Acoustic Differences Between Infant-Directed Speech produced in English and Spanish

Isabella B. Hernandez* & Melanie J. Spence

Department of Psychology, School of Behavioral and Brain Sciences

Research Question & Hypothesis

**Research Question:**
Are there significant differences in vowel hyperarticulation between infant-directed speech (IDS) produced in English compared to Spanish?

**Hypothesis:**
Stronger vowel hyperarticulation will be present in Spanish IDS compared to English IDS

Introduction

**Vowel hyperarticulation:** articulation of vowels during speech

- **Formant 1 (F1):** associated with height of tongue
- **Formant 2 (F2):** associated with frontness/backness of tongue
- IDS is characterized by:
  - Higher and more variable pitch
  - Slower speaking rates
  - Vowel hyperarticulation
  - Infants show preference for IDS over adult-directed speech (ADS)
  - Vowel hyperarticulation in IDS makes language easier to learn
  - Higher F1 and F2 values
  - Longer consonantal releases produced by Spanish-speaking caregivers could be indicative of stronger hyperarticulation

Methods

**Analyzed Monophthongs in English and Spanish**

<table>
<thead>
<tr>
<th>Phoneme</th>
<th>Assigned Word</th>
<th>Assigned Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>/a/</td>
<td>sweet (x2)</td>
<td>kipa (x2)</td>
</tr>
<tr>
<td>/o/</td>
<td>dog (x2)</td>
<td>campo (x2)</td>
</tr>
<tr>
<td>/u/</td>
<td>blue (x2)</td>
<td>tipe (x2)</td>
</tr>
</tbody>
</table>

Analysis & Results

**Analysis**

- Vowel hyperarticulation measured using F1 and F2 values
- 3 blind coders analyzed vowels using Praat
- Formant ceiling: 4500Hz

**Vowel Hyperarticulation in English and Spanish IDS**

<table>
<thead>
<tr>
<th>F1 (Hz)</th>
<th>F2 (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000</td>
<td>2500</td>
</tr>
<tr>
<td>2000</td>
<td>1500</td>
</tr>
<tr>
<td>1000</td>
<td>500</td>
</tr>
</tbody>
</table>

**Results**

- /a/ sound: significantly higher F2 value in Spanish IDS
- /o/ sound: significantly higher F1 value and significantly lower F2 value in Spanish IDS
- /u/ sound: no significant differences
- Spanish IDS has stronger vowel hyperarticulation than English IDS

Limitations & Discussion

**Limitations**

- Only 1 talker used
- Talker was bilingual
- Slightly different pronunciations than monolingual speakers

**Discussion**

- Stronger vowel hyperarticulation in /a/ and /u/ in Spanish IDS
- No significant differences in /a/ between English and Spanish IDS
- This study’s results provide initial evidence of stronger vowel hyperarticulation in Spanish IDS compared to English IDS
- Future research should focus on:
  - Using both monophthongs and diphthongs
  - Larger samples using monolingual talkers
  - Monolingual (English or Spanish) infant attention to IDS in native language

References & Acknowledgments

1. Golinkoff, Can, Soderstrom, & Hirsh-Pasek, 2015
2. Kalachnikova & Carneia, 2021
3. Fish et al., 2017
4. Fernandez Pinaus, 2012
5. Wong & Sun Ng, 2018
6. Werker & Desjardins, 1995
7. Hoelt et al., 2008
8. Panneton, Klimara, Matlock, Burnham, 2006
11. Hirsh Soderstrom, et al., 2008
12. Cooper & Akin, 1990

Special thanks to the bilingual mother who participated, Dr. Melanie Spence for mentoring me, Dr. Pumpli Li Su for her insight and guidance, and to the research assistants at the Infant Learning Project for supporting and working on this study.