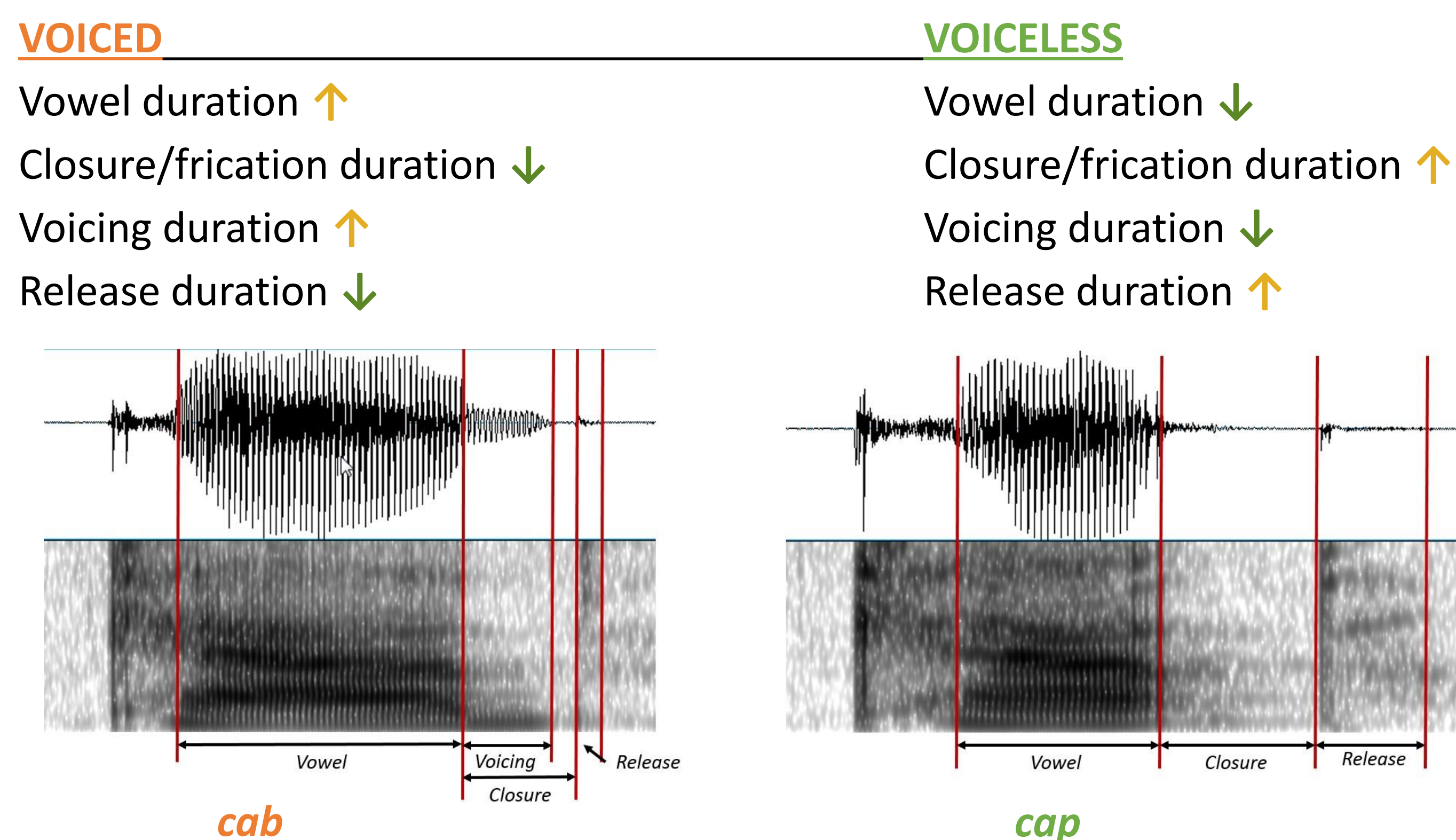




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168th Meeting of the Acoustical Society of America

BACKGROUND

- ❖ In English **voicing contrast** is maintained in **word-final position**.
- ❖ Multiple acoustic correlates differentiate **voiced** and **voiceless** obstruents:



- ❖ However, **word-final devoicing** is a phonetically-natural and cross-linguistically common phenomenon (Ohala, 1983).
- ❖ A tendency for **final devoicing** has been also reported for English (Docherty, 1992), for **fricatives** in particular.

CURRENT STUDY:

- ❖ Examines **the robustness of voicing contrast**:

 1. In different types of obstruents: stops, fricatives, and affricates.
 2. Across multiple acoustic correlates: the vowel duration, closure/frication duration, voicing duration, and release duration.
 3. Possible **compensatory relationship** between acoustic correlates in differentiating voiced and voiceless obstruents.

PREDICTIONS

- ❖ The frequency of unreleased final stops may jeopardize the realization of release duration as a voicing correlate.
- ❖ Other voicing correlates may become more important in unreleased stops in particular.
- ❖ Laryngeal voicing is believed to be incompatible with frication, however other durational correlates of voicing may become more robust in fricatives.

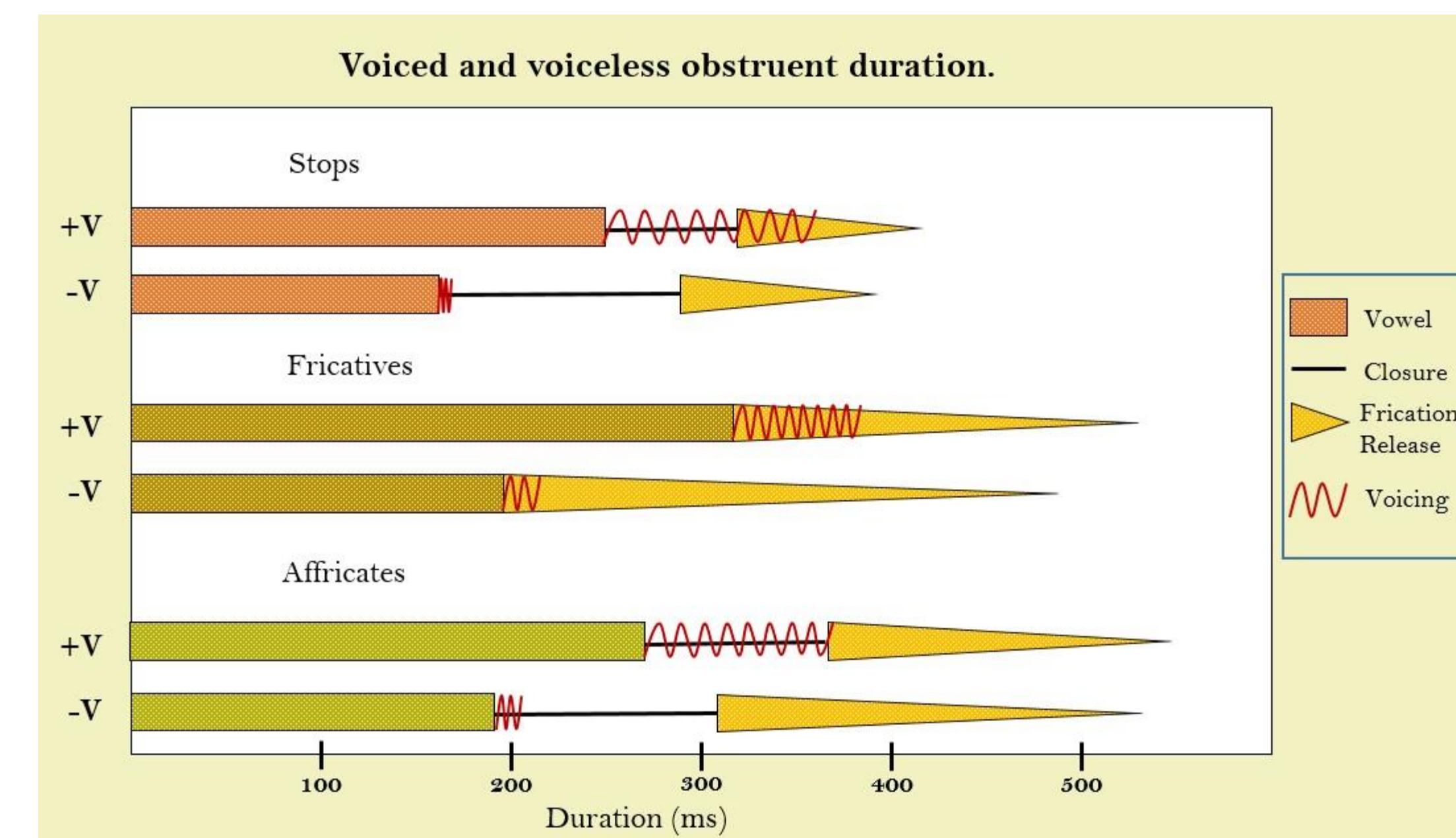
METHODS

- | | | |
|--|---|--|
| STIMULI <ul style="list-style-type: none"> ➢ STOPS: <i>cap - cab</i>
6 min pairs per PA ➢ FRICATIVES:
<i>fuss - fuzz</i>
6 min pairs ➢ AFFRICATES:
<i>rich - ridge</i>
2 min pairs ➢ Fillers: 71 item | PROCEDURE <ul style="list-style-type: none"> ➢ Words on the screen ➢ 3 randomized blocks ➢ Presentation: 2 sec ➢ ISA: 0.5 sec PARTICIPANTS <ul style="list-style-type: none"> ➢ 20 NS Mid Western Am. English ➢ W. Lafayette, IN ➢ 14 analyzed | MEASUREMENTS <p>Continuous:</p> <ul style="list-style-type: none"> ➢ Vowel duration ➢ Closure/frication duration ➢ Voicing duration/% ➢ Release duration <p>Categorical:</p> <ul style="list-style-type: none"> ➢ Presence of voicing ➢ Presence of release |
|--|---|--|

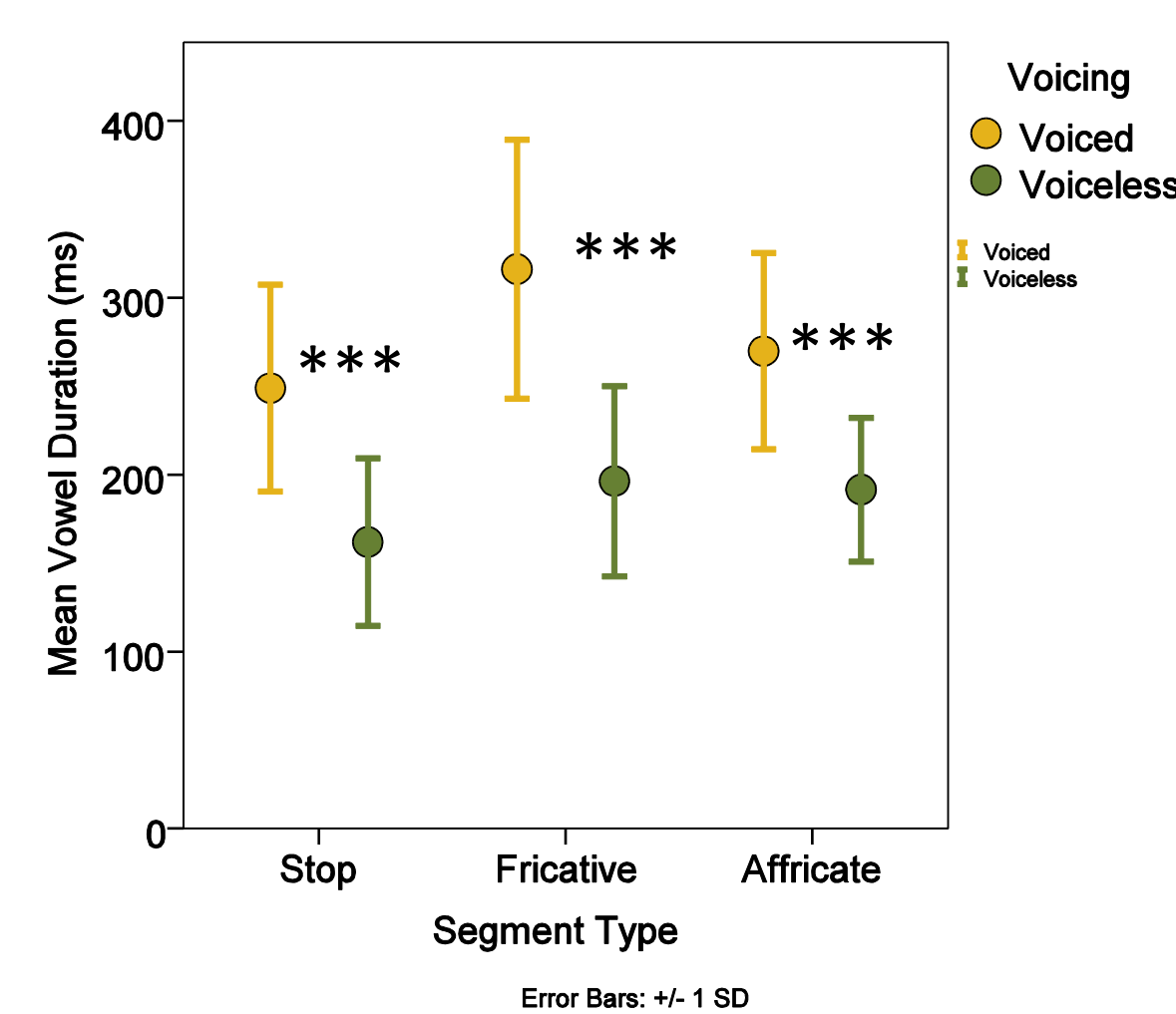
ANALYSIS and RESULTS

Overall Durational Results

- Longer vowel duration in voiced obstruents across segment types
- Longer voicing in voiced obstruents across segment types
- Shorter closure in voiced stops and affricates
- Shorter frication in voiced fricatives and affricates

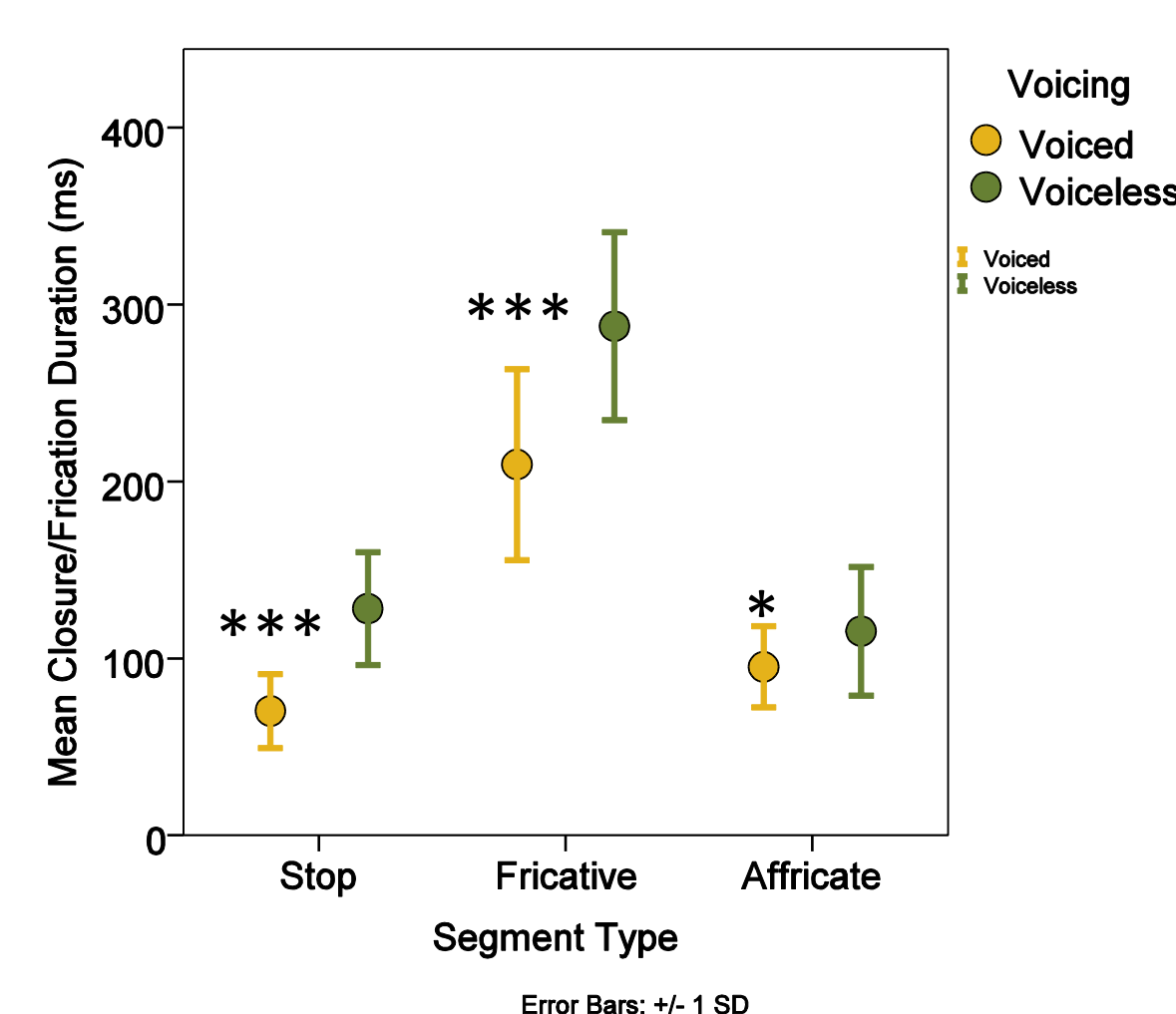


EFFECT OF VOICING AND SEGMENT TYPE ON VOWEL DURATION



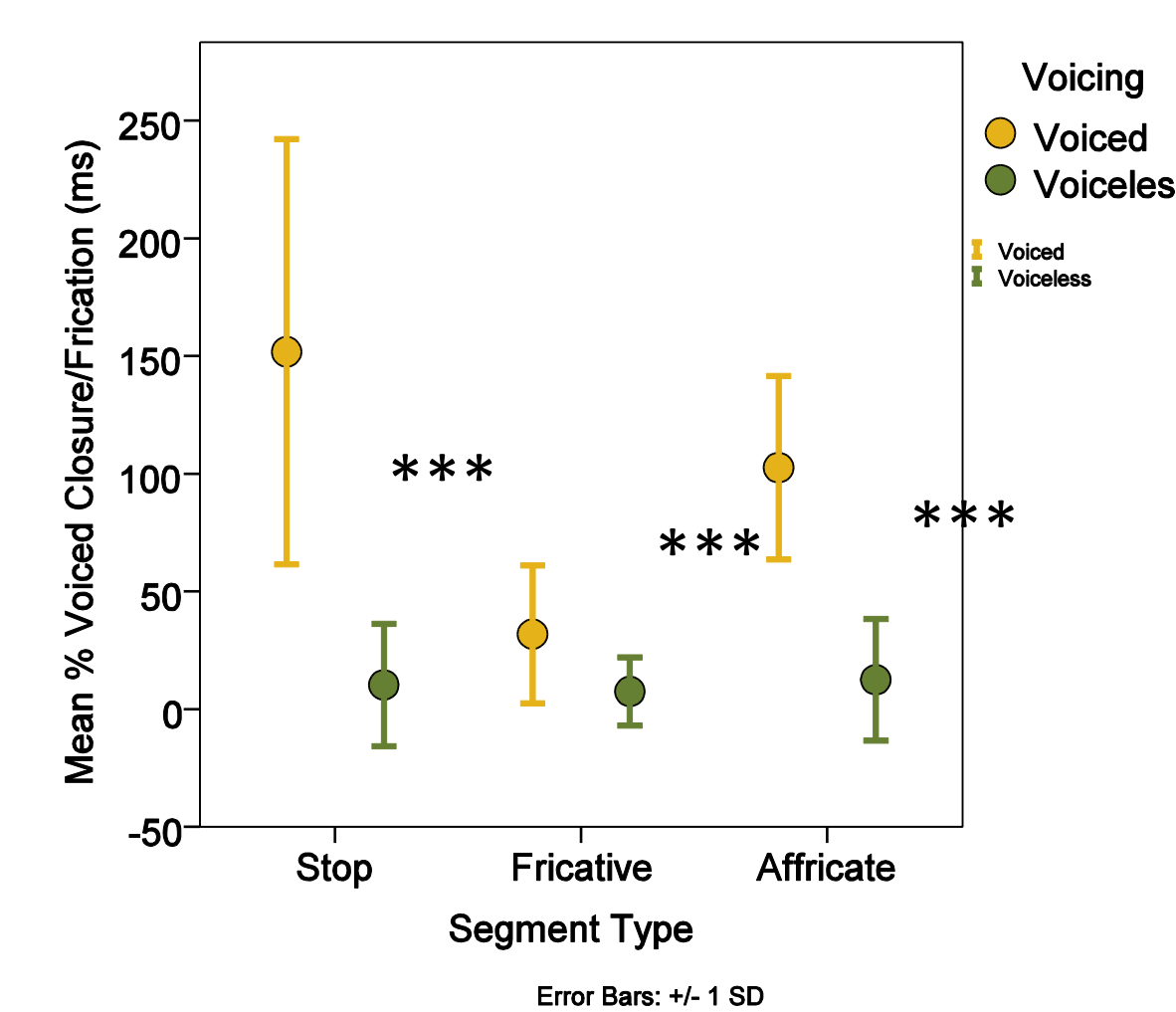
- ❑ Significant Effect of **VOICING** ($p < 0.001$):
voiced > voiceless
- ❑ Significant Effect of **Segment Type** ($p < 0.001$):
stop < affricate < fricative
- ❑ Significant **Interaction** ($p < 0.001$):
the difference is greatest for fricatives, and smallest for affricates

EFFECT OF VOICING AND SEGMENT TYPE ON CLOSURE/FRICATION DURATION



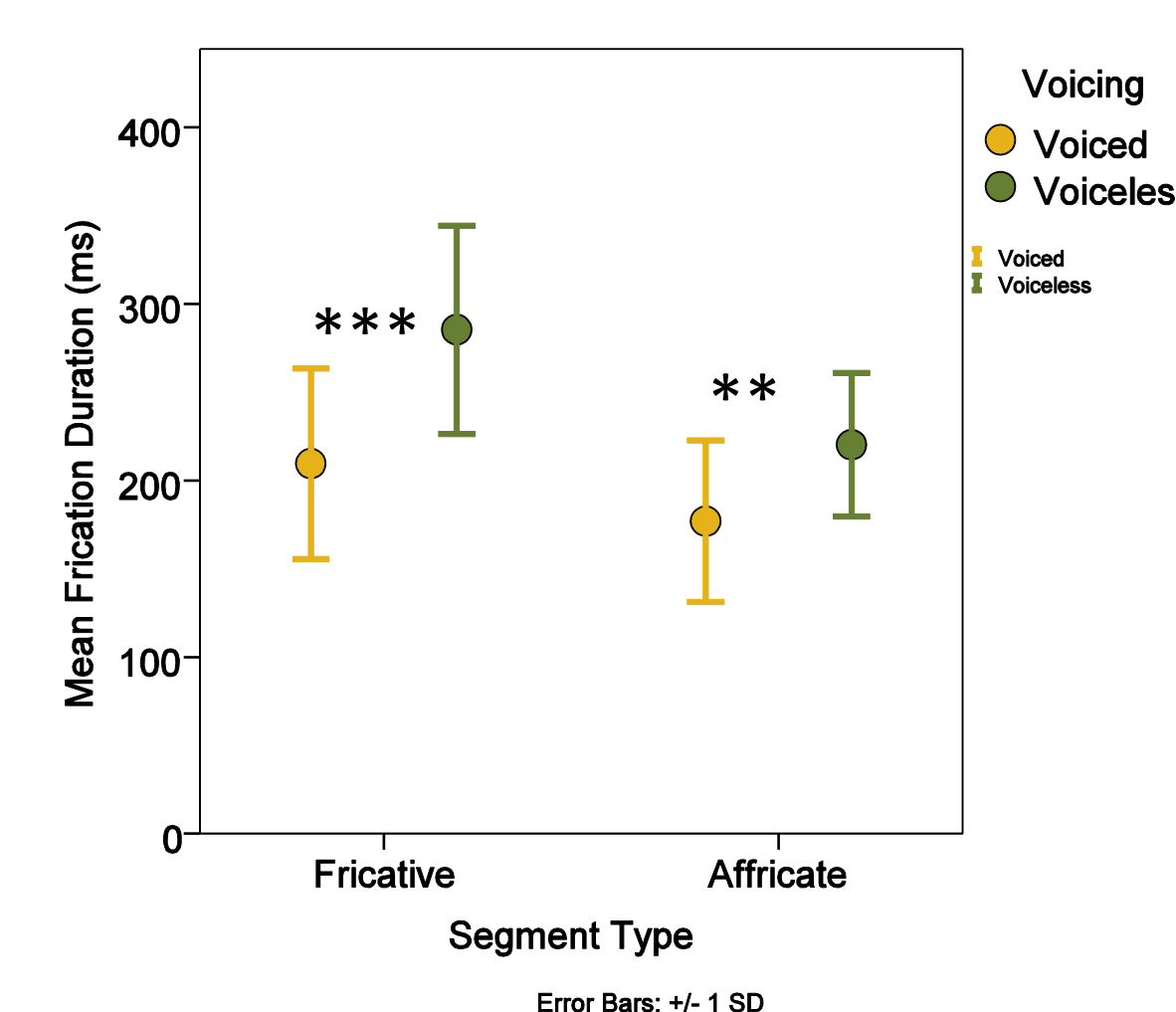
- ❑ Significant Effect of **VOICING** ($p < 0.001$):
voiced < voiceless
- ❑ Significant Effect of **Segment Type** ($p < 0.001$):
stop, affricate < fricative
- ❑ Significant **Interaction** ($p < 0.001$):
the difference is greatest for fricatives, and smallest for affricates

EFFECT OF VOICING AND SEGMENT TYPE ON VOICING DURATION



- ❑ Significant Effect of **VOICING** ($p < 0.001$):
voiced > voiceless
- ❑ Significant Effect of **Segment Type** ($p < 0.001$):
stop > affricate > fricative
- ❑ Significant **Interaction** ($p < 0.001$):
the difference is smallest for fricatives, and greatest for stops

EFFECT OF VOICING AND SEGMENT TYPE ON FRICATION DURATION



- ❑ Significant Effect of **VOICING** ($p < 0.001$):
voiced < voiceless
- ❑ Significant Effect of **Segment Type** ($p < 0.001$):
affricate < fricative
- ❑ Significant **Interaction** ($p < 0.05$):
the difference is greater for fricatives than for affricates

ANALYSIS and RESULTS

- No effect of **VOICING** on Release Duration in stops ($p = 0.226$).
- However, **the likelihood of release** was significantly effected by **VOICING**:
voiceless stops are significantly more likely to be released than voiced stops:
 $\chi^2(1, N = 2253) = 40.863, p < .001$

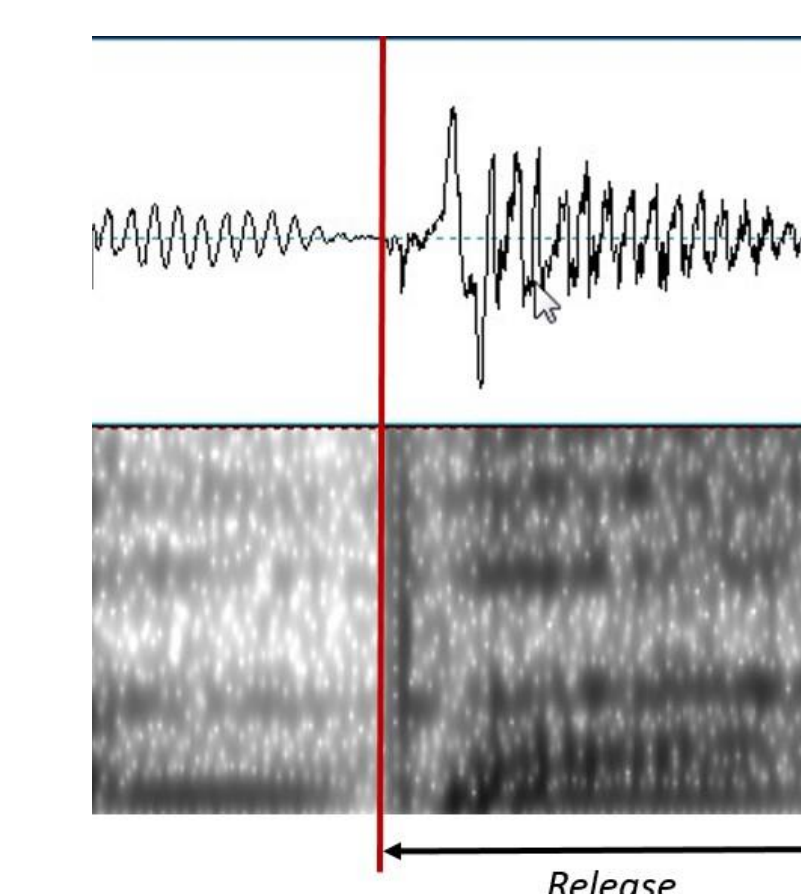
	Released
Voiceless Stops	96%
Voiced Stops	89%

Participants who produced both released and unreleased voiced stops:

RELEASE AND VOWEL DURATION IN VOICED STOPS

- ❑ Significant Effect of **Release** on **Vowel Duration** ($p < 0.05$):

V before Unreleased Voiced Stops > V before Released Voiced Stops



RELEASE AND VOICING DURATION IN VOICED STOPS

- ❑ Significant Effect of **Release** on **Voicing Duration** ($p < 0.01$):

Unreleased Voiced Stops < Released Voiced Stops (for most released stops voicing continued into the Release)

VOICING PRESENCE AND SEGMENT TYPE

- ❑ **Voiced Fricatives** are significant *less likely* than stops and affricates to have **voicing**: $\chi^2(2, N = 1148) = 140.233, p < .001$
- ❑ **Voiceless Fricatives** are significantly *more likely* than stops and affricates to have **voicing**: $\chi^2(2, N = 1107) = 59.456, p < .001$

	Stops	Fricatives	Affricates	Total
Voiced	99%	80%	99%	95%
Voiceless	16.5%	40%	28%	23%

CONCLUSIONS

- Voiced and voiceless **fricatives** are least well distinguished via **the frequency of voicing and duration of voicing**.
 - Possibly for aerodynamic reasons: voicing needs low supraglottal pressure, but frication needs high supraglottal pressure.
- But they are distinguished better via **the vowel and constriction duration**.
 - To compensate for low distinctiveness in voicing?
- **Stops** are well distinguished via all acoustic correlates except **release duration**
 - Released is not used because it is often absent?
- In addition, **voiced stops** are more likely to be **unreleased** but also have a **longer vowel duration** than released voiced stops.
 - To compensate for the unavailability of the **closure duration cue**?
- **Affricates** fare the worst in all parameters but **voicing duration**.
 - Can they afford lower degree of distinctiveness in individual correlates because of higher **cue redundancy**?
 - Affricates are **always released**; both **closure** and **frication duration** are available as cues to voicing.

ACKNOWLEDGMENTS

Many thanks to Audrey Bengert, Alyssa Nymeyer, Bethany Sexton, Anna Williams, and Emilie Zeller for help with data collection and analysis. Thanks to Alexander Francis, CHAT lab, and to all the participants.