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

A perception study of stop initial words

LabPhon 16
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Introduction

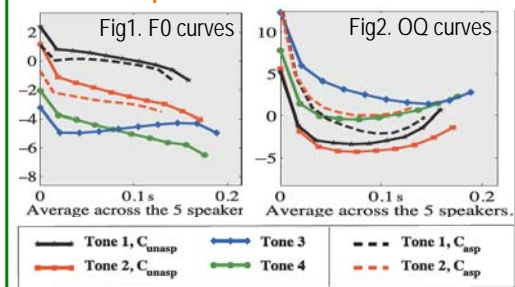
- Tamang: close to Tibetan. ≈ 2000K speakers.
- A transphonologization: Tone split (general pattern) [±voice] > H (+ modal) vs. L (+ breathy)



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

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

- (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 /ʔtsu 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: /ʔ/ perfect quadruplet with a plain stop => target words have a vowel length difference (ambiguous vowel duration was used in all stimuli)
- Variables: 4x2x3x2x2 = 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 (+10 Hz)	•rising (+5 Hz)
•130 Hz	•no	(H1-H2 = 2.5dB)	•falling (-20 Hz)	•falling (-15 Hz)
•145 Hz		•breathy		
•160 Hz		(H1-H2 = 7dB)		
		•super breathy		
		(H1-H2 = 12dB)		

Based on glottal opening degree settings in VocalTractLab (Birkholz)

Results

Fig 3. Identification as High Tone

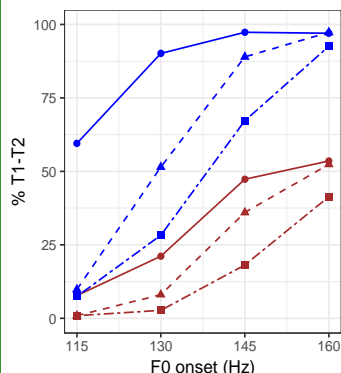
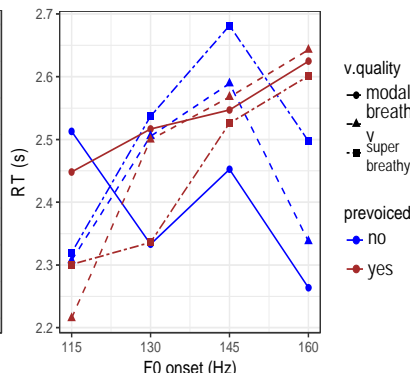
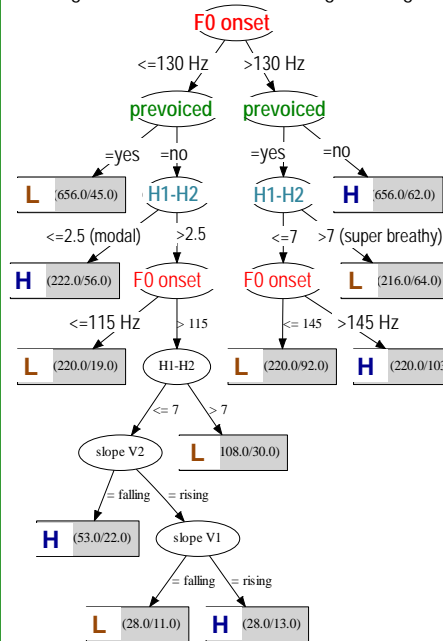


Fig 4. Response Time



- **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 deviate in production still use Ci voicing in word identification