenodora; CASCABELERA, cascalebera, cascatefera, cascebalera, cascibalera; ENUMERACIÓN, enumecarión, enumevasión, enemuración, enimaración; DESTINATARIO, destitanario, destilazario, destanitario, destonetario; APETITO, atepito, alejito, apiteto, apotuto; ENEMIGO, emenigo, eserigo, enimego, enamogo; ABEJORRO, ajeborro, agetorro, abojerro, abajirro; DIMINUTO, dinimuto, disivuto, dimunito, dimenato; CARAMELO, camarelo, cavaselo, caremalo, carimulo; LUMINOSO, lunimoso, lusiroso, lumoniso, lumenaso; SOLITARIO, sotilario, sobidario, solatirio, soleturio; AURICULARES, aurilucares, aurituzares, aurucilares, auracelares; GASOLINERA, gasonilera, gasovitera, gasilonera, gaselunera; CAPACIDAD, cacapidad, canagidad, capicadad, capocudad; VETERINARIA, veteniraria, vetesizaria, vetirenaria, veturonaria; DORMITORIO, dortimorio, dorlirorio, dormotirio, dormaturio; RINOCERONTE, rinoreconte, rinosezonte, rinecoronte, rinacuronte; ESCENARIO, esnecario, esrevario, escanerio, esconirio; CALABOZO, cabalozo, cafatozo, calobazo, calebizo; VITAMINAS, vimatinas, vicalinas, vitimanas, vitemunas; ALMOHADONES, almodahones, almobatones, almahodones, almehidones; MANDARINA, manradina, manvatina, mandirana, manderona; SEGURIDAD, serugidad, sezupidad, segirudad, segerodad; HABITACIÓN, hatibación, halifación, habatición, haboteción; TITULADO, tilutado, tibufado, titaludo, titelido; DESHABITADO, deshatibado, deshalifado, deshibatado, deshebutado; ALFABETO, albafeto, altaleto, alfebato, alfibuto; REGADERA, redagera, relapera, regedara, regidura; TABURETE, tarubete, tanufete, taberute, taborate; CARACOLILLO, caralocillo, caratonillo, carocalillo, careculillo; RELOJERO, rejolero, regofero, relejoro, relajuro; AZUCARERO, azuracero, azunavero, azacurero, azecorero; DEDICATORIA, deditacoria, dedilasoria, dedacitoria, dedocetoria; TEMPERATURA, tempetarura, tempebamura, tempaterura, tempotirura; GANADERO, gadanero, galavero, ganedaro, ganiduro; CAMARERO, caramero, cazanero, cameraro, camoriro; PASAJEROS, pasarejos, pasanegos, pasejaros, pasijuros; RECUPERADO, recurepado, recusegado, recepurado, reciparado; JABONERA, janobera, jacotera, jabenora, jabunira; ANIMALES, aminales, arivales, anamiles, anemoles; SALPICADO , salcipado, salnigado, salpacido, salpocedo

Nonword targets: AMIFACADA, amicafada, amisalada, amaficada, amufecada; IRGAFICIÓN, irfagición, irtajición, irgifación, irgefución; DAMASONO, dasamono, darazono, damosano, damiseno; BAMODILLO, badomillo, batorillo, bamidollo, bamedullo; ESLERACIÓN, esrelación, esnetación, eslareción, esluroción; HENABIGIÓN, hebanigión, hetavigión, henibagión, henubegión; ADMOCUSO, adcomuso, adnoruso, admucoso, admacaso; SOLORENONTE, soloneronte, solozesonte, solerononte, solurinonte; COMOCILLO, cocomillo, corozillo, comicollo, comacullo; DENLOCAVORIO, denlovacorio, denlonasorio, denlacovorio, denlicuvorio; NANOPINIGIDO, nanonipigido, nanocijigido, naniponigido, nanepunigido; TAGOCAZORIA, tagozacoria, tagoraxoria, tagacozoria, tagucezoria; BUSEROSO, buresoso, bunecoso, busoreso, busiruso; BOMOSICO, bosomico, bovorico, bomisoco, bomesuco; AVULOTACIÓN, avutolación, avufobación, avolutación, aviletación; PASABILLA, pabasilla, patarilla, pasiballa, pasebolla; BEMOVECALO, bemocevalo, bemoresalo, bemevocalo, bemuvicalo; PEMODACO, pedomaco, petonaco, pemadoco, pemiduco; TIBONERA, tinobera, tisolera, tibenora, tibunara; TALECADOCA, taledacoca, talefaroca, talacedoca, talocudoca; POLENARIA, ponelaria, pocetaria, polaneria, polinuria; BIMARICAN, biramican, bisazican, bimiracan, bimerocan; AGUCAMOCA, agumacoca, agusaroca, agacumoca, agocemoca; PEMOBERA, pebomera, pelocera, pemebora, pemibura; PALIMORAJE, paliromaje, palisovaje, palomiraje, palumeraje; CAFARENEZA, cafanereza, cafasemeza, caferaneza, caforuneza; TOLECAPURA, tolepacura, tolejazura, tolacepura, tolucipura; CACEGUSA, cagecusa, capenusa, cacugesa, cacogisa; DIMIRADO, dirimado, disivado, dimarido, dimerudo; CASMILEDAR, caslimedar, castiredar, casmelidar, casmoludar; DARMELORIO, darlemorio, darterorio, darmolerio, darmulario; LICALONACIÓN, licanolación, licazofación, licolanoción, licolenución; ANLAJESO, anjaleso, anpafeso, anlejaso, anlijuso; PEMBUNORADO, pemburonado, pembusocado, pembonurado, pembenarado; CILOMICENA, cilocimena, cilovirena, cilimocena, cilamucena; IGUJEMADA, igumejada, igurepada, igejumada, igejumoda; TALUCANOZA, talunacoza, talusaroza, talacunoza, talicuneza; FRICABERO, fribacero, fritasero, fricebaro, fricoburo; BOFOCAVO, bocofavo, bonodavo, bofacovo, boficuvo; CAMASELA, casamela, cavarela, camesala, camisula; ECIDOPO, edicopo, elinopo, ecodipo, ecudapo; RIMUDADA, ridumada, ritusada, rimaduda, rimedoda; DEGECAROCIE, degeracocie, degesanocie, degacerocie, degucirocie; TEPECIRARIO, tepericario, tepenisario, tepicerario, tepocurario; CAVURIDAD, caruvidad, casunidad, cavirudad, caverodad; ONLECIPADO, onlepicado, onlegisado, onlicepado, onlucopado; TASIFUTADA, tasitufada, tasidulada, tasufitada, tasofetada; TOLEJAMIA, tojelamia, topefamia, tolajemia, tolojumia; LEBARIDAD, lerabidad, lezatidad, lebiradad, leboredad; CAMILOTERIA, camitoleria, camidoferia, camoliteria, camulateria; BAMOCERO, bacomero, basovero, bamecoro, bamicuro; ALATOVIDO, alavotido, alarofido, alotavido, alutevido; ANLOZADOZAS, anlodazozas, anlotacozas, anlazodozas, anlezoduzas; BISARIVAR, birasivar, bivanivar, bisiravar, bisurevar; CAMAGOPA, cagamopa, cajazopa, camogapa, camegupa; ANLECISEQUE, anlesiceque, anleriveque, anliceseque, anlucaseque; BEMATICO, betamico, befavico, bemitaco, bemutoco; REMOCADA, recomada, revorada, remacoda, remiceda; MACISOCIO, masicocio, maxinocio, macosicio, macusecio; PASECIRO, pacesiro, paxeniro, pasicero, pasucoro; APIBORRO, abiporro, adigorro, apobirro, apuberro; CALIPATURIA, calitapuria, califaguria, calapituria, calupeturia; PALURICADO, palucirado, palusizado, palirucado, palorecado; ESPICARIO, escipario, esmijario, espacirio, espocerio; ZASPIRENA, zasripena, zasvijena, zasperina, zaspurona; TALORINOCA, taloniroca, talozisoca, talironoca, talerunoca; ALICONARIA, alinocaria, alizosaria, alocinaria, alucenaria; TETABOLIA, tebatolia, teladolia, tetobalia, tetubelia; ASTEROLILLA, astelorilla, astebonilla, astorelilla, asturalilla; ZASCURAFENO, zascufareno, zascudaveno, zascarufeno, zascorifeno; TASCULADEZO, tascudalezo, tascufatezo, tascaludezo, tascolidezo; CAMINOVA, canimova, carizova, camoniva, camuneva; CARCASENA, carsacena, carmarena, carcesana, carcisuna; SITEBALIDAD, sitelabidad, sitedafidad, sitabelidad, sitobulidad; CARMANUDO, carnamudo, carsaxudo, carmunado, carmenodo; BICAJUVÓN, bijacuvón, bigaruvón, bicujavón, bicojevón; MOLUVANICA, molunavica, moluxasica, molavunica, molevonica; CAMPIFENERA, campinefera, campiselera, campefinera, campofunera; BOSMACEZA, boscameza, bosraseza, bosmecaza, bosmicoza; ALENIRADO, alerinado, alexicado, alinerado, alunorado; ZAMOCIDAD, zacomidad, zaronidad, zamicodad, zamecudad; TEGERACIÓN, teregación, tecejación, tegareción, tegurición; AMITOVA, atimova, alirova, amotiva, amuteva; ALOCETIDA, alotecida, aloderida, alecotida, alicutida; RESMODIDA, resdomida, reslovida, resmidoda, resmaduda; DESLEVANARIO, deslenavario, deslesacario, deslavenario, deslivunario; ALEDICIÁN, adelicián, atefición, alidecián, aludocián; ELECENADO, elenecado, elexerado, elecanedo, elecunido; HELIDANIO, hedilanio, hetifanio, heladinio, heludonio; ESETIRALE, eseritale, esenifale, esiterale, esoturale; BILESOSA, biselosa, binetosa, bilosesa, bilusisa; GELAMESO, gemaleso, gezafeso, gelemaso, gelimuso; ACADIPALA, acapidala, acagibala, acidapala, acedupala; DROSCARINA, drosracina, drosnavina, droscirana, droscurena; MALENUSA, manelusa, maredusa, malunesa, malanisa; FANCIRATURA, fancitarura, fancidazura, fancaritura, fancerotura; MOLENARIA, monelaria, mosefaria, molaneria, molunoria; CAMARIDAD, caramidad, cavazidad, camiradad, camerodad; NAVOLECACIÓN, navocelación, navorefación, navelocación, navulicación; MEMUCIDAD, mecumidad, mesuridad, memicudad, memacodad; AMABODO, abamodo, alasodo, amobado, amibedo; INCUDASA, inducasa, inlunasa, incadusa, incedosa; BAMASERA, basamera, baxarera, bamesara, bamisora; BAMUSOTE, basumote, barucote, bamosute, bamisate; IMCATOGULA, imcagotula, imcajofula, imcotagula, amcetugula; ANARENIR, ananerir, anacezir, aneranir, anuronir; ZAMERATO, zaremato, zavesato, zamareto, zamiruto; MOFIROTO, morifoto, mociloto, moforito, mofureto; DELERANOTA, delenarota, delezacota, delarenota, delurinota; HECORINO, herocino, hexosino, hecirono, heceruno; TELECOGIDAD, telegocidad, telejoridad, telocegidad, telicugedad; PREMASERA, presamera, prexavera, premesara, premusira; CLIFORACERA, clifocarera, clifonasera, clifarocera, cliferucera; APICAZÓN, acipazón, anigazón, apacizón, apocezón; INMEDADA, indemada, inlerada, inmadeda, inmudoda; ZAVATERIA, zataveria, zalaneria, zavetaria, zavutoria; DEMAGUMO, degamumo, dejanumo, demugamo, demigomo; ESBARIGENTE, esbagirente, esbajivente, esbiragente, esburogente; DICERUSO, direcuso, dinexuso, dicureso, dicaroso; CONLEBITADO, conletibado, conledifado, conlibetado, conlobutado

Appendix B. Stimuli in Experiment 4

Uppercase targets are followed by the four priming conditions used: identity, preserving phonology, orthographic control and unrelated.

Word targets: BURRO, burro, vurro, nurro, saeca; COMIDA, comida, komida, tomida, bucelo; CAMPO, campo, kampo, fampo, fusga; BOCINA, bocina, vocina, nocina, sinoza; CANARIO, canario, kanario, tanario, lemecia; BATA, bata, vata, sata, cilo; VERDE, verde, berde, ferde, tinlo; BABA, baba, vaba, naba, sifa; BASURA, basura, vasura, casura, roniso; CAPA, capa, kapa, fapa, tego; CABRA, cabra, kabra, tabra, focho; COCINA, cocina, kocina, locina, tamuco; CUEVA, cueva, kueva, tueva, lioro; COCO, coco, koco, hoco, fisa; BUZO, buzo, vuzo, nuzo, rano; BICHO, bicho, vicho, richo, nucha; CARIÑO, cariño, kariño, tariño, fasona; CINTA, cinta, zinta, rinta, nosfo; BALCÓN, balcón, valcón, nalcón, rilzás; CUERPO, cuerpo, kuerpo, buerpo, liosgo; CURA, cura, kura, tura, bina; BALA, bala, vala, nala, cofa; CARETA, careta, kareta, lareta, fineto; BOLLO, bollo, vollo, nollo, rello; CARNE, carne, karne, tarne, larco; CORRAL, corral, korral, lorral, tanol; CAÑA, caña, kaña, faña, huco; BOBO, bobo, vobo, cobo, nita; COLA, cola, kola, fola, heto; CURVA, curva, kurva, lurva, tesna; CABALLO, caballo, kaballo, laballo, fotocha; BANDERA, bandera, vandera, candera, sintero; VESTIDO, vestido, bestido, lestido, benlata; CARTA, carta, karta, larta, fisfo; BIBERÓN, biberón, viberón, ciberón, natusán; BONITO, bonito, vonito, ronito, cemata; CIRCO, circo, zirco, nirco, cesna; CARBÓN, carbón, karbón, tarbón, lisfán; BAÑERA, bañera, vañera, rañera, cesumo; CASCO, casco, kasco, fasco, linza; BARRA, barra, varra, zarra, serro; CAMINO, camino, kamino, famino, losama; COPA, copa, kopa, lopa, bugo; CONEJO, conejo, konejo, fonejo, larafa; VELERO, velero, belero, telero, fatira; GIRASOL, girasol, jirasol, pirasol, punical; CERRADO, cerrado, zerrado, nerrado, virreta; JIRAFA, jirafa, girafa, piraja, pegope; BÚHO, búho, vúho, rúho, cifa; CUCHARA, cuchara, kuchara, tuchara, felloro; CORONA, corona, korona, torona, lisamo; JEFE, jefe, gefe, pefe, pifo; CASILLA, casilla, kasilla, tasilla, fimollo; CARTERO, cartero, kartero, lartero, fislara; CAPITÁN, capitán, kapitán, lapitán, lorefón; CASETA, caseta, kaseta, taseta, lisofo; BIGOTE, bigote, vigote, rigote, cepula; CUBO, cubo, kubo, lubo, tama; CALAMAR, calamar, kalamar, falamar, tofocer; CAZA, caza, kaza, laza, tiso; CAZUELA, cazuela, kazuela, lazuela, lacieta; GENIO, genio, jenio, yenio, yacea; BOTÓN, botón, votón, notón, cutás; CABAÑA, cabaña, kabaña, fabaña, tiremo; CEPILLO, cepillo, zepillo, repillo, vegecha; VIENTO, viento, biento, hiento, liusfa; CATARRO, catarro, katarro, latarro, balerra; BAÑO, baño, vaño, zaño, rira; COCHE, coche, koche, toche, furro; VISITA, visita, bisita, tisita, fesepa; CIELO, cielo, zielo, vielo, seota; CEREZAS, cerezas, zerezas, nerezas, ramocan; BARRIO, barrio, varrio, carrio, norrea; VAGÓN, vagón, bagón, lagón, fojís; COFRE, cofre, kofre, tofre, latra; BAÚL, baúl, vaúl, naúl, caíl; CIRUELA, ciruela, ziruela, niruela, sevielo; CARACOL, caracol, karacol, banacol, henasal; BORDE, borde, vorde, norde, sasto; GIGANTE, gigante, jigante, pigante, puganla; CAZO, cazo, kazo, fazo, tiso; COPIA, copia, kopia, lopia, tugeo; CARTÓN, cartón, kartón, lartón, faslís; CEBRA, cebra, zebra, rebra, nofro; BANDEJA, bandeja, vandeja, nandeja, nostigo; BOTELLA, botella, votella, rotella, saficha; BARBA, barba, varba, sarba, nisfo; CAMA, cama, kama, tama, fosi; VERANO, verano, berano, herano, fanera; BARRO, barro, varro, rarro, nerra; CAMISA, camisa, kamisa, lamisa, teneco; CORAZÓN, corazón, korazón, lorazón, tamirés; VIOLÍN, violín, biolín, liolín, faosán; CORAL, coral, koral, toral, fisol; BOLSA, bolsa, volsa, nolsa, cilna; VIRGEN, virgen, birgen, lirgen, lasjos; BOCA, boca, voca, noca, cezo; BARCO, barco, varco, rarco, morza; GENTE, gente, jente, pente, yasle; BAÑADOR, bañador, vañador, nañador, cevolar; BUZÓN, buzón, vuzón, nuzón, samás; VIOLETA, violeta, bioleta, tioleta, feutalo; CENIZA, ceniza, zeniza, reniza, saceno; CABLE, cable, kable, lable, fucho; CINE, cine, zine, rine, nero; CALOR, calor, kalor, falor, bahan; CARTEL, cartel, kartel, lartel, tesfol; COMEDOR, comedor, komedor, tomedor, fomilas; CALLE, calle, kalle, lalle, tucho; BALÓN, balón, valón, nalón, refas; CAMBIO, cambio, kambio, fambio, tisleo; BAILE, baile, vaile, caile, teita; CUENTO, cuento, kuento, luento, biesla; VOLANTE, volante, bolante, tolante, fitosla; BOLSO, bolso, volso, colso, carza; VECINA, vecina, becina, lecina, ficoso; CAFÉ, café, kafé, tafé, buta; BOLA, bola, vola, zola, sifo; CORO, coro, koro, horo, teza; BARRIL, barril, varril, narril, sirrel; VIVO, vivo, bivo, livo, tuza; BALLENA, ballena, vallena, nallena, richaco; BATIDO, batido, vatido, natido, solora; BESO, beso, veso, neso, muno; CEBOLLA, cebolla, zebolla, rebolla, sitecho; VERDAD, verdad, berdad, ferdad, nertol; COHETE, cohete, kohete, tohete, fatola; CENA, cena, zena, rena, vimo; CUNA, cuna, kuna, funa, bemo; CERDO, cerdo, zerdo, verdo, nisto; COLEGIO, colegio, kolegio, folegio, tilenao; GENIAL, genial, jenial, penial, joreor; CAJÓN, cajón, kajón, lajón, figás; COLOR, color, kolor, folor, hetas; GITANA, gitana, jitana, pijana, pagena; CABEZA, cabeza, kabeza, tabeza, lofaco; CAZADOR, cazador, kazador, bazador, necetin; VENTANA, ventana, bentana, hentana, lambeco; VIÑA, viña, biña, fiña, luco; VIAJE, viaje, biaje, tiaje, feofa; BUFANDA, bufanda, vufanda, nufanda, catisto; BOXEO, boxeo, voxeo, noxeo, tonea; CARRERA, carrera, karrera, tarrera, lichana; CAMELLO, camello, kamello, lamello, finacha; BOSQUE, bosque, vosque, nosque, nampea; COSA, cosa, kosa, hosa, luca; VIEJO, viejo, biejo, tiejo, laipa; COLETA, coleta, koleta, foleta, tatilo; CARO, caro, karo, laro, bino; BELLEZA, belleza, velleza, nelleza, cichono; CAJA, caja, kaja, taja, huga; CAMIÓN, camión, kamión, tamión, feneás; BARRIGA, barriga, varriga, narriga, corrupa; CASO, caso, kaso, faso, luno; CASA, casa, kasa, fasa, lono; VIDA, vida, bida, tida, leto; CARRO, carro, karro, larro, ticha; BARCA, barca, varca, narca, zosmo; BANCO, banco, vanco, sanco, cesna; BEBÉ, bebé, vebé, mebé, rado

Nonword targets: CACICOS, cacicos, kacicos, tacicos, dimaner; VESCADO, vescado, bescado, tescado, firnoba; BULMA, bulma, vulma, culma, zilno; BULMO, bulmo, vulmo, fulmo, dilca; BETÓN, betón, vetón, hetón, lifás; CILGO, cilgo, zilgo, vilgo, rista; CACITRO, cacitro, kacitro, hacitro, bonebra; CAFO, cafo, kafo, lafo, duta; CACAPO, cacapo, kacapo, facapo, herago; BALLERO, ballero, vallero, mallero, sichama; VUTO, vuto, buto, futo, teli; CACI, caci, kaci, daci , ture; BARRAZA, barraza, varraza, sarraza, carrino; VIBÁN, vibán, bibán, tibán, hatós; CECIDOR, cecidor, zecidor, vecidor, ciraler; CACIAL, cacial, kacial, tacial, horeol; CARIZAR, carizar, karizar, tarizar, benecos; CURNA, curna, kurna, durna, lisno; GESÍA, gesía, jesía, pesía, giría; CUENZO, cuenzo, kuenzo, luenzo, tiesca; CAUBA, cauba, kauba, fauba, liuco; CUVE, cuve, kuve, fuve, hico; BONJO, bonjo, vonjo, nonjo, sasga; VENCAD, vencad, bencad, tencad, disrod; BASDÓN, basdón, vasdón, casdón, zorlás; BAKIDOR, bakidor, vakidor, nakidor, mitaher; VACHO, vacho, bacho, hacho, lilla; CECERE, cecere, zecere, vecere, nivema; CANZÓN, canzón, kanzón, banzón, lescás; CAPIBA, capiba, kapiba, tapiba, dugada; BENSERA, bensera, vensera, zensera, viscome; BAOL, baol, vaol, raol, ceal; BUPO, bupo, vupo, nupo, zijo; CERAL, ceral, zeral, veral, cisol; CACEPO, cacepo, kacepo, bacepo, tiraga; GICINA, gicina, jicina, picina, purivo; GICISOL, gicisol, jicisol, picisol, paranel; VENANA, venana, benana, denana, busoco; CECECA, cececa, zececa, sececa, nivase; CIESTO, ciesto, kiesto, biesto, launfa; BACIDO, bacido, vacido, zacido, remote; BICEROS, biceros, viceros, siceros, varucan; CULBA, culba, kulba, dulba, tilto; VORENTE, vorente, borente, forente, tisasfa; CABI, cabi, kabi, labi, zole; VUMA, vuma, buma, tuma, hina ; CICO, cico, zico, sico, naze; BENSEJA, benseja, venseja, renseja, viszapo; VEFO, vefo, befo, tefo, liho; GIVENTE, givente, jivente, pivente, gacenla; BIRRO, birro, virro, nirro, zerra; GEVO, gevo, jevo, pevo, pima; BACURO, bacuro, vacuro, nacuro, vizane; BADO, bado, vado, zado, rute; COCEPA, cocepa, kocepa, tocepa, lemigo; CENCO, cenco, zenco, renco, rasva; CUFA, cufa, kufa, hufa, difo; BOPO, bopo, vopo, ropo, zega; BOCERRA, bocerra, vocerra, cocerra, nivurro; CAVI, cavi, kavi, tavi, deno; VUESTO, vuesto, buesto, fuesto, hienla; CANVERA, canvera, kanvera, fanvera, lincase; CACARO, cacaro, kacaro, lakaro, fetina; CEMO, cemo, zemo, femo, huva ; CABU, cabu, kabu, labu, fiha; COBIO, cobio, kobio, tobio, hifea; VIRTA, virta, birta, dirta, lusbo; VEURETA, veureta, beureta, heureta, fiucado; CERRAL, cerral, zerral, nerral, nirras; CONIR, conir, konir, bonir, tuvas; CACIROR, caciror, kaciror, laciror, dunasas; GIRTE, girte, jirte, pirte, gosla; VIEVO, vievo, bievo, lievo, taija; COCORO, cocoro, kocoro, locoro, fisana; BACHO, bacho, vacho, zacho, sicha ; CEMI, cemi, zemi, nemi, niha; CIFO, cifo, zifo, vifo, zaha; VIZA, viza, biza, hiza, lase; BUHA, buha, vuha, suha, nafo ; CEFRE, cefre, zefre, nefre, sitra; BIALE, biale, viale, niale, veuta; BAFERO, bafero, vafero, nafero, ritusa; CILO, cilo, zilo, rilo, nafa; VUJO, vujo, bujo, hujo, lepa; CADACA, cadaca, kadaca, fadaca, lateno; BUTO, buto, vuto, ruto, sahe; CECORRO, cecorro, zecorro, secorro, zanerra; BUJÓN, bujón, vujón, sujón, zagás; BUJA, buja, vuja, nuja, roge; BUNCA, bunca, vunca, sunca, zasva; CALLI, calli, kalli, lalli, fache; BETREMA, betrema, vetrema, setrema, cabrizo; VEMINO, vemino, bemino, temino, diraca; BUJENDA, bujenda, vujenda, zujenda, sapista; VAIBE, vaibe, baibe, laibe, teufa; CUNSE, cunse, kunse, hunse, bisra; BARGO, bargo, vargo, nargo, cespa; CABÓN, cabón, kabón, fabón, tités; CACNO, cacno, kacno, facno, lisza; CECHE, ceche, zeche, veche, nella; COZADO, cozado, kozado, tozado, hicoba; VELGEN, velgen, belgen, delgen, bilpas; CAVATAS, cavatas, kavatas, havatas, fitebes; GIRRE, girre, jirre, perri, purra; CUGA, cuga, kuga, luga, fipo; BONANA, bonana, vonana, ronana, viseno; BUVA, buva, vuva, zuva, caze; CACERRA, cacerra, kacerra, dacerra, lenirro; CACIRA, cacira, kacira, hacira, lunemo; CAURO, cauro, kauro, lauro, teuna; CECEZOL, cecezol, kecezol, fecezol, bicosal; VINATA, vinata, binata, tinata, deroha; GESIAL, gesial, jesial, pesial, piruel; BULQUE, bulque, vulque, rulque, salguo; CAMPEA, campea, kampea, dampea, lingae; BEJE, beje, veje, neje, repo; CECARRO, cecarro, zecarro, vecarro, sinorra; BIXEO, bixeo, vixeo, rixeo, casea; JETI, jeti, geti, peti, puha; BURÓN, burón, vurón, murón, nisús; CULLIRO, culliro, kulliro, tulliro, dachena; CASIRIA, casiria, kasiria, lasiria, tanosie; CARTE, carte, karte, barte, hisfa; CACARRA, cacarra, kacarra, lacarra, tuderro; BALLEL, ballel, vallel, nallel, zechal; CIRTE, cirte, kirte, tirte, lasbo; CACIR, cacir, kacir, lacir, benos; CEPE, cepe, zepe, nepe, zija; VEPO, vepo, bepo, tepo, duge; BUCOTE, bucote, vucote, nucote, vizado; VEIRÓN, veirón, beirón, teirón, feucás; BORRIA, borria, vorria, zorria, nurrai; COREMIA, coremia, koremia, loremia, hivocio; CAQUISA, caquisa, kaquisa, daquisa, tiquere; VESCE, vesce, besce, tesce, lorfa; CARTOL, cartol, kartol, bartol, desbal; VINTINA, vintina, bintina, lintina, fashomo; VEZERA, vezera, bezera, fezera, dacuso; CUCHA, cucha, kucha, fucha, hulli; CIRIOSA, ciriosa, ziriosa, niriosa, vereozo; CUTA, cuta, kuta, duta, bafu; CONTÓN, contón, kontón, dontón, lasbás; JICIHA, jiciha, giciha, piciha, gasalo; CELLIDA, cellida, zellida, nellida, cocheta; CAZICA, cazica, kazica, bazica, deruno; BULLO, bullo, vullo, nullo, cicha; COSARO, cosaro, kosaro, bosaro, hinavo; BEDÍ, bedí, vedí, zedí, vité; CESAMA, cesama, zesama, vesama, cinevo; CIRTE, cirte, zirte, sirte, vosdo; CALLETO, calleto, kalleto, halleto, bichude; CONFO, confo, konfo, tonfo, hesta; CERRI, cerri, zerri, nerri, carra; CACARRA, cacarra, kacarra, facarra, lisurro; BANCE, bance, vance, cance, rismo; VUBI, vubi, bubi, fubi, hale; BOMO, bomo, vomo, zomo, ruva; COCIJÓN, cocijón, kocijón, tocijón, darepás; JENCO, jenco, genco, penco, pisza; BOMATO, bomato, vomato, nomato, visoba