



Cue weighting after a tone-split in Tamang (Tibeto-Burman, Nepal) A perception study of stop initial words

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Cue weighting after a tone-split in Tamang (Tibeto-Burman, Nepal)

A perception study of stop initial words

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Introduction

- Tamang: close to Tibetan. ≈ 2000K speakers.
- A transphonologization: Tone split (general pattern) [±voice] > H (+ modal) vs. L (+ breathy)



NB. Voicing contrast totally disappeared on continuants in Tamang:
/m,n,r,j,l/ always voiced
/s/ always voiceless

Initial C	tone split
old > modern	height
tone *A	tone *B
p, p ^h	
s	
*b > m, *h > l	
...	
*b > p [p~b~b]	
*z > s	
m, l	
...	

(figured slopes at time of split are symbolic : phonetic value unknown)

- Synchronic consequence in Risiangku Tamang (a conservative Tamang dialect): **multiple cues** used in production of tones

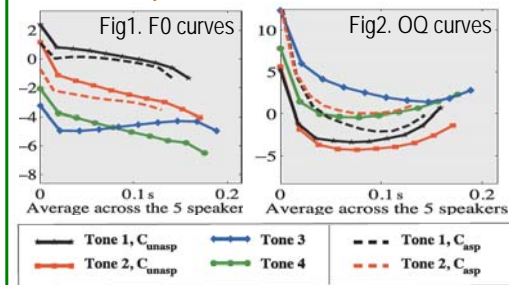
- Production data using electroglottograph (Mazaudon & Michaud 2008):

(higher open quotient (OQ) => breathier voice)

- ~20% token plosive **Ci prevoicing** on **low tones** (0% on high tones)

- lower F0** and **breathier voice** on **low tones**

- some **inter-speaker tradeoff** relation between low **F0** and **breathiness**



smaller F0 difference compared to other tone or tonogenetic lg, e.g.: Seoul Korean (between today's H & L):
-Male: ≈ 4st;
-Female: ≈ 5st (Bang et al. 2018)

This study

Research question

Besides the **new cue** of **F0** (height and slope), what is the contribution of the **older cues** in tone perception?

- Ci pre-voicing**: marginal in production of plosive Ci
- breathiness**: secondary/enhancing cue of low F0 (see Kuang & Liberman 2015)

Method

- Who: **28 participants** (14M + 14F, mean age: 49, from 33 to 79)
- Where: Kathmandu and Risiangku village of Nepal
- What: synthesized stimuli
- carrier sentence /tʃu X-pa/ 'This is X' (A.) or 'Someone X's this' (V.)
- Forced choice among 4 pictures

¹pa-pa 'thin'; ²pa-pa 'harsh'; ³pa-pa 'bring'; ⁴pa-pa 'pile up'

NB: \nexists perfect quadruplet with a plain stop => target words have a vowel length difference (ambiguous vowel duration was used in all stimuli)

- Variables: $4 \times 2 \times 3 \times 2 \times 2 = 96$ stimuli (already too long for some older villagers)
- Synthesized parameters

F0 onset	prevoiced	voice quality of V1	V1 slope	V2 slope
•115 Hz	•yes	•modal	•rising	•rising
•130 Hz	•no	(H1-H2 = 2.5dB)	(+10 Hz)	(+ 5 Hz)
•145 Hz		•breathy	•falling	•falling
•160 Hz		(H1-H2 = 7dB)	(- 20 Hz)	(- 15 Hz)
		•super breathy		
		(H1-H2 = 12dB)		

Based on glottal opening degree settings in VocalTractLab (Birkholz)

Results

Fig 3. Identification as High Tone

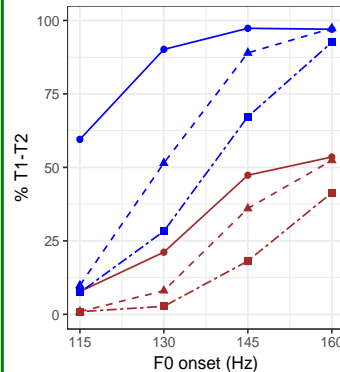
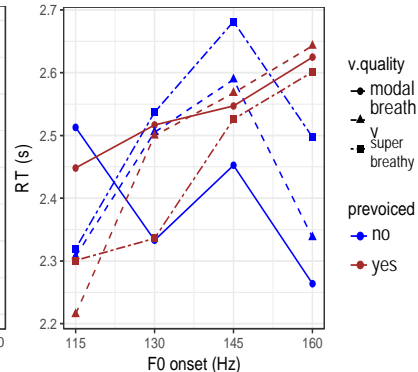
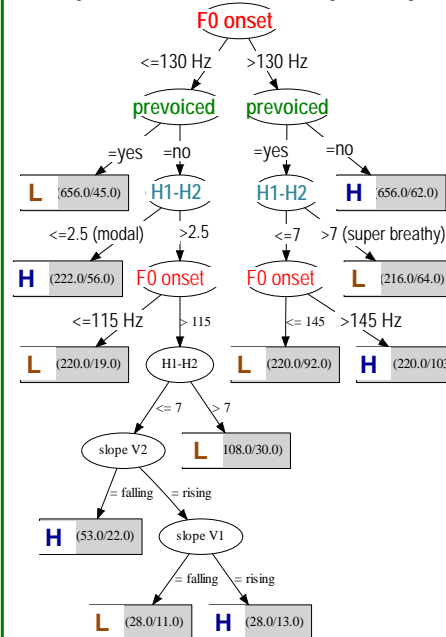


Fig 4. Response Time



- Ci prevoicing**, although rare in production, carries the **decision for Low tone in perception** (>50%) whatever the associated features (H/L pitch or Voice quality)
- RT** ↑ if **High F0** contradicts **Ci prevoicing**
- fastest RT for lowest F0+breathy**, whatever **Ci prevoicing**
- modal voice** has become **associated with high tone** (congruent H + Modal => fastest RT ; clashing L + Modal => 60% H responses)
- breathy voice** does not prevent **high tone** identification in %, but **slows down the RT**, esp. if the pitch is not Highest

Fig 5. Decision tree model using C4.5 algorithm



F0: most important in perception, main component of the tone

Ci prevoicing: very important in perception, although de-phonologized, and currently **marginal** in production

voice quality: important, esp. **when the other two cues are conflicting**

Discussion

- old features/cues continue to be used in perception
- H/L emphasized in this study, because of historical perspective, but each of the 4 tones has its profile: e.g., T3 is breathier and has higher pitch than T4. (Hence, perception results are also influenced by properties other than H or L)
- In perception of high vs. low tones in Risiangku Tamang:
 - F0 (the new cue): most important**, main component of the tone
- If we consider **markedness** for **redundant** cues:
 - modal** phonation signals H tone, while **breathy** is **unmarked**
 - Ci prevoicing** signals L tone, while **Ci voicelessness** is **unmarked**
- loss of oldest cue after phonologization** is **production-driven**: similar pattern observed in Afrikaans (Coetzee et al. 2018) and in Dutch (Pinget 2015): (some) speakers who devolve in production still use Ci voicing in word identification