The effects of prosody on pitch and voice quality of White Hmong tones

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Introduction

White Hmong contrasts seven lexical tones:

Description of citation tones (Ratliff 1992, Esposito 2012)	Example
High or high-rising (55, 45)	[pɔ ˥] *pob* 'ball'
High-falling modal (52)	[pɔ ˥˩] *poj* 'female'
High-falling **breathy** (42,52)	[pɔ̤ ˥˩] *pog* 'grandmother'
Mid (33)	[pɔ ˧] *po* 'spleen'
Mid-rising (24)	[pɔ ˧˥] *pov* 'to throw'
Low (22)	[pɔ ˨] *pos* 'thorn'
Low-falling **creaky** (21)	[pɔ̰ ˩] *pom* 'to see'

Listeners rely on breathy voice to distinguish between the two high-falling but ignore creaky voice when distinguishing between the two low tones (Garellek et al. 2013).

Breathy voice is thus contrastive, whereas creaky voice is not – though it is robustly attested in previous work on production of citation tones.

Why the disparate functions of breathy vs. creaky voice? Could they be due to variation by phrasing?

Descriptive goal: how to characterize White Hmong tones in more conversational speech styles?

Methods

<u>Speakers and Speech Material</u>

- **Five literate White Hmong speakers: 2 M, 3 F.**
- **Speakers read three White Hmong folktales.**
- **All ditones attested in stories.**
- **Recordings took place in Twin Cities.**

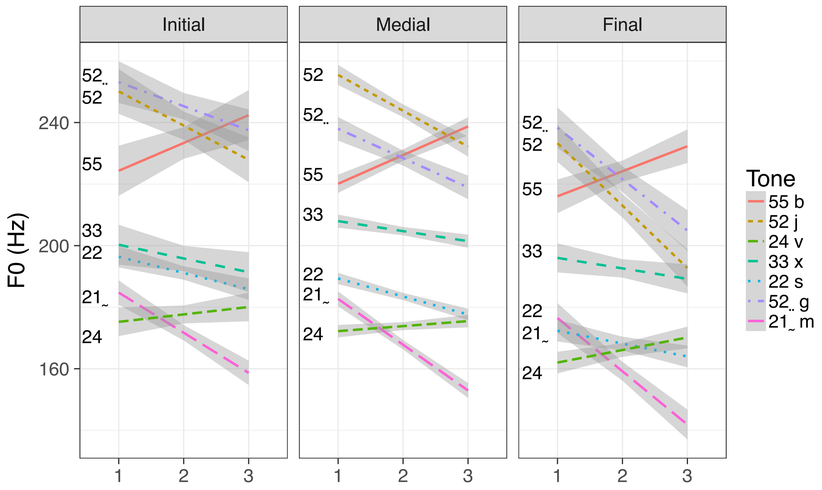
<u>Annotations</u>

- **Vowels were segmented & annotated for Utterance position (initial, medial, or final).**
- **Utterance-medial words that were fluent but lengthened were coded as being phrase-final.**
- **Words adjacent to disfluencies were excluded.**

<u>Analysis</u>

- **Vowels analyzed with VoiceSauce (Shue et al. 2011).**
- **F0, H1*-H2*, Cepstral peak prominence**

F0 by tones and position



Mid-level and low-level tones don't differ U-initially; mid-level tone is lowered.

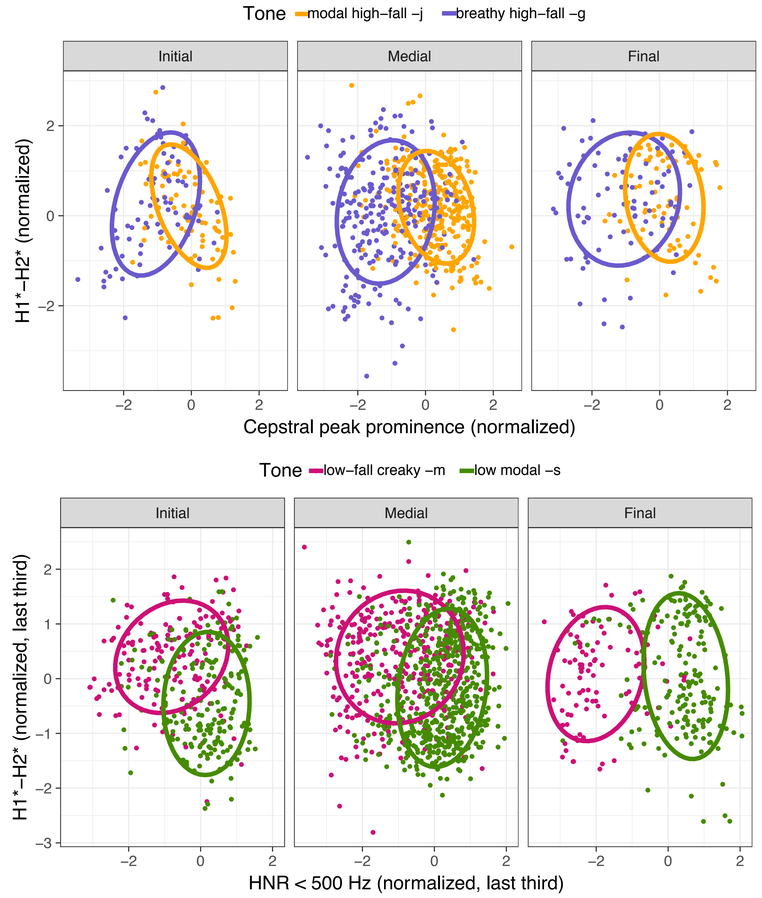
High-falling modal tone is higher-pitched than high-falling breathy tone U-medially.

Falling tones have lower targets U-finally than in other positions.

Low-rising tone is always low-rising (12), regardless of position.

There is little evidence for tone-independent intonational targets in U-initial or U-final positions, at least for declarative sentences attested in these stories.

Voice quality by tones and position



Distinctions between breathy vs. modal, modal vs. creaky tones are robust across phrasal positions, especially in terms of noise (as measured by CPP).

Revised tonal description

Previous description (Ratliff 1992, Esposito 2012)	Proposed revision
High or high-rising (55, 45)	**Only high-rising** 45
High-falling modal (52)	**^54~54~53**
High-falling breathy (42,52)	**54~53**
Mid (33)	33 (**22 U-initially**)
Mid-rising (24)	**Low-rising** 12
Low (22)	22
Low-falling creaky (21)	21

General discussion

Analysis of f0 patterns in different phrasal and tonal contexts shows:

- **Little evidence for boundary tones.**
- **Some mismatches between previous descriptions of citation tones and their f0 patterns in story reading.**
- **Robust voice quality differences in terms of noise could be due to the fact that other measures (e.g. H1*-H2*/spectral tilt) vary more by f0, vowel quality and nasalization (Simpson 2012, Garellek & White 2015).**

References

Ratliff, M. (1992). *Meaningful Tone*: A Study of Tonal Morphology in Compounds, Form Classes and Expressive Phrases in White Hmong, Southeast Asia (Northern Illinois University, Center for Southeast Asian Studies, DeKalb, IL), pp. 1–279. // Esposito, C. M., (2012). An acoustic and electroglottographic study of White Hmong phonation, *JPhon* 40, 466–476. // Garellek, M., Keating, P., Esposito, C. M., & Kreiman, J. (2013). Voice quality and tone identification in White Hmong. *JASA* 133, 1078–1089. // Shue, Y.-L., Keating, P. A., Vicenik, C., and Yu, K. (2011). VoiceSauce: A program for voice analysis, *ICPhS* 17, 1846–1849. // Simpson, A. (2012). The first and second harmonics should not be used to measure breathiness in male and female voices. *JPhon*, 40, 477–490. // Garellek, M., & White, J. (2015). Phonetics of Tongan stress. *JIPA*, 45, 13–34.