

# Acquiring Phonemes: Is Frequency or the Lexicon the Primary Cue?

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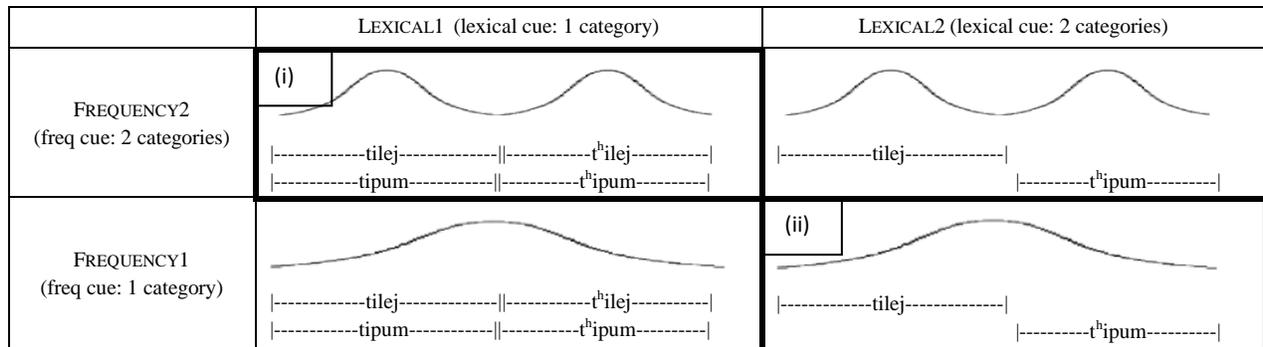
## I. Background: The two cues

- a. The Frequency Cue (aka “distributional learning”): Language learners attend to frequential distributions and can infer categories based on the number of peaks (see Maye et al, 2000, 2002)
- b. The Lexical Cue: If sounds occur in similar-sounding lexical items, these sounds belong to a single category (see Feldman et al, 2009, 2013; Swingley, 2009)

## II. Experiment design

|                       | Stimuli  | Duration of experiment            | Participants       |
|-----------------------|--|-----------------------------------|--------------------|
| Frequency cue support | <ul style="list-style-type: none"> <li>➤ Consonants ([d] vs. [t]) (Maye et al, 2000, 2002)</li> <li>➤ Vowels ([a] vs. [ɔ]) (Escudero et al, 2011)</li> </ul> | One session                       | Adults and infants |
| Lexical cue support   | <ul style="list-style-type: none"> <li>➤ Vowels ([a] vs. [ɔ]) (Feldman et al, 2009, 2011, 2013)</li> </ul>   | One session                       | Adults and infants |
| Present study         | <ul style="list-style-type: none"> <li>➤ Consonants ([t] vs. [t<sup>h</sup>])</li> <li>➤ Vowels ([a] vs. [ɔ])</li> </ul>                                     | 3 sessions spread out over 3 days | Adults             |

- a. Participants: Total of 115 analyzed for Day 1, 61 made it all the way to Day 3; all recruited from Mechanical Turk (an online participant pool)
- b. 3 day experiment: each day consisted of a Familiarization phase followed by a Test phase
- c. Stimuli:
  - i. Consonants (T): 8-point continuum between [t/t<sup>h</sup>], embedded within lexical environment
  - ii. Vowels (A): 8-point continuum between [a/ɔ], embedded within lexical environment
- d. Two groups:
  - i. FREQUENCY2, LEXICAL1 group: Frequency cue tells participants there are two categories (bimodal distribution); lexical cue tells participants there is one category (all points of 8-point continuum are heard in the same lexical environments)
  - ii. FREQUENCY1, LEXICAL2 group: Frequency cue tells participants there is one category (monomodal distribution); lexical cue tells participants there are two categories (points 1-4 in continuum are never heard in the same lexical environment as points 5-8)



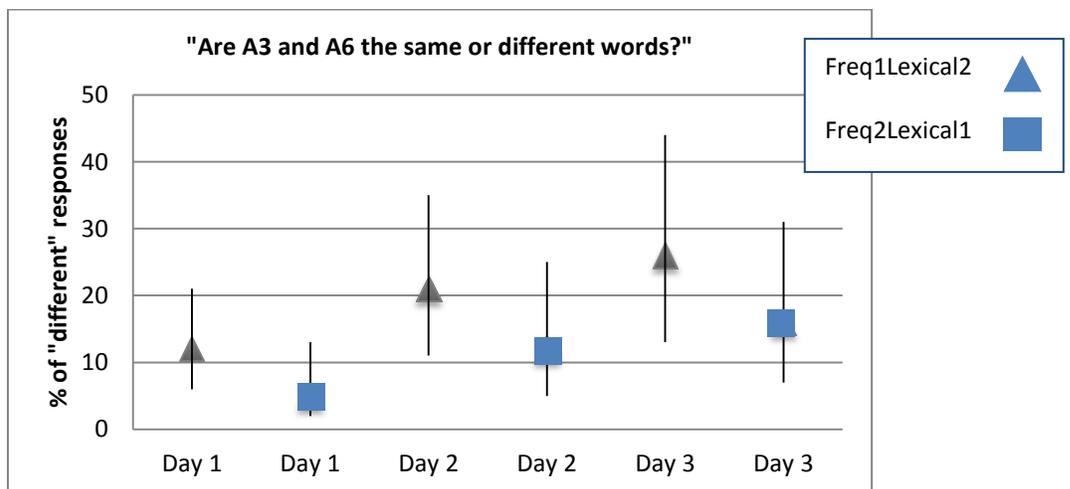
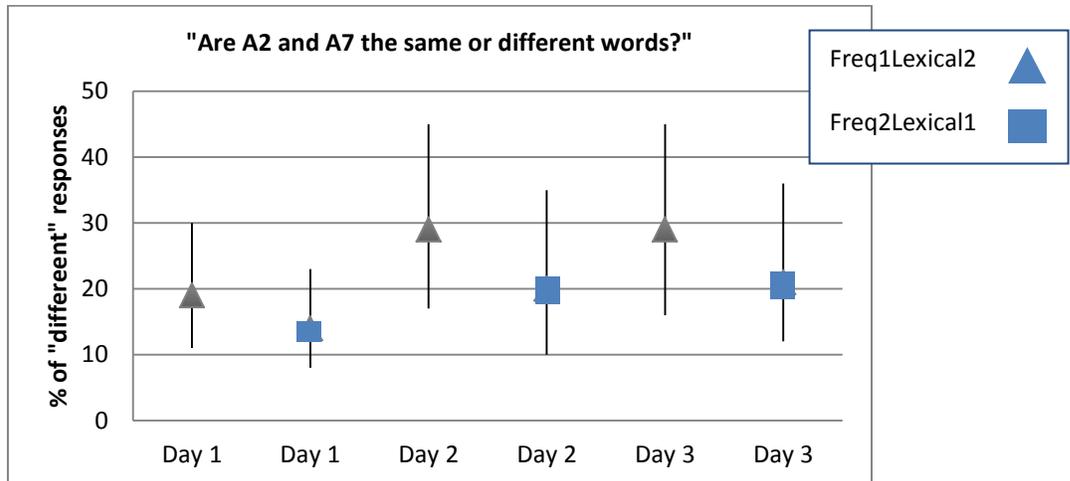
- e. Familiarization phase: listen to 96 test words + 33 fillers
- f. Test phase: “Are [T<sub>2</sub>/T<sub>7</sub>; T<sub>3</sub>/T<sub>6</sub>; A<sub>2</sub>/A<sub>7</sub>; A<sub>3</sub>/A<sub>6</sub>] the same or different words?”

III. Research questions, results, and further research:

When the lexical cue and the frequency cue give the language learner conflicting information...

a. **Research Question A:** Which cue is treated as the primary cue?

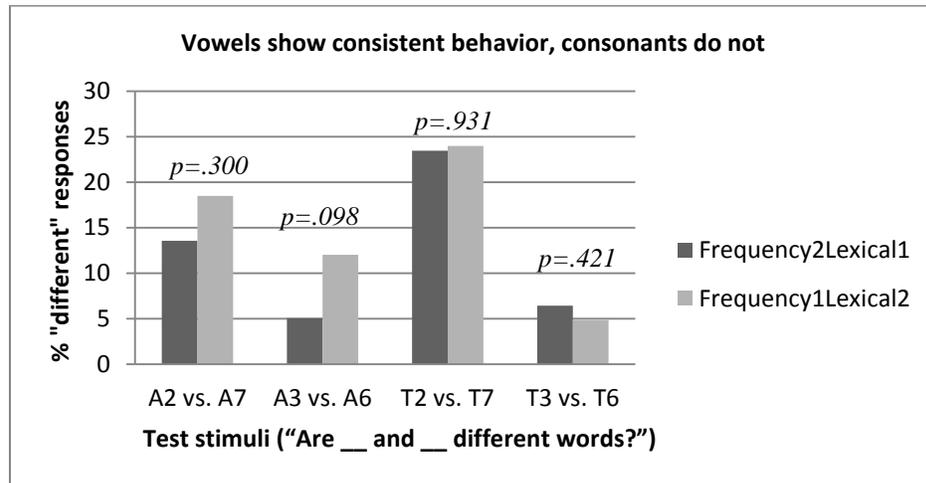
i. Results



- ii. Tentative conclusion (not statistically significant): For vowels, the FREQUENCY1LEXICAL2 group answers “different” more often than the FREQUENCY2LEXICAL1 group, and this trend stays consistent across all three days. **Therefore it is tentatively concluded that the Lexical cue is stronger than the Frequency cue**
- iii. Further research: Results were not statistically significant. A second experiment involving more participants is suggested.

- b. **Research Question B:** Do language learners rely on different cues when determining **vowel vs. consonant** categories?

- i. Results:



- ii. Tentative conclusion (not statistically significant): Vowels show consistent behavior (FREQUENCY2LEXICAL1 answers "different" less often than FREQUENCY1LEXICAL2), but consonants do not. From this it seems that consonants and vowels are not being treated the same way.

*Note: My interpretation of the CV Hypothesis (Nespor et al, 2003; Bonatti et al, 2005; Toro et al, 2008) predicts that consonants and vowels should behave differently from one another, BUT that this difference should look different from these results (it is predicted that consonants will show a stronger Lexical Cue)*

- iii. Further research: Only one pair of vowels and one pair of consonants were tested, and [a/ɔ] and [t/t<sup>h</sup>] differ from one another in many other respects. In addition, there may be a floor effect occurring with the T<sub>3</sub> vs. T<sub>6</sub> stimuli

- c. **Research Question C:** Do language learners rely on one cue **early** on and the other **later**?

- i. Results: No evidence was found that the Day 1 participants relied on either cue more or less than the Day 3 participants. The only trend found was that participants overall answered "different" more often over time.
- ii. Tentative conclusion: The relative weights of the Frequency Cue and the Lexical Cue do not change as lexical entries become stronger across days.
- iii. Further research: It may be the case that Day 1 does not count as "early," and/or that Day 3 does not count as "late," and that this experiment needs to be conducted over more days.

#### IV. Selected references

Feldman, N., Myers, E., White, K., Griffiths, T., Morgan, J. 2013. Word-level information influences phonetic learning in adults and infants. *Cognition*, 427-438. / Leach, L., Samuel, A. 2007. Lexical configuration and lexical engagement. *Cognitive Psychology*, 55, 306-353. / Maye, J., Gerken, L. 2000. Learning phonemes without minimal pairs. *BUCLD 24*, 522-533. Sommerville: Cascadilla Press. / Stager, C.L., Werker, J.F. 1997. Infants listen for more phonetic detail in speech perception than in word-learning tasks. *Nature*, 388, 381-382. / Werker, J., Tees, R. 1984. Cross-language speech perception. *Infant Behavior and Development*, 7, 49-63.