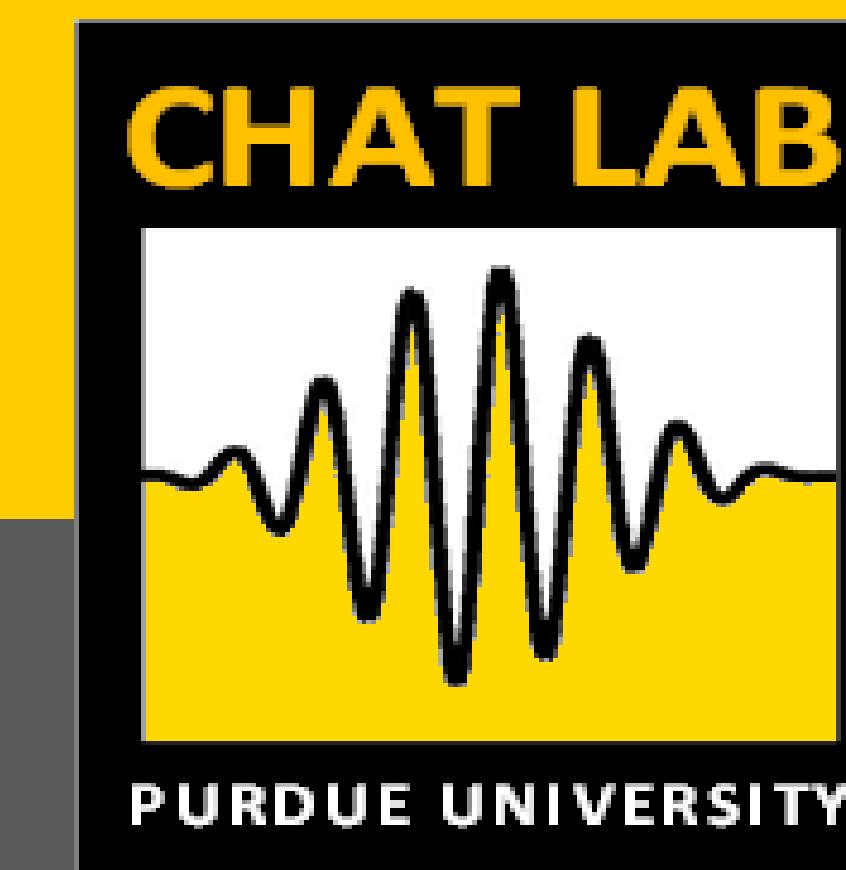




Onset f0 as a Correlate of Voicing in Stops across Word-Positions in English

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BACKGROUND

Across languages, voicing distinctions in stops trigger a systematic difference in the fundamental frequency at the onset of the following vowel – **Onset f0**.

Voiced stops [ba] -> **lower** onset f0 ↓

Voiceless stops [pa] -> **higher** onset f0 ↑

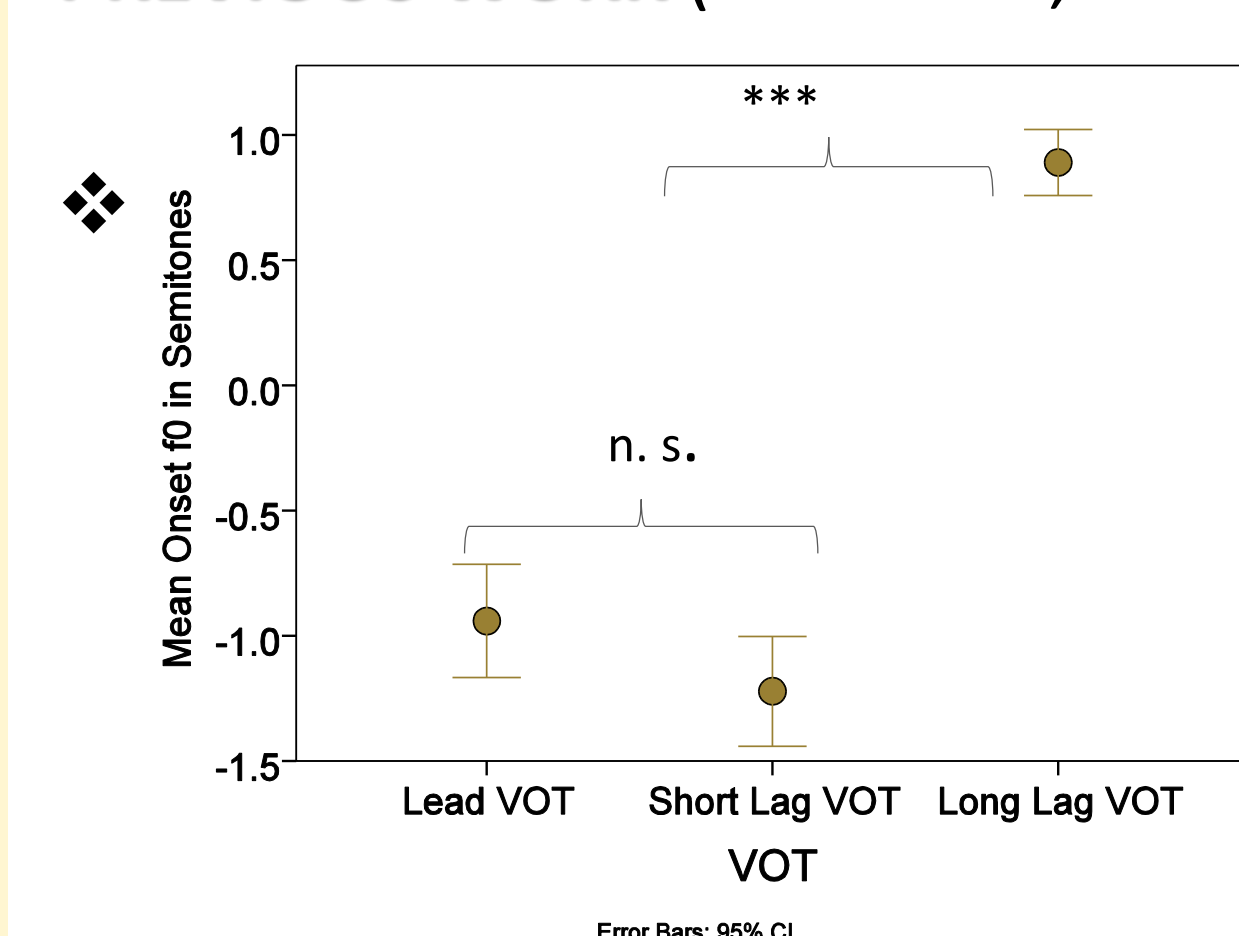
HYPOTHESES about the origins of this covariation:

1. Articulation/aerodynamics of voicing. Automatic and phonetically-determined.
2. Serves to enhance the phonological distinction. Controlled and phonologically determined.

PREDICTIONS:

1. Different *laryngeal setting* and timing of voicing onset (*Voice Onset Time*) = different onset f0.
2. Different *phonological specification* = different onset f0.

PREVIOUS WORK (Dmitrieva, et al., 2014)

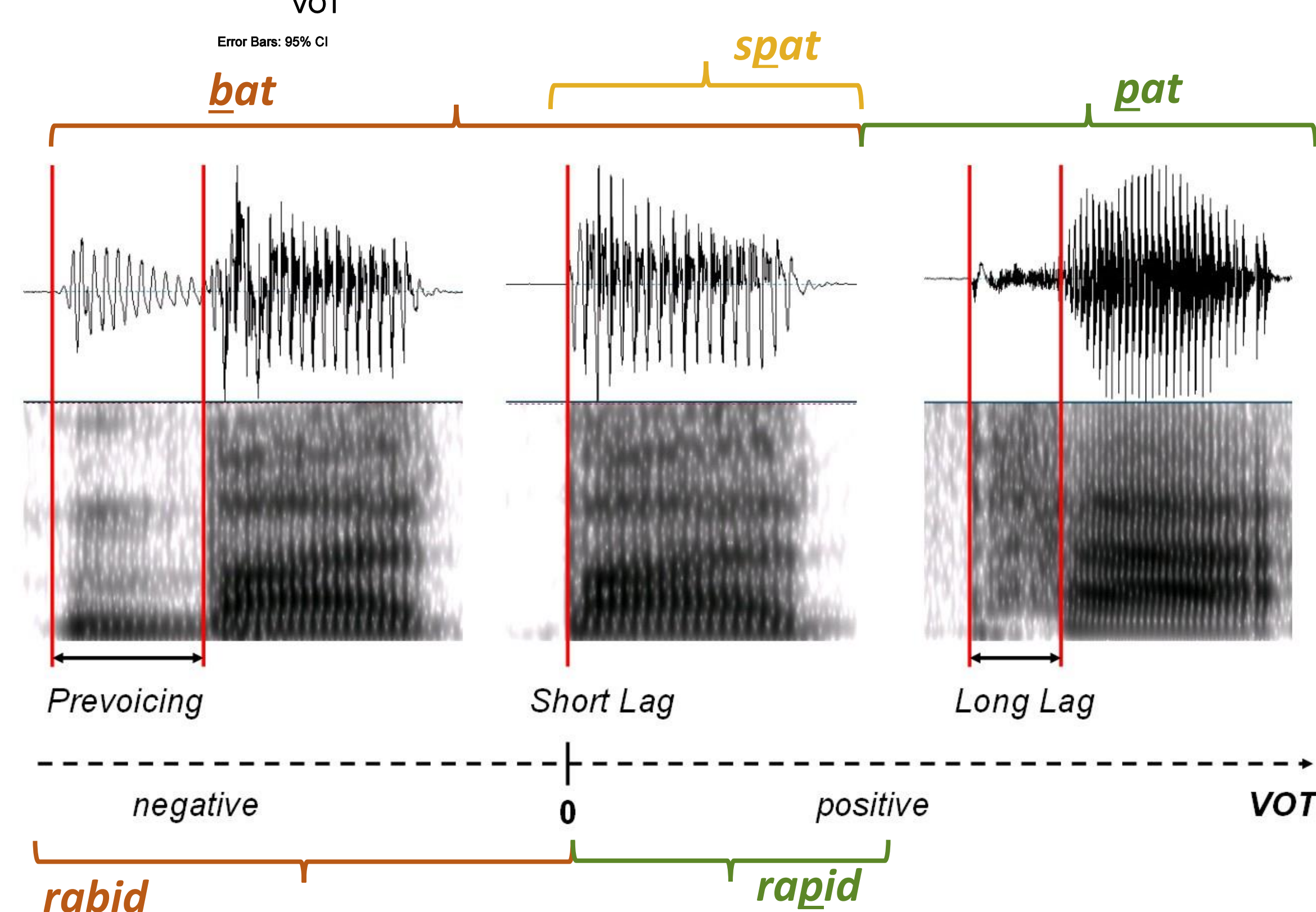


Onset f0 in initial English stops

- No difference between Lead and Short Lag stops (both are [+voice])
- Both differ from [-voice] Long Lags

THE QUESTION:

What about other positions?



METHODS

STIMULI

- **Initial:** pat – bat
6 min pairs per PA
- **Post-s:** spat, stuck
6 stimuli
- **Medial:** rapid – rabid
6 min pairs
- **Fillers:** 69 items

PARTICIPANTS

- 20 NS Am. English
- W. Lafayette, IN
- 8 analyzed

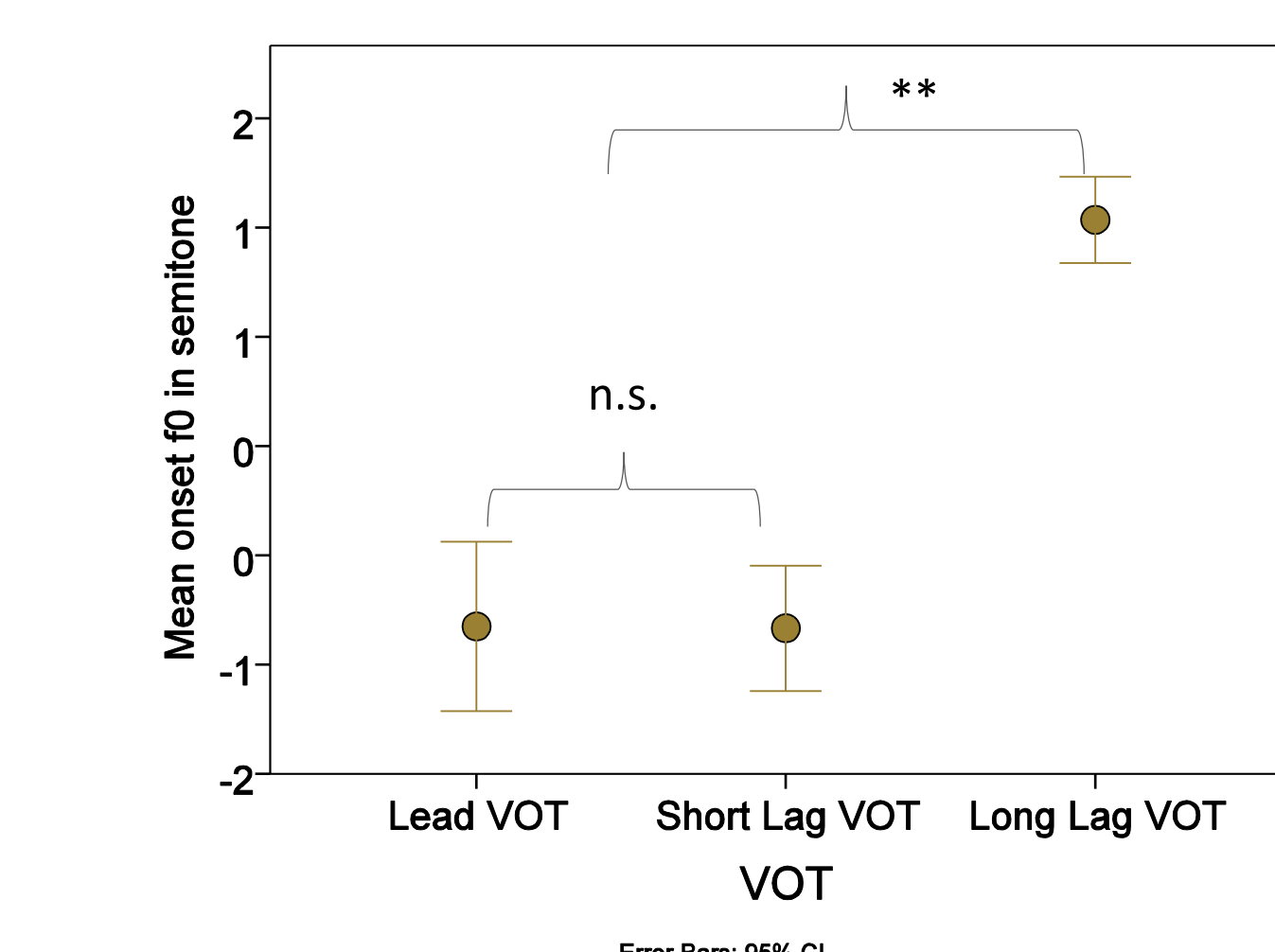
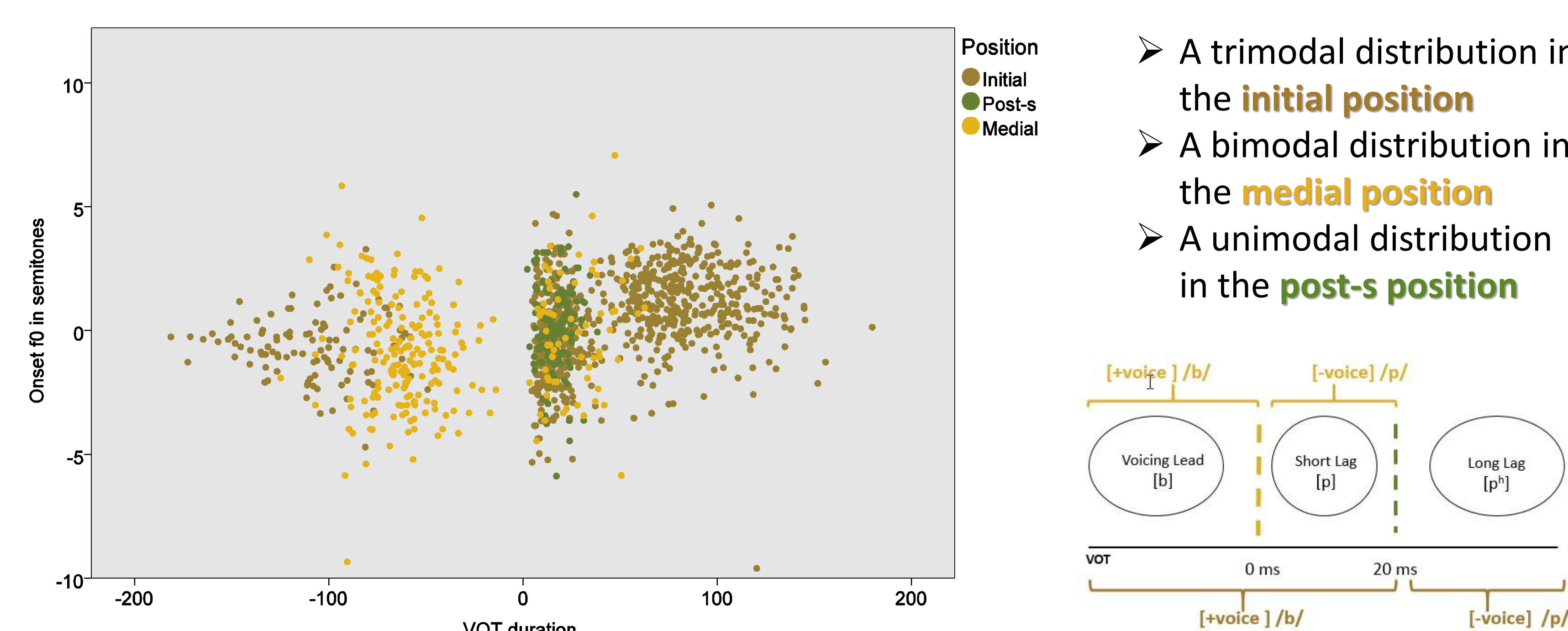
PROCEDURE

- Words on the screen
- 3 randomized blocks
- Presentation: 2 sec
- ISA: 0.5 sec

MEASUREMENTS

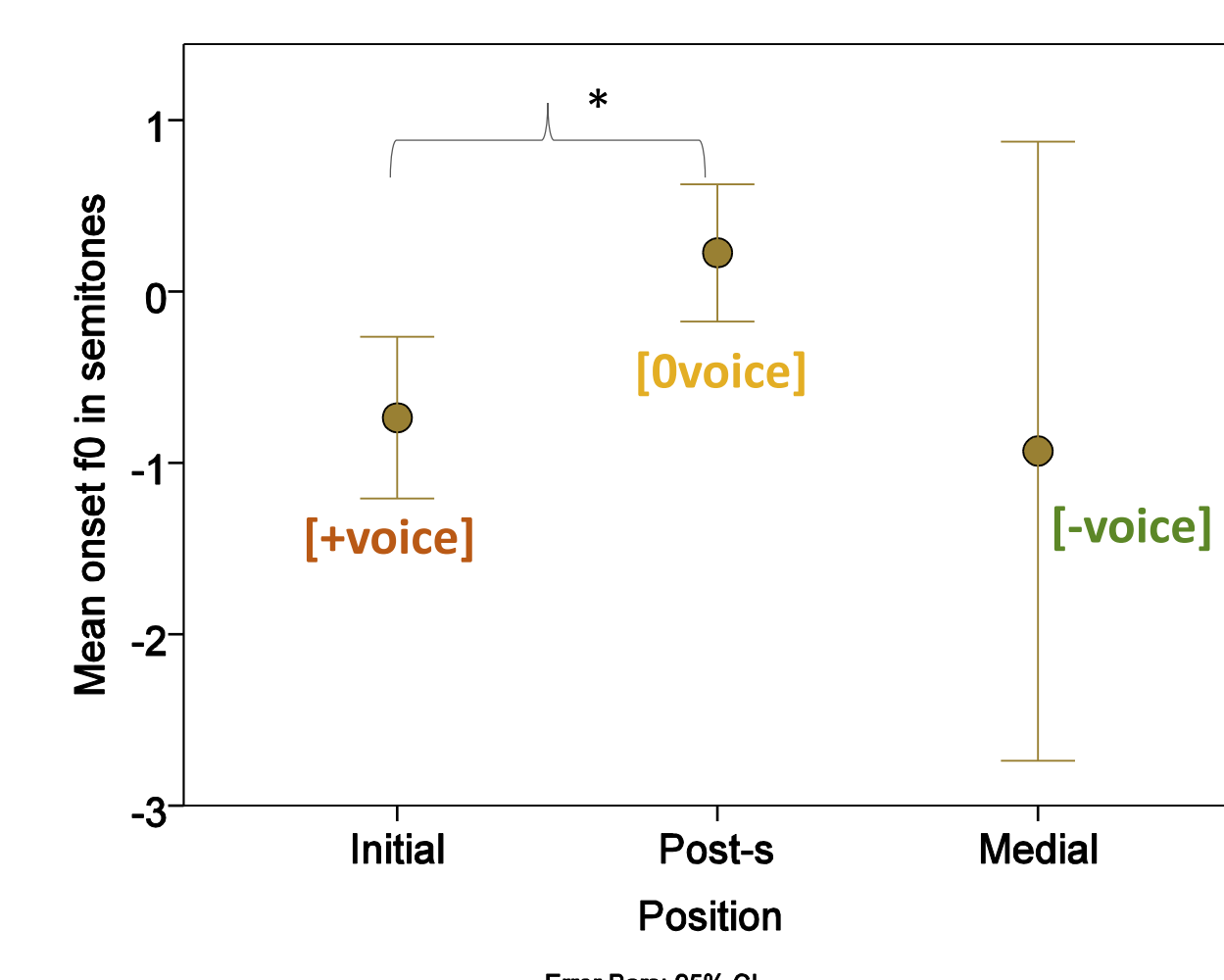
- **VOT**
Beginning of the burst to the onset of voicing.
- **Onset f0**
First post-VOT interval at which Praat algorithm detected periodicity.
- **Semitone normalization**
12 ln(x / individual mean onset f0) / ln2

ANALYSIS and RESULTS



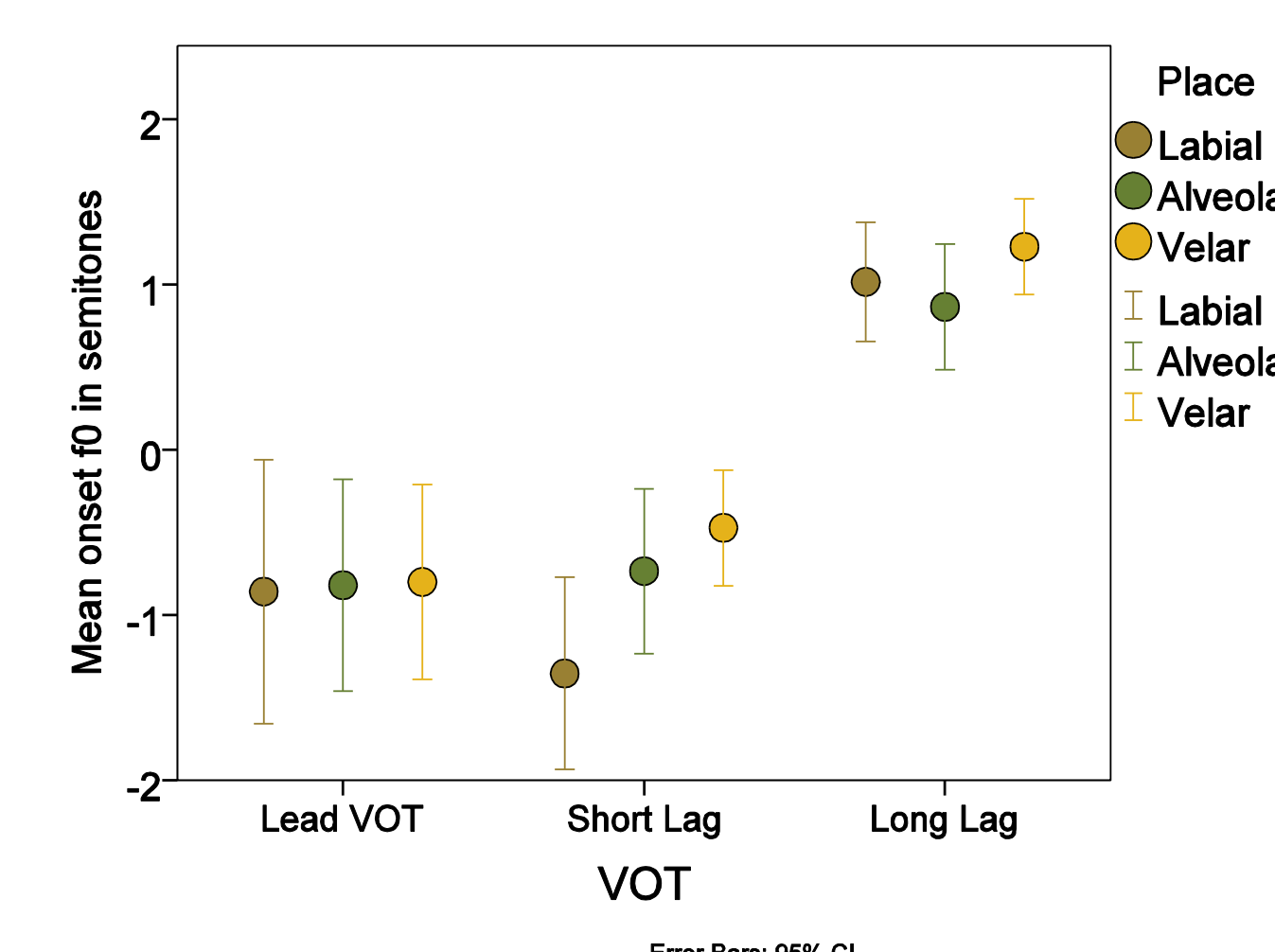
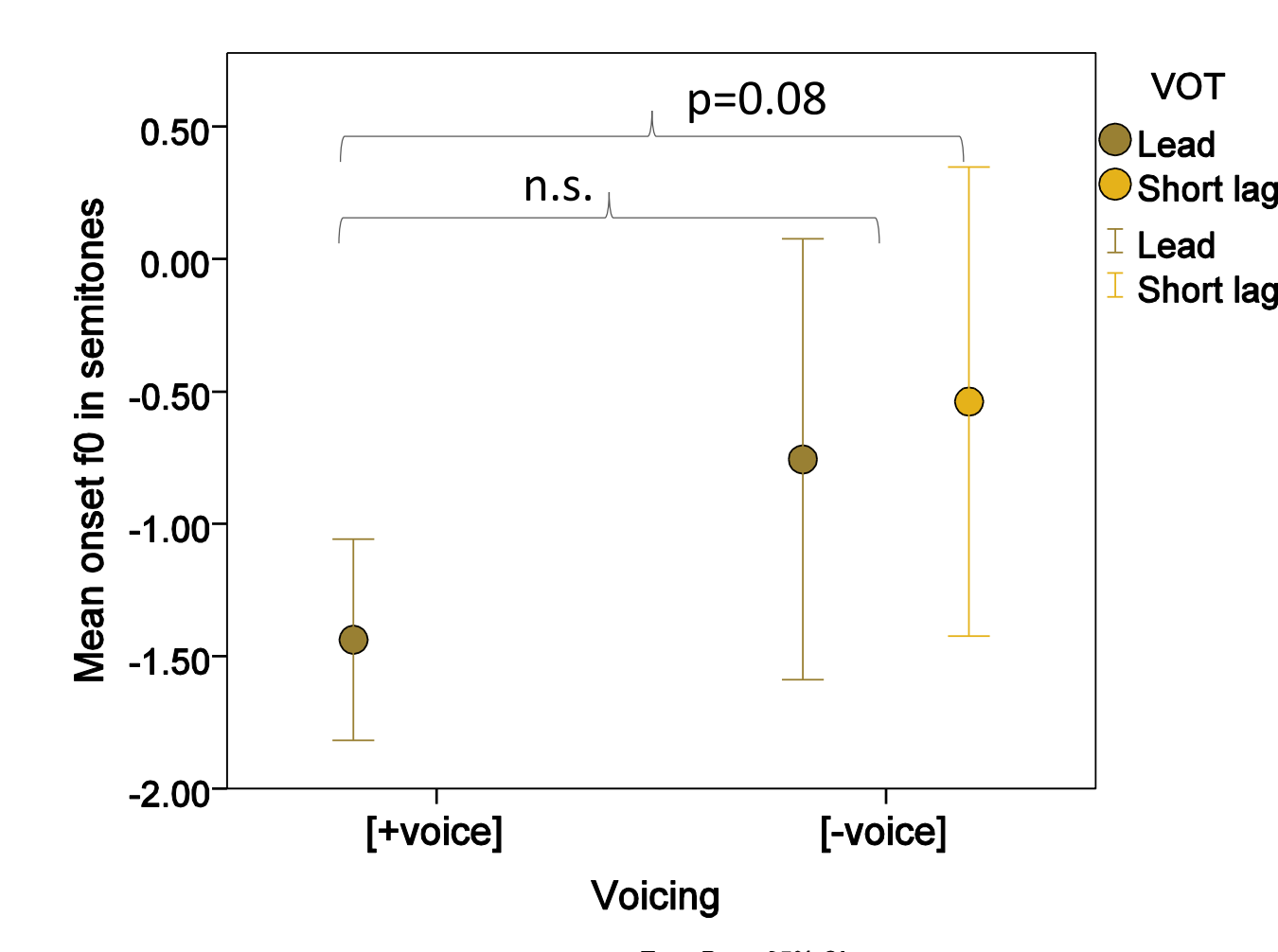
EFFECT OF VOT TYPE ON ONSET F0 IN INITIAL STOPS

Significant Effect of VOT ($p < 0.01$):
(lead VOT = Short Lag) [+voice] < Long Lag [-voice]



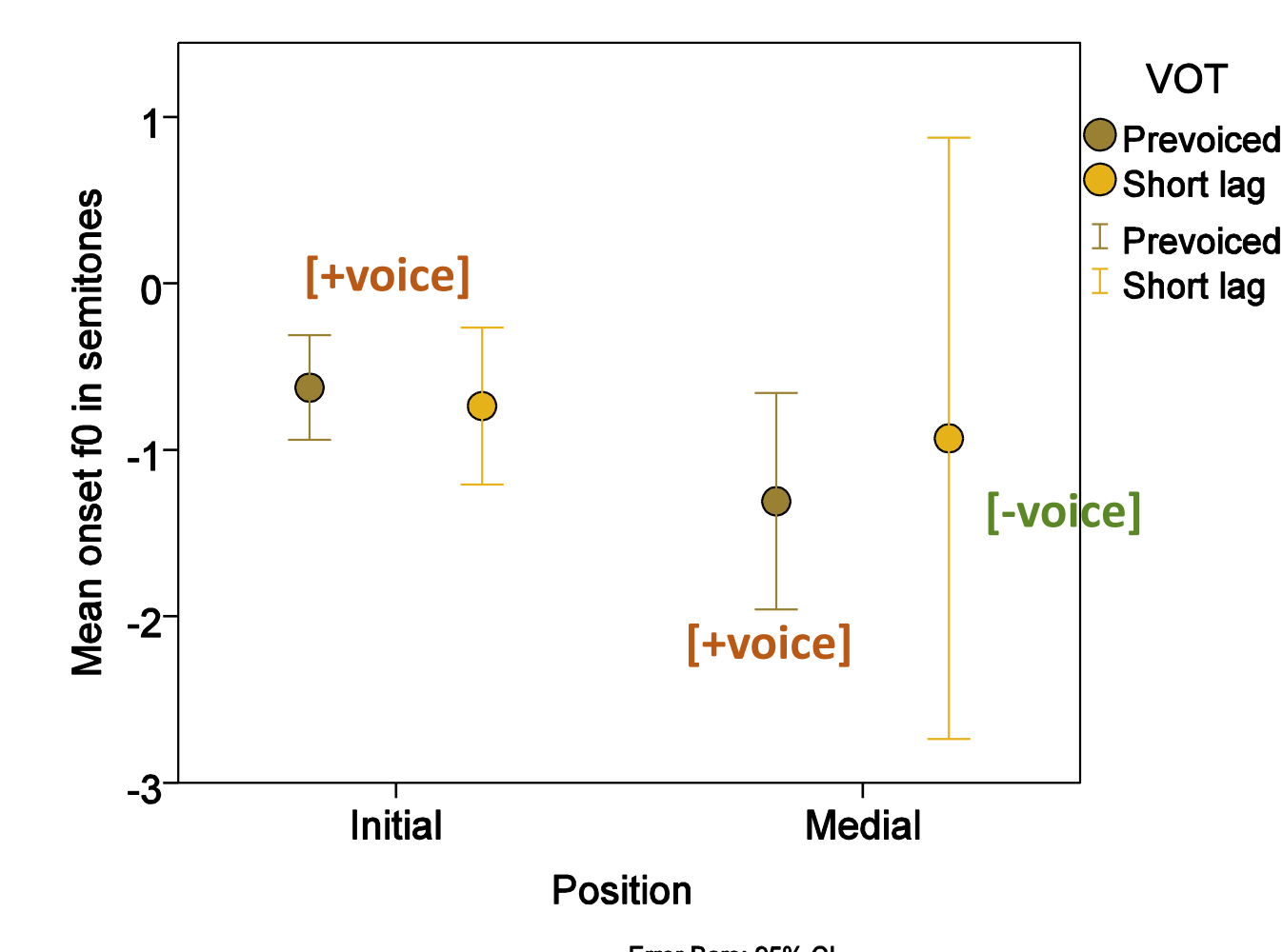
EFFECT OF POSITION ON ONSET F0 OF SHORT LAG STOPS

No overall effect of Position
Pairwise: Initial [+voice] < Post-s [0voice] ($p < 0.05$)



EFFECT OF VOT TYPE and PLACE OF ARTICULATION

Effect of VOT is consistent across PAs
No effect of PA, no interaction



EFFECT OF POSITION ON ONSET F0 OF LEAD AND SHORT LAG STOPS

Near-significant effect of Position ($p = 0.072$)
No effect of VOT or interaction

EFFECT OF VOICING AND VOT ON ONSET F0 OF MEDIAL STOPS

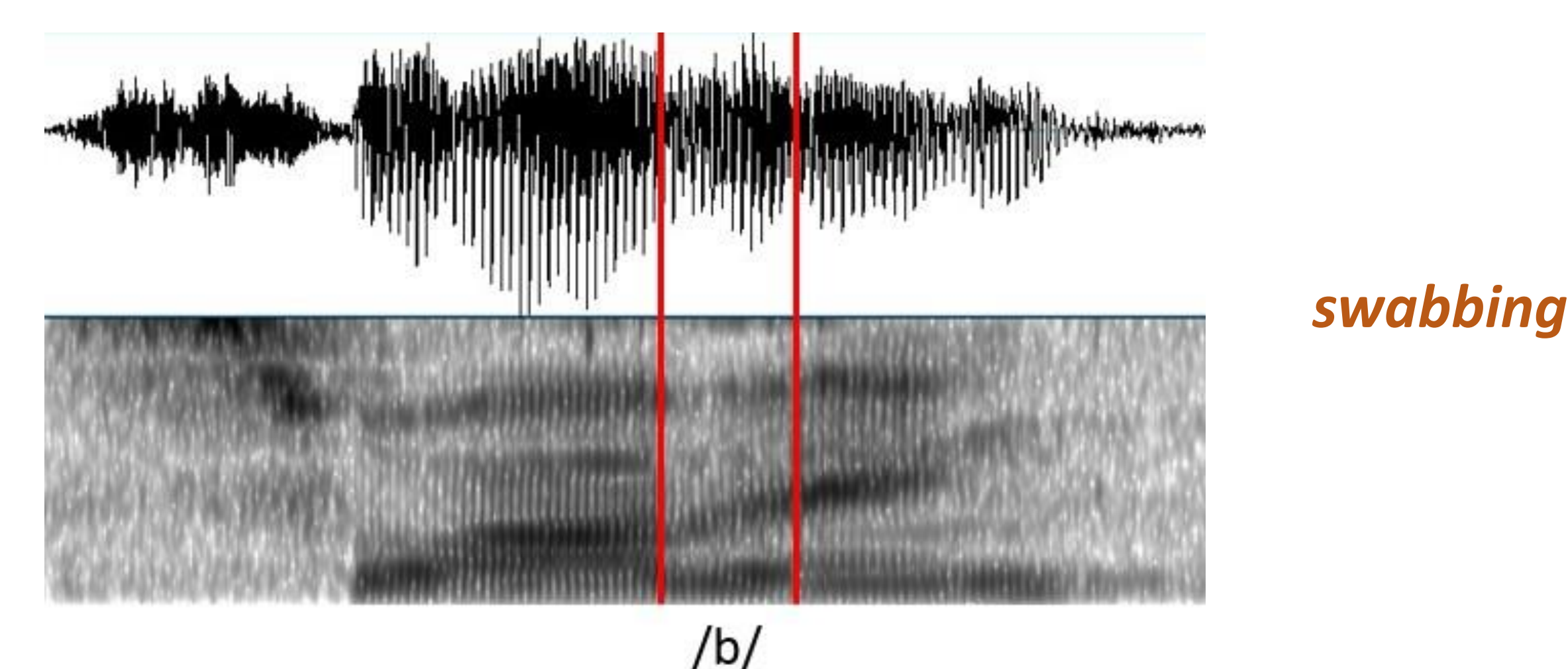
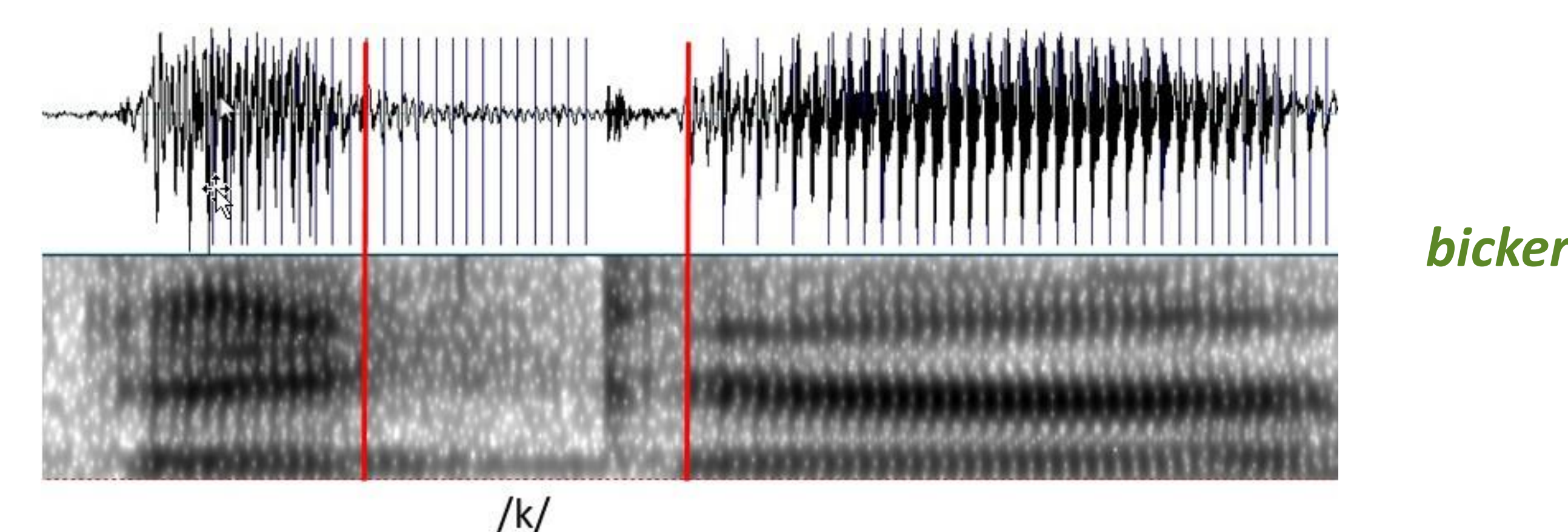
- No significant difference between [+voice] and [-voice] medial stops
- Some of the [-voice] stops are prevoiced!
- A near-significant difference between [+voice] and short lag [-voice] medial stops ($p = 0.08$)

SUMMARY and DISCUSSION

- In the **initial position**, only the phonemically contrasting stops are differentiated via onset f0.
- **Short Lag stops** have a higher onset f0 in **post-s position** than in **initial position** – because initials are [+voice] and post-s are [0voice] (or [-voice])?
- However, **short lag stops** in **medial position** do not differ from short lag stops in **initial** or **post-s positions**, despite the contrasting phonological specifications – initials are [+voice] and medials are [-voice].
- Moreover, even within the **medial environment** the contrast between [+voice] and [-voice] medial stops DOES NOT appear to be maintained via onset f0.

Medial stops - Sound change in progress? Lenition:

- 55% of [-voice] medial stops had some amount of prevoicing
- Among these, the voiced portion occupied on average 63% of the closure
- [+voice] medial stops sometimes looked like approximants (formant structure and no visible release).



CONCLUSIONS

- Onset f0 pattern in the **initial stops** is consistent with the phonological hypothesis. Mixed results in other positions:
- 1. Onset f0 in phonetically comparable stops across positions is neither identical (=phonetic hypothesis) nor distributed according to the phonological specifications ([+voice] < [0voice] < [-voice]).
- 2. The **medial stops** in particular show peculiar results: Even the difference between the prototypical [+voice] (lead VOT) and [-voice] (short lag VOT) did not reach significance. Possibly it is due to the contrast shifting from voiced vs. voiceless stop to approximant vs. voiced stop.
- Analysis of the remaining data may further clarify the patterns of onset f0 across positions.

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