

## Accentualism in Chinese<sup>\*</sup>

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This paper introduces a typology of tone sandhi in Chinese based on two formal properties of sandhi rule: the behavior of the undergoer and the behavior of the trigger. Three major types are proposed. In Type I, the undergoer is confined to its lexical host, and the trigger is active; in Type II, the undergoer spreads beyond its lexical host, and the trigger is not active. Type III contains properties of both: the undergoer is confined to its lexical host, and the trigger is not active. Type I is characteristic of Mandarin, Type II of Wu, and Type III of Min. Based on the typology, I propose an accentual analysis of Wu and Min, and argue that Chinese accentualism is derived from tone. Chinese tone sandhi is not metrical.

Key words: Chinese, tone, accent, stress, tone sandhi typology

In this paper I propose a typology of tone sandhi in Chinese based on two simple considerations: the behavior of the undergoer and the behavior of the trigger. These two factors, when expressed as binary parameters, give a precise characterization of the range of tone sandhi types that have been reported and analyzed in the literature, and allow a clear explication of the distinction between a tonal system and an accentual system in languages where tones must be lexically specified. The paper has 4 sections. In §1 I develop a typology of tone sandhi based on the two factors just mentioned. In §2 I discuss the formal characteristics of each type, and outline an analysis of Chinese accentualism in which accentuation and de-accentuation play a crucial role. In §3 I show that metrical reduction of accentual prominence fails. Section 4 is the conclusion.

### 1. A typology of tone sandhi systems

In the familiar tone sandhi of Beijing Mandarin given below (Chao 1968),

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$$(1) \quad 214 \rightarrow \begin{cases} 35 / \_ 214 \\ 21 / \_ 55, 35, 51 \end{cases}$$

we can identify two sorts of information as integral to the process. First, the lexically-specified tone (214) remains with its host syllable as it undergoes sandhi, and does not spread to neighboring syllables. We may say that the sandhi tone is bound to the host syllable. Second, the sandhi is triggered by adjacent tone. These two properties of the sandhi are part of the structural description of rule (1). However, there is no a priori reason why a lexically specified tone must be bound to its lexical host as it undergoes sandhi, and that tone sandhi must be local, triggered by an adjacent tone. Undoubtedly, the precise specification of these two properties sharpens the formal characteristics of a tone sandhi system. I propose to use these two properties as binary parameters to develop a typology of tone sandhi systems in Chinese. The parameters, [spread] and [trigger], are defined in (2).

- (2) a. [+spread]: sandhi tone is not confined to lexical host.  
       [-spread]: sandhi tone is confined to lexical host.  
       b. [+trigger]: tone sandhi is sensitive to adjacent tone.  
       [-trigger]: tone sandhi is not sensitive to adjacent tone.

The lexical host of a tone is the syllable (or some other tone-bearing unit) with which the tone is associated in the lexicon, or the syllable marked with accent in some accentuation process (see §2.2 below). The parameter [spread] describes two types of behavior of the undergoer in a given sandhi process. In the spreading type, the sandhi tone spreads beyond its lexical host; in the non-spreading type, the sandhi tone stays with the lexical host. It does not change the typological status if the sandhi tone is the target of (local) spreading (see Chaozhou (6c) and Fuzhou (28) below). While [spread] describes the behavior of the undergoer, [trigger] encodes the behavior of the trigger. For a given tone sandhi to be sensitive to an adjacent tone, hence to be triggered by it, the rule or rules must refer to the phonological properties—the register and contour—of the adjacent tone. Rule (1) has precisely this property. A tone sandhi may also be triggered by the historical origin of an adjacent tone, as we shall see shortly. In both cases the presence of a neighboring tone is crucial. In [-trigger] systems, a given tone sandhi takes place in all tonal environments.

The two parameters are heuristic tools we use to help us understand the grammar of tone sandhi. Intuitively, we may divide the grammar of tone sandhi into two parts, the core and the periphery. A complete justification of this division is beyond the scope of

this paper. For our purpose the core, comprising the two parameters, defines the formal character of a tone sandhi system, and the periphery consists of additional rules, such as accentuation and cyclicity, some of which will be discussed in the following pages. Together the core parameters yield a typology of four tone sandhi systems shown in (3).

| (3)      | [spread] | [trigger] | <i>Dialect</i> |
|----------|----------|-----------|----------------|
| Type I   | -        | +         | Mandarin       |
| Type II  | +        | -         | Wu             |
| Type III | -        | -         | Min            |
| Type IV  | +        | +         | ?              |

As it turns out, three of the four types are characteristic of Mandarin, Wu, and Min, three major Chinese dialect groups that have been well studied in the literature. The typology delimits the core properties of the tone sandhi systems. Formal details of tone sandhi vary considerably, and do not cluster in accordance with the boundaries of the dialect groups. But these tend to involve the periphery, not the core. Consider Wu dialects. While they may differ in prominence (right vs. left; see Qian 1992) and cyclicity (cyclic in Danyang vs. noncyclic in Shanghai; see §2.2), sandhi tones nevertheless spread untriggered in all Wu dialects.

Type I is the typical Chinese-style tonal system, where sandhi tones do not spread (i.e., are confined to the lexical host), and the sandhi processes are triggered by adjacent tones. Clearly, rule (1) of Beijing Mandarin is of this type. Type II is the opposite of Type I. In Type II systems, sandhi tones spread (i.e., are not confined to the lexical host), and the spreading processes are not triggered by adjacent tones. In Type III systems, sandhi tones do not spread, and the sandhi processes are not triggered by adjacent tones. Type IV systems are the opposite, where sandhi tones spread, and the spreading processes are triggered by adjacent tones. Broadly speaking, among Chinese dialects, Type I is typical of Mandarin dialects, Type II of Wu dialects, and Type III of Min dialects. I am not able to find a convincing case for Type IV systems, where sandhi tones are not confined to the host syllable, but tone sandhi is triggered by adjacent tones. The following hypothetical sandhi forms belong to this type.

- (4) a.  $T_2 T_1 \sigma \sigma \rightarrow T_2 (T_1 \sigma \sigma)$   
 a'.  $T_3 T_1 \sigma \sigma \rightarrow T_3 T_1 \sigma \sigma$   
 b.  $T_1 T_2 \sigma \sigma \rightarrow (T_1 \sigma \sigma \sigma)$   
 b'.  $T_1 T_3 \sigma \sigma \rightarrow T_1 T_3 \sigma \sigma$

The parentheses mark tone sandhi domains. In (4a, a'),  $T_1$  spreads rightward when

preceded by  $T_2$ , but not when preceded by  $T_3$ . In (4b, b'),  $T_1$  spreads rightward when followed by  $T_2$ , displacing the trigger in the process. It does not spread when followed by  $T_3$ . The strings (4a') and (4b') exhibit different surface sandhi patterns from (4a) and (4b). The absence of Type IV suggests the two logically equivalent entailments:

- (5) a. [+spread]  $\rightarrow$  [-trigger]  
 b. [+trigger]  $\rightarrow$  [-spread]

In other words, spreading sandhi is not triggered, and triggered sandhi does not spread. Exactly why this is the case remains obscure.<sup>1</sup>

The typology displayed in (3), like all typological statements, characterizes the dominant, or core, patterns of tone sandhi. It does not preclude the possibility that peripheral rules attested in one type may play a role in the other types. For convenience I consider Type I systems tonal, Type II systems accentual, and Type III systems mixed, combining properties of the first two systems. In the literature on the typological difference between tone and accent, rule (1) is considered typical in a tonal system, but not in an accentual system, where accent reduction rules and other non-local rules prevail (cf. McCawley 1970, Hyman 1978, Odden 1995). Since lexical tones must be specified for all Chinese dialects, accent-related rules need to be given tonal reinterpretation. In other words, the characteristics of accentuation are dependent upon the lexically specified tones. Rules which manipulate tones and their components can be found in all types, but spreading, excluding the type exemplified in Chaozhou (6c) below, is attested only in Type II systems.

We now proceed to examine the three basic sandhi types.

## 2. Three systems of tone sandhi

### 2.1 The tonal system

Tone rules in tonal systems target register and contour as separate melodic tiers. We find them mainly in the Mandarin family, but in other major dialect families as well. The Wu dialects are notable exceptions, where tone spreading rules prevail. Consider the tone

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<sup>1</sup> We can think of two explanations for this state of affairs. It may be seen as a case of opacity avoidance, as suggested by one anonymous reviewer. If a sandhi tone were to spread, displacing its trigger, the surface pattern would be opaque—the spreading destroys the structural condition that triggers the process in the first place. Alternatively, we can stipulate that tones only spread to untuned syllables, and a tone can serve as trigger only if it is associated with its lexical host. This stipulation is not unreasonable, although it entails a prior de-toning process. However, both explanations leave (4a) unaccounted for.

sandhis shown in (6) and (7).

- (6) a. Jiyuan (He 1981)  
 $53 \rightarrow 31 / \_ 53$
- b. Pinggu (S. Chen 1998)  
 $13 \rightarrow \begin{cases} 35 / \_ 13 \\ 21 / \_ 35, 55, 51 \end{cases}$
- c. Chaozhou (Cai 1991, Bao 1999b)  
 $53 \rightarrow \begin{cases} 35 / \_ 53, 55, 5 \\ 24 / \_ 33, 213, 35, 11, 2 \end{cases}$   
 $213 \rightarrow \begin{cases} 53 / \_ 53, 55, 5 \\ 42 / \_ 33, 213, 35, 11, 2 \end{cases}$
- (7) a. Pingyao (Hou 1980)  
 $35 \rightarrow 53 / \_ 35$   
 $53 \rightarrow 35 / \_ 53$
- b. Pucheng (Norman 1987)  
 $35 \rightarrow 53 / \_ 24, 12$   
 $24 \rightarrow 31 / \_ 24, 12$
- c. Yuanling (Yang 1999)  
 $53 \rightarrow 55 / \_ 53$
- d. Mingshui (Gao 2000)  
 $55 \rightarrow 53 / \_ 55$

These sandhis are typical of systems in which tone spreading is not attested. In Jiyuan (6a), the high fall 53 is lowered to 31 when followed by another 53, making it an obvious example of register dissimilation. The Pinggu sandhi (6b) is also an example of register dissimilation, but here a low rise is raised in front of another low rise. In both sandhis the contour is not affected. (6c) exhibits both register assimilation and contour dissimilation: the high fall 53 becomes a rise, with its register determined by the following tone: high rise if followed by a high tone, low rise if followed by a low tone. The same process affects the low rise 13. In (7), we have sandhi processes that change the contour: fall to rise (7a), rise to fall (7a, b), fall to level (7c), and level to fall (7d). The Pingyao and Pucheng sandhis (7a, b) are especially interesting in that the contour of a tone changes independently of its register. In the Pucheng data, Norman (1987) describes tone 12 as colored by tense glottal quality. This suggests that 12 has the same tonal structure as 24,

i.e., both are rises. The data in (6) and (7) provide crucial empirical motivation for the separation of register and contour in the representation of tone (Yip 1980, 1989, Bao 1990, 1999a, M. Chen 2000).

The sandhis in (6) and (7) can be seen as motivated by the OCP. There are sandhis having no connection to the OCP. They are in fact quite numerous in tonal systems. Three are displayed below.

- (8) a. Beijing Mandarin (part of rule (1))  
        $214 \rightarrow 21 / \_ 55, 35, 51$   
       b. Anqing (Xing 2000)  
        $41 \rightarrow 35 / \_ 11$   
       c. Dunhuang (Liu 1988)  
        $24 \rightarrow 31 / \_ 42$

Regardless of how we interpret the tones, the sequences 213- $\{55, 35, 51\}$  and 41-11 do not constitute a violation of the OCP at any level of representation. Although contour dissimilation of the sort exemplified in (6a, b) and (7a, b) is a dominant process targeting sequences of identical contours (cf. Chang 1992, M. Chen 2000), (8c) does just the opposite: a rise-fall input turns into fall-fall, which is a less optimal output from the perspective of the OCP.

The tone rules which produce the sandhis in (6), (7), and (8) target register and contour as separate and independent units. The rules are enumerated below:

- (9) a. Lowering             $H \rightarrow L$   
       b. Raising            $L \rightarrow H$   
       c. Metathesis         $xy \rightarrow yx$   
       d. Leveling            $xy \rightarrow x$   
       e. Contouring         $x \rightarrow xy, yx$

H and L are register features, and x, y are contour features (cf. Yip 1989, Bao 1990, 1999a, M. Chen 2000). The analysis of the sandhis we have seen will make use of the rules in (9). The mnemonic Leveling and Contouring are deletion and insertion rules. The rules may be triggered to produce assimilatory or dissimilatory tone sandhi effects. In autosegmental phonology, assimilatory raising or lowering can be expressed by the formal mechanism of spreading. In Chaozhou, a Min dialect, the sandhi tone gets its register from the adjacent tone through assimilatory spread (see Bao 1999b and M. Chen 2000 for arguments supporting register spread). This type of spreading does not take the sandhi tone away from its host syllable, so the sandhi is confined to the lexical host. Chaozhou-style tone

sandhi is not triggered by an adjacent tone, and the register-spread originates from the neighboring tone, a sandhi behavior expected from the [-spread, -trigger] Min dialects.

In the cases we have seen, the trigger of tone sandhi is the phonological components of tone, namely, its register, contour, or both. In Dunhuang, a Mandarin dialect, the trigger is the historical category of the tones that still remain in modern Dunhuang, not their phonological properties. Dunhuang has three citation tones, as shown below (all data are cited from Liu 1988).<sup>2</sup>

- (10) a. Ia 24  
       Ib 24  
       b. II 42  
       c. III 44

The Middle Chinese register distinction is lost in modern Dunhuang, but remains important for tone I in tone sandhi. The entire disyllabic sandhi patterns are displayed in (11) through (13).

- (11) a. Ia-I<sub>a</sub> 24-24 → 24-31  
       b. I<sub>a</sub>-Ib 24-24 → 31-24  
       c. Ib-I<sub>a</sub> 24-24 → 24-31  
       d. I-II 24-42 → 31-42  
       e. I-III 24-44 → 31-44  
       (12) a. II-I 42-24 → 42-21  
           b. II-II 42-42 → 31-42  
       (13) a. III-I 44-24 → 44-34  
           b. III-III 44-44 → 4-44

All other disyllabic combinations exhibit no sandhi. I treat 21 in (12a) as a variant of 31, and 34 in (13a) as a variant of 24. The phonetic detail of the Dunhuang sandhi is simple, with 24 and 42 both surfacing as 31, and 44 surfacing as the short tone 4. The rule is given informally below:

<sup>2</sup> The Roman numerals I, II, and III refer to the Middle Chinese (ca. 1000AD) categories of tone, *ping* ‘level’, *shang* ‘rising’, and *qu* ‘entering’, respectively, and the lower-cased *a*, *b* refer to the *yin-yang* registers: *a* to the register associated with voiceless initials (*yin*), and *b* to the register associated with voiced initials (*yang*). The fourth category is the so-called *ru* ‘entering,’ which cooccurs with checked syllables. The Middle Chinese tones have evolved into tone inventories of different sizes in modern Chinese dialects, 3 in Dunhuang, 4 in Beijing, 5 in Shanghai, and 8 in New Chongming.

$$(14) \quad \left. \begin{array}{l} 24, 42 \rightarrow 31 \\ 44 \rightarrow 4 \end{array} \right\} \text{ under Condition C}$$

The crucial analytical step is to determine which tone is singled out for sandhi. From the patterns displayed in (11) through (13), it is clear that Condition C is not the phonological components of the triggering tone. A close inspection of the attested patterns reveals that the undergoer and trigger are selected in accordance with what we might call the sandhi hierarchy:

$$(15) \quad \text{Sandhi Hierarchy} \\ \text{Ia} > \text{Ib} > \text{II, III}$$

In other words, tones Ia, b undergo sandhi if the other tone in the disyllabic compound is either II or III, regardless of position; and Ia undergoes sandhi if the other tone is Ib. In a tie, the second Ia and the first II, III undergo sandhi.

Compared with the more familiar sandhis in Mandarin dialects, the Dunhuang tone sandhi is peculiar in that the phonological properties of tone play no role, and the process is governed purely on the basis of the historical origin of the three remaining citation tones. Although it succeeds in predicting which tone undergoes sandhi, the sandhi hierarchy lacks clear phonological motivation. If we interpret the syllable which retains the lexical tone as accented, i.e., more prominent, the Dunhuang sandhi may be seen as a transitional case of tone-to-accent shift, much like the accentualism of New Chongming, as we shall see in the next section.

## 2.2 The accentual system

In typical accentual systems, there is one tonic syllable per unit of analysis. For McCawley (1970) and Hyman (1978), one crucial difference between a tonal system and a pitch-accent system lies in the number of contrastive patterns: a unit of  $n$  syllables yields  $n$  accent patterns, but  $t^n$  tone patterns, where  $t$  is the number of tones in the language. The formal account of the interaction between tone and accent is not a straightforward one, and the theoretical necessity of accent in tonological analysis has not been universally accepted (see Pulleyblank 1986, Blevins 1993). In the autosegmental literature, the notion “accent” is often invoked to account for tone patterns that cannot be predicted by the Association Conventions (see Leben 1973, Goldsmith 1976). The accented syllable, which anchors the surface tone pattern, is marked by means of a special diacritic (McCawley 1968, 1970, Goldsmith 1976, 1984), or is pre-associated with an



underlying tone (Pulleyblank 1986). Metrical reduction of accent has been attempted in the Africanist literature (Goldsmith 1987, Hyman & Katamba 1993, among others). According to Odden (1995), such attempts have been met with limited success. I shall show in §3 that metrical reduction of Chinese accentual systems is equally problematic.

In all Chinese dialects, tone must be specified on each syllable in the lexical specification of a morpheme. The Wu dialects, as represented in the dialect spoken in Shanghai, exhibit tone patterns resembling those in pitch-accent systems discussed by McCawley (1970) and Hyman (1978). The theoretical question is whether we need to postulate accent, along with tone, in the underlying lexical specification of Chinese, especially Wu Chinese. I argue here that Chinese accentualism is not basic, but derived from underlying tone.

The putative accentual systems in Chinese happen to be those definable in terms of the parametric settings [+spread] and [-trigger]. Tones in such systems are not bound to their lexical hosts, and rules that manipulate them are not triggered by neighboring tones. Of course, these two properties do not make the system that has them accentual. In the systems that M. Chen 2000 identifies as accentual, one syllable is singled out and receives special treatment, which varies from dialect to dialect. If we interpret the singled-out syllable as accent, we can see three ways in which accentualism is tonally expressed. In New Chongming, the accented syllable of a compound surfaces with a high tone, and the other syllables lose their lexical tones and assume the default L. In Shanghai, the accented syllable keeps its lexical tone, which spreads to the neighboring syllable(s), displacing the original lexical tone(s). In Xiamen, the accented syllable keeps its lexical tone, and all the other syllables undergo tone sandhi. In all these cases, accent need not be postulated in the lexical representation of words. It can be determined on the basis of the lexical tones, domain edge, or both. We shall discuss New Chongming, Shanghai and Danyang here. Xiamen, along with the eastern Min dialect of Fuzhou, will be discussed in §2.3.

Unlike the nearby Shanghai, New Chongming has the full complement of Middle Chinese tones shown below (Zhang 1979, 1980, M. Chen 2000:177).

|      |      |    |      |    |
|------|------|----|------|----|
| (16) | Ia   | H  | Ib   | L  |
|      | IIa  | MH | IIb  | LM |
|      | IIIa | HM | IIIb | ML |

For the sake of simplicity I leave out the checked tones, which behave like Ia,b in relevant respects.

The accentualism exhibited in New Chongming trisyllabic compounds is displayed in (17) (H=Ia; E=Ia, b; T, any tone; adapted from M. Chen 2000:235).<sup>3</sup>

- (17) a. H.T.T → \*H.T.T → H.σ.σ  
 b. T.T.E → T.T.\*E → σ.σ.H  
 c. T.T.T → T.\*T.T → σ.H.σ

\* marks accent. The three statements apply in the order given. If the first syllable of a trisyllabic compound is H, the compound surfaces as H.σ.σ, with σ assuming default pitches that need not concern us here. If the last tone is even-contoured (H or L), the compound surfaces as σ.σ.H. Otherwise, the compound surfaces as σ.H.σ. The morphosyntax of the compound does not play a role. Clearly, the trisyllabic compound exhibits culminativity, expressed tonally as H, meeting a crucial condition of an accentual system. Unlike typical accentual systems such as Japanese, where accent must be specified in the lexicon (McCawley 1968, 1970, 1978, Pierrehumbert & Beckman 1988), accent in New Chongming is derived from the lexically-specified tones. In M. Chen's (2000) analysis, accent is first marked on the relevant syllable of a given compound (the first → in (17)), which is then assigned a tonal interpretation (the second →). A strictly tonal analysis is equally plausible, bypassing the accentuation stage altogether.

Details aside, Shanghai exhibits similar derived accentualism, although here the putative accent is assigned to the leftmost syllable of a compound or phrase, and the lexical tone of the accented syllable is realized over the entire compound. Qian (1992) classifies Shanghai as left-prominent, in contrast to the right-prominent southern Wu dialects of Wenzhou (Zhengzhang 1964) and Qingtian (Pan 1988). Shanghai has been studied quite extensively, so its tonology is well understood (Zee & Maddieson 1979, Ballard 1980, Yip 1980, Xu et al. 1981-3, Selkirk & Shen 1990, Qian 1992, Duanmu 1995, 1997, M. Chen 2000, and Z. Chen 2000). Here I shall focus on compounds only. As in New Chongming, the morphosyntax does not play a role in determining the tonal shape of Shanghai compounds. Compounds of the forms in (18) all surface with the same tonal shape, provided that they start with the same lexical tone ([...], morphosyntactic constituency, (...), tone sandhi domain).

<sup>3</sup> The New Chongming Accent Rule is formulated in terms of tone. Since the tones being singled out are Ia and Ib, which are historically *ping* 'level' tones, the Accent Rule can be formulated with reference to this historical phonological information. Historical reference is needed in Danyang and Dunhuang, as we shall see shortly.

- (18) a.  $[\sigma_1 [\sigma_2 \sigma_3]] \rightarrow (\sigma_1.0.0)$   
 $[\sigma_1 [\sigma_2 [\sigma_3 \sigma_4]]] \rightarrow (\sigma_1.0.0.0)$   
 b.  $[[\sigma_1 \sigma_2] \sigma_3] \rightarrow (\sigma_1.0.0)$   
 $[[[\sigma_1 \sigma_2] \sigma_3] \sigma_4] \rightarrow (\sigma_1.0.0.0)$

Here, the lexical tone of  $\sigma_1$  is retained, and the rest of the syllables lose their lexical tones, denoted by “o”, and assume default tones predictable on the basis of the retained tone.

An accentual analysis of these sandhi facts may start by placing accent on the first syllable. The accented syllable keeps its lexical tone, and all other syllables lose theirs. In an end-based account, accent placement may be done by setting the parameter {Left, Lex<sup>max</sup>} (Selkirk and Shen 1990), or by alignment statements in OT that demand alignment of accent with the leftmost syllable of a compound, as M. Chen (2000) has done for New Chongming. In a metrical account, accent corresponds to the metrically prominent position within the compound. For the metrical account to be nontrivial, the foot must meet a binarity requirement, at least in the initial construction of metrical structure, prior to re-footing or de-footing that takes place under specifiable conditions, such as clash avoidance. I return to the metrical analysis in §3.

In Shanghai, and indeed in other Wu dialects, morphosyntactic structure does not play a role in the tonology of compounds. This stands in sharp contrast to Mandarin dialects such as Beijing, where sandhi rules apply cyclically (Shih 1986, M. Chen 2000). In the northern Wu dialect of Danyang, which borders the Mandarin-speaking region to the north, cyclicity interacts with the typically noncyclic Wu accentualism to produce intricate and complex tone sandhi patterns, to which we now turn. The tonology of Danyang compounds has attracted keen interest (see, among others, Yip 1989, Chan 1991, Zhang 1992, and M. Chen 2000). These works are all based on the detailed description and analysis of Lü (1980). In addition to the surface lexical tones, Danyang has six word melodies that must be specified independently of the lexical tones. The word melodies are shown in (19) (Lü 1980:88).

| (19) | basic | disyllabic | trisyllabic | tetrasyllabic |
|------|-------|------------|-------------|---------------|
| a.   | 55    | 55-55      | 55-55-55    | 55-55-55-55   |
| b.   | 33    | 33-33      | 33-33-33    | 33-33-33-33   |
| c.   | 11    | 11-11      | 11-11-11    | 11-11-11-11   |
| d.   | 42-   | 42-11      | 42-11-11    | 42-11-11-11   |
| e.   | 24-   | 24-55      | 24-55-55    | 24-55-55-55   |
| f.   | 24    | 42-24      | 42-42-24    | 42-42-42-24   |

The initial syllable of a polysyllabic compound selects the basic word melody, which is

then realized over the unaccented portion of the compound, subject to conditions to be discussed shortly. The tri- and tetrasyllabic patterns are derived from the basic word melodies through the rightward spread of ‘whole’ tones, except 24- and 42- (19d, e), where only the end pitch spreads. Lü (1980) remarks that Danyang avoids the tone sequence 24-24, and turns it into 42-24 by metathesis. Iterative application of metathesis yields the trisyllabic 42-42-24 and tetrasyllabic 42-42-42-24 in (19f). Note that the polysyllabic string need not be a syntactic constituent, as we shall see shortly.

Two observations made by Lü (1980) are especially important for us. First, phonetically, the first syllable of a right-branching compound and the last syllable of a left-branching compound are louder and longer. This is illustrated on trisyllabic compounds in (20).<sup>4</sup>

- (20) a.  $[\underline{\sigma}[\sigma\sigma]] \rightarrow (\underline{\sigma}\sigma\sigma)$   
 b.  $[[\sigma\sigma]\underline{\sigma}] \rightarrow (\sigma\sigma)(\underline{\sigma})$

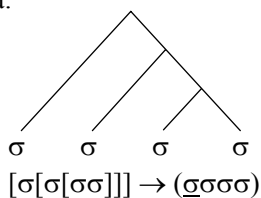
Tentatively we use the parentheses to delimit the domain of tone sandhi, which, in the case of Danyang, constitutes the extent of tone spread. Compounds of the form (20a) are treated as single domains, and those of the form (20b) as two separate domains, with the last syllable keeping its lexical tone. In terms of tonal realization, form (20a) surfaces with one of the trisyllabic word melodies in (19), and the disyllabic constituent of form (20b) surfaces in one of the disyllabic word melodies, with the final syllable retaining its lexical tone. *Prima facie*, this appears to support the metrical analysis, according to which feet are assigned cyclically, and the single foot of (20a) is due to clash avoidance. We shall show shortly that (20) can be given a rule-based accentual interpretation.

Second, among tetrasyllabic compounds, a typical 3-1 compound preserves the tone pattern of its trisyllabic component, but a typical 1-3 compound does not. This is consistent with the sandhi behavior of trisyllabic compounds displayed in (20), in which the disyllable preserves its pattern in 2-1 compounds, but not in 1-2 compounds. In the metrical account, this is the empirical basis of the directional asymmetry of clash avoidance (M. Chen 2000:334). A typical 2-2 compound inherits its two disyllabic tone patterns. Flat tetrasyllabic compounds of the form 1-1-1-1 are few in number, and behave like 1-3 compounds.

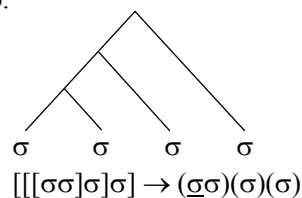
The robust tetrasyllabic compounds are summarized in (21).

<sup>4</sup> According to Lü (1980:87), disyllabic N-N or A-N compounds tend to undergo tone sandhi  $(\sigma\sigma)$ , but disyllabic V-O or S-V compounds tend to keep the lexical tones  $(\sigma)(\sigma)$ . Phonetically,  $(\sigma\sigma)$  is ‘heavy-light’. The two syllables of  $(\sigma)(\sigma)$  are either equal, or light-heavy. This is consistent with his observation about prominence concerning longer compounds.

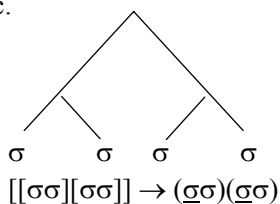
(21) a.



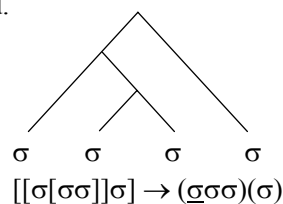
b.



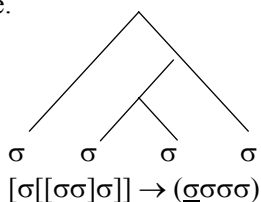
c.



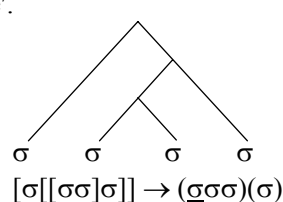
d.



e.



e'.



The last syllable of (21d, e') and the last two syllables of (21b) retain their lexical tones. The underlined syllable helps select the word melody from among the inventory (19). While the sandhi domains are mostly syntactic constituents, this is not the case in (21e').

An accentual analysis of the Danyang compound tonology, summarized in (19), (20), and (21), consists of the following steps:

(22) a. Accentuate

 Place accent on the syllable  $\sigma$ 

- i. if  $\sigma$  c-commands (but is not c-commanded by) other syllables
- ii. if  $\sigma$  is the leftmost syllable

b. De-accentuate

 Given  $\dots\alpha'\dots\alpha\dots$ , and  $\alpha'$  c-commands  $\alpha$ , remove  $\alpha$ 

- i. obligatorily if  $\alpha'$  and  $\alpha$  are adjacent.
- ii. optionally if  $\alpha'$  and  $\alpha$  are not adjacent.

c. Select word melody

d. Spread/Metathesis

Accentual prominence is encoded hierarchically in (22a-i). (22a-ii) is needed for disyllables and flat polysyllables. De-accentuate is both hierarchical and linear—it removes accent only when it follows a c-commanding accent. This accounts for the difference between right-branching and left-branching compound; see (23a, b) below. De-accentuate encodes the intuition that, given two accents, the one which is dominated hierarchically is also weaker accentually, and the weaker accent deletes. Note that since metrical prominence is local, accentual prominence is equally local. This is reflected in the obligatory de-accentuation between two adjacent accents, and the optional de-accentuation when the two accents are spaced by one or more syllables. The tone of the selected word melody spreads rightward to de-accented and hence de-toned syllables, in accordance with the normal conventions governing associations and spreading. Metathesis is required to turn 24 into 42 after tone copying (19f).

Both Accent and De-accent apply cyclically. The derivation of the patterns in (21) is as follows (the affected syllable has been italicized):

|           |      |                                  |     |                                  |             |
|-----------|------|----------------------------------|-----|----------------------------------|-------------|
| (23)      | a.   | $[\sigma[\sigma[\sigma]]]$       | b.  | $[[[\sigma\sigma]\sigma]\sigma]$ |             |
| Accent    | i.   | $[\sigma[\sigma[\sigma]]]$       |     | $[[[\sigma\sigma]\sigma]\sigma]$ | by (22a-ii) |
|           | ii.  | $[\sigma[\sigma[\sigma]]]$       |     | $[[[\sigma\sigma]\sigma]\sigma]$ | by (22a-i)  |
|           | iii. | $[\sigma[\sigma[\sigma]]]$       |     | $[[[\sigma\sigma]\sigma]\sigma]$ | by (22a-i)  |
| De-accent | i.   | $[\sigma[\sigma[\sigma]]]$       |     | -                                | by (22b-i)  |
|           | ii.  | $[\sigma[\sigma[\sigma]]]$       |     | -                                | by (22b-i)  |
|           |      | $(\sigma\sigma\sigma)$           |     | $(\sigma\sigma)(\sigma)(\sigma)$ |             |
|           | c.   | $[[\sigma\sigma][\sigma\sigma]]$ | d.  | $[[\sigma[\sigma\sigma]]\sigma]$ |             |
| Accent    | i.   | $[[\sigma\sigma][\sigma\sigma]]$ |     | $[[\sigma[\sigma\sigma]]\sigma]$ | by (22a-ii) |
|           | ii.  | -                                |     | $[[\sigma[\sigma\sigma]]\sigma]$ | by (22a-i)  |
|           | iii. | -                                |     | $[[\sigma[\sigma\sigma]]\sigma]$ | by (22a-i)  |
| De-accent |      | -                                |     | $[[\sigma[\sigma\sigma]]\sigma]$ | by (22b-i)  |
|           |      | $(\sigma\sigma)(\sigma\sigma)$   |     | $(\sigma\sigma\sigma)(\sigma)$   |             |
|           | e.   | $[\sigma[[\sigma\sigma]\sigma]]$ | e'. | $[\sigma[[\sigma\sigma]\sigma]]$ |             |
| Accent    | i.   | $[\sigma[[\sigma\sigma]\sigma]]$ |     | $[\sigma[[\sigma\sigma]\sigma]]$ | by (22a-ii) |
|           | ii.  | $[\sigma[[\sigma\sigma]\sigma]]$ |     | $[\sigma[[\sigma\sigma]\sigma]]$ | by (22a-i)  |
|           | iii. | $[\sigma[[\sigma\sigma]\sigma]]$ |     | $[\sigma[[\sigma\sigma]\sigma]]$ | by (22a-i)  |
| De-accent | i.   | $[\sigma[[\sigma\sigma]\sigma]]$ |     | $[\sigma[[\sigma\sigma]\sigma]]$ | by (22b-i)  |
|           | ii.  | $[\sigma[[\sigma\sigma]\sigma]]$ |     | -                                | by (22b-ii) |
|           |      | $(\sigma\sigma\sigma)$           |     | $(\sigma\sigma\sigma)(\sigma)$   |             |

(23a) is exclusively right-branching, and (23b) exclusively left-branching. The difference in sandhi domain is due to de-accentuation, which leaves less prominent accents alone if

the c-commanding accent appears to the right. In (23c), neither syllable in the two disyllabic constituents c-commands the other, so De-accentuate fails to apply. The trisyllabic constituent in (23d) maintains its own domain after de-accentuation, as expected. In (23e, e'), the second accent is obligatorily removed because it abuts the c-commanding initial accent; the final syllable is de-accented in (23e), but not in (23e'). Due to the optionality of (22b-ii), compounds of this form may merge with exclusively right-branching compounds (23a, e), or with 3-1 compounds (23d, e').

Compared with the accentualism of Shanghai and New Chongming, Danyang's accentualism is unique in two respects. First, culminativity is syntactically determined—the c-commander is the most prominent syllable, an expected result when accentuation is constrained hierarchically. Note that when morphosyntactic hierarchy is not relevant, as is the case in disyllables or flat polysyllables, accent falls on the left-most syllable (22a-ii), betraying Danyang's Wu pedigree. Second, the tonal shape of the compound is not related phonetically to any of the component tones. Nevertheless, Danyang accentualism is derivative. There is no need to postulate underlying accent in the dialect.

As we have seen, in [+spread] and [-trigger] systems (Type II), the accented syllable of a compound keeps its lexical tone (as in Shanghai, and Danyang left-branching compounds), or otherwise selects the tone melody for the compound from an independent inventory of tone melodies (as in Danyang), or surfaces with a high tone regardless of the underlying lexical tone (as in New Chongming). All other syllables in the compound lose their lexical tones—the tonal consequence of accent reduction rules of McCawley (1970). The de-toned syllables are re-toned in three ways: by the rightward spread of the accented tone or its components (Shanghai, Danyang (19a-e)), by tone copying (Danyang (19f)), or by default insertion (New Chongming, Shanghai). These rules are abundantly attested in accentual systems of African languages, see Hyman and Schuh (1974).

These properties of Chinese accentualism can be easily accommodated in an analysis consisting of three blocks of rules, namely, accent-related rules (Danyang accentuation and de-accentuation rules, cf. (22a)), dialect-specific stipulations (Select word melody, cf. (22b)), and universal tone rules, including association conventions and rules (9) (Spread/Metathesis, cf. (22c)).

### 2.3 The mixed system

For mixed systems, we turn to the southern Min dialect of Xiamen and the eastern Min dialect of Fuzhou, which have been studied extensively in the literature. The two dialects are [-spread, -trigger] and right-prominent, but differ in details of tone sandhi. In Xiamen, culminativity is marked on the last syllable of a polysyllabic compound, or other

phrases delimited by the following parameter setting (Chen 1987).

- (24) {Right,  $X^{\max}$ },  $X^{\max}$  not an adjunct.

Other analyses of Xiamen tonology have been put forth (Lin 1994, Duanmu 1995, Bao 1996), the details of which need not concern us here. The accented syllable retains its lexical tone; all other syllables undergo sandhi in accordance with the so-called Min Circle, which expands into five separate sandhis in (26):

- (25) 24 → 22 → 21 → 53 → 44 → 22  
 (26) a. 24 → 22  
       b. 22 → 21  
       c. 21 → 53  
       d. 53 → 44  
       e. 44 → 22

Formally, the sandhis in (26) resemble those found in other [-spread] systems, without the triggering tonal environment. It is not surprising that they motivate the set of rules shown in (9): (26a, d) are subject to Leveling, (26b) to Contouring, (26c) to Raising, and (26e) to Lowering. The tones are confined to their lexical host, and do not affect, or be affected by, neighboring tones.

Compared with the Xiamen Min Circle, Fuzhou's tone sandhi patterns are much simpler. Fuzhou has seven citation tones, shown below:<sup>5</sup>

- (27) Ia    55            Ib    52  
       II    22  
       IIIa 12            IIIb 342

The Middle Chinese *yin/yang* register distinction is lost for tone II in modern Fuzhou. In disyllabic combinations, the last syllable retains its lexical tone. We conclude that the dialect, like Xiamen, is right-prominent. The initial tone exhibits sandhi, which is summarized below:

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<sup>5</sup> The two checked tones exhibit the same sandhi behavior as their non-checked counterparts. For this reason I do not include them in the discussion. The literature on Fuzhou includes Tao (1930), Chen & Norman (1965), Wright (1983), Li et al. (1979), Yip (1980), Chan (1985), Yuan et al. (1989), and Z. Chen (1998). There are inconsequential differences in tonal transcription among the published sources; here I follow Chan (1985). Chan draws data from Chen & Norman (1965), which I was not able to consult.



|           |     |     |                |
|-----------|-----|-----|----------------|
| (28)      | -Ia | -Ib | -II, -III      |
|           | -55 | -52 | -22, -12, -342 |
| Ia-, III- | 55- | 55- | 52-            |
| II-       | 22- | 22- | 35-            |
| Ib-       | 55- | 22- | 22-            |

In terms of pitch register, tones Ia, b are high, and II and IIIa, b low.

In trisyllabic compounds, the last two syllables follow the disyllabic patterns regardless of whether they form a morphosyntactic constituent, and the first syllable surfaces with 22. The sandhi is summarized below (Li et al. 1979, Chan 1985):

$$(29) \quad \sigma \sigma \sigma \rightarrow 22 \sigma\text{-}\sigma$$

where  $\sigma\text{-}\sigma$  surfaces with one of the patterns displayed in (28). The sandhi is more complicated if the penultimate syllable has the lexical tone Ib. We shall not be concerned with the idiosyncratic complication.

The patterns presented in (28) and (29) have been analyzed in the literature, which I shall not review here (see footnote 5). Suffice it to say that all attempt to derive the sandhi tones from their lexical tone source by means of rules drawn from the list in (9). Here I shall interpret the so-called sandhi tones 55 (52) and 22 (35) as default tones arising from lack of accentuation. The accentual analysis of Fuzhou runs like this. Like Xiamen, the final syllable is accented, and the unaccented syllables undergo sandhi. The sandhi, however, is not due to spreading, as is the case in the Wu dialect of Shanghai. It is due to default tone assignment. We need two default tone assignment rules for the disyllables, and one for the trisyllables. These are shown informally in (30).

- (30) a.  $\sigma \rightarrow 22 / \_ \sigma \sigma]$   
 b.  $Ia, III \rightarrow 55 / \_ \sigma]$   
 c.  $Ib, II \rightarrow 22 / \_ \sigma]$

Rule (30a) has no exception. Additional derivational steps are needed to account for the “exceptional” 52-, 35- and 55- in (28). Clearly, 52- and 35- are due to the influence of the adjacent low-registered tones—the leftward spread of L to derive 52 and the insertion of H between two Ls in the case of 35. They are therefore allotones of 55 and 22, respectively. 55- is idiosyncratic. Note that the untriggered non-spreading sandhi (30) is dominant in the Fuzhou sandhi system, despite the need for additional peripheral rules that are context-sensitive. Compared with Xiamen, where each lexical tone is paired with an independent sandhi tone (cf. (26), the Fuzhou default tone assignment is much simpler,

prompting some scholars to suggest that Fuzhou is evolving into an accent system (cf. Shih 1986).

As we have seen, Chinese accentualism often exhibits boundary effect. In Xiamen and Fuzhou, accent invariably falls on the last syllable; in Shanghai, it falls on the first syllable. In both systems the accented syllable retains its lexical tone. The retention of lexical tone is often associated with prosodic prominence of some sort, which we interpret here as accent.

## 2.4 Summary

The typology of Chinese tone sandhi is summarized below:

- (31) Tonal systems (e.g., Mandarin)
  - a. Rule typically triggered by adjacent tone.
  - b. Sandhi confined to lexical host.
- Accentual systems (e.g., Wu)
  - c. Accented syllable keeps lexical tone, or selects tone melody.
  - d. Unaccented syllable loses lexical tone.
  - e. Tone spreads, subject to constraint.
  - f. Default tone assignment.
- Mixed systems (e.g., Min)
  - g. Accented syllable keeps lexical tone.
  - h. Rule targets unaccented tone; not triggered by adjacent tone.
  - i. Sandhi confined to lexical host.
  - j. Default tone assignment.

Since tones must be lexically specified, the rules which manipulate tonal components, as displayed in (9), remain active in all systems. Spreading to de-toned syllables is robust in accentual systems only. The typology of tone sandhi in Chinese parallels the long-held distinction between tone and accent (see Odden 1995 for a summary). In Chinese, as we have seen, tone is basic, and accent derivative.

## 3. Chinese tone sandhi is not metrical

Many generative studies of Chinese tone have argued that tone sandhi domains are metrical domains (Wright 1983, Chan 1985, Shih 1986, Ao 1993, Yip 1995, Duanmu 1995, 1997, and M. Chen 2000). The notion of the metrical foot in most studies has been varied, ranging from toned monosyllables to polysyllabic compounds or phrases (see

especially Ao's (1993) analysis of Nantong). The variable size of the foot deprives the metrical analysis of any explanatory force. Although the so-called unbounded foot is allowed in some parametric metrical theories, notably Halle & Vergnaud (1987), Halle & Idsardi (1995), I shall adopt a stricter notion of the metrical foot, along the lines of McCarthy & Prince (1986/1996), Kager (1993), Burzio (1994), and Hayes (1995), where the size of the foot is capped at no more than two syllables or moras. Besides foot binarity, another property of typical metrical systems is what Hayes (1995) calls iterativity, by which a string of syllables is parsed into a string of binary feet:

$$(32) \quad \sigma\sigma\sigma\sigma\sigma\sigma \rightarrow (\sigma\sigma)(\sigma\sigma)(\sigma\sigma)$$

The feet may be trochaic (right-headed) or iambic (left-headed) for a given metrical system. By contrast, in a tonal or accentual system, the string in (32) is parsed differently (McCawley 1970, Hyman 1978):

$$(33) \quad \begin{array}{ll} \text{a.} & \sigma\sigma\sigma\sigma\sigma\sigma \rightarrow (\sigma)(\sigma)(\sigma)(\sigma)(\sigma)(\sigma) \\ \text{b.} & \sigma\sigma\sigma\sigma\sigma\sigma \rightarrow (\sigma\sigma\sigma\sigma\sigma\sigma) \end{array}$$

It is the unit of counting that is relevant here: it is the syllable in tonal systems, the foot in metrical systems, and the accentual unit in accentual systems. Although these differences are treated as parametrically derivable in theories such as Halle & Vergnaud (1987), I shall stay with the narrow definition of the notion "metrical analysis" here.

Binarity and iterativity are instantiated in classical Chinese poetry. In the so-called regulated poetry, tonal oppositions within the line exhibit precisely these two properties (Wang 1957, Chen 1979):

$$(34) \quad (oo)(xx)(oo)\sigma$$

where o and x must be tonally contrastive, and  $\sigma$  is subject to rhyming constraint. But tone sandhi is a different matter. With binarity, iterativity, and other common metrical notions, especially clash avoidance, as diagnostic aids, I shall examine the metrical analyses of Chinese that have been proposed and show that they do not stand. I shall focus on Shanghai and Danyang compounds.

M. Chen (2000) is the most recent proponent of a metrical analysis of Shanghai and Danyang, two Wu dialects, which we have seen in §2.2. We consider Shanghai first. At the core of the metrical analysis of Shanghai compound tonology is the parametric settings (35), expressed within the metrical theory of Halle & Vergnaud (1987) (M. Chen 2000:307, Duanmu 1995, 1997):

- (35) a. Morpheme level:  
           Line 0: trochee, left to right, ignore degenerate foot  
           Line 1: left-headed, unbounded stress  
       b. Word/compound level: Assign cyclic left-headed stress  
       c. Phrasal level: Assign cyclic right-headed stress  
       d. Stress Reduction: Optionally delete Line 1 stress  
       e. Clash Resolution: Remove the stress column next to a higher column

For compounds, two properties are especially important: cyclicity (35b) and clash avoidance (35e). The parametric settings in (35) correctly predict the sandhi pattern of right-branching Shanghai compounds, two of which are exemplified below (Duanmu 1997):

- (36) a.  $[(\underline{\sigma})(\underline{\sigma\sigma})] \rightarrow (\underline{\sigma\sigma\sigma})$   
       b.  $[(\underline{\sigma})[(\underline{\sigma})(\underline{\sigma\sigma})]] \rightarrow (\underline{\sigma})[(\underline{\sigma\sigma\sigma})] \rightarrow (\underline{\sigma\sigma\sigma\sigma})$

In (36), feet are assigned cyclically and merged, also cyclically, when stress clash configurations are produced. This analysis, however, does not extend to compounds with different morphosyntactic structures. In the detailed study of Xu et al. (1981-3), all compounds exhibit a single sandhi domain regardless of internal morphosyntactic structure. The compounds in (37) all sport one single tone sandhi domain:

- (37) a.  $[[(\underline{\sigma\sigma})(\underline{\sigma})] \rightarrow (\underline{\sigma\sigma\sigma})$   
       b.  $[[[(\underline{\sigma\sigma})(\underline{\sigma})](\underline{\sigma})] \rightarrow (\underline{\sigma\sigma\sigma\sigma})$   
       c.  $[[(\underline{\sigma\sigma})][(\underline{\sigma\sigma})] \rightarrow (\underline{\sigma\sigma\sigma\sigma})$

(37a, b) are left-branching compounds, where there is no clash-related pressure to merge feet. From the metrical point of view, (37c) is the optimal compound, since its putative metrical structure matches exactly the morphosyntactic structure. The fact that such compounds are parsed as single domains indicates that iterativity is not supported in Shanghai either. If we take the entire corpus of compounds into consideration, which any credible analysis must, cyclicity, iterativity, and clash resolution play no role in Shanghai compound tonology.<sup>6</sup>

<sup>6</sup> Duanmu (1995, 1997) and M. Chen (2000) consider foot merger in (37) as optional, in contrast to the obligatory merger in (36), citing the intuitive judgment of a few native speakers. This move is ad hoc, and unsupported by data analyzed in published studies (Zee & Maddieson 1979, Xu et al. 1981-3). See also Bao (2003) for a critical evaluation of the arguments in favor of a metrical analysis of tone sandhi phenomena.

The metrical analysis of Danyang fares no better. Here I shall give a brief sketch of the problems. Recall that the morphosyntax of Danyang compounds plays a crucial role in fixing the tonal shape of compounds (cf. (20) and (21)). Here we shall consider tetrasyllabic compounds. These are shown in (38) (M. Chen 2000:322-333).

- (38) a.  $(\underline{\sigma})[(\underline{\sigma})[(\underline{\sigma}\sigma)]] \rightarrow (\underline{\sigma})[(\underline{\sigma}\sigma\sigma)] \rightarrow (\underline{\sigma}\sigma\sigma\sigma)$   
 b.  $(\underline{\sigma})[[(\underline{\sigma}\sigma)](\underline{\sigma})] \rightarrow (\underline{\sigma}[\sigma\sigma](\underline{\sigma})) \Rightarrow (\underline{\sigma}\sigma\sigma\sigma)$   
 c.  $[(\underline{\sigma})[(\underline{\sigma}\sigma)]](\underline{\sigma}) \rightarrow [(\underline{\sigma}\sigma\sigma)](\underline{\sigma}) \rightarrow (\underline{\sigma}\sigma\sigma)(\underline{\sigma})$   
 d.  $[[(\underline{\sigma}\sigma)](\underline{\sigma})](\underline{\sigma}) \rightarrow [(\underline{\sigma}\sigma)(\underline{\sigma})](\underline{\sigma}) \rightarrow (\underline{\sigma}\sigma)(\underline{\sigma})(\underline{\sigma})$

The step marked by  $\Rightarrow$  is optional. For (38a, c), cyclic clash-induced foot merger correctly predicts the tone patterns. For (38b), cyclicity breaks down in the step marked by  $\rightarrow$ : the clashing feet do not belong to the same morphosyntactic constituent. In fact, left-to-right noncyclic clash resolution for (38a) would produce  $(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)$ , the rhythmic structure that meets the test of iterativity, as would be expected in truly metrical systems (cf. English (*òno*)(*màto*)(*poéia*)). In (38d), clash is tolerated between the third and fourth syllables, which M. Chen (2000) attempts to explain away in terms of directional asymmetry. What we can conclude from the forms in (38) is that clash resolution is cyclic in some compounds but noncyclic in others, and that it is obligatory in some compounds, but optional in others. The putative metrical effects are ad hoc.

Furthermore, the metrical analysis fails to predict the prominent syllable within a compound. As we have seen in §2.2, prominence falls on the leftmost syllable of a right-branching compound and on the rightmost syllable of a left-branching compound. In both cases it is the c-commanding syllable that is the most prominent. Hierarchical prominence proves difficult for any metrical analysis making use of linearly uniform footing. Cyclic footing places prominence on the leftmost syllable (or foot) of a compound (cf. (35b)), regardless of its morphosyntactic structure. (38a, c) have the structure shown below:

- (39) a. 
$$\begin{array}{lcl} x & & x \\ (x & x) & x \\ x & (x & x) \\ (x) & (x) & (x & x) \\ \sigma & [ & \sigma & [ & \sigma & \sigma ] ] \end{array} \rightarrow \begin{array}{lcl} & & x \\ & & x \\ & & x \\ (x & x & x & x) \end{array}$$
  
 b. 
$$\begin{array}{lcl} x & & x \\ (x & & x) & & x \\ (x & x) & & x \\ (x) & (x & x) & (x) \\ [ & \sigma & [ & \sigma & \sigma ] ] & \sigma \end{array} \rightarrow \begin{array}{lcl} & & x \\ & & x \\ & & x \\ (x & x & x) & (x) \end{array}$$

Structure (39b) makes the wrong prediction. In left-branching compounds, the final syllable, which is in the c-commanding position, is the most prominent. Incidentally, clash resolution in (39b) results in stress lapse, which, *prima facie*, needs to be avoided just as much as stress clash (Kager 1993, Hayes 1995). There is no tonal reflex of stress lapse in any of the metrical accounts of Chinese with which I am familiar.

#### 4. Conclusion

In the preceding pages I have shown that Chinese dialects can be classified into three distinct types, which are conveniently labeled as tonal, accentual, and mixed. The tone-accent distinction is not unique to Chinese, and in fact has been argued for in other tone languages. Of the three types, the tonal system is the familiar tone sandhi system most commonly associated with Chinese. Chinese accentualism is dependent upon tone, which must be specified in the lexicon. The tonal accentualism has three distinct types. The first type includes New Chongming, where the accented syllable, assigned on the basis of the lexical tone, acquires the invariable high tone. This is similar to the accentualism of African languages that have been studied (Hyman & Schuh 1974, Pulleyblank 1986, Odden 1995). Shanghai is the second type. In Shanghai, the accent invariable falls on the initial syllable of a compound, which retains its lexical tone. Spreading and other rules, default rules included, apply to derive the tonal contour. The compound-internal morphosyntax plays no role. The third type is Danyang, where accentuation and de-accentuation are both hierarchically determined, and the ultimate tonal contour of a compound is drawn from an independent inventory of basic word melodies. We have shown that Chinese accentual prominence is irreducible to metrical prominence.

The mixed system contains properties of both the tonal and accentual systems. In mixed systems, accent is marked on the edge (the right edge in Xiamen), which retains its lexical tone, and the unaccented syllables undergo tone sandhi. As in tonal systems, the tone sandhis are confined to the host syllables.

## References

- Ao, Benjamin X. 1993. *Phonetics and Phonology of Nantong Chinese*. Columbus: Ohio State University dissertation.
- Ballard, William L. 1980. On some aspects of Wu tone sandhi. *Journal of Asian and African Studies* 19:83-163.
- Bao, Zhiming. 1990. *On the Nature of Tone*. Cambridge: MIT dissertation.
- Bao, Zhiming. 1996. Local tree geometry and the syntax-phonology interface. *Interfaces in Phonology*, ed. by Ursula Kleinhenz, 27-45. *Studia Grammatica* 41. Berlin: Akademie Verlag.
- Bao, Zhiming. 1999a. *The Structure of Tone*. New York: Oxford University Press.
- Bao, Zhiming. 1999b. Tonal contour and register harmony in Chaozhou. *Linguistic Inquiry* 30:485-493.
- Bao, Zhiming. 2003. Tone, accent, and stress in Chinese. *Journal of Linguistics* 39: 147-166.
- Blevins, Juliette. 1993. A tonal analysis of Lithuanian nominal accent. *Language* 69: 237-273.
- Burzio, Luigi. 1994. *Principles of English Stress*. Cambridge: Cambridge University Press.
- Cai, Jun-ming. 1991. *Chaozhou Fangyan Cihui [A Dictionary of Chaozhou Dialect]*. Hong Kong: Institute of Chinese Culture, Chinese University of Hong Kong.
- Chan, Marjorie. 1985. *Fuzhou Phonology: A Nonlinear Analysis of Tone and Stress*. Seattle: University of Washington dissertation.
- Chan, Marjorie. 1991. Contour-tone spreading and tone sandhi in Danyang Chinese. *Phonology* 8:237-259.
- Chang, Laura Mei-chih. 1992. *A Prosodic Account of Tone, Stress, and Tone Sandhi in Chinese Languages*. Honolulu: University of Hawaii dissertation.
- Chao, Yuen Ren. 1968. *A Grammar of Spoken Chinese*. Berkeley: University of California Press.
- Chen, Leo, and Jerry Norman. 1965. *An Introduction to the Foochow Dialect*. San Francisco: San Francisco State College.
- Chen, Matthew Y. 1979. Metrical structure: Evidence from Chinese poetry. *Linguistic Inquiry* 10:371-420.
- Chen, Matthew Y. 1987. The syntax of Xiamen tone sandhi. *Phonology Yearbook* 4: 109-149.
- Chen, Matthew Y. 2000. *Tone Sandhi: Patterns across Chinese Dialects*. Cambridge: Cambridge University Press.
- Chen, Shujing. 1998. *Pinggu Fangyan Yanjiu [A Study of the Pinggu Dialect]*. Baoding:

- Hebei University Press.
- Chen, Zeping. 1998. *Fuzhou Fangyan Yanjiu* [A Study of the Fuzhou Dialect]. Fuzhou: Fujian Renmin Chubanshe.
- Chen, Zhongmin. 2000. *Studies on Dialects in the Shanghai Area—Their Phonological Systems and Historical Developments*. Berkeley: University of California dissertation.
- Duanmu, San. 1995. Metrical and tonal phonology of compounds in two Chinese dialects. *Language* 71:225-259.
- Duanmu, San. 1997. Recursive constraint evaluation in Optimality Theory: Evidence from cyclic compounds in Shanghai. *Natural Language and Linguistic Theory* 15: 465-507.
- Gao, Xiaohong. 2000. Shandong Mingshui fangyan de shengdiao [Tones in Mingshui, Shandong]. *Fangyan* 2000.3:256-259.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Cambridge: MIT dissertation.
- Goldsmith, John. 1984. Meeussen's Rule. *Language Sound Structure*, ed. by Mark Aronoff and Richard T. Oehrle, 245-259. Cambridge: MIT Press.
- Goldsmith, John. 1987. Tone and accent, and getting the two together. *BLS* 13:88-104.
- Goldsmith, John. (ed). 1995. *The Handbook of Phonological Theory*. Cambridge: Blackwell.
- Halle, Morris, and Jean-Roger Vergnaud. 1987. *An Essay on Stress*. Cambridge: MIT Press.
- Halle, Morris, and William Idsardi. 1995. General properties of stress and metrical structure. In Goldsmith (1995), 403-443.
- Hayes, Bruce. 1995. *Metrical Stress Theory: Principles and Case Studies*. Chicago: University of Chicago Press.
- He, Wei. 1981. Jiyuan fangyan jilue [Notes on Jiyuan dialect]. *Fangyan* 1981.1:5-26.
- Hou, Jinyi. 1980. Pingyao fangyan de liandu biandiao [Tone sandhi in the Pingyao dialect]. *Fangyan* 1980.1:1-14.
- Hyman, Larry. 1978. Tone and/or accent. *Elements of Tone, Stress, and Intonation*, ed. by Donna J. Napoli, 1-20. Washington: Georgetown University Press.
- Hyman, Larry, and Russell G. Schuh. 1974. Universals of tone rules: Evidence from West Africa. *Linguistic Inquiry* 5:81-115.
- Hyman, Larry, and Francis X. Katamba. 1993. A new approach to tone in Luganda. *Language* 69:34-67.
- Kager, René. 1993. Alternatives the iambic-trochaic law. *Natural Language and Linguistic Theory* 11:381-432.
- Leben, William. 1973. *Suprasegmental Phonology*. Cambridge: MIT dissertation.
- Li, Rulong, Wuzhang Liang, and Tianquan Chen. 1979. Fuzhou hua yuyin yanbian



- gaishuo [An outline of sound change in Fuzhou dialect]. *Zhongguo Yuwen* 1979.4: 287-293.
- Lin, Jo-wang. 1994. Lexical government and tone group formation in Xiamen Chinese. *Phonology* 11:237-275.
- Liu, Ling. 1988. *Dunhuang Fangyan Zhi* [*The Dialect of Dunhuang*]. Lanzhou: Lanzhou University Press.
- Lü, Shuxiang. 1980. Danyang fangyan de shengdiao xitong [The tonal system of Danyang]. *Fangyan* 1980.2:85-122.
- McCarthy, John, and Alan Prince. 1986/1996. *Prosodic Morphology* 1986. Technical Report 32. Piscataway, NJ: Center for Cognitive Science, Rutgers University.
- McCawley, James. 1968. *The Phonological Component of a Grammar of Japanese*. The Hague: Mouton.
- McCawley, James. 1970. Some tonal systems that come close to being pitch accent systems but don't quite make it. *CLS* 6:526-532.
- McCawley, James. 1978. What is a tone language? *Tone: A Linguistic Survey*, ed. by Victoria A. Fromkin, 113-132. New York: Academic Press.
- Norman, Jerry. 1987. Notes on the Pucheng dialect. *Wang Li Memorial Volumes*, English Volume, ed. by Chinese Language Society of Hong Kong, 321-329. Hong Kong: Joint Publishing Co.
- Odden, David. 1995. Tone: African languages. In Goldsmith (1995), 444-475.
- Pan, Wuyun. 1988. Qingtian fangyan de liandu biandiao he xiaocheng yinbian [Tone sandhi and diminutive change in Qingtian]. *Wuyu Luncong* [*Wu Forum*], ed. by Wu Research Group, Department of Chinese, Fudan University, 238-248. Shanghai: Shanghai Jiaoyu Chubanshe.
- Pierrehumbert, Janet, and Mary Beckman. 1988. *Japanese Tone Structure*. Cambridge: MIT Press.
- Pulleyblank, Douglas G. 1986. *Tone in Lexical Phonology*. Dordrecht: Kluwer Academic Publishers.
- Qian, Nairong. 1992. *Dangdai Wuyu Yanjiu* [*Studies of Modern Wu*]. Shanghai: Shanghai Jiaoyu Chubanshe.
- Selkirk, Elizabeth, and Tong Shen. 1990. Prosodic domains in Shanghai Chinese. *The Phonology-Syntax Connection*, ed. by Sharon Inkelas and Draga Zec, 313-338. Chicago: University of Chicago Press.
- Shih, Chilin. 1986. *The Prosodic Domain of Tone Sandhi in Chinese*. San Diego: University of California dissertation.
- Tao, Yuemin. 1930. Minyin yanjiu [A study of the sound of Min]. *Bulletin of the Institute of History and Philology, Academia Sinica* 1:445-470. Also published by Beijing: Kexue Chubanshe, 1956.

- Wang, Li. 1957. *Hanyu Shi Lü Xue* [Chinese Poetics]. Shanghai: Shanghai Jiaoyu Chubanshe.
- Wright, Martha. 1983. *A Metrical Approach to Tone Sandhi in Chinese Dialects*. Amherst: University of Massachusetts dissertation.
- Xing, Gongwan. 2000. Anqing fangyan “zi diao qun” de zu jie mo shi [Patterns of tone sandhi in Anqing dialect]. *Xing Gongwan Yuyanxue Lunwen Ji* [Linguistic Papers of Xing Gongwan], 276-293. Beijing: Shangwu Yinshuguan.
- Xu, Baohua, Zhenzhu Tang, and Nairong Qian. 1981-3. Xinpai Shanghai fangyan de liandu biandiao [Tone sandhi in New Shanghai]. *Fangyan* 1981.2:145-155, 1982.2: 115-128, 1983.3:197-201.
- Yang, Wei. 1999. *Yuanling Xianghua Yanjiu* [A Study of the Yuanling Dialect]. Changsha: Hunan Jiaoyu Chubanshe.
- Yip, Moira. 1980. *The Tonal Phonology of Chinese*. Cambridge: MIT dissertation. Also New York: Garland Publishing, 1991.
- Yip, Moira. 1989. Contour tones. *Phonology* 6:149-174.
- Yip, Moira. 1995. Tone in East Asian languages. In Goldsmith (1995), 476-494.
- Yuan, Jiahua et al. 1989. *Hanyu Fangyan Gaiyao* [An Outline of Chinese Dialects]. Beijing: Wenzi Gaige Chubanshe.
- Zee, Eric, and Ian Maddieson. 1979. Tones and tone sandhi in Shanghai: Phonetic evidence and phonological analysis. *UCLA Working Papers in Phonetics* 45:93-129.
- Zhang, Hongming. 1992. *Topics in Chinese Phrasal Phonology*. San Diego: University of California dissertation.
- Zhang, Huiying. 1979. Chongming fangyan de liandu biandiao [Chongming tone sandhi]. *Fangyan* 1979.4:284-302.
- Zhang, Huiying. 1980. Chongming fangyan sanzizu de liandu biandiao [Trisyllabic tone sandhi in Chongming]. *Fangyan* 1980.1:15-34.
- Zhengzhang, Shangfang. 1964. Wenzhou fangyan de liandu biandiao [Tone sandhi in Wenzhou]. *Zhongguo Yuwen* 1964.2:106-152.

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## 漢語中的重音

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本文依據受事者與啓動者的行爲這兩種形式特徵，提出漢語連調變化的類型學。主要類型有三：第一種受事者在詞彙寄主之內、啓動者爲主動；第二種受事者跨越詞彙寄主之外、啓動者爲非主動；第三種兼有二者：受事者在詞彙寄主之內而啓動者爲非主動。第一種爲普通話的特點，第二種爲吳語，第三種爲閩語。根據這種類型學，我將提出吳語與閩語的重音分析，並論證漢語的重音導源於聲調。漢語的連調變化無關節律。

關鍵詞：漢語，聲調，重音，音強，連調變化類型學