PHONOLOGICAL SIGNS OF INFANT DUAL LANGUAGE ACQUISITION

A Case Study of a Bilingual Infant's Intonation Patterns

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THE PURPOSE OF THIS STUDY

- To determine if:

  - A bilingually raised Spanish/English infant at 1;1 is producing intonational patterns that match the language environment (parent's native language).

  - And if he is making a *choice* to produce those intonation patterns based on the language environment (parent's native language).

INTRODUCTION

- What we know about infant sound production and perception:

  ◆ from birth infants can recognize their native language and begin to use sound to communicate (Jusczyk 1997, Kuhl 1992)

  ◆ Even before birth infants begin to identify their native language (Mehler 1988).

  ◆ there are phonological sound preferences infants tend to use in their babbling (Locke 1983, Bardies 1984, Oller and Eilers 1981, Werker and Tees 1984).

  ◆ Suprasegmental features are being learned even before the infant produces his first words (Oller 1980, Whalen et al. 1991) .

WHAT DOES PAST LITERATURE REVEAL?

Physiological Phonological Development

- **Locke** (1983) - babbling is a universal and biological development that leads to universality in speech sound and speech development. (Nature)

- Jusczyk (1997) - phonological development is "innately guided learning" that takes advantage of biological preprogramming and the cognitive endowment for language learning. (Nativist)

- Roger Brown **(1958) - all children start with a total repertoire of sounds but they drift toward the adult sound system of their environment/culture –** *babbling drift theory***.** (Nurture)

WHAT DOES PAST LITERATURE REVEAL?

MONOLINGUAL STUDIES

Empirical Studies:

- **de Boysson-Bardies** (1984) – found statistical and differentiating patterns in the F0 frequency and intensity contours of French, Chinese and Arabic.
  - Listener perception tests

- **Whalen et al.** (1991) - determined that French infants had a more rising intonation and less falling intonation than the English infants using acoustic analysis. Children recognize F0 variation before they have a language system.

WHAT DOES PAST LITERATURE REVEAL?

EMPIRICAL BILINGUAL STUDIES:

- **Bosch and Sebastian-Galles** (1999)- by means of a discrimination test, they found that bilingually raised Spanish/Catalan infants could discern the two languages even though they are similar in syllable time and prosody.

- **Poulin-Dubois and Goodz** (1999) - their bilingual subjects showed a preference for babbling in French in all situations.

METHODS

- Subject
  - Simultaneous bilingualism (Spanish/English)
  - Focus at age 1;1 (with a follow up between 1;6 and 1;8)
- Data Collection
  - 836 video recordings
  - 3 environments: independent play; with English mother (90%); with Spanish father (80%)
  - A diary
- Sampling
  - Analysis of 33 recordings at 1;1
- Equipment
  - Discreetness (handheld devices)
- Data Conversion
  - 3-4 syllable utterances and phrase final
- Analysis Methods
  - Comparison with native language features as outlined by Delattre, Olsen and Poenack (1962)

NATIVE TARGET LANGUAGE PITCH FEATURES

SPANISH
Delattre, Olsen and Poenack (1962)

CONTINUATION PATTERN:

◆ **A mostly rising continuation pattern**

◆ **Sharp ascents**

◆ **And plateaus**

FINALITY:

◆ **The preceding syllable to the final syllable has a high and flat pitch**

◆ **The preceding syllable and the final stressed syllable are nearly equal in pitch**

◆ **The descent of the final syllable is sharp**

◆ **And when present, any sound following the final descent is flat**

NATIVE TARGET LANGUAGE PITCH FEATURES

ENGLISH
Delattre, Olsen and Poenack (1962)

CONTINUATION PATTERN:
- ◆ **Mostly falling pattern**

- ◆ **And a gentle S-curve pattern**

FINALITY:
- ◆ **The preceding syllable to the final syllable is low and falling**

- ◆ **The final syllable rises before descending**

- ◆ **The final descent is gentle**

- ◆ **When present, any sound following the final descent is concave**

RESULTS

- A conglomeration of both English and Spanish features with an overwhelming predominance of Spanish intonation characteristics was found in the babbling of the infant in all three language environments.

- It does not appear as if he is making a *choice* based on environment.

RESULTS: A COMPARISON OF INFANT AND TARGET PITCH PATTERNS

Number of Occurrences for SPANISH Intonation Features
(Total 33 Samples)
Table 1.0

Feature	Number of Occurrences
The preceding syllable (to the final stressed syllable) is high and flat	29
A mostly rising continuation	28
The preceding syllable has the same pitch as the final syllable	25
Sharp Ascents in the continuation	23
Plateaus in the continuation	27
A sharp descent in finality	10 (out of 21 samples)
A flat pattern after the final syllable of descent	11

RESULTS

Spanish Continuation and Finality Features

Table 2.0

Continuation Features	Totals	Finality Features	Totals
Sharp Ascents	23	Preceding high and flat syllable	29
Plateaus	27 → **20**	Preceding syllable pitch equals final stress pitch	25
Mostly Rising Continuation	28	Sharp descending final syllable	10* → **9**
Combined Totals	**14**		**9**

* Out of 21 descending samples

RESULTS

- **IN CONCLUSION – SPANISH**

    the average occurrence = **23.66** (n=33)

    an average of **72%**

    lowest occurring feature (sharp finality) = **33%**

    highest occurring feature (rising continuation) = **88%**

RESULTS: A COMPARISON OF INFANT AND TARGET PITCH PATTERNS

Number of Occurrences of ENGLISH Features
(Total 33 Samples)
Table 3.0

Feature	Number of Occurrences
The preceding syllable (to the final stressed syllable) is low and falling	11
A mostly falling continuation	2
Final stress rises before falling	12
A gentle S-curve continuation	10
A Gentle final descent	9 (out of 21 samples)
A concave upturn after final descent	3

RESULTS

- **The Syllable preceding final stress**

  - Overlap between the English *low and falling* feature and the Spanish *high and flat* feature
  - The reason for this...
    - 5 out of 29 samples labeled as high and flat (Spanish) were <u>NOT</u> flat at all.
    - 0 out of 11 samples labeled as low and falling (English) were <u>NOT</u> low.

- This allowed for a *high* but *falling* pitch in the preceding syllable to final stress.

- 9/11 samples with falling preceding syllables (English) were also high (Spanish) not low (English)

- See Figure 5.0 for an example

RESULTS

- **The Final Stressed Syllable**

  - Overlap between the final stressed syllable starting at the same pitch as the preceding syllable (Spanish) *and* the final stressed syllable rising before falling (English).

- There were 4 samples (out of 12) that had a very minor rise in pitch before final descent. See Figure 6.0

- There were 8 samples with a significant rise in pitch before descent. See Figure 7.0

RESULTS

■ The falling preceding syllable and the rising final syllable account for the most occurring dual English adult target language features in the data.

Total Occurrences for English Continuation and Finality Features
Table 4.0

Continuation Features	Totals	Finality Features	Totals
Gentle S-curves	10	Preceding low and falling syllable	11
Mostly Falling Continuation	2	Final stressed syllable rises before falling	12
Combined Totals	**1**		**7** ←

RESULTS

- **IN CONCLUSION – ENGLISH**

  the average occurrence = **8.8** (n=33)

  an average of **27%**

  lowest occurring feature (falling continuation) = **6%**

  highest occurring feature (finality rise before fall) = **36%**

RESULTS

- **Gentle versus Sharp Descent**

  - **Average Spanish sample descent = 47 Hz/.01s**

  - **Average English sample descent = 15.8 Hz/.01s**

  - **Average independent sample descent = 25.7 Hz/.01s**

  - **Total mean for 21 samples = 28.22 Hz/.01s**

  - **"Sharp" descent = 25 Hz/.01s or higher**

  - **"Gentle" descent = 15 Hz/.01s or lower**

RESULTS

- <u>Gentle versus Sharp Descent</u>

Highest Hz/.01 sec Final Descents
Table 5.0

Hz/.01 sec	Environment
136	Independent
127	Spanish
59	Independent
49	Independent
34	Spanish

RESULTS

- <u>Gentle versus Sharp Descent</u>

Lowest Hz/.01 sec Final Descents
Table 5.1

Hz/.01 sec	Environment
5.2	Spanish
5.8	Spanish/English
6	Spanish
6	Spanish
6.6	Independent

RESULTS

A Comparison of English and Spanish Features
Table 6.0

Feature	Spanish	English
Lowest Occurring Feature	33% (a sharp final descent)	6% (mostly falling continuation)
Highest Occurring Feature	88% (preceding syllable to finality is high and flat)	36% (final stress rises before falling)
Average of Occurrences	72% (23.66)	27% (8.8)
Continuation Pattern and Number of Occurrences	Sharp Ascents + Plateaus + Rising Continuation = 14	Gentle S-curve and a Falling Continuation = 1
Finality	Preceding high syllable + equal pitch to final syllable + sharp descent = 9	Falling preceding syllable + rising then falling final syllable + gentle final descent= 1
Descent in Average Hz/.01s	52.3	15.8

RESULTS

- The Diary (1;0 to 1;8):
  - The child babbled more when in independent play.
  - The father characterized the babbling as Spanish sounding based on the rise in his voice at the end of his utterances.
  - He would engage in Spanish games
  - His first word was 'más' at 1;2 (which he had learned the ASL sign for)
  - At 1;8 he said 'more' in English to the ASL sign.
  - At 1;7 he was: using mixed utterances, lexical equivalents, and verbally translating between languages.

SO WHAT DOES THIS ALL MEAN?

- The data demonstrates:
  - The child is using predominantly Spanish intonation patterns in all 3 environments.
  - And this demonstrates that he is not choosing a phonological pattern based on the language of his interlocutor.
  - <u>The percentage of English and Spanish features corresponds with the amount of time the child was directly exposed to the language of each parent (70%/72% and 30%/26%)</u>. (Vihman 1985)
  - The continuation pattern was 14:1 Spanish
  - The finality features were 9:1 Spanish
  - The final descent was split 50/50 between sharp and gentle
  - English descents averaged 34% of the Spanish descents (47/16) in Hz/.01s

RESULTS

- Six months later... (1;6 to 1;8)
  - I chose this age because he was showing signs of lexical language awareness at this time period (as the diary showed).
  - At this time the mother was now spending equal time with the child.
  - **11 samples reveal:**
  - More variegated babbling (less slurred speech) and more
    "perfect" native language pitch patterns (Fig 9.0; 10.0).
  - He is still producing a preceding syllable to finality that is both high but falling (5/11 samples).
  - *The final descent tends to be gentle more consistently (in 10/11 samples) with an average of a 9.3 Hz/.01s
  - It was still a mostly rising continuation (8/11 samples)
  - *Gentle S-curve continuation and a sharp ascent plus plateau continuation were split 5:6.

CONCLUSIONS

- child is predominantly using intonational patterns from his dominant language
  - some features from his second language
  - This is also reflected in his mixed lexical productions.
- ratio approximates the amount of language exposure.
  - Confirms Vihman 1985 study which found (not empirically) that amount of English child spoke equaled amount of time he spent in an English environment
- There was code-switching in the home. This lead to "prosodic interference" (Taeschner 1983).

FURTHER THOUGHTS

- While he had more exposure to Spanish than English from the parents, all of his exposure outside of one-one-one parent communication was in English.

    ➤ **On what basis is he "choosing" a dominant language?**

- A supposition: The child may be using Span/Eng synonyms to bridge the gap in communication with the mother when the father is present (Rothman and Niño-Murcia 2008).

- <u>Update</u>: as he matured, he used more synonyms. Listening to the tapes again revealed that the father typically translated for his son in their interactions- questioning the supposition.

FURTHER RESEARCH

◆ Better quantitative delineation of sharp versus final descents.

◆ Providing a pitch contour analysis of the parental speech.
  ◆ UPDATE!: Done. Both parents pitch patterns show these native language patterns laid out by Delattre.

◆ A more thorough analysis of the utterance as phrase final

◆ A look at the effects of direct and indirect language exposure

◆ A more thorough monthly analysis of pitch patterns

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