

Tone Rule Typology

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TONE RULE TYPOLOGY

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1. Introduction

One question that has intrigued students of comparative tonology concerns the distribution of various types of tonal processes among different language groups. For instance, downstep, and spread/movement (both local and long distance) are commonplace among African languages, but unattested or highly restricted in Chinese and other SE Asian languages. On the other hand, melodic changes (e.g. rising → falling, or vice versa) and paradigmatic replacement of one tone by another that we see in many Chinese dialects must strike the Africanist as utterly alien. Are these distributional facts mere accidents, or do they reflect some deeper typological differences? For lack of space, I will confine myself to three topics: downstep, the syntagmatic processes of spread/movement, and metathesis or melodic inversion.

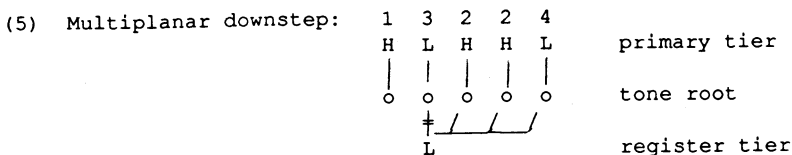
2. Downstep

As a purely intonational property, catathesis or declination is presumably universal, and occurs in Chinese, as suggested by instrumental evidence (cf. Shih, p.c.). On the other hand, the analog of the Bantu-type of downdrift and downstep, has thus far not been documented for Chinese or other SE Asian languages. Why?

First of all, downstep is typically the phonetic encoding of a floating L, as suggested by Clements and Ford 1979 among others. Floating tones are exceedingly rare among Chinese dialects. Granted, some have argued for floating H's as a derivational process morpheme in Cantonese and S.Min. But as far as I know, there has been no reliable report of floating L's anywhere in SE Asia. For this reason alone, we do not expect to find downstep among Chinese dialects.

But I have a hunch that there exists a deeper reason why downstep does not, in fact, *cannot* happen in Chinese. There is an ongoing debate whether tone has an internal geometry like (1a), as proposed by Yip 1989, or (1b) as advocated by Bao 1990. In Chen 1991b I argued in favor of (1a).

number of technical problems, the most obvious of which is the crossing of association lines. There are several logical alternatives, one of which is to put the register and the primary tiers on two separate planes, as in (5).



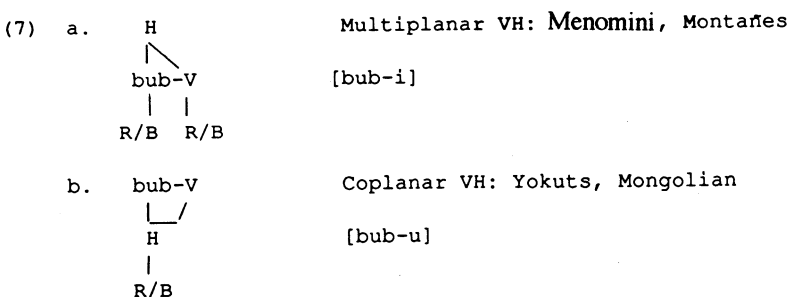
Since the register tier is on a separate plane, it can spread to any number of tone roots, without creating cross-linkage. This is exactly the tack taken by Inkelas 1987, 1989 in her analysis of Tiv. Therefore, the answer to the collateral question seems to be this: Chinese has a coplanar geometry (1a). Accordingly, downstep equals tone copy. Bantu languages, on the other hand, have a multiplanar structure like (1b), which makes it possible for register to spread independently of the primary tier, creating the global effect characteristic of downstep, as shown in (5).

This kind of geometry-based typological explanation for the presence or absence of downstep I am proposing is not without *bona fide* precedent. Consider two hypothetical types of vowel harmony represented in a nutshell by (6a,b): the former attested in Menomini and Montañes, the latter in Yokuts and Mongolian.

- (6) a. bub-V → bub-i (H-harmony independent of R/B)
 b. bub-V → bub-u (H-harmony entails R/B-harmony)

H, R, B = [high, round, back]

How can we make sense of this typological difference? One proposal advanced by Archangeli 1985 turns on precisely the geometrical difference we are contemplating. (6a,b) can be represented as (7a,b) respectively. In (7a), [high] spread does not affect the value of [round, back] of the target vowel; in (7b), on the other hand, [high] cannot spread without taking [round, back] along with it.



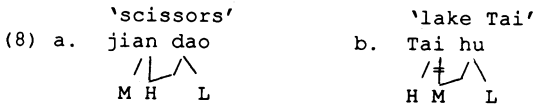
Seen in this light, the dichotomy between (1a,b) looks like a reasonable formal representation of discrete-level tone languages like Chinese, vs. terraced-level tone languages like Bantu.

3. Syntagmatic Processes

Turning to the second topic, it has often been observed in tonological literature that whereas African tones undergo the familiar syntagmatic changes of spread and shift etc., their Asian counterparts tend to stay put or undergo paradigmatic replacement instead. Schuh 1978 speculates that since tone plays a much greater functional lexical role in Chinese than in African languages, if tones in Chinese were to undergo syntagmatic changes, one tone would have many allotones, in which case, "the lexical role of tone would be jeopardized" (p.251).

I suspect the lexical functional load of tonal contrast has been greatly exaggerated. For instance, Old Chongming has 8 underlying tones. Instead of the expected 64 combinatorial possibilities for disyllabic compounds, we find only 7 (see Chen and Zhang 1990). Shanghai, to take another, better-known example, has a 5-tone system; yet instead of 5^n patterns for n-syllable compounds, we have exactly five 'word melodies', analogous to the Mende case as described in Leben 1978. This drastic neutralization of potential tonal contrasts has not, in all appearances, handicapped either the Chongming or the Shanghai speakers.

More importantly, syntagmatic processes do occur in Chinese, even across long distances. Local spread and shift are exemplified in Zhenhai (8a,b). In (8a) the terminal H of the first syllable spreads to the second syllable; in (8b) the M shifts altogether into the syllable to the right (see Rose 1990, Chen 1991b).



More strikingly, long distance spread and shift also occur, for instance, in the related S.Wu dialect of Wenzhou. In (9a) the function words (locatives, prepositions etc.) are inherently toneless (except in citation forms) and assume their pitch values by 'cliticizing' to the preceding tone. Thus the H of *na* and the L of *zhe* spread several syllables to the right. (9b) illustrates a rare case of long distance shift. Wenzhou obliterates all word-initial tones, retaining only the tonal categories of the last two syllables. In most cases, the toneless initial syllables assume some default tonal values. In one particular case, if the lexical sandhi rules produce an intermediate [HM-ML] pattern, [HM-] moves to the word-initial position, across an indefinite number of intervening toneless syllables. The compound-internal syllables assume the default mid level pitch, presumably by virtue of WFC (see Chen 1989).

	'that one is taller than this one'								
	that		Loc DE		than this		Loc DE	tall	
(9) a.	na	tou	de	bi	zhe	tou	de	gao	
	MH	ML	HM	MH	L?	ML	HM	M	Base tone
	MH	o	o	o	L?	o	o	M	Tone deletion
	MH	h	h	h	L?	l	l	M	Tone spread (to the right)
	'radio receiver'								
	wireless telephone receiver								
b.	wu-xian	dian-hua	tong						
	ML	HM	L	L	ML				Base tone
	o	o	o	L	ML				Tone deletion
	o	o	o	HM	ML				Lexical tone sandhi
	HM	o	o	o	ML				Shift (to the left)
	HM	m	m	m	ML				WFC

On the face of it, Chinese tones do not behave all that differently from their Meso-American or African cousins. On closer scrutiny, however, there is one big difference. We can identify six types of syntagmatic changes. As a mnemonic aid, I give each of them a suggestive name. (10a) is a case of peaceful *settlement* of empty space by a neighboring tone. (10b) represents the *encroachment* of one tone on the territory already occupied by an existing tone. I give (10c) a colorful name, *Anschluss*: here one tone annexes a neighboring syllable and throws out the original tone in an expansionist take-over, as it were. One can think of (10d) as the nomadic *migration* of prehistoric tribes across uninhabited land. (10e), on the other hand, is the analog of a far more violent act of *colonization*, i.e. the aggressive movement of one tribe into an already populated area, sometimes wiping out the indigenous population, in which case, *genocide* may be an apt description of what goes on in (10f).

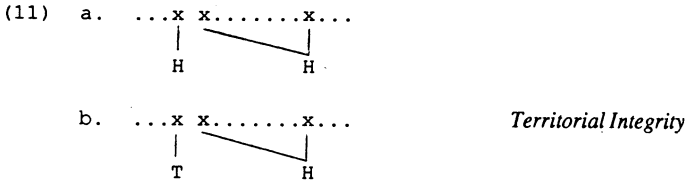
(10) a.	x(x)	b. x x	c. x x
	/	/	/‡
	T	T T	T T
	settlement	encroachment	Anschluss
d.	x(x)	e. x x	f. x x
	‡/	‡/	‡/‡
	T	T T	T T
	migration	colonization	genocide

(x) = toneless

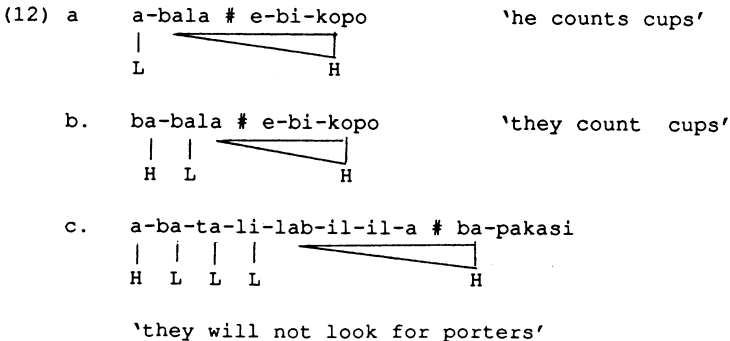
It appears as if African tones behave much more aggressively than their Asian cousins: all six types of syntagmatic changes listed in (10) occur with some frequency in African languages. Chinese tones, on the other hand, move in a kinder, gentler world, so to speak: they only migrate or settle into otherwise unoccupied land. The long distance spread and shift of (9a,b) are instances of (10a) and (10d) respectively, namely movements into/across toneless span. As for (8a,b), the L of the second syllables *dao*, *hu* is the default L, supplied by a late

rule. They, too, instantiate spread/shift into tonally empty space. It is noteworthy that 'imperialist' tone movements, like (10b,c,e,f) either do not occur, or have gone unreported.

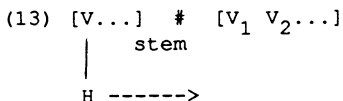
One way to characterize the syntagmatic processes we do find in Asian languages is to say that tone movements respect the *Territorial Integrity* of a neighboring tone. This notion is not as far-fetched as it may sound at first blush. Despite the first impression of African tones as aggressive movers and shakers, most of them do respect the etiquette of territorial sovereignty. (11a) is a typical case of long distance tone spread attested in many Bantu languages. Essentially, a H tone spreads as far back as possible until it hits another H. This extremely common process is referred to as 'bridging' in Kongo (Carter 1980), and as 'plateau *mélodique*' in Kinyarwanda (Furere and Riailand 1985). The analog of (11a), or its mirror image, also occurs in Luganda (Hyman 1982), Tonga (Goldsmith 1984, Pulleyblank 1986), Kimatuumbi (Odden 1985), Shona (Odden 1992) and, no doubt, many others. One might attribute the constraint on (11a) to some sort of OCP effect. But I think the explanation lies elsewhere. The correct generalization seems to be: Tone-spread tends to stop short of infringing on a syllable already occupied by another tone. In other words, we can generalize (11a) as (11b).



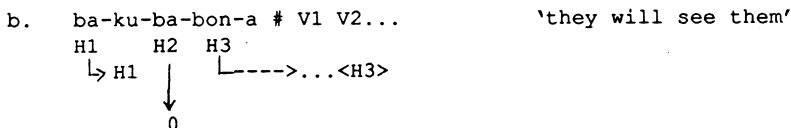
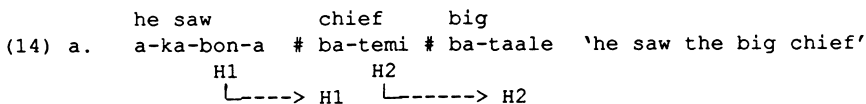
Luganda (Hyman 1982) provides us with some interesting supporting evidence. In Luganda the leftward spread of H's is blocked not only by another H, but also by a L. There are three sources of the surface L's: the phrase-initial boundary L, as in (12a), the buffer L as in (12b), and the L's derived by Meeussen's Rule in (12c). What is important is that H-spread respects the *Territorial Integrity* of a neighboring tone, either H or L, regardless of its origin.



Turning from tone spread to tone migration, the Proto-Bantu H tone in modern Sukuma moves from the verb-stem-initial position to the right by two syllables within the word and by three syllables across words (Goldsmith 1985). Informally stated as (13), if the stem-initial H lands on V_1 across the word, it moves further to V_2 on the right.



Significantly, rule (13) also obeys the *Territorial Integrity* principle: In (14a) we see that H_2 indeed moves three syllables away and lands on *ta*. Interestingly, H_1 moves only two positions to the right, docking on *ba*. In all likelihood, rule (13) applies iteratively left-to-right. Consequently, the presence of H_2 blocks the rightward movement of H_1 . (14b) further illustrates what happens when fidgety tones try to move around in a crowded space. H_1 moves only one position to the right, blocked by H_2 . More interestingly, H_2 itself has no place to move, and drops out of sight. H_3 is set afloat and eventually docks on V_1 or V_2 if available.



The correct generalization that emerges from Luganda, Sukuma and other Bantu languages seems to be this: already linked tones tend to block spread or any other kind of syntagmatic movement. Now, turning back to Chinese, it is fair to say that, (a) with a few exceptions (notably, function words, grammatical particles etc.), every morpheme carries a lexically specified tone; (b) for all practical purposes, morpheme and syllable are coextensive; (c) tones are associated with the TBU's early on, as in canonical tone languages; (d) outside of the Wu dialects, tone deletion does not occur in general. Given these facts, the *Territorial Integrity* principle predicts: (i) tones do not spread or move except to inherently toneless morphemes like object pronouns, grammatical particles and other enclitics; (ii) tone spread/movement occurs only in the Wu dialects known to undergo extensive tone deletion. These predictions are borne out by the documented facts.

I submit that the principle of *Territorial Integrity* explains, at least in part, why Chinese tones tend to stay put, firmly anchored in their host syllables. However it cannot explain everything, for the simple fact that African tones *do* move

around in crowded space, often aggressively encroaching on occupied territories, sometimes forcing out the original tones from their natural habitat. One of the worst offenders seems to be Aghem (Hyman 1987). In Aghem, both H and L spread rightwards, dislodging the original occupant, and creating a domino effect. This is illustrated by (15a). In particular, (15b) demonstrates a case of *Anschluss*: the L on the prefix of 'dogs' is forced out by the H of the associative marker, eventually surfacing as the downstep operator.

- (15) a. o tsOngO kI--bE 'he has stolen fufu'
-
- L H L H H
- b. rat AM dogs
- (kI)-fu + kI + tI-bvU 'rat of dogs'
-
- H H H L HL
- AM = assoc. marker
- = [(kI)-fu + kI + tI-bvU] E, O = open [e, o]
- H H H H !H I, U = barred [i, u]

In view of cases like Aghem, we have to ask why Asian languages generally abide by the territoriality protocol, while African languages operate under no such restraint.¹ The answer may lie in another typological difference between African and Asian languages. African tonal systems typically consist exclusively of level tones, with surface contour tones arising only as the by-product of association conventions, spreading, or syllable contraction etc. In contrast, contour tones freely enter into the make-up of Asian languages at the underlying as well as the surface phonetic level.² A quick check of 20 dialects in *Hanyu Fangyin Zihui* (second edition, Beijing 1989) attests to the preponderance of contour tones in Chinese. The figures are given in (16).

	Free CV(N)	Checked CVC
level	1.5	1.2
contour	3.2	0.8

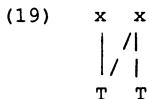
For *free* syllables (i.e. ending in a sonorant), the ratio between contour and level tones is 1.5 to 3.2. Given the preponderance of complex, branching tones in Asian languages, if spread were to operate freely, the effect would be either (17a), if terminal elements spread, or, worse, (17b), if it is the tone root that spreads.

- (17) a. x x
-
- a b c d
- b. x x
-
- a b c d

In either case, the resulting tonal configurations would be highly marked, if not outright impossible by virtue of a constraint like (18). The insight behind (18), or some other versions of it (cf. Bao 1990), is that there is a 'Tonal Saturation' principle that prohibits the 'overcrowding' of the tonal space.

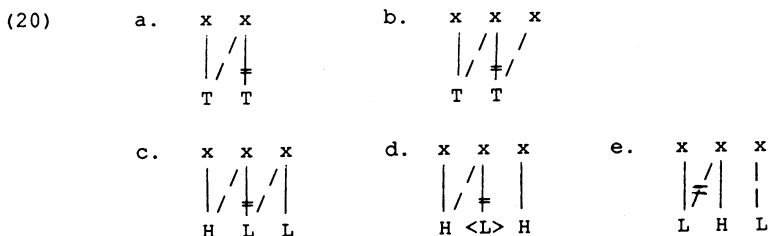


In light of (17,18), it is not surprising that contour tone systems generally disallow syntagmatic moves, while pitch level systems have no trouble accommodating such changes, which typically create an unremarkable configuration like (19)



I suggest, therefore, it is *Tonal Saturation* that, in conjunction with *Territorial Integrity*, helps to explain why syntagmatic processes such as spread and move are so restricted in Asian languages. To use a metaphor, whereas African tones are free to roam about across open savannas, Asian tones are largely confined to their pigeonholes in the densely populated Yangzi delta.

What is less clear is why, in order to alleviate 'overcrowding', Asian languages do not make use of a number of repair strategies that are readily available. For instance, some languages impose even stricter limits of tonal saturation, prohibiting contour tones altogether, including (19). In such cases, they resort to strategies such as delinking as in (20a), which in turn either creates the ripple effect of relinking the displaced tone to the next syllable on the right as in (20b), or, under the right circumstances, undergoes tonal absorption as in (20c); or else, the delinked L is set afloat and phonetically interpreted as downstep, as in (20d); finally, the effect of (19) is neutralized by some other contour simplification devices exemplified in (20e).



<L> = floating L

4. Metathesis

We have seen above two types of tonal rules, downstep and ‘imperialist’ spread/move, that recur in African languages, but do not surface in Chinese. Conversely, there are tonal processes that operate in Chinese but do not appear in African languages. Tonal metathesis is one such example. Metathesis, outside of resyllabification, is rare in general; tonal metathesis, in particular, is virtually unknown, at least in Niger-Congo languages (according to Hyman 1985:66). On the other hand, metathesis has been documented in several Chinese dialects, including Chongming (Chen 1991a) and Pingyao (Bao 1990, Chen 1991b). Pingyao has only two rising tones (LM, MH) and one falling tone (HM). The relevant facts of Pingyao are given in (21).

$$(21) \begin{array}{lcl} \text{LM-MH} & \rightarrow & \text{ML-MH} \\ \text{MH-MH} & & \text{ML-MH} \\ \text{HM-HM} & & \text{MH-HM} \end{array}$$

Obviously what is going on is that before a high tone (MH and HM), the adjacent tones must *dissimilate* in terms of their melodic *contour*: rising-rising \rightarrow falling-rising, and falling-falling \rightarrow rising-falling. Dissimilation functions as a way to satisfy OCP defined over the entire melodic contour (independent of register). However, since rising and falling tones are decomposed into sequences of relative pitch levels, there is no way to formulate the underlying dissimilatory process except in terms of the permutation of terminal tone segments making up the contour, as in (22).

$$(22) \begin{array}{ccc} \begin{array}{c} \text{T} \\ \wedge \\ \text{x} \quad \text{y} \end{array} & \rightarrow & \begin{array}{c} \text{T} \\ \wedge \\ \text{y} \quad \text{x} \end{array} \quad / \quad \text{---} \quad \begin{array}{c} \text{H} \\ \wedge \\ \text{x} \quad \text{y} \end{array} \\ \text{T} = \text{tone root (of either register)} & & \\ \text{H} = \text{high register} & & \\ \text{x, y} = [\text{h}] \text{ or } [\text{l}] \text{ terminal nodes} & & \end{array}$$

Dissimilation and polarity rules do occur in African languages. Thus, whatever the historical account, synchronically speaking, the definite marker *ma* carries the opposite tone to the noun in Tubu (Saharan) (Wolff & Alidou 1989:71). A similar polar relation holds between the possessor and the possessed NP's in Mende (Conteh et al. 1983), between the affixes and the stem in Margi (Hoffman 1963), etc. In a sense metathesis and polarity rules are both *dissimilatory* in nature. The fact that functionally equivalent processes are implemented by distinct formal mechanisms (metathesis vs. alpha-switching rules) reflects the dual nature of contour tones in Chinese: on the one hand, there are very good reasons to construe the rising and falling tones as LH and HL respectively, hence LH \leftrightarrow HL looks like a permutation rule; on the other hand, LH and HL are opposites in the ‘same’ way as H and L are to each other, a symmetry that is not captured in the conventional representation of tones.

5. Concluding Remarks

We have shown that at least some of the differences in the distribution of tonal processes stem from other typological properties of the various tonal systems. Thus the multiplanar vs. coplanar tonal geometry may account for the presence and absence of downstep. Likewise, the prevalence of toneless syllables in African languages (many of which distinguish H vs. 0 rather than H vs. L) makes ample room for tones to spread and move around, while the one-to-one relation between tone and the TBU (syllable, morpheme) in conjunction with the preponderance of contour tones in SE Asian languages inhibit such syntagmatic changes, consistent with the principles of *Territorial Integrity* and *Tonal Saturation*. Finally, while dissimilatory processes operate in both African and Asian languages, only contour dissimilation calls for a formal statement involving a permutation of elements.

One can no doubt think of other asymmetries in tone rule typology and speculate about their underlying causes. In some cases, the different 'flavors' of the tonology of different language families may have nothing to do with tonology per se. For instance, one striking feature of African languages, from the Sinitic point of view, is the proliferation of tonal morphemes, in particular disembodied, segmentless tones marking certain grammatical functions. Thus, just as Tiv marks the general past vs. the recent past by two melodies, independent of the segmental composition of the verb stem, Kikuria (Odden 1987), signals such inflectional categories like remote past, recent past, subjunctive, and perfective by assigning a H tone on the first, second, third and fourth mora respectively. Such exploitation of pitch is totally foreign to Chinese (outside of such marginal cases as the diminutive suffix in Cantonese). One might hazard the hypothesis that the heavy lexical functional load borne by the tones preempts their playing a significant grammatical role. The truth of the matter is that Chinese doesn't mark any such grammatical functions *tout court*. Therefore, the lack of tonal morphology is not a peculiarity of tones, but a property of Chinese in general.

Notes

* Over the years I have pestered my friends and colleagues with the persistent question I have attempted to address here. My thanks go to them for sharing their thoughts on the subject matter with me, in particular: Larry Hyman, Laura Downing and Chilin Shih.

- 1 It is worth noting that there does not appear to be any case of long distance spread or shift in violation of *Territorial Integrity*.

- 2 Note in passing that contour tones are claimed to function as phonological primes in Hausa (Newman, this volume) and some Kru languages such as Grebo (Newman 1986) and Wobe (Bearth & Link 1980). Conversely, Duanmu (1990, and this volume) argues against contour tones in Chinese.

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