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OCP EFFECTS IN DAGAARE

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(1) In tone languages, adjacent high tones are often avoided. Different languages resolve the problem in different ways (see e.g. Myers 1997).

(2) Four responses to /H-H/ in Dagaare (Gur, Niger-Congo, Anttila and Bodomo 2000, Bodomo 1997, Kennedy 1966):

(a) Tonal polarity	(b) Downstep	(c) Merger	(d) No change
yí -rì	bú-ˡmá	kúlí	pí-kúú-rɔ̀
| |	| |	∣	| | |
H L	H ˡH	H	H H L
‘house-SG’	‘thing-PL’	‘go.home-PERF’	‘sheep-kill-IMPF’

(3) Questions:
- (a) Why are adjacent H tones sometimes not resolved?
- (b) Why do we have different resolutions in different words?

(4) Answers:
- (a) Adjacent H tones are resolved only if they belong to the same TONAL FOOT (Leben 1997, 2001, Zec 1999, cf. Akinlabi and Liberman 2000).
- (b) The choice among resolutions is morpholexical and depends on the identity of both the stem and the suffix morpheme. The result is derived by RANKING COMPOSITION.

1. Tonal polarity

(5) Three major tone patterns in nouns

	SINGULAR	PLURAL	TONE	
(a)	kùù-rí	kù-é	LH	‘hoe’
(b)	yí-rì	yí-è	HL	‘house’
(c)	nyúɔ́-rí	nyɔ́-ɛ́	HH	‘nose’
(d)	--	--	LL	--

(6) Tonal polarity as dissimilation. Kenstowicz et al. 1988 (Moore), see also Hyman 1993 (Dagbani), Cahill 1999:53-56 (Kɔnni).

	UR	ASSOCIATION	DISSIMILATION	OUTPUT
(a)	/kuu -ri/	kùù-rí	kùù-rí	kùù-rí
		| |	--	| |
	L H	L H		L H
(b)	/yi -ri/	yí -rí	yí -rì	yí -rì
		| |	| |	| |
	H H	H H	H L	H L

(7) H-H nouns have a toneless root:

	UR	ASSOCIATION	SPREADING	DISSIMILATION	OUTPUT
(a)	/nyʊɔ -rɪ/	nyúɔ́ -rɪ	nyúɔ́ -rí	--	nyúɔ́ -rí
	H	H	H		H

(8) The Kenstowicz et al. (1988) analysis has several correct consequences:
- (a) No dissimilation in H-H nouns because there is only one H tone.
- (b) No L-L nouns because there are no L suffixes.
- (c) In H-H nouns, the root becomes L if the suffix is absent:

nyúɔ́-rí + vìl-àá	**nyɔ̀**-vìl-àá	'nose-good-SG'
pɔ́g-ɔ́ + bíl-é + vìl-àá	**pɔ̀g-bìl**-vìl-àá	'woman-small-good-SG'

2. Downstep

(9) Three minor tone patterns in nouns

	SINGULAR	PLURAL	TONES		
(a)	pí[!]-rúú	píí-rɪ	H[!]H	HL	'sheep'
(b)	sáán-à	sáá[!]m-á	HL	H[!]H	'stranger'
(c)	sú-[!]á	súɔ́[!]n-í	H[!]H	H[!]H	'rabbit'

(10) [!]H is not M (cf. Buli, Akanlig-Pare & Kenstowicz 2003). There is no three-way tonal contrast (H, [!]H, L) on the initial syllable (Kennedy 1966:43). [!]H only occurs after H.

(11) Could downstep be a floating L (Clements & Ford 1979, Pulleyblank 1986)? This would "phonologize" the polarity/downstep distinction: /H-H/ → HL vs. /HL-H/ → H[!]H.

(12) Prediction: HL roots and H roots should differ in compounds. This is not so:

(a) Both types of roots trigger downstep on H-H:

yí-rì	bíl-é	yí-ꜜbíl-é	'house + small'
sʊ́-ꜜá	síí-rɛ́	sʊ́ɔ-ꜜsíí-rɛ́	'rabbit + skinner'

(b) Neither type of root triggers downstep on H-L:

yí-rì	dúó-rò	yí-dúó-rò	'house + climber'
sʊ́-ꜜá	kʊ́ʊ́-rɔ̀	sʊ́ɔ-kʊ́ʊ́-rɔ̀	'rabbit + killer'

(c) Neither type of root triggers downstep on HꜜH:

sáá-nà	píꜜ-rʊ́ʊ	sáá-píꜜ-rʊ́ʊ	'stranger + sheep'
náá-ꜜú	kʊ́ɔꜜr-áá	náá-kʊ́ɔꜜr-áá	'bullock + farmer'

(13) Our analysis of downstep: In a HH sequence the second H is interpreted phonetically at a lower pitch value than the first (/HH/ → HꜜH); see Carlson 1983 (Supyire), Liberman *et al*. 1993 (Igbo), and Odden 1982, 1986 (Kishambaa).

(14) Conclusion: /H-H/ may trigger either polarity or downstep. The choice is morpholexical.

3. No resolution: Tonal feet

(15) Why is H-H downstepped, but H-L and HꜜH are not ((12a) vs. (12bc))?

(16) Proposal: The domain of the OCP is the TONAL FOOT (Leben 1997, 2001, Zec 1999, cf. Akinlabi and Liberman 2000) which is cyclic and binary.

(17) Downstep within a tonal foot

pí-sɪɪ-rɛ́	→	pí-ꜜsíí-rɛ́	'sheep skinner', lit. 'sheep-skin-IMPF'
| |		| ⟍	
H H		(H ꜜH)	

(18) Polarity within a tonal foot, no resolution across feet

pí-kʊ́ʊ́-rɔ́	→	pí-kʊ́ʊ́-rɔ̀	'sheep killer', lit. 'sheep-kill-IMPF'
| | |		| | |	
H H H		H (H L)	

(19) Downstep within a tonal foot, no resolution across feet

náá-kʊ́ɔr-áá	→	náá-kʊ́ɔꜜr-áá	'cattle farmer', lit. 'cattle-farm-IMPF'
| | |		| | |	
H H H		H (H ꜜH)	

(20) The tonal foot analysis explains the absence of
  (a) downstep sequences (*H!H!H)
  (b) iterative polarity (*/HHH/ → HLL)

(21) OCP violations are systematically tolerated across words:

a	dɔ́b-ɔ́ pɔ́g-bɔ́	the man-PL woman-PL	'the men's wives'
	H H		

(22) /nă/ 'future' and /kŭng/ 'neg. future' show that postlexical HH sequences are not resolved:

(a)
à	bí-é	**dìg**-ré	!lá	sɔ́ɔ́!ŋ-áá
the	child-SG	chase-IMPF	FACT	rabbit

'The child is chasing a rabbit'

(b)
à	bí-é	nà	**díg**-ré	!lá	sɔ́ɔ́!ŋ-áá
the	child-SG	FUT	chase-IMPF	FACT	rabbit

'The child will be chasing a rabbit'

(c)
à	bí-é	kùng	**díg**-ré	sɔ́ɔ́!ŋ-áá
the	child-SG	FUT.NEG	chase-IMPF	rabbit

'The child will not be chasing a rabbit'

(23) Adjacent H tones within a verb

bi -e	na	dig -re	→	bí -é	nà	díg -ré	
↘	|	|		↘	|	|	|
H	LH	H		H	L	H	H

(24) Conclusion: Tonal foot construction is lexical, not postlexical.

4. Merger: The verbal paradigm

(25) Verbal tone paradigms: Root classes and morphological categories

		CITATION	IMPF	PERF	NOM	
		--	H	H	H	
(a) CLASS 1	--	LL	LH	LH	HH	
		bùrì	bùr-ó	bùrí	búr-úú	'soak'
(b) CLASS 2	H	HH	HL	HH	HL	
		kúlí	kúl-ò	kúlí	kúl-ùù	'go home'
(c) CLASS 3	H	HL	H!H	H!H	H!H	
		búrì	bú!r-ó	bú!rí	bú!r-úú	'fetch'

(26) Class 1: Rightward alignment and spreading

CITATION	IMPERFECTIVE	PERFECTIVE	NOMINAL	
bùrì	bùr-ó	bùrí	búr-úú	'soak'
	H	H	H	

(27) Class 2: Tonal polarity and merger

CITATION	IMPERFECTIVE	PERFECTIVE	NOMINAL	
kúlí	kúl -ò	kúlí	kúl-ùù	'go home'
H	H L	H	H L	

(28) Class 3: Downstep

CITATION	IMPERFECTIVE	PERFECTIVE	NOMINAL	
búrì	bú!r-ó	bú!rí	bú!r-úú	'fetch'
H	H !H	H!H	H !H	

(29) More evidence for tonal feet: downstep in verbs, /lá/ 'factitive'

	IMPERFECTIVE	PERFECTIVE	NOMINAL	
Class 1:	bùr-ó !lá	bùrí !lá	búr-úú	'soak'
	(H !H)	(H !H)	H	
Class 2:	kúl -ò lá	kúlí !lá	kúl-ùù	'go home'
	(H L) H	(H !H)	(H L)	
Class 3:	bú!r-ó lá	bú!rí lá	bú!r-úú	'fetch'
	(H !H) H	(H!H) H	(H !H)	

5. Summary

(30) Four possible responses to /H-H/: polarity, downstep, merger, no change.

(31) A summary of the attested tone patterns in disyllabic simple words:

	ROOT	SFX	SURFACE PATTERN		MORPHOLEXICAL CATEGORY
(a)	--	--	X.X	toneless	Class 1 verbs: citation form
(b)	L	H	L.H	no change	Class 2 nouns
(c)	H	--	H=H	spreading	Class 2 verbs: citation form
			H.X	left align	Class 3 verbs: citation form
(d)	--	H	H=H	spreading	Class 1 nouns
			X.H	right align	Class 1 verbs: imperfective, perfective
(e)	H	H	H.L	polarity	Class 2 nouns; Class 2 verbs: imperfective
			H$^{!}$H	downstep	Class 3 nouns; Class 3 verbs: imperfective, perfective
			H=H	merger	Class 2 verbs, perfective
			H.H	no change	Postlexical tonology

6. Constraints

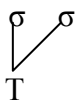
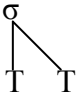
(32) Correspondence constraints on tone (McCarthy and Prince 1995)

(a)	MAX-IO(T)	("No deletion")	Each input tone has an output correspondent.
(b)	DEP-IO(T)	("No insertion")	Each output tone has an input correspondent.
(c)	UNIFORMITY(T)	("No merger")	Each output tone has at most one input correspondent.
(d)	INTEGRITY(T)	("No split")	Each input tone has at most one output correspondent.

(33) Identity constraints on tone

(a)	IDENT(T)	Do not change the value of a tone.
(b)	IDENT-ROOT(T)	Do not change the value of a root tone.

(34) Tone-TBU mapping constraints

	PATTERN	VIOLATES	
(a)		*SPREAD	'Every tone has at most one TBU.'
(b)		*CONTOUR	'Every TBU has at most one tone.'
(c)	T	*FLOAT	'Every tone has at least one TBU.'
(d)	σ	*TONELESS	'Every TBU has at least one tone.'

(35)

(a)	OCPφ	Avoid adjacent identical tones within a tonal foot.
(b)	ALIGN-RIGHT-SUFFIX	Every suffix tone is linked to the word-final TBU.

(36) 7 constraints are never violated (= Stratum 1), 5 are violated somewhere (= Stratum 2).

STRATUM 1		STRATUM 2
MAX-IO DEP-IO INTEGRITY IDENT-ROOT *CONTOUR *FLOAT ALIGN-RIGHT-SUFFIX	>>	UNIFORMITY IDENT OCP *SPREAD *TONELESS

(37) Different rankings of Stratum 2 constraints derive all and only the attested tone patterns.

(38) A schematic sample tableau for the input /H-H/

	STRATUM 1	STRATUM 2				
/$H_1.H_2$/		UNIF	IDENT-(T)	OCP	*SPREAD	*TLESS
a.→ H=$H_{1,2}$		*			*	
b. L=$L_{1,2}$	IDENT-RT					
c.→ $H_1.H_2$				*		
d. $H_{1,2}$.H	DEP-IO					
e. H.$H_{1,2}$	DEP-IO					
f. $L_1.L_2$	IDENT-RT					
g. $L_{1,2}$.L	IDENT-RT					
h. L.$L_{1,2}$	IDENT-RT					
i.→ $H_1.L_2$			*			
j. $H_{1,2}$.L	DEP-IO					
k. H.$L_{1,2}$	DEP-IO					
l. $L_1.H_2$	IDENT-RT					
m. $L_{1,2}$.H	IDENT-RT					
n. L.$H_{1,2}$	IDENT-RT					
o. X.$H_{1,2}$	IDENT-RT					
p. $H_{1,2}$.X	ALIGN-S					
q. X.$L_{1,2}$	IDENT-RT					
r. $L_{1,2}$.X	IDENT-RT					
s. X.X	IDENT-RT					

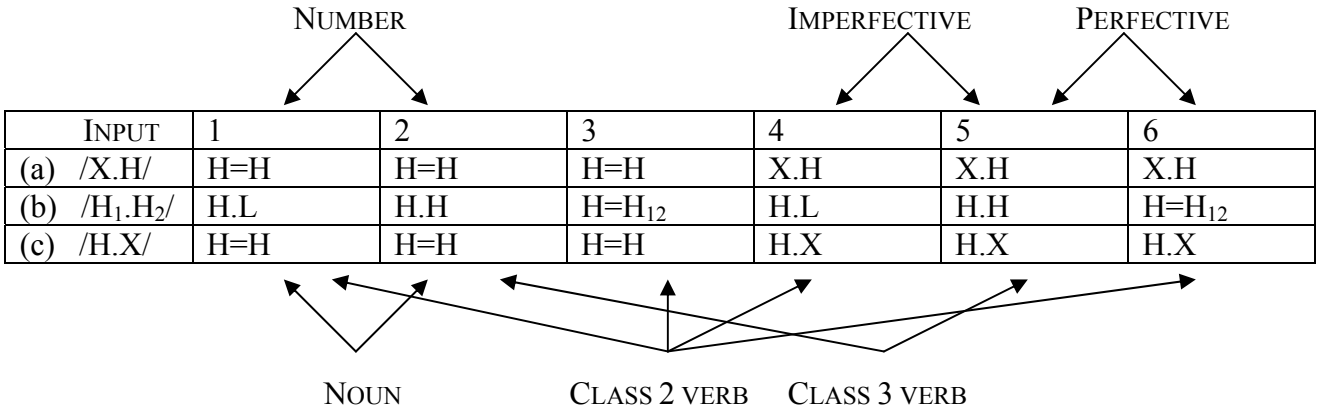
7. Tonal composition

(39) How are the morpholexically conditioned OCP effects derived?

(a) A morpheme specifies an underlying tone and a partial constraint ranking.

(b) The tone of the complex word is the concatenation of the tones of its constituent morphemes, evaluated by the union of their rankings.

(40) Factorial typology of {UNIFORMITY, IDENT, OCP, *SPREAD, *TONELESS}



INPUT	1	2	3	4	5	6
(a) /X.H/	H=H	H=H	H=H	X.H	X.H	X.H
(b) /$H_1.H_2$/	H.L	H.H	H=H_{12}	H.L	H.H	H=H_{12}
(c) /H.X/	H=H	H=H	H=H	H.X	H.X	H.X

(41)

NUMBER	*TLS >> *SPR; *SPR >> ID(T)	spreading, polarity, downstep
IMPERFECTIVE	*SPR >> *TLS; *SPR >> ID(T)	polarity, downstep
PERFECTIVE	*SPR >> *TLS; ID(T) >> *SPR	downstep, merger
NOUN	*TLS >> *SPR; *SPR >> ID(T)	(same as NUMBER)
CLASS 2 VERB	OCP >> *SPR; OCP >> ID(T)	polarity, merger
CLASS 3 VERB	ID(T) >> OCP; *SPR >> OCP	downstep

(42) RANKING COMPOSITION: The phonological form of a complex word is the concatenation of the phonological forms of its constituents, evaluated by the union of their rankings.

(43) (a) Union of rankings

[*kúlò*]
*SPR >> *TLS
*SPR >> ID(T)
OCP >> *SPR
OCP >> ID(T)

/kul-, H/ /-o, H/
OCP >> *SPR *SPR >> *TLS
OCP >> ID(T) *SPR >> ID(T)

(b) Intersection of columns

[*kúlò*]
{4}

/kul-, H/ /-o, H/
{1,3,4,6} {4,5}

(44) Tableau for *kúlò* 'go.home-IMPF'

/$H_1.H_2$/	OCP	*SPREAD	*TLESS	IDENT-(T)	UNIF
H=$H_{1,2}$		*!			*
$H_1.H_2$	*!				
→ $H_1.L_2$				*	

(45) Tonally neutral morphemes: Class 1 verb roots have neither tones nor rankings, e.g. the tone in *bùró* 'soak-IMPF' is entirely dictated by the suffix.

8. Deriving tone in nominals

(46) Analyzing the six tonal classes of nouns

	SINGULAR	PLURAL	TONE		
(a)	kùù-rí	kù-é	LH		‘hoe’
(b)	yí-rì	yí-è	HL		‘house’
(c)	nyúɔ́-rí	nyɔ́-ɛ́	HH		‘nose’
(d)	pí!-rúú	píí-rì	H!H	HL	‘sheep’
(e)	sáán-à	sáá!m-á	HL	H!H	‘stranger’
(f)	sú-!á	súɔ́n-í	H!H	H!H	‘rabbit’

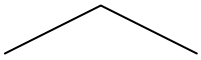
(47) A three-way classification of nominal morphemes (noun roots, number suffixes)
- (a) Morphemes that trigger/undergo polarity: *yí-* (root); *-rí, -é -á* (suffixes)
- (b) Morphemes that trigger/undergo downstep: *súóŋ-* (root); *-má, -rúú* (suffixes)
- (c) Morphemes that do either: *pí-, sáá-* (roots); *-úú* ’nominalizer’ (suffix)

(48) Polarity and downstep correspond to one single ranked constraint pair:
- (a) POLARITY NOUN/NUMBER noun ranking ∪ OCP >> ID(T)
- (b) DOWNSTEP NOUN/NUMBER noun ranking ∪ ID(T) >> OCP
- (c) OTHER NOUN/NUMBER noun ranking

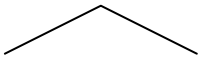
(49) A polarity noun and a downstep noun

(a) [*kúl-ùù*]

*TLS >> *SPR
*SPR >> ID(T)
OCP >> ID(T)
OCP >> *SPR

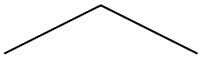


/kul-, H/	/-uu, H/
OCP >> ID(T)	*TLS >> *SPR
OCP >> *SPR	*SPR >> ID(T)

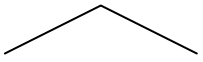


(b) [*bú!r-úú*]

*TLS >> *SPR
*SPR >> ID(T)
ID(T) >> OCP
*SPR >> OCP



/bur-, H/	/-uu, H/
ID(T) >> OCP	*TLS >> *SPR
*SPR >> OCP	*SPR >> ID(T)



(50) Tableau for *bú$^{!}$r-úú* 'fetch'

/$H_1.H_2$/	*TLESS	*SPREAD	IDENT-(T)	OCP	UNIF
H=$H_{1,2}$		*!			*
→ $H_1.H_2$				*	
$H_1.L_2$			*!		

9. Implications for morphological theory

(51) Three types of morphemes

	UNDERLYING FORM	PARTIAL RANKING	MORPHEME TYPE
(a)	/*x*/	--	item
(b)	--	*a* >> *b*	process
(c)	/*x*/	*a* >> *b*	item and process

10. Conclusions

(52) The avoidance of adjacent high tones is universal (= the OCP).

(53) The resolutions are language-specific, even lexeme-specific.

(54) We have maintained universal phonological constraints by assuming
- (a) tonal feet as the domain of the OCP
- (b) a combinatorial theory of morphology
- (c) that lexical phonology reduces to lexeme-specific constraint rankings

References

Akinlabi, Akin & Mark Liberman (2000). Tonal Complexes and Tonal Alignment. In Minjoo Kim & Uri Strauss (eds.) *NELS 31*.

Akanlig-Pare, George & Michael Kenstowicz (2003). Tone in Buli. *Studies in African Linguistics* **31**. 55-96.

Anderson, Stephen (1992). *A-morphous Morphology*. Cambridge: Cambridge University Press.

Anttila, Arto (2002). Morphologically Conditioned Phonological Alternations. *NLLT* **20**. 1-42.

Anttila, Arto & Adams Bodomo (2000). Tonal Polarity in Dagaare. In Vicki Carstens & Frederick Parkinson (eds.) *Trends in African Linguistics 4: Advances in African Linguistics.* Trenton, NJ: Africa Worlds Press. 119-134.

Bodomo, Adams (1997). *The Structure of Dagaare*. Stanford Monographs in African Languages. Stanford, California: CSLI Publications.

Bodomo, Adams (2000). *Dàgáárè*. Languages of the World / Materials 165, Lincom Europa.

Cahill, Mike. 1999. *Aspects of the Phonology and Morphology of Kɔnni*. Ph.D. dissertation, Ohio State University.

Carlson, Robert (1983). Downstep in Supyire. *Studies in African Linguistics* **14**. 35-45.

Clements, George N. (1983). The Hierarchical Representation of Tone Features. In Ivan R. Dihoff (ed.) *Current Approaches to African Linguistics, Vol. 1*. Dordrecht—Holland and Cinnaminson—USA: Foris Publications. 145-176.

Clements, G. N. & K. C. Ford (1979). Kikuyu tone shift and its synchronic consequences. *LI* **10**. 179-210.

Dakubu, M. E. K. (1982). The tones of Dagaare. Manuscript, Language Centre, University of Ghana, Legon, Accra.

Goldsmith, John (1976). *Autosegmental phonology*. Ph.D. dissertation, MIT.

Goldsmith, John (1984). Meeussen's Rule. In Mark Aronoff & Richard T. Oehrle (eds.) *Language Sound Structure. Studies in Phonology Presented to Morris Halle by His Teacher and Students*. Cambridge, Massachusetts: MIT Press. 245-259.

Hall, Edward (1977). Dagaare. In M. K. Dakubu (ed.) *West African Language Data Sheets, Vol. I*. The West African Language Society.

Hyman, Larry M. (1979). A Reanalysis of Tonal Downstep. *Journal of African Languages and Linguistics* **1**. 9-29.

Hyman, Larry (1993). Structure preservation and postlexical tonology in Dagbani. In Sharon Hargus & Ellen Kaisse (eds.) *Phonetics and Phonology, Volume 4: Studies in Lexical Phonology*. San Diego, California: Academic Press. 235-254.

Hyman, Larry & Knut Olawsky (2000). Dagbani verb tonology. In Victor Manfredi (ed.) *Proceedings of 31st Annual Conference on African Linguistics*.

Kennedy, Jack (1966). *Collected Field Reports on the Phonology of Dagaari*. Collected Language Notes No. 6, The Institute of African Studies, University of Ghana.

Kenstowicz, Michael, Emmanuel Nikiema & Meterwa Ourso (1988). Tonal polarity in two Gur languages. *Studies in the Linguistic Sciences* **18**. 77-103.

Leben, William R. (1973). *Suprasegmental phonology*. Ph.D. dissertation, MIT.

Leben, William R. (1978). The representation of tone. In Victoria Fromkin (ed.) *Tone: A Linguistic Survey*. New York: Academic Press. 177-219.

Leben, William R. (2001). Tonal Feet. Paper presented at *Typology of African Prosodic Systems Workshop*, Bielefeld University, Germany, May 18-20, 2001.

Liberman, M., J. M. Schultz, S. Hong & V. Okeke (1993). The Phonetic Interpretation of Tone in Igbo. *Phonetica* **50**. 147-160.

McCarthy, John J. (1986). OCP Effects: Gemination and Antigemination. *LI* **17**. 207-263.

McCarthy, John J. & Alan S. Prince (1995). Faithfulness and reduplicative identity. In Jill N. Beckman, Laura W. Dickey & Suzanne Urbanczyk (eds.) *Papers in Optimality Theory*, University of Massachusetts, Amherst: GLSA. 249-384.

Myers, Scott (1997). OCP Effects in Optimality Theory. *NLLT* **15**. 847-892.

Odden, David (1982). Tonal phenomena in Kishambaa. *Studies in African Linguistics* **13**. 177-208.

Odden, David (1986). On the Obligatory Contour Principle in phonological theory. *Lg* **62**. 353-383.

Prince, Alan & Paul Smolensky (1993/2004). *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, Massachusetts: Blackwell Publishing.

Pulleyblank, Douglas (1986). *Tone in Lexical Phonology*. Dordrecht: Reidel.

Stump, Gregory (2001). *Inflectional Morphology: A Study of Paradigm Structure*. Cambridge: Cambridge University Press.

Yip, Moira (1988). The Obligatory Contour Principle and Phonological Rules: A Loss of Identity. *LI* **19**. 65-100.

Zamma, Hideki (2005). Predicting Varieties: Partial Orderings in English Stress Assignment. Manuscript, ROA-712-0205.
Zec, Draga (1999). Footed Tones and Tonal Feet: Metrical Constituency in a Pitch Accent Language. *Phonology* **16**. 225-264.
Zwicky, Arnold (1985). How to describe inflection. In Mary Niepokuj, Mary van Clay, Vassiliki Nikiforidou & Deborah Feder (eds.) *BLS 11*, 372-386.

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