Preservation of Tone in Right-Dominant Tone Sandhi: A Fragment of Disyllabic Tone Sandhi in Máodiàn Wú Chinese

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Abstract

Impressionistic and acoustic data are presented for the nine citation tones, and a small part of the disyllabic tone sandhi, of a speaker of the previously undescribed Chinese dialect of Maodian 毛店 from the Wuzhou 婺州 subgroup of Wu 吳. The data are used to refine the typology of the apparent right-dominant tone sandhi characteristic of the southern Wu and Min area. It is shown that not all word-final tones are the same as citation tones; and that therefore preservation of word-final tones cannot be criterial for right-dominance.

Index Terms: Tone Sandhi, Right-dominance, Tonal acoustics, Wu dialects, Wuzhou, Maodian.

1. Introduction

Language likes to exploit the polarity of metrical strength. One striking example is the typological difference, independent of segmental phonotactics, between right- and left-dominant tone sandhi systems found in the highly complex morphotonemics of the so-called *sandhi-zone* of China's eastern coastal provinces [1, 2]. In right-dominant varieties, it is the tones on the morphemes on the rightmost syllables of a word which determine the sandhi shape. The tone on the word-final syllable is said to be 'preserved', 'unchanged' or 'in agreement with' the citation tone, and tonal contrasts on the preceding syllables tend to be neutralised, although the neutralisation groupings are often bewilderingly complicated. Right-dominant varieties are said to be found in the southern Wu and Min dialects [3, p.287], but the exact distribution is not known. The variety described in this paper is located the southern Wu subgroup of Wuzhou, so it can be expected to be right-dominant.

But is right-dominance monolithic, or are there degrees to this typological parameter? We present data from a variety in the right-dominant area which appear to show the latter. We will focus in this paper on just one aspect of the relationship described as criterial for right-dominant sandhi: the extent to which the citation tone values are preserved on word-final syllables. For the purposes of this paper we define *preservation* thus. Preservation occurs *iif* word-final and citation tonal acoustics are intrinsically related, i.e. if the word-final tonal acoustics can be understood to be the same as the citation tone, once allowance is made for the effect of occurrence in word-final position and the expected perseverative assimilatory effect from the tone on the preceding syllable.

Since the disyllabic data are complicated we only have space to present two cases: one (relatively) simple, which is prototypically right-dominant; and one which is clearly not. We describe the citation tones first, then tones on disyllabic words with the simple case preceding the more complex.

2. Data

The data are from a high quality recording which was part of a wider survey of tones and tone sandhi in ca. 30 southern Wu varieties conducted by Professor W. Ballard in 1988 [4], and his generosity in making the data available is gratefully acknowledged here. The recording consists of three replicates each of ca. 40 monosyllabic and 190 disyllabic utterances elicited from a then 27 year old male speaker who was born and grew-up in Maodian until 17. A comparison of Wu dialect descriptions done in 1928 and 1992 [5,6] shows that they changed considerably in this ca. thirty year period, and more recent socio-phonetic findings [7] suggest that tonal change is accelerating, at least in metropolitan areas. In a sense, therefore, this description may also be partly considered a salvage operation. The digitised recordings – both citation tones and disyllabic tone sandhi – can be listened to on the second author's web-page (http://philjohnrose.net), where their individual and mean acoustics are also plotted.

3. Citation tones

In Chinese tonology, a citation tone is the tone given to a morpheme when its Chinese character, which may represent either a free or bound morpheme, is read out. The speaker has nine citation tones which may be described auditorily as follows (segmentals are transcribed phonemically). The **upper-mid level tone**, a reflex of Middle Chinese (MC) tone Ia**,** has a level pitch contour in the upper third of the pitch range, e.g. fi *fly* 飛, kɑ *liver* 肝, nuŋ *east* 東. The **lower-mid level tone**, from MC Ib, has level pitch in the lower third of the pitch range, e.g. bi *skin* 皮, dzɯa *tea* 茶, nia *year* 年. The **mid rising tone** (< MC IIa) has prolonged pitch in the mid pitch range with a final rise, e.g. siəu *arm* 手, nia *point* 點, hua *fire* 火. The **lower-mid rising tone** (< MC IVa) has the same delayed pitch rise a little below that of the mid rise tone e.g. siɛ *snow* 雪, ɓɛi *north* 北. The **low rising** tone (<MC IIb, IVb) has pitch which rises from low in the speaker's pitch range to mid with a prolonged initial component, e.g. bi *blanket* 被, zua *sit* 坐 , [ɔ] *to study* 學, dɑu *poison* 鰳. The **high falling** tone (<MC IIIa) has pitch which falls through the speaker's modal pitch range, e.g. si *four* 四, tʰɯa *to jump* 跳. The **depressed high falling tone** (<MC IIIb) has similar pitch to the high falling tone, but with a low onset which results in a convex pitch contour in the bottom two thirds of the pitch range. Examples are di *ground* 地, vɑ *rice* 飯, miɛ *face* 面. The **short stopped mid tone** (<MC IVa) has a short pitch in the lower-mid pitch range truncated by a glottal stop, e.g. kuaʔ *bone* 骨, tɕʰyaʔ *to come out* 出. The **short stopped low rise**

tone (<MC IVb) has a short rising pitch in the lower third of the pitch range truncated by a glottal stop, e.g. zaʔ *ten* 十.

This rather large number of observed tones relates primarily to the historical development of morphemes with tonal cognates of Middle Chinese so-called *entering tones* IVa and IVb. Originally, in Proto Wu say, these two tones had short duration and ended in a glottal stop. In many modern Wu dialects their reflexes retain these features and are still considered separate tones; but in other varieties the tones have lost their glottal stop and undergone further development. In some Wuzhou varieties the short tones have lengthened and merged with other tones; in others they have lengthened but remained separate by virtue of different pitch shapes [8, p.23]. Interestingly, the Maodian speaker provided a further variation on this theme, in that he clearly showed a merger of etymological tone IVb with tone IIb (the low rising tone), whilst keeping a lengthened version of etymological tone IVa separate (as the lower-mid rise tone).

This situation was further complicated, however, by a phenomenon, again said to be typical for Wuzhou, whereby some morphemes with etymological IVa and IVb tones have alternative phonological shapes [8, p.23]. One shape is conservative, preserving the short pitch ending in a glottal stop; the other is the innovative lengthened tone. This alternation was also shown by the Maodian speaker. For most IVa and IVb cognates he had innovative long reflexes. For a few IVa and IVb cognates, however, he retained a conservative short stopped tonal shape. Although this phenomenon is traditionally termed 文白異讀 *different colloquial and literary character readings*, there was nothing in the linguistic structure of any of the morphemes involved that would serve as an obvious conditioning factor. Thus, for example, he read the characters for the morphemes *bone*, *come out* and *ten* with short stopped tones, but, in the same formal elicitation session, those for *snow*, *put out* and *month* were given long tones. Indeed, Ballard's notes show some free variation, in that *bone* was also said with a long tone. Although the conditioning of such short forms remains elusive, therefore, it is clear that one has to deal with nine different tonal shapes.

Citation tone acoustics were quantified with the same method used in a previous study of a right-dominant Wu variety [9]. A wideband spectrogram was generated in *Praat*, together with its wave-form and superimposed F0. The token's tonally relevant F0 was then identified, extracted and modeled in *R* by an 8th order polynomial. This enabled F0 values to be sampled from the polynomial F0 curve with a sufficiently high sampling frequency (at 10% points of the curve as well as 5% and 95%) to capture the details of its time-course.

The mean tonal acoustics of the nine Maodian citation tones (F0 as function of duration) are shown in figure 1. The tonal F0 shapes have been plotted in two panels, as their complex configuration would have made it difficult to identify their shapes otherwise. In order to demonstrate that some IVb morphemes have indeed merged with reflexes of IIb, the low rising tone is plotted separately with a green dotted line for its IVb and a black dotted line for its IIb constituents. Their extreme similarity indicates provenance from the same synchronic tone.

The F0 shapes of the individual tones are clear and generally correspond fairly well to their pitch descriptions. The two short stopped tones (brown) can be seen to have a duration of about half that of the unstopped tones, and also to have very similar onsets to their corresponding long tones (green). The lower-mid level tone (blue) appears to have a slightly depressed onset extending for the first 10 csec. or so. One clear area of disagreement between the F0 and tonal pitch is in the high falling and depressed high falling tones (red). Their offsets, between ca. 105 Hz and 110 Hz, lie considerably below the two low rising tones that sound to lie near the bottom of the speaker's range. Including these falling tone offsets as tonally relevant will have the effect of distorting the way the F0 represents tonal pitch, and they are best considered as idiosyncratic offset perturbations (some speakers end their falling tones with a glottal stop or creak; others, like this Maodian speaker, have a gradual offset to modal phonation). In the following sections, we describe tone sandhi in words ending with morphemes which carry the lower-mid level and mid rising citation tone.

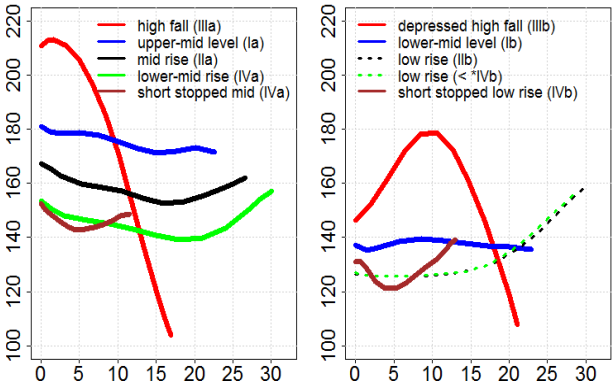

Figure 1: *Mean F0 (Hz) of the speaker's nine isolation tones plotted against mean duration (csec.).*

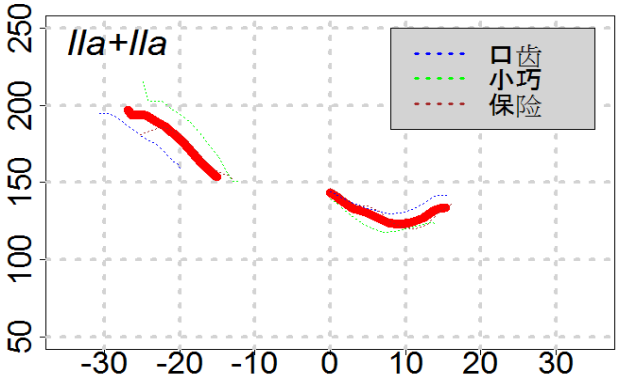

Figure 2. *Tonal acoustics of three Maodian words with mid rising morphotonemes on both syllables. Thick solid line = mean F0, dotted line = individual tokens' F0. X axis = duration (csec.) y axis = F0 (Hz).*

4. Disyllabic tone sandhi: procedure

The same procedure for extracting the tonal acoustics of the disyllabic words was used as in [9], which sampled F0 as a function of the word's segmental structure – first Rhyme, intervocalic consonant and second Rhyme – using 8th order polynomial modeling in *R*. Three different words were measured for each etymological tonal combination, and their mean values calculated. Figure 2 shows the individual values and their mean for three words with the mid rising morphotoneme on both syllables. These have a high falling pitch on the first syllable followed by a low dipping pitch on

the word-final syllable. (One example was /ɓɯa ɕie/ [52.212] *insure*, which is a synonym compound consisting of the bound morpheme {保 *protect* ɓɯa 323} and the free morpheme {險 *danger* ɕie 323}. F0 is plotted as a function of absolute duration aligned at onset of second-syllable Rhyme (csec.0). The fairly tight clustering of the individual words' F0 values is typical.

5. Disyllabic tone sandhi: a minimally complex example

To demonstrate the mechanics of the least complex tone sandhi in Maodian disyllabic words, we examine combinations with underlying mid rising tone on the word-final syllable, and all tones on the preceding syllable. Examples are given in table 1. The procrustean Chao five-point scale transcribing tonal pitch is intended as convenient abbreviation only.

Table 1. *Examples of Maodian speaker's tone sandhi in words with underlying mid rising tone on word-final syllable. Pitch representations are color-coded with figure 3.*

word-final mid-dipping isolation tone [323] preceded by …			
… upper-mid level morphotoneme [44] on S1		… lower-mid level morphotoneme [22] on S1	
kɔ kʰɔ 33.323	高考	ɔŋ ɕy 23.323	洪水
college entrance exam		*flood*	
… mid rising morphotoneme [323] on S1		… short mid stopped morphotoneme [3̲] on S1	
ɓɯa ɕie 43.212	保險	tɕʰyə̆ kʰəu 4̲.323	出口
insure		*export*	
… high falling morphotoneme [51] on S1		… depressed high falling morphotoneme [241] on S1	
ɗe ɓi 33.323	對比	ʐ̩ nia 32.212	字典
compare		*dictionary*	
… lower-mid rising morphotoneme [212] on S1		… low rising morphotoneme [13] on S1	
ɓa kuo 43.212	百果	ba kuo 32.212	白果
all kinds of fruits		*ginko*	

Table 1 indicates, firstly, five pitch shapes for the first syllable tone: upper-mid level [33], low rising [23], high and mid falling [43], [32], and short stopped high [4̲]. These shapes reflect several complex mergers. The mid level [33] tone is the realization of a merger between the underlying high falling tone and the underlying upper-mid level tone. The high falling [43] tone is the realization of a merger between mid rising and lower-mid rising tones. The mid falling [32] tone represents a merger between underlying low rising and depressed high falling tones. The low rising [23] tone corresponds to underlying low level tone, and the short high [4̲] tone corresponds to short stopped mid. Note that none of the resulting first syllable tonal allomorphs corresponds to its citation shape. A high falling citation tone is realized as mid level, for example, and a high rising citation tone is realized as high falling. The same sort of first tone complexity was also demonstrated for the Wu dialect of Wencheng [9], and appears typical.

In contrast to the first syllable tones, the word-final tone is straightforward. Table 1 shows it has two surface forms, both with delayed rising pitch like the corresponding citation tone. One is in the mid pitch range, represented as [323], and one slightly lower "[212"]). The conditioning is very largely clear: the lower version occurs after preceding falling pitched tones, the higher elsewhere. Exactly the same intrinsic perseverative allotony conditioned by a [+/- fall] on the preceding syllable occurs in Wencheng [9], showing that even in right-dominant systems the weak tone can influence the strong. The lower allotone also occurs after the short high tone, which has a falling F0, but is too short to have a pitch contour. The conditioning is not clear in this case.

Figure 3 shows the mean tonal acoustics corresponding to the shapes in table 1 (colour-coding is used for the first-syllable tones). The mid rising citation tone acoustics are also shown. Five different mean F0 shapes – two falling, one level, one rising and one short – can be seen for the first syllable tone corresponding to the five pitch shapes just described. The two dipping F0 shapes corresponding to the two intrinsic word-final allotones can be seen lying a little lower than the citation tone. Figure 3 shows the word-final tone can be considered as a mid rising citation target intrinsically perturbed by co-articulation with the preceding syllable tones: a clear case of word-final preservation of tone.

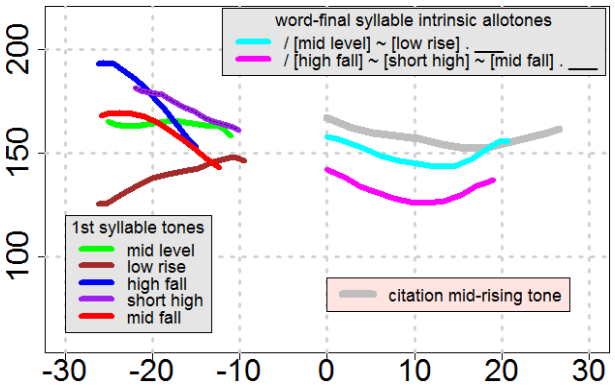

Figure 3. *Mean tonal acoustics of Maodian disyllabic words with underlying mid rising tone on word-final syllable. X-axis = duration (csec.) aligned at onset of second syllable rhyme, y-axis = F0 (Hz).*

6. Disyllabic tone sandhi: a more complex example

Table 2 gives examples of words with underlying lower-mid level [22] tone on the word-final syllable, and the corresponding acoustics are shown in figure 5. The mean acoustics of the low level citation tone have also been plotted. It is evident that the situation is more complex for both first syllable and word-final tones. Unlike before the mid rising tone just discussed there are no first syllable mergers. There are eight different tonal shapes on the first syllable. Their F0 shapes of are all clear in figure 4. Again none match their citation tones. Risking confusion, we list them here (they are colour-coded with table 2 to help matching). As in the previous section, the lower-mid level citation tone corresponds to a low rising tone (brown), the mid rising tone corresponds

to a high fall (blue), the high falling citation tone corresponds to mid level (green), and the depressed high fall corresponds to a mid fall (yellow). Unlike the previous section, the upper-mid level citation tone corresponds to a high rising tone (red), the low rise tone corresponds to a low concave tone (magenta), the mid short stopped citation tone corresponds to a short high rise (purple) and the short stopped rising tone corresponds to a low level (orange). None of these look like morphotonemic alternations easily generalizable with conventional tone features.

Table 2. *Examples of Maodian speaker's tone sandhi in words with lower-mid level morphotoneme* [22] *on word-final syllable. Pitch representations are color-coded with figure 4.*

word-final lower-mid level morphotoneme [22] preceded by …	
… upper-mid level morphotoneme [44] on S1	… lower-mid level morphotoneme [22] on S1
tʰia dʑɔ **45.41** 天橋 *flyover*	jɔ muɑ **24.51** 羊毛 *wool*
… mid rising morphotoneme [323] on S1	… low rising morphotoneme [13] on S1
ɓuɑ dʐ **53.21** 保持 *preserve*	du bi **243.31** 肚皮 *stomach*
… high falling morphotoneme [51] on S1	… depressed high falling morphotoneme [241] on S1
tʰa bɐŋ **33.334** 太平 *peace*	di dʑiəu **32.22** 地球 *globe*
… lower-mid rising morphotoneme [212] on S1	… short stopped low rise morphotoneme [12] on S1
tsŏ dʑiəu **34.51** 足球 *soccer*	zĕ dəu **2.223** 石頭 *stone*

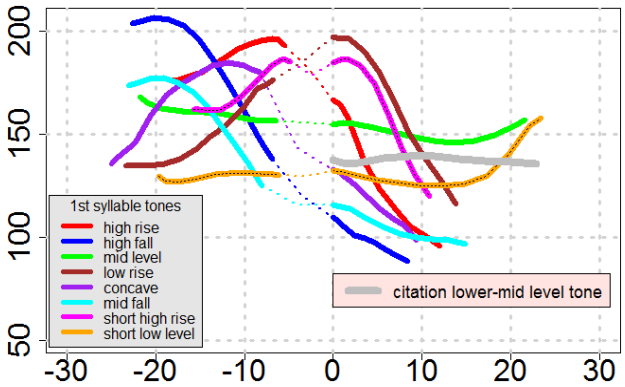

Figure 4. *Mean tonal acoustics of Maodian disyllabic words with underlying lower-mid level tone on word-final syllable. X-axis = duration (csec.) aligned at onset of second syllable rhyme, y-axis = F0 (Hz). Dotted lines indicate F0 on intervocalic consonant.*

The word-final tonal pitch shapes fall into three classes. There are, firstly, four pitches falling from different heights to low: [51], [41], [31] and [21]. The onsets of the five F0 shapes corresponding to these four falling pitches are clearly all determined by the trajectory of the preceding tone, and therefore can be considered intrinsic variants of a falling pitched tone (or even realisations of no tone, with their falling pitch conditioned by a low boundary tone). Secondly, there are two pitches rising to mid: [224] and [334]; these too are intrinsically determined by the height of the preceding tone. Finally, there is one low level [22] pitch, its percept corresponding to the clear leveling out of the F0. There are thus three extrinsic allotones of the word-final lower-mid level tone: falling, rising and level, only the last of which, just, can be considered a case of preservation. Moreover, a case can be made for combinations with the entirely predictable falling word-final allotone to be instantiations of *strong-weak* metrical structure rather than the *weak-strong* structure implied by right dominance. Two of the shapes – 53.21 and 243.31 – are reminiscent of spread high falling and depressed high falling first-syllable tones, except there is no explanation for where such first-syllable tones might have come from: (depressed) high falling and convex tones exist in Maodian to be sure, but table 2 shows they are related to first-syllable [33] and [32] shapes! It seems that, for these data at least, right dominance is not monolithic, and word-final tone preservation cannot be considered criterial for it.

7. Summary

A small part of the tone sandhi behavior has been described for a speaker of Wuzhou Wu, and the data interrogated for typical right-dominant behavior using impressionistic description and quantified acoustics. Complex first syllable behavior typical of right dominant systems was observed. The mid rising tone was shown to be preserved word-finally, but not the lower-mid level tone, showing that preservation of word-final tone is not invariant in putatively right-dominant systems. Clearly, right-dominance is worthy of further study.

8. Acknowledgements

Many thanks to our two anonymous reviewers!

9. References

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