2aSC18

Acoustic Correlates of Stop Consonant Voicing in English and Spanish

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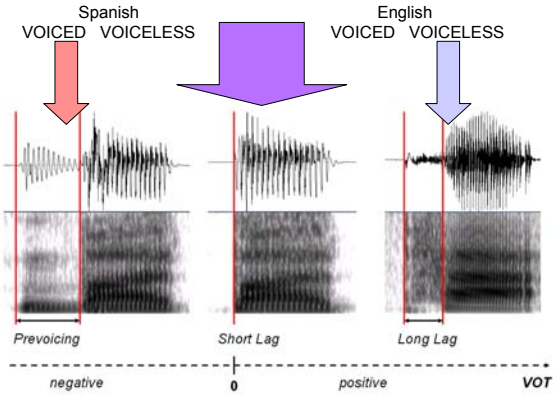
INTRODUCTION

FOCUS: Onset f0 as a correlate of initial stop voicing.

Voiced stops -> lower onset f0↓ Voiceless stops -> higher onset f0↑

The **ORIGIN** of this effect?
- ❑ Phonetics: articulation/aerodynamics. Greater VOT = higher onset f0
- ❑ Less phonetically deterministic; a cue to a ***phonological*** category.

The **GOAL**: To explore the f0 correlation with voicing in languages with the same ***phonological*** categories [+/- voice] expressed via diverse ***phonetic*** categories in initial, prevocalic position.



QUESTIONS:
- ❑ What is the distribution of the f0 cue to stop voicing in these languages?
- ❑ Does the distribution support the phonetic or phonological view of onset f0 covariation with stop voicing?

METHODS

PARTICIPANTS
- 30 NS Am. English (W. Lafayette, IN)
- 24 NS Spanish (Madrid, Spain)

STIMULI
- English: 4 b/p min. pairs BAT/PAT + 8 filler pairs
- Spanish: 4 b/p min. pairs BATA/PATA + 8 filler pairs

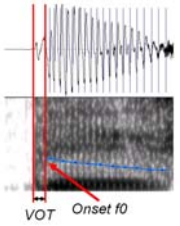
TASK
- Words on screen
- 5 randomized blocks
- Presentation: 2 sec
- ISI: 0.5 sec

MEASUREMENTS

❑ **VOT:**
Beginning of the burst to the onset of voicing.

❑ **Onset f0:**
First post-VOT interval at which Praat algorithm detected periodicity.

❑ **Onset f0 normalization:**
Converted to semitones relative to the mean onset f0 of each speaker:
12 ln(x / individual mean onset f0) / ln2.



ANALYSIS AND RESULTS

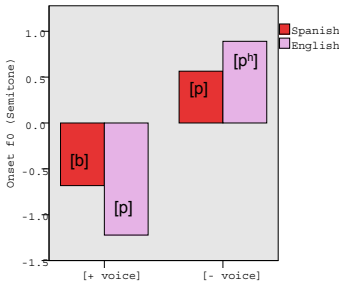
I. EFFECT OF **PHONOLOGICAL CATEGORIES** AND **NATIVE LANGUAGE** ON ONSET *F0*

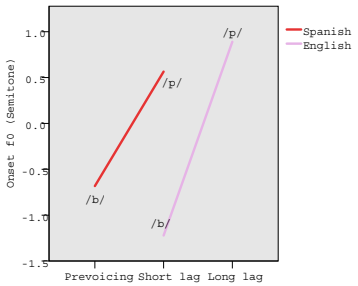
RM ANOVA	*English*	*Spanish*
[+ voice]	[p]	[b]
[- voice]	[pʰ]	[p]

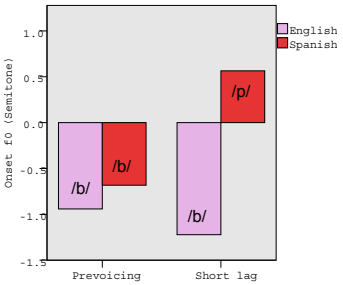
MAIN EFFECTS:
- ❑ Onset f0 [-voice] > [+voice] across languages.
  - Significant effect of *Phonological Category* ($p < 0.001$).
- ❑ Onset f0 overall lower in Spanish than English.
  - Near-Significant effect of *Language* ($p = 0.052$).
- ❑ Greater difference between onset f0 voiced and voiceless in English than in Spanish.
  - Significant *Phonological Category x Language* interaction ($p < 0.01$).

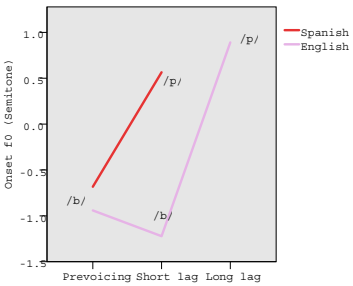
POST-HOC COMPARISONS:
- ❑ Effect of *Phonological Category* within each language:
  Onset f0 voiceless > voiced ($p < 0.001$).
- ❑ Effect of *Language* within each phonological category:
  [+voice] Onset f0 English < Spanish ($p < 0.001$).
  - *[p] < [b] → Greater VOT ≠ higher onset f0 !*

  [-voice] Onset f0 English > Spanish ($p < 0.001$).









II. EFFECT OF **PHONETIC CATEGORIES** AND **NATIVE LANGUAGE** ON ONSET *F0*

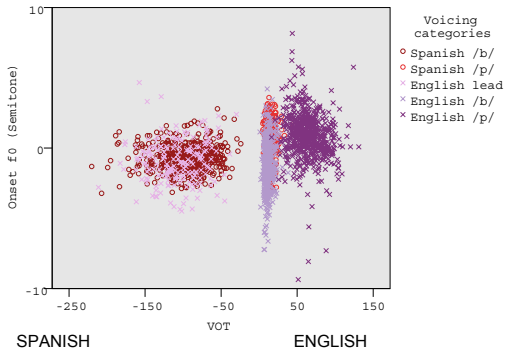
RM ANOVA	*English*	*Spanish*
prevoiced	[b]	[b]
short lag	[p]	[p]

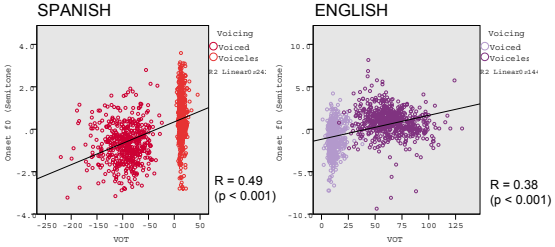
MAIN EFFECTS:
- ❑ Onset f0 prevoiced < short lag.
  - Significant effect of *Phonetic Category* ($p < 0.05$).
  - Driven by Spanish group ($p < 0.001$).
- ❑ Onset f0 overall higher in Spanish than English.
  - Significant effect of *Language* ($p < 0.001$).
- ❑ Onset f0 differences are of different magnitudes and directions in Spanish and English.
  - Significant *Phonetic Category x Language* interaction ($p < 0.001$).

POST-HOC COMPARISONS:
- ❑ Effect of *Phonetic Category* within each language:
  Spanish: onset f0 short lag > prevoiced ($p < 0.001$).
  English: non-significant difference in the opposite direction.
- ❑ Effect of *Language* within the shared phonetic categories:
  [prevoiced]: Onset f0 Spanish > English ($p < 0.01$)
  [short lag]: Onset f0 Spanish > English ($p < 0.001$).

RESULTS

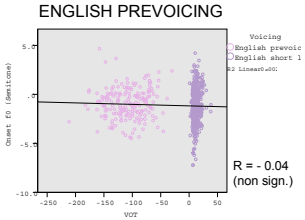
III. EFFECT OF **VOICING CATEGORIES** AND **NATIVE LANGUAGE** ON THE VOT-ONSET *F0* RELATIONSHIP





Across phonological categories:
- ❑ Significant VOT-onset f0 correlation in both languages.
  - Greater correlation in Spanish (non-significant, t-test of mean individual r-coefficient $p = 0.078$).

Within phonological category:
- ❑ No VOT-onset f0 correlation between prevoiced and short lag in English.



CONCLUSIONS

PHONOLOGY – NOT PHONETICS
- ❑ Onset f0 is maximally distinctive between contrasting phonological categories of each language.
- ❑ Equivalent phonetic categories across languages do no agree in onset f0 (short lag [p] and prevoiced [b]).
- ❑ Equivalent phonological categories within language are not distinguished through onset f0 (prevoiced vs. short lag in English).

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