Preferences Among Permitted Sequences: A Weighted Markedness Constraint Model

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Introduction & Background

- A lexical gap in Thai exists where *high* tone never occurs following *voiced* or *unaspirated* voiceless onsets (C_{else} = other Consonants) (Ruangjaroon 2006; Morén & Zsiga 2006; Lee 2008, 2011).

1) Consonant-tone gaps in native Thai words (unchecked syllables)

Onset	Mid Tone	Low Tone	Falling Tone	High Tone	Rising Tone
C_{else}	Attested	Attested	Attested	Attested	Attested
Unaspirated	Attested	Attested	Attested	Unattested	Unattested
Voiced	Attested	Attested	Attested	Unattested	Unattested

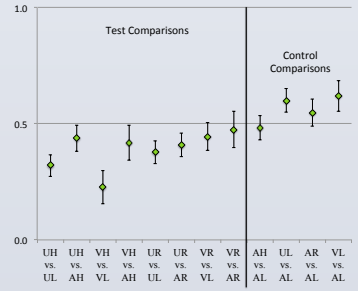
- A perception experiment revealed Thai speakers have preferences between attested consonant-tone sequences in addition.
- The perception experiment involves a choice between two nonce candidates.
  - This involves competition between markedness constraints only; the grammar is applied in a *non-standard* way.
- An OT phonological account of the grammar is adopted (Perkins 2013)
  - Constraints are from Morén & Zsiga (2006), Lee (2008) and Perkins (2013).
- A task-specific weighted constraint model is compared with the experimental results, with a close fit.

Methods

A. Perception Experiment

- Native Thai speakers were presented with two CV: nonce words, differing in only their tone or the aspiration of the onset.
- Participants chose the nonce word that sounded more likely to be a Thai word.
- The results are plotted in (2) below for each comparison, with the unattested sequences coded with a value of 1.
  - U, V, A stand for "unaspirated", "voiced", and "aspirated onsets"; L, H, R are low, high and rising tones; so UH = unaspirated-high tone sequence.

2) Mean response scores in the perception experiment



- A bias was found for voiced-low and unaspirated-low sequences over aspirated-low sequences (see the right side of (2) above).
  - Low tone has an affinity for voiced and glottalized C's (Lee 2008).
- A categorical grammar cannot explain these results.
  - A weighted constraint model is posited to explain these results.

B. Weighted Constraint Model

- Predictive Model based on a categorical OT grammar is proposed.
- Biased Constraint Demotion (BCD; Prince & Tesar 2004) was run on input-output mappings for the Thai grammar.
  - Markedness constraints are initially undominated.
  - Learning involves demoting markedness constraints below faithfulness constraints.
- It yields ranked constraint strata, each with a weighting, *k*.
  - As a default method, increasing whole number values for each higher stratum were used.

3) BCD Strata Results with Constraint Weights, *k*

Stratum 1 (k = 8): *[+voice]-LH, REALIZE-TONE, OCP-H, OCP-L, *[[+CG]…H…[+CG]]σ, LIC-T-Rt, *[+CG]-[H]μ2
Stratum 2 (k = 7): MAX[L]
Stratum 3 (k = 6): MAX[H]
Stratum 4 (k = 5): *H, *[CG]…H, C.G.Coda → L, *[+voice]…H
Stratum 5 (k = 4): *2TONES, *L, *[μμ]T, ALIGN-R, *[+SG]…L
Stratum 6 (k = 3): ALIGN-L, [+voice]-L, [+CG]-L
Stratum 7 (k = 2): LINEARITY (TONE)
Stratum 8 (k = 1): *LH, [+SG]-H

- For each comparison in the perception experiment, the constraints evaluate both output candidates, yielding a score, *c*.
- There are 3 possible outcomes for a given constraint on a given comparison:
  1. The first stimulus is the winner (*c* = 1).
  2. The second stimulus is the winner (*c* = 0).
  3. Neither stimulus is preferred (*c*= 0.5).
- Constraints that were never decisive in any comparison were dropped; all faithfulness constraints were dropped.

4) Constraint violation scores, *c*, for each comparison

Comparison	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
UH vs. UL	0.5	W	W	W	0.5	0.5	L	0.5	0.5	0.5	0.5	0.5	0.5
UH vs. AH	0.5	W	0.5	W	0.5	0.5	0.5	0.5	e	e	W	L	e
VH vs. VL	e	W	W	W	W	e	L	e	e	e	e	e	e
VH vs. AH	e	W	e	W	W	e	e	e	e	W	W	L	e
UR vs. UL	e	W	W	W	e	W	e	e	e	e	L	e	W
UR vs. AR	e	W	e	W	e	e	e	L	e	e	e	L	e
VR vs. VL	W	W	W	W	W	W	e	e	e	L	L	e	W
VR vs. AR	W	W	e	W	W	e	e	L	e	e	e	L	e
AH vs. AL	e	e	W	e	e	e	L	L	L	e	e	e	e
UL vs. AL	e	e	e	e	e	e	e	L	L	e	W	L	e
AR vs. AL	e	e	W	e	e	W	e	e	L	e	e	e	W
VL vs. AL	e	e	e	e	e	e	e	L	L	W	W	L	e

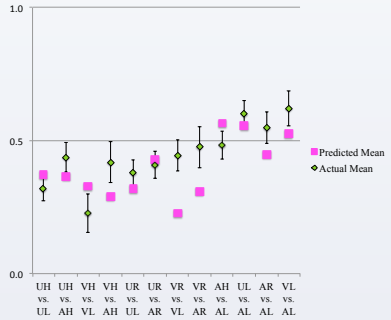
- A predicted response mean for each comparison, P_x ranging from 0 to 1 is calculated via a weighted normalized sum of the c-scores:

$$P_x = \frac{\sum_{i=C1}^{i=C13} k_i * c_i}{\sum_{i=C1}^{i=C13} k_i}$$

- The predicted response scores for each comparison are then compared to the results from the perception experiment.

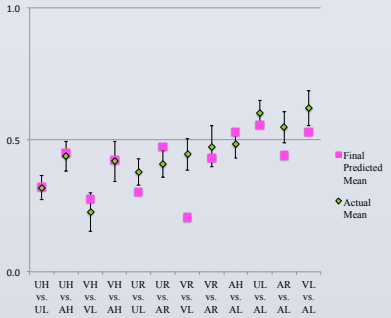
Results

5) Initial Weighted Constraint Model with Experimental Results



- Theoretically-motivated adjustments are made to account for the following two observations:
  1. Comparisons where both stimuli had the same tone yielded results that closer to random than predicted.
  2. Comparisons involving H vs. L tone all had biases towards L tone that were stronger than predicted by the model.
- **Adjustment 1**: H and R tone are phonetically similar and may be more easily confused.
  - A scaling factor was introduced to adjust for this difference in confusability for comparisons with same-tone stimuli.
- **Adjustment 2**: L is considered to be less-marked than H tone (Yip 2002:41).
  - *L is removed from the constraint set, following Gouskova (2003), where there are no markedness constraints for least-marked values.

6) Final Weighted Constraint Model with Experimental Results



- These adjustments improve the fit of the model to within the 95% confidence intervals of all but 4 of the experimental results.
- In all 3 comparisons between rising and low tone, a rising tone bias exists that is not predicted in the model.

Conclusion

- A weighted constraint model correlates closely with experimental results for consonant-tone interaction in Thai.

1. Forced-choice tasks with nonce words involve a non-standard application of the phonological grammar.
   - Only markedness constraints are applied.
   - Speakers apply information from the entire ranking.
2. The fit improves when *L is removed from the model.
   - This result suggests that L tone is less marked, even in languages where there is no evidence for that on the surface.
3. Comparisons with the same tone in both stimuli yielded results closer to random than expected perhaps due to tone confusion.
   - A scaling factor is introduced to remove this confusion effect.
4. Constraints that are not active on the surface of a grammar can show effects in this kind of task.
   - Cross-lingusitically grammatical preferences exist for voiced or glottalized consonants adjacent to low tone.
   - No such effect is present on Thai on the surface, but speakers nonetheless preferred these consonant-tone sequences.
5. There is a general bias for rising tone over low tone that is unaccounted for.

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