A Pathway to Tonogenesis
Shifting Language Dynamics in Kuy and the Perception-Production Link

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Acknowledgments

I am honored to be learning on the traditional, ancestral, and unceded lands of the Ohlone people and to be attending a conference hosted by universities on the traditional, ancestral, and unceded territories of the Musqueam, Squamish, Tsleil-Waututh, Okanagan, Kwikwetlem, Semiahmoo, Katzie, Kwantlen, Qayqayt and Tsawwassen Nations.
Acknowledgements

Sidawun Chaiyapha
สิดาวรรณ ไชยภา

Thongwilai Intanai
ทองวิไลย์ อินตะนัย
Objectives

Bilingualism/Contact as a *catalyst* for change

- Previous tonogenesis studies have primarily focused on generational differences.
- Limited studies on role of contact languages in tonogenesis (Brunelle, 2009).
- In this study, I want to provide contemporary experimental evidence to support circumstantial evidence for contact-induced tonal spread.

Goals of current study

1. To explore role of language usage & life experience in shifting of cue weights in perception of voice quality distinction in Kuy, a minority language of Northeast Thailand.
2. To connect perception to production results looking at same question.
Cue weighting and Tone

Relationship between phonation and f0

**Voicing**: vowels after voiced C lower f0 on average than after voiceless C

**Voice Quality**: breathy vowels lower f0 on average than modal vowels

- **Tonogenesis**: development of phonemic tone
  - f0 becomes primary cue (Maran, 1973)

- **Cue Weighting**: relative usage of cue in perceiving/producing a contrast
  - Heavier cue weighting of f0 over VOT shown in younger speakers
    - Korean (Kang, 2014)
    - Afrikaans (Coetzee et al., 2018)
Why do cues shift?

* Actuation Problem: Why does a change happen when it does? (Weinreich et al., 1968)

Bilingualism affects both perception and production

- Convergence at all levels (phonology: Hinton 1991, syntax: Ross 2007)
- If one of a speaker’s languages exploits a cue primarily, it can potentially cause that cue to be more prominent in another of their languages
- Bilingualism may interact with social factors to actuate change
Multilingualism in Mainland Southeast Asia (MSEA)
Multilingualism in Mainland Southeast Asia

- Longtime multilingualism in MSEA potential catalyst for tonogenesis (Kirby and Brunelle, 2017)

- Tonogenetic languages in largely non-tonal families—happen to be in heavy contact with tonal languages
  - Vietic (Austroasiatic)—Vietnam under colonial rule by China for over a millennium (Haudricourt, 1954)
  - Chamic (Austronesian)—Vietnam, Hainan (China) (Thurgood, 1996)

- More recently, tonogenesis described in languages in Thailand
  - Austroasiatic: Khmu (Premsrirat, 2001) & Kuy (Sukgasame, 2003; Abramson et al., 2004)
Kuy (Katuic, Austroasiatic)
Kuy (Katuic, Austroasiatic)

Modal vs. breathy voice

- ti: ‘old’
- tiː: ‘tall’

Breathiness can lead to bundle of side effects

- Lowered f0 > low tone
- Lowered F1 > vowel raising or diphthongization
  (Wayland and Jongman, 2002)

Map 9.3. Distribution of Kuy in relation to Northern Khmer. Kuy is shown by wavy shading. Overlap in shading shows areas where communities speaking the respective languages are intermingled.

Smalley (1994, 149)
Kuy linguistic situation

- For at least 20 years, preference for using Thai has grown (Sukgasame, 2003)
- Present-day in Ban Khi Nak
  - Parents in 20s and 30s generally speak Thai to their children
  - Children respond in Thai even if parents use Kuy
- Majority of participants express worry that Kuy might stop being used

Pride in ability to speak 4 languages (Kuy, Thai, Lao, Northern Khmer), but multilingual ability decreasing

- 2/32 older speakers (age ≥ 50) can’t speak Khmer
- 9/32 younger (age < 40) can’t speak Khmer (2 among them cannot speak Lao)
- Children becoming monolingual in just Thai
Kuy social situation

- Most older speakers attended school at Ban Khi Nak up to 4th grade
  - 5th and 6th grades began to be offered in 1972
  - 7th to 9th grades began to be offered in 1998

- Most younger speakers attended Ban Khi Nak through 9th grade, finished high school nearby, and then left for college or work
  - 13/32 older speakers have never left home
  - Only 3/32 younger speakers have never left home

Increased Thai usage in younger generation

- Longer schooling
- More movement to other regions
Motivations for change

- Social: integration into rapidly modernizing & centralizing Thai society
  - Better transportation—younger people more likely to move
  - Increased media access and schoolteachers from other provinces

- Linguistic: other parts of phonology nearing Thai/Lao
  - Loss of prenasalization: ncʰu:n .sound~cʰu:n .sound ‘to send’
  - Merger between final /l/ and /r/: pi:r .sound~pi:l .sound ‘flower’
  - These mergers lead to fewer onset/coda distinctions

- Pressure to increase f0 diff if breathiness weakened by contact

- Tonogenesis in other Ku(a)y dialects (Sukgasame, 2003; Abramson et al., 2004)
Hypothesis

1. Kuy speakers who are more integrated into Thai society and/or use more Thai/Lao will be less sensitive to breathiness cues and more to f0 cues

2. Agnostic about *alignment* of perception & production (Kim, 2004; Kleber et al., 2012; Coetzee et al., 2018)
Stimuli Design

- Adapted Praat script using KlaatGrid synthesizer (Brunelle and Kirby, 2020)

<table>
<thead>
<tr>
<th>/tiː/ ‘old’</th>
<th>~</th>
<th>/tiː/ ‘tall’</th>
</tr>
</thead>
<tbody>
<tr>
<td>/taʔ/ ‘to grab’</td>
<td>~</td>
<td>/taʔ/ ‘to place under’</td>
</tr>
</tbody>
</table>

- Acoustic parameters enhanced from average trajectories of speakers with clear distinction, taken from production study
  - Tonal cue: f0
  - Breathiness cue: H1*–H2* (Iseli et al., 2007)

- Intermediate F1 value between modal and breathy voice for all stimuli
- Continuum of 5 starting f0 values crossed with 5 starting OQ (open quotient: breathiness correlate) values
- Stimuli were piloted and revised for naturalness
Experiment Presentation

- Presented on OpenSesame on Microsoft Surface Go tablet in temple room
- 2AFC task: participants listened to stimuli with AKG K240 Headphones and chose with a stylus which of the minimal pair they heard
- Ex. /taʔ/ ‘to grab’ vs. /tɑʔ/ ‘to place under’
Experiment Layout

- Practice round for familiarization with task & images
- 8 alternating blocks of each syllable, optional breaks
- $5 \times 5$ OQ values = 25 tokens / block, 400 total
- Half of participants saw $ta?$ pair first, half $ti$: first

**$ta?$ first**

Practice $ta?$ \(\rightarrow\) Practice $ti:$ \(\rightarrow\) Test $ta?$ \(\rightarrow\) Break \(\rightarrow\) Test $ti:$ \(\rightarrow\) Break \(\rightarrow\) Test $ta?$ \(\rightarrow\) ...

**$ti$: first**

Practice $ti:$ \(\rightarrow\) Practice $ta?$ \(\rightarrow\) Test $ti:$ \(\rightarrow\) Break \(\rightarrow\) Test $ta?$ \(\rightarrow\) Break \(\rightarrow\) Test $ti:$ \(\rightarrow\) ...
Demographics & Conditions

- Analyzed 64/74 participants (10 thrown out for issues)
- Balanced for gender (F, M) and age by decade (20, 30, 50, 60)
- For each gender-decade combination, 4 saw taʔ first, other 4 saw ti: first
- For each of these conditions, 4 possible configurations of modal-breathy minimal pairs (i.e. which picture was on the left and which on the right)
- Follow-up interview on demographics, life experience, language attitudes, identity, etc.
Example Raw Results

- Expect variation in weighting of OQ and f0 cues
- Example from 2 extreme speakers: 60 F vs. 29 M
  - Left speaker has s-curve function barely influenced by f0
  - Right speaker’s responses strongly depend on f0

% ID of tokens as breathy by OQ & f0

![Graph 1](image1.png)

![Graph 2](image2.png)
Variable Selection

PCA: combine social variables

- **Dimension 1 (“Experience”)**
  - Age
  - Kuy Relative Ability
  - Kuy Relative Frequency of Usage

- **Dimension 2 (“Integration”)**
  - Time away from home
  - Kuy Relative Identity (inverse)
Modeling results

- Mixed effects logistic regression analysis with \texttt{lme4} (Bates et al., 2015) in R
- Interaction of all fixed effects: \textit{OQ}, \textit{f0}, \textit{Gender}, \textit{Experience}, \textit{Integration}
- Random intercepts for \textit{Speaker} and \textit{Syllable}
- 5-way interaction significant (p < .05 *)
- Effects estimated with \texttt{effects} package (Fox and Hong, 2009)
### Estimated OQ by f0 curves for male speakers

<table>
<thead>
<tr>
<th>Integration</th>
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<th>Integration</th>
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<tbody>
<tr>
<td>much less</td>
<td>much less</td>
<td>much less</td>
<td>much less</td>
</tr>
<tr>
<td>less</td>
<td>less</td>
<td>less</td>
<td>less</td>
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<tr>
<td>average</td>
<td>average</td>
<td>average</td>
<td>average</td>
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<tr>
<td>greater</td>
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<td>greater</td>
</tr>
<tr>
<td>much greater</td>
<td>much greater</td>
<td>much greater</td>
<td>much greater</td>
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</table>

#### f0
- 110
- 117.5
- 125
- 132.5
- 140

**Higher OQ → more breathy responses**
Higher f0 → curve lowers (fewer breathy responses)
Estimated OQ by f0 curves for male speakers

Greater experience → curves become closer together (f0 affects less)
Greater integration → curves flatten, less s-like (OQ affects less)
Exception in UL: upper left less s-like than upper right
Exception in UL: identification of low-OQ tokens heavily depends on f0
Patterns

- Higher OQ leads to more breathy responses
- Higher f0 shifts the curve down (fewer breathy responses)
- Greater experience leads the OQ × f0 curves to be closer together
- Greater integration flattens the curves, making them less s-like
  - However, this is not fully true if experience is low
  - Identification of low-OQ tokens is heavily dependent on f0
Estimated OQ by f0 curves for female speakers

Same general patterns, but flatter and curves are less s-like
Social effects weaker for women: integration
Social effects weaker for women: experience
Low-experience women: breathy bias if less integrated, modal if more
Gender Patterns

- Same general patterns but women’s curves flatter and less s-like
- Social effects weaker for women
  - Women’s curves are less flattened by higher integration
  - Women’s reliance on f0 is less affected by experience
- Women who rank low on experience
  - Biased towards breathy responses if less integrated
  - Biased towards modal responses if more integrated
Previous Production Results: Away Long

- 32 speakers, balanced for generation (20s, 60s), gender (F, M), & away long

Those away longer (≥4 years) have smaller $H1^* - H2^*$ difference and a larger $f0$ difference between voice qualities in expected directions.
Previous Production Results: Gender & Generation

- Not enough speakers yet for cross section with *away long*

- Younger women have weakest $H1^*-H2^*$ difference, men don’t differ much
- Younger people, especially women, have clearer $f0$ difference
## Comparison of Perception & Production

<table>
<thead>
<tr>
<th>Perception</th>
<th>Production</th>
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<tbody>
<tr>
<td>Older/Higher Exp men most conservative</td>
<td></td>
</tr>
<tr>
<td>Younger/Lower Exp women spearheading loss of breathiness</td>
<td></td>
</tr>
<tr>
<td>Lower Exp men rely most on f0</td>
<td></td>
</tr>
<tr>
<td>Younger women rely most on f0</td>
<td></td>
</tr>
<tr>
<td>Men more affected by social factors</td>
<td></td>
</tr>
<tr>
<td>Lower Exp + Lower Int = ↓OQ  ↑f0</td>
<td></td>
</tr>
<tr>
<td>Higher Int = ↓OQ</td>
<td></td>
</tr>
<tr>
<td>Younger (Lower Exp) = ↓OQ  ↑f0</td>
<td></td>
</tr>
<tr>
<td>Away (Higher Int) = ↓OQ  ↑f0</td>
<td></td>
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</tbody>
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Conclusions

1. Both lower age (experience) and being away (integration into Thai society) lead to tradeoff between breathiness and f0 cues in production.

2. In perception, greater integration only weakens breathiness cues.

3. Perceptual cue tradeoff in **low experience, low integration** group:
   - Lower experience means receiving more Thai input, proportionally.
   - When away, people hear little to no Kuy—breathiness cue is dulled.
   - Thai tonal contrast may be recruited to enhance contrast in production.
   - Younger Kuy people socialize with peers of similar age, many of who have gone away and may be enhancing the f0 difference.

4. Back to actuation, situation is ripe for tonogenesis in Kuy because of increasing encroachment of Thai, a tonal language, **in the village**.

5. These micro-effects show how contact, particularly in a society with changing social dynamics, can play a role in catalyzing tonogenesis.
ขอบคุณ ครับ/ครับ
[kʰàpʰ’un krąpnəʔ]
Thank you everyone!

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References I


References II


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References III

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(Extra) Differences by syllable stimulus

- Judgments for *ti*: notably more affected by f0, especially when low-OQ
- Some speakers said *ti*: did not sound as “natural” (however, *ti*: reaction times faster on average by ~100 ms)
- May be because *taʔ* minimal pair has larger breathiness difference
(Extra) Average $H_1^*-H_2^*$ trajectories

* $ti$: has smaller $H_1^*-H_2^*$ difference—perhaps speakers more attuned to $f_0$

/ti:/ vs. /tiː:/

/taʔ/ vs. /taʔ/