Eccentric C-V timing across speakers of diaspora Tibetan with and without lexical tone contrasts

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Background

- Articulatory timing is language-specific
- Temporal coordination of *gestures* is used to capture timing in Articulatory Phonology
- Some coordination relations (*in-phase* and *anti-phase coupling*) are hypothesized to be intrinsically stable (Saltzman & Byrd 2000)
- Language-specific timing patterns are derived from the interaction of coordination relations, e.g. *competitive coupling* (see right). May include consonant, vowel, and tone gestures
- **Research Question: Does the presence or absence of a tone gesture affect articulatory timing?**

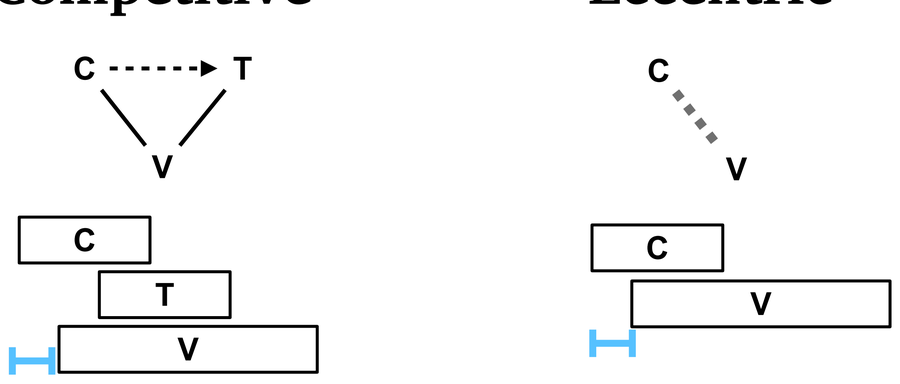
Hypothesis

- Past work shows differences in C-V timing…
  - … across tonal and non-tonal languages (Gao 2008, Katsika et al. 2014, Karlin 2018)
  - … across tonal and non-tonal syllables within a language (Zhang et al. 2019)
- **In this study, we investigate C-V timing across speakers of diaspora Tibetan, comparing speakers who maintain a lexical tone contrast with those who do not**
  - raised in dialectically-diverse Tibetan-speaking enclaves in India/Nepal, living in USA
- Tonal speakers are predicted to have competitive coupling among C, V, and tone gestures
- Non-tonal speakers, lacking tone gesture, are predicted to have in-phase or eccentric timing
- **In-phase coupling predicts ~0ms C-V lag**
- **Competititve coupling predicts covariation of C-V lag and C gesture duration**

Coupling Relations

- *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

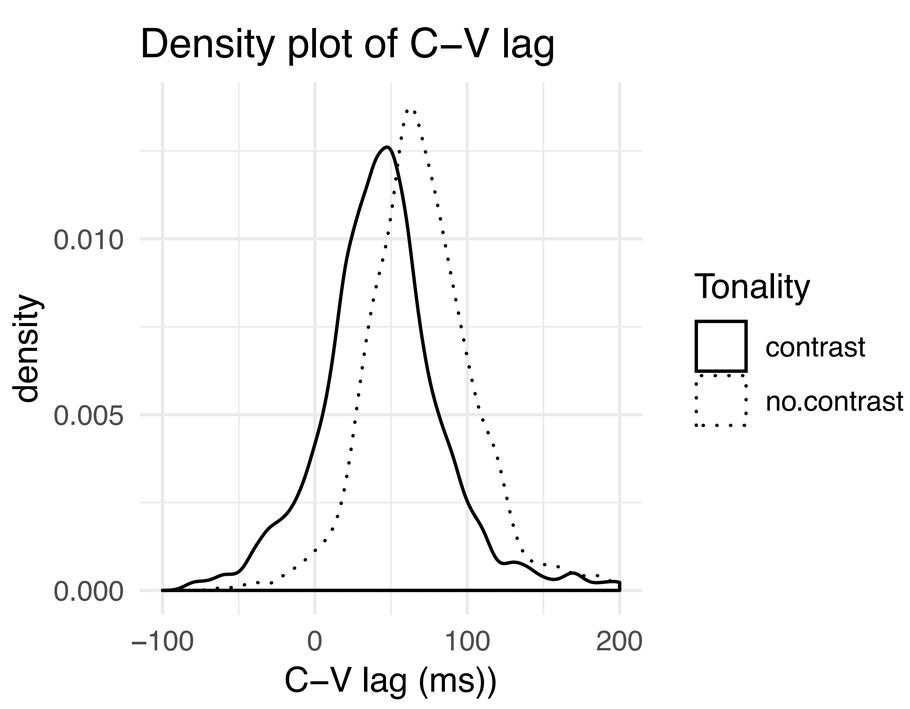


- Identical C-V timing can result from different coupling

Methods

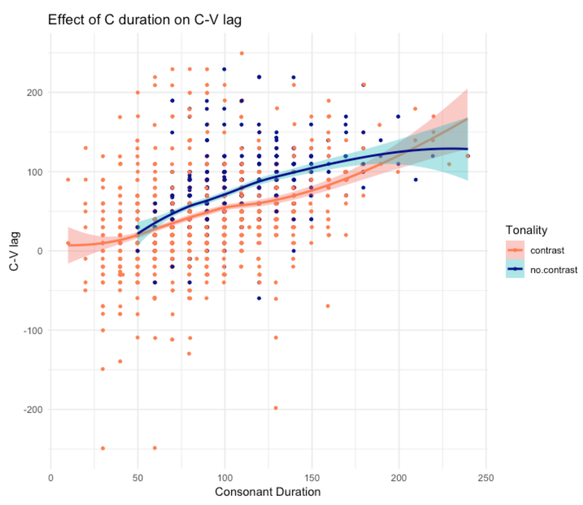
- Participants: 6 speakers of diaspora Tibetan, four who maintain a lexical tone contrast and two who do not
- Electromagnetic articulography (EMA): NDI Wave
- Stimuli presented in Tibetan orthography:
  - [p p^h m] + [a o u] + [H, L] + coda/no coda
  - ID start of gesture at 20% max velocity to target; end of gesture at 20% of max velocity

C-V lag Results and Interpretation



- **~50 ms C-V lag is consistent with both competitive and eccentric coupling**
- Predicted for tonal speakers, but not for non-tonal speakers

- **C-V lag covaries with C gesture duration**



- Covariation would be consistent with competitive coupling, but non-tonal speakers lack the tone gesture needed
-

- Tonal speakers: match hypothesized competitive coupling
- Non-tonal speakers: resembles competitive coupling, but these speakers lack a contrastive tone gesture

- **Conclusion:**
  - evidence for eccentric coupling
  - apparent persistence of tonal-type timing after tone loss

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Tone-conditioned

Yale

Introduction

- Diaspora speakers (Nepal): Central Tibetan dialect
- High and Low register tones
  - word tone determined by tone of first syllable
  - here analyzed as contrast between H vs. L tone
- Stops only contrast for aspiration, used as phonological primitives. Show temporal arrangement in *gestural score*
- Simplex onsets: synchronous C-V start time:
- Complex onsets: displace consonant gestures's start times before and after start of vowel gesture ("C-center effect"):
- Why? Coupling relations:
- Onset timing: *in-phase* (C-V) or *anti-phase* (C-C); displacement in

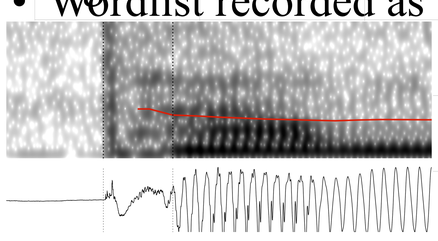
Background

Articulatory

Tongue

Data

- 19 speakers, all raised in Nepal, recorded in Kathmandu
- Wordlist recorded as



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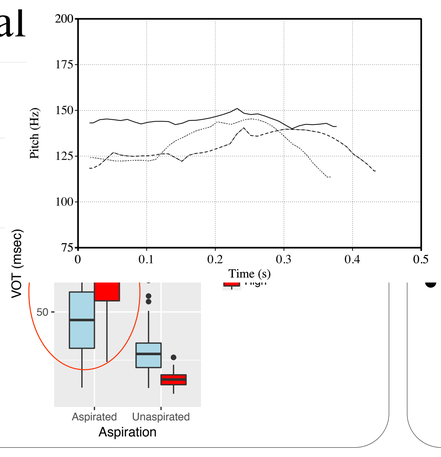

Spectrogram of [tʰá.mak] *'cigarette'; VOT measured on dotted lines; red line indicates pitch track*

- Within aspirated stops, VOT longer for high tone
  - not for unaspirated stops—possible skewed data

Analysis

- Total closure and glottis:

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1	9	
6	13	
7		

- Tone gestures cause displacement around "c-center".
- Laryngeal gesture timed to C-T 'cluster', not to onset consonant gesture alone
- Next steps: electromagnetic articulography (EMA) to directly observe movement of articulators
- Further questions:
  - Tones organized as consonants—relic of tonogenesis?
  - What happens in unaspirated onsets?
  - What glottal gestures, if any, appear in unaspirated stops?
  - Here: absence of gestures in Thai

- Coupling relations:
  - in-phase C_{oral}-V, T-V; anti-phase C_{oral}-T gestures
- What about wide-

- Displacement of closure gesture: "exposes" more of wide glottis gesture following release of closure:

	aspirated	unaspirated
High Tone	[tʰá.mak]	[tá.mak]
Low Tone	[tʰòm] 'bear'	[tòm]

Conclusion

- Anomalous three-way aspiration contrast simplified to interaction of two-way contrast plus tone:

Acknowledgements

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