Distinct lexical strata in Thai consonant-tone interaction

Jeremy Perkins

University of Aizu

Introduction & Background

- A lexical gap in Thai exists where **high** and **rising** tone never occur following **voiced** and **unaspirated** voiceless onsets (C_{else} = other Consonants) (Ruangjaroon 2006; Lee 2011).
- Previous studies note the high-tone restrictions; rising tone is similarly unattested though according to lexical statistics based on Slayden's (2013) online dictionary and the ORCHID Thai corpus (Kasuriya et al. 2003).

(1) Consonant-Tone Gaps in native Thai words

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

- This gap holds in unchecked syllables only (CV:, CV:N and CVN, where N = any sonorant).
- The following lexical statistics are from Slayden's (2013) online Thai dictionary (left – token frequency; right - % of words with x onset that have y tone)

(2) Distribution of Consonant-tone Sequences in English Loans

Onset	Mid Tone		Low Tone		Falling Tone		High Tone		Rising Tone	
C_{else}	151	93.2%	1	0.6%	3	1.9%	7	4.3%	0	0.0%
Unaspirated	56	87.5%	0	0.0%	2	3.1%	6	9.4%	0	0.0%
Voiced	33	82.5%	0	0.0%	3	7.5%	3	7.5%	1	2.5%

- In English loanwords, mid tone is dominant for all onsets.
- However, high tone is the 2nd most frequently attested tone, and is more commonly seen with voiced and unaspirated onsets, in violation of the consonant-tone restriction.
- This suggests that the restriction involving high tone may be relaxed in loan words.

Research Questions

Research Question 1: Is this lexical gap present in the phonological grammar of Thai speakers?
- The two experiments seek to find differences in grammaticality via a head-to-head judgment experiment.

Research Question 2: Is there evidence that the Thai grammar separates English loans from native Thai items? If so, is the high tone restriction relaxed in English loans?
- Loan Stratification: Ito & Mester (1995) posit that lexical strata stand in a set-containment relation:
- Native strata contain the strictest set of grammatical restrictions, and loan strata contain a subset of those restrictions, such that some restrictions are relaxed.

Methods

Experiment 1:

- Loan interpretation is elicited:
  - Experimenter is a monolingual native *English* speaker.
  - Location: *USA*.
  - Participants are told the stimuli are *not* Thai words.
- 14 Participants were recruited in Bensalem, PA.
- **Task**: They heard pairs of nonce words, and were told to *choose the word that sounded more like it could be a Thai word*.
- **Stimuli**: Nonce stimuli with each of four non-occurring consonant-tone sequences, recorded at the Rutgers Phonology Lab.
- All stimulus pairs are minimal pairs, differing only in tone or onset.
- Onset place of articulation and vowel quality vary between stimuli.
- Two types of test stimulus pairs:
  - Tone varied, manner constant (i.e. [tóː] vs. [tòː])
  - Manner varied, tone constant (i.e. [tóː] and [tʰóː])
- The experimental design also includes two control comparisons between grammatical nonce stimuli, summarized below with one example:

(3) Experimental Design illustrated for Unaspirated-High sequence

	H Tone	L Tone
Aspirated Onset	Grammatical ↕	Grammatical ↕
Unaspirated Onset	Ungrammatical	Grammatical

Experiment 2:

- Native interpretation is elicited:
  - Experimenter speaks only in Thai.
  - Location: *Thailand*.
  - Participants are told the stimuli *are ancient Thai words*.
- 16 native Thai speaking participants were recruited in Bangkok.
- The same task and stimuli were used as in Experiment 1.

Predictions:

- In Experiment 1, if the lexical gaps in loans are grammaticalized, then high tone should be preferred to low tone regardless of onset.
- However, if the restrictions in English loans are a subset of those in native items, as in Ito & Mester (1995), then different predictions are made, as summarized in (4):

(4) Experimental Predictions by Comparison Type

	Stimulus 1	Stimulus 2	Experiment 2 – Predicted Preference in Native Words	Experiment 1 – Predicted Preference in English Loans (Lexical Gap)	Experiment 1 – Predicted Preference in English Loans (Ito & Mester (1995))
Test Comparisons	UH	UL	UL	UH	UL or Same
	UH	AH	AH	Same	AH or Same
	VH	VL	VL	VH	VL or Same
	VH	AH	AH	Same	AH or Same
	UR	UL	UL	Same	UL or Same
	UR	AR	AR	Same	AR or Same
	VR	VL	VL	Same	VL or Same
	VR	AR	AR	Same	AR or Same
Control Comparisons	AH	AL	Same	AH	Same
	UL	AL	Same	Same	Same
	AR	AL	Same	Same	Same
	VL	AL	Same	Same	Same

- 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

Results

(5) Experiment 1 – Loan Interpretation

Mean Response By Comparison
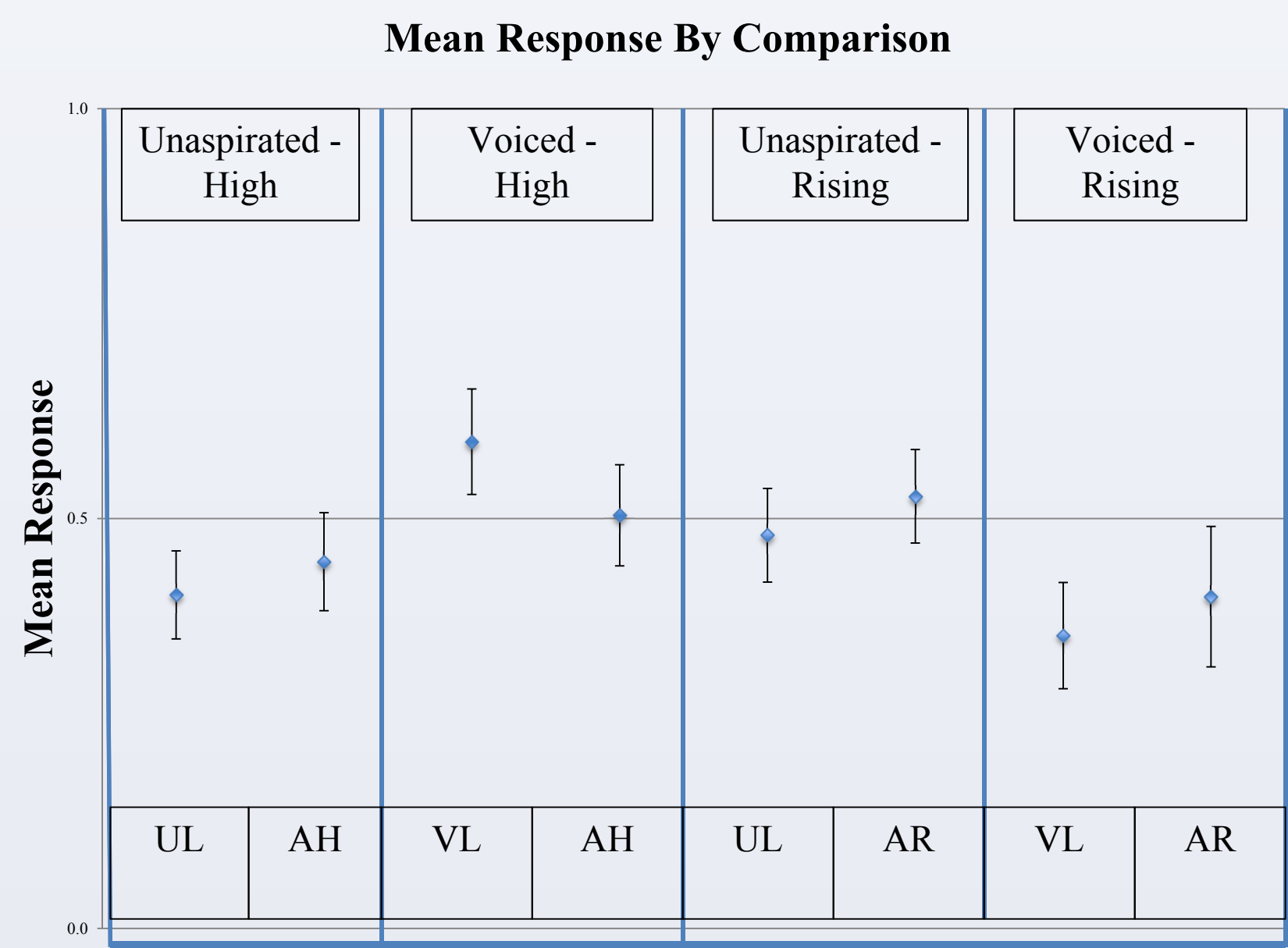
- Logistic Regression is run to confirm significant effect of interaction between tone and onset manner.
- Voice-High (VH) sequence is preferred to Voiced-Low (VL) sequence but not to Aspirated-High (AH) sequence.
- Voiced-Rising (VR) sequence is ungrammatical in loans.
- Unaspirated-High (UH) sequences preferred to Unaspirated-Low (UL); but not to Aspirated-High (AH).

(6) Experiment 2 – Native Interpretation

Mean Response By Comparison
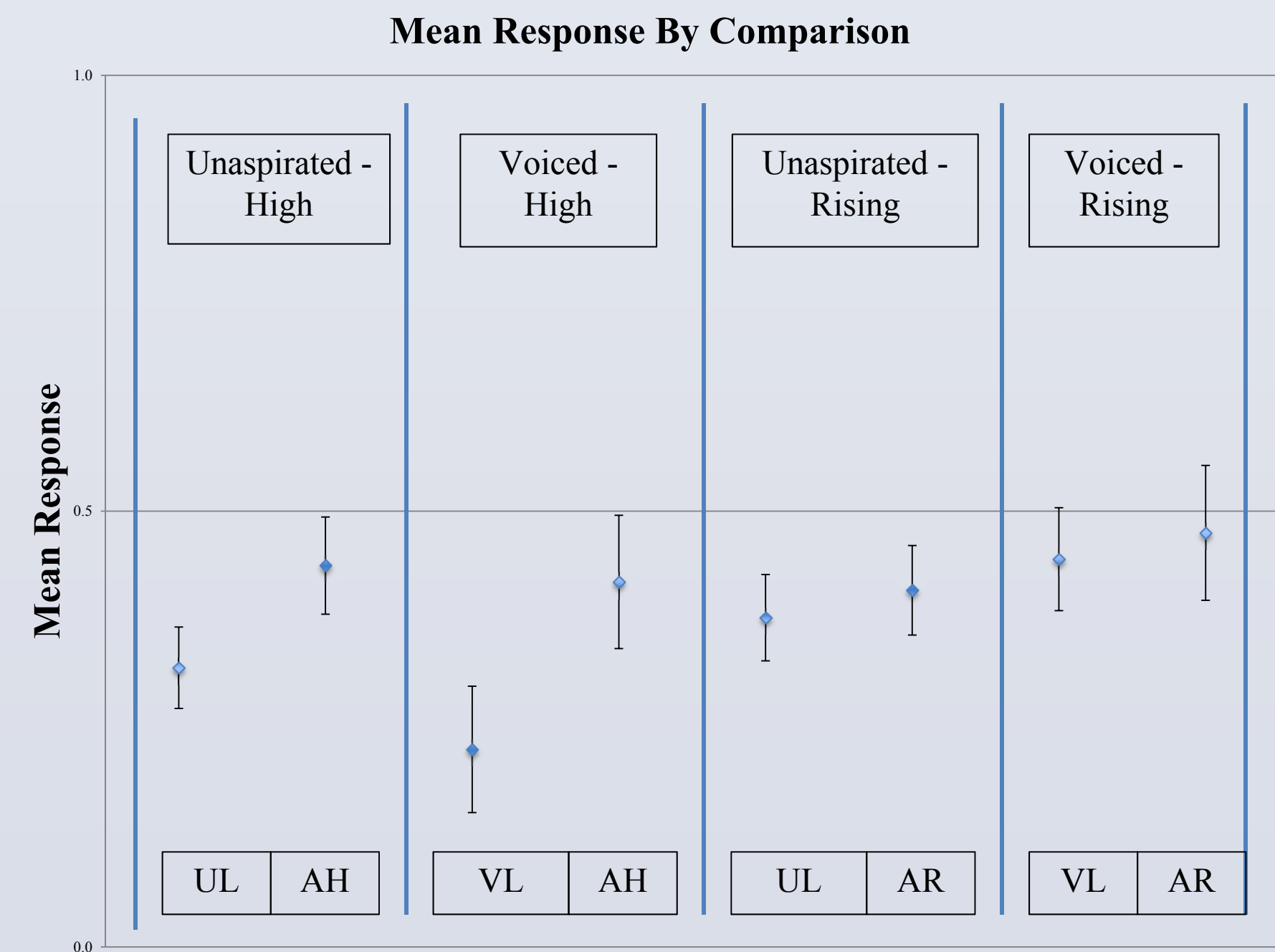
- Unaspirated-High (UH), Voiced-High (VH) & Unaspirated-Rising (UR) sequences are all significantly dispreferred.
- Downward shift for each of the three sequences indicates the native stratum is stricter in its grammatical restrictions.
- Voiced-Rising (VR) is surprisingly dispreferred to a greater degree in the loan stratum.

- **Research Question 1**: Therefore, Experiment 2 shows that the consonant-tone restrictions in Thai are psychologically real, and are represented in Thai phonology.
- **Research Question 2**: There is evidence that English loans relax three of the four restrictions investigated here (UH, VH, and UR).
  - The VR sequence is ungrammatical in both strata.
  - Experiment 1 responses may have been exaggerated for the VR sequence, since it is the only ungrammatical sequence.
- Ito & Mester's (1995) lexical strata hypothesis is consistent with the results for Thai.

Discussion & Conclusions

- Ito & Mester (1995)'s hypothesis is consistent with all results except the VH preference over VL in English loans.
  - An explanation: Of all the words containing VH sequences, a large portion are English loans, but there are no VL loanwords. The preference for VH sequences may reflect this.
- In control comparisons, participants exhibited significant preferences for VL (both experiments) and UL (experiment 2 only), both of which are grammatical.

(7) Results – Control Comparisons (Both Experiments)

Mean Response by Comparison
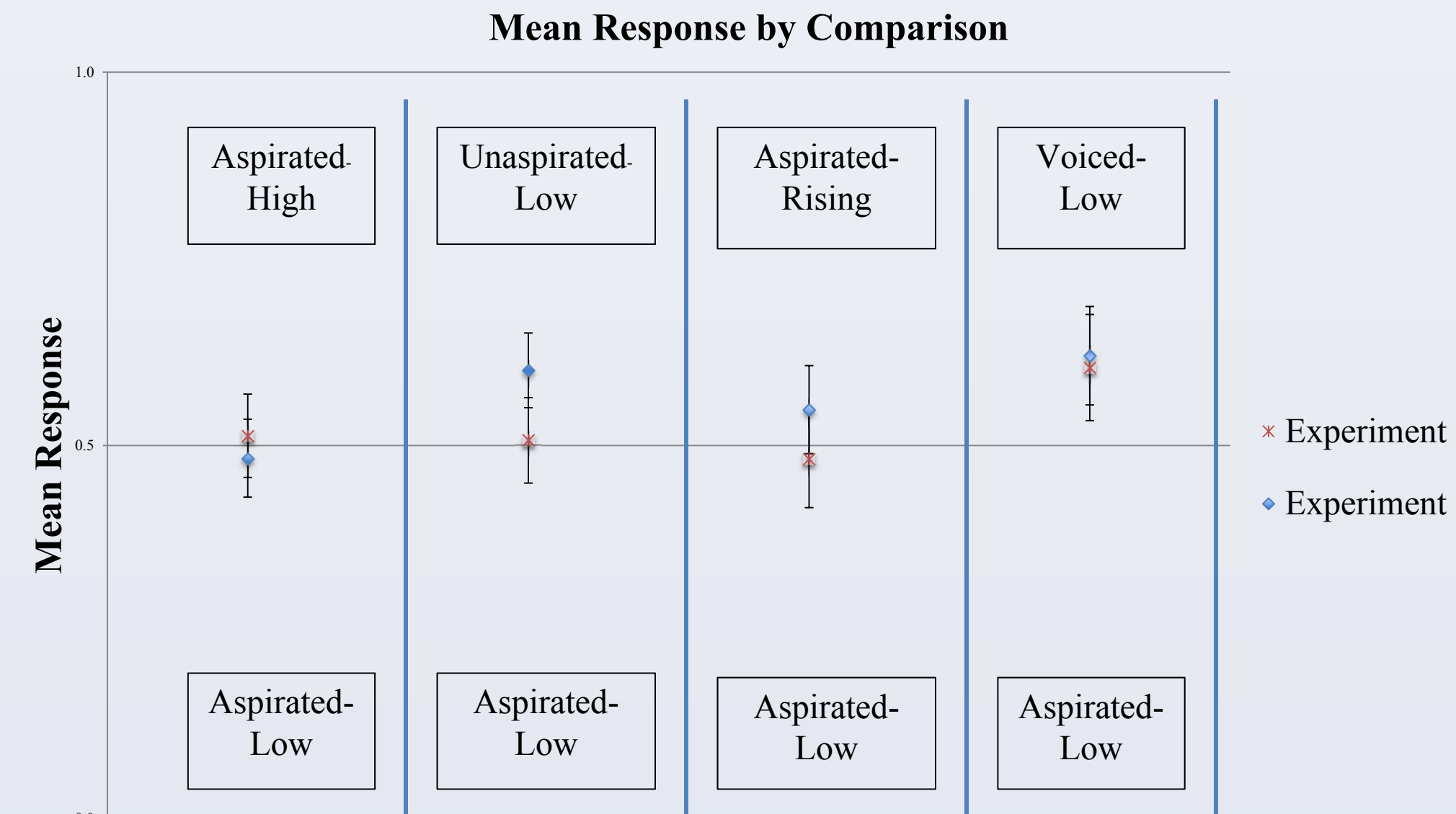
- This preference cannot be learned since both alternatives are grammatical; Similar findings are attested in Hebrew & English (Frisch & Zawaydeh 2001; Berent et al. 2007; Coetzee 2008, 2009).
- This preference is universal: Unaspirated and Voiced stops are less marked preceding low tone (Bradshaw 1998; Lee 2008).
- In conclusion, all four consonant-tone restrictions are psychologically real in Thai, with only one of these four being significant in English loans.

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