

Are Non-Cognate Words Phonologically Better Specified than Cognates in the Early Lexicon of Bilingual Children?

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1. Introduction

Early in development infants can discriminate many phonetic contrasts, either present or not in their native language, while after a few months of exposure to the language in their environment, perceptual reorganization begins to take place. These perceptual processes reflect increasing sensitivity towards the sound categories of their native language and a perceptual decline for contrasts that are not present in the ambient language (Werker & Tees, 2005). These perceptual reorganization processes begin to develop earlier for vowels (Kuhl, Williams, Lacerda, & Stevens, 1992) than for consonants (Werker & Tees, 1984). The attunement to the phonetic contrasts of the native language at the pre-lexical stage has an impact on the perception and phonological representation of sounds in the early lexicon. Different studies exploring toddlers' ability to learn and recognize their first words suggest that the format of representation of these words has enough phonological detail to allow them to react in front of a slight change in the pronunciation (Ballem & Plunkett, 2005; Fennell & Werker, 2003; Swingley & Aslin, 2000; Swingley & Fernald, 2002; White, 2008; Mani & Plunkett, 2007; Mani & Plunkett, 2008; Mani, Coleman, & Plunkett, 2008; Ramon-Casas et al., 2009; Swingley & Aslin, 2002; Swingley, 2003; Swingley, 2009; White, Morgan, & Wier, 2005; White & Morgan, 2008). The ability to detect these small changes in the phonological form of words has been studied and confirmed at different ages (starting around 14 months of age) and with different language populations, as well as with different vowel and consonant contrasts. However, few studies have addressed this issue in bilingual populations (but see Fennell, Byers-Heinlein, & Werker, 2007; Ramon-Casas et al., 2009).

In our laboratory we studied the format of bilingual' word representations using the intermodal visual fixation task, a methodology that is typically used for the study of accuracy and precision in word recognition (Fernald, Pinto, Swingley, Weinberg, & McRoberts, 1998). The main goal of our study was to explore the ability of Catalan-Spanish bilingual infants to detect mispronunciations in familiar words, using a vowel contrast to modify them, in this case, the Catalan front mid-vowels /e/ and /ɛ/, only contrastive in Catalan, not in Spanish. If bilingual infants have lexical representations phonologically detailed, they would have to react in front of these mispronunciations. Previous research had shown that by 12 months of age, Catalan-Spanish bilingual babies managed to discriminate this Catalan vowel contrast (Bosch & Sebastián-Gallés, 2003). Then, it was expected that later on, by 18 to 24 months of age, Catalan-Spanish bilingual infants would have access to this contrast at a lexical level, being able to detect mispronunciations of familiar words involving this specific vowel contrast. However, this prediction was not confirmed. While toddlers from Catalan monolingual families succeeded in a word recognition task and showed a mispronunciation effect for /ɛ/-/e/ vowel changes in familiar words, Catalan-Spanish bilingual toddlers failed to react to these mispronunciations, even though Catalan exposure was present in their homes (Ramon-Casas et al., 2009). When the same bilingual population was tested on common vowel contrasts between Catalan and Spanish (that is, mispronunciations involving /e/-/i/ and /e/-/a/ changes) they easily succeeded. This result revealed that their failure in the task, when the Catalan-specific contrast was used to create word mispronunciations, was not the consequence of a general problem in vowel encoding. Differences between vowel systems in bilingual exposure and partial or incomplete overlapping between specific vowel categories in both languages would compromise toddlers' reaction to word mispronunciations, at least until more experience with the language is gained and these language-specific vowel categories are eventually represented in the lexicon. This is actually what we observed in an experiment with 3-4 year-old

bilinguals, in which Catalan-dominant ones (but not Spanish-dominant bilinguals) were able to adequately react to the changes in Catalan /ɛ/-/e/ vowel realization (Ramon-Casas et al., 2009).

However, all the target words in the previous experiments were cognates. It remained to be explored if the same behavior was going to be found when non-cognate words were involved. The research question was, then, is it possible that this Catalan-specific vowel contrast is differently represented in cognate and non-cognate words?

Different studies with adults have shown the different status that cognate words have (words that are equivalent in two languages and share most of their phonology -and their orthography-) compared with non-cognate words. Some of these studies demonstrate that bilinguals are faster in translating cognate words compared to non cognated (de Groot, 1992; de Groot, Dannenburg, & Van Hell, 1994; Kroll & Stewart, 1994). The same is true for L2 learners (Lotto & de Groot, 1998). That is, bilingual adults process faster and more efficiently cognate words than non-cognates (Dufour & Kroll, 1995), in production and in perception (Costa, Santesteban, & Caño, 2005). In child language acquisition, few studies have explored the possible benefit of the cognate status of words in bilinguals' lexical development (Schelletter, Sinka, & Garman, 2001; Schelletter, 2002). It is possible that the formal similitude between cognate words facilitates word learning but, at the same time, this similarity may have a negative consequence on the encoding of phonological detail. In other words, can our previous results in a word recognition task using cognate words be explained by the cognate status of the material?

The goal of the present research was to explore the impact of the cognate status of words in Catalan-Spanish bilinguals' encoding of the /ɛ/-/e/ vowel contrast, using the same procedure as in our previous study and testing participants with a similar age range (Ramon-Casas et al., 2009). Two outcomes are possible. First, considering our interpretation of the results from previous experiments with bilinguals (arising from the specific distribution and frequency of these vowels and their partial overlapping in the acoustic space), it is possible that this vowel contrast is neither encoded in non-cognate words, so a parallel result would be observed for both cognates and non-cognates. But a second type of result can also be found if, as in adult bilingual' studies, cognate and non-cognate words have a different status and differences in phonological encoding can possibly be found. The absence of formal proximity between non-cognates may reduce interference and, consequently, the Catalan-specific /e/-/ɛ/ vowel contrast might be better specified in this kind of words.

2. Method

2.1. Participants

A total of 48 infants participated in this experiment, 24 of them from Catalan monolingual environments and 24 from Catalan-Spanish environments (bilinguals). The amount of exposure to both languages was carefully assessed by a questionnaire (Bosch & Sebastián-Gallés, 1997). In the bilingual group 22 of the 24 infants were from Catalan-dominant homes (mean estimate of Catalan exposure: 61%). All of them were exposed to both languages from birth (simultaneous bilinguals). Mean age for the bilingual group was 24;21 (range 19;26 – 28;00) and the mean age for the Catalan monolingual group was 25;05 (range 20;00 – 28;29). No significant age differences between groups were found. Expressive vocabulary size (measured with Spanish and Catalan versions of the McArthur CDI) was 307 words for the monolingual group and 343 for the bilingual group (median values). No significant group differences in expressive lexicon were observed. All of the participants were healthy, with no previous history of hearing problems. Seven additional toddlers were tested but not included in the final sample due to experimental error (2) and failure to complete the task (5).

2.2. Stimuli and Procedure

Four target non-cognate Catalan words were used in this experiment All of them have the Catalan /ɛ/ vowel in stressed position. The words were: [pi'tet] (bib); [bu'let] (mushroom); [gə'λeðə] (bucket); [əs'pelmə] (candle). In addition to these four target words, four filler words were used with no /ɛ/ or /e/ vowels and always presented in correct pronunciation. Auditory material was recorded from a highly competent female Catalan-Spanish bilingual speaker using a child-directed speech register. F1 and F2 vowel values for the mid-front vowels in the target words (/ɛ/ correct and /e/ incorrect rendering of these sounds) can be seen in Figure 1.

The procedure was the intermodal visual fixation methodology (as in Swingley & Aslin, 2000), used in several studies to explore the accuracy and precision in word recognition in two-year-old children. Participants were seated on their parents lap, in front of two screens where the images were displayed. To start a trial two different images were presented first (one in each screen). After three seconds the audio began, with sentences that encouraged children to look at one of the images (Where is the....? Do you like it?). The whole experiment involved 28 trials, 16 of them were test trials, where one of the target words appeared, either correctly pronounced or mispronounced via a vowel change (/e/ instead of /ɛ/). The ocular movements of children were recorded for off-line coding. Fixation times were calculated in a time window of analysis that ended 2 seconds after the presentation of the target word. This measure gives an indication of the sensitivity to phonological detail represented in the target words used in this task. Lower fixation times are expected when infants are detecting mispronounced items.

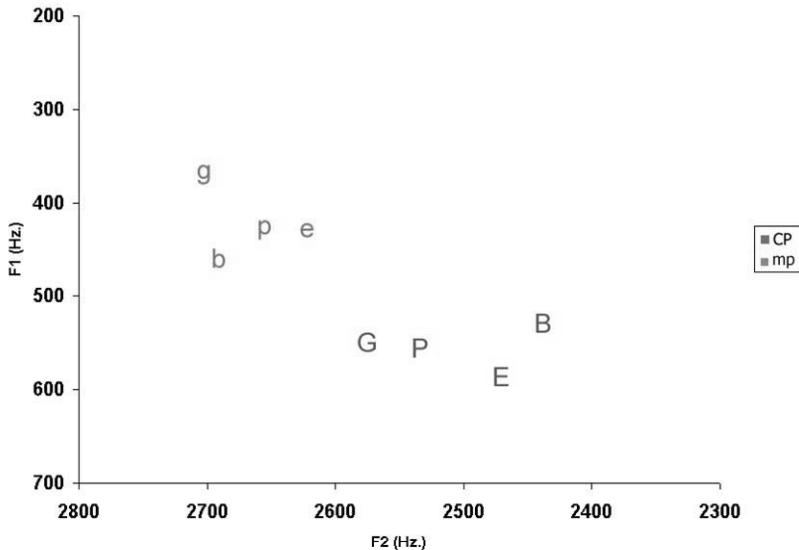


Figure 1: First and second formant values of Catalan vowels in the test words of the experimental stimuli (measured in Hz.). Plotted letters g, p, b, and e refer to the target words *galleda*, *pitet*, *bolet* and *espelma*. Capital letters indicate formant values of correctly pronounced words (CP); lower case letters show mispronounced words (MP).

3. Results

Mean values of percentage visual fixation for the Catalan monolingual group were 70% for the correct pronunciation (CP) condition and 59% for the mispronunciation (MP) condition. For the bilingual group values were 67% for the CP condition and 57% for the MP condition. The analyses showed that both groups recognized the target words (fixation > 50% in both conditions). The ANOVA showed a main effect of condition (CP vs. MP; $F(1, 46) = 19.17, p < 0.001$), no differences between groups, neither interaction group x condition (F 's < 1). The difference between conditions (CP and MP) was significant in both groups ($p = 0.002$ and $p = 0.01$ for monolinguals and bilinguals, respectively). These results indicate that they could detect the mispronunciations in this experiment with non-cognate words, with significant differences in target fixation between CP and MP conditions (see Figure 2). The range of individual results for each group can be seen in Figure 3.

Finally, an ANOVA was run to compare bilinguals' results in this experiment with results from a different group of bilinguals previously tested using cognate words (Ramon-Casas et al., 2009). This analysis showed a significant interaction between type of words (cognates vs. non-cognates) and experimental group [$F(1, 46) = 7.003, p = 0.01$]. These results suggest that cognate status of words has an effect on the level of phonological detail represented in the lexicon, at least in this early stage of vocabulary acquisition. It has to be mentioned, however, that age differences between these two groups

of participants were found to be significant. Although minor, this mean age difference of nearly two months must be taken into account when interpreting the results as it may constrain the generality of the present conclusion. However, even some older bilingual children, when tested between 3 and 4 years of age do still seem to have difficulties in perceiving this Catalan contrast in cognate words (see data from the Spanish-dominant bilingual group in Ramon-Casas et al., 2009). For this reason, it seems unlikely that the small age difference between groups that we have found in the current experiment plays a critical role in explaining the non-cognates' advantage.

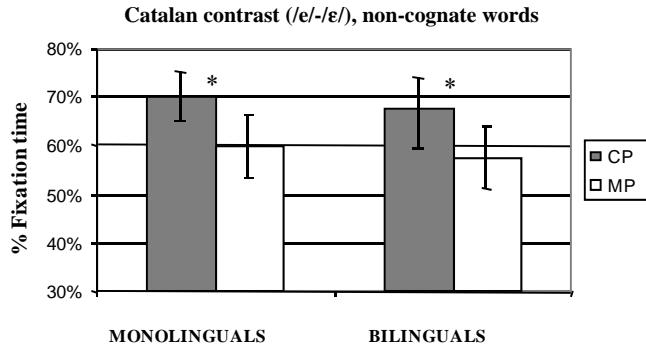


Figure 2: Percentage of fixation to target words in correct pronunciations (CP) and mispronunciations (MP) for Catalan monolingual group and bilingual group.

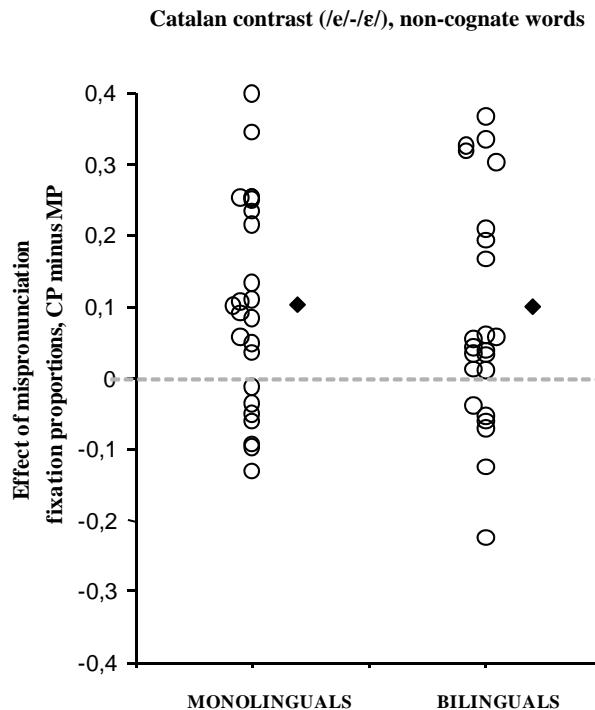


Figure 3: The effects of mispronouncing /ɛ/ as /e/ among Catalan monolinguals and bilinguals. The y axis displays, for each child, the difference between target fixation proportions on correct pronunciation (CP) and mispronunciation (MP) trials. Positive numbers indicate better performance on CP than MP trials. Filled black diamonds display the mean (CP-MP) difference for each group.

4. Discussion

Catalan-Spanish bilingual infants as well as Catalan monolingual infants could detect mispronunciations in non-cognate words via a vowel change, using a vowel contrast that only belongs to one of their languages (Catalan). This result differs from previous data obtained with cognate words, where bilingual toddlers couldn't react to the vowel change in familiar words (Ramon-Casas et al., 2009). When ability to detect a vowel mispronunciation is tested with non-cognates, two-year-old bilinguals do not differ from their Catalan monolingual peers in this task.

This result suggests a continuity between the ability to discriminate this Catalan vowel contrast (/e/-/ɛ/) at 12 months of age (Bosch & Sebastián-Gallés, 2003), and toddlers' capacity to use this contrast at a phonological level in their first words. For non-cognates, less interference between word forms in each of the languages of the bilingual is present and this fact may have as a consequence a more stable representation of this Catalan-specific vowel in the lexicon.

However, other factors cannot be ruled out as possible determinants in the positive results from the non-cognates' experiment. The requirements in selecting the material for this task led us to use four target words with differences in their frequency of use. While Catalan words for bib and bucket are very frequent in children's everyday experience with the language, the other two target words (mushroom and candle) are really low frequency words for children. It may be the case that low frequency words are heard less often and, for this reason, they might be less affected by speakers' variation in pronunciation (very common among L1 Spanish individuals when they attempt to pronounce Catalan (L2) words involving Catalan-specific segments). If this is true, then bilingual toddlers might have an adequate representation of this Catalan vowel in less frequent non-cognate words, which are subject to less interference and less variability. Further research should try to address this issue by using a different set of non-cognate words to test toddlers' ability to detect /e/-/ɛ/ vowel mispronunciations.

Another factor to be taken into consideration is the direction of the mispronunciation. In the present experiment all vowel changes went in the same direction, from /ɛ/ to /e/, while in the previous study only half of the targets words' mispronunciations went in this direction. This difference might be thought to be responsible for the different results we have obtained. However, the direction of the change in the present experiment can be considered the most difficult to be detected, as this is the common tendency in production errors by L1 Spanish speakers when attempting words in Catalan (in their L2; Sebastián-Gallés, Echeverría & Bosch, 2005). So, if exposure to variability plays a role in building less stable representations, then, it should have been hard to detect this vowel change in the current experiment, where all target words were modified in this way. But this was not the case. Therefore, the direction of the mispronunciation cannot be considered as a determinant factor that could favor an easier detection in the present experiment. Rather, we suggest that phonological form differences between non-cognate words may facilitate the building of more stable representations and preserve them from the effects of input variability.

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References

- Ballem, Kate & Kim Plunkett (2005). Phonological specificity in 1;2. *Journal of Child Language*, 32, 159-173.
- Bosch, Laura, Albert Costa & Núria Sebastián-Gallés (2000). First and second language vowel perception in early bilinguals. *European Journal of Cognitive Psychology*, 12, 189-221.
- Bosch, Laura & Núria Sebastián-Gallés (1997). Native-language recognition abilities in 4-month-old infants from monolingual and bilingual environments. *Cognition*, 65, 33-69.
- Bosch, Laura & Núria Sebastián-Gallés (2003). Simultaneous bilingualism and the perception of a language-specific vowel contrast in the first year of life. *Language and Speech*, 46, 217-243.
- Costa, Albert, Mikel Santesteban & Agnes Caño (2005). On the facilitatory effects of cognate words in bilingual speech production. *Brain and Language*, 94, 94-103.
- de Groot, Annette M. B. (1992). Determinants of word translation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 1001-1018.
- de Groot, Annette. M. B., Lucia Dannenburg & Janet G. Van Hell (1994). Forward and backward word translation by bilinguals. *Journal of Memory and Language*, 33, 600-629.

- Dufour, Robert & Judith F. Kroll (1995). Matching words to concepts in two languages: A test of the concept mediation model of bilingual representation. *Memory and Cognition*, 23, 166-180.
- Fennell, Christopher T., Krista Byers-Heinlein & Janet Werker (2007). Using speech sounds to guide word learning: The case of bilingual infants. *Child Development*, 78, 1510-1525.
- Fennell, Christopher T. & Janet F. Werker (2003). Early word learners' ability to access phonetic details in well-known words. *Language and Speech*, 46, 245-264.
- Fernald, Anne, John P. Pinto, Daniel Swingley, Amy Weinberg & Gerald W. McRoberts (1998). Rapid gains in speed of verbal processing by infants in the 2nd year. *Psychological Science*, 9, 228-231.
- Kroll, Judith F. & Erika Stewart (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149-174.
- Kuhl, Patricia K., Karen A. Williams, Francisco Lacerda, Kenneth N. Stevens & Björn Lindblom (1992). Linguistic experience alters phonetic perception in infants by 6 months of age. *Science*, 255(5044), 606-608.
- Lotto, Lorella & Annette M. B. de Groot (1998). Effects of learning method and word type on acquiring vocabulary in an unfamiliar language. *Language Learning*, 48, 31-69.
- Mani, Nivedita, John Coleman & Kim Plunkett (2008). Phonological specificity of vowel contrasts at 18-months. *Language and Speech*, 51, 3-21.
- Mani, Nivedita & Kim Plunkett (2007). Phonological specificity of vowels and consonants in early lexical representations. *Journal of Memory and Language*, 57, 252-272.
- Mani, Nivedita & Kim Plunkett (2008). 14-month-olds pay attention to vowels in novel words. *Developmental Science*, 11, 53-59.
- Ramon-Casas, Marta, Daniel Swingley, Núria Sebastián-Gallés & Laura Bosch (2009). Vowel categorization during word recognition in bilingual toddlers. *Cognitive Psychology*, 59, 96-121.
- Sebastian-Galles, Núria, Sagrario Echeverría & Laura Bosch (2005). The influence of initial exposure on lexical representation: Comparing early and simultaneous bilinguals. *Journal of Memory and Language*, 52, 240-255.
- Schelleter, Christina (2002). The effect of form similarity on bilingual children's lexical development. *Bilingualism: Language and Cognition*, 5, 93-108.
- Schelleter, Christina, Indra Sinka & Michael Garman (2001). Early nouns in bilingual acquisition: A test of the separate development hypothesis. *Reading Working Papers in Linguistics*, 5, 301-317.
- Swingley, Daniel (2003). Phonetic detail in the developing lexicon. *Language and Speech*, 46, 265-294.
- Swingley, Daniel (2009). Onsets and codas in 1.5-year-olds' word recognition. *Journal of Memory and Language*, 60, 252-269.
- Swingley, Daniel & Richard N. Aslin (2000). Spoken word recognition and lexical representation in very young children. *Cognition*, 76, 147-166.
- Swingley, Daniel & Richard N. Aslin (2002). Lexical neighborhoods and the word-form representations of 14-month-olds. *Psychological Science*, 13, 480-484.
- Swingley, Daniel & Anne Fernald (2002). Recognition of words referring to present and absent objects by 24-month-olds. *Journal of Memory and Language*, 46, 39-56.
- Werker, Janet F. & Richard C. Tees (1984). Cross-language speech perception: Evidence for perceptual reorganization during the first year of life. *Infant Behavior & Development*, 7, 49-63.
- Werker, Janet F., & Richard C. Tees (2005). Speech perception as a window for understanding plasticity and commitment in language systems of the brain. *Developmental Psychobiology*, 46, 233-251.
- White, Katherine S. (2008). Developmental continuity in word representation: Infants and adults show parallel effects of phonological mismatch and word familiarity. ProQuest Information & Learning. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 68, 4861-4861.
- White, Katherine S., & James L. Morgan (2008). Sub-segmental phonology in infants' early lexical representations. *Journal of Memory and Language*, 59, 114-132.
- White, Katherine S., James L. Morgan & Lauren M. Wier (2005). When is a *dar* a car? Effects of mispronunciation and referential context on sound-meaning mappings. In Brugos, A., Clark-Cotton, R. & Ha, S. *Proceedings of the 29th Annual Boston University Conference on Language Development* (pp. 651-662). Somerville, MA: Cascadilla Press.

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