

From Tonal to Accentual: Fuzhou Tone Sandhi Revisited

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FROM TONAL TO ACCENTUAL: FUZHOU TONE SANDHI REVISITED
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This paper investigates the tone sandhi phenomenon of Fuzhou, a Northern Min dialect spoken in South Eastern China. Some fairly extensive analyses on this topic are presented in Yip (1980) and Wright (1983). They propose a number of standard tone rules, such as insertion, deletion, and spreading to derive the surface tone patterns from underlying forms, but do not provide justification for these rules. This paper suggests that insertion or deletion rules in Fuzhou apply in conformity with a surface constraint that allows at most one high peak in a given domain. This constraint functions as a filter, and language specific adjustments can be implemented to derive the exact output for any given variant of the Fuzhou dialect. The lack of surface violations, among all types of tone sandhi patterns, and across all reported sub-dialects, strongly supports the validity of such a constraint.

This paper concludes that the constraint reflects the evolution of Fuzhou from a tone language to an accentual language. Fuzhou is a typical Asian tone language at the phonemic level. Each syllable is associated with one of several contrasting tone melodies: H (high), L (low), LH (rising), HL (falling) and so on. Tone segments H and L, the building blocks that make up tone melodies, are equally significant. After the application of tone sandhi rules and the constraint, tonal contrast is drastically reduced at the surface level, and the tone segment H is given more prominence than the segment L. These are the characteristics shared by many accentual languages.

1. TONAL INVENTORY OF FUZHOU

Fuzhou has seven "citation" tone melodies: tone melodies that are elicited when syllables/morphemes are pronounced in isolation: [44], [52], [22], [12], [242], [13], and [4]. The numerals 1 through 5 represent five levels of pitch height, from low to high. Underlining indicates "Checked Tones", tone melodies with co-occurring final obstruents and shorter duration. They exhibit aberrant tone sandhi patterns in many Chinese dialects. I will not discuss problems related to Fuzhou checked tones. Interested readers are referred to Yip (1980) and Wright (1983) for details.

I assume phonemic representations of Fuzhou tone melodies as stated in (1). Because the surface [13] participates in tone sandhi rules in different ways (see Table I), it is better to analyse it by two different underlying representations LH and L, the former co-occur with final -h, and the latter with -k. Therefore, I assume that there are eight underlying tone melodies in Fuzhou.

- (1) [44]: H [52]: HL [4]: HL [12]: LH [22]: L
[242]: LHL [13] (-h): LH [13] (-k): L

2. DISYLLABIC TONE SANDHI

In Fuzhou, as in many Min dialects, the last tone melody of a given domain α maintains the underlying value, and all the rest undergo tone changes, as shown in (2).

$$\begin{array}{rcl}
 (2) & [T_1 \ T_2 \ \dots \ T_n]_{\alpha} & T : \text{underlying tone} \\
 & \downarrow \quad \downarrow & T' : \text{sandhi tone.} \\
 & T'_1 \ T'_2 \ \dots &
 \end{array}$$

Disyllabic or trisyllabic lexical items are within the tone sandhi domain of Fuzhou. Some non-lexical forms also undergo tone sandhi, under specific syntactic conditions (Chan 1980) and/or prosodic conditions (Wright 1983).

Some of the Min dialects, such as Amoy, have context-free rules. Then each underlying tone has only one surface realization at sandhi position. Fuzhou, however, has context-sensitive rules, and each underlying tone may correspond to more than one surface value. For example, a high tone remains high when it precedes another high tone, but changes to a falling tone when the following tone is low. A low tone remains low in front of a high tone, but changes to a rising tone when preceding another low tone.

In disyllabic tone sandhi, the eight tones in Fuzhou are grouped into classes. Interestingly, they exhibit different classifications as context tones and as input tones. As context tones, [44], [52] and [4] form one class, while [22], [13], [242], and [13] form another class. A high tone [44], for example, remains high when it precedes [44], [52], or [4], but changes to a falling tone when it precedes [22], [13], [242], or [13]. As input tones, [44], [13], [242], and [13] (-h) form one class, [52] and [4] form another class, while [22] and [13] (-k) form the third class. For example, [44], [13], [242], and [13] (-h) all change to falling tones when the following tone starts with L. [52] and [4] change to low tones, and [22] and [13] (-k) change to rising tones in the same environment.

Yip (1980) made the following generalization of these tonal classifications. The initial tone segment determines the grouping of context, or domain-final tone melodies. [44], [52], and [4] all start with H, and [22], [13], [242] and [13] all start with L. However, the last tone segment is the common denominator of the grouping of input, or non-final tone melodies. [44], [13], [242], and [13] (-h), represented as H, LH, LHL, and LH respectively, end in H, with the exception of LHL. [22] and [13] (-k), represented as L and L respectively, end in L. Falling tones HL and HL form a separate class. LHL fits into its class by a simplification rule that drops the final L. This rule should apply quite early in the derivation. In later sections, this rule is assumed to have applied before all tone rules under discussion.

Since the non-initial tone segments of the context tones, or the domain final tone segments, do not affect the major tone sandhi rules, and in a few places where they seem to play a role, we

TABLE I

Disyllabic Tone Sandhi of 3 Fuzhou Dialects

1. Yip

2nd σ 1st σ	H H(L) <u>H(L)</u>	L L(H) L(HL) <u>L</u> <u>L(H)</u>
H LH LHL <u>LH</u>	1 H	4 HL
HL <u>HL</u>	2 H	5 L
L <u>L</u>	3 L	6 LH

2. Chen & Norman

2nd σ 1st σ	H H(L) <u>H(L)</u>	L L(H) L(HL) <u>L</u> <u>L(H)</u>
H LH LHL <u>LH</u>	1 H	4 HL
HL <u>HL</u>	2a H	5 L
L <u>L</u>	3 L	6 LH

3. Wright

2nd σ 1st σ	H H(L) <u>H(L)</u>	L L(H) L(HL) <u>L</u> <u>L(H)</u>
H LH LHL <u>LH</u>	1 H	4 HL
HL <u>HL</u>	2a L	5 L
	2b H	
L <u>L</u>	3 L	6a LH

can simply refer to the existence or absence of the extra tone segments without specifying their values, I consider these segments extramelodic and enclose them in parentheses.

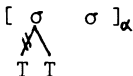
Tone classes as described above are a very important aspect in Fuzhou tone sandhi, and such a classification is found in all sub-dialects discussed in literature. Disyllabic tone sandhi patterns in three sub-dialects of Fuzhou are given in Table I to illustrate this point. The conditioning tone segments are set in bold face, and the extramelodic elements are in parentheses. In each chart, underlying tones of the first syllable, namely, the input tones, are listed at the left. The underlying tones of the second syllable, or the context, are on the top line. The boxes in the center give the sandhi form of the first syllable. The tone value of the second syllable remains unchanged, and is not given in the boxes.

Comparing the three charts in Table I, one finds invariant sandhi forms in most cases, namely, the forms in box 1, 3, 4, and 5, which are also set in bold face. These changes, restated in (3) below, demonstrate a common process: Initial Tone Segment Deletion (ITD), as given in (4a). This rule has the same function as Yip's T Deletion and Wright's Mora Deletion. The form in box 4 requires the further modification rule Low Spread, given in (4b), where a low tone spreads leftwards and changes a preceding high tone into a falling tone. In the following rules, "x" is a variable representing H, L, or null.

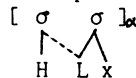
(3)

xH Hx	ITD	H Hx	(box 1)
xL Hx	----->	L Hx	(box 3)
xH Lx	----->	H Lx	(box 4)
HL Lx	----->	L Lx	(box 5)
		-----> HL Lx	

(4) (a) ITD



(b) Low Spread



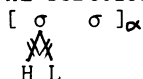
In Yip's data, a HL tone at sandhi position assumes the value of the following tone segment. She correctly captures this phenomenon by positing a HL Deletion Rule, dropping a non-final falling tone, and allows tone segments to spread leftward to a toneless syllable later in the derivation. HL Deletion is stated in (5a). This rule should be ordered before ITD, or ITD will always destroy the environment of HL Deletion.

If this rule is correct, then the L tone in box 5 will be derived by HL Deletion and tone spread, instead of by ITD. I assume this approach, and will show later that such a rule is indispensable in trisyllabic tone sandhi.

One more rule is required to account for Yip's data. In box 6, there is a H on the surface without a possible source in the

underlying forms. So a H Insertion Rule (Yip's L Dissimilation) is necessary. It is stated in (5b).

(5) (a) HL Deletion



(b) H Insertion



More specific rules are required to derive forms in dialects (2) and (3) in Table I, from Chen & Norman and Wright respectively. To distinguish sandhi forms in box (2a) and (2b) in both dialects, one may restrict the environment of HL Deletion. To derive forms in box (6a) and (6b) of Wright's data, one may define the H insertion rule differently so that a H tone may be inserted at various positions. I will not explore the details here, but turn to the discussion of the motivation of the aforementioned rules.

3. THE HIGH PEAK CONSTRAINT

Some of the rules discussed above, or rules with similar functions, have been proposed in various articles (Yip 1980, Wright 1983). Yip does not discuss the motivation of her rules. Wright suggests that ITD (her Mora Deletion) occurs at weak position as a result of syllable reduction. Aside from this, there is no explanation of other insertion and deletion rules (Wright proposed several more rules than those discussed above). Many rules are written with very specific environments as if the larger context were not relevant. However, if we take a look at the sandhi output, it is apparent that tone sandhi in Fuzhou does not occur at random. All the output forms, without exception, contain at most one high peak, not considering the extramelodic elements. So I propose the High Peak Constraint (HPC) to account for this. All the melody-changing rules, ITD, HL Deletion, and H Insertion, function to eliminate an extra high peak, or to create one where there is none. Sustaining H or L is permitted, so is an overall rising falling pattern. But a falling-rising pattern, or any pattern containing it, is ruled out.

ITD and HL Deletion greatly simplify the tonal contour of the first syllable. All contour tones are eliminated since there is at most one tone segment left behind in a tone melody. H Insertion is the only rule that brings in complexity in pitch contour. It creates a high peak among sequences of underlying low tones. Notice that this is the only environment in the underlying forms that lacks a high peak. What the tone sandhi rule achieves is just such a high peak. This shows that having a high peak in a word or a compound, the usual domain of disyllabic and trisyllabic tone sandhi, is the preferred prosodic structure in Fuzhou.

One may argue that box 5 presents a counterexample to the above statement, where a HL tone is changed to a L when followed by a L, creating a sequence of L's that lacks a high peak.

However, if we adopt the analysis of HL Deletion, then we can see that, after the HL Deletion, there is only one L tone segment left in the entire tone sandhi domain. Therefore, H Insertion will not apply. It requires two L tone segments in the structural description.

Tone spread may create a contour tone later in the derivation, but the tonal contour can only change in the direction specified by the following tone segment. For example, Low Spread can only create a falling tone, not a rising tone, because the following tone segment is low. In other words, spreading rules can only modify the existing overall melody, but cannot bring in drastic changes. These types of rules are more phonetically oriented, and are likely to be ordered after all phonological rules, or the melody-changing rules, such as H Insertion, HL Deletion, and ITD. This is another reason why a high peak will not be created among sequence of "phonetic" L's resulting from Low Spread.

In Fuzhou tone sandhi, the non-initial tone segments of the final tone melody are always considered extramelodic, as indicated by the parentheses in the top lines of Table I. Their values do not affect tone sandhi rules, and are not counted in the HPC. Tones with initial L tones, L, LH, LHL, and the corresponding checked tones, all induce the same sandhi output. The HPC is blind to the extra H peak to the left of the initial L in exactly the same way. It treats word final LH, LHL, and LH just as L or L. It is not a coincidence that what is extramelodic to tone sandhi rules is also extramelodic to the HPC. In fact, tone sandhi rules and the HPC are dependent on each other. The HPC defines a general direction that gives the permissible output, but leaves room for possible variations, as exemplified by different surface forms in the three sub-dialects. Tone sandhi rules may be very specific, but should satisfy the general constraint.

The position of the high peak, if any, correlates with the directionality of tone sandhi described in (2). Since the entire Min family shows right-prominent tone sandhi rules, that is, the rightmost tone melody maintains its underlying value, and the rest change, it is not surprising to find that Fuzhou maintains the rightmost high peak, and levels off any preceding peaks.

4. TRISYLLABIC TONE SANDHI

The major works on trisyllabic tone sandhi are Chen and Norman (1965), and Wright (1983). Most of the data discussed are trisyllabic compounds.

When a trisyllabic compound participates in the trisyllabic tone sandhi rules, its internal syntactic structure, left branching or right branching, has no effect on the tone sandhi output. For example, [[H HL] LHL] and [H [HL LHL]] both give rise to [HL L LHL].

- (6) (a) ku[H]-i[HL] iɛɰ[LHL] → ku[HL]-i[L] iɛɰ[LHL]
 orphan hall orphanage
 (b) k'iɲ[H] yɲ[HL]-ei[LHL] → k'iɲ[HL] yɲ[L]-ei[LHL]
 very easy very easy

This phenomenon strongly favors non-cyclical application of tone sandhi rules, regardless of how trisyllabic tone sandhi rules are given.

Chen & Norman's description, paraphrased in (7), is linguistically insufficient not only because it requires cyclical application, but also for the unmotivated conditions introduced.

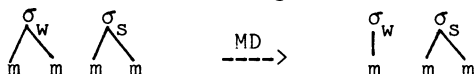
- (7) In a trisyllabic sequence $\sigma_1\sigma_2\sigma_3$, σ_3 remains unchanged.
 If $\sigma_2 \neq \text{HL}$, then $\sigma_1 \rightarrow \text{L}$, σ_2 is derived by 2-TS.
 If $\sigma_2 = \text{HL}$, and $\sigma_1 = \text{L}$, then $\sigma_1 \rightarrow \text{LH}$.
 If $\sigma_2 = \text{HL}$, and $\sigma_1 \neq \text{HL}$, but $\sigma_3 = \text{HL}$, then $\sigma_2 \rightarrow \text{H}$.
 Otherwise, apply 2-TS cyclically, from R→L, namely,
 $[\sigma_1 [\sigma_2 \sigma_3]]$ regardless of the syntactic bracketing.

I would say this is needlessly complicated and totally ad hoc. One would look for something more general.

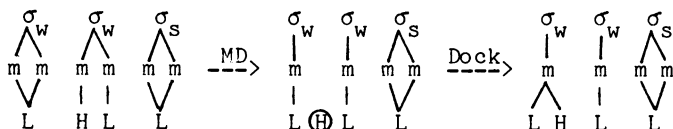
It should be noted that, even with these detailed rules, Chen & Norman haven't covered all the sandhi output. One obvious exception is H H H → H H H. According to (7), σ_1 should be L.

Wright (1983) suggests the right direction. She attempts to relate trisyllabic tone sandhi rules to the disyllabic ones, and tries to derive trisyllabic tone sandhi forms by non-cyclical application. In general, she argues that all syllables contain two morae underlyingly, and all non-final syllables in a tone sandhi domain are weak positions, and therefore lose one mora and the associated tone segment. The deleted tone segment becomes a floating tone, and may "dock" to another tone segment in later derivation. Wright's Mora Deletion Rule (MD) and one sample derivation are given below.

- (8) (a) Mora Deletion (Wright 1983)



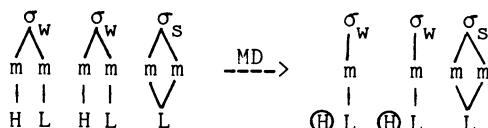
- (b) L HL L → LH L L



Wright has several problems with the above rules. For example, the Docking rule seems to be unpredictable, and there are many unexpected initial low tones. She is forced to adopt many unmotivated restrictions that weaken her analysis.

To derive (9), Wright constrains her Docking rule to apply when there is a preceding floating \oplus in the tonal sequence, as a contrast to (8b). The sequence *LH L L is expected if the Docking rule were to apply.

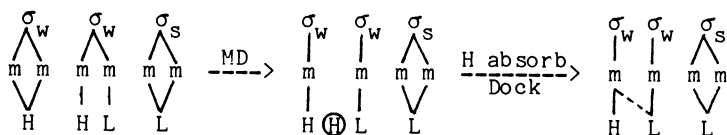
(9) HL HL L \rightarrow L L L



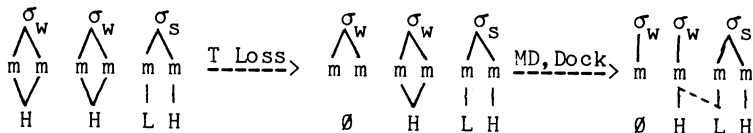
To account for some unexpected initial low tones, Wright posits a Tone Loss Rule that deletes an initial tone melody under two conditions: when the following tone segment is associated with two morae, or when it is low. The rule is given in (10), and (11) shows why the number of association lines needs to be specified in the structural description. The underlying initial H shows up on the surface in (11a), but not in (11b) and (11c). Wright suggests that Tone Loss deletes the initial H in (11b) and (11c), and the toneless syllable is realized as L by universal convention.

(10) $T \rightarrow \emptyset / _ \left\{ \begin{array}{c} \vee \\ T_w \\ L_w \end{array} \right\}$

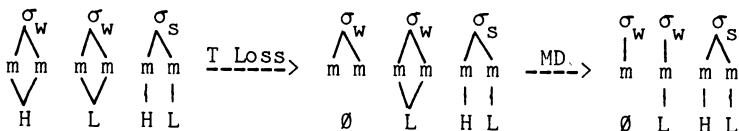
(11) (a) H HL L \rightarrow HL L L



(b) H H LH \rightarrow L HL LH



(c) H L HL \rightarrow L L HL



Yip's HL Deletion can avoid the problem raised by the Docking Rule, and several other rules in Wright (1983) which are not discussed in this paper. The HPC explains why initial tones tend to be low. There is no need to adopt complicated devices as Wright suggests.

In the following, I will give derivations of trisyllabic tone patterns, based on the disyllabic rules discussed in section 2, namely, HL Deletion, ITD, H Insertion, and Low Spread.

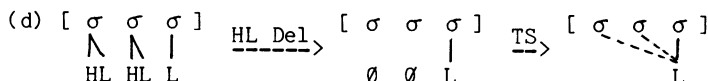
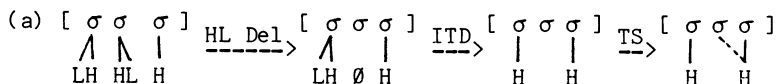
The rule ordering also follows what is required by disyllabic tone sandhi: HL Deletion precedes ITD. It is assumed that the melody-changing rules, HL Deletion, ITD, and H Insertion, which are more phonologically oriented, should apply before the spreading rules, which are more phonetic. The HPC modifies the output of all melody-changing rules, and eliminates any extra high peak to the left. It must apply after all the melody-changing rules. Since the HPC also changes the melody, I order it before spreading rules.

The forms in (12) are derived from ITD (which may apply vacuously). LHL is simplified to LH before ITD applies. No other rules are applicable to these forms.

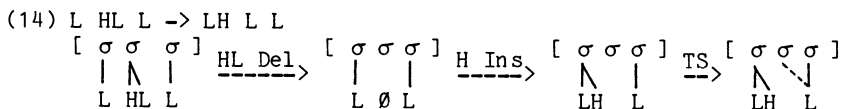
- (12) (a) H H H \rightarrow H H H (b) L L H H \rightarrow L H H
 (c) L H L HL \rightarrow H H HL (d) L H H \rightarrow L H H
 (e) L H HL \rightarrow L H HL (f) L L H HL \rightarrow L H HL

The following forms are derived from HL Deletion, ITD, and Tone Spread.

- (13) (a) L H L H \rightarrow H H H (b) H L L H \rightarrow H H H
 (c) L L L HL \rightarrow L H HL (d) H L L L \rightarrow L L L

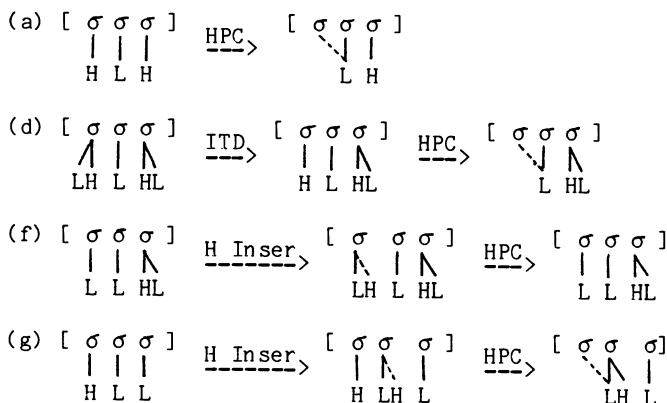


(14) is derived by HL Deletion, H Insertion, and Tone Spread.



In the following forms, the melody-changing rules apply first, and the result contains two high peaks. The HPC removes the first one, and gives the expected output.

- (15) (a) H L H \rightarrow L L H (b) H L HL \rightarrow L L HL
 (c) LH L H \rightarrow L L H (d) LH L HL \rightarrow L L HL
 (e) L L H \rightarrow L L H (f) L L HL \rightarrow L L HL
 (g) H L L \rightarrow L LH L (h) L L L \rightarrow L LH L



Given a random combination of Fuzhou underlying tones, there are numerous cases where we find two, even three high peaks in the trisyllabic domain. After applying tone sandhi rules, the number of high peaks will be reduced, due to the nature of tone sandhi rules, but not eliminated. Without the HPC, it is logical to expect some falling-rising patterns or its variations. However, no tone sandhi output in any sub-dialect of Fuzhou, as reported in Chen & Norman (1965) and Wright (1983), contains two high peaks (extramelodic elements excluded). This strongly suggests that the HPC is a filter rather than a rule: it does not allow any violation.

From another perspective, we might expect to find variations within the range of the HPC, were it a filter rather than a rule. This is exactly the case. There are often found free variations corresponding to the same tonal input. These forms may be affected by style, speed of speech, and social factors.

In trisyllabic tone patterns, there are several forms that show unexpected initial L's, and the replacement of H's cannot be attributed to violation of the HPC. Many of the low tones can be resolved by restricting the spreading of a high tone. That is, only H's in the final syllable, or the strong position, can spread leftwards, and H's in the medial position do not spread. All the forms in (16) involve a deleted HL tone. It usually assumes the value of a following tone segment, but in (16) a L tone surfaces. If the medial H does not spread, then the initial toneless syllable will receive a default L. This phenomenon suggests that a medial H tone is less prominent than a final H, and that a L tone is unmarked while a H tone is marked. This correlates nicely with the HPC, which gives prominence to the rightmost H.

- (16) (a) HL HH → LHH
 (b) HL HHL → LHHL
 (c) HL HL → LHL

5. CONCLUSION

In this paper I suggest that Fuzhou tone sandhi rules are subject to a very general constraint that allows at most one high peak, the rightmost of the potential ones, in a tone sandhi domain. This tendency is especially clear in trisyllabic tone sandhi, considered unmotivated and exceptional in (7). Under my analysis, disyllabic and trisyllabic tone sandhi are treated in exactly the same way.

The constraint (HPC) functions as a filter. On the one hand, it places restrictions on possible output, and there is no violation. On the other hand, it allows variations, and those do occur.

The proposed constraint has interesting consequences for a tone language. First, it drastically reduces tonal contrasts on the surface. Second, it reinterprets tonal segments H and L, two meaning-differentiating elements, and gives more prominence to H. Third, it requires non-local rules to operate. In my analysis, high tones are eliminated in the presence of a distant high tone. This is very similar to a rule of accent shift, but deviates from usual tone rules, where tone changes are conditioned by neighboring tones. All these are characteristics of accentual languages, and Fuzhou acquires them through the application of tone sandhi rules. It seems that Fuzhou is evolving from a tone language to an accentual language.

In a tone language, tones differentiate meaning. One may ask whether the loss of tone would cause communication problems, and if so, whether it is possible to have large-scale tonal neutralization rules as proposed in this paper. My guess is that this reduction is possible under the following condition. Fuzhou, as many other Chinese dialects, has gone through a long process of disyllabification, and has built up many disyllabic or trisyllabic lexical items. The function load of tones is therefore reduced (though the tone may still be distinctive), and at this stage, tonal neutralization is made possible.

Fuzhou provides an interesting area of study. Further research will lead to better understanding of the relation of tone and accent, and of the interaction between the typological change of syllable structure and of tonal structure.

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