WENZHOU DIALECT DISYLLABIC LEXICAL TONE SANDHI WITH FIRST SYLLABLE ENTERING TONES

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ABSTRACT An acoustic description and tonological analysis are presented for some tonologically interesting lexical tone sandhi data in a subset of tonal combinations involving the Entering Tone category in the Southern Wu dialect of Wenzhou.

INTRODUCTION

This paper describes and analyses a part of the lexical tone sandhi in the Southern Wu Oujiang dialect of Wenzhou (Wz). The Wu dialects are well known for their complex tone sandhi, and Wz is no exception. One of the many sources of the complexity is the often opaque morphotonemic relationship between a dialect's isolation tones, and the tones when they occur on morphemes within a word. It is a goal to try to make tonological sense of these relationships. An account of the morphotonemics in about a third of the Wz tone sandhi can be found in Rose (in press); Zhengzhang (1964) contains an auditory description of tone sandhi in a variety of Wenzhou dialect. Wenzhou dialect contrasts eight tones on monosyllabic words or citation forms, but as a result of neutralisation commonly found in Wu there are much less than (8^2 =) 64 combinations to be explained. This paper focuses on sandhi combinations specifically involving two of the tones on the first syllable.

CITATION TONES

Phonetic description, tonological representation in Yip's (1980) framework, and names of the eight Wz citation tones are given in table 1. A detailed description of the auditory (pitch and length) and acoustic (F0, duration, amplitude) characteristics of the tones can be found in Rose (1994). Figure 1, from Rose (1994), shows the F0 values of the eight Wz citation tones of a male speaker plotted as a function of absolute duration. Each curve is a mean of ca. 10 tokens. From table 1, and figure 1, it can be seen that the eight Wz tones comprise upper ("a", [+ upper register]) and lower ("b", [-upper register]) values of the same four pitch shapes: *level* (tones Ia and IIIb); *rising* (tones IIa and IIb); *falling* (tones IIIa and Ib); and *dipping* (tones IVa and IVb). Length also appears to be an important auditory dimension for some tones. Thus the high-rising tone IIa is notable for its shortness, and the low-level tone IIIb and especially the dipping tones IVa and IVb sound long. The combinations examined in this paper can now be nominated as those with the upper and lower overlong dipping tones IVa and IVb on the first syllable, and all eight tones on the second. These combinations are examined because they constitute a subset (with one exception) from the point of view of their coherent tone sandhi behaviour. Tones IVa/b also belong to the historical category of Ru, or entering tone.

A	B	C	D	E	F
Ia	Yinping	mid-level	[33]	+U	L
Ib	Yangping	mid-falling	[331]	-U	HL
IIa	Yinshang	high-rising	[34]	+U	LH
IIb	Yangshang	low-rising	[114]	-U	LH
IIIa	Yinqu	high-falling	[52]	+U	HL
IIIb	Yangqu	low-level	[222]	-U	H
IVa	Yinru	mid-dipping	[3312]	+U	HLH
IVb	Yangru	low-dipping	[2212]	-U	HLH

Table 1. Wenzhou citation tones. A = tone name, B = Middle Chinese tonal category, C = simple pitch descriptor, D = Chao integer pitch transcription, E = tonological register, F = tonological melody.

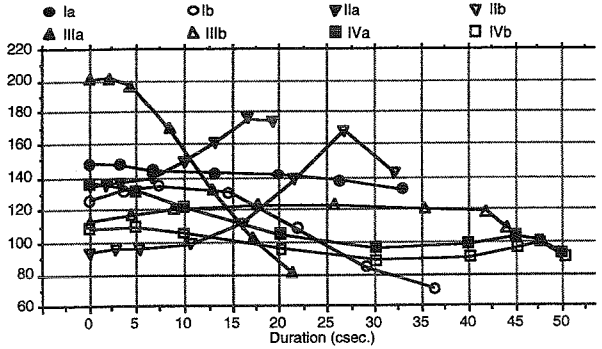

Figure 1. Mean F0 shapes and duration for the eight Wenzhou citation tones.

IVa + Ia				
tse 3312	+ kwɔ 33	⇒	tse kwɔ	*Zhejiang*
pl. name	*river*		1 33	*province*
IVb + Ia				浙江
ɲy 2212	+ kwɔ 33	⇒	ɲy kwɔ	*moon-*
moon	*light*		1 33	*light*
IVa + Ib				月光
kai 3312	+ dzɻ 331	⇒	kai dzɻ	*national*
country	*flag*		31 11↑	*flag*
IVb + Ib				國旗
ɲy 2212	+ de 331	⇒	ɲy de	*platform*
moon	*terrace*		21 11↑	月台
IVa + IIa				
pa 3312	+ ku 34	⇒	pa ku	*all kinds*
hundred	*fruit*		1 34	*of fruits*
IVb + IIa				百果
ba 2212	+ ku 34	⇒	ba ku	*ginko*
white	*fruit*		1 34	白果
IVa + IIb				
tɕi 3312	+ dzaŋ114	⇒	tɕi dzaŋ	*to ap-*
to contact	*near*		1 114	*proach*
IVb + IIb				接近
wu 2212	+ duŋ 114	⇒	wu duŋ	*activity*
to live	*to move*		1 114	活動
IVa + IIIa				
pa 3312	+ fu 52	⇒	pa fu	*general*
hundred	*goods*		3↑ 52	*goods*
IVb + IIIa				百貨
mu 2212	+ $ts^hɻ$ 52	⇒	mu $ts^hɻ$	*wooden*
wood	*articles*		2 52	*articles*
IVa + IIIb				木器
tɕa 3312	+ bœ 222	⇒	tɕa bœ	*foot-*
foot	*steps*		3↑ 33	*steps*
IVb + IIIb				脚步
vu 2212	+ œy 222	⇒	vu œy	*to serve*
to serve	*affair*		12 33	服務
IVa + IVa				
hu 3312	+ tse 3312	⇒	hu tse	*rule*
law	*rule*		4 311↑	法則
IVb + IVa				
le 2212	+ ky 3312	⇒	le ky	*rib*
rib	*bone*		23 211↑	肋骨
IVa + IVb				
$ts^hɻ$ 3312	+ le 2212	⇒	$ts^hɻ$ le	*tired*
eat	*strength*		4 311↑	吃力
IVb + IVb				
de 2212	+ bi 2212	⇒	de bi	*special*
special	*other*		23 211↑	特別

Table 2. Examples of Wenzhou tone sandhi in disyllabic words with input complex tones IVa and IVb on the first syllable.

resemble the (mid-falling) Ib citation tone pitch at all.

The upper ("a") and lower ("b") Wz citation tones are distributed in typical Wu fashion with respect to several segmental and suprasegmental features of the syllable, in particular the manner of articulation of syllable-initial obstruents. Like other Wu dialects, Wz has three morphophonemically separate sets of syllable-initial stops (voiceless aspirated; voiceless unaspirated; and voiced), and two sets of syllable-initial fricatives (voiceless and voiced). The first two sets of stops occur on syllables with the upper ("a") tones and are realised by voiceless aspirated and voiceless unaspirated allophones. The third set of stops, which co-occurs with the lower ("b") tones, has different realisation depending on position in the word. Word-internally the realisation is modally voiced. Word-initially, the third series of stops is realised in this corpus predominantly by voiceless, coincident VOT articulations, but there is a small amount of free variation with modal, VOT lead tokens. The same applies *mutatis mutandis* to the two sets of fricatives: voiceless in upper, "a" tones; voiced word-internally, and voiceless in free variation with voiced word-initially in lower, "b" tones. In this paper, the morphophonemically voiced series are transcribed with voiced symbols both word-initially and word-internally.

TONE SANDHI

Table 2 shows the pitch of tones in disyllabic words with input complex tones IVa and IVb on the first syllables, and all tones on the second. The particular tonal combination, e.g. "IVa + Ia", is given at the left, and under it an actual example. Thus it can be seen that a word like ɲy kwɔ *moonlight* with an input low dipping tone IVb on the first syllable and an input mid level tone Ia on the second has a short low pitch on the first syllable and a mid level pitch on the second thus: [1 33]. By convention, the tones are shown grouped by historical pairs (Ia/Ib etc). Interestingly, the synchronic register pairing sometimes does not reflect this. Thus on the second syllable, Ia pairs phonetically with IIIb: both are [33]. It can be seen that the combinations in table 2 have, with one exception, two main characteristics. The first syllable is very short and located in various positions in the pitch range, and the pitch of the tone on the second syllable closely resembles that of the input citation tone. The exception to this is where the second syllable has mid-falling tone Ib; in this case the tone on the first syllable is of normal length - not short - and the (low level-rising) pitch of the tone on the second syllable does not

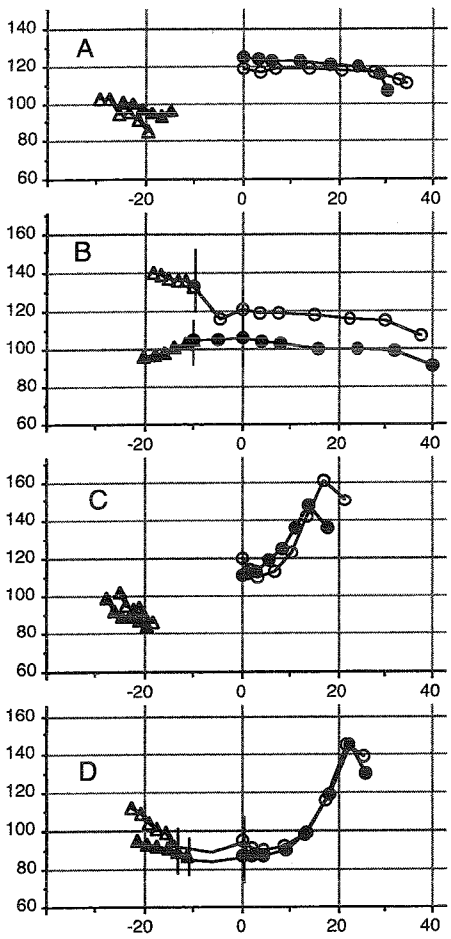

Figure 2. Mean F0 shapes for disyllabic Wz words with tones IVa and IVb on the first syllable and tones Ia (A), IIIb (B), IIa (C), IIb (D), IIIa (E), IVa (F) and IVb (G) on the second.

The acoustics corresponding to the combinations in table 2 are shown in figure 2. This figure shows F0 on the first and second syllable rhymes, and on their intervocalic consonant if voiced, in Wz disyllabic words spoken by the same male native speaker as in figure 1. Each curve is the mean of three different words. In each of these figures, two F0 curves are shown corresponding to each second syllable tone: one for the mean value after tone IVa on the first syllable, and one for the mean value after tone IVb. This permits assessment of possible progressive assimilatory effects. The F0 curves are aligned at the onset of the second syllable vowel, in order to best show the degree of similarity between them. Expected intrinsic duration differences in the first syllable F0 shapes associated with the intervocalic consonant can be seen in the figure. Thus F0 shapes before "b" tones are slightly longer; and F0 shapes before "a" tones show a sharper negative offset perturbation (these features are also noted for the Wu dialect of Zhenhai in Rose (1990)). The short duration of the first syllable tones – ca. 10 csec. – can also be seen.

Tones on the second syllables will be discussed first, since they have simpler phonetics and morphophonemics. Then first syllable tones are discussed. As noted above, combinations with input Ib on the second syllable input tones are an exception, from the realisation of both first and second syllable tones, and these are addressed last of all.

Second syllable tones The auditory impression from table 2 suggests that, apart from tone Ib, the tones on the second syllable after tones IVa and IVb are similar to their citation values. Four of them - tones Ia, IIa, IIb and IIIa - have a single allotone with the same pitch as in citation form. Three tones - IIIb, IVa and IVb - appear to have two allotones conditioned by the first syllable, one of which has the same pitch as in citation. Thus tone IIIb is [33] after IVa, which is higher than citation, but [22], the same as citation, after IVb. A glance at figure 2b, f and g shows that these allotonic differences are probably due to persevatory assimilation from the first syllable.

The F0 of the seven tones which relate directly to the citation forms were compared with the citation form acoustics by normalisation. Specifically it was examined to what extent the F0 shapes of tones Ia, IIa, IIb and IIIa could be considered instances of the same target, and what the nature of the assimilatory process was for tones IIIb, IVa and IVb. Normalisation involved, firstly, pooling values for both tokens of each of the tones Ia, IIa, IIb and IIIa to give a mean F0 shape for the respective tonal target in the environment after tone IVa/IVb. These are the tones for which it was shown there is negligible difference between the F0 shapes and durations after tones IVa and IVb on the first syllable. The

shapes of these tones, and the two values each of IIIb IVa and IVb were then z-score normalised and compared with the corresponding normalised citation tone shapes. A z-score normalisation requires normalisation parameters (of mean and standard deviation) to be calculated from comparable items (Rose 1987). In this case, then, the parameters were calculated from all seven data points in the tones which sounded to have the same pitch shape both in citation and after tones IVa and IVb, viz: tones Ia, IIa, IIb, and IIIa. The values of the normalisation parameters - mean and standard deviation respectively - were 139.9, sd = 32.1 for the citation tones, and 120.0, sd = 26.0 for the tones after tones IVa and IVb, with n = 28 in both cases. These values show that tones after IVa/IVb are realised in a narrower range and around a lower mean F0 than tones in citation form.

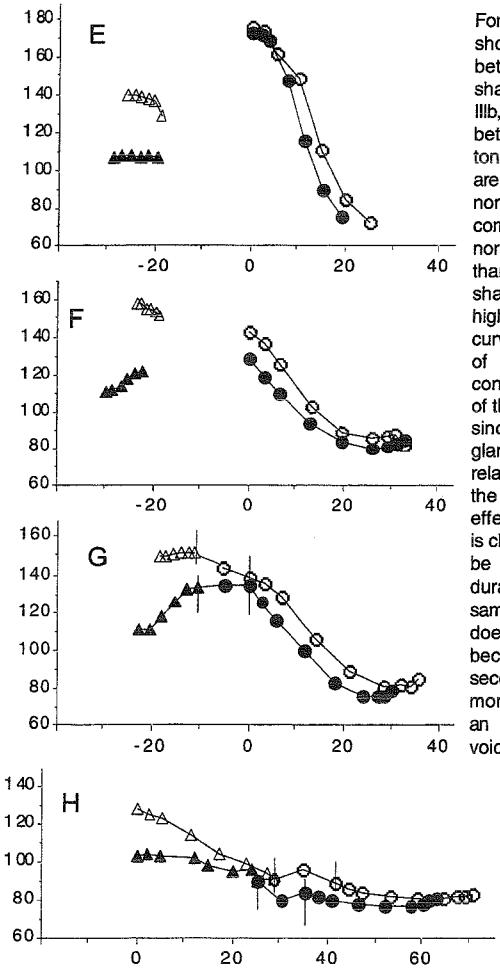

Figure 2. (con't)

For tones Ia IIa, IIb, and IIIa, the normalisation showed agreement in considerable detail between the citation F0 shapes and the shapes after tones IVa and IVb. For tones IIIb, IVa and IVb, however, the agreement between citation form and allotones after tones IVa/b was not quite so close. These are shown in figure 3, together with the normalised curves for tone Ia for comparison. Figure 3a shows that the normalised IIIb F0 shape after IVb is lower than the citation IIIb shape, and that the IIIb shape after IVa is higher, and that the higher IIIb allotone is in fact very close to the curves for tone Ia. The auditory description of IIIb after IVa as [33] is of course consistent with this, but the [22] description of the lower allotone pitch is not consistent, since the citation tone pitch is also [22]. A glance at figure 2b shows that the shifting relative to citation IIIb might well be due to the well-known progressive assimilation effect from the previous syllable, since IVa is clearly high before IIIa, and IVb low. It can be noted here that the F0 shape and duration of IIIb after IVa are effectively the same as for tone Ia after tones IVa & b. This does not result in any confusion however, because morphemes with tone IIIb on the second syllable are still distinguishable from morphemes with Ia by the voicing value of an initial obstruent (before IIIb they are voiced), and by the pitch of the first syllable (before IIIb, tone IVa on the first syllable has a higher pitch [4 33] vs. [1 33] for IVa + Ia)).

The same kind of assimilatory conditioning occurs with tones IVa and IVb on the second syllable, but with slightly different consequences. Figure 3b presents the normalised F0 shapes of citation tones IVa/b together with the normalised shapes of the same tones after IVa and IVb on the first syllable. Firstly some small contour differences are visible. It is clear from figure 3 that the second syllable IVa/b shapes have higher onsets than in citation form. As a possible consequence, they also fall to a later trough, at 80% of equalised duration compared to 60% in citation form, and the slight rise at the end is not as great as in citation

form. Secondly, it can be seen that the F0 of IVb has been raised after IVa on the first syllable so that it is the same as the F0 of IVa after IVa, whilst the opposite has happened to the F0 of IVa after IVb: it has been lowered so that it is in fact slightly lower than the F0 of IVb after IVb. The magnitude of this effect is big enough to swamp the difference between the IVa and IVb tones. The effect of this is to neutralise tones IVa and IVb on the second syllable, although the identity of the morphemes is still clear from their initial consonant.

The tonological interpretation for all the second syllable cases just discussed is one of a 'citation target', This is one of the categories of relation between citation tones and tones in sandhi, and refers to cases where a tone in sandhi 'can be identified as one of the citation tones, once allowance is made for intrinsic influence of various conditioning factors...' (Rose and Toda 1994: 271). The analytical implication is therefore that no tonological change in the derivation is required for any of the tones Ia, IIa, IIb, IIIa IIIb, IVa and IVb. (There is, for example no paradigmatic change to another tone, as commonly happens in Chinese tone sandhi.) It is interesting to note that this is somewhat parallel to the situation in the Northern Wu dialect of Zhenhai, where after tone IVb on the first syllable, citation targets occur. The main phonetic conditioning factor here, apart from the narrowing and lowering of range mentioned above, is the perseverative assimilation from the preceding syllable. It is interesting to note, however, that the assimilation is not totally systematic. Figure 2 shows no assimilatory conditioning of second syllable tones Ia, IIa, and IIb, presumably because there is no difference between the first syllable tones to condition it. However, tone IIIa also shows no conditioning, despite a large difference in the potential conditioning factor on the first syllable. Tones IVa IVb and IIIb show less coarticulation resistance than IIIa, therefore.

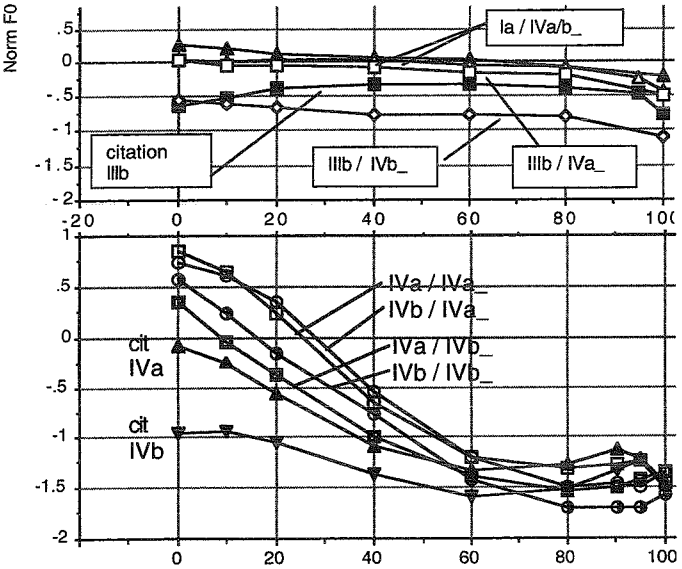

Figure 3. Above: normalised F0 shapes for Wz tones Ia and IIIb in citation form (solid symbols), and after tones IVa and IVb (empty symbols). Below: normalised F0 shapes for Wz citation tones IVa/b (solid symbols) and after tones IVa/b (empty symbols).

First syllable tones

The auditory descriptions show that input tones IVa and IVb differ markedly in pitch and length from prepausal position, showing the widest extremes of allotonic realisation of the Wenzhou tones. In contrast to their prepausal bidirectional, over-long allotones they have in initial position very short unidirectional allotones located in various positions in the pitch range. (There is also the exception before Ib, which is not short.) In three cases the tonal contrast between IVa and IVb appears neutralised. Thus before tones Ia, IIa or IIb there is no audible difference in pitch or duration between tones IVa and IVb, which both have short low level pitches. Before the other tones, there is an audible difference in pitch between IVa and IVb morphemes. Before IIIa, the difference is one of pitch height, tone IVb being (short and) low, and tone IVa (short and) mid. Before tones IIIb, IVa and IVb the IVa/IVb difference includes pitch contour too. Before these tones, tone IVb has a low slightly rising pitch shape which is slightly lower before IIIb than before IVa/b, and tone IVa has a (short) high or mid level pitch.

The tonological interpretation of these first syllable forms is complicated. It is probably best to understand the rather large difference in length between tones IVa and IVb on the first syllable and their overlong prepausal forms in terms of a shortening of the prepausal form of tones IVa and IVb before all second syllables except when they carry tone Ib. In this way the idiosyncratic fall and final rise on the prepausal allotones are conventionally accounted for as being underlying. In the tonological framework adopted for this paper, this must be expressed as the loss, in first syllable position, of the last two tonal autosegments of tones IVa/b (which have an underlyingly HLH melody, see table 1). Interestingly, this appears in fact to be the opposite of the historical development. The proto-Wu cognates of Wz tones IVa/b were short and occurred on syllables with a final stop, and these features have been retained in most of the Modern Wu dialects. For example, proto-Wu *fat 45 *put forth* has become Zhenhai fa? 5, but Wz hu:: 3312. Thus it is the short first-syllable forms in Wz that most resemble Proto-Wu, and the proto-Wu short tones *IVa/b have grown rather long tails in Wz, which is perhaps related to the loss of the syllable-final stop.

In order to account for the neutralisation of IVa/b to [1] before Ia, IIa and IIb, it is best to first posit, before tones Ia, Ia and Ib, a categorical shift of IVa to IVb, and then change the H in IVb, which is [H, -U] to L, which then becomes [L, -U], or [1]. A separate derivation by rule of IVa would otherwise be too complex. Note that it is very difficult to motivate these changes, the conditioning of which is totally opaque. The remaining short first-syllable forms, before tones IIIa/b and IVa/b, can be understood as retaining the contrast between IVa and IVb, which themselves show conditioning by the twin factors of anticipatory assimilation of the second syllable tone, and the voicing specification on the intervocalic consonant. Both of these factors have been shown to be operative in the phonetic realisation of the sandhi of other Wu dialects (Rose 1990).

Combinations with Ib on second syllable Finally, the combination of IVa/b and Ib has to be considered. In this combination, the acoustics of which are shown in figure 2h, the first syllable is not short, and has a mid (IVa) or low (IVb) falling pitch, and the second syllable, with tone Ib, has a low level and slightly rising pitch very different from its mid falling input tone. There are two plausible analyses of this. The first involves a conventional tone spreading of the first syllable pitch contour over both syllables (with prior loss of the tone on the second syllable). The second involves a loss of the final H on the underlyingly HLH first syllable tone, and an extrinsic allotonic realisation of Ib as [112] after IVa/b. Although the first accounts rather well for the low pitch of the second syllable with its small final rise, and the equalised F0 contours agree well, tone Ib actually has a low level-rising prepausal allotone after tones Ia/b, where first-syllable contour spreading is not plausible, and so the second solution is preferable.

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