



Tonal Interactions in Rugaohua

Huang, Tsan

huang@ling.ohio-state.edu

Department of Linguistics
The Ohio State University

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Talk Outline

- Introduction and Background
- Experiment design and methods
- Predictions
- Results and Discussion
- Summary of discussion
- Future Research

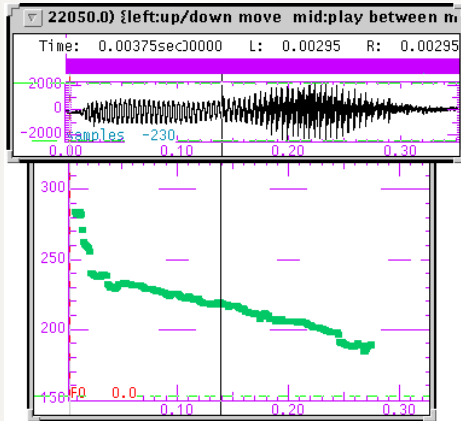
Rugaohua and its Tones

a. A Southern Mandarin dialect spoken on the border between Mandarin Chinese and the Wú dialects in Jiangsu, China

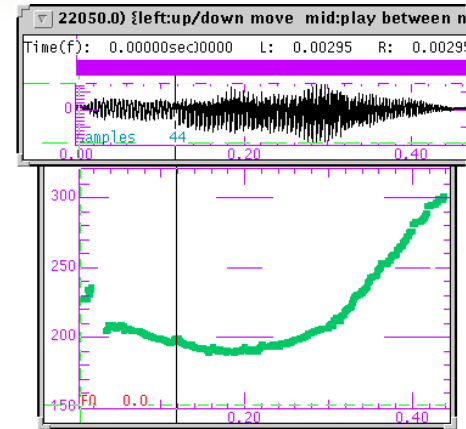
b. Six tones:

falling (F1)	HL	low (L3)	LL
rising (R2)	LH	high (H5)	HH
checked high (sH7)	<u>HH</u>		
checked rising (sR8)	<u>LH</u>		

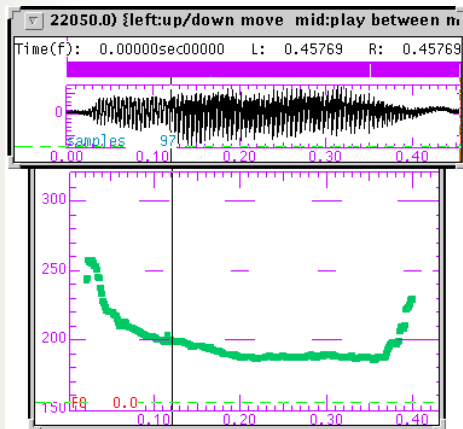
Pitch traces of Rugaohua tones (1)



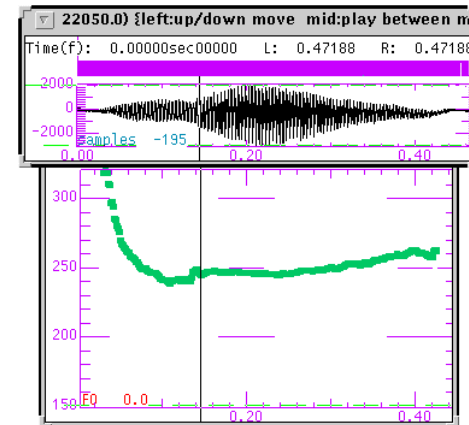
[η^{HL}] with a Falling tone [F1]



[η^{HL}] with a Rising tone [R2]

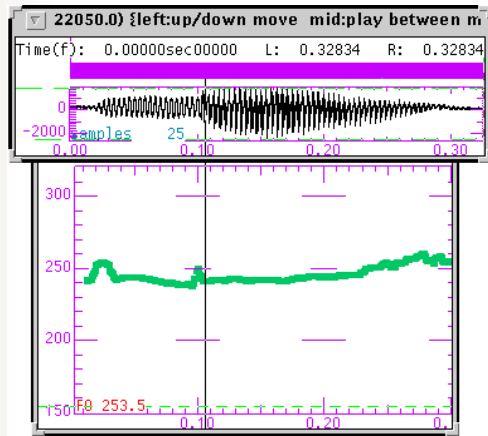


[η^L] with a Low (dipping) tone [L3]

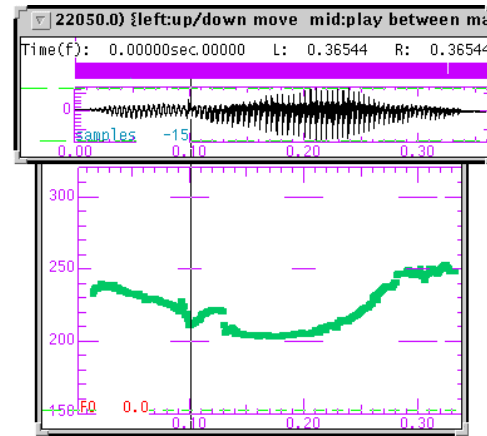


[η^H] with a High (level) tone [H5]

Pitch traces of Rugaohua tones (2) – checked tones



[ŋaʔ^H] with a Checked High tone [sH7]



[ŋaʔ^{LH}] with a Checked Rising tone [sR8]

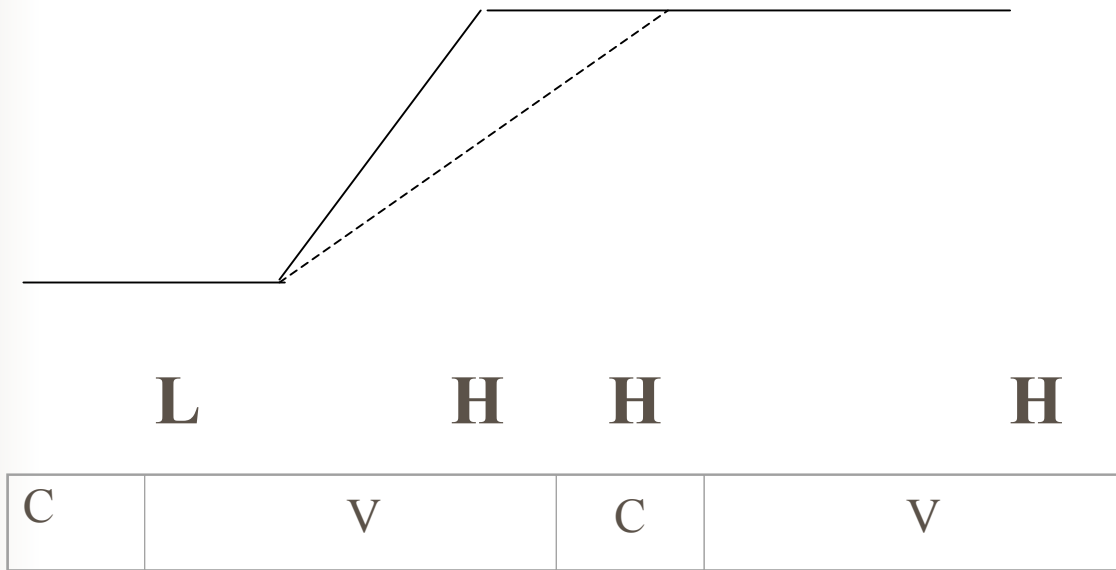


Tonal Coarticulation

- Perseveratory (or carry-over):
 - Thai (Gandour et al. 1994)
 - Anticipatory: Thai (Gandour et al. 1994);
Taiwanese (Peng 1997)
- Change in tonal height only:
 - Thai (Gandour et al. 1994); Vietnamese (Han & Kim 1974)
vs. slope as well as height:
 - Mandarin, Shih 1988 and Xu 2001

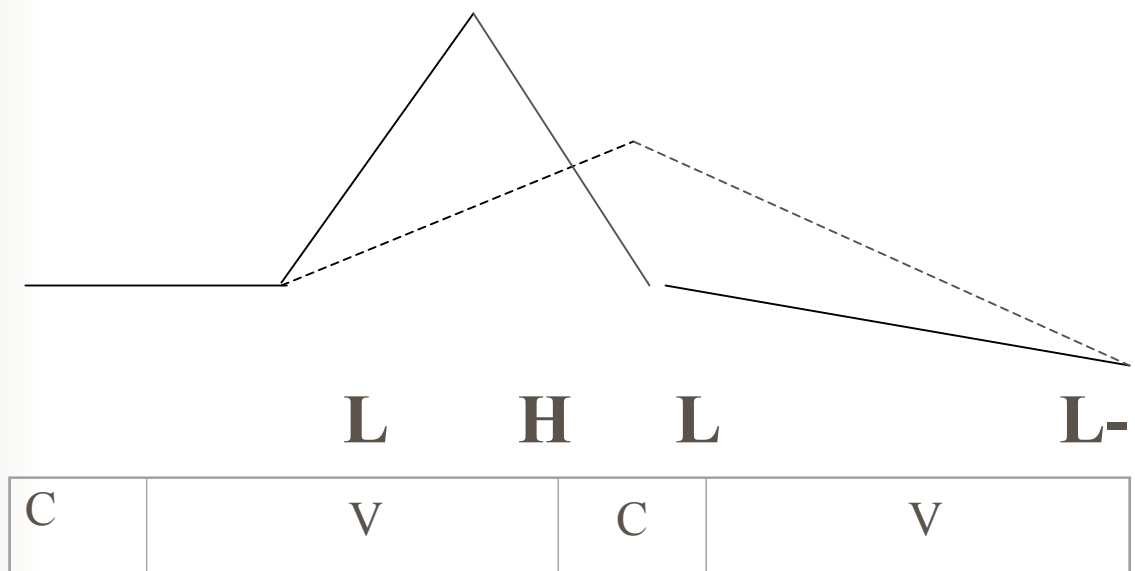
Rising tone realization before a H

Shih 1988



Rising tone realization before a L

Shih (1988)





Catathesis (or Downstep)

- African tone languages

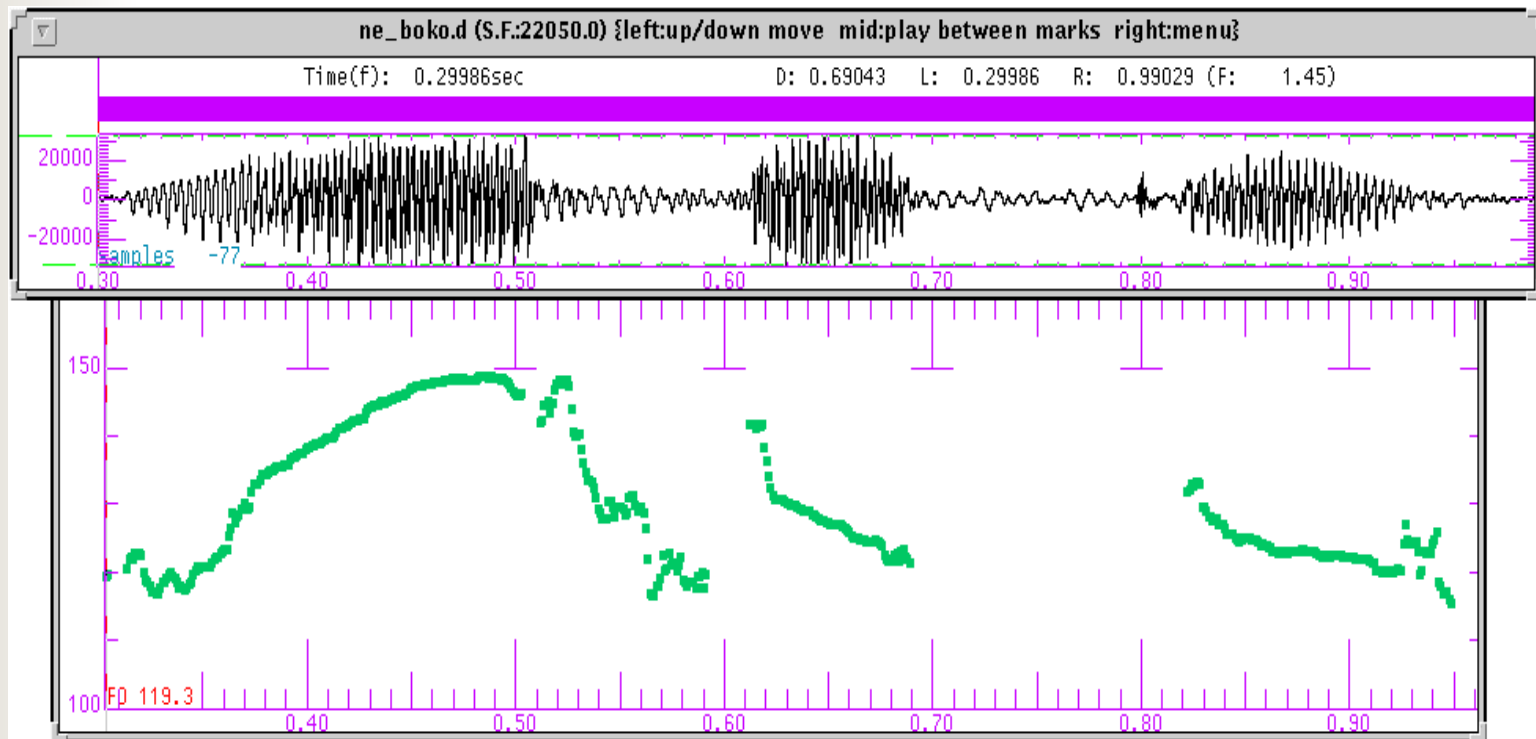
Typical case involves H-L-H but L does not always have to be present:

Kikuyu (examples from my own field notes)

(1)	[né]	"(it) is"
	[bókó]	"rabbit"
	[né 'bókó]	"it is rabbit"
	[góogoní]	"bedbug"
	[né 'góogoní]	"it is bedbug"

([´] marks a H tone, and [! ´] a downstepped H.)

Downstep in [boko] caused by a preceding H



[n e^H !b o^H k o^H]



Languages where L is crucial trigger of downstep

English: L+H and H+L accents triggers downstep

(Lieberman & Pierrehumbert 1984)

Tokyo Japanese: H*+L !H

(Pierrehumbert & Beckman 1988)

Mandarin: LH, L, HL tones triggers downstep

(Shih 1988)



Overall downtrend (or Declination)

1. Gradual narrowing pitch range and lowering of f_0 peaks toward the end of an utterance.

(Fujisaki 1981 for Japanese; Vaissiere 1971 for French; Liberman 1975 for English)

2. Downtrend is predictable if utterance is analyzed into initial raising, final lowering, local downstep, etc.

(Liberman & Pierrehumbert 1984)



Pitch range effect on tonal realization

Changes in a speaker's pitch range (by increasing volume) have a greater impact on phonetic realization of tones with higher f_0 values.

(Lieberman & Pierrehumbert 1984;
Pierrehumbert & Beckman 1988)



Purpose of present study

Examine effects of preceding tone and pitch range (by increasing volume) on phonetic realization of target tone in Rugaohua.

Experiment Design and Methods (1)

- all ($6 \times 6 = 36$) disyllabic tonal combinations
- carrier phrases used in the recording:

[tsəʔ^H.kʊ^H._. _ .pəʔ^H.ts^hʊ^H]

"this + classifier ... is not bad."

[tsəʔ^H.kʊ^H._. _ .pəʔ^H.ɕiə̃^{LH}]

"this + classifier ... will not do."

[tsəʔ^H.ts^hi^H._. _ .pəʔ^H.ts^hʊ^H]

"this time ... is not bad."

[tsəʔ^H.ts^hi^H._. _ .pəʔ^H.ɕiə̃^{LH}]

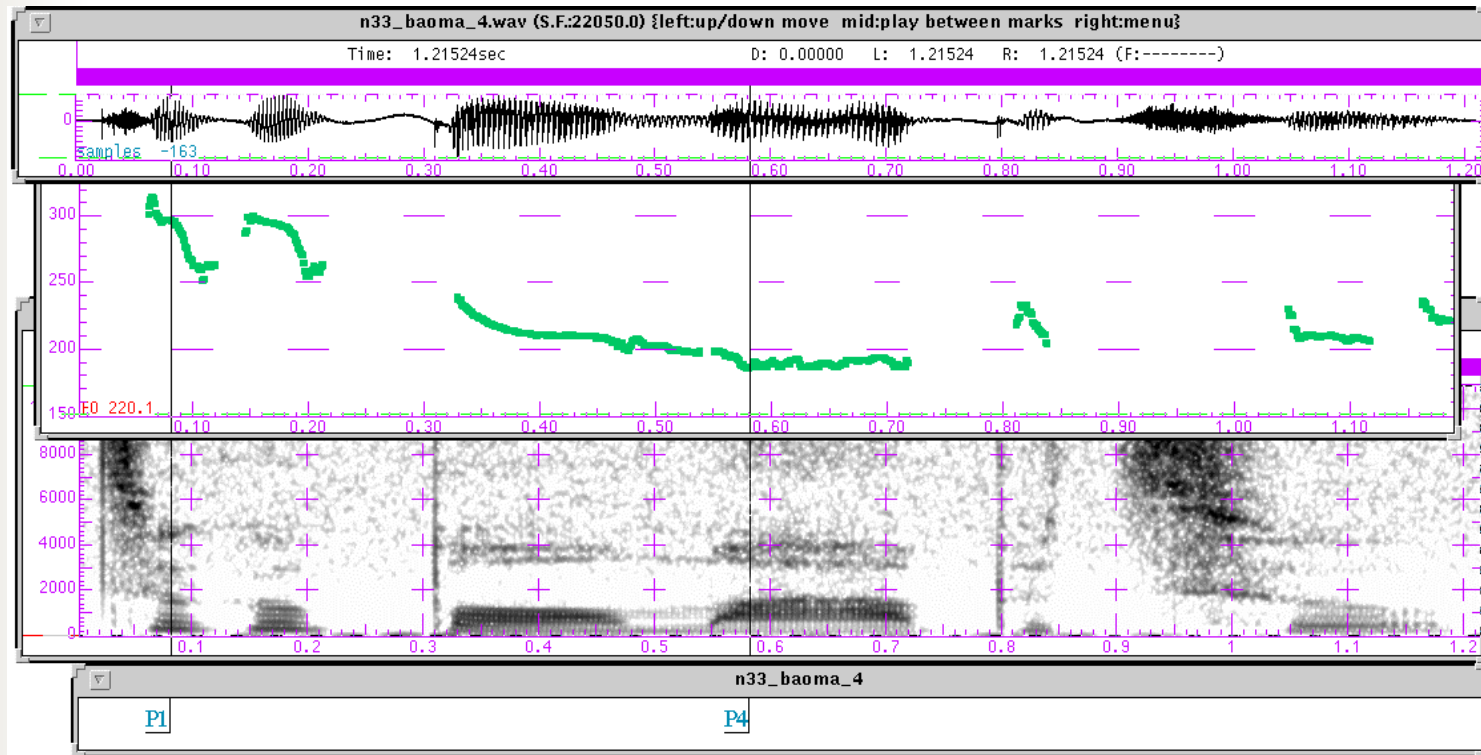
"this time... will not do."



Experiment Design and Methods (2)

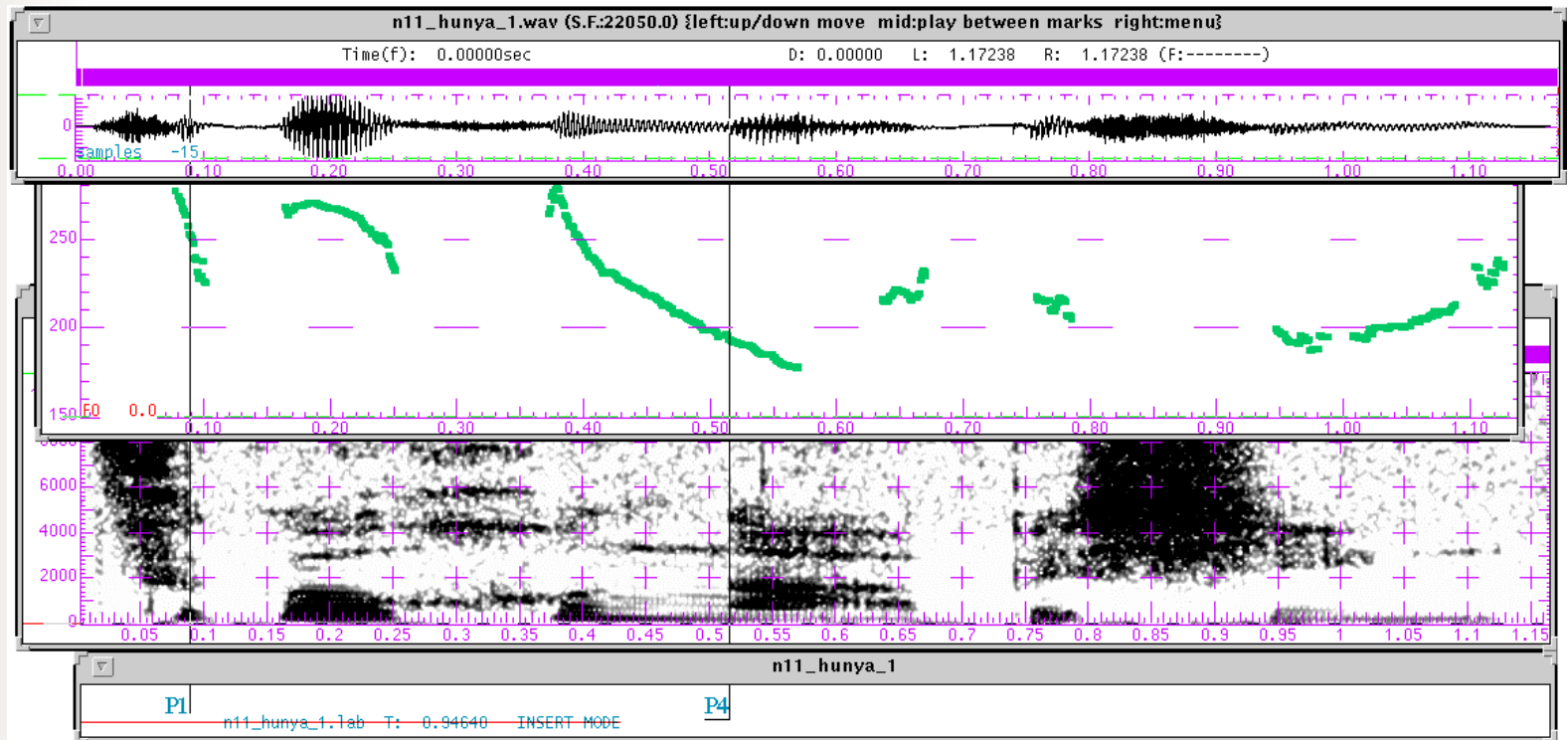
- Three pitch ranges: "soft", "normal", "loud"
- Six repetitions for each pitch range
- One speaker
- 648 utterances (36 * 3 pitch ranges * 6 repetitions)
- measurements:
 - calibration "P1f0": H-toned 1st syllable
 - target tone "P4f0": H or L in the 4th syllable

Tagging sound files (1)



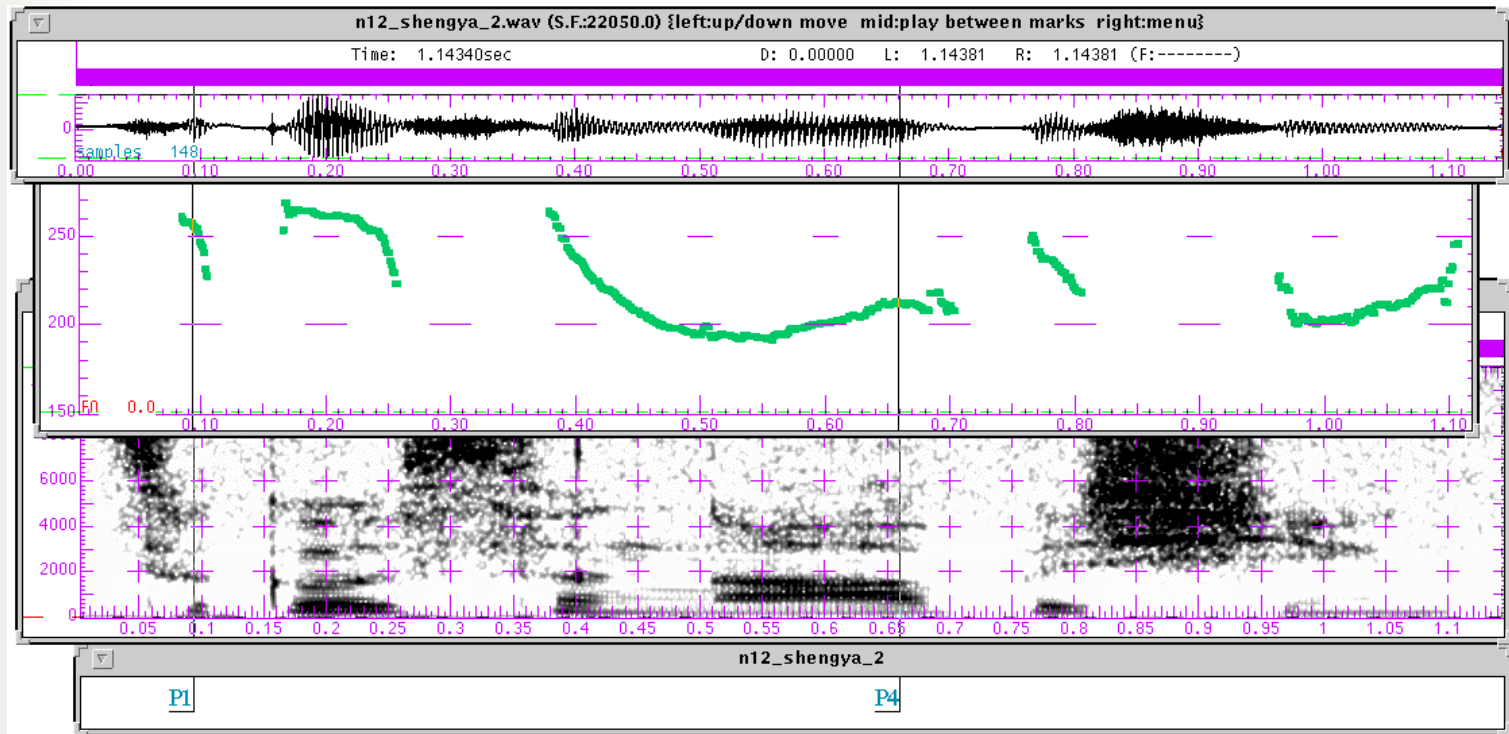
/tsəʔ^H.ku^H.pɔ^L.ma^L.pəʔ^H.ts^hu^H/ 'this (treasure + horse) is not bad'. "P4" is marked at the lowest point after the nasal release.

Tagging sound files (2)



/tsəʔ^H.ku^H.xuə̃^{HL}.ŋa^{HL}.pəʔ^H.çiə̃^{LH}/ 'this (twilight/confused + crow) will not do'.
“P4” is marked at the highest point after the nasal release.

Tagging sound files (3)



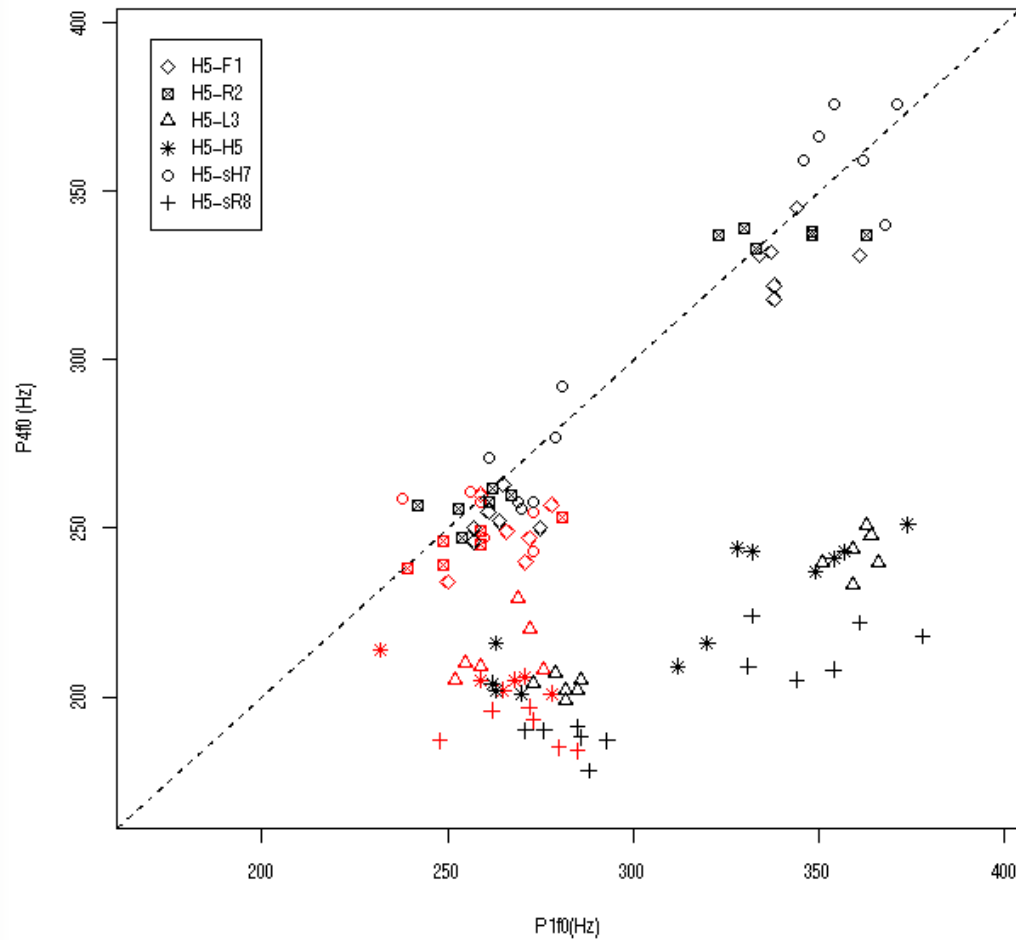
/tsəʔ^H.ku^H.sə̃^{HL}.ŋa^{LH}.pəʔ^H.ɕiə̃^{LH}/ 'this ginseng sprout will not do'. "P4" is marked at the highest f_0 point in the vowel.



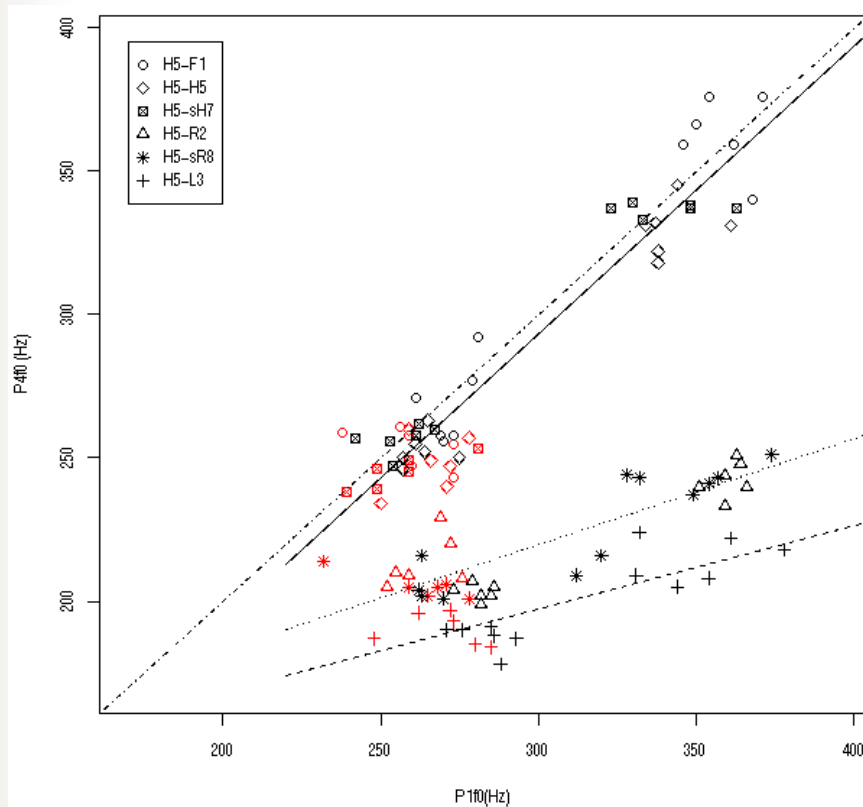
Predictions

- Relevant factors in target tonal realization:
 1. lexical tone of target syllable
 2. preceding tone (3rd syllable)
 3. pitch range ('normal', 'soft', or 'loud' volume)
 4. (overall downtrend, etc.)
- Linear Regression: $P4f0 = C + \beta * P1f0$

P4f0-against-P1f0 plot – H5x

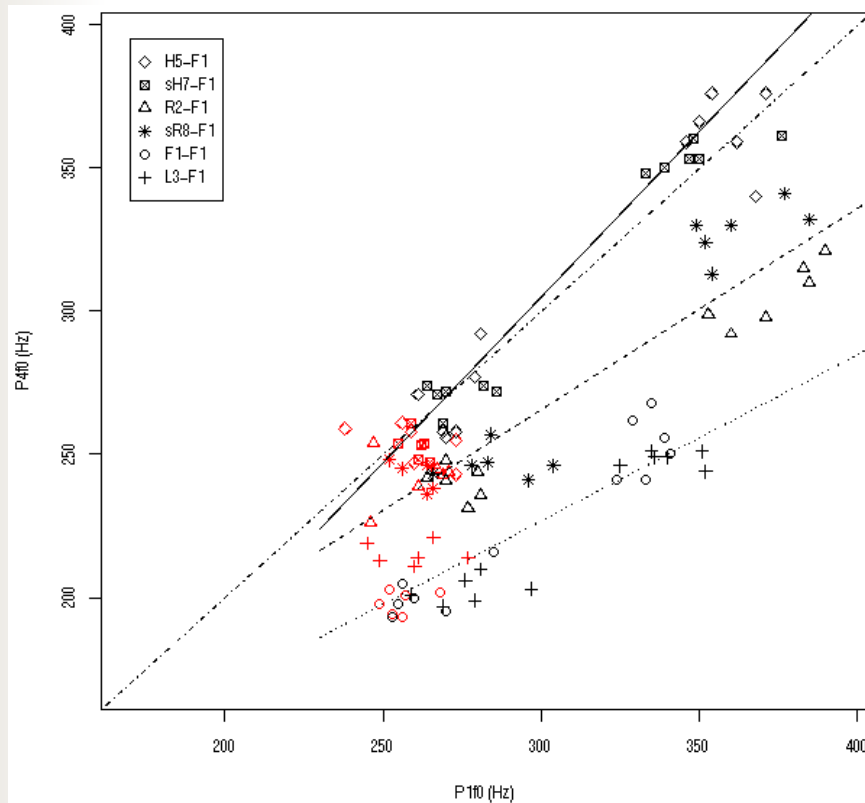


P4f0-against-P1f0 plot – H5x, regression lines



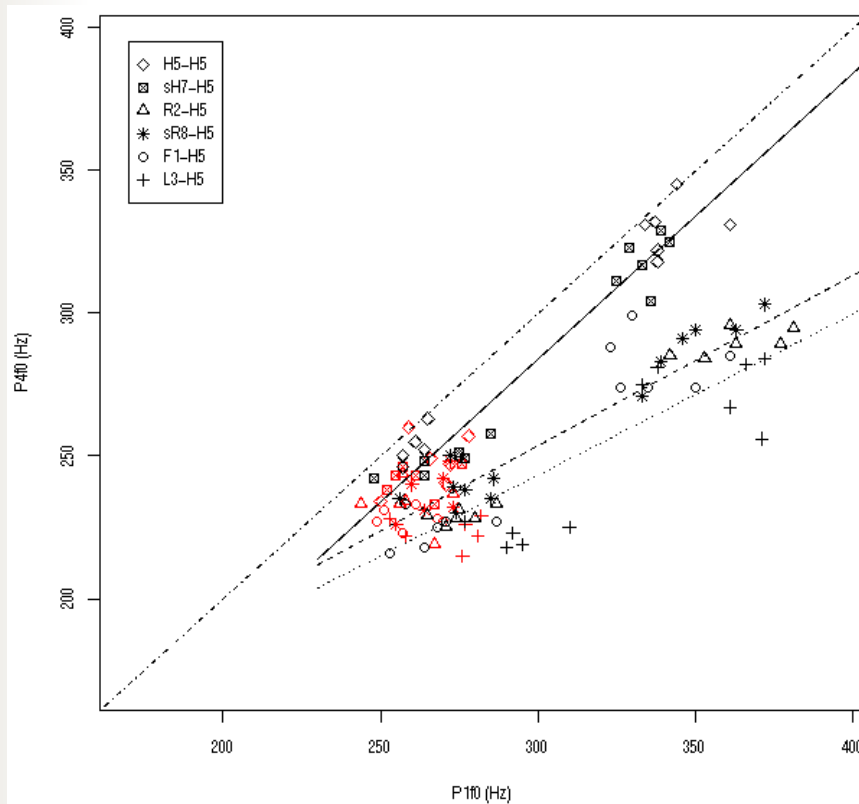
With the added regression lines (solid line for H5-F1, H5-H5, H5-sH7 sequences; dotted line for H5-R2, H5-sR8; dashed line for H5-L3), the pitch range effect can be seen clearly in this plot. There is also a slight downtrend as reflected by the solid line.

P4f0-against-P1f0 plot $-xF1$



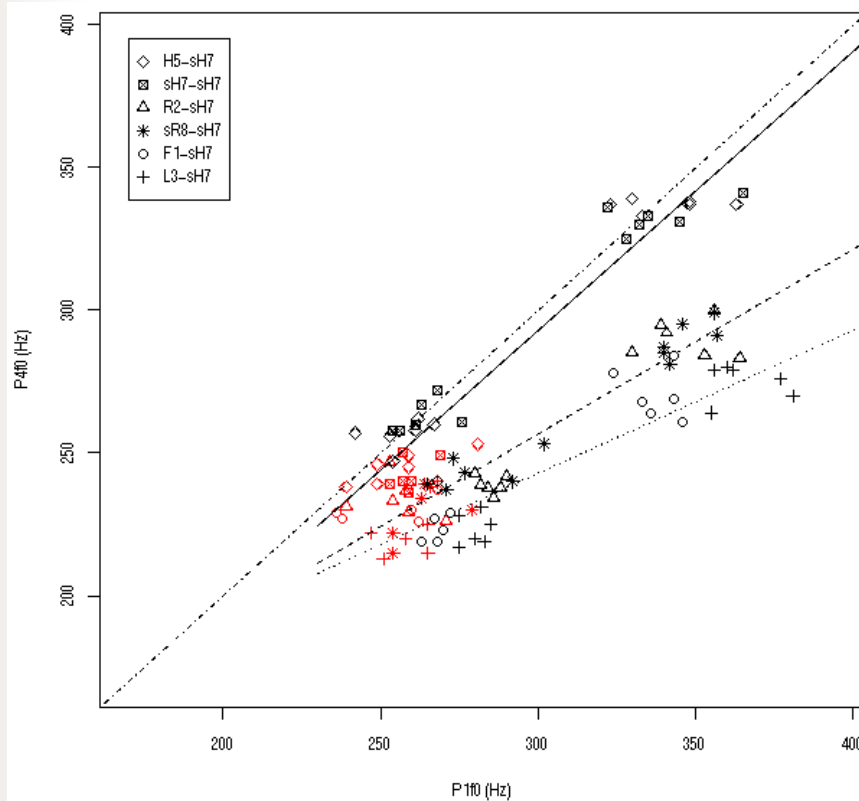
The dash-dot, solid, dashed, and dotted lines are the diagonal $y = x$ line and the regression lines for [H5-F1, sH7-F1], [R2-F1, sR8-F1], and [F1-F1, L3-F1] plots, respectively. Although P4f0 values were taken from the highest point in F1, they vary dramatically depending on the preceding tone, which seem to have different downstepping effects.

P4f0-against-P1f0 plot –xH5



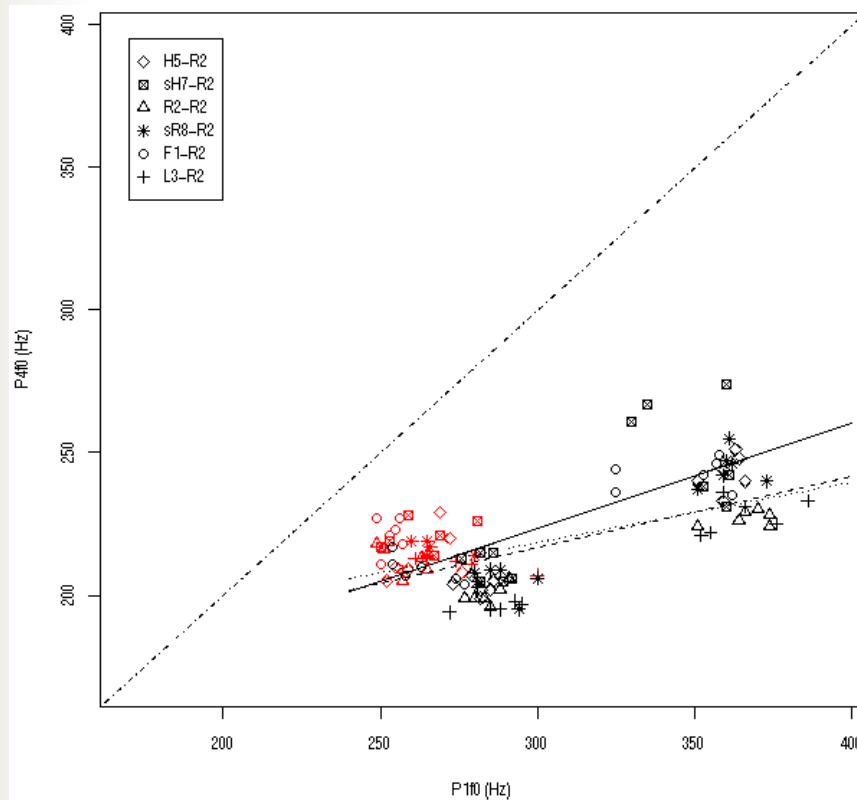
Plots of H5 preceded by six tones. There is a downtrend in the H-toned sequences. The R tones and F and L tones seem to have a slightly different downstepping effect on H5, but the pattern is obviously different from that observed in the “xF1” plot.

P4f0-against-P1f0 plot –xH7



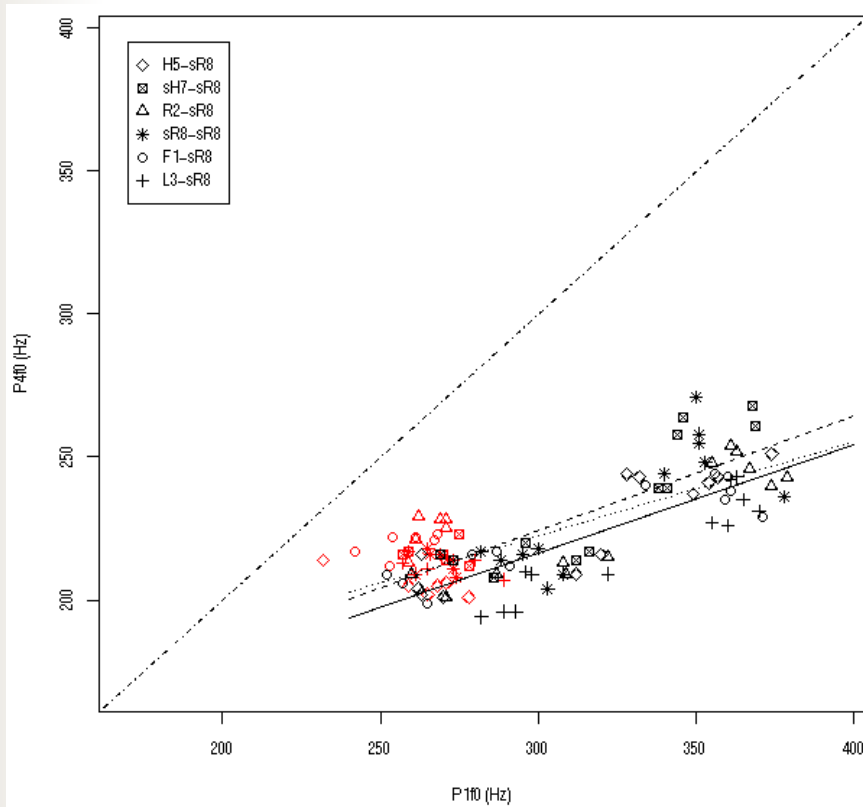
Plots of sH7 as target tone. The patterns seen here are very similar to those observed in the “xH5” plot previously.

P4f0-against-P1f0 plot -xR2



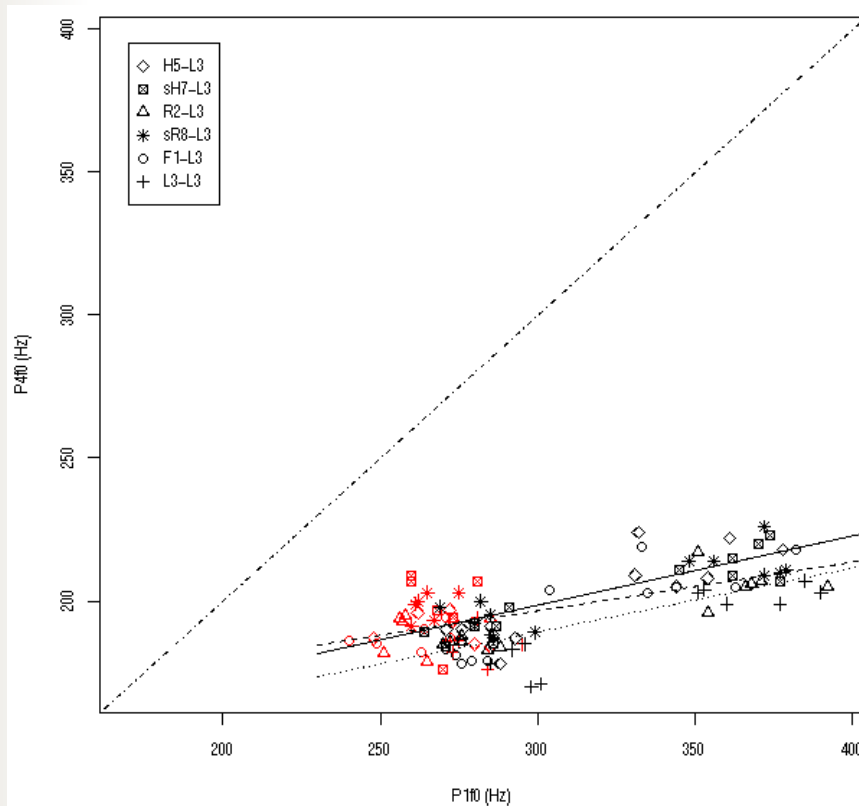
Plot with R2 as the target tone. There is a lot of overlap in the β the three regression lines, suggesting no significant difference in the influence from preceding tones.

P4f0-against-P1f0 plot –xsR8



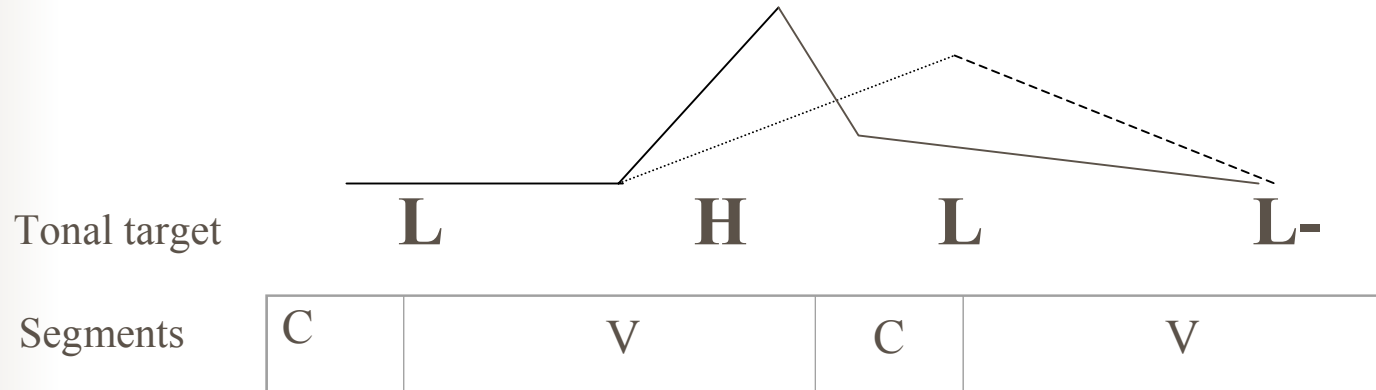
Plots of sR8 preceded by six tones. Everything huddles together, as in the “xR2” plot.

P4f0-against-P1f0 plot -xL3



Plots of L3 as target tone. The f0-at-P4 values are the greatest after the R tones, suggesting peak delay, which is consistent with Shih (1988) and Xu's (2001) findings with Mandarin.

Realization of L after a rising (LH) tone





Summary of Discussion

- Inherent differences in tonal targets
- Rising tone peak delay/deletion
- All tones with a Low component cause downstep
- Different degrees of downstep



Future Research

* Effect of prosody on tonal realization.

(Peng 1997, Shih 1988)

* Effect from following tone on tonal realization.

i. Rising tones H realizations before different tonal contexts (Shih 1988; Xu 2001)

ii. Anticipatory dissimilation in L3

(Peng 1997; Gandour et al. 1994)

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