Universals of Tone Rules: 30 Years Later

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Abstract

Over 30 years ago, Hyman & Schuh (1974) surveyed a number of West African tone systems and determined that the most common forms of tone rules were tone spreading and (contour) tone simplification. Since then the study of tone has undergone dramatic development both in terms of theory as well as descriptive coverage of the world's languages. In this paper I re-examine and elaborate on the major findings of the earlier study. Drawing on a wider range of tone systems, I show that Hyman & Schuh's claims are confirmed in languages outside West Africa as well. Concerning the perseverative bias of tone spreading, cases of tone anticipation in Eastern Bantu are shown to originate at the right edge of a domain, originally triggered by a final boundary tone. Contour tone simplification is systematically examined in context, revealing that the process may be sensitive to the nature of the preceding and/or following tone. At various points a distinction is made between the articulatory vs. perceptual factors motivating recurrent tone rules. These findings cohere with the tendencies in F0 alignment documented in intonational systems as well.

1 Introduction

Among the major questions of concern to phonologists working on tone are: What is a possible tone system? What is a possible tone rule? Over thirty years ago, in an early endeavour to address the latter question, Hyman & Schuh (1974) attempted to: (i) catalogue recurrent types of tone rules; (ii) determine which rule types are simplex vs. composite in nature; (iii) establish universal tendencies and implicational universals. Attention was primarily focused on how tones affect each other and how consonant types affect tones. Hyman & Schuh's examples were almost exclusively limited to West African Niger-Congo and Chadic languages. Since that time there has been a succession of theoretical developments in phonology and an explosion of descriptive studies of prosodic systems from all parts of the world. It seems thus appropriate to review some of the proposals of Hyman & Schuh (henceforth H&S) and see if they are confirmed by more recent findings. The purpose of this paper is to update the H&S generalizations and to determine how well they hold up in light of subsequent research and discoveries. The paper is organized as follows. Paragraph 2 presents H&S's basic approach to the typology of tone rules, focusing especially on the tendency tones have to spread perseveratively ("from left to right"). Paragraph 3 expands on H&S's comments on contour tones, particularly the surrounding tonal context which determines whether a contour will be realized or simplified to a level tone. Paragraph 4 responds to reported cases of tonal anticipation. Paragraph 5 concludes the paper with a brief discussion of tone inversion in Bantu.

2 Natural tone rules

As part of their study, H&S make a distinction between diachronic and synchronic naturalness (cf. Hyman 1978; Schuh 1978). The authors attempt to separate tone rules which are simplex, resulting from a single natural sound change, from those which are composite,

resulting from the interaction of two or more simplex processes, reanalysis, analogy and so forth. They state: "any... historical sound change is a potential synchronic P-rule.... it is not the case that every synchronic P-rule is a possible sound change.... One frequent cause of this asymmetry is that some synchronic rules collapse or 'telescope' more than one (natural) sound change." (Hyman and Schuh, 1974: 84). As a result, two sound changes A > B and B > C may be telescoped into the synchronic rule A ⊂ C. The rule types covered are thus classified as in (1).

(1) Tone rule typology (H&S)

a. natural diachronic tone rules: downdrift, low-raising, spreading, absorption, simplification

b. natural synchronic tone rules: downstep, shifting, copying, polarization, dissimilation, replacement, displacement

Others have spoken instead of 'natural' vs. 'unnatural' rules. The idea in H&S was that some non-phonetic rules may still be synchronically 'natural' in the sense that they recur. In some cases it might even be possible to say that a rule which could not have arisen by a simplex phonetic process is nonetheless a natural synchronic target. I shall, however, sidestep this aspect of H&S and follow the slightly different terminology in Hyman (1975):

(2) Tone rule typology (Hyman 1975)

a. phonetic tone rules

i. assimilation: vertical vs. horizontal

ii. contour simplification: absorption vs. levelling

b. morphophonemic tone rules: dissimilation, copying, polarization, replacement, floating tones

As seen, the phonetic (or natural diachronic) rules are subdivided into assimilation (treated in this section) and contour simplification (treated in paragraph 3). The natural synchronic rules are instead identified as morphophonemic. Of course, an assimilatory rule can also be morphophonemic, but the intention of the above division is to sort out what would now be referred to as phonetically 'grounded' rules from those which are not. What is important is that so-called phonetic tone rules exhibit important asymmetries which are quite different from segmental assimilations. In the following sections I shall refer to common processes as 'natural' and uncommon processes as 'unnatural'.

2.1 Vertical assimilation

The table in (3) illustrates what is meant by vertical assimilation:

(3) Vertical assimilation (Hyman 1975: 222)

a. **Natural**		b. **Unnatural**	
L-H → M-H		H-L → H-M	(raising)
L-H → L-M		H-L → M-L	(lowering)

Input /L/ and /H/ tones in sequence may undergo raising and lowering. The natural rules in (3a) show that the step-up interval of a /L-H/ input is subject to *F*0 *compression*. Thus, /L-H/ frequently undergoes anticipatory raising to become [M-H] or perseverative lowering to

become [L-M]. The corresponding unnatural changes in (3b) show that the step-down interval of a /H-L/ input is not subject to compression: /H-L/ rarely undergoes perseverative raising to become [H-M] or anticipatory lowering to become [M-L].

In fact, both phonetic and phonological studies have shown that a /H-L/ interval is subject to *F*0 *polarization*: "The high tone [also mid & rising] was significantly greater in height when followed by either the rising or low tone....[in Thai]" (Gandour and Potisuk 1994: 483). Connell and Ladd (1990) and Laniran and Clements (2003) show this phonetic effect in Yoruba, while a pre-L H tone is raised to a contrastive superhigh (S) "toneme" in Engenni (Thomas 1974), Mankon (Leroy 1979), Moba (Rialland 1983), Krachi (Snider 1990), and Kirimi (Hyman 1993b). The following examples from Engenni show that the conditioning /L/ may be either realized (4a) or latent/floating (4b):

(4) Engenni H → S (Thomas 1974: 12)

a.	/únwónì/ 'mouth'	b.	/únwónì + ólíló/	'mouth of a bottle'
	↓		↓	
	[únwőnì]		[únwőn ólíló]	

In this context one can note the complex interplay of polarization and compression in the downstepping of H*-L*-H*-L*... sequences (Stewart 1965; Clements 1979; Laniran and Clements 2003; Rialland 2001). The following examples show that a /H/ may be raised in pitch in anticipation of a phonemic downstep which is to occur several syllables later:

(5) H → ↑H in anticipation of phonemic downstep may be non-local

a.	kìté úkɔ́ɔ́mí fínáwà	'the place of the bed of the animal'	(Amo; Hyman 1979: 25)
	kì↑té úkɔ́ɔ́mí fíká!lé	'the place of the bed of the monkey'	
b.	àbásíbá kígùùndú	'the ones who tie up Kigundu'	(Luganda; Hyman and
	tè↑básíbá !kígùùndú	'they do not tie up Kigundu'	Katamba 1993)

In the above examples, L-↑H indicates a step-up of two vs. L-H, which indicates a step-up of one.

2.2. Horizontal assimilation

While vertical assimilation involves the up- or downward adjustment of pitches, horizontal assimilation refers to cases tone-segment desynchronisation as occurs when a tone is realized on a neighbouring tone-bearing unit (TBU). As seen in (6a), this naturally occurs when a tone perseverates onto the following TBU:

(6) Horizontal assimilation (Hyman 1975: 223)

a.	**Natural**	b.	**Unnatural**
	L-H → L-LH		L-H → LH-H
	H-L → H-HL		H-L → HL-L
	(perseverative)		(anticipatory)

/L-H/ is frequently realized as [L-LH] by left-to-right L-tone spreading (LTS); similarly, /H-L/ is frequently realized as [H-HL] by left-to-right H-tone spreading (HTS). Anticipatory or

right-to-left tone spreading is however much less natural: /L-H/ does not frequently become [LH-H] by H-tone anticipation (HTA), nor does /H-L/ frequently become [HL-L] by L-tone anticipation (LTA). Cases of HTA whereby /Ø-H/ becomes [H-H] are discussed in paragraph 4.

In addition to directionality, H&S distinguish between partial and complete HTS/LTS, depending on whether the spreading tone forms a contour with the following tone, or whether the latter is replaced. The representations in (7a,b) show how partial and complete tone spreading have been formulated in autosegmental terms:

(7) Some parameters of (perseverative) tone spreading

a. in partial spreading, the trigger combines with the target to create a contour tone

(H-L → H-HL, L-H → L-LH)

b. in complete spreading, the trigger causes delinking of the target tone

(H-L → H-H, L-H → L-L)

c. spreading may also be to a toneless TBU

(H-Ø → H-H, L-Ø → L-L)

In addition, note in (7c) that the targeted TBU may also be toneless. Other generalizations of H&S concerning tone spreading are identified in (8).

(8) According to H&S, tone spreading

a. is the most basic tonal process

"Tonologists have focused too much attention on the raising and lowering effects of tone and not enough on the basic spreading nature of tone." (Hyman and Schuh, 1974: 97)

b. tends to be perseverative rather than anticipatory

"Spreading is an assimilatory process of the progressive or perseverative type, rather than of the regressive or anticipatory type. That is, the earlier tone appears to last too long, rather than the later tone starting too early." (Hyman and Schuh, 1974: 88)

c. is not copying

"There is no process of tone copying or tone addition in the second syllable. Rather, the earlier tone simply enlarges its domain." (Hyman and Schuh, 1974: 88)

d. tends to first affect tonal sequences which are widest apart in interval, e.g. /L-H/ and /H-L/ are affected before /L-M/ and /M-L/, e.g. Yoruba.

In principle, any tone can spread onto a following TBU with unlike tone. The Yoruba phrases in (9) show that a language can have both HTS and LTS:

(9) A language may have both HTS and LTS

a. /máyò mí rà wé/ [máyo̩ mǐ râ wě] ‘Mayomi bought books’ (Yoruba)
H L H L H (Laniran and Clemens 2003: 207)

b. /nè fé-ghàm -fé/ [nè fè-ghām̀-fè˚] ‘with a mat’ (Kom; *LH)
L H L H

c. /kà zóoŋ lìen thúm/ [kà zòoŋ líen thǔm] ‘my three big monkeys’
L H L H (Kuki-Thaadow; *prefinal LH/HL)

However, a number of arguments suggest the hierarchy in (10).

(10) Hierarchy: HTS > LTS > MTS

The most likely tone to spread is /H/, followed by /L/, then mid /M/ (cf. Pulleyblank’s 1986 H > L > M tonal markedness scale). That /H/ is more spreadworthy than /L/ is supported by the following observations:

(i) HTS occurs in many languages which do not have LTS. This is true not only of languages which contrast /H/ vs. /Ø/, but also of languages where both /H/ and /L/ are phonologically active. That HTS is more frequent than LTS may be partly attributable to the vertical polarization effects of /H-L/ vs. the compression of /L-H/: tone spreading first occurs where the interval between TBUs is greatest.

(ii) Very few languages have LTS without HTS. H&S cite Nupe, where LTS is triggered by both linked and floating L: /è-bé/ → [èbě] ‘coming’, /` bé/ ⊂ [bě] ‘& come’. This is not a “pure’ case of LTS, since the intervening consonant must be voiced (cf. dialectal Ewe, where LTS applies only through a voiced obstruent). Another case is Thlantlang Lai: /bòoy vók hmâa/ → [bòoy v̲ò̲k hmâa] ‘chief”s pig’s wound’ (Hyman 2005). Other apparent cases of LTS may instead derive from tonal reduction (e.g. in compounding) or from an output constraint prohibiting a H after a HL, e.g. Barasana (Gomez & Kenstowicz 2000) and perhaps Kalam Kohistani (Baart 1998). It should be noted that [H-L-H] sequences are frequently prohibited (Cahill 2002).

(iii) Many languages which have both HTS and LTS restrict LTS in ways they do not restrict HTS. In Kuki-Thaadow, LTS will not apply to a /L-H-H/ input, but HTS will apply to /H-L-L/. In Kom, LTS will not apply to /L-H/ if a floating L follows; by comparison, HTS will apply to /H-L/ if a floating H follows. In Dagbani, LTS will not apply to /L-H/ if the H syllable is stressed; but HTS will apply to /H-L/ if the L syllable is stressed (Hyman 1993a). Finally, in some languages, LTS only targets a prepausal H, whereas it is rare for HTS to be so constrained. Kenstowicz & Kidda (1987) represent Tangale final lowering as in (11a), where a prepausal (//) H is delinked. However, the reinterpretation in (11b) is more in keeping with how L˚ (a prepausal non-falling L tone) arises in other languages, e.g. Grassfields Bantu:

(11) Prepausal LTS in Tangale: /tùužé/ → [tùuzè˚] ‘horse’

a. Kenstowicz & Kidda (1987)
tuuže
H //

b. Reinterpretation
tuuže
L H //

c. No lowering
laŋoro
L H //

Kentowicz & Kidda (1987) suggest that *làŋóró* 'donkey' is exempt from their prepausal L-delinking rule in (11a) because the final /H/ is doubly linked (geminate inalterability). In the reinterpretation in (11b), which assumes postlexical default Ls, *làŋóró* fails to undergo LTS in (11c) because the targeted prepausal H TBU must be immediately preceded by L.

2.3. HTS in Bantu

As seen in the last section, there is reason to believe that HTS is more frequent and has fewer constraints on it than LTS. To a large extent H&S based their study on languages that have phonologically active /H/ and /L/ tones (if not also /M/). The non-occurrence of LTS in most Bantu languages is consistent with analyses which posit a single active tone /H/ which stands in contrast to its absence (Ø). Still there is considerable variation in the HTS processes that are attested. Although we will not be concerned with all of them, for reference, the following parameters are necessary to sort out the observed variation:

(12) Tone spreading rules in terms of parameters (cf. Archangeli and Pulleyblank 1994)

a. domain (stem, word, phrase etc.)
b. directionality (left→right; right→left? See §4)
c. extent (bounded/unbounded)
d. attractors (e.g. accent, domain edge)
e. inhibitors (e.g. depressor consonants)

The examples in (13) are representative of bounded and unbounded HTS, both widely attested in Bantu:

(13) Representative cases of HTS in Bantu languages (underlying Hs = underlined)

a. bounded, e.g. Kikerewe (Odden 1998: 177)
ku-bóh-a 'to tie'
ku-bóh-él-a 'to tie for'
ku-bóh-él-an-a 'to tie for each other'

b. unbounded, e.g. Ndebele → antepenult (Sibanda 2004)
ú-kú-lima 'to cultivate'
ú-kú-lím-is-a 'to cause to cultivate' (output: ú-kú-ǃlím-is-a)
ú-kú-lím-ís-el-a 'to cause to cultivate for' (output: ú-kú-ǃlím-ís-el-a)

In (13a), an underlying H spreads one vowel to its right. (HTS fails to apply in the first case, since HTS will not occur onto a phrase-final vowel.) In (13b) an underlying H spreads up to the antepenultimate vowel. The parenthetical forms to the right reflect a lowering process conditioned by a stem-initial %L boundary tone.

One variation on HTS is referred to as tone shift or displacement. As seen in (14a), an underlying H shifts to the next vowel in Jita:

(14) H tone shift/displacement

a. bounded, e.g. Jita (Downing 1990a)

o-ku-ßón-a	'to get/see'	(no shift onto final vowel)
ku-ßon-ér-a	'to get for'	
ku-ßon-ér-an-a	'to get for each other'	

b. unbounded HTS + delinking, e.g. Zulu → antepenult (Downing 1990b: 265)

u-kú-hleka	'to laugh'
u-ku-hlék-is-a	'to amuse' (< 'make laugh')
u-ku-hlek-ís-an-a	'to amuse each other'

In (14b) we see that rather than simply spreading, an underlying H *shifts* to antepenultimate position in Zulu, with which Ndebele is mutually intelligible. Another oft-cited example concerns Chizigula, where a H tone shifts to the metrically strong penult:

(15) Tonal attraction to penult in Chizigula (Kenstowicz and Kisseberth 1990: 171)

a. na-ku-gulusa 'I am chasing you' vs. b. a-ku-gulúsa 'he is chasing you'

H

H&S see tone shift/displacement as a composite "telescoped" process (cf. Downing 1990a, Philippson 1991). Whereas (15b) indicates the displacement as a shift + delinking, where it is possible to tell, the evidence appears to always be in favour of unbounded local spreading + delinking (Cassimjee and Kisseberth 1992; Kisseberth and Odden 2003; Odden 2001—cf. (26) below). We thus need to expand the parameters to include those in (16).

(16) Additional parameters

a. ± target delinking (H&S: partial vs. complete tone spreading)
b. ± trigger delinking (H&S: tone spreading vs. shifting)
c. iterative/non-iterative (e.g. in the case of domain-juncture rules)

The last of these refers to cases where HTS is bounded and iterative. In (17a), for example, bounded HTS occurs across phonological word (PW) boundaries:

(17) Bounded iterative ≠ unbounded spreading

a. in Shona, bounded HTS crosses a PW boundary (Myers 1997: 862n; ex. from Odden 1981: 83)

[va [ma [zi [mi [chero → vá-má-zí-mí-chéro 'Mr. Big Ugly Fruits'

H cf. ma-zi-mi-chero 'big ugly fruits'

b. in Luganda, bounded LTS crosses a PW boundary (Hyman and Katamba 1993a)

[na [ku [byaa [mu-limi → nà= kù= byàa= mù-límí 'and on those of the farmer'

%L H% (cf. LH* on a single word: è-bí-súmúlúzó 'keys')

Similarly, (17b) shows that bounded iterative LTS in Luganda. (H% is a final boundary tone marking declarative intonation in Luganda.) It is clear that something which began by phonologising the late realization of H pitch targets has been restructured in Shona in such a way that the synchronic rule is quite different from its diachronic origin. It is, however, what H&S refer to as synchronically natural.

3 Contour tones

Besides tonal assimilations, contour tones receive considerably attention in H&S. Some generally agreed upon "facts" about contour tones can be summarized by the complexity scale in (18).

(18) Markedness ranking of contours: RF, FR > R > F > H,L (cf. Yip 2002: 27–30)

Rising-falling and falling-rising tones are more complex than rising and falling tones, rising tones are more complex than falling tones, and both rising and falling tones are more complex than level tones. In principle, the more complex ('marked') a tone is, the more likely it is to be (i) absent in a tone system (although there are counterexamples); (ii) restricted to a hospitable TBU (e.g. a long, prominent, sonorous TBU); (iii) cause a TBU to become more hospitable, e.g. by conditioning vowel lengthening.

Two recent studies attempt to account for the cross-linguistic distribution of contour tones according to the phonetics of syllable rimes. According to Gordon (2001: 405), who conducted a survey of 105 languages, "[there is] an implicational hierarchy of tone bearing ability, whereby long vowels are most likely to carry contour tones, followed by syllables containing a short vowel plus a sonorant coda, followed by syllables containing a short vowel plus an obstruent coda, followed by open syllables containing a short vowel.... syllable types which are phonetically better suited to carrying tonal information are more likely to support contour tones. Languages whose tone distributions superficially appear to fall outside the range of variation predicted on phonetic grounds are demonstrated, upon closer examination, to be unexceptional in their behaviour." Basing himself on a survey of 187 languages, Zhang (2001) similarly states: "...the distribution of contour tones is found to correlate closely with the duration and sonority of the rime. Syllables with longer rime duration, e.g. those that are long-vowelled, sonorant-closed, stressed, prosodic-final, or in a shorter word, are more likely to carry contour tones." (pp. xiv–xv). The proposed hierarchies concerning hospitable TBUs are summarized in (19)

(19) Proposed hierarchies concerning hospitable TBUs (S = sonorant, O = obstruent)

a. rime types: CVV > CVS > CVO > CV
b. # of syllables in word: monosyllabic > bisyllabic > polysyllabic
c. metrical prominence: stressed > unstressed
d. domain position: final > non-final

Contour tones may thus be lacking from the underlying inventory or be subject to simplification if landing on a non-hospitable TBU: "contour simplifications are in some sense an alternative to lengthening the syllabic support to accommodate the contour" (Hyman 1978: 262).

Strikingly missing from these studies is discussion of the relevance of neighbouring tones on contours. H&S distinguish between two kinds of contour simplification (CS): (i)

absorption, where one of the components of the tonal contour is lost when it is followed (preceded?) by a like tone; (ii) levelling, where a tonal component is lost in other environments (e.g. in Haya, any derived LH rising tones are converted to H). As in the case of tone spreading, tonal absorption shows a directional asymmetry:

(20) Tonal absorption

a. **Natural**		b. **Unnatural**	
LH-H	→ L-H	L-LH	→ L-H
HL-L	→ H-L	H-HL	→ H-L
(progressive)		(regressive)	

In (20a), the end point of a contour is lost ("absorbed") when followed by a like tone. The converse in (20b), loss of the initial point of a contour when preceded by a like tone, is less common. H&S attribute this difference to the overall perseverative nature of tone-segment desynchronisation: in (20a) the endpoints of the LH and HL contours are delayed into the following TBU, where they are absorbed into a like H and L tone, respectively. Anticipatory absorption is less natural, as is anticipatory spreading in general (see paragraph 4).

Within Bantu, contour tones are frequently restricted to long (bimoraic) vowels, to long or short vowels in penultimate position, or to final vowels which are typically monomoraic. In addition, contours may arise from cases of vowel coalescence, which occur both word-internally and across words. In many cases the surface realization of a contour will depend on the surrounding tones. A particularly striking case of this concerns the Law of the Like Neighbour, exemplified by Luba in (21).

(21) Contour simplification in Luba (Meeussen 1951; Coupez 1954: 29–33)

a. if a contour is followed by a like tone, progressive absorption will apply
   L-LH-H → L-L̲-H : bà-dì-él-á → bà-dy-è̲l-á 'ils se jetaient'

b. if a contour is not followed but is preceded by a like tone, regressive absorption will apply
   L-LH-L → L-H̲-L : bà-tù-énz-èl-è → bà-tw-é̲nz-èl-è 'qu'ils fassent pour nous'

c. if a contour is neither followed nor preceded by a like tone, the full contour will be realized
   H-LH-L → n.c. : mú-tù-ámb-ìl-é → mú-tw-ă̲mb-ìl-é 'nous ayant dit'

The examples in (21) reveal the importance of 'like' vs. 'unlike' neighbourhoods in CS—cf. Xu's (1994: 2250) "compatible" vs. "conflicting" contexts. The full range of contour realizations is schematized in the table in (22), where parenthetical outputs follow the above rules but are not illustrated in Coupez's examples:

(22) Summary of contour simplification in Luba

#	LH	L	→	LH-L	#	HL	L	→	H-L
#	LH	H	→	L-H	#	HL	H	→	HL-H
#	LH	#	→	---	#	HL	#	→	---
L	LH	L	→	L-H-L	L	HL	L	→	(L-H-L)
L	LH	H	→	L-L-H	L	HL	H	→	L-HL-H
L	LH	#	→	L-H	L	HL	#	→	L-H
H	LH	L	→	H-LH-L	H	HL	L	→	(H-H-L)
H	LH	H	→	H-L-H	H	HL	H	→	(H-L-H)
H	LH	#	→	H-L	H	HL	#	→	H-L

As summarized in (23), many languages prohibit contours in like neighbour contexts, thereby requiring the presence of a –αT 'bounce' to precede and/or follow:

(23) Languages may prohibit contours in like neighbour contexts

a. contour must not precede like tone (*LH-H, *HL-L)
   i. Yao: LH appears only before L (Hyman and Ngunga 1994; Odden 1998)
   ii. Dagbani: HL appears only before H (Hyman 1993a); also Ngizim (Schuh 2002)

b. contour must not follow like tone (*L-LH, *H-HL)
   i. Tembo: rising tone appears only when preceded by H (Kaji 1996: 3)
   ii. Malinke (Kita): HL appears only when preceded by L (Creissels and Grégoire 1993)

c. contour must not follow or precede like tone: Luba

Other languages are exactly opposite and disprefer contours in unlike neighbourhoods, thus requiring an αT "assist" to precede and/or follow:

(24) Languages may prohibit contours in unlike neighbour contexts

a. contour must not precede unlike tone (*LH-L, *HL-H)
   i. Isthmus Zapotec: LH must not precede L , e.g. LH-L → L-HL (Mock 1988: 214)
   ii. Gwari: HL must not precede H or M (Hyman & Magaji 1970: 18)

b. contour must not follow unlike tone (*H-LH, *L-HL)
   i. Makonde (Chimaraba): LH must not follow H (extrapolated from Odden 1990)
   ii. Taita: HL must not follow L (extrapolated from Odden 2001); also Aghem

c. contour must not follow or precede unlike tone: no example yet found

Even within the same subgroup of languages, the neighbourhood conditions on tonal contours can be quite different. As seen in the table in (25),

(25) Comparison of four Kuki-Chin languages (Tibeto-Burman)

	Hakha, Mizo	Falam	Kuki-Thaadow	
LH-L	*	√	*	= articulatorily complex
LH-H	√	*	*	= perceptually complex

the four cited Kuki-Chin languages exhibit three different properties with respect to what can follow a LH rising tone (Hyman 2003): Hakha Lai and Mizo do not allow LH to be followed by L, while Falam does not allow LH to be followed by H. Both are ruled out in Kuki-Thaadow, which prohibits both LH and HL on prefinal syllables. The differences can be accounted for as follows: The rising contour is perceptually enhanced by a subsequent drop to L, but a L-HL sequence is articulatorily complex. A LH-H sequence has just the opposite properties: It is less taxing, articulatorily, to continue a LH rising tone on a H tone level, but the LH is perceptually vulnerable in a context where the rise is masked by a following H tone. As was seen in (20a), LH-H readily becomes L-H by absorption. Although for different reasons, both 'bounce' and 'assist' situations are phonetically grounded and attested in tone systems.

While neighbourhood constraints seem to exhaust most or all of the logical possibilities, there are some asymmetries. In many languages LH is more sensitive to context than HL. It also appears that the post-contour environment is more likely to have an effect than the pre-contour environment. There is variation in how the prepausal environment affects contours: LH is tolerated before pause in Kuki-Thaadow (9c), but not in Kom (9b). In addition, some neighbourhood constraints may hold of a particular domain, but not another. Finally, it should be noted that the neighbourhood effects may result from a single rule, especially if the latter is the only source of contours in the language.

Like other constraints, the effect of a neighbourhood tone constraint can be either 'active' (e.g. enforcing the delinking of tone) or 'passive' (e.g. blocking the delinking of a tone). The latter occurs in Taita (Dembwa), which, as seen in (26), requires HL to be preceded by a H assist:

(26) Taita (Dembwa) (Odden 2001: 96–7)

a. H of copula /ní/ spreads two syllables to the right + double delinking (cf. Sukuma)

ní	mu-sangaaga	→	nì mùsángààgà 'it's sands'
H			H

b. H spreads two syllables to the right + single delinking

ní	ma-geembe	→	nì má-géèmbè 'it's hoes'
H			H

c. H spreads one syllable + no delinking

ní	baandu	→	ní báàndù 'it's people'
H			H

In (26a) we see the /H/ of the copula /ní/ shifts two syllables to the right. Odden argues that this is to be accounted for by spreading plus delinking, as indicated. In (26b) the /H/ again spreads two syllables to the right, but this time only the original association is delinked, thereby leaving a H-HL sequence. In (26c), only one syllable is affected by HTS, since the /H/ cannot spread onto the final syllable. As seen, the original H association is not delinked. The generalization is that delinking will be blocked if the result is a HL falling tone preceded by L. Taita (Dembwa) requires that a HL tone be preceded by H. Note that the long vowels in the above examples result from penultimate lengthening. A metrical interpretation might specify that HL requires pretonic H assist.

It is not surprising that some languages would require an αT assist before or after a contour. CS is motivated by what I have termed the Principle of Ups and Downs (PUD):

> "Tonally induced changes tend to minimize the number of ups and downs over a given stretch. In the case of contour simplication, the 'stretch' may be as short as a syllable.... The principle of ups and downs not only accounts for most instances of vertical assimilations and contour levellings, but also predicts that change will occur first where the ups and downs are the most complex. Thus, a H-LH or HL-H sequence is much more likely to undergo change than a L-LH or HL-L sequence. Also, a sequence of interspersed Ls and Hs is more likely to undergo change than a sequence of interspersed Ls and Ms, or Ms and Hs etc." (Hyman 1978: 261)

Among the sequences most avoided as a result of this principle are LH-L and L-HL. Both involve a LHL sequence realized over two syllables, a step up followed by a step down. The sequences HL-H and H-LH have the reverse gestures: a step down followed by a step up. Silverman (2003) suggests a greater likelihood of modification of LH-L vs. HL-H into one of three patterns which he labels A, B and C: "In Pattern (A) the pitch peak may spread/displace on to the following vowel [→ L-HL], whereas falling contours do not spread/displace their troughs. In Pattern (B) the rising contour occurs only on longer vowels/sonorous rimes, in comparison to vowels/sonorous rimes associated with falling contours (Zhang 2001). Finally, the rise in pitch of a rising contour may be somewhat smaller than the fall in pitch of a falling contour. This is Pattern (C)" (Zhang 2001).

The worst violations of the PUD consist of inputs of identical contours occurring in sequence. A striking case of this is found in Tianjin, a Mandarin dialect much discussed in the literature. As seen in (27a), the tonal inventory of Tianjin has been interpreted in a variety of ways:

(27) Tianjin (Chen 2000: 105; Bao 1999: 61)

a. tonal inventory

21	45	213	53	(attributed by Chen to Li and Liu 1985)
↓HL	↑LH	↓LH	↑HL	(Bao 1999: 60) (↑/↓ = registers)
11	55	24	53	(attributed by Chen to Shi 1990)
L	H	LH	HL	(Chen 2000) (LH, HL = his R, F)

b. tone rules

i. 213-213 → 45-213 53-53 → 21-53 21-21 → 213-21 53-21 → 45-21 (Bao)
'register dissimilation' 'contour metathesis/OCP'

ii. LH-LH → H-LH HL-HL → L-HL L-L → LH-L HL-L → H-L (Chen)
contour levelling dissimilation absorption

As indicated in (27b), the four tone rules of Tianjin have also received different interpretations. I shall follow Chen: The first two rules concern sequences of identical contours: LH-LH → H-LH, HL-HL → L-HL. The two symmetric CS processes change an input with three pitch changes to an output with only two. The repair consists of maintaining the second part of the contour: LH becomes H and HL becomes L. The third tone rule, L-L → LH-L, converts an input sequence with no pitch change to an output sequence with two pitch changes! The last rule, HL-L → H-L might appear to be a simple case of absorption. These facts are restated as output constraints in (28).

(28) Sequential constraints on Tianjin tones

a. *LH-LH, *HL-HL
b. *L-L, *HL-L

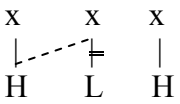
While the constraints in (28a) have been attributed to the OCP (Yip 1989), I suggest instead to attribute them to the PUD. Motivation for treating (28a) as extreme PUD violations derives from the treatment of the constraints in (28b). While the *L-L prohibition in (28b) might also appear to be an OCP effect, Tianjin does allow H-H in violation of the OCP. (H has sometimes been seen as the unmarked tone in Chinese, suggesting it might escape the OCP if it is underspecified. One can however question this move, given that H would still have to be specified in LH and HL contours.) If *L-L has been attributed to the OCP, then HL-L → H-L might exemplify the natural rule of tone absorption (20a), a tonal neighbourhood effect. However, we would then not be able to explain why HL does not simplify before LH. The generalization that accounts for both constraints in (28b) is that a /L/ tone must be preceded by [H]. That is, /L/, but not /LH/ must realize a –αT 'bounce'. (A change of L-LH to LH-LH would, of course, violate the PUD constraint in (28a).) Whereas some of the previous analyses have grouped *LH-LH, *HL-HL and *L-L together as OCP violations vs. *HL-L, an equally reasonable interpretation is to assume that these sequential constraints group into *LH-LH, *HL-HL vs. *L-L, *HL-L, as I have presented them in (28a,b). In any case, Tianjin provides an excellent example of how CS may be triggered by extreme violations of the PUD and possibly also by a –αT neighbourhood constraint.

4 Tone anticipation

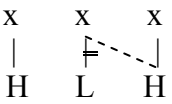
Recall that H&S largely limited their attention to the tone rules they knew from West African languages. As indicated in the preceding sections, there is reason to believe that the same generalizations hold in other languages. There is, however, one outstanding issue which H&S claimed to occur only under special circumstances: tone anticipation. Consider first the two common sources of tonal downstep in (29).

(29) Two sources of tonal downstep

a. H-L-H → H-H-$^{!}$H



b. H-L-H → H-$^{!}$H-H



As indicated, H&S interpreted the derivation of $^{!}$H in (29a) to be the result of HTS + CS (=delinking). However, H&S had a different view of the second source of $^{!}$H in (29b). Here the idea was that /H-L-H/ first becomes H-L-$^{!}$H by automatic downstep ('downdrift') and then the L is raised by vertical assimilation, first reaching the lowered level of the following $^{!}$H. This interpretation is hard to reconcile with tone systems where $^{!}$H is triggered by a floating L tone. As indicated in (29b), subsequent autosegmental analyses have instead invoked anticipatory HTS + delinking in a mirror-image fashion to (29a).

The strongest challenge to H&S's favoring of perseverative tone spreading (6) comes from certain Bantu languages in East Africa: "As I have shown by numerous examples from Bantu, Hyman's claim is not correct since tonal anticipation (by spreading, absorption, shifting, and displacement) does in fact occur as a natural process in many languages." (Schadeberg 1977: 202) While cases of perseverative HTS vastly outnumber cases of anticipatory HTS (=HTA) even in Bantu, there is a restricted region where the latter occurs:

"High Tone Anticipation... can be said to be a rather general rule in this area of eastern Zaire, Rwanda, Burundi and adjacent areas, that is the Interlacustrine Bantu region" (Kaji 1996: 19). Philippson (1991: 180) also notes the geographic restrictions, but adds that anticipation "ne saurait se réduire à une simple image en miroir" of tone spreading/displacement. I would like first to reiterate the position of H&S in (30)

(30) My current position... (= the same as my old position)

a. if you leave tones to their own devices, they will spread to the right

"...when tones and syllables come to be out of phase with one another, it is almost always the case that the tones will last too long, rather than the reverse" (Hyman 1978: 262)

b. perseverative tone spreading phonologises the tendency of tone targets to be realized late, other things being equal

"...the F0 target for a single static tone tends to occur at the (temporal) end of the associated phonetic region...." Akinlabi & Liberman (2000: 5)

"Late realization of tonal targets has been demonstrated both for languages in which tones are lexical... and for those in which they are intonational...." (Kingston 2003: 86)

c. phonetic explanations/speculations have been articulatory and perceptual, e.g. H&S, Javkin (1979), Silverman (1997), Xu (2004)

"...the rightward principle was conceived as a purely phonetic one, i.e. as motivated by nothing more than the juxtaposition of nonidentical tones...." (Hyman and Schuh, 1974: 104)

d. where tone spreading is anticipatory, more than the natural phonetic tendencies must have been implicated (cf. Hyman and Schuh 1974: 103–105).

The key point is that where horizontal tone anticipation occurs, it is quite different from tone perseveration. As H&S reported, it is almost non-existent in West African languages, which generally have more than one active tone. Instead, it is found in 'restricted' or 'accentual' tone systems, i.e. those which have been claimed to have a /H/ vs. Ø opposition. These were not studied by H&S. The claim that tone anticipation is qualitatively different from perseveration can be tested in two ways. First, we can seek to determine if every type of perseverative process has an anticipatory analogue. Second, we can see if H&S (103) were right that cases of tones spreading or shifting to the left do so because they receive a push from the right edge—or, as we shall see, a pull from a strong internal position.

I shall distinguish several sources of tone anticipation, each one involving a special circumstance. The first is tone anticipation as a sign of strength (SOS). This occurs when a tone is attracted to a metrically strong (i.e. accented) position. In (31) we see that a final tone is attracted to the phrase-penultimate syllable in Haya:

(31) Tone anticipation as a sign of strength (SOS)

a. H-L → HL-L / __ %

mu-kono → mù-kônò 'arm'

H L

b. L-H → H-H / __ %

bu-golo → bù-góló 'snuff'

H

Since Haya has an underlying /H/ vs. Ø system, the L in (31a) can be interpreted either as a late default L or as a L% phrase-boundary tone. In the example, the penult is realized with a short HL contour. In (31b) H tone anticipation (HTA) occurs, creating a H-H sequence over the last two syllables. However, 'snuff' is pronounced [bù-gólò] in prepausal position, which is marked by an additional L// boundary tone. Since neither HL-L nor anticipatory HTA appear in any other position in Haya, it is clear that it is the penult that is responsible.

From the Haya example one can see the interaction of two right-edge factors: attraction of a tone to the metrically strong penult and avoidance of H before pause. The realization of final /Ø-H/ as [H-L] can set off a chain reaction such that /Ø-H-Ø/ is then realized as [H-H-L]. The result would be bounded HTA, which has been reported only in closely related Kirundi and Kinyarwanda, with considerable phonetic variation (Meeussen 1959; Kimenyi 1976, 2002; Coupez 1980; Furere and Rialland 1983; Myers 2003). Philippson (1991: 186) summarizes the different realizations of /umugozí/ 'rope' as in (32).

(32) Bounded H tone anticipation (HTA) in Kirundi-Kinyarwanda: /umugozí/ 'rope'

	before L	**before H**	**before pause**
Rwanda	umugózí	umugózí	umugózi
"Hima"	umugózí	umugózi	umugózi
Standard Rundi	umugózi	umugózi	umugózi
Eastern Rundi	umúgózi	umúgózi	umúgózi

As seen, the final /H/ may be anticipated onto the penult, realized or not on its original TBU. In addition, Eastern Rundi shows anticipation + spreading (cf. Kinande in (34b,c) below). The intuition that many have had is that the H's in certain /H/ vs. Ø languages should be interpreted as accents. Concerning Kinyarwanda, Furere and Rialland (1983: 149–150) write: "Cette notion d' 'accent tonal' paraît ici bien adéquat dans la mesure où l' 'accent tonal' présente des caractéristiques bien typiquement accentuelles comme se déplacer en fonction d'exigences rythmiques mais où il est marqué par des tons et des plateaux mélodiques constitués de tons phonologiques." Kirundi-Kinyarwanda thus appear to follow Hyman's (1978: 264) generalization: "The more accentlike a H tone is, the more likely tonal anticipation will occur."

We can sidestep the thorny issue of how to know when a tone is an accent, but note that certain cases of HTA in European languages are also consistent with the view that tonal anticipation implies a certain kind of tone/accent. Such is the case in Belgrade Serbian, which Inkelas and Zec (1988) analyze with a synchronic rule of HTA, as seen in (33).

(33) Pretonic HTA in Belgrade Serbian (Inkelas and Zec 1988: 230–1)

a. 

b.

/papríka/	→	páprika	'pepper'
/raazlíka/	→	raázlika	'difference'
/ne-ráadnik/	→	né-ráadnik	'non-worker'

Such cases are consistent with the general tendency of pretonic position to be more prominent/less reduced than post-tonic position (see Barnes 2002 and references cited therein). Still in Europe, Hualde (2003: 256) describes an anticipatory accent-shift in Markina Basque, which is realized as a H to L pitch drop: lagúnek > lágunek 'the friends, ABS'.

Returning to Bantu, outside Kirundi-Kinyarwanda, languages with HTA are rare and have one or more of the following properties: (i) bounded HTA + delinking; (ii) unbounded HTA (±delinking); (iii) attraction to strong position (accent); (iv) attraction to weak position. As an example, consider the following complications in Kinande:

(34) Complications in Kinande (Hyman and Valinande 1985; Mutaka 1994; Hyman 1990)

a. /H/ spreads to preceding vowel and delinks
/e-ri-na-túm-a/ → e-ri-ná-tum-a... 'to send indeed'

b. /H/ is anticipated a second time within "macrostem"
/e-ri-na≠mu-túm-a/ → e-ri-ná-mú-tum-a... 'to send him indeed'

c. /H/ is anticipated a second time across words
/e-ki-ryatu ki-néne/ → e-ki-ryatú kí-nene... 'big shoe'
H

(34a) shows that the /H/ of /-túm-/ 'send' shifts onto the preceding vowel of /-na-/ 'indeed'. In (34b), however, the /H/ of /-túm-/ not only shifts onto the preceding object prefix /-mu-/, but also spreads onto /-na-/. The same double anticipation (shift + spread) occurs postlexically in (34c). The reason for this difference is that the form in (34a) contains a single domain, while (34b) and (34c) consist of two, marked by the boundary ≠ and a space, respectively. But how did HTA begin?

The claim of this section is that HTA is always initiated by right-edge factors in Bantu. As we have seen, one factor is attraction of the final tone to the penult. Another is the effect of a final boundary tone. In many tone languages /H/ is realized HL before pause. (In some three-level tone systems, /M/ becomes ML before pause.) Depending on which of these effects is the prime mover, and the order of subsequent changes, we get diachronic scenarios such as in (35).

(35) Development of tonal anticipation from Proto-Bantu *L-H before pause

a. Chichewa pattern: trigger = attraction to penult
*L-H > LH-H > H-H > H-HL > H-L

b. Luganda pattern: trigger = final contouring with L%
*L-H > L-HL > LH-HL > H-HL > H-L

The scenario in (35a) begins by attraction of the prepausal H to the penult, thereby creating a LH-H sequence, e.g. in standard Chichewa, where the penultimate vowel is also lengthened. The subsequent changes involve contour simplification (H-H), final contouring with L% (H-HL), and anticipatory absorption (H-L). The scenario in (35b) begins by final contouring with L%, thereby creating a L-HL sequence, as in Luganda. This can be followed by creating an anticipatory assist (LH-HL), contour simplification (H-HL) and anticipatory absorption (H-L). All of the stages in (35a,b) are attested in Bantu languages, which also frequently show comparable developments of final *H-L.

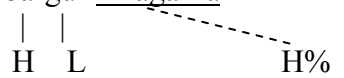
The implication of the above is that anticipatory tonal processes such as HTA are first phonologised before pause. As a consequence, in many Bantu languages, the only syllables affected are the two preceding pause. After prepausal phonologisation has occurred, the process may be extended in one of two ways. First, by boundary narrowing, HTA may be generalized to all phrase-final (and ultimately word-final) sequences, whether followed by pause or not. Or, as was seen in Kirundi-Kinyarwanda in (32) and Kinande in (34), right-edge HTA may cause a chain effect whereby internal H tones are 'pushed' further to the left. (34b,c) also show that where domain junctures are involved, HTA may apply twice (followed by delinking of the original H association).

As we have seen, some Bantu languages only have prepausal or phrase-final HTA. The implication is that no language will have internal HTA unless a final H is also anticipated. There is no corresponding implication concerning perseverative HTS: No language limits perseverative HTS to the first two syllables of an utterance (phrase etc.). As was seen in (13a), synchronic HTS sometimes fails to target a final syllable. Other than this restriction, when HTS is phonologised, all H tones participate. This is to be expected: Perseverative HTS phonologises the phonetic tendency for pitch targets to be realized late (30b). As argued by H&S and reinforced in this section, HTA does not have the same phonetic underpinnings. Rather, something else is always involved: an accent, boundary tone etc.

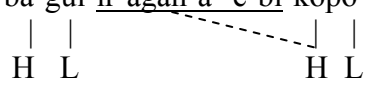
In addition to L%, some Bantu languages have a final H% boundary tone showing various functions. Although typologically unusual, H% marks declarative intonation in Luganda (Hyman and Katamba 1993b):

(36) Lexically toneless vowels anticipate H% or a H from the next word in Luganda

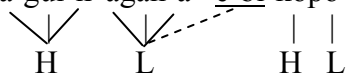
a. bá-gùl-ír- ágán-á ‘they are buying for each other’



b. bá-gùl-ír-ágán-á é-bí-kópò ‘they are buying cups for each other’
(cf. è-bì-kópò)



c. a-bá-gúl-ír-àgàn-à è-bì-kópò ‘they who are buying cups for each other’



In (36) the underlined sequences are lexically toneless. As indicated, the declarative H% boundary tone links to the sequence in (36a). In (36b), it is instead the lexical /H/ of ‘cups’ that spreads onto the same sequence. (36c) shows that HTA will not affect a L (which contrasts with Ø in Luganda). The example also shows that the prefix sequence *e-bi-* is realized L. HTA will not apply unless it can cross a word boundary. Instead, the preceding L spreads onto these vowels.

As in the case of *L-H discussed above, boundary tone effects begin with pause and are then generalized to smaller domains. We see evidence for this from Bukusu in (37).

(37) Bukusu verb forms, as realized in three contexts

	/xú-la-lim-il-an-a/	/xú-la-rém-er-an-a/	
a.	xù-là-lìm-ìl-àn-à	xù-lá-rèm-èr-àn-à	‘we will cultivate/cut for each other’
b.	xù-lá-lìm-ìl-àn-à...	xù-lá-rèm-ér-àn-à...	+ músìrò ‘... at night’
c.	xù-lá-lím-íl-án-á	xù-lá-rèm-ér-án-á	+ H% ‘will we cultivate/cut for e.o.?’

In these forms, underlined vowels have underlying /H/, while non-underlined vowels are underlyingly toneless. In (37a) we see the effects of two tone rules in Bukusu: First, the last rightmost /H/ is deleted before pause. This affects the first person plural subject prefix *xú-* in the left column and the verb *rém-* ‘cut’ in the right. As seen in *xù-lá-rèm-èr-àn-à*, where the H of *xú-* is not deleted, surviving H tones shift one vowel to the right. The forms in (37b) show the same verb forms as they are realized before *músìrò* ‘at night’: Consequently, the H tones on the verbs all survive and shift one vowel to the right. In (37c) the interrogative H%

boundary tone links to all of available toneless vowels. (Although not shown, Bukusu verbs may also end in a sequence of Ls, only the last of which will accept the H% tone.)

The above contrast between (37b) vs. (37c) suggests that HTA originates from intonational H% as in Bukusu, then generalizes to anticipate Hs occurs across words, as in Luganda (36b). A third step in this development is found in Tiriki, where unbounded HTA occurs within words as well:

(38) Bukusu > Luganda > Tiriki

a.	/xu-lol-a mu-limi/	→	xù-lòl-à mù-lìmì	'to see a farmer'
	/xu-lol-a mu-lína/	→	xú-lól-á mú-línà	'to see a friend'
b.	/mu-mu-vili/	→	mù-mù-vìlì	'in a body'
	/mu-mu-xúzu/	→	mú-mú-xúzù	'in a corpse'

In (38a) the H of /mu-lína/ 'friend' is anticipated onto all of the preceding toneless vowels. That HTA is not restricted to applying across word boundaries is seen in (39b), where the H of /mu-xúzu/ 'corpse' is anticipated onto the preceding two prefixes.

Although phrase-level HTA comes to be attested in the above ways, there appears to be a curious asymmetry. As the examples in (39) show, a H tone may either spread or shift to a metrically strong position across words:

(39) Perseverative attraction to metrically strong penult across words

a. rightward spreading to penultimate accent in Shambala (Philippson 1998: 320)

i. mawe magana mane na= miloŋgo mine '440 stones'

ii. magí mágána matátú ná= mílóŋgo mine '340 eggs'

b. rightward displacement to penultimate accent in Giryama (Philippson 1998: 321)

i. ku-tsol-a ki-revu 'to choose a beard' /-tsol-/ 'choose'

ii. ku-on-a ki-révu 'to see a beard' /-ón-/ 'see'

To my knowledge, no corresponding case has been reported where a H is anticipated onto the penult of a preceding word. This would be expected only if the preceding word were metrically strong and the host word weak. Although such cases sporadically arise in lexicalized compounds in Luganda, where the second member loses its H, phrasal strong-weak structure is not the norm in Bantu. Hence we do not expect phrase-level HTA to be metrically driven.

To summarize thus far, it is clear that HTA does exist in a small number of Bantu languages, to which we can add the complex case of Tonga, cited by van Spaandonck (1971). (Van Spaandonck's other case of HTA, Nkhumbi, is subject to reinterpretation.) There is, however, one remaining putative case of tone anticipation cited by Schadeberg (1977) which is widely attested: postradical vowels assimilate to the H tone of the final vowel. Meeussen (1961: 427) attributes HTA to Proto-Bantu: "les extensions—syllabes radicales sauf la première... avaient le ton bas, mais elles étaient représentées avec ton haut si elles étaient suivies d'une finale à tonalité haute...." This tonal agreement between extensions and the final vowel is illustrated from Lingala in (40).

(40) Lingala examples from Guthrie, cited by Schadeberg (1977: 198)

		'to get confused'		'to stagger'		
		pre-stem	**stem**	**pre-stem**	**stem**	**final V**
a.	infinitive:	kò-	kàk-àt-àn-à	kò-	tél-èng-àn-à	/-à/
	future:	nà-kò-	kàk-àt-àn-à	nà-kò-	tél-èng-àn-à	/-à/
	subjunctive:	ná-	kàk-àt-àn-à	ná-	tél-èng-àn-à	/-à/
b.	past:	nà-	kàk-át-án-<u>í</u>	nà-	tél-éng-án-<u>í</u>	/-í/
	remote past:	nà-	kàk-át-án-<u>á</u>	nà-	tél-éng-án-<u>á</u>	/-á/
	imperative:		kàk-át-án-<u>á</u>		tél-éng-án-<u>á</u>	/-á/

For comparison, consider anticipatory vowel harmony in Punu, schematized in (41).

(41) Anticipatory vowel harmony in Punu (Fontaney 1980: 55–56)

a.	/CVC-iCiC-a/	→	CVC-iCiC-ə	(postradical a → [ə])
	/CVC-uCuC-a/	→	CVC-uCuC-ə	(postradical a → [ə])
	/CVC-aCaC-a/	→	CVC-əCəC-ə	(postradical a → [ə])
b.	/CVC-iCiC-i/	→	CVC-iC-i	
	/CVC-uCuC-i/	→	CVC-uC-i	
	/CVC-aCaC-i/	→	CVC-<u>i</u>C<u>i</u>C-i	(postradical a → ə → i / __ i)
c.	/CVC-iCiC-u/	→	CVC-<u>u</u>C<u>u</u>C-u	(postradical i → u / __ u)
	/CVC-uCuC-u/	→	CVC-uCuC-u	
	/CVC-aCaC-u/	→	CVC-<u>u</u>C<u>u</u>C-u	(postradical a → ə → u / __ u)

Elsewhere I have proposed that stem-internal vowels constitute a "prosodic trough" in Bantu (Hyman 1998). As in the case of Punu vowel harmony, Meeussen's HTA may therefore be a sign of weakness (SOW): prosodically weak vowels can anticipate features from the final vowel. Most cases of vowel harmony and HTS are perseverative in Bantu, and there is no prohibition against weak elements taking on features from the final. What's important is that the process is again triggered by the right edge.

It should be noted, however, the argument for attributing the anticipated tone to the final vowel is indirect: Verb conjugation often varies the final vowel (*-a*, *-e*, *-i*) and/or final tone. It is therefore natural to assume that the two go together, i.e. that we have /-a, -e, -i/ vs. /-á, -é, -í/. There is some evidence that at least some suffixal Hs do not belong to the final vowel, but rather are enclitics, i.e. similar to tonal morphemes and boundary tones. We therefore have to leave open the possibility that the suffixal tones may have come from reduced postverbal elements, and that HTA is again a response to a push from the right.

I should like to conclude this section by briefly pointing out that tone anticipation has also figured prominently in observations concerning another phenomenon attested in Bantu: tone inversion. Note that both of the scenarios in (35) provide last stages where /L-H/ is realized as [H-L]. Among the languages where Proto-Bantu *H corresponds to synchronic /L/ are those in (42).

(42) HTA + delinking is more likely to lead to reanalysis of /H/ in terms of /L/ than HTS

a. L-marked languages, where /L/ poses no synchronic complications
   i. Ruwund: attributed to HTA (Nash 1992–1994)
   ii. Tembo: attributed to HTA & HTS (Kaji 1996)

iii. Luba: attributed to HTS (Maddieson 1976)

b. L-marked languages, where /L/ requires a H pre- and/or post-"bounce"

i. Tonga: /L/ is preceded by unbounded Hs (Carter 1971; cf. Meeussen 1963)

ii. Shi: /L/ is preceded by unbounded Hs, followed by one H (Polak-Bynon 1975)

iii. Sukuma: /L/ spreads once to right and is followed by one H (Batibo 1976)

The languages cited in (42a) have inverted the proto-Bantu tones and are non-controversially 'L-marked', i.e. they have underlying /L/ and H is the default tone. Nash (1992–1994) gives a very detailed and convincing account of how HTA fed into the reinterpretation of marked *H as /L/. The same appears to work in Tembo and Luba. (Maddieson 1976 proposes perseverative HTS as the source, but has difficulty explaining how proto L* sequences come to be reinterpreted as H*.) The languages cited in (42b) have not perfectly inverted the proto-Bantu tones. They have generally been analyzed with underlying /H/, but lend themselves to a reinterpretation with /L/. Tonga and Shi clearly have HTA + delinking of the original H. Sukuma, on the other hand, realizes a historical H two TBUs to the right of its original site. We can account for Sukuma as follows: (i) Sukuma has underlying /L/; (ii) bounded LTS requires a L to spread one syllable to the right; (iii) a L must be followed by a (single) H tone bounce. While (near-) perfect tone inversion seems to require HTA, a change from H-marked to L-marked can result from either anticipatory or perseverative horizontal tone assimilations.

5 Conclusion

The goal of this paper has been to update some of the claims made in the 1970s concerning the general properties of tone rules as they affect tonal sequences and tonal contours. Much of the focus has been on the directionality of horizontal tone assimilations. We have seen that tone spreading/shifting will be perseverative unless there is: (i) attraction to a strong (e.g. stressed) position (SOS); (ii) attraction to a weak (e.g. unstressed) position (SOW); (iii) pressure from the right edge (assignment of H%, erosion of final vowel etc.). In this last connection, such right-edge effects have been noted in the realization of intonational features as well: "Overall, the tendency was that for the most part the right hand prosodic context alters the *F*0 trajectories by pushing the F_0 peaks to the left" (Silverman and Pierrehumbert 1990: 90). It is encouraging to note that the categorical tone rules of Bantu and other tone languages not only have strong phonetic underpinnings, but also find parallels in intonational systems as well.

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