Phonetic Differences Between Lexical Categories in Spanish

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Interaction in Speech Production

• Lexically conditioned phonetic variation
  – A lexical property of a word affecting how the word is realized phonetically

• What aspects of words?
  – Lexical properties of words themselves
  – Relations of these words to other words
Background

• Lexical Properties of the word
  – Frequency
    • Significantly effects duration of words (Jurafsky et al., 2001; Aylett and Turk, 2004).
    • Syllables in high frequency words have shorter duration than in low frequency words (Aylett and Turk 2004).
    • High frequency words have more second mention reduction than low frequency words in conversational speech (Baker, 2006).
Background

• Relations to other words
  – In the same language
    • Vowel spaces in high density neighborhoods are more dispersed than in low density neighborhoods (Wright, 1997, 2004; Munson, in press; Munson and Solomon, 2004; Scarborough, 2004).
    • Words that form minimal pairs are produced with longer VOT than words that do not (Baese and Goldrick, in prep).

• What about relations between languages?
Current Study

• We set out to examine whether lexical relations to other words across languages can condition phonetic variation.
  – However, the relationships other words within the target language were not controlled.
  – This may be contributing to our results.
Current Study

• If relationships between words across languages can affect phonetic variation, we should see these effects in bilingual speech production.

• Cognates have a special status.
  – Bilinguals are faster (Costa, Caramazza, and Sebastian-Galles 2000) and more accurate (Gollan and Acenas 2004) at naming pictures of cognates than non-cognates.
  – Suggests co-activation of shared phonological structure, facilitating processing.
  – All aspects of words that are co-activated should influence phonetic realization of a word.
Current Study

• Focus: Cognates with different vowels.
  – In particular, Spanish words with /e/ and Catalan cognates with either /E/ or /e/.
  – Prediction: Vowels in these cognates will be produced with properties more similar to their Catalan counterpart than non-cognates.
Vowel Space

/e/ and /E/ in Spanish and Catalan

Catalan /e/  ◊

Spanish /e/  ▲

Catalan /E/  □
Methods

• Subjects
  – 8 Catalan-Spanish bilinguals
    • Catalan L1

• Task was picture naming, with fillers.
  – Performed task in Spanish first - then named the same pictures in Catalan.
  – For each block, all instructions were given in the target language.

• 4 repetitions of the stimulus set.
Methods

• Stimuli
  – 2 sets of word pairs
    • Cognate with /E/ + Non-Cognate
      – Example:
        » Catalan ‘cervesa’
        » Spanish ‘cerveza’
        » Paired non-cognate ‘cabeza’
    • Cognate with /e/ + Non-Cognate
      – Example:
        » Catalan ‘cebra’
        » Spanish ‘zebra’
        » Paired non-cognate ‘seta’
  – Words were controlled for phonetic environment and frequency.
Bilingual Results (/E/)

- The F2 of the Spanish and Catalan cognates shifts toward the F2 value of the Catalan word, compared to the non-cognate.
- This difference is significant (p<0.01).
Bilingual Results (/e/)

- There is a shift in both the F1 and F2 of the Spanish and Catalan cognate toward the Catalan values, as compared to the non-cognate.
- The difference in both formants is significant (F1: $p<0.02$ and F2: $p<0.05$).
Results so far

• As predicted, there was a shift in the vowel values of the cognate words toward their Catalan values as compared to non-cognates.
• In order to ensure that this was not some property of the words themselves, but rather of their cognate status, we ran 8 Spanish monolingual controls.
• Subjects lived in Tenerife (Canary Islands) and had no exposure to Catalan.
Monolingual Results (/E/)

• The monolinguals have the same size and direction of shift in F2 for cognates with /E/ in Catalan.
• The difference is significant (p<0.01).
Monolingual Results (/e/) 

- Monolinguals also have the same shift in size and direction for words that have Catalan cognates with /e/.
- The difference in both formants is significant (F1: p<0.04, F2: p<0.005). 

![Graph showing differences in F1 and F2 for Spanish cognates and non-cognates]
Conclusions

• Bilinguals’ Spanish production of vowels in cognate words appears to reflect influence of Catalan.
  – /e/ productions are shifted towards F1/F2 values of Catalan /e/ and /E/.

• Spanish monolinguals show the same pattern.
Conclusions

• These results cannot be due to phonetic features of the word or to frequency.
  – Both were controlled in the design of stimuli.
    • Following vowel, stress position.

• It also cannot be attributed to subjects’ experience with Catalan, since the monolinguals don’t have any experience with Catalan.
Discussion

• If it can’t be any of those factors, why did we find this result?

• We know from the research mentioned at the beginning of the talk that the relationship of a word to other words in the language can affect how the word is produced.

• Due to the large amount of lexical overlap between the two languages it is very likely that another lexical property of the words (e.g., neighborhood density) is causing this effect.
Discussion

• 2 possible explanations
• Gender or other morphological properties.
• Properties of neighbors
  – Mean % of neighbors ending in /a/ vs. /o/
    • /E/
      – Cognates - 100%
      – Non-Cognates - 49%
    • /e/
      – Cognates - 43%
      – Non-Cognates - 67%
Acknowledgements

• Northwestern University Phonatics Group
• SoundLab
The End
### Properties of the Stimuli

<table>
<thead>
<tr>
<th>Word</th>
<th>final phoneme</th>
<th>final consonant</th>
<th>vowel following syllable</th>
<th>previous phoneme</th>
<th>syllable #</th>
<th>syllabic structure</th>
<th>position syllable containing &quot;e&quot;</th>
<th>another &quot;e&quot; in the word</th>
<th># neighbors</th>
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<tbody>
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Stimuli

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<th>CONTROL C01</th>
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