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Stress and Tone in Lizu (Tibeto-Burman)

Katia Chirkova (CRLAO, CNRS)



Outline

Part 1. Broader Context



Sino-Tibetan
Tibeto-Burman
Tibeto-Burman languages of Southwest China
Qiangic

prosodic systems: tone & stress
typology

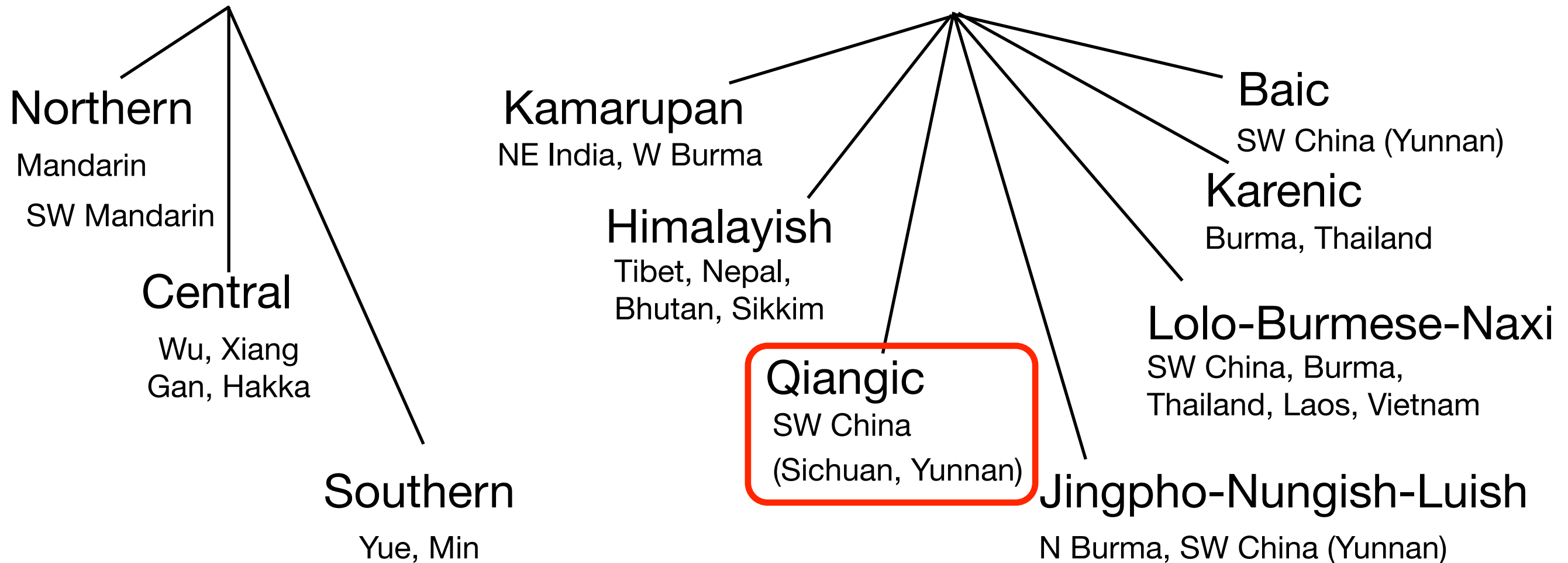
Part 2. Case Study: Lizu

prosodic organization
problems & challenges in descriptive and comparative work
experiment
results & implications

Sino-Tibetan

Chinese

Tibeto-Burman

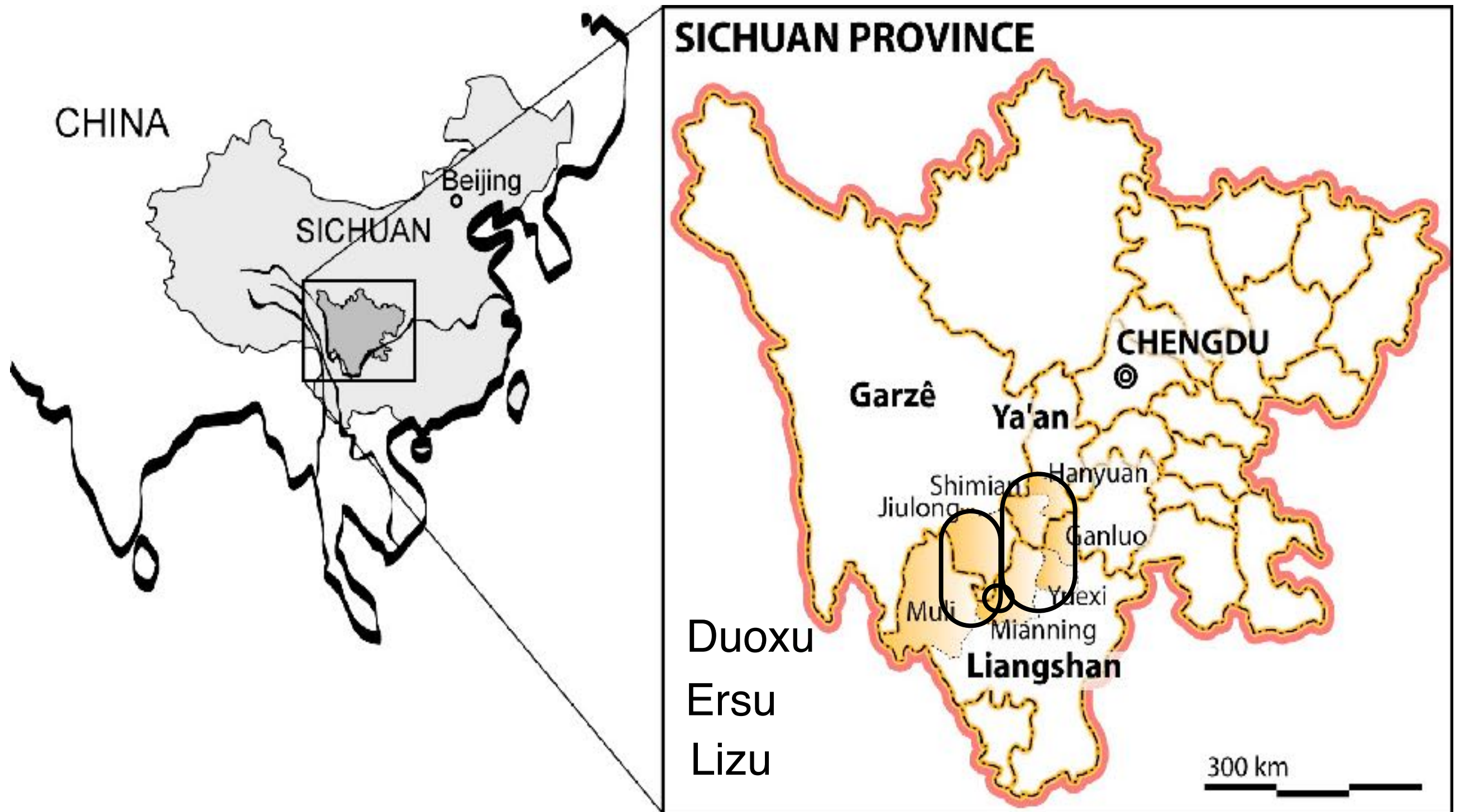


Based on: Matisoff, James A. 2003. *The Handbook of Proto-Tibeto-Burman: System and Philosophy of Sino-Tibetan Reconstruction*. Berkeley: University of California Press, 5.

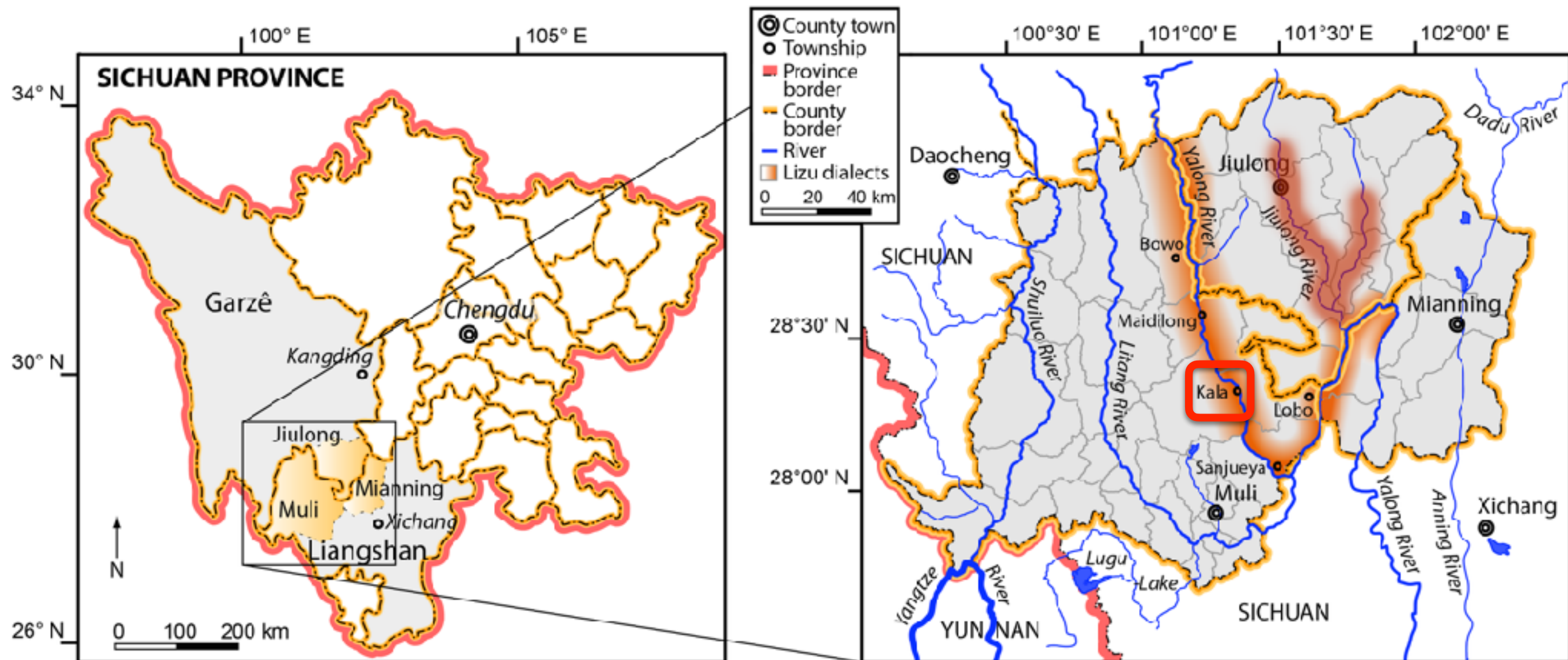
Qiangic



Location



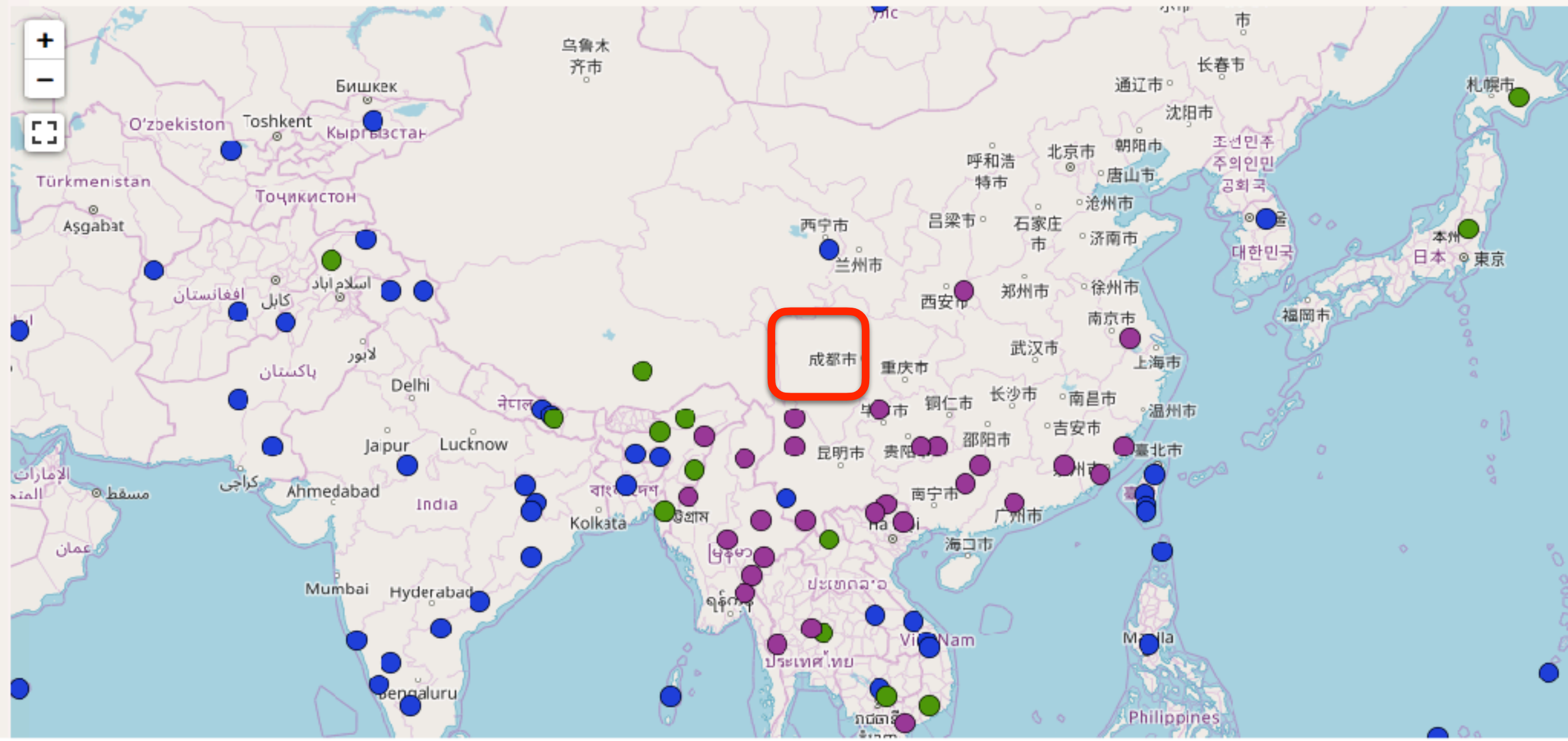
Lizu



Suprasegmental Features

- properties of syllables and larger units of speech
 - tone, stress, intonational pitch movements (pitch realized over units larger than a single word), pause, rate of speech
- a combination of these phonetic features are used to segment, and organize connected discourse, and to convey emotion and attitude

Legend ▾ Icon size ▾ Show/hide Labels



Tone		Number of languages
<input type="checkbox"/>	Simple tone system	132
<input type="checkbox"/>	No tones	307
<input type="checkbox"/>	Complex tone system	88

Legend - Icon size - Show/hide Labels



	Fixed Stress Locations	Number of languages
+	Ultimate	51
+	Third	1
+	Second	16
+	Penultimate	110
+	No fixed stress	220
+	Initial	92

Prosodic Organization

- sparse or 'culminative' tone systems
 - in which no more than one pitch pattern is pronounced per word (or longer phonological unit)
 - situated within a continuum between non-tonal stress languages and tonal languages without lexical stress (cf. Hyman 2001:1377)
- characteristics
 - lexical tone on monosyllabic domains; simple tone inventories (basic tonal categories H & L)
 - small number of tonal patterns on polysyllabic domains
 - the connection between lexical tone on monosyllabic words and tonal patterns on polysyllabic words is seen as that involving tone spread from its pre-specified location (mostly at the left edge of the prosodic word) rightwards, determining all or most of the tonal melody of the word (e.g. Evans 2008, Evans & Huang 2007)

African languages (typical)	Chinese dialects (typical)	Mianchi more like...
Privative /T, Ø/ or binary contrast (/H, L/ or /H, L, Ø/)	Rich tonal inventory	African (/H, L, Ø/)
Limits on adjacency of marked tone (OCP) or co-occurrence at word level (culminativity)	Limited OCP	African
Sparse distribution of tone specifications	Every lexical syllable has a tone	African
Toneless syllables receive default tone (usually L)	Pitch of toneless syllables determined by context	African
Tones can float	Tones are pre-linked to syllables, no floating tones	African
One-to-many tone associations (spreading)	Mostly one-to-one tone associations	Chinese
Downstep caused by L	No downstep	Chinese
Level tones primary	Level and contour tones are both primary	African
Contour tones are sequences of level tones	Contour tones form units at a deeper level of structure	African
Restricted occurrence of contour tones	Contour tones occur freely	African
Morphological tones	No morphemes that lack segmental content	African
Morphological tone polarity	Phonological tone polarity	African
Tendency toward fixed tone patterns	No higher order restrictions	African

Word Structure

- Lizu morphemes are generally monosyllabic but words are generally disyllabic (over 80% of the collected vocabulary)
- monomorphemic words are for the most part monosyllabic, e.g. /dʒě/ ‘water’
- polysyllabic words are mostly composite, e.g. /dʒê-k^hwæ/ ‘flood’ (from /dʒě/ ‘water’, /k^hwǎě/ ‘be large’), /tôNbu-mu/ ‘nose hair’ (from /tôNbu/ ‘nose’, /mû/ ‘animal hair, fur’)
- there is also a handful of disyllabic and trisyllabic monomorphemic words, e.g. /mîdzê/ ‘hare, rabbit’

Monosyllabic Words

- at monosyllabic level, Lizu distinguishes two lexical tones: rising and high falling in isolation
- the two tones are fairly evenly distributed in the lexicon
- this is a robust opposition, supported by many minimal pairs
- tones are fully independent: any vowel may bear any tone and all consonants, including sonorants and voiced obstruents, can be associated with both tones

Rising	Falling
<i>/dzǐ/</i> ‘to cut’	<i>/dzî/</i> ‘to speak’
<i>/mǐ/</i> experiential marker	<i>/mî/</i> ‘monkey’
<i>/tçě/</i> ‘cloud’	<i>/tçê/</i> ‘hair’
<i>/ts^hě/</i> ‘goat’	<i>/ts^hê/</i> ‘to cough; to wash’
<i>/ně/</i> ‘two’	<i>/nê/</i> ‘you, thou’
<i>/lě/</i> ‘to be old’	<i>/lê/</i> ‘to be heavy’
<i>/tǎě/</i> ‘mule’	<i>/tâê/</i> ‘tendon’

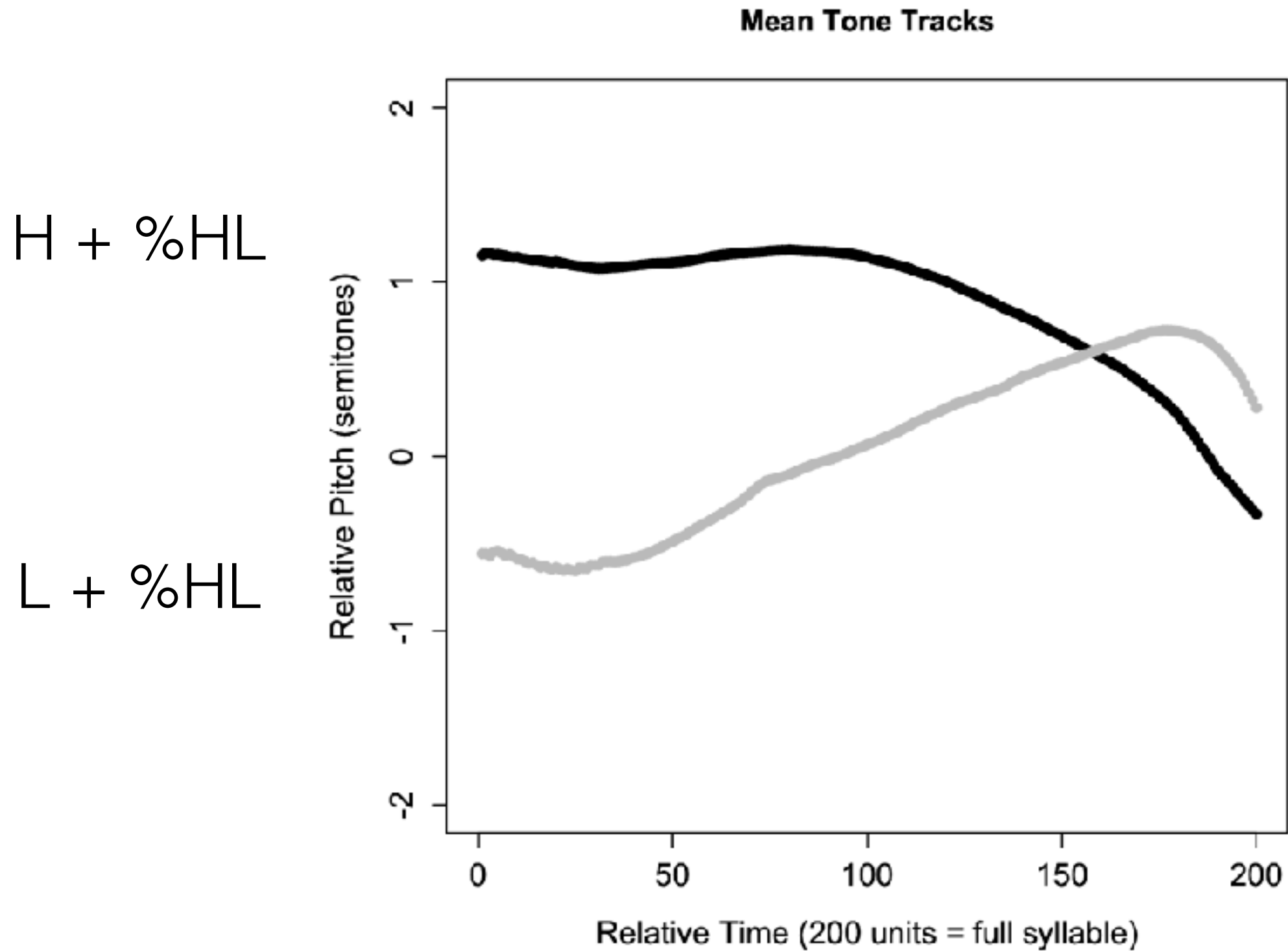
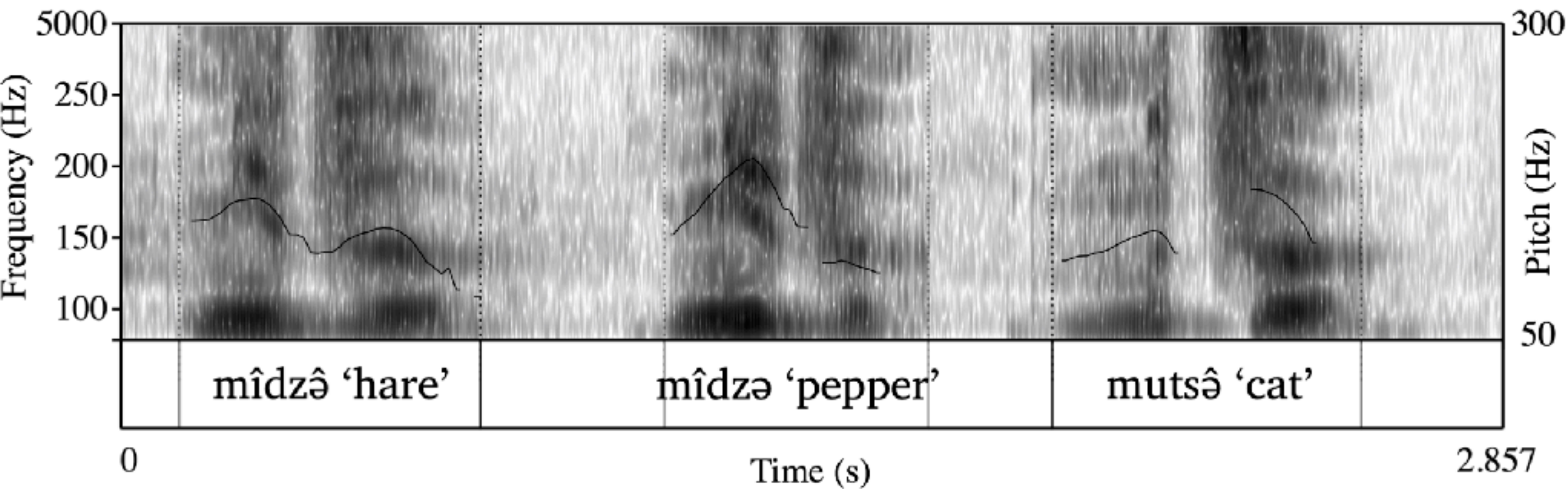


Figure 1. Two contrastive tones on monosyllabic words: (1) high falling (black), 15 tokens; (2) mid rising (grey), 11 tokens. Plotted as relative time versus Hz. Normalized for duration and mean T2 pitch.

Disyllabic Words

- in disyllabic words, three pitch patterns are observed: HH, HL, LH (LL)
- fairly evenly distributed in the lexicon
 1. HH: both syllables have a mid- to high-level pitch contour, though the first is slightly higher than the second, and the second syllable has a falling pattern, as in /mîdzê/ 'hare', /sêNgê/ 'lion' (WT *seng ge*), /mêlyê/ 'thrush', and /nôNbuê/ 'brain'
 2. HL: the f0 peak is typically realized before the end of the first syllable, where the pitch starts to fall and continues to fall in the second syllable, as in /mîdzə/ 'pepper', /mêlje/ 'place', and /tôNbu/ 'nose'
 3. LL (LH): within the first syllable, there is a mid-level pitch contour with a slight rise. The f0 peak is realized within the second syllable where there is also a clear fall, as in /mutsê/ 'cat', /meljê/ 'wind', and /nəNbuê/ 'deaf person'



HH

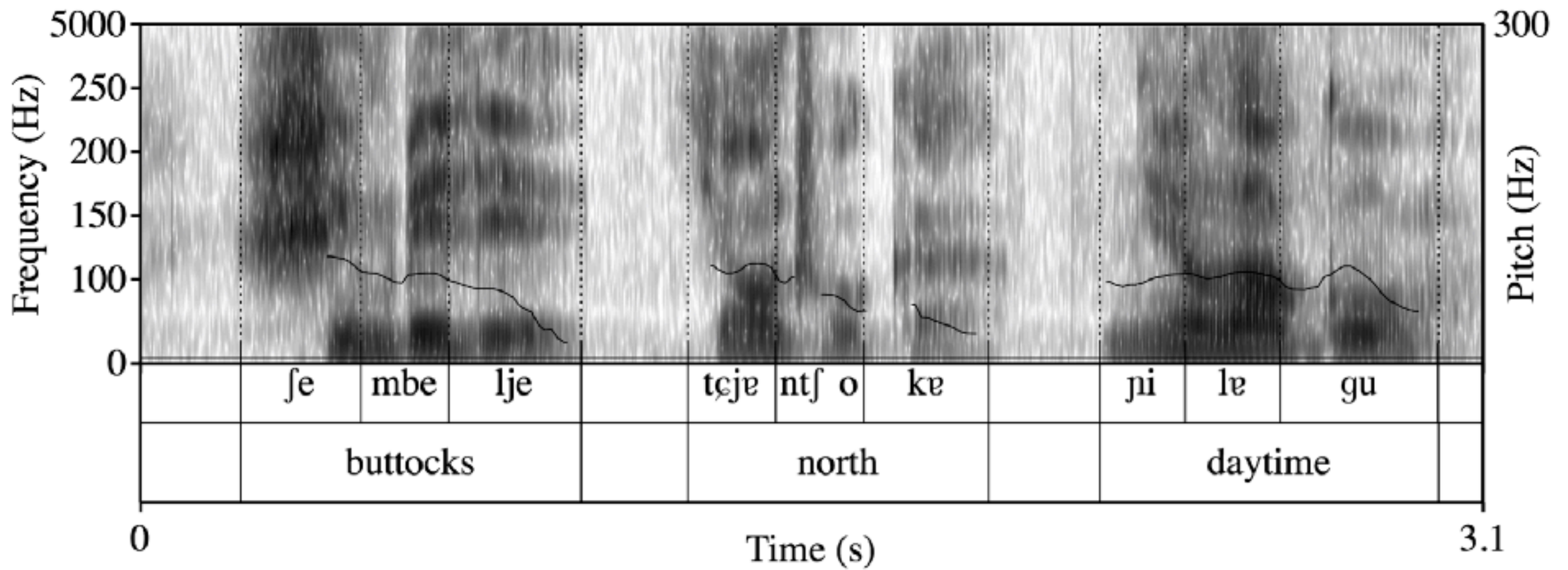
HL

LL (LH)

- in contrast to the two lexical tones on monosyllabic words, the three-way contrast on disyllabic words is not supported by minimal sets
- many pairwise minimal pairs

Tri- and Tetra-syllabic Words

- in tri- and tetra-syllabic words (both monomorphemic and polymorphemic): three common pitch patterns, comparable to the ones over disyllabic domains:
 1. HHH: The pitch contour over all syllables remains mid or high level until the last syllable where there is a clear falling pattern, as in /ʃêN**bê**ljê/ ‘buttocks’
 2. HLL: There is a rising contour on the first syllable, the peak of which varies slightly depending on the length of the word. For a three-syllable word, the peak is typically realized at the beginning of the second syllable, while for a four-syllable word, the peak is further delayed within the second syllable, after which there is a clear falling contour till the end of the word, as in /tɕjêNtʃ^hokɐ/ ‘north’ (WT *byang phyogs*)
 3. LLL (LLH): The f0 peak is realized within the last syllable and the preceding syllables show a mid-level f0 contour, as in /**ni**lɛgû/ ‘daytime’



HHH

HLL

LLL (LLH)

- no contrastive minimal sets for the three patterns

Tone Derivation Patterns

- dynamic tone combinations
- in compounds, lexical tones undergo sandhi changes
- compounds and phrases beginning with a noun
noun-noun, noun-verb, noun-classifier, noun-clitic
- the synchronically productive pattern as attested on syntactic compounds is one in which only the tonal contour of the initial word is retained and realized over the whole compound domain

Tone Derivation Patterns

- if the domain-initial monosyllabic root or word has the rising tone, the resulting pattern is generally L(...L)H
- if the domain-initial monosyllabic root or word has the falling tone, the resulting pattern is generally H(...)H
- in domains that begin with a disyllabic root or word, the resulting contours are determined by the tonal contour of the initial disyllabic item

Noun-Noun Compounds

	Ndʒǎ 'skin'	mû 'animal hair, fur'
ŋû 'cow'	ŋûNdʒê 'cow hide'	ŋûmû 'cow hair'
ɹwǎ 'chicken'	ɹwæNdʒê 'chicken skin'	ɹwæmû 'chicken feathers'
wô 'pig'	wôNdʒê 'pig skin'	wômû 'pig hair, bristles'
ɲǒ 'sheep'	ɲoNdʒê 'sheep skin'	ɲomû 'sheep fur'

Noun-Noun Compounds

	tɕôɪâ ‘footprint’	mêNtʃ ^h o ‘tail’	temî ‘heart’ nɛpî ‘ear’
ŋû ‘cow’	ŋû tɕôɪâ ‘cow footprint’	ŋû mêNtʃ ^h ô ‘cow’s tail’	ŋû têmî ‘cow heart’
ɹwǎ ‘chicken’	ɹwǎ tɕôɪâ ‘chicken footprint’	ɹwǎ meNtʃ ^h ô ‘chicken tail’	ɹwǎ temî ‘chicken heart’
wô ‘pig’	wô tɕôɪâ ‘pig footprint’	wô mêNtʃ ^h ô ‘pig tail’	wô têmî ‘pig heart’
ɲǒ ‘sheep’	ɲo tɕôɪâ ‘sheep footprint’	ɲo meNtʃ ^h ô ‘sheep tail’	ɲo temî ‘sheep heart’

Summary

- the synchronically productive pattern: only the tonal contour of the initial word is retained and realized over the whole compound domain
- different tonal contrasts on the monosyllabic level (2 lexical tones) and on the level of words of over one syllable (3 contrastive patterns on disyllabic words)
- questions:
 - are the three patterns really contrastive?
 - how do the 2 lexical tones on monosyllabic words transform into 3 tonal patterns on words of two syllables and longer?
 - $HH > H(\dots)H$, $LH > L(L\dots L)H$, $? > H(L\dots)L?$

HL Tonal Pattern

- lexicalized compounds (high-frequency, disyllabic noun-verb compounds)

ɣǒ 'wine' + tɕ^hê 'to drink' > ɣô tɕ^he 'to drink wine; wine-drinking'

- recent loanwords from Mandarin:

kwâtsə 'seeds', SW Mandarin /kwa⁴⁴tsə⁵³/

- tone change in compounds

lêmæ 'finger' > lemâ je-je 'little finger'

k^hêNts^hæ 'remember' > k^heNts^hâ p^hǎ 'be able to remember'

Problems

1. Organization of the system
2. Comparative work

Comparative work

Table 4: Surface tone values of monosyllabic cognates in Ganluo Ersu and Kala Lizu

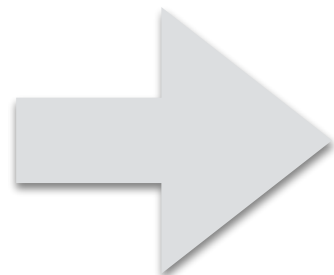
Gloss	Ersu	Ersu tone	Lizu	Lizu tone
month	la	H	lae	H
pig	ve	H	wo	H
wheat	ʃa	H	ʃæ	H
sheep	jo	H	no	L
iron	ʃe	H	ʃe	H
silver	əŋua	H	ŋu	L
tree	si	H	se	L
chicken	ʃa	H	ɰwæ	L
goat	ts ^h i	H	ts ^h e	L
four	ʒo	L	ʒe	H
horse	Nbo	L	Nbɪə	H
meat	ʃə	L	ʃə	H
blood	ʃo	L	ʃe	H
gall/bile	ʃro	L	tʃə	L
blow	ma	L	mɪə	L

Comparative work

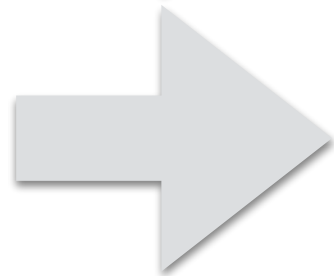
Gloss	Ersu	Ersu tone	Lizu	Lizu tone
sow	vɛma	HH	womæ	HH
spider	kara	LH	kiəwæ	HH
pine needle	ntɕ ^h o sits ^h a	LLH	ntɕ ^h omu	HH
gall, bile	tɕore	LH	tɕərə	HH
mole	ʃənwa	LH	ʃənə	HH
aubergine	ŋgatsə	HH	ŋgætsə	LH
crops	rɛp ^h u	HH	ɹət ^h u	LH
tree	sipu	HH	sepu	LH
hoof	ŋk ^h wadzə	LH	ŋk ^h wædzə	LH

Analysis

- structure of the lexicon: Lizu morphemes (lexical and grammatical) are generally monosyllabic, but words are generally disyllabic



preference in Lizu for syllables being grouped into binary units



the binary preference is an instance of a strong cross-linguistic bias found in stress systems

- possibility for an analysis of Lizu as combining lexical tone with stress
- an analysis allowing for the contextualization of the phonetic properties of stress in Lizu relative to the broader literature on acoustic correlates of prominence

Stress

- stress (Hyman 2009: 217): a language with stress-accent is one in which there is an indication of word-level metrical structure meeting the following two central criteria
 - A. obligatoriness: every lexical word has at least one syllable marked for the highest degree of metrical prominence (primary stress)
 - B. culminativity: every lexical word has at most one syllable marked for the highest degree of metrical prominence
 - C. stress-bearing unit is the syllable
- stress is a relative property arising from a relationship between two (or more) syllables, put differently, syllables are perceived as stressed only by virtue of their relationship with nonstressed syllables

Acoustic Cues for Stress

- in stress languages, such as English, the principle auditory cues that correlate with word stress are duration, intensity, and vowel quality (e.g. Fry, 1958; Bolinger, 1961; Gordon 2016)
- stressed syllables tend to have greater intensity, longer duration, and full (nonreduced) vowel quality, compared with nonstressed syllables
- stressed syllables also tend to have higher pitch (fundamental frequency, F0)

Teasing apart Acoustic Cues for Stress and Tone

- the difficulty of teasing the two apart is canonically due to analyzing words in isolation
- Pierrehumbert (2000): “The citation form is reconstructed as the form produced in a specific prosodic context – when the word is both phrase-final and bears the main stress of the phrase.”

Pierrehumbert, Janet. 2000. Tonal elements and their alignment. In M. Horne (ed.), *Prosody: Theory and Experiment. Studies Presented to Gosta Bruce*. Kluwer, Dordrecht, 11-26.

Experiment

- measurement parameters: intensity, duration, and f0 (= common correlates of stress in languages of the world)
- basis: recordings of eight subjects (four female and four male), all of whom were native speakers of Lizu (the /ʃætɕ^hôpæt/ dialect) (age 23-70)
- the list of targeted words: 30 disyllabic lexical words, presented to the subjects to read in randomized order in two contexts

in isolation, where the word is both phrase-final and bears the main stress of the phrase

in a phrasal context

- in each context, the target words were read each four times
- measurements taken (in Praat): mean intensity, mean duration, and fundamental frequency (1/3, 2/3, 3/3) over each vowel in the word

Words Experiment

HH	HL	LH
/me-ly/ 'thrush'	/melje/ 'place'	/melje/ 'wind'
/midzə/ 'hare'	/midzə/ 'pepper'	/mutsə/ 'cat'
/ts ^h o-mo/ 'old man'	/Nts ^h olo/ 'louse'	/ts ^h o-mo/ 'tomb'
/pimæ/ 'frog'	/jimæ/ 'sun'	/jimæ/ 'living room, parlor'
/noNbu/ 'brain'	/toNbu/ 'nose'	/nəNbo/ 'deaf person'
/wæɪæ/ 'cloth'	/ɪwæ-ɪwæ/ 'irritable'	/wæɪæ/ 'beer, rice wine'
/kælæ/ 'difficulty'	/gæ-gæ/ 'to have fun'	/kælæ/ 'butterfly'
/mæ-mæ/ 'grandmother'	/læ-mæ/ 'lama'	/mæ-mæ/ 'fruit'

Words Experiment Final

HH	HL	LH
k ^h æ-k ^h æ 'split'	gæ-gæ 'play'	
	də-də 'short'	
	tə-tə 'chew'	jə-tə 'left'
ts ^h æ-t ^h æ 'hot'		
ʃo-ʃo 'clean'		ʃə-ʃə 'long'
		ʃæ-ʃæ 'search'
qətə 'knot'	qə-qə 'filter'	qwə-qwə 'hard'
ts ^h u-t ^h u 'thick'	tɕy-tɕy 'straight'	
ʒu-ʒu 'narrow'		zu-zu 'thread (needle)'
		ʒy-ʒy 'thick'
	sə-sə 'touch'	

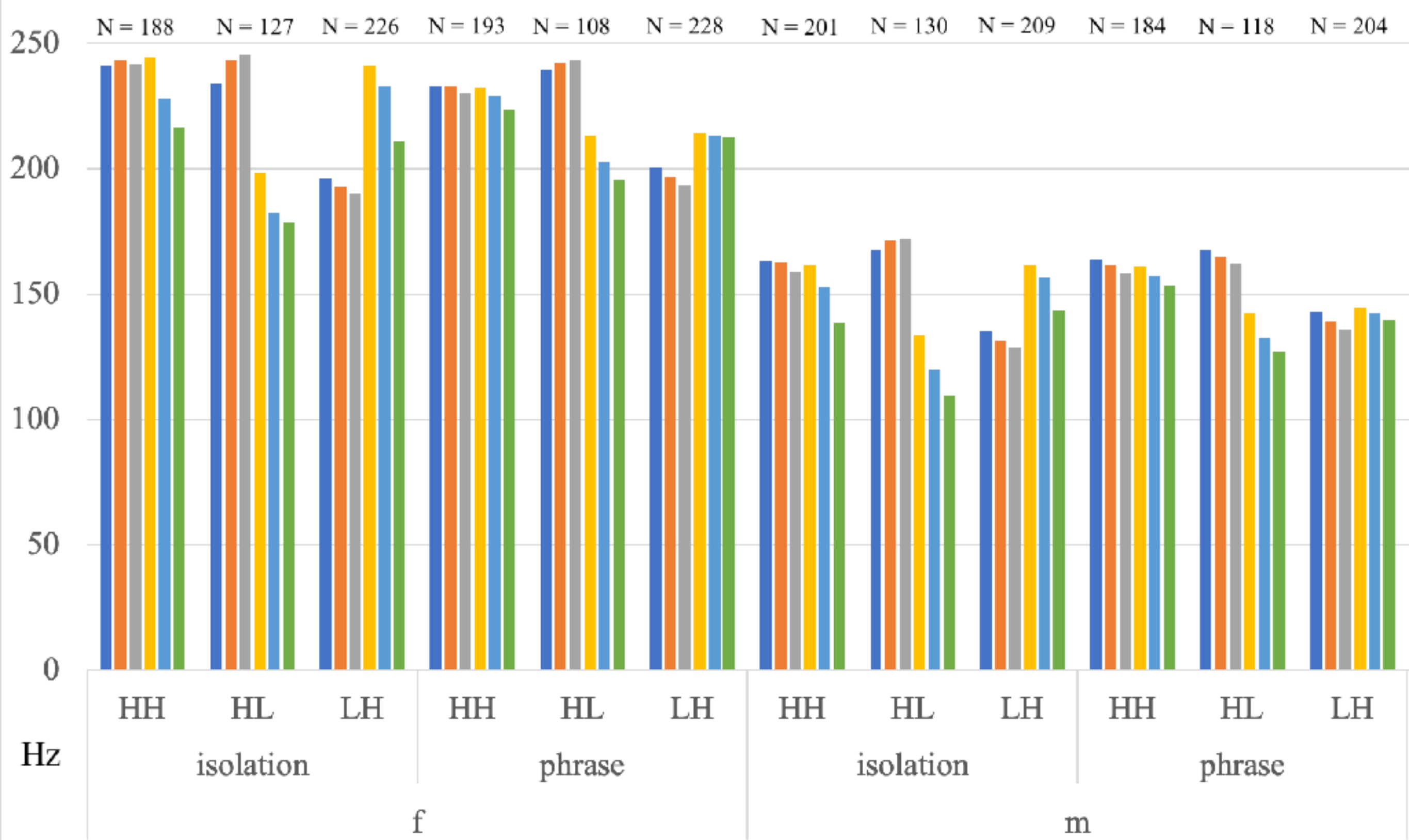
Experiment

- after analysis, data were subjected to statistical analysis (repeated measures ANOVAs (analyses of variance))
- the three tone patterns were compared in two contexts (isolation, phrase) as a function of (1) average intensity and duration (all speakers), and (2) fundamental frequency at the 1/3, 2/3, 3/3 of the syllable (female and male speakers separately)
- post hoc comparisons using the Tukey HSD test, t-tests
- given that stress is a relative property arising from a relationship between two syllables, comparisons for intensity and duration were based on the differences between two syllables in each word (value Syl1 - value Syl2)

Questions

- can we detect phonetic properties of stress in Lizu?
- what is the correlation between stress and tone?
- are the three patterns on disyllabic words really contrastive?
- why do words of two syllables and longer have three tonal patterns, while there are only two lexical tones on monosyllabic words?
 - $HH > H(\dots)H$, $LH > L(L\dots L)H$, $? > H(L\dots L)L?$

F0 at 1/3, 2/3, 3/3 in Isolation and in the Phrasal position



Context: Isolation

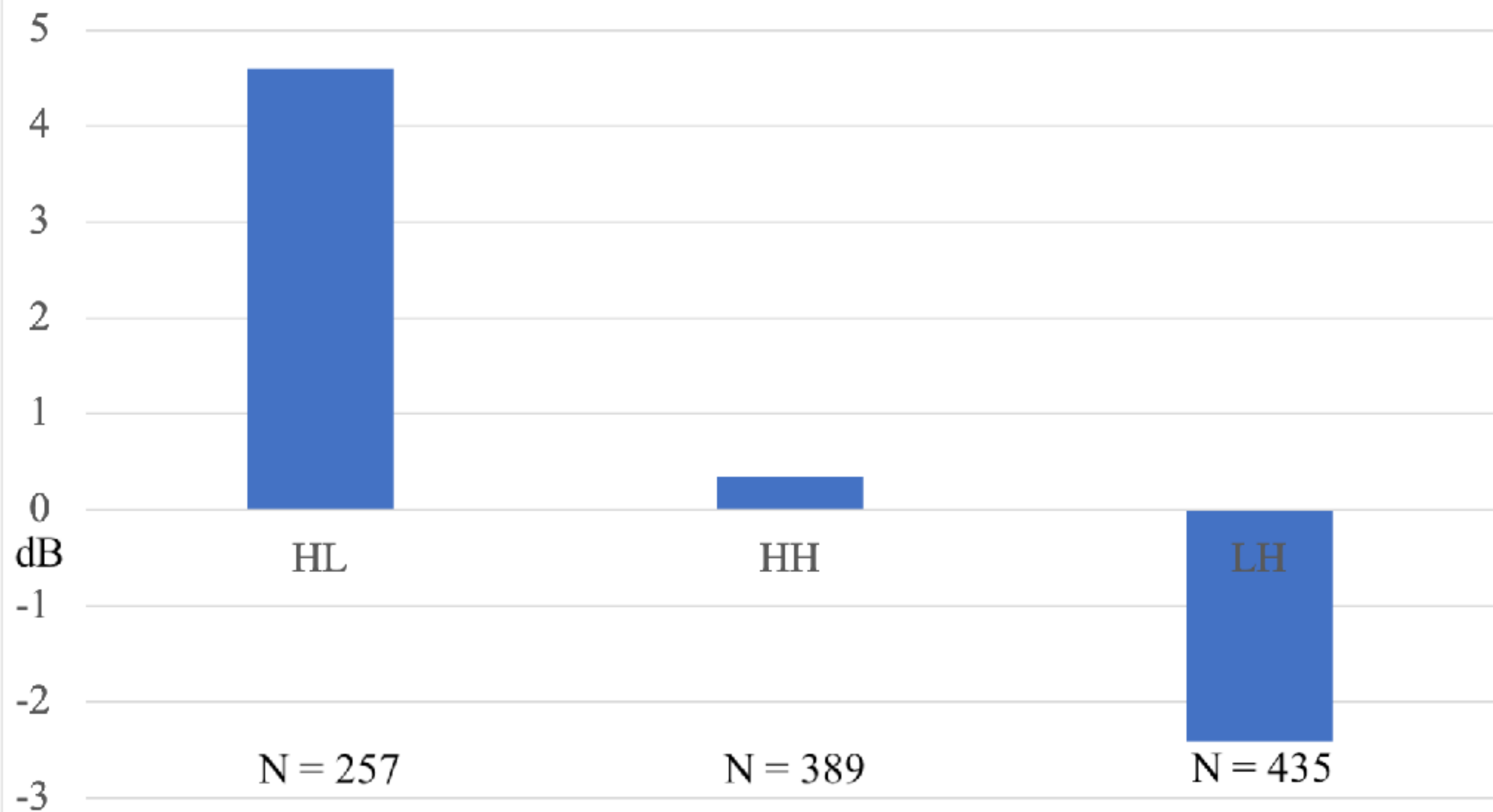
- Intensity

In isolation, HL, HH, LL differed significantly as a function of the difference in intensity between the two syllables

MinInt : $F(2, 654) = 178.2, p < 0.001$

All Tukey's HSD tests showed that all tonal groups were significantly different from each other at the .001 level of significance (post-hoc Tukey's HSD comparisons were insignificant).

MinInt in Isolation



Context: Isolation

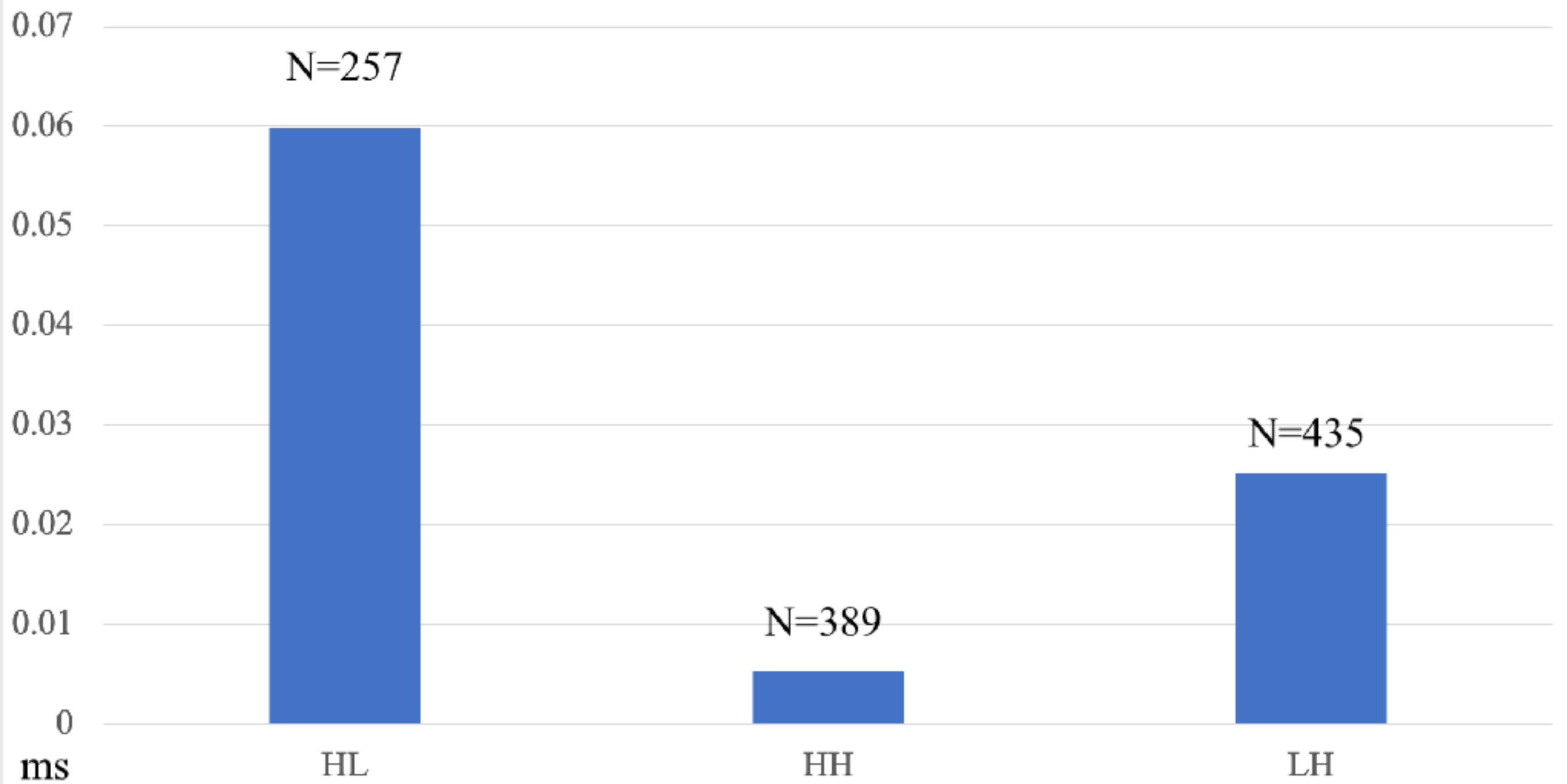
- Duration

In isolation, HL, HH, LL differed significantly as a function of the difference in duration between the two syllables

MinDur : $F(2, 1078) = 51.81, p < 0.001$

All Tukey's HSD tests showed that all tonal groups were significantly different from each other at the .001 level of significance (post-hoc Tukey's HSD comparisons were insignificant).

MinDur in Isolation



Pitch: Women

1/3:

1st syllable: $F(2, 538) = 115.6, p < 0.001$; post-hoc Tukey's tests : no difference between HL&HH; other comparisons not significant

2nd syllable: $F(2, 536) = 110.4, p < 0.001$; no difference between HH/LL; other comparisons not significant

2/3:

1st syllable: $F(2, 538) = 146.1, p < 0.001$; no difference between HL/HH; other comparisons not significant

2nd syllable: $F(2, 536) = 144.3, p < 0.001$; no difference between HH/LL; other comparisons not significant

3/3:

1st syllable: $F(2, 538) = 173.4, p < 0.001$; no difference between HL/HH; other comparisons not significant

2nd syllable: $F(2, 523) = 13.02, p < 0.001$; no difference between HH/LL; other comparisons not significant

Pitch: Men

1/3:

1st syllable: $F(2, 534) = 193.5$, $p < 0.001$; post-hoc Tukey's tests : no difference between HL&HH; other comparisons not significant

2nd syllable: $F(2, 532) = 111.6$, $p < 0.001$; no difference between HH/LL; other comparisons not significant

2/3:

1st syllable: $F(2, 535) = 254.3$, $p < 0.001$; all three patterns are different; other comparisons not significant

2nd syllable: $F(2, 533) = 206.4$, $p < 0.001$; no difference between HH/LL; other comparisons not significant

3/3:

1st syllable: $F(2, 535) = 286.8$, $p < 0.001$; all three patterns are different; other comparisons not significant

2nd syllable: $F(2, 515) = 90$, $p < 0.001$; no difference between HH/LL; other comparisons not significant

HL:

wa-wa | wa-wa | wa-wa | ...

HH:

wa-wa | wa-wa | wa-wa | ...

LL:

wa-wa | wa-wa | wa-wa | ...

Context: Phrase

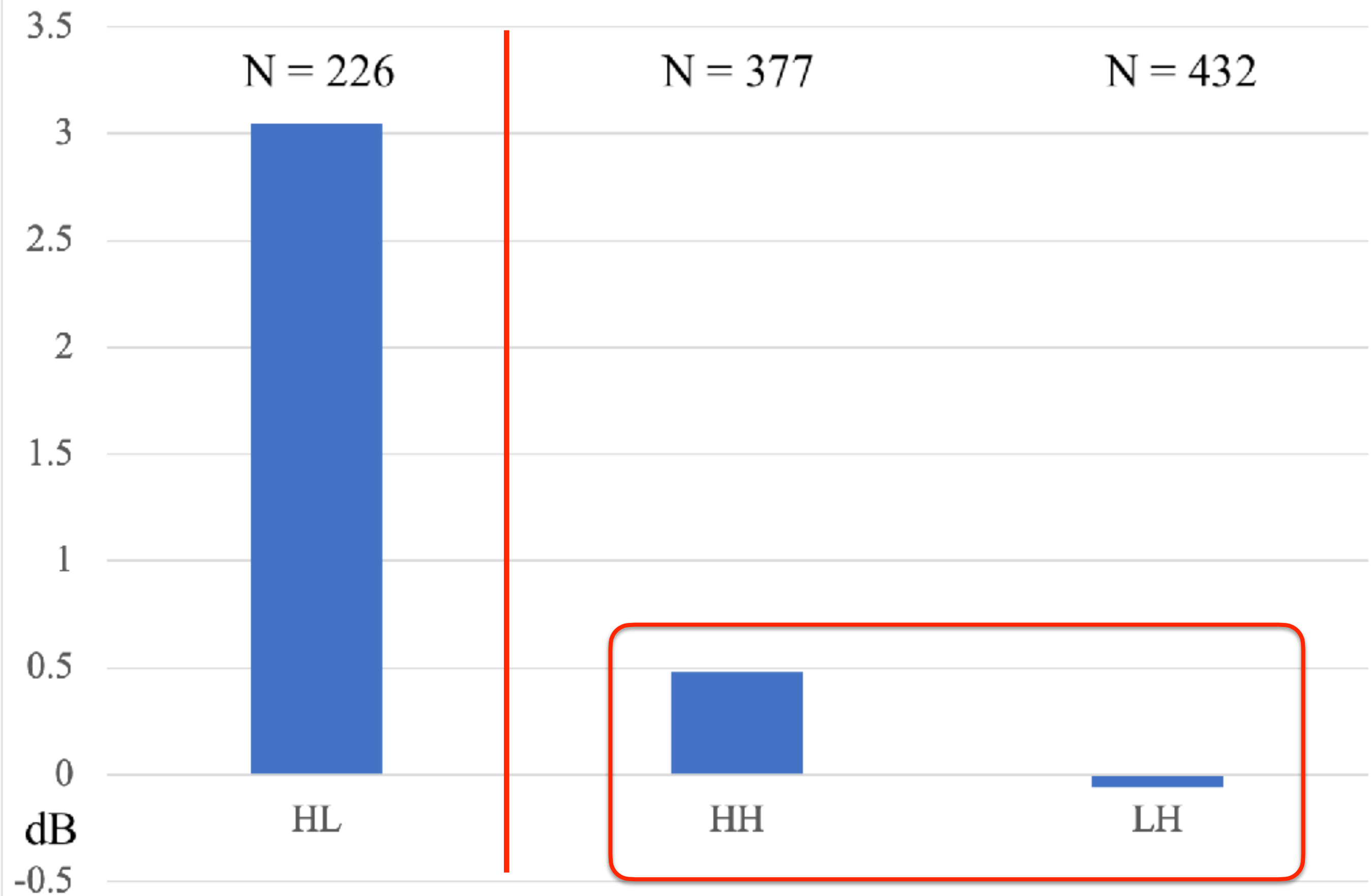
- Intensity

In the phrase-initial position, the three tonal patterns differ significantly as a function of MinInt (difference in the intensity between the two syllables)

MinInt : $F(2, 1032) = 70.41, p < 0.001$

Post-hoc Tukey's HSD show that there is a statistically significant difference between the pattern HL&HH, HL&LL, but there is no difference between the patterns HH & LL

MinInt Phrase



Context: Phrase

- Duration

In the phrase-initial position, the three tonal patterns differ significantly as a function of MinDur (difference in the duration between the two syllables)

MinDur : $F(2, 1032) = 13.34, p < 0.001$

Post-hoc Tukey's HSD show that there is a statistically significant difference between the pattern HL&HH, HL&LL, but there is no difference between the patterns HH&LL

MinDur in Phrase



Pitch: Women

1/3:

1st syllable: $F(2, 524) = 113.9, p < 0.001$; post-hoc Tukey's tests : no difference between HL&HH; other comparisons not significant

2nd syllable: $F(2, 522) = 24.3, p < 0.001$; no difference between HL/LL; other comparisons not significant

2/3:

1st syllable: $F(2, 524) = 139.7, p < 0.001$; no difference between HL/HH; other comparisons not significant

2nd syllable: $F(2, 523) = 27.91, p < 0.001$; no difference between HL/LL; other comparisons not significant

3/3:

1st syllable: $F(2, 524) = 148.6, p < 0.001$; no difference between HL/HH; other comparisons not significant

2nd syllable: $F(2, 520) = 26.03, p < 0.001$; no difference between HH/LL; other comparisons not significant

Pitch: Men

1/3:

1st syllable: $F(2, 497) = 81.35, p < 0.001$; post-hoc Tukey's tests : HL&HH not different; other comparisons not significant

2nd syllable: $F(2, 494) = 41.96, p < 0.001$; no difference between HL/LL; other comparisons not significant

2/3:

1st syllable: $F(2, 498) = 86.21, p < 0.001$; no difference between HL/HH; other comparisons not significant

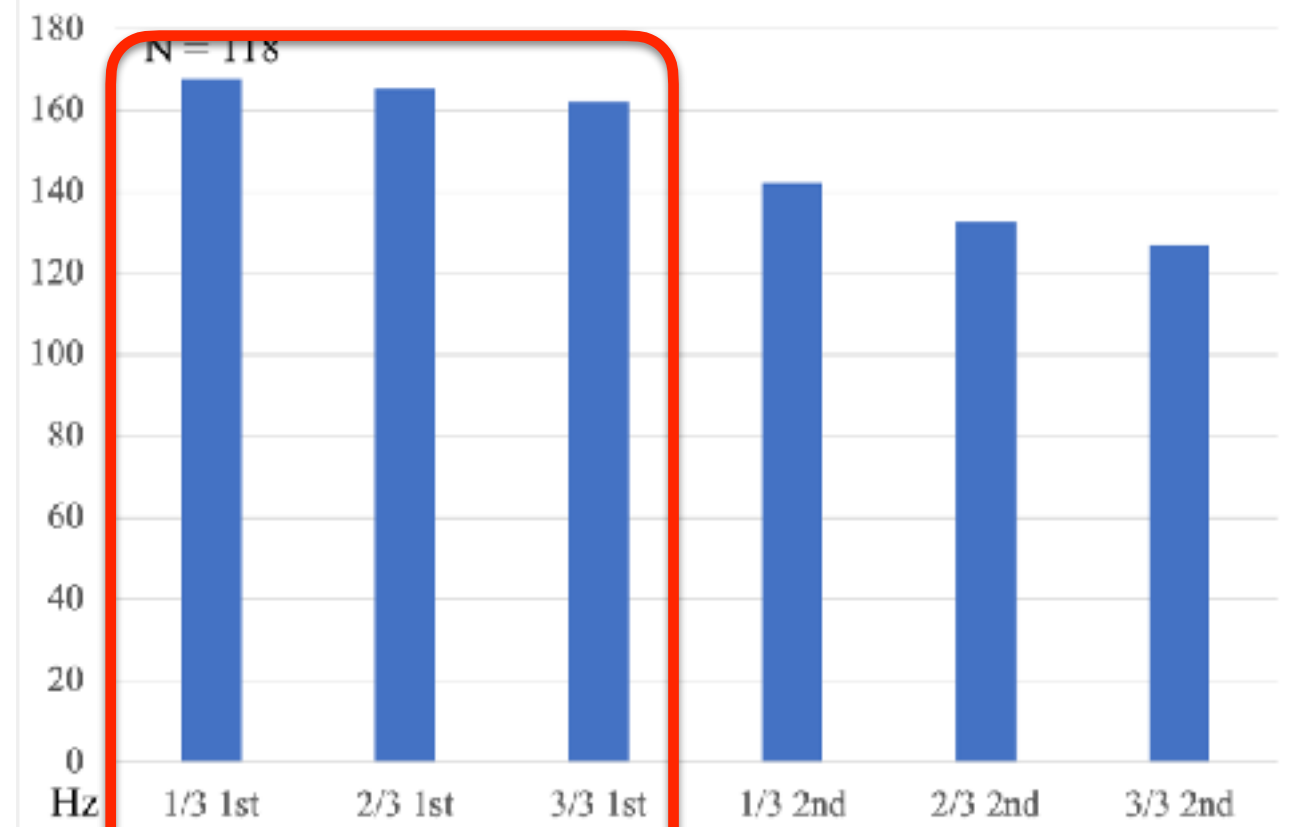
2nd syllable: $F(2, 495) = 54.6, p < 0.001$; no difference between HL/LL; other comparisons not significant

3/3:

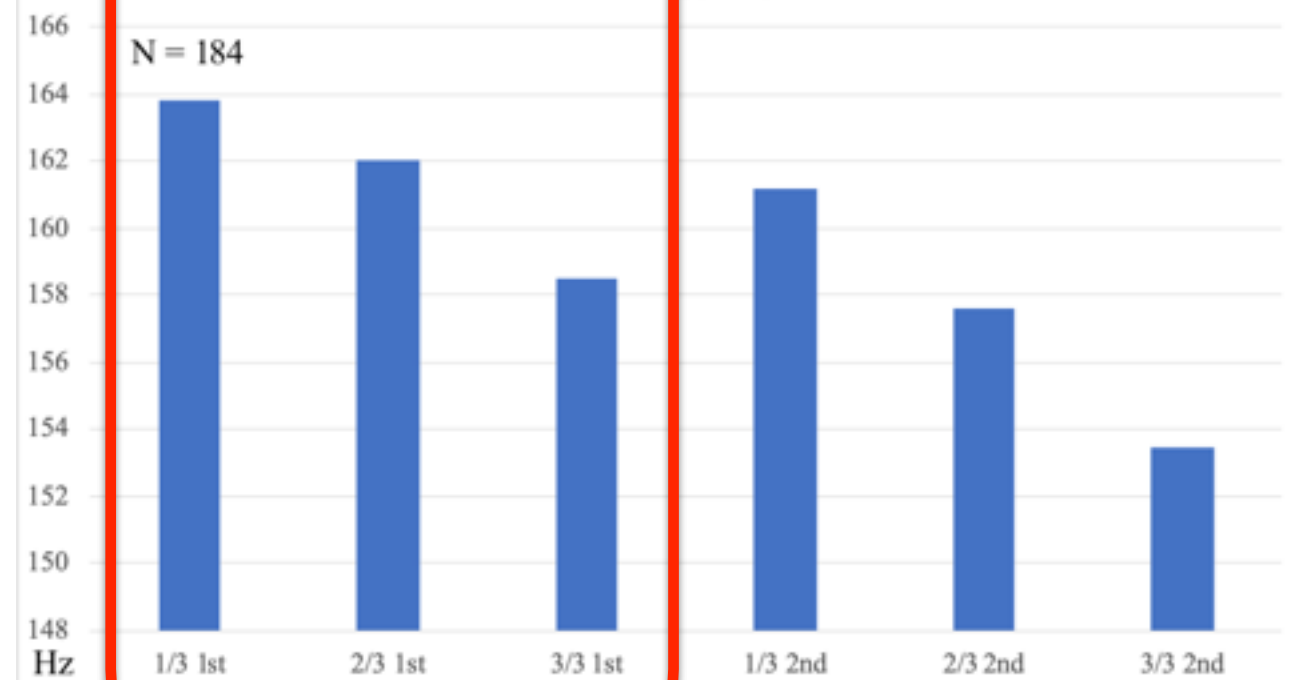
1st syllable: $F(2, 498) = 87.4, p < 0.001$; no difference between HL/HH; other comparisons not significant

2nd syllable: $F(2, 491) = 58.25, p < 0.001$; all three patterns are different; other comparisons not significant

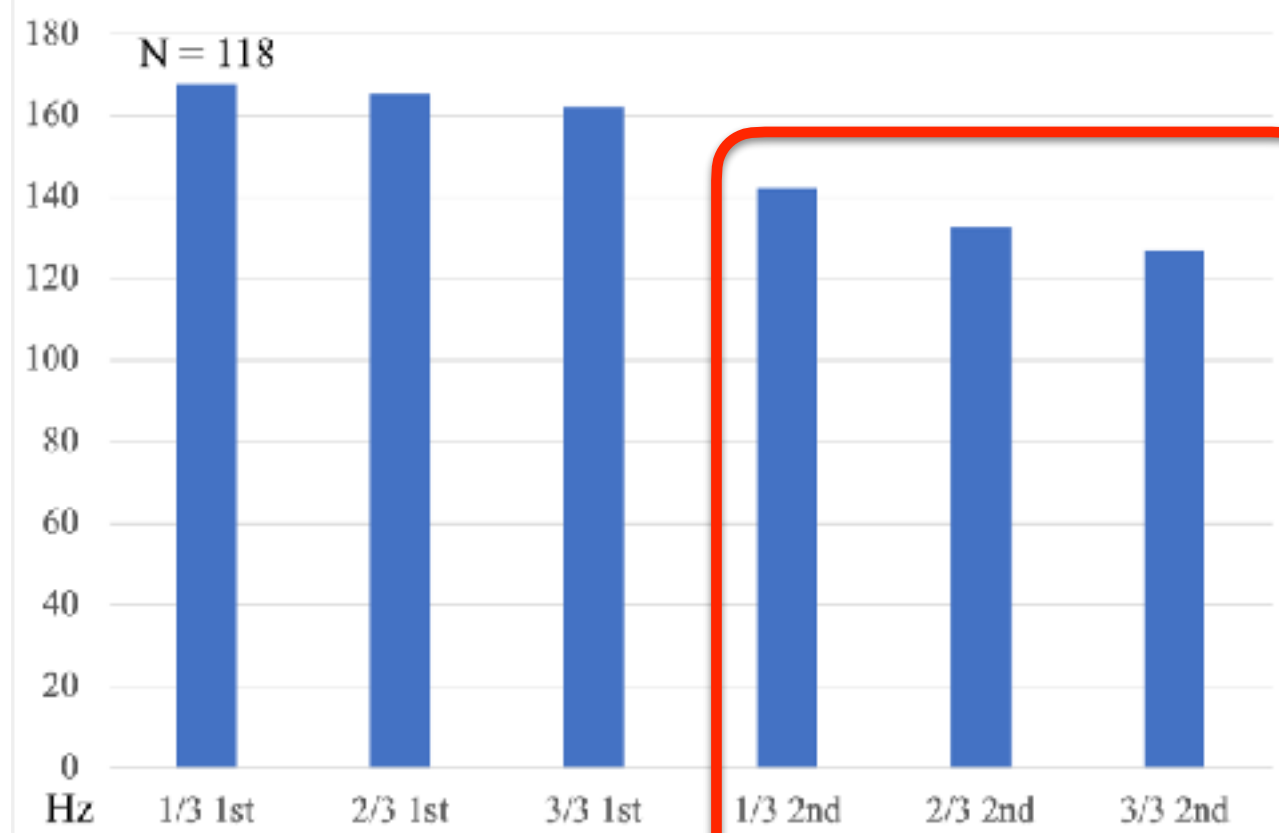
HL Phrase Men



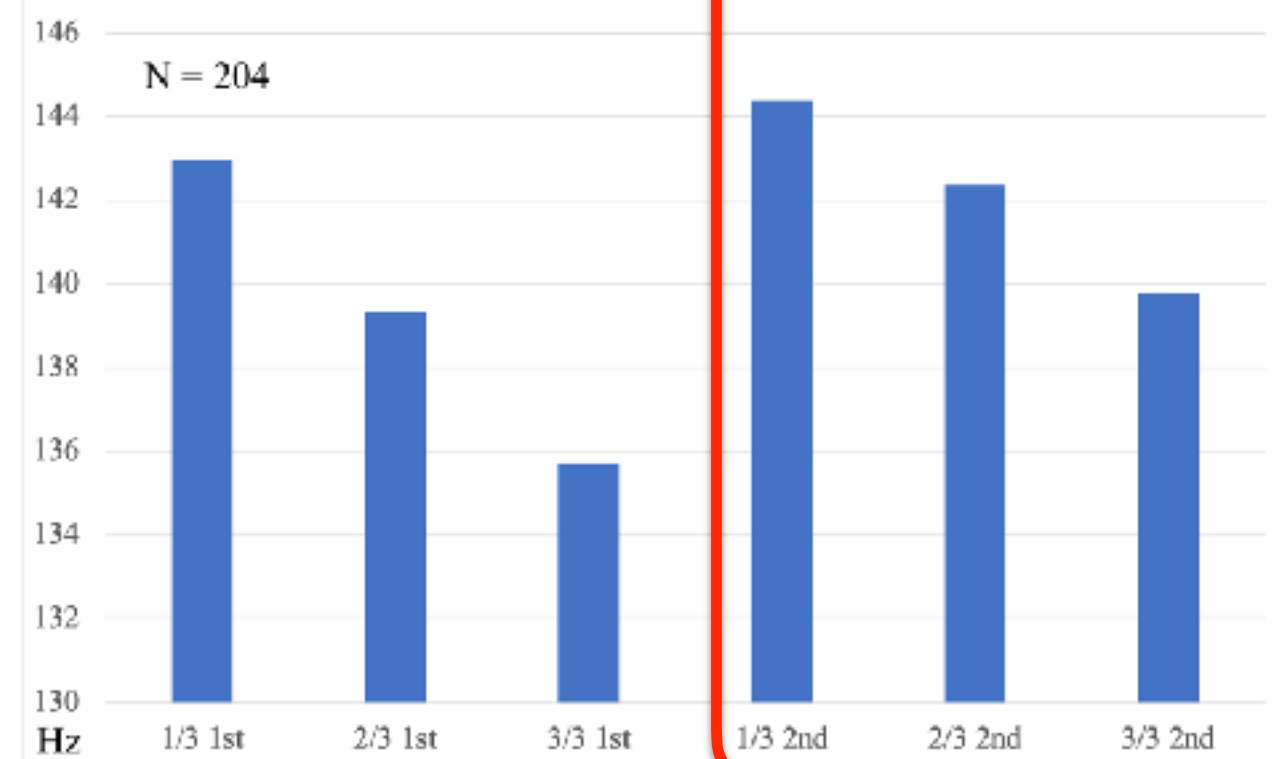
HH Phrase Men



HL Phrase Men



LH Phrase Men



HL: wa-wa | wa-wa | wa-wa | ...

HH: wa-wa | wa-wa | wa-wa | ...

LL: wa-wa | wa-wa | wa-wa | ...

HL: wa-wa | wa-wa | wa-wa | ...

Putting it all together

- context = isolation (in citation form, in which the word is both phrase-final and bears the main stress of the phrase)

significant differences between the three tonal patterns in intensity and duration, and in pitch

- context = phrasal

binary opposition between HL vs. HH & LL

HL: intensity, duration (pitch)

stress properties

HH & LL: consistent contrast in pitch on both syllables

tone properties

Putting it all together

- Lizu has both lexical tone (pitch) and stress (intensity, duration, pitch)
- stress: on the initial syllable in the domain (trochaic)
- the three tone patterns on disyllabic domains are contrastive, however, the contrast is heterogenous, combining two tonal patterns (HH&LL) and one stress-only pattern (HL)
- all words are stressed (+stress), whereas not all words may be specified for tone (+/- tone)

Interaction of Tone & Stress

- + stress, + tone: if the initial, stress-able syllable in the domain is specified for tone (one of the two basic tones on monosyllabic words: H & L), that tone is realized on the stressed syllable and spreads to the right onto the remaining syllables
 - synchronically productive tone derivation rules
- + stress, - tone: if the domain-initial syllable is not specified for tone, the (disyllabic) domain receives the default HL pattern (right-edge demarcating trochaic stress; with a maximum reduction in terms of duration of the second syllable)
 - lexicalized combinations, loanwords, etc.

Stress: 'syllable-syllable | 'syllable-syllable | ...

(intensity, duration, f0)

Tone: 'H-H | 'L-L | '∅-∅ => '[H]-∅ | ...

(f0)

Intonation: 'H-H + HL% || 'L-L + HL% || '∅-∅ + HL% ||

(f0)

Tone & Stress in Lizu

- comparative work
 - a hybrid system, combining tone and stress: a cross-linguistically unusual type
 - separate stress and tone for comparative purposes
- although future consensus might suggest that Lizu is better classified as lacking stress, the present analysis allows for contextualizing their phonetic properties relative to the broader literature on acoustic correlates of prominence

Legend - Icon size - Show/hide Labels



Fixed Stress Locations		Number of languages
+	● Ultimate	51
+	● Third	1
+	● Second	16
+	○ Penultimate	110
+	● No fixed stress	220
+	● Initial	92

Thank you for your attention!

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