

# **Temporal articulatory stability, phonological variation, and lexical contrast preservation in diaspora Tibetan**

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# Acknowledgements

## It takes a village to write a dissertation

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- Participants & research assistants
- Teachers, mentors, collaborators, colleagues, students, conference buddies, co-work partners...

We'll get through this



# Introduction

- Framework ← Articulatory Phonology: represents temporal coordination  
*(Browman & Goldstein 1988; Nam & Saltzman 2003)*
- Methods ← audio recordings, articulatory imaging
- Perspectives:
  - Cognitive/Theoretical ← representations and processes
  - Social ← variation between speakers
  - Historical ← change over generations



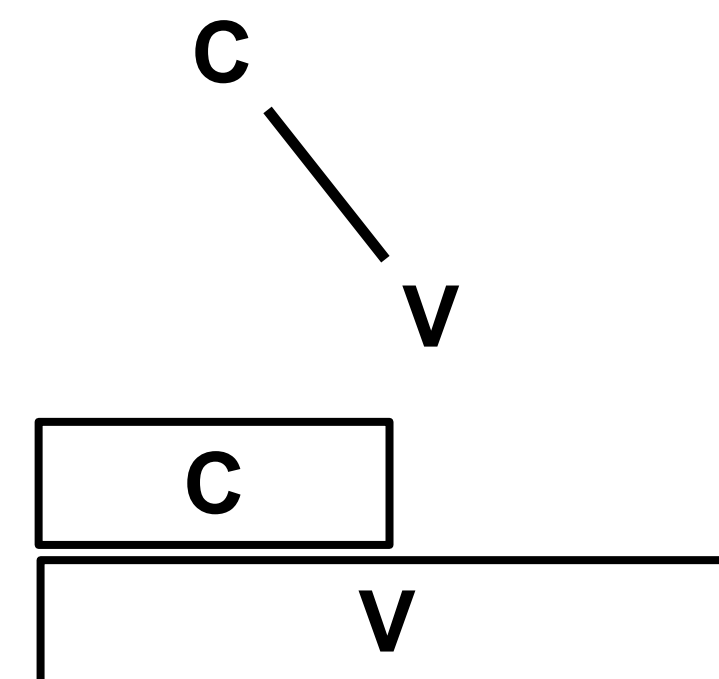
# Coordinating gestures in time

## Articulatory Phonology in one slide

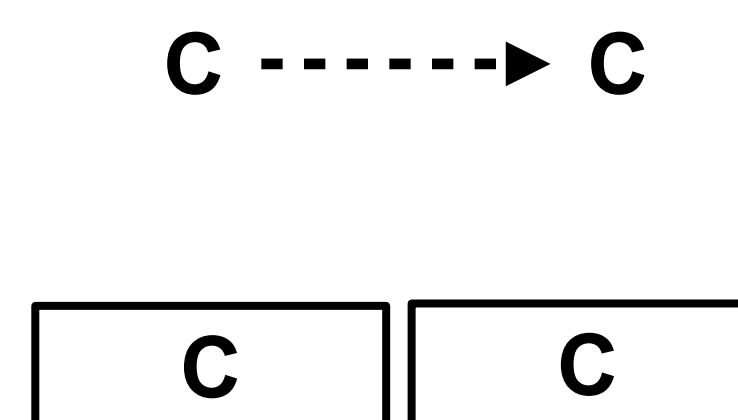
- *Gesture*: dynamic movements in the vocal tract that unfold over time.
- Gestural coupling modes:
  - *In-phase coupling*: (synchronous) and *Anti-phase coupling* (sequential) are most stable
  - *Competitive coupling*: combination of in-phase and anti-phase coupling relations
  - *Eccentric coupling*: one coupling relation, just not intrinsically stable

(Nam & Saltzman 2003, Nam et al. 2009, Goldstein 2011)

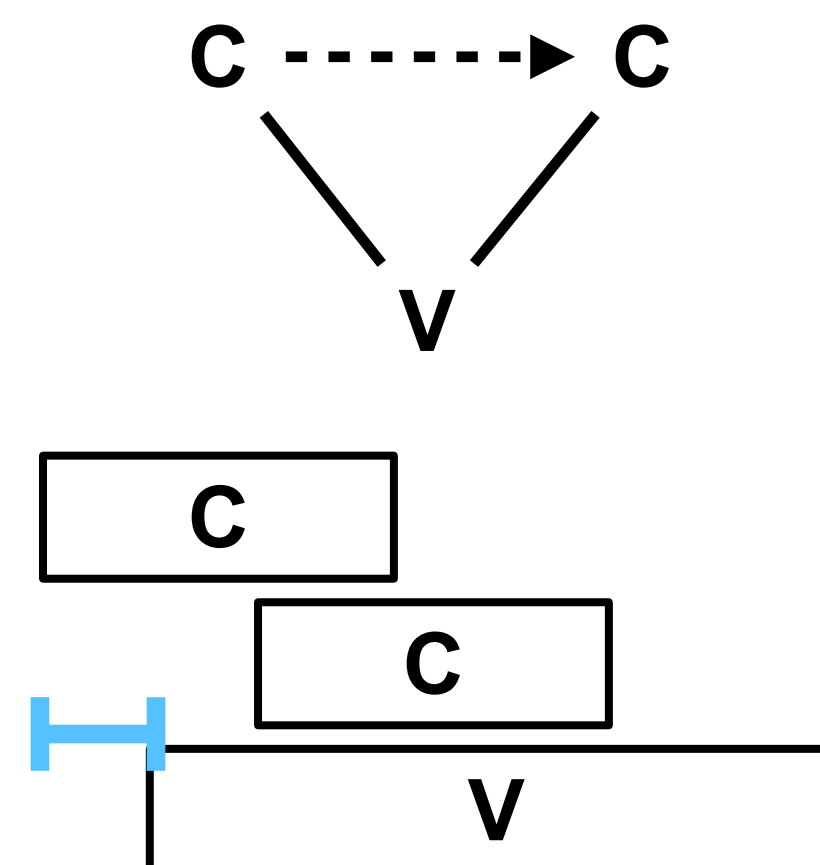
### In-phase



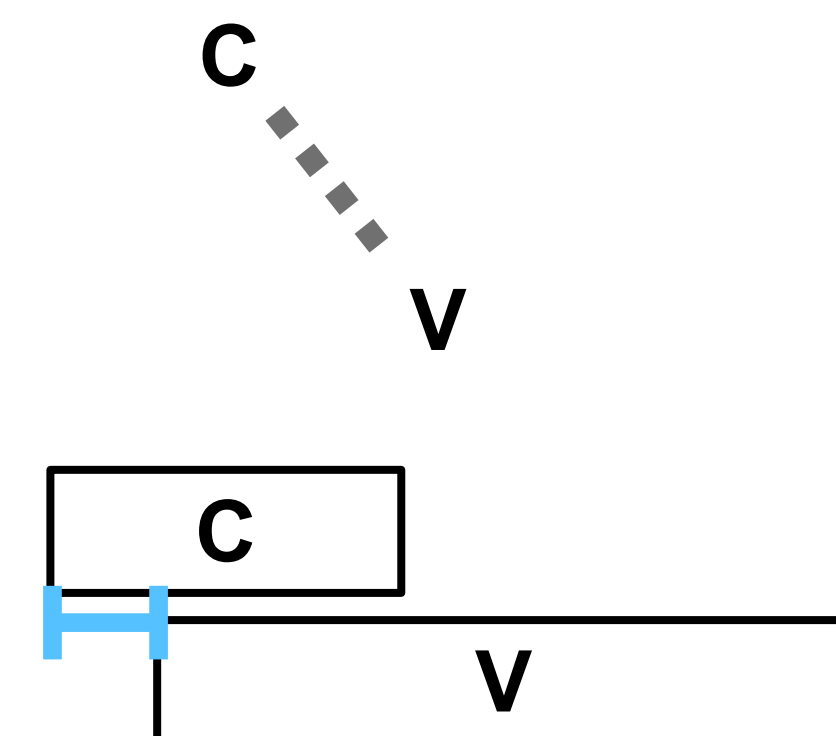
### Anti-Phase



### Competitive



### Eccentric

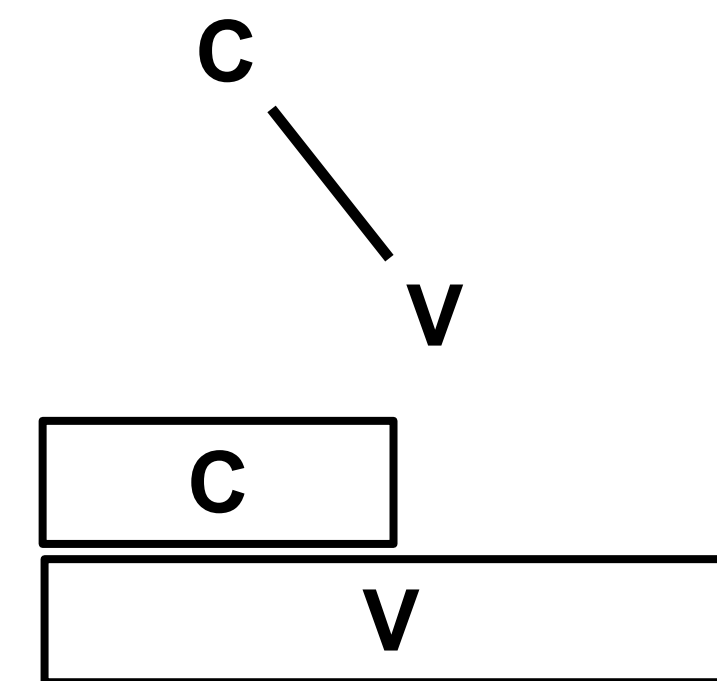


# Coordinating tone gestures

## Articulatory Phonology in one slide

- *Tone gesture*: treat F0 targets similar to articulatory targets
- For lexical tone languages, C-V timing has a **lag** suggesting competitive coupling
- difference between lexical tone and intonational tone...

### In-phase

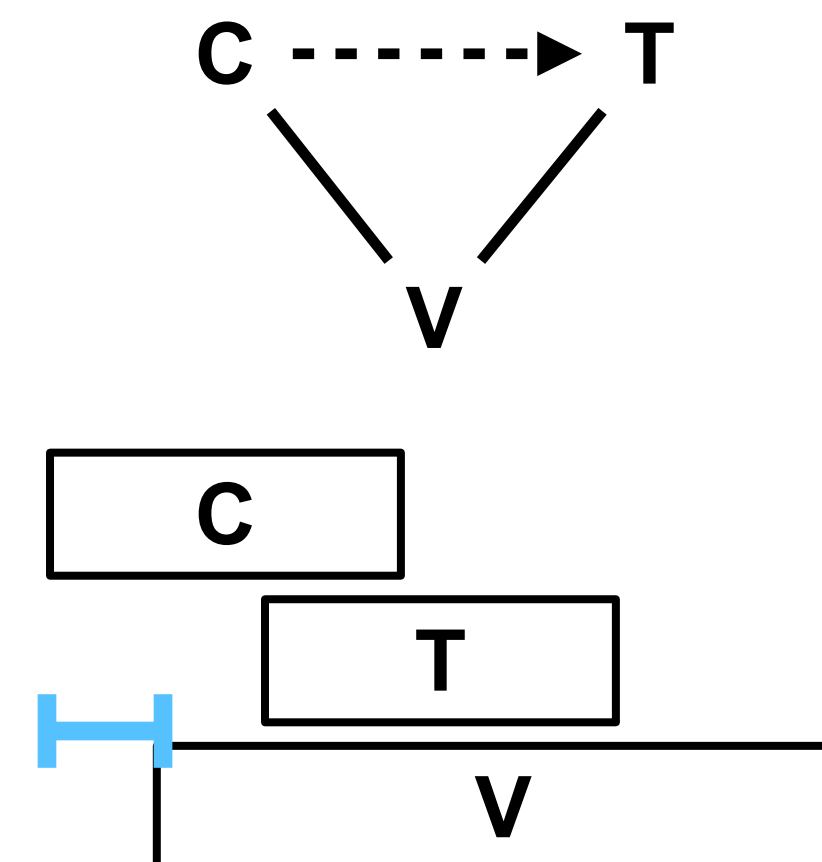


### Anti-Phase

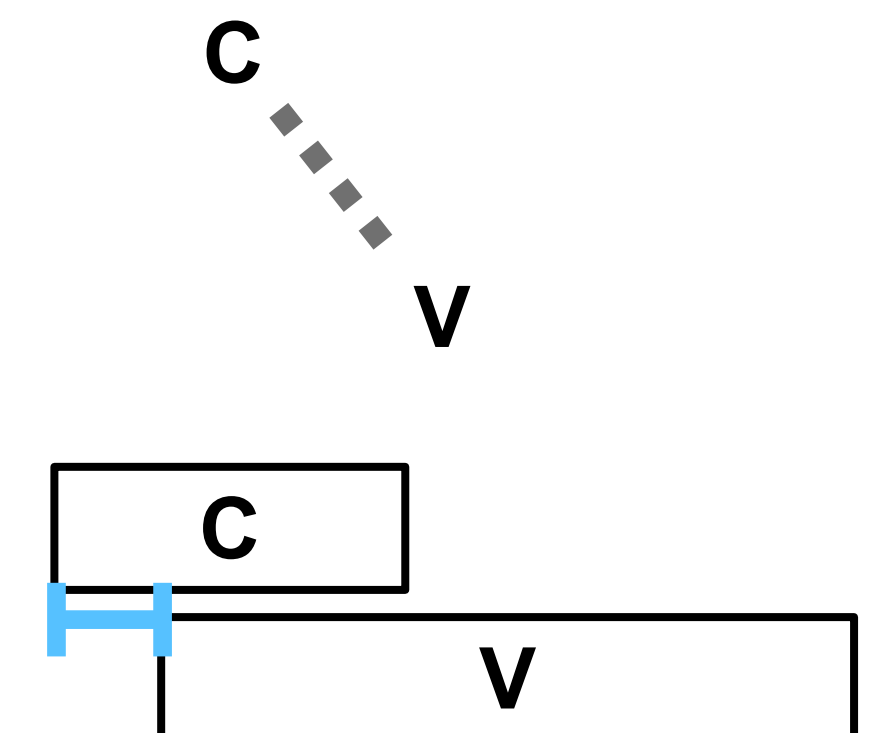
C -----> T



### Competitive



### Eccentric



# A “Natural Laboratory”

- A language with variation across dialects & speakers:
  - lexical tone
  - onset consonant clusters
  - laryngeal phonology
- Tone gestures predicts that tone affects relative C-V timing. Observed in:
  - lexical tone languages (Mandarin, Thai, Lhasa Tibetan)  
*(Gao 2008, Karlin 2014, Hu 2016)*
  - contextually-toneless syllables (Mandarin)  
*(Zhang et al. 2019)*
  - across speakers of the same language...

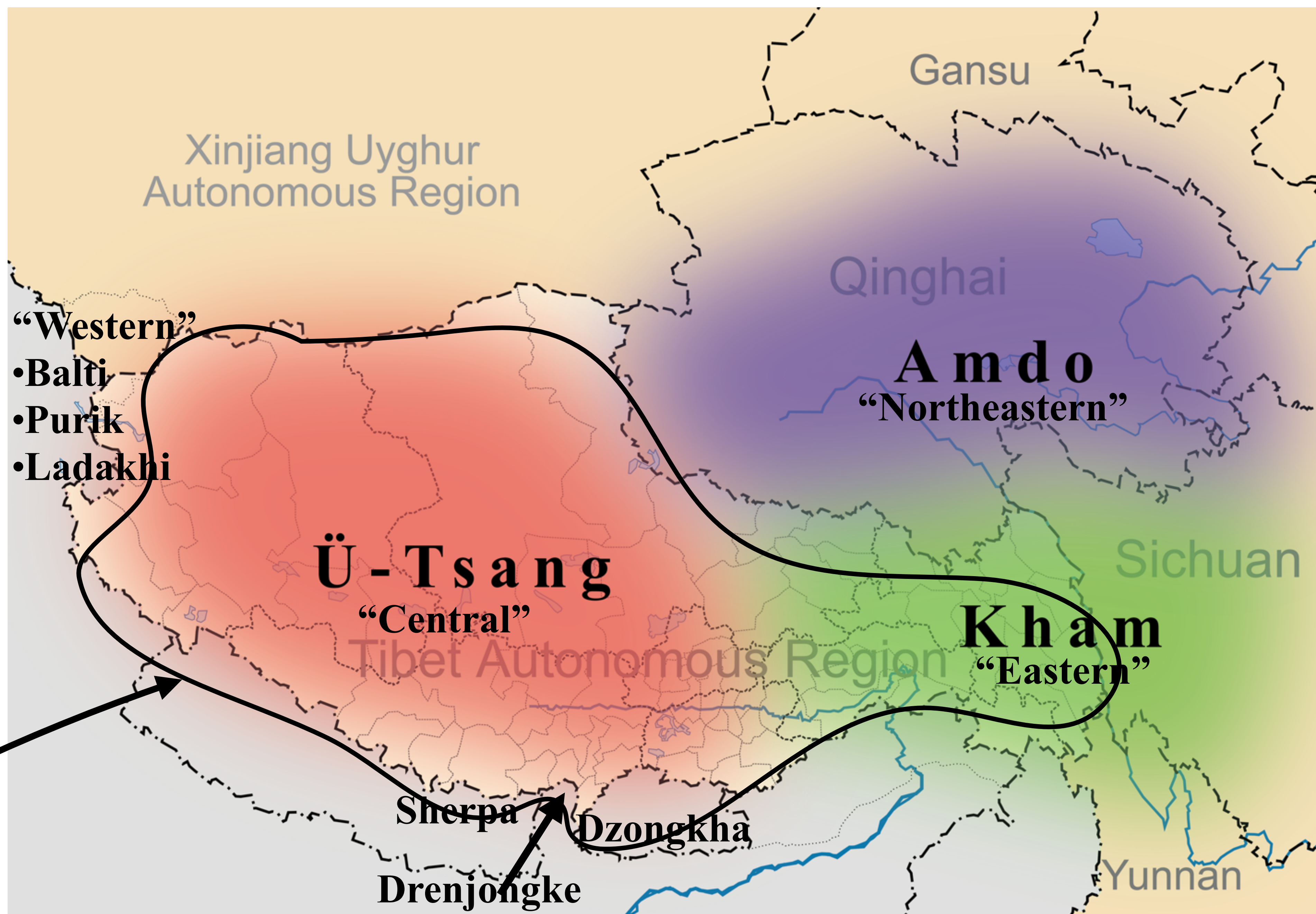


# Tibetan

བོད་སྐད་

- “archaic”/“cluster”
- “innovative”/“non-cluster”
- dialect continuum
- post-1959 diaspora

Approx.  
extent of  
tone



# Dialects: Natural laboratory

- tonogenesis
- laryngeal variation
- cluster simplification
- vowel shifts, spirantization, retroflexion, palatalization
- evidential, honorifics, modality, etc.

Written (Classical) Tibetan	Balti (Western)	Rebkong (Northeastern)	Tokpe Gola (Central)	Gloss
<i>khrag</i>	[kʂʌk]	[t̪ɕʁɣ]	[tʰʌk] ([tʰák])	‘blood’
<i>rtswa</i>	[xstsoa]	[xtsa]	[tsá]	‘grass’
<i>spyang ki</i>	[spjaŋ.ˈku]	[xt̪ɕaŋ.ˈkʰɣ]	[t̪ʂáŋ.gú]	‘wolf’
<i>bcu bdun</i>	[t̪ɕub.ˈdun]	[t̪ɕɣb.ˈdɣn]	[t̪ʂúp.tũ] ([t̪ʂúp.tý])	‘seventeen’

(Adapted from Caplow 2013)



# Tonogenesis

(tonal dialects only)

- Voiceless onsets > high tone
- Voiced onsets > low tone
- Sonorants with pre-initial > high tone
- \*p<sup>h</sup>ar ‘over there’ > H  
  \*sa ‘earth’ > H
- \*bar ‘between’ > L  
  \*za ‘eat’ > L  
  \*mar ‘butter’ > L
- \*sman ‘medicine’ > H

# Laryngeal differences

	Etymological onsets				Innovative features
Orthography	ཤྭ	ཕྭ	བྭ	མྭ	
Old Tibetan	s <sup>ə</sup> pa	p <sup>h</sup> a	ba	s <sup>ə</sup> ba	only voicing contrastive
Northeastern and Western dialects	spa	p <sup>h</sup> a	ba	ɣba	consolidation of clusters aspirated/unaspirated contrast
Eastern dialects	pá	p <sup>h</sup> á	pà	bà	tonogenesis cluster simplification
Central dialects (Lhasa)	pá	p <sup>h</sup> á	p <sup>h</sup> à	pà	voiced clusters > voiceless voiced simplex > aspirated

- Why do languages have the temporal coordination they do?
  - Cognitive ← representations and combinations
    - **lexical tone—how does it affect timing of other gestures?**
  - Social ← variation between speakers
    - **variation in community around tone**
  - Historical ← change over generations
    - **documented history of tonogenesis and tone change**



# Corpus study

# Goals

- Establish facts about consonantal and tonal contrasts
  - Interspeaker variation?
  - How to tone and laryngeal contrasts co-occur?
- Inform hypotheses for controlled articulatory study

# Methods

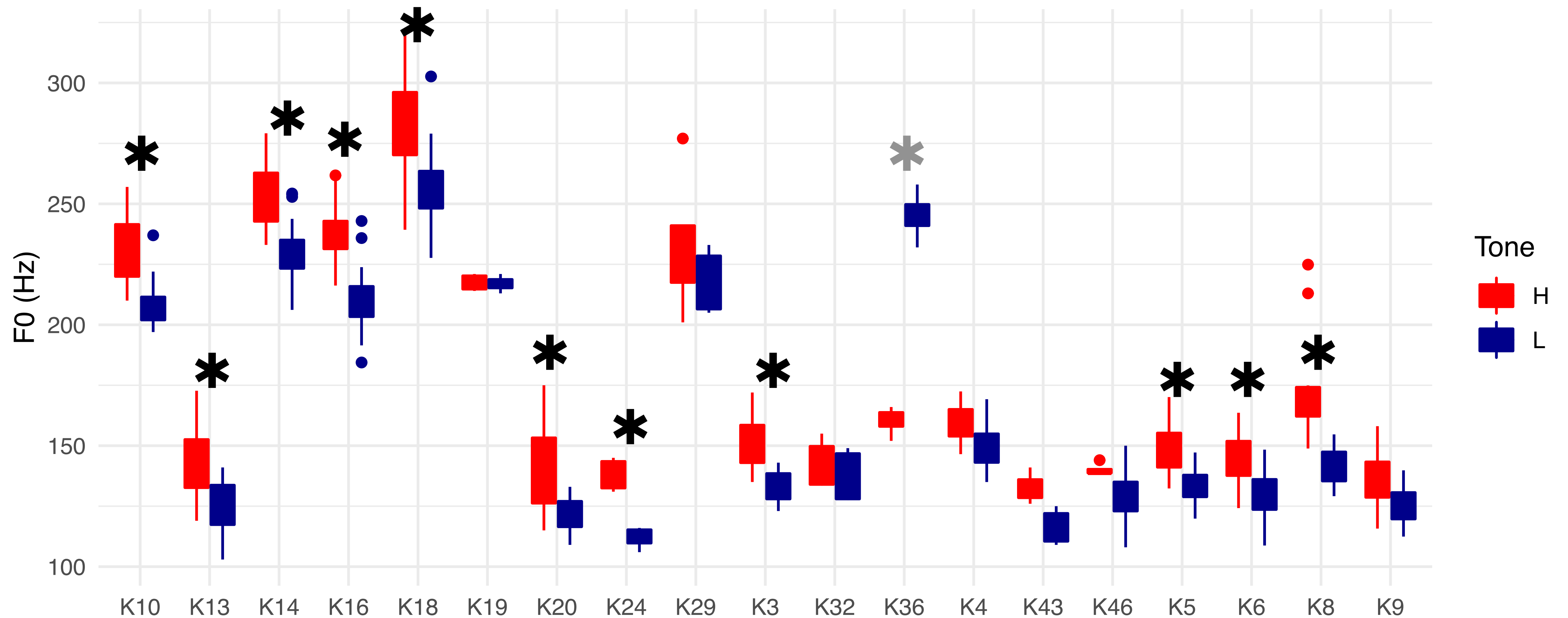
- Word list presented in Tibetan orthography
  - 22 items \* 2 repetitions (from 64-item wordlist)
- Data presented from 19 speakers raised in diaspora (30s or younger)
- Part of a larger study:
  - speakers from other dialects
  - sociolinguistic interviews with other tasks



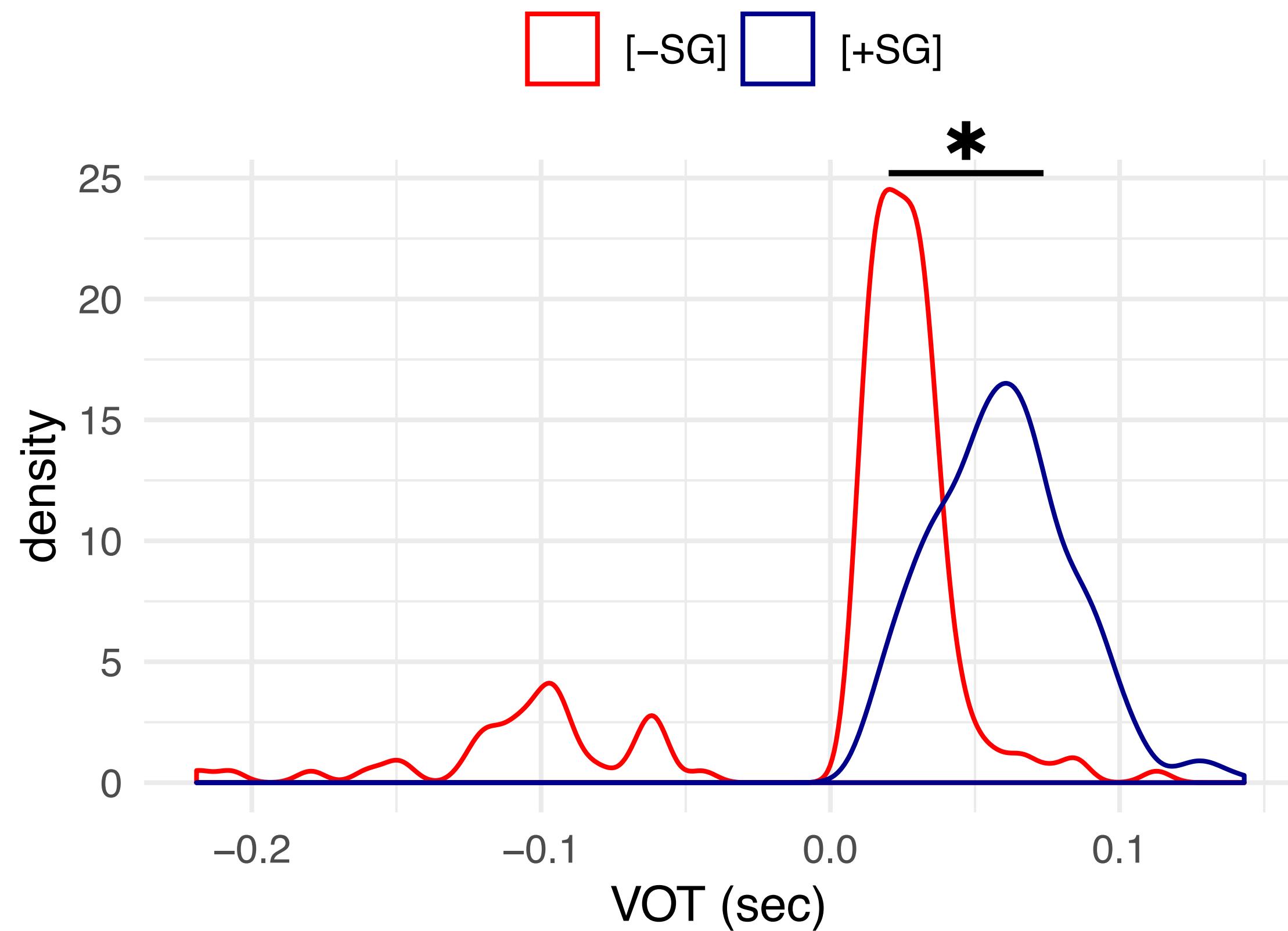
- $H > L$  significant for 11/19 speakers
- no significant difference for 7/19 speakers

# F0-tone

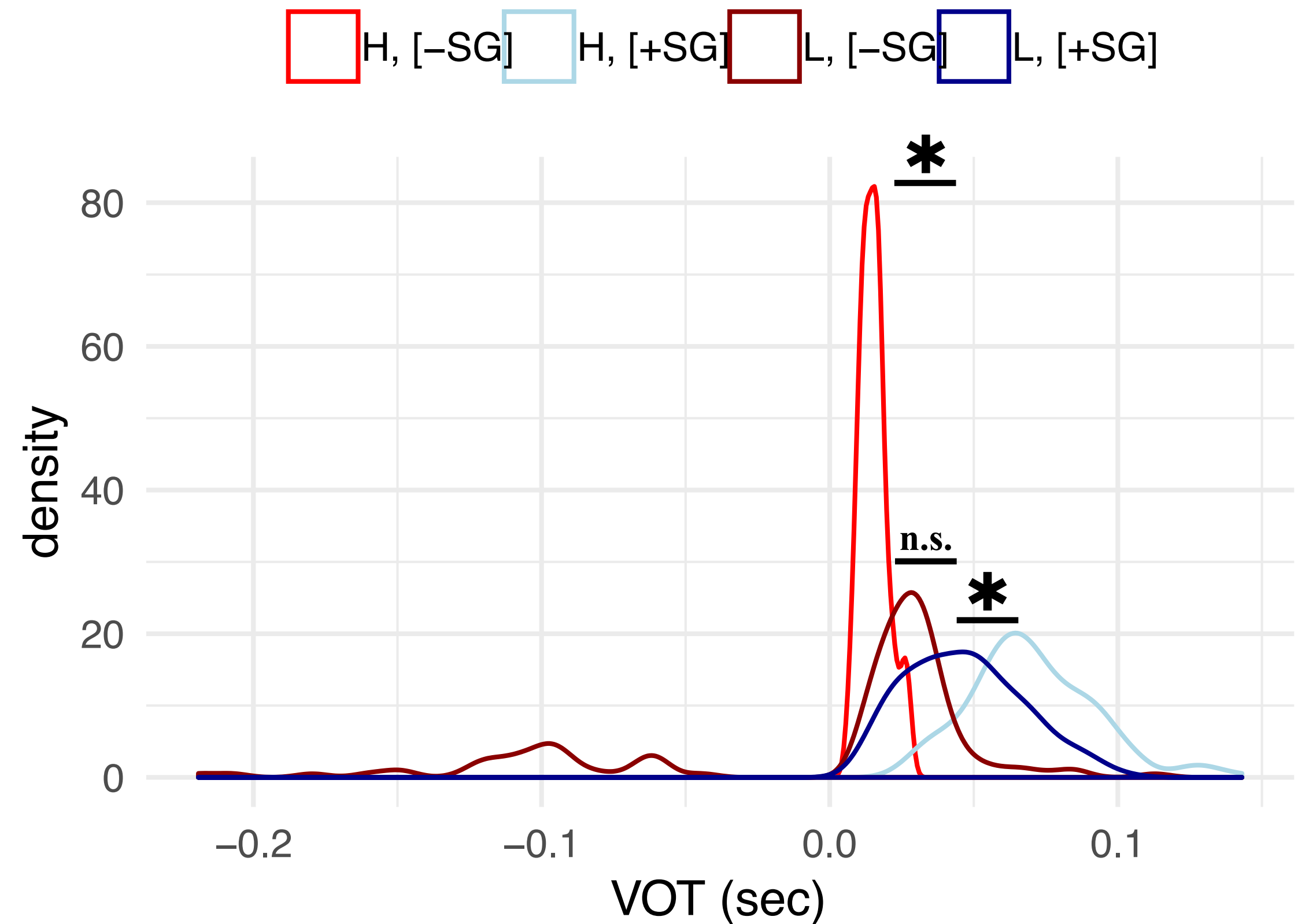
## F0 at onset of voicing



# VOT and tone categories



- Unaspirated vs. aspirated



- Unaspirated vs. aspirated...  
... plus tone

# Summary of corpus study

- Confirmed:
  - no clusters in diaspora speakers
- Novel findings:
  - some speakers lack tone contrast (production)
  - effect of tone on aspiration duration
  - effect of tone on prevoicing



# Articulatory study

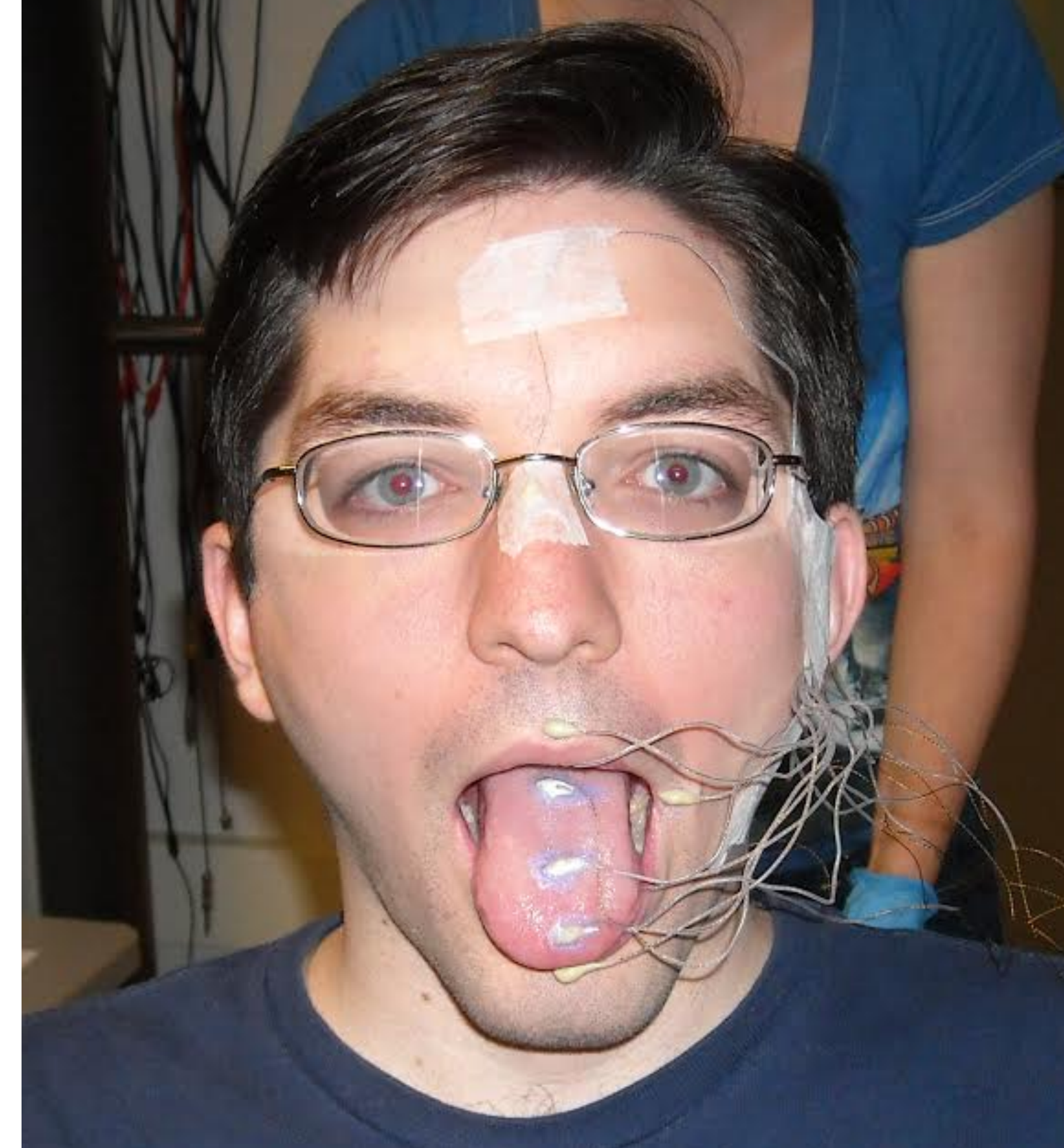
# Hypotheses

- H1: variation in timing conditioned by presence/absence of lexical tone
  - speakers with tone contrast will have competitive coupling (pos. C-V lag)
  - speakers without tone contrast will have in-phase C-V timing (no C-V lag)
- H2: timing convergence:
  - all speakers will have similar coordination patterns despite interspeaker variation in presence/absence of tone
- What kind of tone contrast is there?
  - If H- $\emptyset$ , then difference will be visible in high vs. low tone words
  - If H-L, then no difference in timing by tone.



# Electromagnetic Articulography (EMA)

- A method to track movement with high spatial and temporal resolution
- Speakers read words in carrier phrase on a screen, in Tibetan orthography
- EMA sensors on each lip and three on tongue; head movement corrected w/r/t/ three sensors on rigid points of the head
- Gesture start labelled at 20% of peak velocity to target





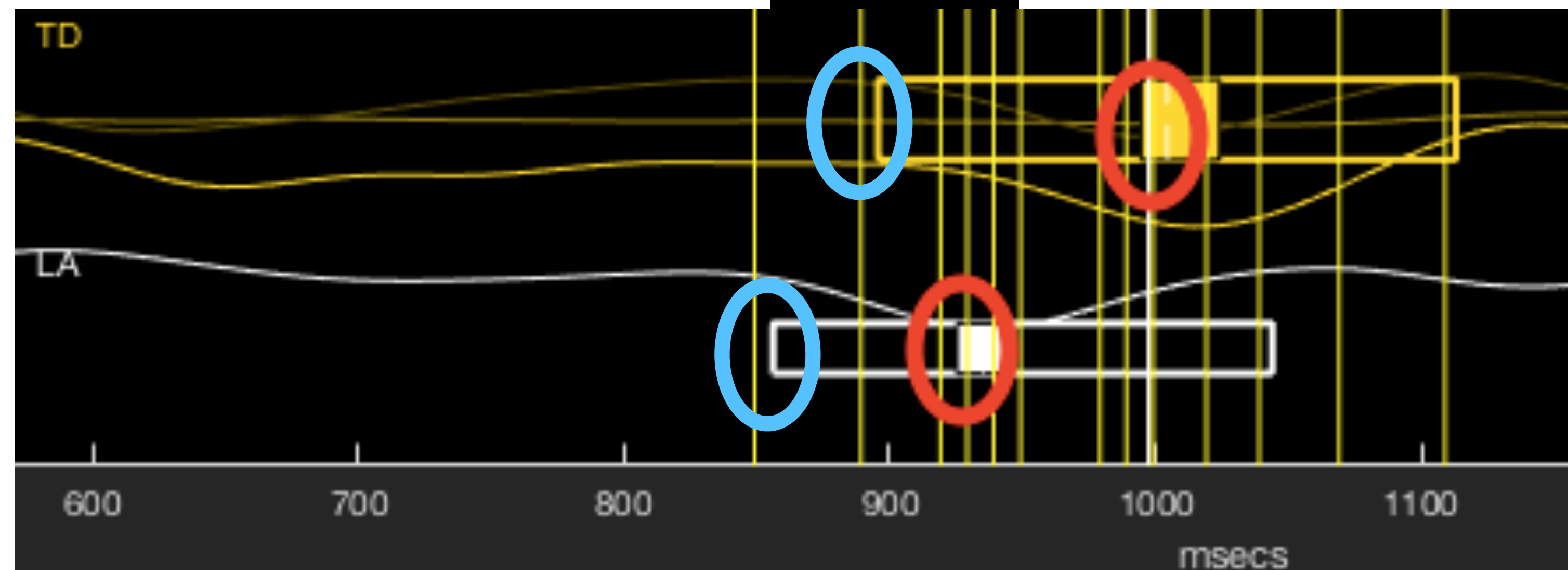
# EMA data

## articulatory trajectories

- Tracks movement of sensors over time
- [p p<sup>h</sup> m]: distance between lip sensors
- [i]→[u o a]: tongue dorsum retraction

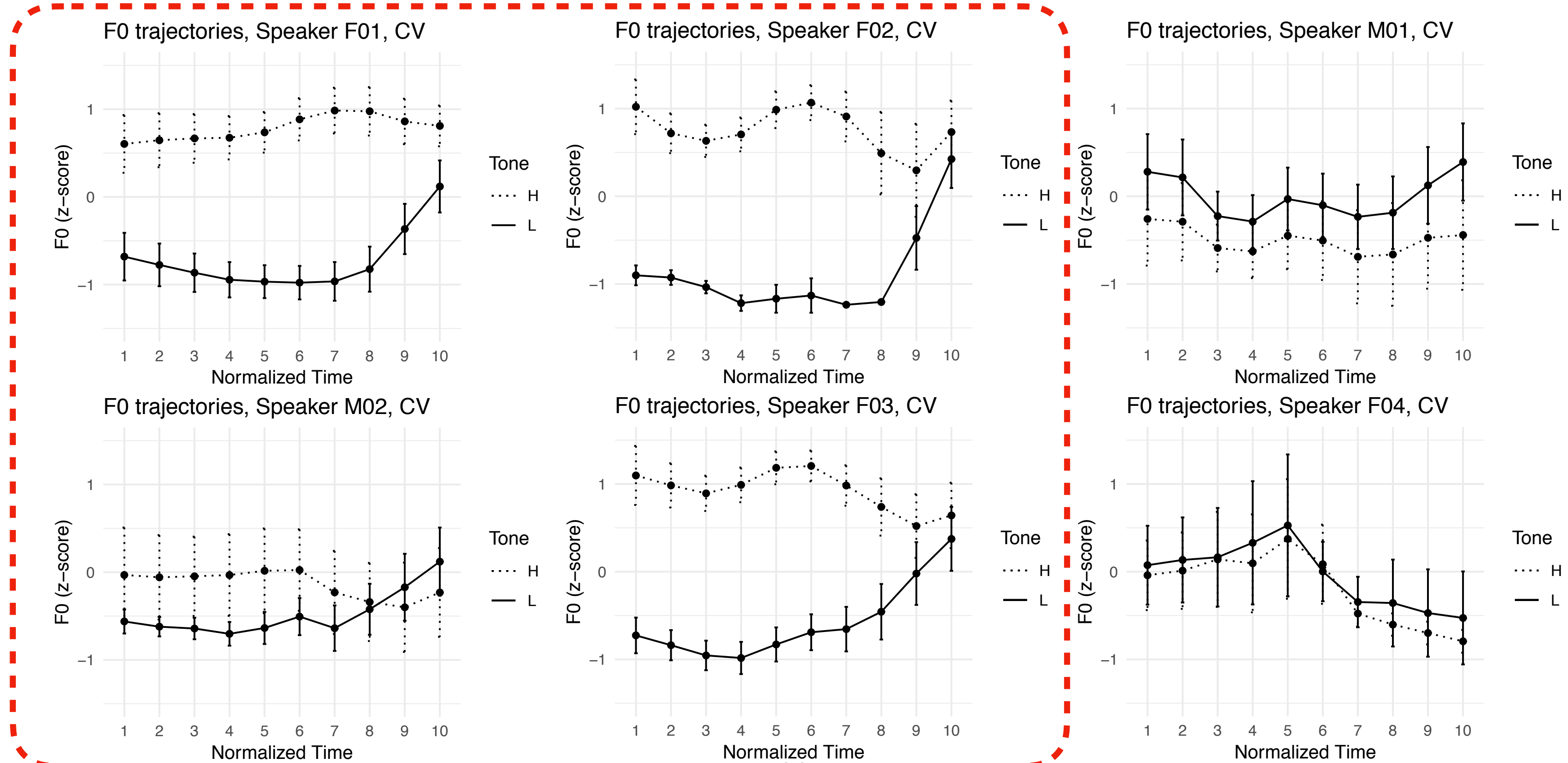
Tongue Dorsum  
front  
↓  
back

Lip Aperture  
open  
↓  
closed



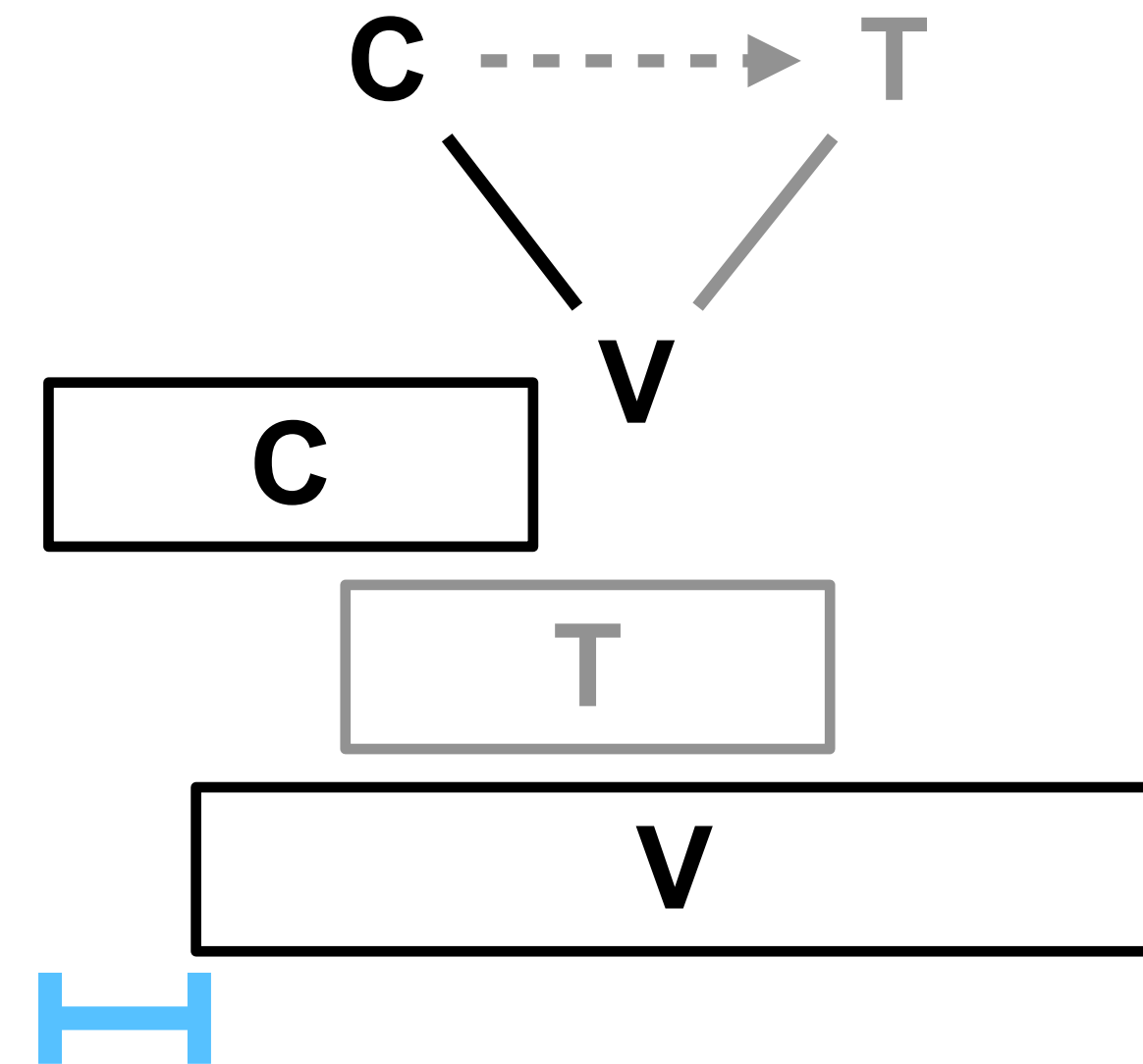
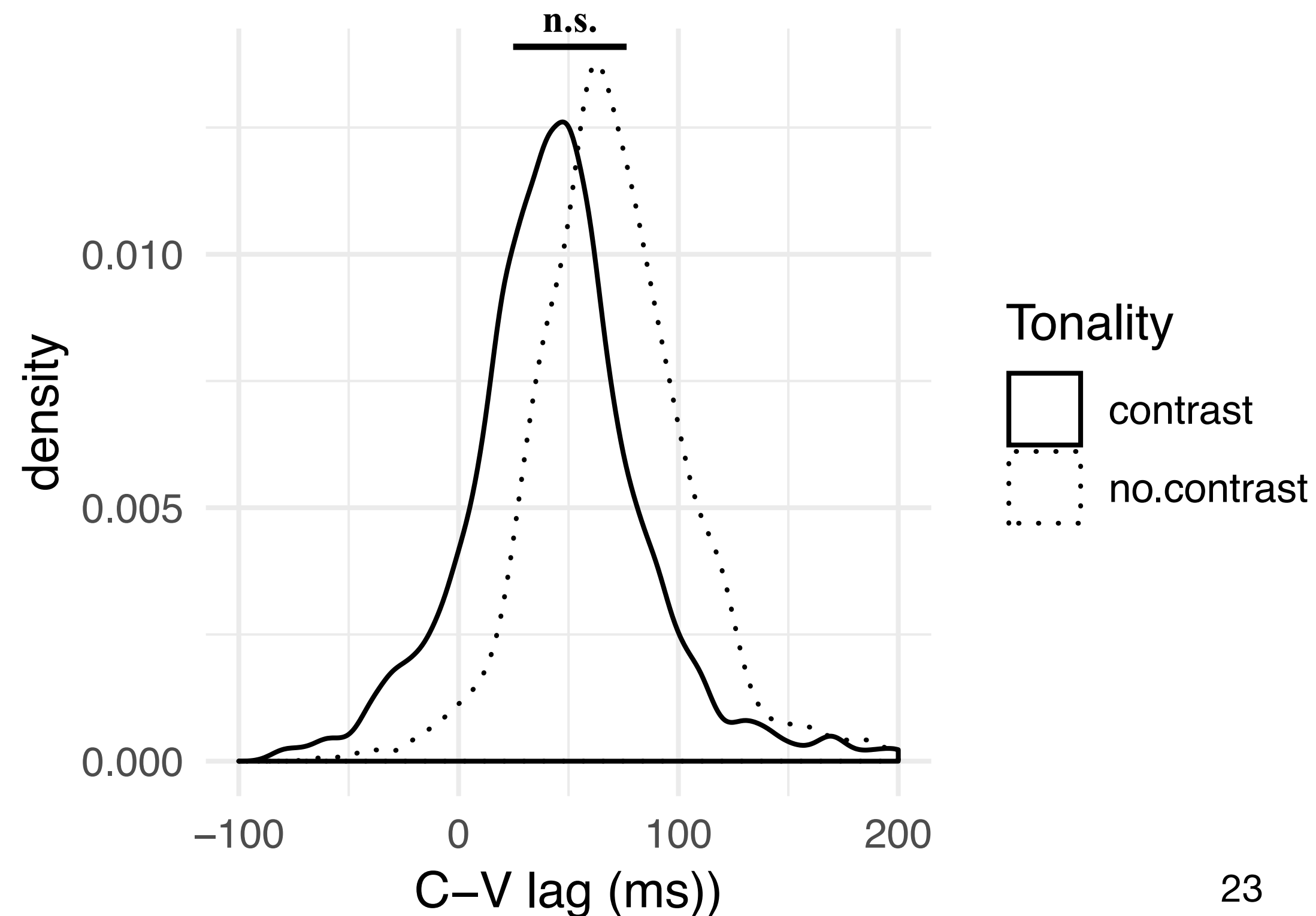
# Results: tone contrast

- 4 speakers produce a tone contrast, two do not (on /mV/)



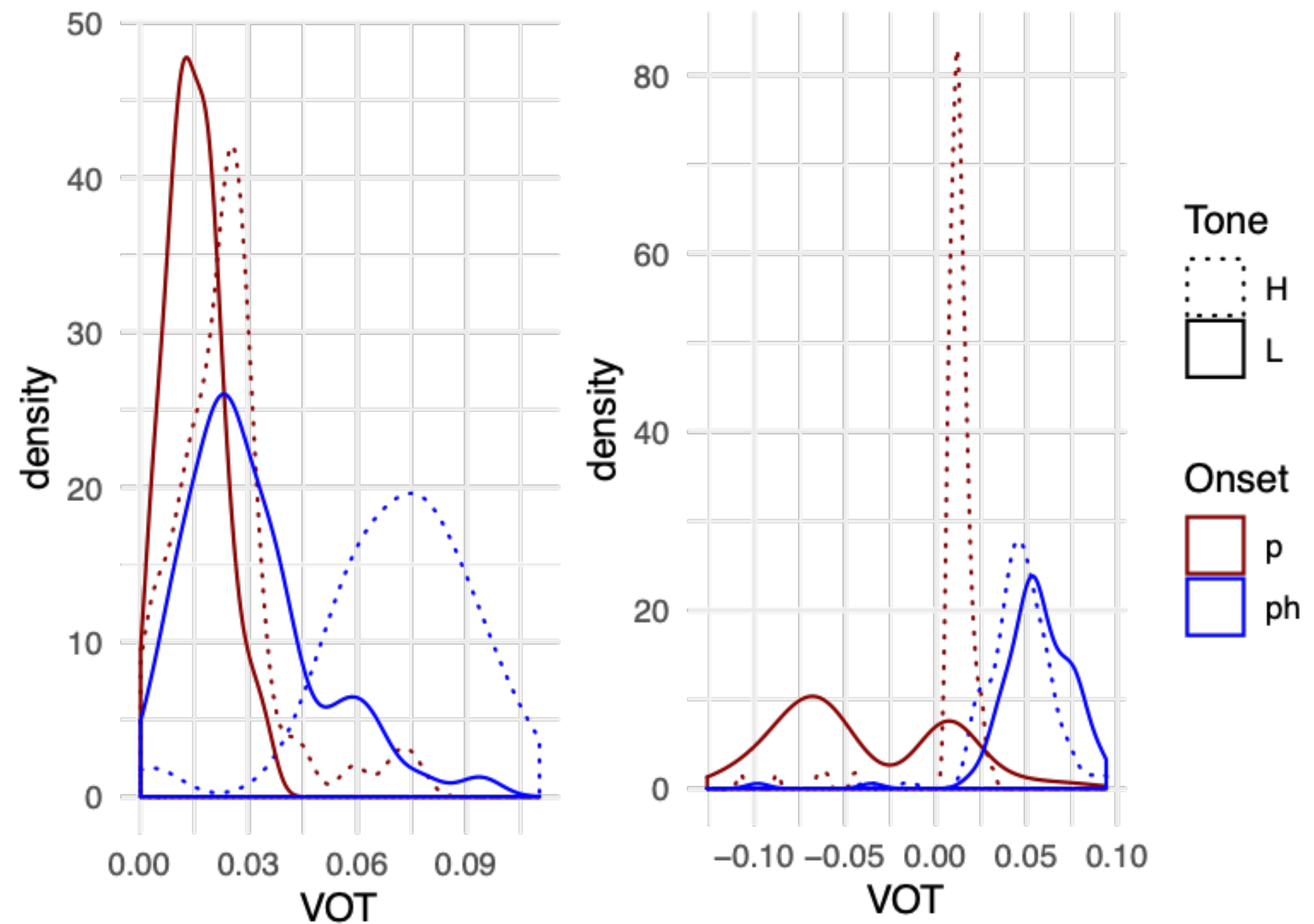
# Results: C-V lag

- There is a positive C-V lag... for speakers with and without the tone contrast
- No significant difference between the tones



# Two systems of laryngeal contrasts

- Both conditioned by tone:
- Left speaker
  - no prevoicing
  - long VOT only with H tone
- Right speaker:
  - prevoicing with L tone
  - long VOT with both tones



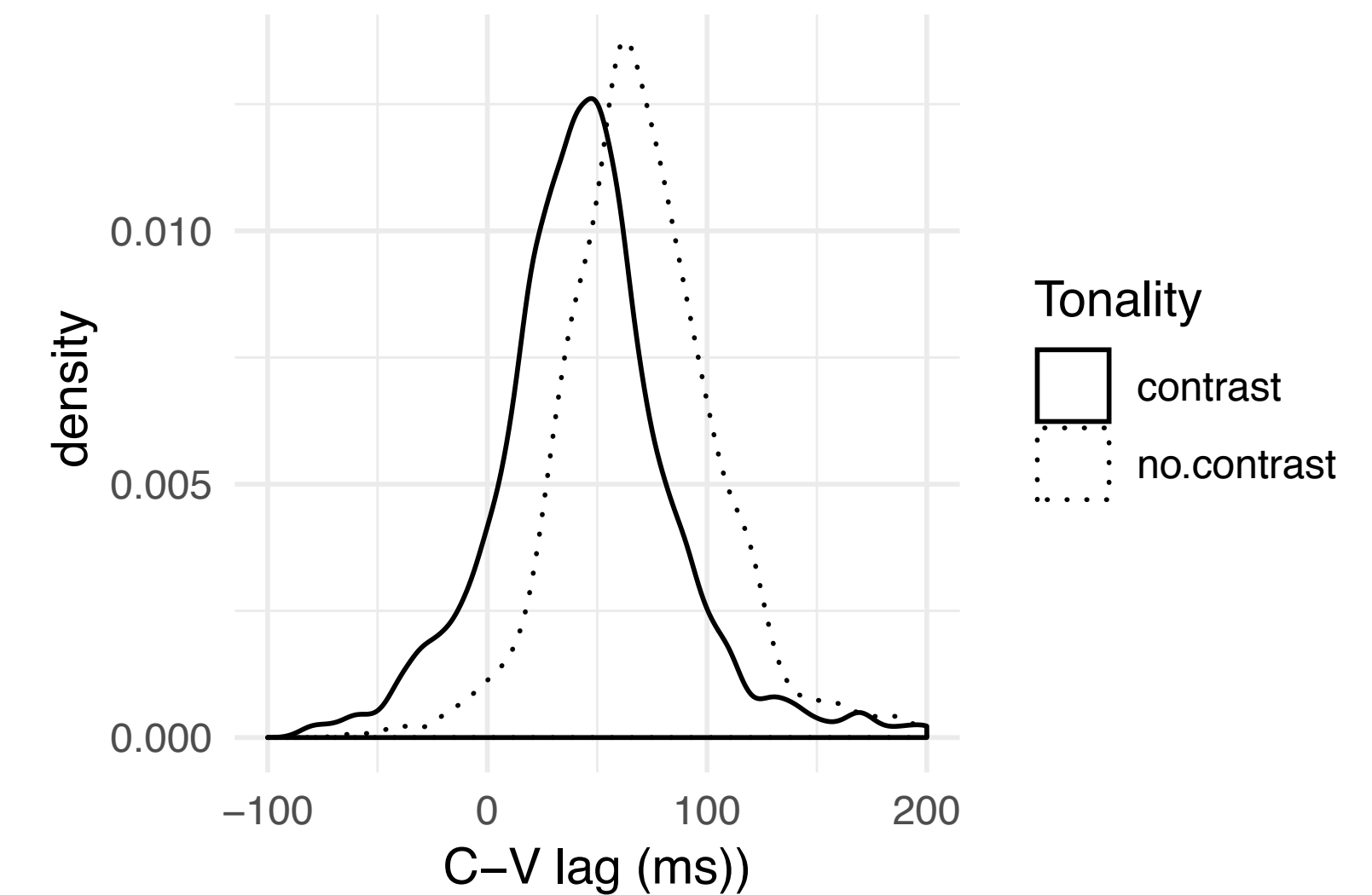
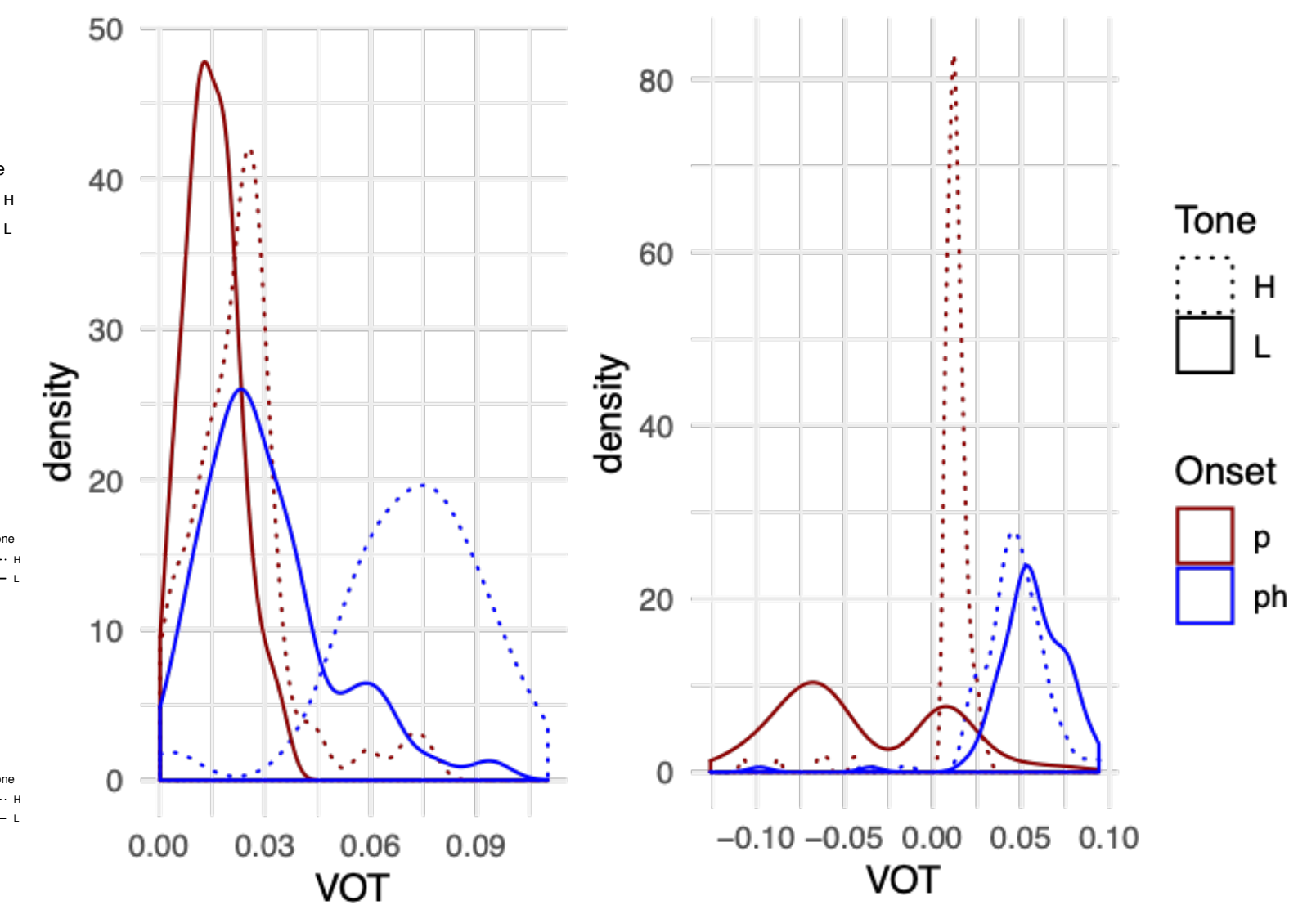
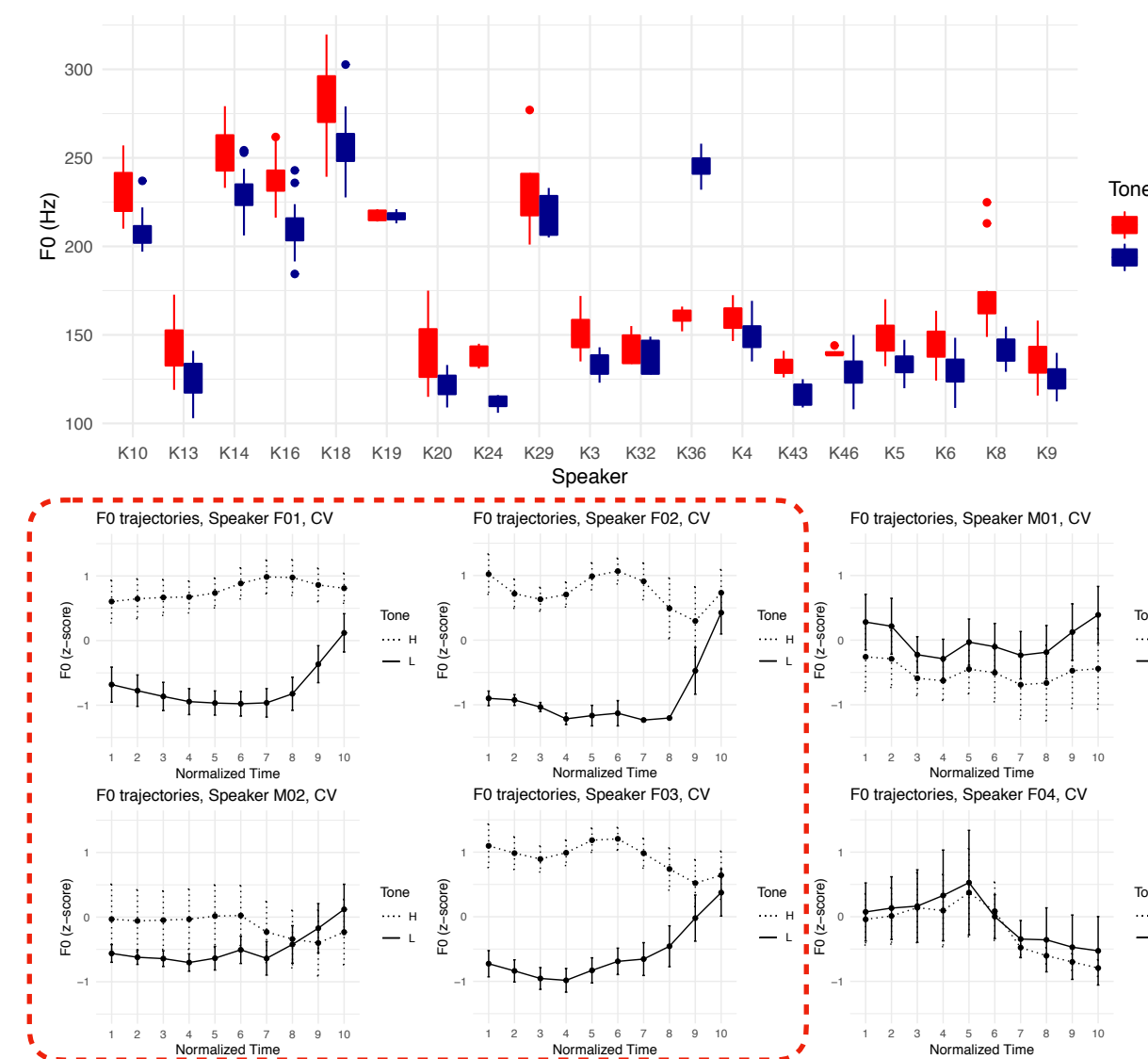
# EMA Study conclusions

- H1: variation in timing conditioned by presence/absence of lexical tone
  - speakers with tone contrast will have competitive coupling (pos. C-V lag)
  - speakers without tone contrast will have in-phase C-V timing (no C-V lag)
- **✓ H2: timing convergence:**
  - all speakers have similar coordination patterns despite interspeaker variation in presence/absence of tone
- What kind of tone contrast is there?
  - If H- $\emptyset$ , then difference will be visible in high vs. low tone words
  - **✓ If H-L, then no difference in timing by tone.**



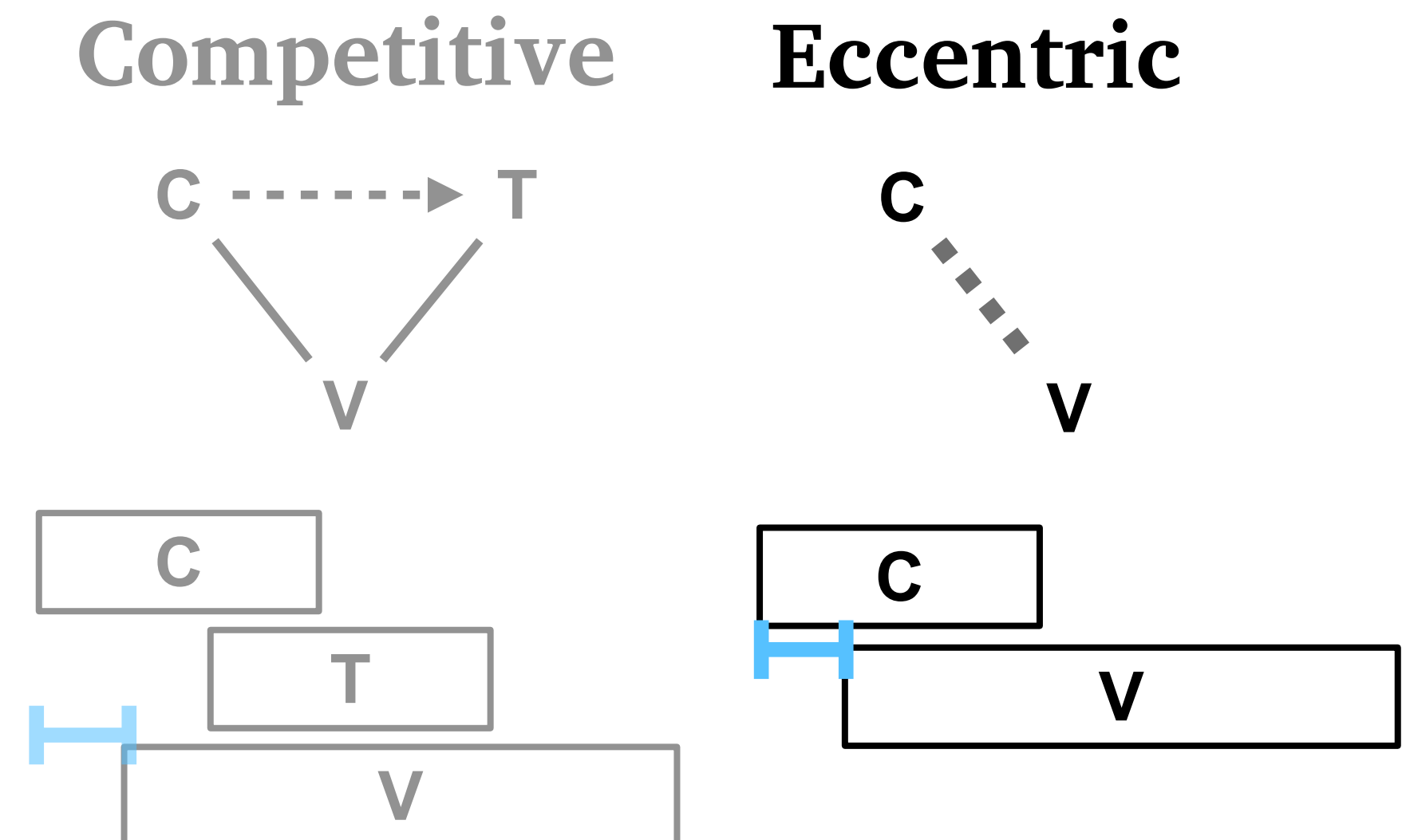
# Summary of Findings

- Tibetan speakers in diaspora..
  - ... vary in their phonology
    - presence/absence of tone
    - two laryngeal contrast systems
- ... preserve lexical contrasts
  - tone-conditioned VOT categories persist even when speakers don't have tone contrast
- ... maintain temporal stability in articulation



# Implications

- Members of a speech community can have different phonologies
- Multi-lingual, multi-dialectal situations are *helpful* for linguistic research
- C-V lag related to tone, but not always through competitive coupling
  - at least not for non-tonal speakers
- Stable C-V timing amid variation
  - this is something we can learn
  - even the “mechanical” is social



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**Thank you!**