A foot-based Harmonic Serialism typology of Bantu bounded tone

Jeroen Breteler
j.m.w.breteler@uva.nl
University of Amsterdam

1 Towards a factorial typology of tone

The typology of tone is a longstanding research topic within OT (e.g. Meyers 1997; Yip 2002; Zoll 2003). Bantu bounded tone patterns have received particular attention in this respect (Bickmore 1996; Cassimjee and Kisseberth 1998; Key 2007). However, unlike analogous work on stress (Gordon 2002; Kager 2005), these works fail to investigate the full range of typological predictions that follow from their proposals. This talk presents a new approach to the typology of Bantu bounded tone, with a focus on investigating the range of predictions made.

An overview of bounded tone patterns is shown in (1). *σ́* is a high-toned syllable, other syllables are low.

(1)

Pattern	**UF**	**SF**	**Example attestation**
Binary spreading	*..σ́σ..*	*..σ́σ́..*	Ekegusii (Bickmore 1996)
Ternary spreading	*..σ́σσ..*	*..σ́σ́σ́*	Copperbelt Bemba (Bickmore and Kula 2013)
Binary shift	*..σ́σ..*	*..σσ́..*	Kikuyu (Clements 1984)
Bin. shift + bin. spread	*..σ́σσ..*	*..σσ́σ́..*	Saghala (Patin 2009)
Ternary shift	*..σ́σσ..*	*..σσσ́..*	Sukuma (Sietsema 1989)

The languages in (1) show a variety of spreading and shifting patterns. Crucially, this tonal mobility is restricted to a two or three-syllable domain. It is proposed that this domain is a manifestation of foot structure. The proposal fits with recent literature arguing for the organizing role of foot structure beyond stress assignment (Pearce 2006; Shimoji 2009; Bennett 2012).

2 Foot-driven tone in Harmonic Serialism

Previous research has analysed bounded tone using foot structure (see Sietsema 1989; Bickmore 1995, for overviews). There, foot edges mark the bounding domain. For example, binary shift might follow the steps in (2). Crucially, after step 2, spreading halts because the edge of the foot has been reached.

(2)

σ́σσ	→	*(σ́σ)σ*	→	*(σ́σ́)σ*	→	*(σσ́)σ*
0. UF		1. Footing		2. Spreading		3. Delinking

This proposal follows Martínez-Paricio and Kager (forthcoming), hereafter 'MPK', in assuming that a binary foot and an unparsed syllable can combine to form a layered, trisyllabic foot. The typological trend of two and three-syllable bounding then follows from languages preferring either binary or ternary feet.

Derivations such as (2) require a grammar that can model seriality. This talk adopts Harmonic Serialism ('HS', Prince and Smolensky 1993/2004; McCarthy 2010) for that purpose. HS is a variation of standard OT that makes two changes. Firstly, evaluation is serial; an output is fed back into the grammar until no changes occur. Secondly, GEN can only apply one 'operation' to the input, thus restricting the candidate set. The operations considered here are tone linking and delinking, foot construction, tone split, and tone deletion.

Finally, this talk proposes a constraint set to relate feet to tone. This proposal expands on De Lacy (2002) by allowing for licensing effects. The relevant constraints are instantiated for the different foot layers of MPK, and for both left and right edges of feet. The constraint set further includes standard faithfulness and markedness constraints for tone, and syllable parsing constraints taken from MPK.

3 Investigating the full typology

To keep the computation feasible, the typological investigation of the present approach has made several limitations. Firstly, the input is a single form, /σσσσσσσσσσσσσσσσσ/. The 17-syllable length of this form helps to distinguish between bounded and unbounded patterns, and various domain sizes. The middle syllable of the form is linked to a high tone. This way, both leftward and rightward patterns can be detected.

Secondly, a random sample of grammars is used. Specifically, 200,000 random constraint rankings were generated, and the input form was then fed to a HS grammar for each ranking. The outputs of these trials are collapsed across foot structures so that only surface tone is considered. Symmetrical results are also collapsed. Frequency counts for a selection of patterns are shown in 3.

(3)

Description	UF	SF	Frequency	Attestation
Faithful mapping	..σ́..	..σ̲́..	98229	✓
Deletion	..σ́..	..σ̲..	59851	✓
Bounded spread				
Binary spreading	..σ́σ..	..σ̲́σ́..	26587	✓
Ternary spreading	..σ́σσ..	..σ̲́σ́σ́	3371	✓
'Two-way' spreading	..σσ́σ..	..σ́σ̲́σ́..	2370	✗
Quaternary spreading	..σ́σσσ..	..σ̲́σ́σ́σ́..	67	✗
Bounded shift				
Binary shift	..σ́σ..	..σ̲σ́..	88	✓
Binary shift+spread	..σ́σσ..	..σ̲σ́σ́..	31	✓
Ternary shift	..σ́σσ..	..σ̲σσ́..	1	✓
Unbounded spread				
Unbounded to final	..σ́σ..σ]	..σ̲́σ́..σ́]	221	✓
Unbounded to penult	..σ́σ..σσ]	..σ̲́σ́..σ́σ]	186	✓
Unbounded to antepenult	..σ́σ..σσσ]	..σ̲́σ́..σ́σσ]	8	✓

The approach correctly predicts all the attested bounded tone patterns mentioned previously in (1). There is some overgeneration: the 'two-way' and quaternary spreading patterns are generated, but not attested. The full talk will discuss the role of extragrammatical factors in paring down the predicted typology.

An exciting result is the unbounded spreading category; although the framework was aimed at accounting for bounded patterns, unbounded patterns are also generated. The listed patterns are attested in a.o. Copperbelt Bemba (Bickmore and Kula 2013), Shambaa (Odden 1982), and Xhosa (Downing 1990), respectively. The full talk will discuss more generated patterns, including unbounded shift and iterative tone.

4 Conclusion

This talk has presented a HS framework using layered feet to account for Bantu bounded tone patterns. For the first time in tone typology, the framework's range of predictions was investigated, using a random sample of grammars. The predictions include attested and unattested bounded patterns, as well as attested unbounded patterns. In conclusion, this talk advances our understanding of problems in tone typology, and their potential solutions.

Selected references

Bennett, Ryan Thomas, 2012. *Foot-conditioned phonotactics and prosodic constituency*. PhD thesis, UC Santa Cruz.

Bickmore, Lee S, 1995. Tone and stress in Lamba. *Phonology*, 12(03):307–341.

Cassimjee, Farida and Kisseberth, Charles, 1998. Optimal domains theory and Bantu tonology. In Kisseberth, Charles and Hyman, Larry, editors, *Theoretical aspects of Bantu tone*, pages 33–132. CSLI.

De Lacy, Paul, 2002. The interaction of tone and stress in Optimality Theory. *Phonology*, 19(1):1–32.

Martínez-Paricio, Violeta and Kager, René, forthcoming. Non-intervention constraints and the binary-to-ternary rhythmic continuum. *Phonology*.

McCarthy, John J, 2010. An introduction to Harmonic Serialism. *Language and Linguistics Compass*, 4(10):1001–1018.