

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










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## Voice quality in tonal systems

- Lexical tones are often distinguished by **voice quality**, in addition to f<sub>0</sub>/pitch.
- Assumption: if voice quality differences are found, these are probably used as cues to tonal identification.
- Possible exception: creaky tone in White Hmong?

# White Hmong citation tones

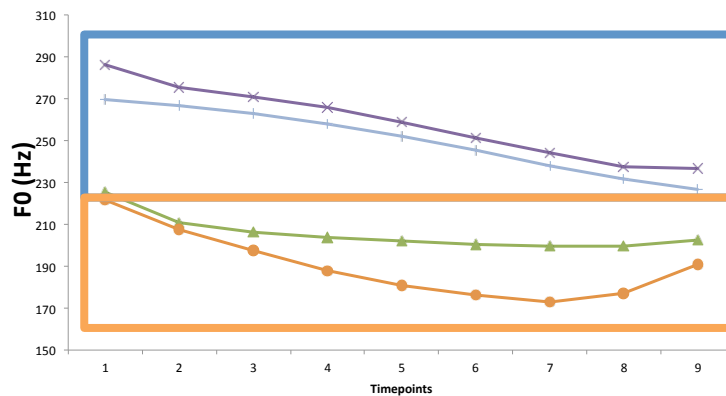
High-rising	/pɔ̌ 1/	'ball'	
High-falling	/pɔ̌ ʋ/	'female'	
High-falling <b>breathy</b>	/pɔ̌ ʋ, pɔ̌ ʋ/	'grandmother'	
Mid	/pɔ̌ ɹ/	'spleen'	
Low-rising	/pɔ̌ ɹ/	'throw'	
Low	/pɔ̌ ɹ/	'thorn'	
Low-falling <b>creaky</b>	/pɔ̌ ɹ/	'see'	

Ratliff (1992, 2015); Esposito (2012); UCLA Voice Project

2

# White Hmong citation tones

Two high falling tones, one breathy



Two low tones, one falling and creaky

Esposito (2012)

3

## Voice quality in WH citation tones

	Breathy tone	Modal tones	Creaky tone
<b>H1*-H2*</b> (lower = more contact)	↑	—	↓
<b>Harmonics-to-noise ratio</b> (lower = more aspiration, more irregular voicing)	↓	—	↓

Garellek (2012), Esposito (2012)

4





## Voice quality in WH citation tones

- Consistent acoustic correlates of the **breathy** high-falling tone and **creaky** low-falling tone, relative to the other modal tones.
- Do listeners make use of voice quality to identify tones?
  - It depends on the particular contrast.

Garellek et al. (2013, 2014)

5

## White Hmong tone identification

High-rising	/pɔ̌ 1/	‘ball’	
High-falling	/pɔ̌ ʋ/	‘female’	
High-falling <b>breathy</b>	/pɔ̌ ʋ, pɔ̌ ʋ/	‘grandmother’	
Mid	/pɔ̌ ɬ/	‘spleen’	
Low-rising	/pɔ̌ ɰ/	‘throw’	
Low	/pɔ̌ ɬ/	‘thorn’	
Low-falling <b>creaky</b>	/pɔ̌ ɬ/	‘see’	

Listeners rely only on breathy voice

Listeners do not rely on creaky voice, only f0 and duration

Garellek et al. (2013, 2014)

6

## Production vs. perception

- Why do speakers produce the high-falling breathy tone with a consistently falling pitch contour, but **ignore f0** in perception?
- Why do speakers produce the low-falling creaky tone with consistent creaky voice, but **ignore creaky voice** in perception?

7

## Production vs. perception

Two possibilities:

1. Voice quality might not always be perceived independently of pitch.
2. Production of citation tones differs from non-citation forms.

8

## Hypotheses for non-citation tones

**Hyp1:** Maybe the high-falling **breathy** tone is consistently breathy...

- But not consistently high-falling in  $f_0$

**Hyp2:** Maybe the low-falling **creaky** tone is consistently low-falling...

- But not consistently creaky

9

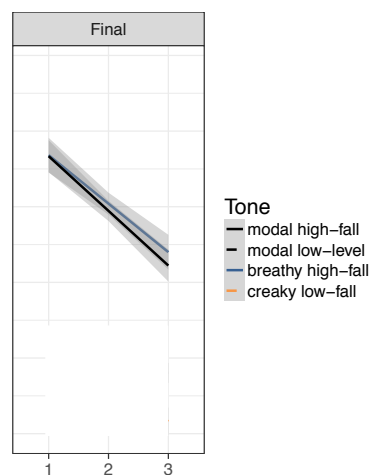
## Corpus

- 10 literate speakers of White Hmong from the Twin Cities, Minnesota.
- Speakers read 3 folk tales, with all possible ditones.
- All words were coded for position in utterance (initial, medial, final).
- Words adjacent to disfluencies, utterance-medial phrase boundaries were excluded.
- Vowels were segmented and analyzed for f<sub>0</sub>, voice quality measures.

10

## High-falling breathy tone

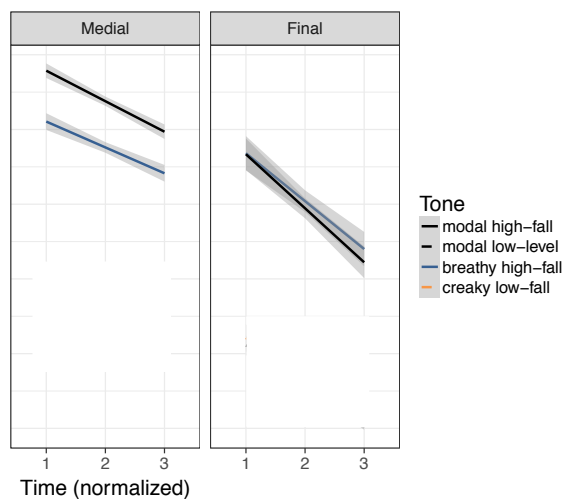
- Utterance-finally, both high-falling tones are high-falling.



11

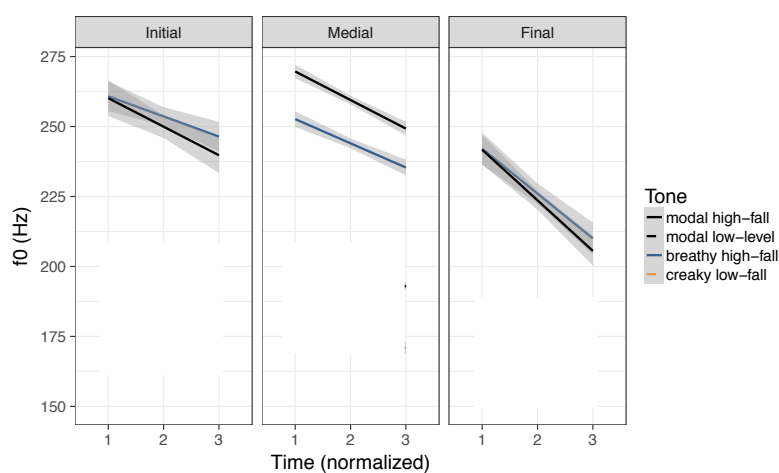
## High-falling breathy tone

- Medially, the **breathy** high-falling tone is lower in  $f_0$  than the modal high-falling tone.



12

## High-falling breathy tone



13

## Results for high-falling tones

Hyp1: Maybe the high-falling **breathy** tone is consistently breathy...

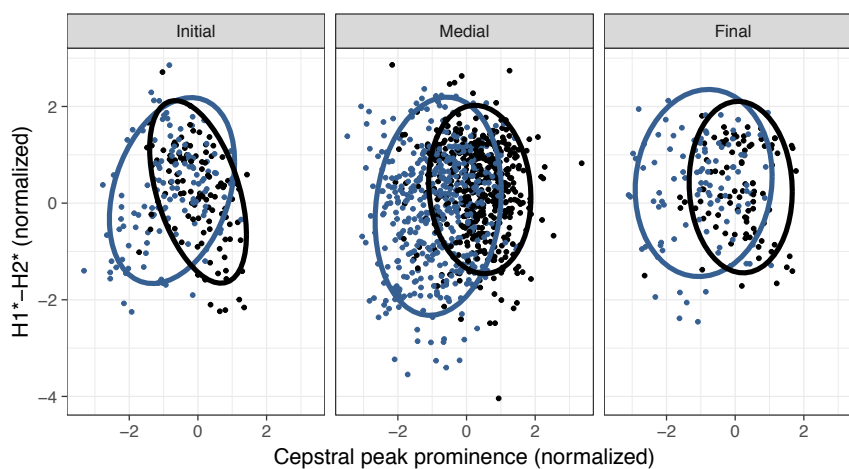
– But not consistently high-falling in  $f_0$ .

- **Result:** it's consistently high-falling
  - But in different phrasal positions, the **breathy** tone differs in scaling from the modal high-falling tone.

14

## High-falling breathy tone

Tone — modal high-fall — breathy high-fall



15



## Recall: hypotheses

Hyp1: Maybe the high-falling **breathy** tone is consistently breathy...

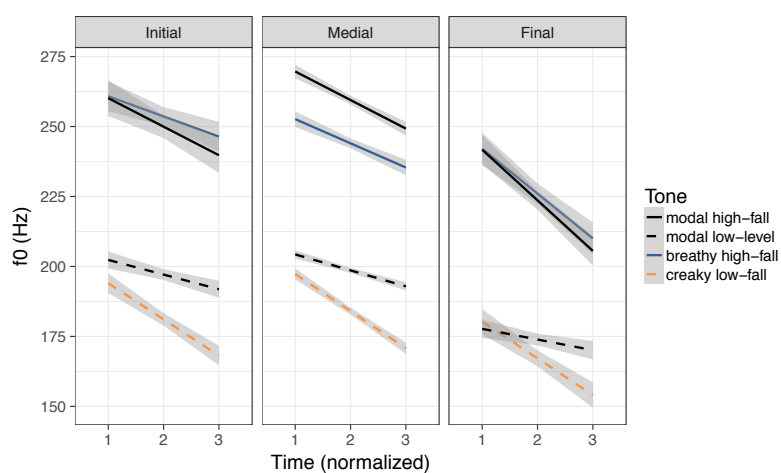
– But not consistently high-falling in  $f_0$

Hyp2: Maybe the low-falling **creaky** tone is consistently low-falling...

– But not consistently creaky

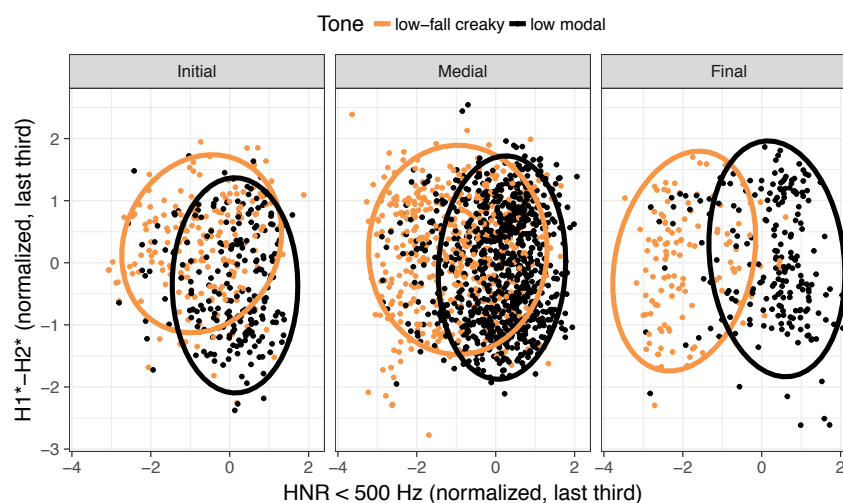
16

## Low-falling creaky tone



17

## Low-falling creaky tone



18

## Results for low tones

Hyp2: Maybe the low-falling **creaky** tone is consistently low-falling...

– But not consistently creaky

• **Result:** it's consistently creaky

– Also consistently low-falling

19

## Interpretation

- High-falling **breathy** tone is consistently high-falling, but scaling varies vs. modal.
  - Listeners could rely on  $f_0$ , but it would be a more variable cue.
- Low-falling **creaky** tone is consistently low-falling, but also consistently creaky.
  - Listeners ignored creaky voice.

20

## Interpretation

- Production target for low-falling **creaky** tone is a falling  $f_0$ .
- Creaky voice is being used in White Hmong to guarantee an extra-low pitch
  - More like a pitch setting than like a phonation type

Garellek et al. (2013, 2014)

21

## Implications

- Role of voice quality in tonal systems can be either:
  - Independent of pitch
  - Dependent on pitch
- Studies of non-citation forms of tones in different prosodic positions help elucidate listener behavior in tonal identification.

Kingston (2005) Kuang (2013), Brunelle & Kirby (2016)

22

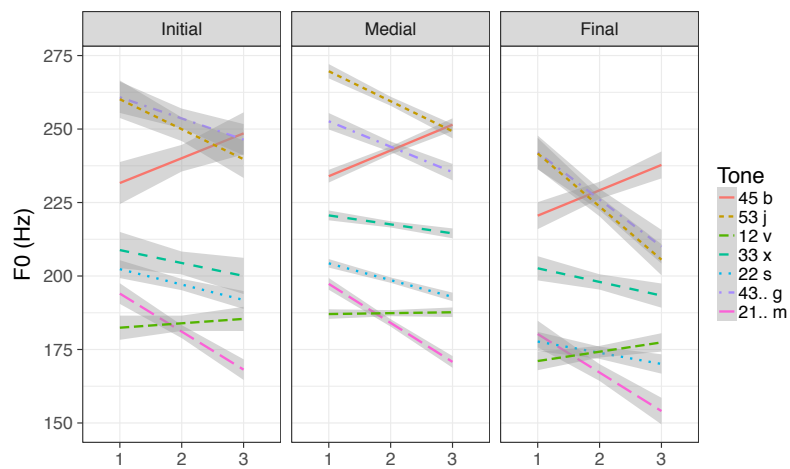
Thank you! Ua tsaug!

23

# Appendix

24

## White Hmong tone contours



25

