Early and late Spanish bilinguals’ production of unstressed English vowels

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Overview

- Age-related effects in L2 learning
- Cross-linguistic comparison of English & Spanish stress.
- Present study: participants, speech materials, acoustic measurements and vowel normalization procedures
- Results: duration, intensity ratios and vowel quality
- Discussion and further research
Theoretical Framework: FH
(McAllister, Flege & Piske 2002)

- L2 phonetic features not used to signal phonological contrasts in an L1 will be more difficult to perceive than those that are.

- The difficulty in perceiving phonetic features that are not phonologically meaningful will be reflected in low production accuracy of these features in the L2.
Theoretical Framework: SLM (Flege 1995)

- L2 speech learning: “Phonetic category” (long-term memory representations).
- L1-L2 exist in a common phonological space.
- Phonetic systems remain adaptative over the life span.
  - New phonetic categories can be established
  - Old phonetic categories can be modified
- Category formation may be blocked by a mismatch of the phonetic features between L1 and L2.
Age-related effects in L2 learning

- CPH: changes in brain structure, loss of neural plasticity diminishes L2 learning (Scovel 1988, Patkowski 1980)

- Other causes: amount and quality of L2 input (Flege & Liu 2001), amount of L1 and L2 use (Guion, Flege & Loftin 2001), interactions between the L1 and L2 systems (Flege, Schirru & MacKay 2003)

- AOA: important factor in accurate production of L2 sounds (Flege, Munro & MacKay 1995)
English word stress

- Unstressed vowels: perceived as lower in pitch, shorter, and less loud than stressed vowels.

- Acoustic correlates: lower F0, shorter duration and weaker intensity (Fry 1955)

- Acoustic correlates: duration and overall intensity were the most reliable acoustic correlates of stress (Beckman & Pierrehumbert 1986)

- Stress affects vowel quality by way of a process called vowel reduction (Lindblom 1963)
Spanish word stress

- F0, duration & intensity contribute to the perception of Spanish lexical stress but F0 has a stronger weight (Llisterrri et al. 2005)

- Vowel duration is a stronger correlate of stress in Spanish (Ortega-Llebaria & Prieto 2010)


- Prosodic errors contribute to the loss of intelligibility of L2 speech (Munro & Derwing 1999) and to the perception of FA (Pennigton & Richards 1986)
L2 acquisition of English stress (Flege & Bohn 1992)

- Participants: Spanish speakers of L2 English
- Method: glossometry and phonetic transcription
- Stress placement was not a learning problem for Spanish learners of English and it was acquired on a word-by-word basis
- NSp implemented unstressed/stressed differences in terms of duration and intensity in a nativelike fashion
- Vowel reduction was more difficult to learn.
The present study: goals

- Assess the role of L1 (Sp) phonetic features in the production of L2 (Eng) features

<table>
<thead>
<tr>
<th>Phonetic feature</th>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Intensity</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Vowel reduction</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>

- Assess the effect of AOA on the production of English unstressed vowels
The present study: hypotheses

- **H1**: NSp bilinguals will produce English unstressed vowels with shorter duration and lower intensity than stressed vowels.

- **H2**: the English reduced vowels produced by the NSp bilinguals will be more peripheral in the vowel space than those produced by the NE.

- **H3**: AOA in the host country will influence the production of English unstressed vowels by NSp bilinguals.
Method: participants

- 2 groups of Sp-Eng bilinguals (early, late)
- 1 group of native English monolinguals

<table>
<thead>
<tr>
<th></th>
<th>NEng (N=10)</th>
<th>ENSp (N=10)</th>
<th>LNSp (N=10)</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>25</td>
<td>25</td>
<td>33</td>
</tr>
<tr>
<td>AOA</td>
<td>4</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>LOR</td>
<td>23</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>EDU</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>L2 use</td>
<td>84</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>TOAL 1</td>
<td>30</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>TOAL 2</td>
<td>28</td>
<td>22</td>
<td>24</td>
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Method: speech materials

- 19 English words embedded in the carrier phrase: *I say .... this time*

<table>
<thead>
<tr>
<th>agénda</th>
<th>introducé</th>
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<tbody>
<tr>
<td>ágent</td>
<td>kangaróó</td>
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<tr>
<td>banána</td>
<td>machíne</td>
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<tr>
<td>básket</td>
<td>mánage</td>
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<td>cálednar</td>
<td>médium</td>
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<td>cómpensate</td>
<td>órigin</td>
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<td>descént</td>
<td>possés</td>
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<td>éléven</td>
<td>potáto</td>
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<td>giráffe</td>
<td>spaghétti</td>
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<tr>
<td>índicate</td>
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</tbody>
</table>
Method: measurements

- Stressed and unstressed vowel intervals labelled and annotated with *Praat* TextGrids (Boersma & Weenik 2012).

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Method: acoustic analysis

- Stressed and unstressed vowels mean intensity calculated with Praat script (Lennes 2003)
- Stressed and unstressed vowel intervals calculated with Praat script (Lennes 2003)
- Unstressed-to-unstressed intensity ratio (Int UV / Int SV)
- Unstressed-to-unstressed duration ratio (Dur UV / Dur SV)
- F1, F2, F3 measured automatically at the midpoint with Praat script (Lennes 2003)
Method: vowel normalization

- Speaker normalization of NSp data to one randomly selected NE speaker based on the average F3 of [æ] to neutralize sex-linked differences and variations in vocal-tract length (Guion 2003, Yang 1996)
- Formant frequencies were converted to the Erb scale which more closely reflects human perception.
Results: intensity ratios

- One-way ANOVA $F(2,44)=3.61 \ p=.02$
- Pair-wise comparisons: NEng, ENSp > LNSp
Results: duration ratios

- One-way ANOVA $F(2, 639) = 26.46 \ p < .001$
- Pairwise comparisons: NEng < ENSp or LNSp
Results: vowel quality NEng

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Results: vowel quality ENSp

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Results: Vowel quality LNSp

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Discussion

• In line with FH: phonetic features (i.e. Unstressed-to-stressed duration and intensity ratios) that are used in the L1 are easier to acquire.

• Vowel quality differences between stressed and unstressed vowels more difficult to acquire.

• Age-related effects: ENSp more nativelike than LNSp in intensity ratios and vowel quality but not in length differences.
Discussion II

- Task effects: reading target words in citation form might have inhibited vowel reduction among LNSp.

- Orthography might also have influenced LNSp production of unstressed English vowels (Erdener & Burnham 2005, Rafat 2010).

- Lexical effects: High-frequency words easier to acquire than low-frequency words.
Further research

• Euclidean distances between vowel points to measure vowel reduction numerically.

• Investigate implementation of stress differences among learners in FI settings.

• Interesting to know differences between Spanish and Catalan learners.
Acknowledgements

- Research grant FFI2010-21483-C02-02 by the Spanish Ministry of Science and Innovation.
- Grup de Recerca Consolidat en Fonètica Experimental SGR-2009-003 by the Catalan Government.
- Susan Guion Anderson (University of Oregon).
- Tetsuo Harada (Waseda University, Tokyo).
- Celia Rosselló (Universitat Illes Balears).
Thank you!