North East Linguistics Society

Volume 12
Issue 1 *NELS 12*

Article 21

1982

Tone Sandhi and Vowel Changes in Fuzhou

Martha Wright
University of Massachusetts, Amherst

TONE SANDHI AND VOWEL CHANGES IN FUZHOU

MARTHA WRIGHT

UNIVERSITY OF MASSACHUSETTS, AMHERST

The tonal sandhi systems of the southeastern Chinese Min and Wu dialects display, on the surface, extremely complex alternations of syllable tonal contours, with interaction of these contours with vowel quality changes in certain cases. This paper will discuss one such case, the Northern Min dialect of Fuzhou. First, an analysis for Fuzhou will be constructed, with rules given for deriving changes in vowel quality and tonal contours on the weak syllable of the foot, which syllable shows greatly decreased duration. After this presentation, implications of the analysis will be discussed. At present we do not have a constrained theory of what possible sandhi systems can be for languages such as Fuzhou, which appear to be stress-timed tonal languages. Therefore, a brief sketch will be given which sets out what the particular languages rules are which are needed for this language, and which indicates in what direction research on sandhi systems might go.

The Fuzhou sandhi problem is as follows. In a disyllabic span, consisting either of a compound, or of certain other constructions, such as verb and following noun of certain types, stress falls on the final syllable, which syllable remains basically unchanged in terms of tonal contour and vowel quality from its form in isolation. In the weak first position, syllables of certain tonal classes have a vowel shortening and tonal change, whereas other tone classes, while showing a tone change in weak position, show no vowel alternation.

Various proposals have been put forth to account for these alternations. Chao (1934) first discussed the problem, and he claimed that there was a vowel diphthongization and lowering rule which has certain tones as a conditioning factor. Recent analyses by Maddieson (1976) and Yip (1980) present opposing views on the vowel quality/tone sandhi problem, with Maddieson seeing the vowel changes as purely segmental and unconditioned by tone, and Yip viewing the vowel changes as tonally conditioned, albeit in a reverse direction to that advocated by Chao. One problem with all of these analyses is that the given solution stated informally seems to explain the facts, but when the solution is stated formally, none of the analyses cover all the data, as will be discussed below, in section 2.

Instead of these proposals, this paper will present an account of the alternations based on constraints on the weak member of a stress foot. It will be shown that in weak position all initial tones are deleted, and the first part of a branching nucleus is also deleted. These rules are complicated by the special role that rounding plays in vowel assimilation, and by local tonal rules which are not stress-related, but the generalization is clear: Delete under weak stress.

1. Fuzhou syllable types and stress

Fuzhou syllables can be divided into initial and final constituents, with free co-occurrence between the initial consonants and the remainder of the syllable, here called the final. This division into constituents allows us to focus on the vowel quality problem by referring only to the finals.

Finals in Fuzhou can be classified into three types: a first group of finals which figure in the alternation described above, a second group which is immune to the alternation, and a final group, also immune to the alternation, but requiring a separate treatment from the second group.

The first group of finals is shown in (1).

(1)

A finals	B finals
i	ei
iŋ	eiŋ
u	ou
uŋ	ouŋ
y	øy
yŋ	øyŋ
øy	ɔi
øyŋ	ɔiŋ
ouŋ	auŋ
eiŋ	aiŋ

TONE SANDHI AND VOWEL CHANGES IN FUZHOU

In chart (1) ŋ is an abbreviatory symbol standing for either ŋ or ?. ŋ and ? have co-occurrence restrictions with the various tones, but either may occur with either A or B type syllables, so the abbreviation will be used here.

A word is in order about length of nuclei. Those diphthongs which are in column A are basically short "segmental" diphthongs, with basic quality ^{ø}y, o^{u}, and e^{i}.[1] Those diphthongs in column B are long, basically two segment diphthongs. Now, the term "alternating" finals may be a bit misleading. In strong position, there is a contrast between A and B finals, and either can appear; in weak position only A finals can appear, and B finals change to a corresponding A final in this position. (2) makes this clearer.

(2)

Finals in strong position	Finals in weak position
i	i
ei	i
...	
ouŋ	ouŋ
auŋ	ouŋ

Examples follow in (3).

(3) a. Examples with first syllable B-type

1. $?ei^{12}$ + $ky\varepsilon ŋ^{12}$ $?i^{52}$ $ky\varepsilon ŋ^{12}$
   idea+ perceive = opinion
2. $?eiŋ^{12}$ +$tswɔŋ^{242}$ $?iŋ^{52}$ $tswɔŋ^{242}$
   press+impression = impression
3. kou^{12} + $tswɔ^{12}$ ku^{52} $tswɔ^{12}$
   rent + house (object)
4. $tɔi^{12}$ + pi^{12} $tøy^{52}$ pi^{12}
   facing + compare = contrast
5. $tauŋ^{242}$+ $yü^{22}$ $touŋ^{52}$ $yü^{22}$
   fall + rain = to rain
6. $taiŋ^{242}$+ $naŋ^{12}$ $teiŋ^{52}$ $naŋ^{12}$
   hard + charcoal = coal
7. $k'ai?^{13}$ + $k'ei^{12}$ $k'ei^{52}$ $k'ei^{12}$
   guest + manner = polite

(3) b. <u>Examples with first syllable A-type</u>

1. hi^{44} + ki^{44} hi^{44} ki^{44}
   fly + machine = airplane
2. c'iŋ^{44} + ts'ai^{12} c'iŋ^{52} ts'ai^{12}
   fresh + vegetable = fresh vegetable
3. ku^{52} + tsai^{22} ku^{22} tsai^{22}
   paste + paper (object)
4. tsøy^{52} + puŋ^{52} tsøy^{22} puŋ^{52}
   cut + tailor = tailor
5. pouŋ^{44} + siu^{22} pouŋ^{52} liu^{22}
   help + hand = assistant
6. teiŋ^{44} + pau^{12} teiŋ^{52} pau^{12}
   place ad + newspaper = place ad in newspaper
7. seiʔ^{4} + cieʔ^{13} sei^{2} cieʔ^{13}
   ten + classifier

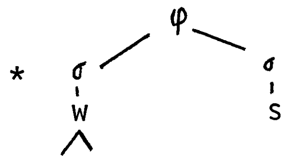
In the first group we see initial syllables with basic B finals which change, in the second group we see initial syllables with basic A finals and no change.

As a first approximation of the Fuzhou syllable template, then, we give the template shown in (4).

(4)
```
              Syllable
             /        \
      Initial          Final
                      /     \
                   Nuc       (coda)
                  /   \         |
               (V)     (V)    { ʔ }
                              { n }
```

In strong position, we can have both branching and non-branching nuclei, whereas in weak position, if the short "segmental" diphthongs are actually a single segment, as I have argued elswhere, (see Wright, 1981, Wright forthcoming), then only non-branching nuclei can occur, i.e., a constraints exists as shown in (5).

(5)



Such a constraint is well-documented for various languages (see Hayes (1980)), although such a constraint is usually posited to exist at the stage of foot formation. However, if Fuzhou constructs w-s feet, regardless of syllable weight, and only then imposes the condition, the branching nuclei in weak position will reduce to non-branching to fit the allowable type.

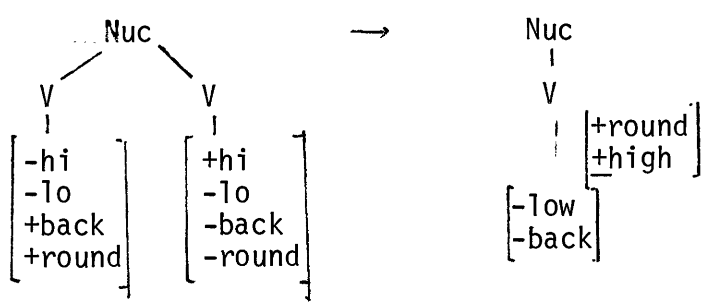
We now need rules to derive the proper vowels under reduction. The alternation of finals shown in (1) can be accounted for by the rules shown in (6) below.

(6) a. <u>Deletion</u>: If the two segments of the nucleus agree on all features but one, delete the first segment.

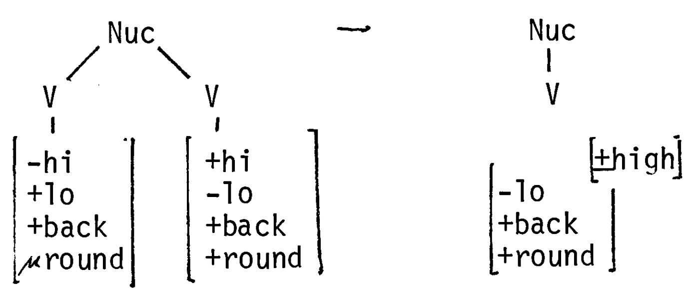
b. <u>Quasi-Deletion</u>: If the two segments of the nucleus differ on more than one feature, a short diphthong will be formed, with distribution of [-hi][+hi] in that order, and [+round] if either segment shows rounding. The other features will be drawn from the second vowel.

(7) shows how this will work for the diphthongs in question.

(7) a. <u>ɔi</u>→<u>øy</u>

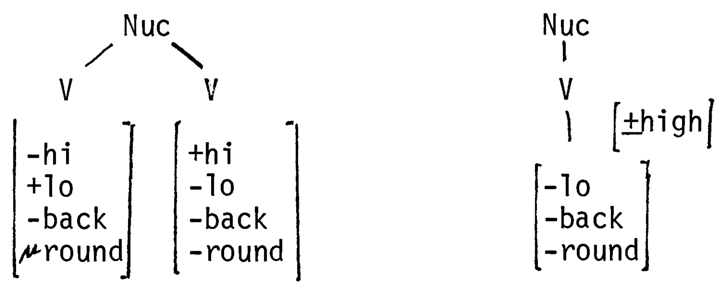


b. <u>au</u>→<u>ou</u>



North East Linguistics Society, Vol. 12 [1982], Iss. 1, Art. 21

(7) c. ai → ei



However, this is only a partial solution to the vowel problem. There also exist finals which appear in any tone class and which show no alternation in weak position. (8) shows the first subset of these.

(8) First subset of non-alternating finals

a	ja	wa	(ŋ = ŋ or ʔ)
an	jaŋ	waŋ	
e	je		
oe	jeŋ		
	jɔ	wɔ	
	jɔŋ	wɔŋ	

These finals can be handled by the syllabic template shown in (4) if we assume that the glide is part of the final. This is not unwarranted. As mentioned previously, initials and finals have free co-occurrence in Fuzhou, but if a w or j glide exists, then at most two other segments can exist, *wain, *wei?. Putting the glide in the first vowel slot of the nucleus leaves at most two other slots available, and no further extension of the template will be necessary to account for the number of segments in the final.

These finals, though showing branching nuclei do not reduce, while the first group of finals do. However, the two groups differ in relative sonority patterning, the B group of ei, ouŋ, etc. showing a s-w sonority pattern, whereas the non-alternating wa, jɔŋ group show a w-s sonority pattern. Kiparsky (1981) proposes an explanation for why onsets in general do not count in prosodic rules referring to syllable quantity. In this framework, syllable quantity rules will look over weak left branches; weak left branches of the onset will not "count" for segment counting. I suggest that we accept Kiparsky's reasoning here for onsets and extend that reasoning to glides in the Fuzhou final. This means that the Fuzhou syllable template must then label the V-V sequence as either w-s or s-w, and the rules in (6) will then require the additional stipulation that they apply to s-w nuclei only.

TONE SANDHI AND VOWEL CHANGES IN FUZHOU

Finally, we are left with the four remaining, non-alternating finals, as shown in (9).

(9) ai (aai)   wai
    au (aau)   wei

Length isn't mentioned in various descriptions of Fuzhou, but there is greatly increased length on the a part of the ai and au diphthongs, in comparison to the diphthongs of ain/auŋ.[2] Therefore, these are treated as long vowels followed by glide.

If we are to keep the syllable template as given in (4), then it is necessary to allow a possible glide in the coda. This is the least distortion of the template; other solutions would involve three slots in the nucleus, which would only occur if there was no coda. A simpler solution is to allow glide codas in addition to consonantal ones.

We now need an explanation for the non-alternating nature of this last group of finals. wai and wei are already exempt from alternating, though, since these are w-s nuclei. aai and aau will in fact "alternate" between long versions in strong position and short versions in weak position. The relative sonority question for long vowels is problematic, but since the revised version of rule (6), with the stipulation applies here, we can either stipulate these nuclei as s-w, an Occam's Razor solution, or better still, since only w-s nuclei don't count as branching, we can suspend labelling on equal segments, a not unnatural thing to do since s-w are relational terms throughout metrical theory, and the rule applying to branching nuclei will therefore apply.

2. Comparison of present analysis to previous analyses

Before turning to the tonal sandhi part of the problem, we will review briefly why this solution is to be preferred to other solutions such as those advocated by Yip (1980), Maddieson (1976), and Chao (1934).

As we can see from examples which were given in (2) above, when syllables are in weak position, they not only undergo vowel changes in the cases described, but they also undergo tonal changes in most cases. So, for example, in (3.a.1), repeated below,

(10) (3.a.1)

ʔei^{12} + kyɛŋ^{12} ʔi^{52} kyɛŋ^{12}
idea + perceive = opinion

ʔei^{12} with a low rising tone becomes high falling in weak position before kyɛŋ^{22}. We can see from all of the examples of syllables which are shown in (3a), that they are low rising or low rising-falling in isolation, but become high falling in all the examples. (A second possibility for these syllables is also high level; an example of this is given in (11)).

(11) twai^{242} + øym^{52} twai^{44} øym^{52}
large + red = bright red

Those syllables in (3b) in weak first position are basically high, either level or high falling, and as shown by the output, have either 44/52 or 22 tones in weak position. These facts were the basis for Yip's analysis which included the notion of "Register", which divided tones into Upper or Lower Register, and correlated the tone and the possible vowel quality. (22 was treated as an Upper Register tone, 242 as a Lower Register tone). However, Yip's solution will not work for the full array of data. Notice that we have five finals with low diphthongs, with only auŋ and aiŋ finals being subject to "raising"; wai, aai and aau are immune. If we were to have a raising rule under the condition Upper Register, as suggested by Yip, we would need to add the additional stipulation that this occurred only with short low vowels not preceded by a glide, and at the same time followed by a consonantal coda, which coda can be either voiced (ŋ) or voiceless (ʔ). While it is known that consonants can affect tones, such a stipulation as that above presents an extremely unusual type of tonal conditioning.

A second problem with Yip's analysis is probably due to an oversight; her actual rule for Raising is written as follows:

(12) $$\begin{bmatrix} \text{V} \\ \text{low} \end{bmatrix} \longrightarrow \begin{bmatrix} -\text{low} \\ \alpha\ \text{high} \end{bmatrix} \ / \ \overline{[+\text{Upper}]}$$

This, unfortunately, would raise all non-high vowels, which is not what happens, in fact.

Maddieson's (1976) analysis also fails on similar grounds. The analysis is briefly as follows. He notes that the apparent "vowel raising" involves only diphthongs, but he treats only the first group, that group involved in what I have called the A/B alternation. He notes that what I have called "Quasi-Deletion" is actually an assimilatory process between two vowels, and the two analyses therefore agree on this point. However, to account for Deletion, he assumes that there is also an assimilation, producing a "sequence of identical vowels". There are two problems with such an approach. The first problem, again, is the lack of coverage of the behavior of wai, wei, aai and aau. The second problem is that he assumes that the ei/i alternation results in a long vowel. However, as part of an experiment described in Wright (forthcoming), I tested duration of finals, and found little difference in duration between basic i/u in weak position and derived i/u also in weak position. (Basic i in weak position is approximately equal to 112 msec; derived i is approximately equal to 136 msec; basic u is approximately equal to 144 msec; derived u approximately equal to 152 msec). If the derived i/u were a sequence of two segments, then the basic i/u, being approximately equal would also be a sequence of two segments, and one would be forced into double segments for all nuclei.

Chao's (1934) analysis, consisting of a sketch for diphthongization and lowering, while providing a better coverage than a raising analysis, also runs into some empirical coverage problems. The analysis is not stated formally, but is basically as follows. For the ei/i type of alternation, he posits the i as basic for all finals, and has a diphthongization rule:

> "...it is common practice to consider the first tone, which goes with [i], [u], [y], as basic, so it is convenient to write these phonemes as [i], [u], [y], in which case a tone mark would suffice to remind one of the addition of [e-], [o-], [ø-], (by no means weak and parasitic), though these elements still have no symbol to themselves except as implied by tone." (Chao (1934): 44)

He also treats the second half of the A/B alternation, along with an alternation which this analysis assumes is lexical, that of a/e in words such as a^{242} 'to be able' versus e^{52} $goung^{22}$ 'able to speak.' He assumes that the e of both e^{52} 'to be able to X' and of eiŋ, the weak form of the final involved in the A/B alternation are basic, and states:

> "...As there are very definite rules for the diphthongization of single vowels (or opening of close vowels), as [e], versus [a]),..." (Chao (1934): 48)

However, there are some empirical problems with the "opening" approach. The a/e or e/a alternation is not a regular change. a in most cases shows no change to e:

(13) dza^{12} 'to explode'
dza^{52} $raŋ^{242}$ 'bomb'

If one were to assume the e to be basic for a^{242} 'to be able', there would still be counter-examples such as de^{24} de^{22} 'finally', derived from de^{22}+de^{22} 'end+end', if one assumes that the 24 tone should be equated with a low-rising 24 finally, one of the tones which a lowering analysis would require as a conditioning environment for the lowering. The few examples which show the e/a or a/e alternation should therefore best be treated as exceptions. The lowering, or opening, rule does account for why aai, aau and wai don't alternate, since they are already low. However, one would expect the close vowels proceeded by glide to alternate, i.e. the je/jeŋ series, and they do not show any alternation. So, in order for the analysis to hold, one still needs reference to part of the syllable structure to account for alternation.

Therefore, any of the analyses suggested thus far for Fuzhou fail on empirical grounds, all being felled by the same problem; all require at least partial specification of the syllable structure in which the vowels involved find themselves. The analysis presented here takes the syllable structure as basic, and derives the change as a result of the impoverished syllable structure possible in weak position in the stress-foot.

3. Tone sandhi

Fuzhou has seven tone categories. The citation contours for these are given in (14), where 1 = lowest pitch, 5 = highest pitch.

(14) Fuzhou citation contours

44	22	12	13
52		242	

Underlining indicates that the syllables of the class in question are closed in isolation by ʔ. In the full array of data, there is some splitting of the tone classes given in (14) as 13 and 22; here I will give a simplified picture.

Representations for citation contours. The first question to be resolved is the number of tone levels within the Fuzhou system. We have a contrast between high and low level tones, i.e., 44 and 4 versus 22, with no contrasting mid level noted, so that it would be desirable to employ a two-level phonological system if possible. The falling 52 could be easily accomodated within such a system; however the 12 and 13 rise only to mid. (These function identically in the sandhi facts to be discussed here, and will therefore be treated as a single class).

Some evidence exists for positing an underlying H final tone on the 12/13 class, however. Directional verbal particles lose their inherent tone in Fuzhou, and their phonetic pitch is parasitic on the tone of the preceding syllable. Those particles following a syllable ending on a low pitch receive a low tone, whereas those following a syllable ending on a H tone or a rising tone receive a H tone, as shown in (15).

(15) p'a^{52} k'ei^{12} li^{52} p'a^{52} k'i^{20} li^{20}
run up come = 'run away (to here)'

tauŋ^{242} lɔʔ^{13} li^{52} taun^{242} lɔʔ^{20} li^{20}
drop fall come = 'drop down'

BUT tai^{12} ts'ou^{12} k'au^{12} tai^{12} ts'ou^{50}k'ɔ^{50}
carry out go = 'carry out'

Let us therefore assume that the rising tones 12/13 have a basic LH representation, with phonetic rules lowering a H after a L when the syllable receives full stress, i.e. is at the end of the sandhi domain or in isolation. That this is not unwarranted may be argued from sentential intonation in which overall declination occurs, especially H after L.[3] Therefore, the analysis assumes H and L as primitives of the system.

One additional factor needs to be taken into consideration in setting up representations for these tone classes. Under stress, final voiced segments are lengthened, with the lengthening applying regardless of the position of the segment in the syllabic template. For example, øy --- øyyy, eiŋ -- eiŋŋŋ, etc. The non-branching finals of tone class 44 will receive this lengthening, whereas syllables of tone class <u>4</u>, also having non-branching finals, will not receive this lengthening, being closed by <u>ʔ</u>. One could designate H as the representation for both tone classes, but exposition of the sandhi changes will show a more illuminating picture if phonetic length of strong syllables is included in the tonal representation. Therefore, we give somewhat hybrid representations for the Fuzhou syllable-tone classes, with HH standing for the 44 tone class and H for the <u>4</u>. Syllables of the <u>13</u> tone class all display branching nuclei, and so they too will be posited as being long for tone representation purposes.

The representations for the entire inventory are then as follows:

(16) <u>Representations for Fuzhou isolation contours</u>

44 = HH
52 = HL
22 = LL
12/13 = LH
242 = LHL
<u>4</u> = H

From now on, we will use these representations with H and L as primitives, rather than numerical ones, although this is not uncontroversial.[4]

Fuzhou weak syllable contours are conditioned by the pitch of the following strong syllable, as the chart in (17) makes clear.

(17) Disyllabic sandhi contours for Fuzhou

2nd syl s / 1st syl w	HH	HL	H	LL	LH	LHL
HH LH LHL		H			HL	
LL		L			LH	
HL		L			L	
H		H			L	

We can examine the chart in (17) and note that before tones which begin on a H pitch, there are two possibilities for tonal contours, H and L. Except for the LHL category, these correlate with the rightmost tone of the isolation representation. The tone on LHL will also correlate if the final L is lost. In the dialect I am describing here, the rule for this L tone loss will have to be written as in (18) to exclude the HL tone from losing final L; other dialects delete L here also.

(18) Low Tone Loss

$$L \longrightarrow \emptyset \ / \ T\ H \ \_\_ \ H$$

Given the deletion in (18), then, for weak syllables before high-pitched syllables, deletion of the first initial tone marker for all classes but single H would yield a single tone marker of the correct pitch to be mapped onto the syllable. Deletion of the single H would leave this syllable toneless, but the Well-Formedness Condition usually assumed in autosegmental frameworks would require that a toneless syllable receive pitch from within the domain. Therefore, a rule of Initial Tone Deletion would yield correct results for all classes before strong high tones. This rule is given in (19).

(19) <u>Initial Tone Loss</u>

T_1 --- $\emptyset$ / $[_{\varphi}$ ___

The contours before L initial tones are more complex. We can see that HL and LL show the same sandhi before H initial tones, but split before L initial tones, with LL showing a LH sandhi. If we order the LH dissimilation rul before Initial Tone Loss, we can write the rule as in (20).

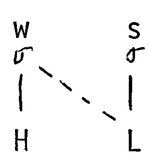
(20) $\emptyset \longrightarrow$ H / LL _ L

Here I am treating rules (18) and (20) as local rules, although the definition of locality is somewhat strained by the use of the double L and the T variable. By "local" here, however, I will mean "not related to the stress-timing" of Fuzhou. Both rules (18) and (20) are familiar in non-stress-reduced Chinese languages, the Cantonese L tone loss being more or less equivalent to (18), and the Mandarin Third Tone dissimilation rule being the most widely discussed of the regularly occurring dissimilation rules of Chinese dialects.

The basic single H which becomes L before L tones requires no special discussion. The single H will delete by rules given so far, and the syllable will then acquire pitch parasitically as previously discussed.

The rule deriving the HL contours for those displaying it will be virtually identical to that presented in Yip (1980); strong low tones are anticipated, and extend their domain onto the weaker syllable, unless blocked by H.

(21)



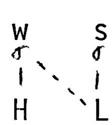
The rules necessary to derive the Fuzhou contours are then those shown in (22), with (a) and (b) ordered before (c).

(22) a. L --- $\emptyset$ / T H ___ H

b. $\emptyset \longrightarrow$ H / LL ___ L

c. T_1 --- $\emptyset$ / [___

d.



North East Linguistics Society, Vol. 12 [1982], Iss. 1, Art. 21

Final Remarks

This analysis of Fuzhou has based rules for vowel alternation and tone sandhi on weakened duration of the first syllable of the stress-foot. Within this weak member, all initial tones and first members of branching nuclei are subject to deletion. The branching nucleus rule is complicated by the special role of rounding, and the rules for heterogeneity of the segment involved. The tone deletion rule is also complicated by two local rules unrelated to the stress pattern.

Much of recent linguistic theory has attempted to base descriptions of particular languages within a universal framework. In this type of approach, each rule of an analysis of a given language must follow either as a universal, which exists across languages, or by a language-specific choice made along a given parameter, for which other languages might make the opposite choice. In constructing the present analysis, a number of language specific stipulations have been given:

(23) Fuzhou language specific stipulations

1. Fuzhou constructs stress feet.
2. These feet are labelled right strong.
3. Weakly stressed syllables reduce in duration.
4. The weakened duration imposes a constraint on possible nuclei of the weak syllables.
5. The weakened duration imposes deletion only of the initial tone marker of the foot, configurationally, it deletes the tone marker furthest from stress.
6. There are local tone rules separate from the stress-induced changes.
7. There is spreading from the strong member of the foot onto the weak member.
8. Strong spreading applies to low tones only.

The possibility of choice (4) or (5) is of course dependent upon the language having chosen (3), and so forth.

If the present approach in linguistic theory is correct, then for each of the independent choices made by Fuzhou, we would expect that we would find the opposite choice being made in a different language. Chinese languages can be divided into whether or not they form branching stress feet over a given domain, or whether the foot is equivalent to the syllable, the Wu and Northern Min dialects being examples of the first type of situation, Southern Min and Cantonese being examples of the second. Furthermore, the labelling can differ; Northern Wu shows left strong, Southern Wu and Northern Min show right strong. Other foot-stress systems differ as to whether local rules are allowed: Shanghai deletes across the board in a weak position with no interference from local rules; Wenzhou, another Wu dialect, allows local rules.

Therefore, the specific claims of this analysis of Fuzhou have implications for a general theory of tone sandhi, and it is presented as a step towards that general theory.

FOOTNOTES

[1]For instrumental evidence that this is so, see Wright (forthcoming).

[2]For additional evidence that these are in fact, long low vowels followed by glide, see Wright (forthcoming).

[3]Lowering is illustrated by sentence (i); lack of lowering by sentence (ii).

(i) i^{44} sei^{242} swɔʔ^{4} cieʔ^{13} ceiŋ^{242} laŋ^{12} i^{22} nøym^{52}
he- is - one-classifier-very - lazy-gen.-person
i^{44} si^{22} swɔ^{2} yeʔ^{13} ciŋ^{52} laŋ^{12} i^{22} nøym^{32}

(ii) i^{44} sei^{242} sye^{22} kɔ^{44} nøym^{52}
he- is - WH - classifier-person
i^{44} si^{22} sye^{22} nɔ^{44} nøym^{52}

[4]The only controversial part of this is the use of LH for the contour of the basic LL before LL, LH and LHL. The contour given by Chen and Norman (1965) is 35, rather than 13, 12. Chen and Norman give 24 for the contour I have given 13, and they then treat the 35 and 24 as members of the same tonal phoneme. This is an entirely plausible solution in light of the overall intonation contour of HL over the sandhi group, and so I simply give LH here for ease of exposition.

REFERENCES

Chao, Y.R. (1934) The non-uniqueness of phonemic solutions of phonetic systems. BIHP, Academia Sinica 4.4: 363-397. Repreinted in Martin Joos (ed.), Readings in Linguistics, I, Chicago: University of Chicago Press, 1957. pp. 38-54.

Chen, L. and J. Norman (1965) An Introduction to the Foochow Dialect. San Francisco State College.

Hayes, B. (1980) A Metrical Theory of Stress Rules, Ph.D. dissertation, MIT.

Kiparsky, P. (1981) Remarks on the Metrical Structure of the Syllable, ms, MIT.

Liberman, M. and A. Prince (1977) On Stress and Linguistic Rhythm. Linguistic Inquiry 8: 249-336.

Maddieson, I. (1976) The intrincis pitch of vowels and tone in Foochow. UCLA Working Papers in Phonetics 33: 191-202.

T'au, Y.M. (1930) Min yin yan jiu. BIHP, Academia Sinica 1.4: 445-470.

Wright, M. (1981) Tone sandhi and vowel quality in Fuzhou - a metrical analysis. Paper circulated at the 14th International Conference on Sino-Tibetan Languages and Linguistics, Gainesville, Florida, October 1981.

Wright, M. (forthcoming) A Metrical Approach to Tone Sandhi in Chinese Dialects, Ph.D. dissertation, UMass.

Yip, M. (1980) The Tonal Phonology of Chinese, Ph.D. dissertation, MIT.