The role of between-language interaction in the diagnosis of phonological disorders in bilingual children

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Background

Bilingual Phonological Representation and Production
Processing Rich Information from Multidimensional Interactive Representations (PRIMIR)

- Curtin, Byers-Heinlein, and Werker (2005);
- Fabiano-Smith and Goldstein (2010a; 2010b);
- Fabiano-Smith and Barlow (2010);
- Fabiano-Smith, Shuriff, Barlow, and Goldstein (2014);

Bilingual Phonological Acquisition: Spanish and English

- Studies on typically-developing bilingual preschoolers have found:
  - Production differences by language
  - Production differences on gross vs. discrete measures
  - Variable production across children

- Gildersleeve-Neumann, et al. (2008); Fabiano-Smith and Goldstein (2010a; 2010b); Fabiano-Smith and Barlow (2010); Goldstein, Fabiano, and Washington (2005).

Clinical Issues

- Bilingual children demonstrate lower levels of consonant accuracy at age 3;0 but catch up by age 5;0
- Mean age of referral for children with phonological disorders is 4;3
- 67% of clinicians have reported using informal measures of phonological assessment
- Over half of SLPs report calculating phonological patterns for diagnostic purposes

- Fabiano-Smith and Goldstein (2010b); Goldstein, Fabiano, and Washington (2005); Skahan, Watson, and LoF (2007).

Previous Work

- Inflation of frequency of Stopping of Fricatives
  - As compared to what is expected for English-speaking children on a standardized test
  - English speakers used fricatives as substitutes;
  - Bilingual kids used stops in English
- Spanish stop-spirant alternation is not stable in bilingual children
- Influence of Spanish on English

- Fabiano-Smith, Ogilvie, Maiefski, and Schertz (2015); Fabiano-Smith (2010).
Research Questions

- Can we extend the PRIMIR model to account for production in bilingual children?
- Can we predict where between-language interaction will occur in production based on the structure of English and Spanish?
- Can we predict where and when between-language interaction will occur based on how the two systems are organized?

Sutherland & Gillon, 2005

Current Study

Initial Consonant Deletion

- The first sound in a word is perceived by listeners as its own, unique sound
- Initial sounds in words are easily identifiable visually
- Often simplistic sounds
- Therefore, children should quickly acquire initial consonants

Bauman-Wangler, 2000; Rieben & Perfetti, 1991; Fougeron & Keating, 1997; Barlow, 2005; Faingold, 1990

Past Studies and Clinical Observations

- Low, but consistent, occurrence of initial consonant deletion in the speech of Spanish-speakers
- Considered disordered if observed by SLPs
- Are we observing initial consonant deletion or initial syllable deletion? Cluster reduction?

Gildersleeve, Davis, and Stubbe (1996); Wing and Flipsen (2010); Goldbarn (2005); Anderson (1987); Paden and Moss (1985)

Theoretical Possibilities

- Prosodic structure account
  - Productions will conform to one trochaic foot; variation in truncation
- Trochaic constraint
  - Initial weak syllable will be deleted
- Perceptual salience
  - Stressed, word-final syllables will be preserved


Segmental Influence

- Word-internal unstressed syllables with sonorant onsets are vulnerable to deletion
  - /n/, /l/
- Word-internal unstressed syllables with an obstruent onset are likely to be preserved
  - /p/, /k/
- Does this hold for word-initial syllables as well?

Kehoe (1995)
Cross-Linguistic Considerations

- Developmental differences between English and Spanish
- English speakers acquire stress earlier than Spanish speakers; avoid final syllable for stress placement
- Spanish speakers progress to foot plus unfooted syllable structure sooner

Hochberg (1986; 1987a; 1987b; 1988); Pons and Bosch, (2010); Allen and Hawkins, (1980); Lleó and Demuth (2000)

Cross-Linguistic Considerations

- Spanish and English both have trochaic stress
- Spanish is syllable-timed, while English is stressed-timed
- In West Germanic languages, children’s productions are faithful to the initial consonant in a syllable
- Spanish does not have reduced vowels
- Unstressed syllables have non-reduced vowels
- English-speaking children tend to delete initial syllables when they contain a reduced vowel
- Spanish has more complex word shapes than English
- More multi-syllabic words

Kehoe (2001); Demuth (2000); Rose (2002); Goad and Rose (2002) Gennari and Demuth (1997); Lleó and Demuth (1999); Roark and Demuth (2000)

Research Questions

- Do typical Spanish-speaking preschoolers omit initial consonants more often than bilingual Spanish-English speakers?
- Are children omitting initial consonants or initial syllables? Are we simply observing cluster reduction?

Methods

Participants

- 8 bilingual Spanish-English speaking children, mean age 4;0
- Children were recorded in San Diego, CA and Tucson, AZ
- Speakers of Mexican Spanish
- At least 20% input in both Spanish and English
- 9 monolingual Spanish-speaking children, mean age 3;5
- Recorded in Querétaro, Mexico
- No input in any other language but Spanish
- Mann-Whitney U showed no significant difference between language groups on age (p = .059)

Pearson, Fernández, Leeuward, and Offer (1997)

Data Collection

- Spanish single word speech samples were recorded using the Assessment of Spanish Phonology (ASP) and the Bilingual English-Spanish Assessment (BESA)
- Target items reflect the type and frequency of sounds, syllable types, and clusters in Spanish and English, respectively
  - ASP: 25-60 items  BESA: 30 items
- Previous work has not found a difference in child performance on the two probes, thus data were aggregated

ASP: Barlow (2003); BESA: Peña, Gutierrez-Clellen, Iglesias, Goldstein, & Bedore (2013); Reiden & Fabiano-Smith (2012)
Analyses

- Speech samples were phonetically transcribed
- Undergraduate and graduate students trained in narrow IPA
- Native Spanish speakers
- Inter- and intra-rater reliability greater than 90% for all samples
- Logical International Phonetics Program (LIPP)

Statistical Analyses

- Mann-Whitney U test
- Compared the percent occurrence of initial consonant deletion in the productions of monolingual Spanish speakers with the Spanish productions of bilingual children

Results

Initial Consonant Deletion: Group Comparison

- Monolingual Spanish speaking children were omitting initial consonants at a higher frequency than bilingual children ($p = .046$)

Types and Tokens of Errors

- Number of Tokens

Fabiano-Smith and Cuzner (in preparation)
Segmental vs. Syllabic Deletion

ICD vs. Cluster Reduction

Context of Deleted Segment: Stressed or Unstressed Syllable

Segmental Effects in Word-Initial, Unstressed Syllables

Percentage of Productions Conforming to One Trochaic Foot

Common Target Word Triggers

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Production</th>
<th>Language Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>rompuchezas</td>
<td>rompachezas / rompach/ac</td>
<td>Monolingual</td>
</tr>
<tr>
<td>leja / leuca / lea</td>
<td>lej/leu/ac</td>
<td>Monolingual</td>
</tr>
<tr>
<td>roñila / roñila / rea</td>
<td>roñal / [roñal]</td>
<td>Monolingual</td>
</tr>
<tr>
<td>pintura / pintura / pintura</td>
<td>pintura / pintura</td>
<td>Bilingual</td>
</tr>
<tr>
<td>guitara / gitara / guitar</td>
<td>guitara / gitara</td>
<td>Monolingual</td>
</tr>
</tbody>
</table>
Interesting Patterns

- One bilingual child inserted the glottal stop in initial position across words
  - e.g., humo, sombrero, llueve, castillo
- Initial cluster reduction was common
  - “clavo” (nail) /klaβo/ [laβo]
  - “flor” (flower) /floɾ/ [hoː], [loɾ]
- M03 demonstrated a higher percent occurrence of ICD than any other child in the group
- Reducing clusters and omitting initial consonants

Summary

<table>
<thead>
<tr>
<th></th>
<th>Bilinguals</th>
<th>Monolinguals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Occurrence ICD</td>
<td></td>
<td>🡯</td>
</tr>
<tr>
<td>Initial Segment Deletion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster Reduction</td>
<td></td>
<td>🡯</td>
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<tr>
<td>Initial Syllable Deletion</td>
<td></td>
<td>🡯</td>
</tr>
<tr>
<td>Initial Cluster Deletion</td>
<td></td>
<td>🡯</td>
</tr>
<tr>
<td>Unstressed Context</td>
<td></td>
<td>🡯</td>
</tr>
<tr>
<td>Sonorant/Obstruent Rule?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reduced to Trochee?</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Discussion:

Discussion: Similarities

- Both groups followed some typical developmental patterns for Spanish speakers:
  - Produced tri-syllabic words without truncation
  - Reduced 4-5 syllabic words to 3 syllable words
  - Both used eponthesis
  - “pirata” /piɾaɾa/ [piɾaɾa] (bilingual)
  - “bruja” /bɾuɾa/ [bɾua] (monolingual)
- All children were well beyond the 1-foot developmental level

Discussion: Differences

- Initial consonant deletion was more widespread in the monolingual group
- Monolinguals reduced more initial clusters than bilinguals
- Monolinguals followed the sonorant/obstruent rule
- Bilinguals reduced segments in unstressed syllable contexts

Discussion: Differences

- Bilinguals are omitting less initial segments and cluster members
- Bilinguals are demonstrating knowledge of stress and omission rules
- Bilinguals are maintaining the production of multi-syllabic words
- Bilinguals are not demonstrating the same error pattern on obstruent/sonorant omission

Lleó and Demuth (1996)
Discussion

- On this particular measure, we could be observing a possible acceleration effect, interference, and transfer (PRIMIR 2)
- English speakers acquire stress earlier than Spanish speakers
- Facilitative
- English speakers tend to delete initial syllables when they contain a reduced vowel
- Transfer/Interference
- Bilinguals still producing multisyllabic words
- No effect

Conclusion

- Between-language interaction at the representational level presents itself at the production level in a bi-directional fashion
- Facilitation, interference, or no effect are all possibilities
- Result is difference, not evidence of disorder
- Structural knowledge of the two languages aids in predicting the type and frequency of between-language interaction
- Aids in accurate diagnosis of phonological disorders

Future Directions

- Acoustic analysis for initial glottal stop
- Analysis of English for cross-linguistic comparison
- Large-scale normative data for bilingual children are essential for bilingual children; larger, more inclusive set of phonological error patterns

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