

Towards a Typology of Postlexical Tonal Neutralizations

Larry M. Hyman
University of California, Berkeley

Paper presented at the International Conference on Phonetics and Phonology, January 25-27, 2013, National Institute for Japanese Language and Linguistics, Tachikawa, Japan

ABSTRACT

This paper surveys a number of contributing factors which result in postlexical tonal neutralizations, including properties of the target and trigger, the nature and extent of the process, and the domain within which the process occurs. Distinguishing between “intentional” vs. “incidental” neutralization, I illustrate neutralizations which result from assimilatory processes, reductions, and overwriting (by morphology, syntax or intonation). Of particular interest are systems such as Kalabari, an Ijoid language spoken in Nigeria, that exhibit phrasal reduction + melodic overwriting. After sorting out the different kinds of postlexical neutralization processes that occur (and in which environments), I present the typological generalizations which emerge. For example, one clear tendency is for the lexical N or V head of an XP to undergo modification in both head-initial and head-final languages. While this is clear in the case of tonal reduction and tonal overwriting, I consider how this generalization interacts with the tendency for tonal assimilations to be perseverative (vs. accentual phenomena, which are often anticipatory). Since there is some ambiguity and disagreement concerning the prosodic analysis of certain languages, e.g. the different dialects of Japanese, an accurate understanding of such phenomena may ultimately be useful in determining whether a given language is tonal vs. accentual.

1. Intentional vs. incidental neutralization

Specialists of accentual systems are well aware that word-based prominences often neutralize postlexically, and hence fail to receive full phonetic realization at the phrase level. Specialists of tone systems are equally aware that lexical tonal contrasts can be neutralized at the phrase level by a number of processes, some of which are suggestive of “accentual” behavior. In this paper I attempt to provide an overview of the issues involved in postlexical (phrasal) tonal neutralizations across different languages and prosodic systems. Logically we can distinguish the following relevant parameters of tonal neutralization:

- (1) a. properties of the target (e.g. H, L, all tones)
- b. properties of the trigger (e.g. a tone, domain boundary, grammatical construction, intonation)
- c. nature of the process (e.g. assimilation, dissimilation, reduction, melodic overwriting)
- d. extent of the process (e.g. total neutralization of all tones vs. of some tones)
- e. domain of the process (e.g. compounds, phonological phrase, intonational phrase)

In what follows I will distinguish between *intentional neutralization*, where the process in question has neutralization as an explicit goal, vs. *incidental neutralization*, where the process in question produces neutralization as an innocent bystander. It is well-known that tonal contrasts may not be completely realized on words in isolation. A rather striking example of intentional neutralization occurs in Coreguaje, a Tukanoan language of Colombia, schematized in (2).

(2)	CVCV:	<i>Basic form</i>	<i>statement</i>	<i>question</i>	CVV:	<i>Basic form</i>	<i>statement</i>	<i>question</i>
		/H-H/	L-HL	H-L		/H/	HL	HL
		/H-L/	L-HL	H-L		/HL/	HL	HL
		/L-L/	L-HL	H-L		/L/	LH	HL
		/L-H/	L-HL	H-L				

As seen, all four combinations of underlying /H/ and /L/ on CVCV nouns merge as L-HL with statement intonation and as H-L with question intonation. Thus Gralow (1985: 3) states: "...we found that in certain frames there were four contrasting sets, but in isolation phrase stress completely neutralized the contrasts, at least in CVCV nouns." Also indicated in (2), CVV nouns undergo similar neutralization, but maintain a distinction between /L/ vs. /H/ and /HL/ in statements. Corejuage thus provides a rather dramatic example of how intonation often obscures tonal contrasts. Since words in isolation are subject to intonation, we are reminded of Pike's (1948) insistence on finding the best "frame" to reveal the full extent of the tonal contrasts. The Corejuage case is an example of *intentional* neutralization: the intonational melodies directly overwrite the lexical tones and thus explicitly enforce the neutralizations.

Sometimes it is not obviously an intonational melody that overwrites the lexical tones, but rather a boundary tone which has such an effect. In Hakha Lai, a Tibeto-Burman language spoken in Myanmar and Northeast India, words are largely monosyllabic, contrasting two different tones in isolation (Hyman & VanBik 2004: 823):

- (3) a. HL hmâa 'wound' lûŋ 'heart' râal 'enemy'
 b. HL kêe 'leg' hrôm 'throat' kôoy 'friend'
 c. L sàa 'animal' ràŋ 'horse' kòom 'corn'

Although the noun tones in (3a,b) are identical in isolation, when preceded by a toneless pronominal proclitic such as *ka=* 'my', they differ:

- (4) a. HL ka= hmâa 'my wound' ka= lûŋ 'my heart' ka= râal 'my enemy'
 b. LH ka= kêe 'my leg' ka= hrôm 'my throat' ka= kôoy 'my friend'
 c. L ka= sàa 'my animal' ka= ràŋ 'my horse' ka= koom 'my corn'

As seen, the nouns in (4a) remain HL after *ka=*, while those in (4b) are realized LH. The natural analysis is to consider the latter to be underlyingly /LH/. The reason why /LH/ is realized HL in (3b) is related to the fact that Hakha Lai doesn't permit LH to be preceded by a H tone feature. Thus, as seen in (5a), an input /LH/ + /LH/ sequence is realized LH + HL after *ka=*:

- (5) a. /ka= kooy + kee/ → ka= kôoy kêe 'my friend's leg'
 LH LH LH HL
 b. /kooy/ → kôoy 'friend'
 %H LH HL

If we posit an initial %H boundary tone in (5b), the same rule will convert /LH/ to HL in utterance-initial (and isolation) forms. In this case the merger of /LH/ with /HL/ as [HL] is an

example of *incidental* neutralization, the consequence of a tone rule triggered by either a lexical or boundary tone.

That this second type of neutralization is incidental is seen even more clearly in closely related Kuki-Thaadow, which contrasts three tones (Hyman 2010: 32-33):

- (6) a. /HL/ vâa ‘bird’ lâm ‘path’ môot ‘banana’
 b. /H/ thỏo ‘fence’ găm ‘country’ khũoy ‘bee’
 c. /L/ hlàa ‘wing’ vò? ‘pig’ hùn ‘garden’

As indicated in (6b), /H/ words are realized LH in isolation. This can be related to a rule of L tone spreading whereby /L/ + /H/ is realized L + LH, as in (7a).

- (7) a. /vò? + thỏo/ → vò? thỏo ‘pig’s fence’
 L H L LH
 b. /thỏo/ → thỏo ‘fence’
 %L H LH

As in Hakhai Lai, a boundary tone is needed in (7b), this time %L, in order to predict the realization of /H/ as LH on isolation forms. However, unlike the change of /LH/ to HL in Hakha Lai, in this case there is no neutralization, since Kuki Thaadow does not contrast /H/ and /LH/. This shows that boundary tones and tonal assimilation rules do not exist explicitly to neutralize underlying contrasts, although there sometimes is an incidental neutralization.

2. Recoverable vs. unrecoverable neutralization

Often when two tones do merge phonetically, their underlying tones can be identified by their effect on other tones. Such a situation arises in Kuki-Thaadow, where rules of H tone spreading and contour simplification have the following effects:

- (8) a. /H/ + /L/ → H + HL
 b. /HL/ + /L/ → H + L (also applies to derived HL; see (9c))

As seen in (9a,b), /gám/ ‘country’ and /môot/ ‘banana’ neutralize as H before /hùn/ ‘garden’:

- (9) a. /khuoy + gam + huon/ → khúoy gám hùn ‘bee’s country garden’
 H H L H H HL
 b. /khuoy + moot + huon/ → khúoy móot hùn ‘bee’s banana garden’
 H HL L H H L
 c. /khuoy + vo? + huon/ → khúoy vó? hùn ‘bee’s pig garden’
 H L L H H L

This is directly due to the rule in (8b), whereby the /HL/ of /môot/ is simplified to H before /L/. However, as also noted, the tones of /hùn/ are different: Rule (8a) has spread the H of /gám/ to produce a HL on [hùn], whereas H tone spreading does not occur in (9b), since /môot/ has an underlying /HL/ tone. While the phrases in (9a) and (9b) thereby remain distinct, there is a

complete neutralization between (9b) and (9c). This is because the /L/ of /vòʔ/ undergoes H tone spreading (8a) to merge with the /HL/ of /môot/. Both then undergo contour simplification (8b).

Another distinction is therefore useful based on the syntagmatic recoverability of merged tones: *Recoverable neutralization* occurs when the underlying contrast can be recovered contextually, as in the case of [gám] vs. [móot] in (9a) vs. (9b). *Unrecoverable neutralization* occurs when the underlying contrast cannot be contextually determined, as in the case of [móot] vs. [vòʔ] in (9b) vs. (9c). While such syntagmatic recoverability is especially common in tone, it also occurs in segmental phonology. Thus consider the following examples from Yaka, a Bantu language spoken in the Democratic Republic of Congo (Kidima 1991; Hyman 1995: 21):

- (10)
- | | | | |
|----|-------------------------|-----------------------|------------|
| | <i>nasal harmony</i> | <i>denasalization</i> | |
| a. | /m-mak-idí/ → m-mak-iní | → m-bak -iní | ‘I carved’ |
| b. | /m-bak-idí/ | → m-bak -idí | ‘I caught’ |

In (10a) the perfective suffix /-idí/ becomes [-iní] by long distance nasal harmony with the root-initial /m/ of /mak-/ ‘carve’. This is followed by a rule of postnasal denasalization by which /mm/ becomes [mb]. In (10b), where the root is /bak-/ ‘catch’, there is no nasal harmony. As a result, the underlying contrast between the /m/ of /mak-/ and the /b/ of /bak-/ is recoverable from the nasal of [-iní] vs. the oral consonant of [-idí]. Of course if the roots had instead been directly followed by the general inflectional final vowel /-a/, as in other tenses, there would have been unrecoverable neutralization.

3. Morphologically triggered neutralization

At the lexical or word level it is extremely common for specific derivational or inflectional morphology to neutralize tones by assigning a tonal melody, as in Kalabari [Ijoid; Nigeria] (Harry & Hyman 2012):

- (11)
- | | | | | | | |
|----|-----------------------|-------------------|---------------------|---------|-------|-----------------------|
| | <i>transitive</i> | | <i>intransitive</i> | | | |
| a. | kán | H | ‘tear demolish’ | kàán | LH | ‘tear, be demolished’ |
| | kòn | L | ‘judge’ | kòón | LH | ‘be judged’ |
| b. | ányá | H-H | ‘spread’ | ànyá | L-H | ‘be spread’ |
| | díma | L-L | ‘change’ | dímá | L-H | ‘change’ |
| | sá [↓] kí | H- [↓] H | ‘begin’ | sàkí | L-H | ‘begin’ |
| c. | kíkíma | H-H-L | ‘hide, cover’ | kíkímá | L-L-H | ‘be hidden, covered’ |
| | pákírí | H-L-H | ‘answer’ | pàkírí | L-L-H | ‘be answered’ |
| | gbóló [↓] má | H-H- | ‘join, mix up’ | gbòlómá | L-L-H | ‘be joined, mixed up’ |
| | | [↓] H | | | | |

In the first column of examples, we see that verbs may contrast several different tone patterns. On the right we observe a process of detransitivization whereby a /LH/ melody replaces the lexical tones of the verb: This will result in a rising LH tone on monosyllabic verbs, L-H on bisyllabic verbs, and L-L-H on trisyllabic verbs. Such derivational tonal processes are not rare. As seen in the following examples from different languages, the tonal melodies that are assigned by such processes are arbitrary (and can be all L):

- (12) a. $V \rightarrow N$ (\widehat{HL}) in Standard Mandarin [tone marking standardized]
 shán ‘to fan’ H → shân ‘fan’ HL (Wang 1972: 489)
 lián ‘to connect’ LH → lián ‘chain’ HL
 shù ‘to count’ L(H) → shù ‘number’ HL
- b. $N \rightarrow A$ (all H) in Chalcatongo Mixtec [Otomanguean; Mexico]
 bīkò ‘cloud’ M-L → bīkó ‘cloudy’ H-H (Hinton et al 1991: 154;
 sòʔò ‘ear’ L-L → sóʔó ‘deaf’ H-H Macaulay 1996: 64)
 káʔbā ‘filth’ H-M → káʔbá ‘dirty’ H-H
- c. $A \rightarrow V$ (all L) in Lulubo [Central Sudanic; Sudan]
 ōsú ‘good’ M-H → òsù ‘to become good’ L-L (Andersen
 àkēlí ‘red’ L-M-H → àkèli ‘to become red’ L-L-L 1987:51)
 áfǒró ‘yellow’ H-H-H → àfǒrò ‘to become yellow’ L-L-L

4. Neutralization by postlexical reduction

There are three different situations which may arise when the tones are reduced postlexically:

- (13) a. reduction, especially to all L pitch
 b. reduction + a phonological effect triggered by the tone of a non-reduced word
 c. reduction + melodic overwriting determined by construction

We discuss the first two in this section. What is perhaps most striking about postlexical tonal neutralizations is that the result is often all L pitch. This is particularly so in languages with privative /H/ vs. \emptyset contrasts, suggesting that the reduction process is one of tone deletion. One such case comes from Haya, a Bantu language of Tanzania (Hyman & Byarushengo 1984), where L is unmarked in the following examples:

(14)	<i>no reduction before DEM, NUM</i>		<i>reduction before POSS, ADJ</i>		
	‘that ...’	‘one ...’	‘our ...’	‘Kato’s ...’	‘good ...’
‘frog’	ekikéle kili	ekikéle kimo	ekikele kyáitu	ekikele kyaa Káto	ekikele kilúngi
‘basket’	ekikapú kili	ekikapú kimo	ekikapu kyáitu	ekikapu kyaa Káto	ekikapu kilúngi
‘tale’	ekigano kili	ekigano kimo	ekigano kyáitu	ekigano kyaa Káto	ekigano kilúngi

Although there is no reduction before demonstratives or numerals, the /H/ root tones of /é-ki-kéle/ ‘frog’ and /é-ki-kapú/ ‘basket’ are deleted before possessives and adjectives. (By a separate process the /H/ on the initial vowel /é-/ is deleted postpausally.) Many verb forms also lose their H tones when followed by a post-verbal element, e.g. the personal name *Káto* in (15).

(15) a. ‘they tie’ etc.	b. ‘they tie Kato’ etc.	
ba-kóm-a	ba-kom-a káto	PRESENT HABITUAL
bá-á-kôm-a	ba-a-kom-a káto	TODAY PAST
ba-kom-íl-e	ba-kom-il-e káto	YESTERDAY PAST
ba-a-kóm-ag-a	ba-a-kom-ag-a káto	PAST HABITUAL
ba-laa-kôm-a	ba-laa-kom-a káto	TODAY FUTURE
ba-li-kóm-a	ba-li-kom-a káto	GENERAL FUTURE

Besides illustrating neutralization to L pitch, the examples in (15) illustrate Gussenhoven's (2006: 204) observation that "... in languages generally it is not uncommon for verbs to have reduced prominence in relation to their objects." Thus, verbs are often unaccented or toneless in languages such as Somali (Hyman 1981) and Basque (Hualde 1991: 153). Haya also underscores the fact that there are often corresponding neutralizations in both noun and verb phrases.

Reduction to L is also well-known from Shanghai Chinese (Zee 1987; cf. Selkirk & Shen 1990). Thus, in (16), the tones are deleted from the non-initial words which are pronounced with L pitch:

- (16) a. $\begin{matrix} \text{ɕiŋ} & + & \text{vəŋ} & & \rightarrow & \text{ɕiŋ} & \text{vəŋ} & & \text{'news'} & < & \text{ɕiŋ} & \text{'new'} & \text{(HL)} \\ \text{HL} & & \text{LH} & & & \text{H} & \text{L} & & & & & & \end{matrix}$
- b. $\begin{matrix} \text{ɕiŋ} & + & \text{vəŋ} & + & \text{tɕia} & \rightarrow & \text{ɕiŋ} & \text{vəŋ} & \text{tɕia} & \text{'news reporting circle'} \\ \text{HL} & & \text{LH} & & \text{MH} & & \text{H} & \text{L} & \text{L} & \end{matrix}$
- c. $\begin{matrix} \text{ɕiŋ} & + & \text{ɕiŋ} & + & \text{vəŋ} & + & \text{tɕi} & + & \text{tɕe} & \rightarrow & \text{ɕiŋ} & \text{ɕiŋ} & \text{vəŋ} & \text{tɕi} & \text{tɕe} & \text{'new news reporter'} \\ \text{HL} & & \text{HL} & & \text{LH} & & \text{MH} & & \text{MH} & & \text{H} & \text{L} & \text{L} & \text{L} & \text{L} & \end{matrix}$

However, as seen in (17), the endpoint of a contour tone, here the H of the /MH/ rising tone of $k^h\Lambda?$ 'cough', goes on the second word, the rest of the phrase being L:

- (17) a. $\begin{matrix} k^h\Lambda? & + & s\gamma & & \rightarrow & k^h\Lambda? & s\gamma & & \text{'to cough'} \\ \text{MH} & & \text{MH} & & & \text{M} & \text{H} & & \end{matrix}$
- b. $\begin{matrix} k^h\Lambda? & + & s\gamma & + & d\tilde{a} & \rightarrow & k^h\Lambda? & s\gamma & d\tilde{a} & \text{'cough drops'} \\ \text{MH} & & \text{MH} & & \text{LH} & & \text{M} & \text{H} & \text{L} & \end{matrix}$
- c. $\begin{matrix} k^h\Lambda? & + & s\gamma & + & j\Lambda? & + & s\gamma & + & b\eta & \rightarrow & k^h\Lambda? & s\gamma & j\Lambda? & s\gamma & b\eta & \text{'cough tonic bottle'} \\ \text{MH} & & \text{MH} & & \text{LH} & & \text{MH} & & \text{LH} & & \text{M} & \text{H} & \text{L} & \text{L} & \text{L} & \end{matrix}$

This is what was meant by "reduction + a phonological effect" in (13b). A similar pattern involving noun compounding occurs in Barasana, a Tukanoan language of Colombia (Gomez & Kenstowicz 2000:433-4) which contrasts H-H, H-L, L-H, L-HL on bisyllabic words (~ = nasality):

- (18) a. $\begin{matrix} \text{H-H} & + & \text{H-L} & \rightarrow & \text{H-H} & + & \text{H-H} & \sim\acute{\text{id}}\acute{\text{e}} & \sim\text{b}\acute{\text{i}}\acute{\text{d}}\acute{\text{i}} & \text{'bird (sp.)'} & (\sim\text{b}\acute{\text{i}}\acute{\text{d}}\acute{\text{i}} & \text{'bird'}) \\ \text{H-H} & + & \text{L-H} & \rightarrow & \text{H-H} & + & \text{H-H} & \sim\text{k}\acute{\text{o}}\text{b}\acute{\text{e}} & \text{c}\acute{\text{o}}\acute{\text{t}}\acute{\text{i}} & \text{'metal cooking pot'} & (\text{c}\acute{\text{o}}\acute{\text{t}}\acute{\text{i}} & \text{'cooking pot'}) \\ \text{H-H} & + & \text{L-HL} & \rightarrow & \text{H-H} & + & \text{H-H} & \text{h}\acute{\text{e}}\acute{\text{a}} & \sim\text{g}\acute{\text{i}}\text{t}\acute{\text{a}}\text{-}\acute{\text{a}} & \text{'flint stone'} & (\sim\text{g}\acute{\text{i}}\text{t}\acute{\text{a}}\text{-}\acute{\text{a}} & \text{'stone-CL'}) \end{matrix}$
- b. $\begin{matrix} \text{H-L} & + & \text{H-L} & \rightarrow & \text{H-L} & + & \text{L-L} & \sim\acute{\text{u}}\acute{\text{j}}\acute{\text{u}} & \sim\text{k}\acute{\text{u}}\text{b}\acute{\text{a}} & \text{'kind of fish stew'} & (\sim\text{k}\acute{\text{u}}\text{b}\acute{\text{a}} & \text{'stew'}) \\ \text{H-L} & + & \text{L-H} & \rightarrow & \text{H-L} & + & \text{L-L} & \sim\text{k}\acute{\text{i}}\acute{\text{i}} & \text{j}\acute{\text{e}}\text{c}\acute{\text{e}} & \text{'peccary (sp.)'} & (\text{j}\acute{\text{e}}\text{c}\acute{\text{e}} & \text{'peccary'}) \\ \text{H-L} & + & \text{L-HL} & \rightarrow & \text{H-L} & + & \text{L-L} & \text{h}\acute{\text{e}}\acute{\text{e}} & \text{r}\acute{\text{i}}\text{k}\acute{\text{a}} & \text{'tree fruits (in ritual)'} & (\text{r}\acute{\text{i}}\text{k}\acute{\text{a}} & \text{'fruits'}) \end{matrix}$

As seen, the neutralized tone of the second member of the compound depends on the tone of the first. One interpretation is that there is tone reduction + spreading of the last tone of the first word. As seen in the next set of data, this would not be an isolated case.

In Kalabari, an Ijoid language of Nigeria, bisyllabic nouns and verbs contrast the following five tonal patterns:

(19)	a. <i>nouns</i>	b. <i>verbs</i>
L-L :	pùlò ‘oil’	sèlè ‘choose’
H-L :	sírì ‘leopard’	pùmà ‘break’
L-H :	gàrí ‘garri’	dǒkí ‘discover, find out’
H-H :	féní ‘bird’	éí ‘see’
H- [↓] H :	wá [↓] rí ‘house’	jí [↓] ké ‘shake’

In this head-final (OV) language, when an object is present, the verb loses its tones and copies the last tone of the object (Harry & Hyman 2012):

(20)	a. the object ends L	éí → èrì	(= sèrè, pùmà, dǒkì, jíkè)
	pùlò ‘oil’ L-L	→ ò pùlò èrì té [↓] é	‘he has seen the oil’
	bélè ‘light’ H-L	→ o bélè èrì té [↓] é	‘he has seen light’
	lùbùlù ‘sheath’ L-L-L	→ o lùbùlù èrì té [↓] é	‘he has seen the sheath’
	b. the object ends H-H, H- [↓] H	sèlè → sélé	(= pùmá, dǒkí, éí, jíké)
	námá ‘meat’ H-H	→ ò námá sélé té [↓] é	‘he has chosen the meat’
	wá [↓] rí ‘house’ H- [↓] H	→ ò wá [↓] rí sélé té [↓] é	‘he has chosen the house’
	búrú má ‘indigo’ H-H-H	→ ò búrú má sélé té [↓] é	‘he has chosen the indigo’
	c. the object ends L-H	sèlè → [↓] sélé	(= [↓] pùmá, [↓] dǒkí, [↓] éí, [↓] jíké)
	gàrí ‘garri’ L-H	→ ò gàrí [↓] sélé té [↓] é	‘he has chosen the garri’
	kókàlí ‘fruit’ H-L-H	→ ò kókàlí [↓] sélé té [↓] é	‘he has chosen the fruit’

In (20a), verbs become all L if the object ends L, while in (20b) verbs become all H if the object ends H-H or H-[↓]H (where [↓]H = a downstepped H). These changes take place independent of the input tone pattern or syllable length of the verb. The one complication is observed in (20c): When the object ends L-H, the H spreads, as expected, but a downstep is inserted by a general rule of the language. This, then, is a rather clear case of reduction + tonal assimilation.

4. Neutralization by postlexical reduction + melodic overwriting

In the previous section we observed straight reduction, as well as reduction combined with a phonological effect such as tone spreading from the preceding word. The third situation consists of reduction + assignment of a specific melody by construction. To illustrate this we can remain with Kalabari, in which the noun occurs at the end of the noun phrase. As illustrated via the /H-H/ word *námá* ‘meat, animal’ in (21), a preceding modifier assigns one of four tone melodies to the following noun (Harry 2004, Harry & Hyman 2012):

(21)	<i>construction</i>	<i>phrasal tones</i>	<i>example</i>
a.	N _{poss} + N	HL	tùbò námà ‘the child’s meat’
b.	PRO _{poss} + N	HLH (→ H- [↓] H)	ìnà ná [↓] má ‘their meat’
c.	Determiner + N	LH	tò námá ‘which meat?’
d.	Quantifier + N	L	jà námá ‘some meat’

Possessive noun assign HL, while possessive pronouns assign a HLH melody (realized in the example as H-[↓]H). Demonstratives and other determiners assign LH, while numerals and other quantifiers assign an all L melody. The five tone patterns on bisyllabic nouns seen earlier in (19a) are shown in (22) all to acquire the above tone melodies:

(22)					<i>'the child's'</i>	<i>'their'</i>	<i>'which'</i>	<i>'some'</i>
					(HL)	(HLH)	(LH)	(L)
a.	féní	'bird'	H-H	→	tùb̀d̀ féní	ìnà fé [↓] ní	t̀d̀ fèní	jà fèní
b.	pùlò	'oil'	L-L	→	tùb̀d̀ pùlò	ìnà pù [↓] lò	t̀d̀ pùlò	jà pùlò
c.	sírì	'leopard'	H-L	→	tùb̀d̀ sírì	ìnà sí [↓] rì	t̀d̀ sìrì	jà sìrì
d.	gàrí	'garri'	L-H	→	tùb̀d̀ gàrí	ìnà gà [↓] rì	t̀d̀ gàrì	jà gàrì
e.	wá [↓] rì	'house'	H- [↓] H	→	tùb̀d̀ wàrì	ìnà wá [↓] rì	t̀d̀ wàrì	jà wàrì

As seen in (23), the whole noun phrase is implicated as intervening modifiers will also undergo reduction + melodic overwriting, e.g. of the determiner /LH/ melody:

(23)	a.	DEM + NUM + N :	mí [↓] ná	+	sóná	+	féní	→	mí [↓] ná	s̀nà	fèní	'these five animals'
			HLH		H-H		H-H		HLH	L	H	
	b.	DEM + ADJ + N :	mí	+	òpù	+	sírì	→	mí	òpù	sìrì	'this big leopard'
			H		L-L		H-L		H	L	H	

The examples in (24) similarly show that the two possessive melodies, /HL/ and /HLH/ are assigned to recursive genitive noun phrases:

(24)	a.	HL:	tùb̀d̀	+	féní	+	námá	→	tùb̀d̀	fèní	nàma	'the child's bird's meat'
			L-L		H-H		H-H		L H	H	L	
			féní	+	m̀njì	+	kúkú	→	fèní	m̀njì	k̀kù	'the bird's water pot'
			H-H		L-L		H-H		H-H	H	L	
	b.	HLH:	ì	+	féní	+	námá	→	ì	fèní	nàma	'my bird's meat'
			L		H-H		H-H		L	H	L H	
			í	+	m̀njì	+	kúkú	→	í	m̀njì	k̀kù	'your sg. water pot'
			H		L-L		H-H		H	H	L H	

For discussion of how these melodies are aligned, as well as other properties of the Kalabari tone system, see Harry & Hyman (2012).

While all of the above cases involve reduction of words “on the right”, it is also possible to get quite comparable reduction of the PRECEDING word, as in Tommo So, a Dogon language of Mali. In Tommo So, adjectives and demonstratives, but not numerals, make the preceding noun all L (Heath & McPherson, to appear; McPherson 2012):

(25)					<i>reduction to all L</i>			<i>no reduction</i>		
	<i>noun</i>	<i>gloss</i>		→	<i>'black'</i>		<i>'this'</i>		<i>'three'</i>	
a.	gámmá	'cat'	H-H	→	gámmà	gém	gámmà	nó	gámmá	tàandú
b.	tàgá	'shoe'	L-H	→	tàgà	gém	tàgà	nó	tàgá	tàandú
c.	pállà	'strip of cloth'	H-L	→	pállà	gém	pállà	nó	pállà	tàandú

As in Kalabari, intervening modifiers may also be affected by reduction:

(26)		<i>'black'</i>	<i>'this'</i>		<i>'three'</i>	<i>'black'</i>		<i>'three'</i>	<i>'these'</i>	
	<i>'cat'</i>	gàmmà	gè̀m	nó	gàmmà	tààndù	gém	gàmmà	tààndù	nò=mbé
	<i>'shoe'</i>	tàgà	gè̀m	nó	tàgà	tààndù	gém	tàgà	tààndù	nò=mbé
	<i>'strip'</i>	pàllà	gè̀m	nó	pàllà	tààndù	gém	pàllà	tààndù	nò=mbé

As was stated above, the expectation is that the target of reduction will be the lexical N or V of the corresponding NP/VP. Further evidence that most postlexical reduction targets the lexical head is that the trigger may occur on either side of the noun in Tommo So. Specifically, possessors precede the noun, while other modifiers follow. As seen in (27), possessive nominals and alienable possessive pronouns assign L; inalienable possessive pronouns assign bisyllabic H-H, trisyllabic H-L-L (McPherson 2012: 14-15):

(27)	a.	gámmá	<i>'cat'</i>	H-H	→	íí=gε	gàmmà	L-L	<i>'the child's cat'</i> (gε = def.)
					→	wómɔ	gàmmà	L-L	<i>'his/her cat'</i>
	b.	jàndùlu	<i>'donkey'</i>	L-H-Ø	→	sána	jàndùlù	L-L-L	<i>'Sana's donkey'</i>
					→	mímɔ	jàndùlù	L-L-L	<i>'my donkey'</i>
	c.	bàbé	<i>'uncle'</i>	L-H	→	mí	bàbé	H-H	<i>'my uncle'</i>
		ánigé	<i>'friend'</i>	H-H-H	→	mí	ánigè	H-L-L	<i>'my friend'</i>

The examples in (27) establish that specific melodies can be assigned from either side of the noun, thereby setting up a potential conflict between triggers. For an analysis in terms of c-command, see McPherson (2012).

5. Lexical triggers of phrasal phonology

In §4 we saw that in both Kalabari and Tommo So specific construction can assign different melodies to the head noun of the noun phrase, entrapping intervening modifiers on their way. In Kalabari this meant that the first modifier of the NP determines the melody for the whole NP, with some variation (see Harry & Hyman 2012). A seemingly related phenomenon concerns cases where it is the *lexical* identity of the first modifier that determines the overall NP melody. To illustrate, let us start with another Ijoid language, the Bumo dialect of Izon. As described by Efere (2001: 158-9), Bumo distinguishes the four tone classes A-D, whose tones and tone assignment properties are indicated in (28).

(28)	<i>class</i>	<i>isolation tone</i>	<i>tone pattern determined by the A-D class of phrase-initial word</i>
	A	(L) H	all syllables in the phrase = H
	B	(L) H	first word = all H; subsequent syllables = L
	C	(L) H-L	first word keeps its HL drop, subsequent syllables = L
	D	(L) H	first word = all H, H on the first syllable of the second word; subsequent syllables = L

In (28) the L in parentheses refers to the fact that initial vowels can, but do not have to be L tone. As seen, classes A, B and D otherwise have all H tone, while class C exhibits a H to L pitch drop

somewhere within the word (but not as a falling tone on the last syllable). What is important is the effect on what follows. As seen in the following illustrations of the indicated A-D words in the frame ... /náná kímí/ ‘man who owns/has....’ (whose tones are deleted), the crucial distinction appears to be where a drop to L tone will occur, if any:

- (29) A /bɛɛ/ [bɛ́ɛ́] ‘pot(s)’ → bɛ́ɛ́ náná kímí (no L; H all the way to the end)
 B /warí/ [wárí] ‘house’ → wárí nà̀nà kìmì (L starts on σ_1 of second word)
 C /sêrì/ [sé̀rì] ‘scarf’ → sé̀rì nà̀nà kìmì (L starts on σ_2 of first word)
 D /ikɛ̃/ [ikíé] ‘friend’ → ikíé náná kìmì (L starts on σ_2 of second word)

As indicated in the underlying representations, which are a slight variant of Eferé’s analysis, I have considered a “Japanese” analysis involving a /HL/ “pitch accent”: Class A words have no pitch-accent. Class B and class C words contrast only in that the former has a pitch accent on the final syllable, while the latter has a pitch-accent on a non-final syllable. Class D words are “post-accenting”, meaning that the H is assigned the first syllable of the next word, followed immediately by a drop to L.

There are at least two significant differences between Kalabari and Bumo. The first is that the phrasal melodies are determined by construction (or word class) in Kalabari vs. by lexical classes which in turn might lend themselves to an underlying analysis such as the one considered in (29). The second one has to do with the issue of neutralization with which we are concerned. Strictly speaking, three of the tone patterns are neutralized as (L) + all H in isolation forms—the differences coming out only in phrasal contexts. If the /HL/ pitch accent analysis is correct, this directly results from the fact that both the syllable that carries the pitch accent as well as those which precede are pronounced H. This, then, is a sort of reverse neutralization situation: lexical neutralization vs. postlexical contrast.

The Bumo case is not isolated, but in fact is found in tone systems even beyond Africa. In the Move dialect of Yagaria, a Papuan language of Papua New Guinea, Ford (1993: 196-7) distinguishes between tonally stable (S) vs. unstable (U) adjectives, illustrated in (31).

- (30) a. S hógà ‘left’ → hógà kàyàlè ‘left pig’ (no change) + all L
 S fáipái ‘white’ → fáipái kàyàlè ‘white pig’ (no change) + all L
 b. U₁ kòlí ‘scared’ → kòlí káyálé ‘scared pig’ (L-L + H-H-H)
 U₂ fèlá ‘wild’ → fèlá káyálé ‘wild pig’ (L-L + L-H-H)
 U₃ lòlé ‘two’ → lòlé káyálé ‘two pigs’ (L-L + L-L-H)

At issue is how nouns such as /káyálé/ ‘pig’ are treated. In (30a) the stable adjectives keep their tones and the noun is reduced to all L. In (30b) the three classes of unstable adjectives, which are all L-H in isolation, become L-L, but condition a different tonal assignment on the following noun. Although Ford doesn’t provide more data to test this, it appears that the modifier + noun sequence can have H tone(s) only on one of the two words. In all cases the adjective determines what happens to the lexical head noun /káyálé/, whose underlying /L-H-L/ is not observed in any of the examples. Whereas the Bumo patterns differ in where a L tone begins, if present, the unstable adjective + noun patterns appear to differ in where a H begins on the noun, either on the first (U₁), second (U₂) or third (U₃) syllable of the noun. Syllables which follow are themselves also H. It is tempting to conceptualize this as a difference in where a /LH/ pitch accent is assigned. However analyzed, the tonal contrasts again are lexically neutralized in the word in isolation, but contrastive phrasally.

The third and final case I will consider is Urarina, an isolate spoken in Peru, in which most words occur as all L + one final H in isolation. As described by Olawsky (2006: 128), when occurring as object, the four noun tone classes A-D assign a H tone differently onto a following verb. This is illustrated in (31), where L tone is unmarked:

(31)	A	raaná	‘peccary (sp.)’	→	raana rú.a.kaa	‘he has carried a peccary’
	B	obaná	‘peccary (sp.)’	→	obana rü.a.káá	‘he has carried a peccary’
	C	reemaé	‘dog’	→	reemae rü.a.kaá	‘he has carried a dog’
	D	makusajarí	‘pepper’	→	makusajarí rü.a.kaa	‘he has carried the pepper’

Olawsky identifies the above patterns as follows:

- (32) *class tone pattern determined by A-D class of the phrase-initial word*
- A first word = L; H is assigned to initial syllable of following word
 - B first word = L; H is assigned to 2nd/3rd syllable of following word depending on syllable weight
 - C first word = L; H is assigned to last syllable [mora?] of the final word of the phrase
 - D first word keeps its final H tone, the following word being all L

In this case, the tone class of the object noun determines where a single H tone will be realized.

As pointed out, the above systems show differences with the construction-triggered postlexical neutralizations in Kalabari and Tommo So. But there are also similarities, especially in considering how one might account for the tonal patterns. One possibility is to establish different co-phonologies (see Inkelas 2011 and references cited therein), either by construction or on the lexical triggers themselves which place tones differently on what follows. Concerning Ijoid in general, Williamson (1988) analyzes tonal classes such as Izon’s A-D as having different floating tones to assign to the rest of the noun phrase (often with OCP violations). Woodbury (2012) presents an interesting parallel analysis of San Marcos Zacatepec Eastern Chatino, an Otomanguean language spoken in Mexico, while Harry & Hyman (2012) show how at least three of the four tonal melodies of Kalabari develop diachronically from lost connectives whose tones contribute to the creation of the phrasal melodies. Although apparently all Ijoid languages show tonal reductions within the phonological phrase, it is interesting that some trigger the melodic overwriting constructionally, others lexically.

6. Partial postlexical neutralization

One of the parameters mentioned in (1d) is the extent of neutralization. Most of the above examples have involved total neutralization: all tones have the same output in a given neutralizing context. In Northern Mao, an Omotic language of Ethiopia, there is only partial neutralization. As described by Ahland (2012: 145), “... the [nine] citation melodies of two-syllable nouns (the vast majority of nouns in the language) collapse into three melodies when they are modified by any element: MM, ML and LL.” Ahland identifies these latter as “construction noun melodies” with clear reference to notion of “construct state”, known from Berber and other languages. The correspondences are shown in (33).

(33)	<i>Citation Tone Classes</i>			<i>“Construct Noun Melody”</i>
	H-H ₁	→		M-M
	M-M, L-L, H-L ₁ , M-H, M-L	→		M-L
	H-H ₂ , H-L ₂ , L-H	→		L-L

As seen, there are two H-H and two H-L patterns, which are identified with subscripts. In the examples in (34) we see that the above changes take place on the noun independent of the tone of the preceding modifier (Ahland 2012: 147-9):

(34)	a.	k'èts'é	'land'	H-H ₁	→	íʃ	k'èts'è	M-M	'the land'
					→	nà	k'èts'è	M-M	'this land'
	b.	p'íʃè	'child'	M-M	→	íʃ	p'íʃè	M-L	'the child'
					→	nà	p'íʃè	M-L	'this child'
	c.	mùnts'è	'woman'	H-L	→	íʃ	mùnts'è	L-L	'the woman'
					→	nà	mùnts'è	L-L	'this woman'

Besides being only a partial neutralization, it is not clear whether this phenomenon is comparable to Kalabari and Tommo So. One difference is that intervening modifiers are not affected: “...only the head noun/nominal (I.e. whatever serves as the head of the NP) takes on the construct form” (Michael Ahland, pers.comm.). While McPherson reports a similar situation with respect to the head of relative clauses, the neutralizations otherwise generally affect the whole phonological phrase (where we have evidence, which unfortunately is lacking in Yagaria and Urarina). Still, there is no reason why comparable postlexical tonal neutralizations could not be partial.

7. Conclusions

In the preceding sections I have presented some of the factors which condition postlexical tonal neutralizations. Focus has been on what was termed intentional neutralization, i.e. cases where neutralization is directly implicated in the process itself vs. being an indirect byproduct, as it is in incidental neutralization. Especially in the lexical trigger cases in §5, we saw rather impressive examples of neutralization recoverable only from the phrasal realizations. Clearly underrepresented here are cases where neutralization results from defocusing and other forms of accentual reduction. Whereas phrasal de-accenting does not cause a word-stressed syllable to become stressless, de-accenting a H tone often causes the tone-bearing unit to become toneless. Such an example from Nubi, an Arabic-based Creole spoken in Uganda, is discussed by Gussenhoven (2006: 206): Whereas the H tone is contrastive in *pángisa* ‘to rent to someone’ vs. *pangisa* ‘to rent from someone’, the two words merge as all L tone in gerund deaccenting reduction. The result is ambiguity: *pangisa júa séma má* ‘renting a house to/from someone is not good.’

One inescapable generalization from the above examples is that reduction/neutralization most frequently involves a non-head targeting the head of a construction. In (35) modification of the lexical head is schematized as $N \rightarrow N'$, $V \rightarrow V'$ triggered by X, which stands for a modifier, specifier, or complement, whether preceding or following the N or V:

- | | | | | |
|------|---------------------------|---------------------------|---------------------------|---------------------------|
| (35) | $N \rightarrow N' / _ X$ | $N \rightarrow N' / X _$ | $V \rightarrow V' / _ X$ | $V \rightarrow V' / X _$ |
| | Haya (14) | Shanghai (16) (17) | Haya (15) | Urarina (31) |
| | Tommo So (25) | Barasana (18) | (+ many more) | Kalabari (20) |
| | | Kalabari (21) | | |
| | | Tommo So (27) | | |
| | | Yagaria (30) | | |
| | | N. Mao (33) | | |

I know of no case where the head is systematically the trigger of neutralization on modifiers within the noun phrase, or where the verb is the trigger of neutralization on, say, a direct object. However, I have found one case where lexical triggering goes from head to modifier, as seen in the following adjective + noun sequences in Urarina (Olawsky 2006: 122):

- | | | | | | | |
|------|---|---------------|------------------|---|-----------------------|---------------|
| (36) | B | <i>hjaané</i> | ‘achiote (tree)’ | → | <i>hjaane lanáhaj</i> | ‘red achiote’ |
| | C | <i>hjaané</i> | ‘urine’ | → | <i>hjaane lanaháj</i> | ‘red urine’ |

Recall from (31) that the four classes of object nouns A-D determine the tonal output on a following verb. The two nouns in (36), a minimal pair in terms of their phrasal effects, do the same to the following adjective ‘red’: the class B noun *hjaané* thus assigns a H to the second syllable of ‘red’, while the homophonous class C noun *hjaané* ‘urine’ assigns a H to the final syllable of ‘red’. The question is whether we should expect to find cases where nouns cause following adjectives to neutralize their tones? If yes, then the generalization based on (35) is false, and lexical heads can be both targets and triggers of postlexical tonal neutralizations. If no, then we still may be able to hypothesize that lexical determination of postlexical tone can either go from non-head to lexical head or from left-to right. In this case we would not expect the mirror image of Urarina, where the triggering adjective precedes the noun. Related to this is a potential directional asymmetry: Since non-assimilatory processes typically involve a nonhead trigger and a lexical head target, and since tonal assimilations are typically perseverative, we might expect few(er) cases of postlexical tonal neutralization by assimilation in head-final languages.

Of course there is always the possibility that we may not be able to unambiguously identify which element is the trigger and which is the target. This naturally brings us to languages like Japanese and Basque which have tone/accent assignment rules that potentially override the tonal properties of both constituents, particularly in the case of compounding. As an example, in Tokyo Japanese the following three compounding patterns are observed when the second element is short (Kubozono 1993:15-16):

- | | | | | | | | | | | | |
|------|----|---------------|--------------------------|----------------|-----------|-------------|-------------|---------|--------------------|---------------------|-------------------|
| (37) | a. | preaccenting: | <i>kábùto</i> | ‘helmet’ | + | <i>musi</i> | ‘insect’ | → | <i>kabutó-mùsi</i> | ‘beetle’ | |
| | | b. | deaccenting: | <i>syákài</i> | ‘society’ | + | <i>tóò</i> | ‘party’ | → | <i>syakai-too</i> | ‘Socialist party’ |
| | | c. | N ₂ -initial: | <i>pérùsya</i> | ‘Persian’ | + | <i>nékò</i> | ‘cat’ | → | <i>perusya-nékò</i> | ‘Persian cat’ |

Concerning Basque, Hualde (1995: 184) states that “in present-day western varieties, compounds are normally accented on either the last syllable of the first member or the first

syllable of the second member, with preferences depending on the variety.” Excepting the cases with lexical triggers, the constructional neutralizations involved a trigger which keeps its tones vs. a target or targets whose tones are neutralized. In the case of compounding, however, the tone patterns are sometimes defined over the whole constituent, both elements of which may lose their lexical tones. An interesting question is whether there is anything comparable to this at the higher phrase level, i.e. configurations which assign a melody to the whole construction, thereby neutralizing the tones of the lexical head AND the non-head(s).

To summarize, we have seen the following in the above discussion:

(i) Postlexical tonal neutralizations can be either an incidental byproduct of a tone rule or a boundary tone, or an intentional effect of a neutralizing process, e.g. intonation, reduction, constructional melody assignment.

(ii) Constructional neutralizations typically involve a lexical head target and a non-head trigger, which can occur in either order.

(iii) Although postlexical tonal neutralization is usually total, it may also be partial, as in Northern Mao.

(iv) While postlexical neutralization may be more expected in a two-height privative /H/ vs. \emptyset system, it is also attested in /H, L/ and multiheight systems, e.g. in Northern Mao, which contrasts /H, M, L/.

(v) For this reason postlexical tonal neutralization may not be probative in determining whether a prosodic system is tonal vs. accentual.

With regard to this last point, stress-accent systems have not been known to assign different stress patterns at the phrase level, whether by construction or by lexical trigger. Thus, neutralizing constructional melodies may be another indication that tone can do things that nothing else can (Hyman 2011).

References

- Ahland, Michael Bryan. 2012. *A grammar of Northern Mao (Màwés Aas'è)*. Unpublished doctoral dissertation, University of Oregon.
- Andersen, Torben. 1987. An outline of Lulubo phonology. *Studies in African Linguistics* 18.39-651.
- Ford, Kevin. 1993. A preliminary comparison of Kamano-Yagaria. *Language and Linguistics in Melanesia* 24.191-202.
- Gomez-Imbert, Elsa & Michael Kenstowicz. 2000. Barasana tone and accent. *IJAL* 66.419-463.
- Gralow, Frances L. 1985. Coreguaje: Tone, stress and intonation. In Ruth M. Brend (ed.), *From phonology to discourse: studies in six Colombian languages*, 3-11. Lang. Data, Amerindian Series No. 9. Dallas: SIL.
- Gussenhoven, Carlos. 2006. Between stress and tone in Nubi word prosody. *Phonology* 23.192-223.
- Harry, Otelemate. 2004. *Aspects of the tonal system of Kalabari-Ijo*. Stanford: C.S.L.I.
- Harry, Otelemate & Larry M. Hyman. 2012. Construction tonology: The case of Kalabari. Ms. University of the West Indies, Mona and University of California, Berkeley.
- Heath, Jeffrey & Laura McPherson. To appear. Tonosyntax and reference restriction in Dogon NPs.. *Language*.
- Hinton, Leanne, Gene Buckley, Marv Kramer & Michael Meacham . 1991. Preliminary analysis of Chalcatongo Mixtec tone. *Southern Illinois University Occasional Papers in Linguistics* 16.147-155.

- Hualde, José Ignacio. 1991. *Basque phonology*. London & New York: Routledge.
- Hualde, José Ignacio. 1995. Reconstructing the ancient Basque accentual system: Hypotheses and evidence. In José Ignacio Hualde, Joseba A. Lakarra & R. L. Trask (eds), *Towards a history of the Basque language*, 171-186. Amsterdam: John Benjamins.
- Hyman, Larry M. 1995. Nasal consonant harmony at a distance: The case of Yaka. *Studies in African Linguistics* 24.5-30.
- Hyman, Larry M. 2010. Kuki-Thaadow: An African tone system in Southeast Asia. In Franck Floricic (ed.), *Essais de typologie et de linguistique générale*, 31-51. Lyon: Les Presses de l'Ecole Normale Supérieure.
- Hyman, Larry M. 2011. Tone: Is it different? In John Goldsmith, Jason Riggle & Alan Yu (eds), *The Handbook of Phonological Theory*, 2nd edition, 197-239. Blackwell.
- Hyman, Larry M. & Kemmonye C. Monaka. 2011. Tonal and non-tonal intonation in Shekgalagari. In Sonia Frota, Gorka Elordieta & Pilar Prieto (eds), *Prosodic categories: production, perception and comprehension*, 267-290. Springer Verlag.
- Hyman, Larry M. & Kenneth VanBik. 2004. Directional rule application and output problems in Hakha Lai tone." In *Phonetics and Phonology, Special Issue, Language and Linguistics* 5.821-861. Academia Sinica, Taipei.
- Inkelas, Sharon. 2011. The interaction between morphology and phonology. In John Goldsmith, Jason Riggle & Alan Yu (eds), *The Handbook of Phonological Theory*, 2nd edition, 68-102. Blackwell.
- Kidima, Lukowa. 1991. *Tone and accent in KiYaka*. Unpublished doctoral dissertation, UCLA.
- Kisseberth, Charles W. 2009. The theory of prosodic phrasing: the Chimwiini evidence. ACAL 40, Urbana-Champaign, April 9-11, 2009.
- Kubozono, Haruo. 1993. *The organization of Japanese prosody*. Tokyo: Kurosio Publishers.
- Macaulay, Monica. 1996. *A grammar of Chalcatongo Mixtec*. Berkeley & Los Angeles: University of California Press.
- McPherson, Laura. 2012. Replacive grammatical tone in the Dogon languages: A factorial typology. Prospectus of doctoral dissertation, UCLA.
- Olawsky, Knut J. 2006. *A grammar of Urarina*. Berlin: Mouton de Gruyter.
- Pike, Kenneth L. 1948. *Tone languages*. Ann Arbor, MI: University of Michigan.
- Selkirk, Elisabeth & Tong Shen. 1990. Prosodic domains in Shanghai Chinese. In Sharon Inkelas & Draga Zec (eds), *The phonology-syntax connection*, 313-337. Stanford: CSLI.
- Wang, William S.-Y. 1972. The many uses of Fo. In A. Valdman (ed.), *Papers in linguistics and phonetics dedicated to the memory of Pierre Delattre*, 487-503. The Hague: Mouton.
- Watters, David. 2002. *A grammar of Kham*. Cambridge University Press.
- Williamson, Kay. 1988. Tone and accent in Ijo. In Harry van der Hulst & Norval Smith (eds), *Autosegmental studies on pitch accent*, 253-278. Dordrecht: Foris Publications.
- Woodbury, Anthony C. 2012. The unusual complexity and typological diversity of otne in Chatino languages of Oaxaca, Mexico. Paper presented at the University of Florida, February 10, 2012.
- Zee, Eric. 1987. Tone demonstration: Shanghai noun compound tone patterns. Handout. Hyman/Leben course at LSA Summer Institute, Stanford University.