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))

<table>
<thead>
<tr>
<th>Initial C</th>
<th>old &gt; modern</th>
<th>height</th>
<th>tone split</th>
<th>tone *A</th>
<th>tone *B</th>
</tr>
</thead>
<tbody>
<tr>
<td>p, ph</td>
<td>high</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>s, *m &gt; m, *n &gt; l</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>*b &gt; p [p–b–b]</td>
<td>low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*g &gt; s</td>
<td>m, l</td>
<td></td>
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</tbody>
</table>

(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% tonal 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

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 prevoicing: 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 Ptxa X-pai 'This is X' (A.) or 'Someone X's this' (V.)
  - Forced choice among 4 pictures
    1. pa-pa 'thin'; 2. pa-pa 'harsh'; 3. pa-pa 'bring'; 4. pa-pa 'pile up'

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 if not Highest

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 devoice in production still use Ci voicing in word identification

Based on glottal opening degree settings in VocalTractLab (Birkholz)