Revisiting the TBU in an ABC+Q approach to tone*

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0 ABC & TONE

- ABC:
  - consonant harmony (e.g., Hansson 2001; Rose & Walker 2004)
  - vowel harmony (e.g., Sasa 2009; Walker 2009; Rhodes 2012)
  - dissimilation (e.g., Bennett 2013)
  - local harmonies (e.g., Inkelas & Shih 2013a, b; Shih & Inkelas 2014)
  - tone (Shih, 2013/ms)

- Tone = original testing ground of autosegmental approach to harmony.
- Long-standing questions in the tone literature: What are tone-bearing units (TBU)?

  Yip (2002:xxi): TBU is "the entity to which tones associate."

  - What units trigger and undergo tonal processes?
  - What do we expect by way of transparency and opacity effects?
  - How many tones can a single TBU carry? Only one? Multiple?

⇨ Proposal: Unpack notion of 'TBU' into representational and grammatical components via ABC+Q:

(1) Unit bearing tone features = subsegment (i.e., smallest representational unit)
↳ Q representations

(2) The relevant set of units that participate in tone interactions = a proximity/similarity correspondence set established in the grammar.
↳ ABC

⇨ Predictions:
↳ Similarity and proximity lead to interaction and harmony in tone.
↳ Tone processes can target subsegmental units.

0.1 Roadmap of talk

1. Similarity and proximity in tone-segment interactions: Dioula case study.
   Segmental features of both vowels and consonants can be preconditions for tone interactions
2. Unit of tone association: Q theory
3. Consequences for the traditional notion of 'TBU'

* Thank you to Larry Hyman for decades of discussion about tone.

1 CASE STUDY: DIOULA D'ODIENNÉ

- Dioula d'Odienné (Mande, Côte d'Ivoire) (henceforth, Dioula)
- data from Braconnier & Diaby's (1982) Dioula lexicon

1.1 Basic Dioula pattern

- In TYPE 1 lexical items, morphological H(igh) tone denoting definiteness[1] will appear on the final vowel of the root.
- In TYPE 2 stems, the definite H tone triggers L → H tone harmony[2] on the final and penultimate syllables.

(3)

	indefinite	*definite*			
a.	fòdà	fòd**á**	'season'	**TYPE 1**	L L → L H
	brìsà	brìs**á**	'bush'		
	sɛ̀bɛ̀	sɛ̀b**ɛ́**	'paper'		
	hàmì	hàm**í**	'concern'		
b.	kùnà	k**ú**n**á**	'leprosy'	**TYPE 2**	L L → H H
	tùrù	t**ú**r**ú**	'oil'		
	bègì	b**é**g**í**	'white cotton cloth'		
	bìlì	b**í**l**í**	'flagstone terrace'		

- Distinction between TYPE 1 and TYPE 2 nouns is largely predictable by the final intervocalic consonant = 'C_f'. (Braconnier 1982:27; Shih, ms.)

(4) C V C_f V #
t u r u

(5) Dioula consonant inventory (Braconnier & Diaby 1982:5)

		labial	alveolar	palatal	velar		
obstruents	voiceless stops	p	t	c	k	kp	
	voiced stops	b	d	j	g	gb	
	voiceless fricatives	f	s	ʃ			h
	voiced fricatives	v	z				
sonorants	nasals	m	n	ɲ	ŋ		
	liquids		l r				
	glides	w	y		(w)		

Note: [g] ~ [ɣ] behaves phonotactically like a sonorant in Dioula.

[1] Braconnier also reports that this pattern can be triggered by a H tone in the following word but provides no indication of the systematicity of that particular environment in triggering tone changes. Thus, this talk will focus on the case triggered by the definite suffix because evidence is more readily available.

[2] In underlyingly high roots, the tone pattern is more complex: tone changes involve contour formation or LH spread. The basic pattern of tone change boundedness on the final two syllables versus the final syllable remains the same and can be modeled, with the addition of ANTI-HOMOPHONY constraints, under the same ABC analysis presented here. (for summaries, see Braconnier 1982; Shih 2013)

(6) Distribution of C_f sonorants and obstruents by tone type class (Shih, ms)

C_f =	TYPE 1 - LH	TYPE 2 - HH
obstruent	408	13
sonorant	359	352
Ø	15	30
	$\chi^2 = 275.004$, df = 2, $p < 0.0001$	

- ABC prediction: segments that are more similar to one another (i.e., vowels and sonorant consonants) are more likely to interact than segments that are less similar (i.e., vowels and obstruents).
  - Relevant dimension of similarity = sonority

(7)[3]

CORR-X::X [son]	*Adjacent [sonorant] segments correspond.*
IDENT-XX [H tone]	*Corresponding segments agree in H tone.*
IDENT-IO [son]	*IO-faithfulness to sonority.*
IDENT-IO-V-[tone]	*IO-faithfulness to vowel tone.*

(8)

	/kùná/	IDENT-IO-[son]	CORR-X::X-[son]	IDENT-XX-[H]	IDENT-IO-V-[tone]
a.	kùná		W2 (un, na)		
b.	$kù_i n_i á_i$			W1	1
☞ c.	$kú_i ń_i á_i$				L2

(9)

	/brìsá/	IDENT-IO-[son]	CORR-X::X-[son]	IDENT-XX-[H]	IDENT-IO-V-[tone]
☞ a.	brìsá				
b.	$brì_i s_i á_i$			W2 (ìs, sá)	
c.	$brí_i ś_i á_i$				W2
d.	$brí_i ń_i á_i$	W1			W2

1.2 Gradient similarity in Dioula

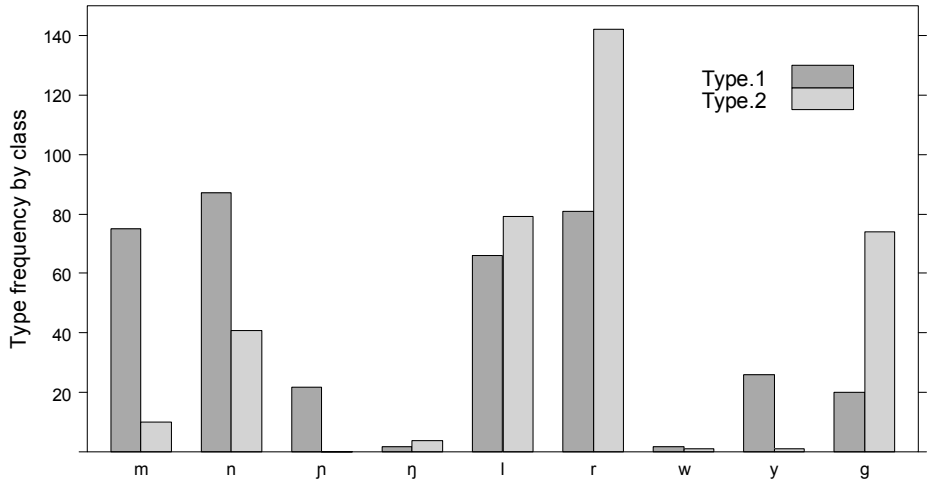
- Obstruent vs. sonorant distinction in C_f's isn't the whole story with predicting TYPE 1 vs. TYPE 2 behavior in Dioula nouns.

1.2.1 Sonority

- Sonority effect scales quantitatively with increasing sonority within the sonorant series (Shih, ms.).
- Increase in sonority → increased likelihood of tone agreement (TYPE 2).

[3] Following Hansson (2007), we assume that correspondence is local and pairwise (cf. McCarthy 2010; Bennett 2013).

(10) C_f sonorants by tone type



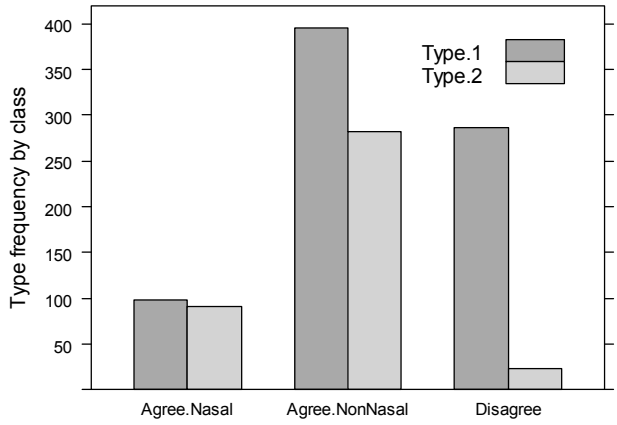
1.2.2 Nasality

- Words in which V_f is nasal and C_f is nasal → increased likelihood of tone agreement (TYPE 2).

(11)

indefinite	definite			
sànà̀	s**ánā́**	'tree'	**TYPE 2**	L L → H H

(12) Nasality agreement by tone type



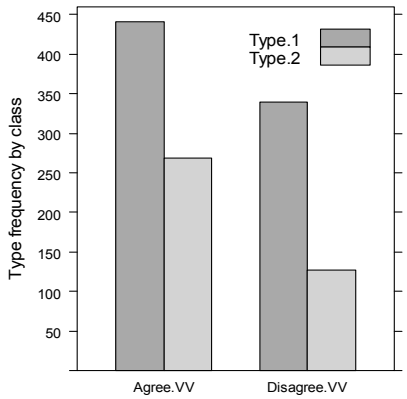
1.2.3 V…V Identity

- Long distance vowel…vowel featural identity → increased likelihood of tone agreement (TYPE 2).

(13)

indefinite	definite			
tùrù	t**úrú**	'oil'	**TYPE 2**	L L → H H
bìlì	b**ílí**	'flagstone terrace'		

(14) V…V agreement by tone type



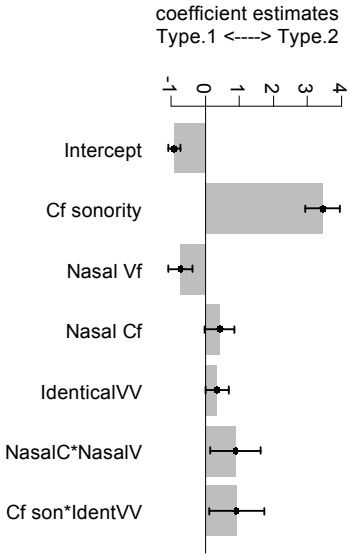
1.2.4 Cumulative similarity

- The more similarity that is exhibited amongst members of the VCV# sequence, the more likely it is for the penultimate vowel to assimilate the definite H tone from the final vowel.

(15) Logistic regression estimates[4]: conditioning factors for TYPE 1 vs. TYPE 2 nouns

Factor	**Estimate**	**Std. Error**	***z* value**	**Pr (>|t|)**	
Intercept	-0.9146	0.0903	-10.128	<0.0001	***
C_f sonority[5]	3.4445	0.2552	13.496	<0.0001	***
Nasalized V_f	-0.7310	0.1812	-4.034	<0.0001	***
Nasalized C_f	0.4186	0.2125	1.970	0.0488	*
Identical V…V	0.3503	0.1694	2.068	0.0386	*
Interactions					
Nasal C_f * Nasal V_f	0.8825	0.3705	2.382	0.0172	*
C_f sonority * IdentVV	0.9171	0.4027	2.277	0.0228	*
model AIC_C	1065.803	R^2		0.469	
Dxy	0.687	%correct (%baseline)		84.35 (48.4)	

* significant at $p < 0.05$, ** significant at $p < 0.01$, *** significant at $p < 0.001$



1.2.5 Formalisation

- Culminativity implemented via weighted constraints (i.e., Harmonic Grammar (Legendre et al. 1990; Smolensky & Legendre 2006; et seq.); Maximum Entropy implementation forthcoming).
- Constraints have been hand-weighted here, based on predictor ranking from regression results.

[4] Using `bayesglm()` in the `R` package `arm` (Gelman et al. 2013). All predictors were centered and standardized (following Gelman 2008; a.o.).
[5] coded as a scalar variable.

- For simplicity, we illustrate the system with consonant sonority (simplified) and full vowel identity.

(16) CORR-VV-[F] *Vowels identical in feature set [F] correspond.*

- CORR-X::X-[son] receives a higher weight than CORR-VV, since sonority similarity between adjacent segments has greater weight in the regression model.

(17) Sonorant C_f + Identical VV

	/tùrú/	CORR-X::X-[son]	CORR-VV-[F]	IDENT-XX-[tone]	IDENT-IO-V-[tone]	*H*
		w = 8	w = 7	10	2	
a.	tùrú	2	7			*-23*
b.	$tù_{i}rú_{i}$	2		1		*-26*
c.	$tú_{i}rú_{i}$	2			1	*-18*
d.	$tù_{ij}ŕ_{i}ú_{ij}$			2 (VV, VC)	1	*-22*
☞ e.	$tú_{ij}ŕ_{i}ú_{ij}$				1	*-2*

- Best (e) and second best (c) candidates both show tone harmony.

(18) Sonorant C_f + Non-identical VV

	/kùná/	CORR-X::X-[son]	CORR-VV-[F]	IDENT-XX-[tone]	IDENT-IO-V-[tone]	*H*
		w = 8	w = 7	10	2	
a.	kùná	2				*-16*
b.	$kù_{i}ná_{i}$	2		1		*-26*
c.	$kú_{i}ná_{i}$	2			1	*-18*
d.	$kù_{ij}ń_{i}á_{ij}$			2 (VV, VC)	1	*-22*
☞ e.	$kú_{ij}ń_{i}á_{ij}$				1	*-2*

- Only best candidate (e) shows harmony. Runner up (a) does not.

(19) Non-sonorant C_f + Non-identical VV

	/brìsá/	CORR-X::X-[son]	CORR-VV-[F]	IDENT-XX-[tone]	IDENT-IO-V-[tone]	*H*
		w = 8	w = 7	10	2	
☞ a.	brìsá					*0*
b.	$brì_{i}sá_{i}$			1		*-10*
c.	$brí_{i}sá_{i}$				1	*-2*
d.	$brì_{ij}ś_{i}á_{ij}$			2	1	*-22*
e.	$brí_{ij}ś_{i}á_{ij}$				1	*-2*

- Winning candidate (a) shows no tone harmony because lack of similarity (i.e., CORR constraints do not compel correspondence and thus agreement.)

(20) Non-sonorant C_f + Identical VV

- Because CORR-VV has less weight than CORR-X::X, predicted effect is a slight increase in chance of harmony when there are only identical vowels.
  e.g., /wààjìbì/ → [wààjíbí] 'obligation'

- Two co-existing correspondence relationships are indexed as *i* and *j* (e.g., see Lionnet 2014; this conference).

	/wààjìbí/	CORR-X::X-[son]	CORR-VV-[F]	IDENT-XX-[tone]	IDENT-IO-V-[tone]	*H*
		w = 8	w = 7	10	2	
a.	…ìbí		1			*-7*
b.	…$ì_{j}bí_{j}$			1		*-10*
☞ c.	…$í_{j}bí_{j}$				1	*-2*
d.	…$ì_{ij}b_{i}í_{ij}$			2	1	*-22*
☞ e.	…$í_{ij}b_{i}í_{ij}$				1	*-2*

- Dioula pattern: stacking of similarity, as well as the primacy of adjacent CV tone interactions over VV interactions → predicted under an analysis that allows segments to bear tone features; not predicted if vowels or prosodic units are the bearers of tone features.
- This Dioula pattern is typologically unusual in exhibiting regressive tone harmony. (see perhaps Zina Kotoko for another possible regressive C-tone effect where lowering of a vowel's tone occurs before voiced obstruents; Odden 2007:76)

2 UNITS OF TONE ASSOCIATION

- Our proposal, again:
  – Relevant set of units for tone is specified via the grammar using similarity, proximity.
  – Unit of tone association

- For Dioula, tone had to at least be hosted on segments, in order to get effects of VCV correspondence leading to tone agreement. → segment as the unit of tone association?

2.1 Subsegment as unit of tone association

(21) **Nupe** (Niger-Congo, Niger State; George 1970): rightward L spreads if intervening consonant is [+voice] or sonorant.

a.	Spreading:	èdǔ			'taxes'
		/è-lé/	→	[èlĕ]	'past'
		/è-mí/	→	[èmĭ]	'I' or 'me' (Kpada dialect)
b.	No spreading:	ètú			'parasite'

- Like Dioula, in Nupe, sufficient sonority → no blocking of tone spread, but unlike Dioula, tone spread results in contour formation.
- How can this be handled in a segment-based ABC approach? It cannot. Solution: ABC+Q (Inkelas & Shih 2013a, Shih & Inkelas 2014)

⇨ Unit of tone association = subsegment *q*

For each segment *Q*: Q → Q(q^1 q^2 q^3), for which each *q* is featurally uniform.[6]

a.	Vowel with double tone contour	V(H^1 H^2 L^3)	Dinka "Fall" (Remijsen 2013)
b.	Vowel with double tone contour	V(H^1 L^2 L^3).	Dinka "Low^{Fall}" (Remijsen 2013)
c.	Vowel with triple tone contour	V($é^1$ $è^2$ $ē^3$)	e.g., Iau *bê*⁻ 'tree fern' (Bateman 1990:35–36, via Hyman 2011)

- Prediction: tone interactions can target *q* subsegments.
- In Nupe, L tone spread = tone agreement between *q* subsegments, creating contours.

(22) *èmí* → [èmǐ]: V(è è è) C(m̀ m̀ $m̀_i$) V($ì_i$ í í)

(23)
IDENT-IO-v^2-[tone] — *IO-faithfulness to* v^2 *tone specification.*
CORR-q::q-[+voice] — *Adjacent [+voice] subsegments correspond.*[7]
IDENT-qq-[tone] — *Corresponding subsegments agree in tone.*
IDENT-IO-*v*-[tone] — *IO-faithfulness to vowel tone (assessed on v subsegments)*

(24)

	V(è è è)-C(m m m)V(í í í)	IDENT-IO-v^2-[tone]	CORR-q::q-[+vd]	IDENT-qq-[tone]	IDENT-IO-*v*-[tone]
a.	V(è è è) C(m m m) V(í í í)		W8		
b.	V($è_i$ $è_{ij}$ $è_{jk}$) C(m m m) V($ì_{kl}$ $ì_{lm}$ $ì_m$)	W1	W4		3
c.	V($è_i$ $è_{ij}$ $è_{jk}$) C(m m m) V($ì_{kl}$ $í_{lm}$ $í_m$)		W4	1	1
d.	V($è_i$ $è_{ij}$ $è_{jk}$) C($m̀_{kl}$ $m̀_{lm}$ $m̀_{mn}$) V($ì_{no}$ $ì_{op}$ $ì_p$)	W1			3
☞ e.	V($è_i$ $è_{ij}$ $è_{jk}$) C($m̀_{kl}$ $m̀_{lm}$ $m̀_{mn}$) V($ì_{no}$ $í_{op}$ $í_p$)			L1	1

⇨ ABC+Q:

1. **Unit of tone association**: subsegments.
   reflects the presence/absence of pitch that afflicts every part of every segment
2. **Set of subsegments that are relevant for tone interactions**: Determined by correspondence and agreement in the grammar, and based on proximity and shared featural and/or structural similarity.

3 CONSEQUENCES OF ABC+Q FOR TONE

3.1 Segment-tone connection

[6] The most complex tone contour on a single segment is ternary. Additional contours are accompanied by vowel lengthening: see e.g., Gordon 2001; Zhang 2001.
[7] Correspondence could also be modeled via scalar sonority: see e.g., Shih, ms.

- By building similarity preconditions into tone interactions, ABC gains traction on a difficult phenomenon: i.e., interference in tone patterns by onset consonants and/or obstruents, none of which seem to bear lexically contrastive tone but yet affect grammatical patterns.
- Under the ABC approach, units meeting a given similarity/proximity threshold correspond and "interact". → Upshot: consonants (onsets, codas alike) are included in tone interactions automatically.

(25) **Ngizim** (Chadic, Nigeria; data from Hyman & Schuh 1974:107): Tone spreads rightward if followed by the opposite tone value: L H H → L L H and H L → H H L.

	L tone spread				
a.	Spreading:	/mù**gbá** + bái/	→	[mù**gbà** bái]	'it's not a monitor'
		/màa**rə̀**m + tə́n/	→	[màa**rə̀**m tə́n]	'big nose'
b.	No spreading:	/šìi**tá** + bái/	→	[šìi**tá** bái]	'it's not pepper'
	H tone spread[8]				
c.	Spreading:	/ná k**à**asúw/	→	[ná **ká**àsúw]	'I swept'
		/á rə̀pcí/	→	[á **rə̌**pcí]	'open!'
d.	No spreading:	/ná b**à**kə́ tlùwái/	→	[ná **bà**kə́ …]	'I roasted the meat'

- Depressor/elevator consonant phenomena can be modeled as a blocking effect on tone via a high-ranking markedness constraint.
- Markedness constraints, based on phonetically-grounded articulatory incompatibility or affinity for certain feature value co-occurrences (see e.g., Tang 2008; Lee 2008; following Peng 1992; Archangeli & Pulleyblank 1994):

(26) *H/[+voice]OBSTR: Assign a violation when a voiced obstruent has an associated H tone feature.
*L/[-voice]OBSTR: Assign a violation when a voiceless obstruent has an associated L one feature.

- For Ngizim, all adjacent segments correspond (CORR-Q::Q) and strive to agree in tone (IDENT-QQ [tone]). Ranking of tone markedness constraints blocks spread (cf., Hansson 2007).

(27) *H/[+voice]OBSTR, *L/[-voice]OBSTR » CORR-Q::Q, IDENT-QQ [tone] » IDENT-IO [tone]

(28) *L/[-voice]OBSTR blocks L tone spread; *H/[+voice]OBSTR blocks H tone spread

	/mùgbá/	*L/ [-voice]OBSTR	CORR-Q::Q	IDENT-QQ-[tone]	IDENT-IO-V-[tone]
a.	$mù_{x}gbá_{x}$		W2 (ugb, gba)		
b.	$mù_{x}gb_{x,y}á_{y}$			W2 (ùgb, gbá)	
☞ c.	$mù_{x}g̀b_{x,y}à_{y}$				L2
	/šìitá/				
☞ d.	$šìi_{x}tá_{x}$		L2 (iit, ta)		
☞ e.	$šìi_{x}t_{x,y}á_{y}$			L2 (iit, tá)	
f.	$šìi_{x}ṭ̀_{x,y}á_{y}$	W1			W2

- ABC analysis predicts that sonorants will allow spread because

[8] Hyman & Schuh (1974: 107) explain that L tone spread does not create contours as H tone spread does because rising contours are not permitted in the relevant environment. Thus, simplication occurs from *mùgbá bái > mùgbă bái > [mùgbà bái].

- (1) relevant correspondence set for tone interactions are all adjacent segments, and
- (2) there is no markedness constraint at work to block tone process from occurring with intervening sonorants.

- For Nupe, there is no evidence that voiceless segments interact with tone, so we can instead obtain the prevention of L spread by restricting the relevant set of interacting (sub)segments to those that are sufficiently similarity in sonority (e.g., [+voice], including sonorant consonants) – similar to approach for Dioula.
- *OR* the Nupe could be modeled as markedness blocking of tone spread (as with Ngizim), with no featural restrictions on the relevant subsegments:

(29) *L/[-voice]OBSTR » CORR-q::q, IDENT-qq [tone] » IDENT-IO *v* [tone]

- Whether there is a relationship (and what it is) between phonetically-based markedness that restricts certain tones on certain segments and the similarity bases that can underlie tone patterns is left for future work (cf. perhaps role of similarity in Mielke 2004's analysis of Zina Kotoko C-tone interaction).
- Dioula crucially demonstrates a case in which all obstruents interact (i.e., block H tone spread), even if they are [-voice]. Under a markedness blocking analysis, [-voice] would *want* H tone spread.

3.2 Mora/Syllable-tone connection?

- What about all the evidence that the mora or syllable is the 'tone-bearing unit', or TBU?

3.2.1 Counting

- Hyman (1992; 2001; 2009): mora is the TBU in cases like Somali, Luganda, where tone assignment rules count moras.

(30) Somali (Hyman 2001): The (vocalic) mora is claimed to be the TBU in Somali, where H is assigned to the penultimate mora of masculine nouns (tautosyllabic long vowels are represented as doubled for clarity; acute accent = H, unmarked = L):

i.	qaálin	'young male camel'	cf.	qaalín 'young female camel'
ii.	ʕeesáan	'young he-goat'	cf.	ʕeesaán 'young she-goat'

(31) Luganda (Hyman 1992): "The preconsonantal nasal counts as a tone-bearing unit in Luganda. This is seen in the relative clause affirmative present tense …, where a H suffixal tone is assigned to the second mora of the verb stem":

i.	(a-) lim-á	'he who cultivates'	(→ [a-lim-â])
ii.	(a-) lagír-à	'he who commands'	
iii.	(a-) liím-à	'he who spies'	(→ [a-líím-à])
iv.	(a-) gen´dà	'he who goes'	(→ [a-gé:nd-à])

3.2.2 Contrast

- Yip 2002:73–74: Cross-linguistically, syllabic nasals bear tone but onset nasals do not, so the segment as TBU should be ruled out.

- But (Hyman 1992): in Cibemba, nasals that are moraic for purposes of compensatory lengthening do not count as a TBU for purposes of tone spreading "one mora to the right" (p. 257).

(32)	a.	tu-ka-súm-a	→	tu-ka-súm-á	'we will bite' (→ [súm-â])
	b.	tu-ka-pútul-a	→	tu-ka-pútúl-a	'we will cut'
	c.	tu-ka-léet-a	→	tu-ka-léét-a	
	d.	tu-ka-béelesh-a	→	tu-ka-béélesh-a	'we will be familiar with'
(33)	a.	tu-ka-lúng-a	→	tu-ka-lúng-á	'we will hunt' (→ [lú:ng-â])
	b.	tu-ka-kúngub-a	→	tu-ka-kúngúb-a	'we will gather' (→ kú:ngúb-a])

3.2.3 Licensing

- In some languages (e.g., Hausa; Newman 2000), tone contours are allowed only on long vowels or heavy syllables, which suggests that the mora is the TBU.

(34) Hausa (Newman 2000)

kâ:	'2sg. masc. indef.future'	cf.	hàwwá	(name)
gâm	'gum'		kái	'2sg pronoun'
nâs	'nurse'		*etc.*	
kâi	'head'			
jâmmá	'(this) afternoon'			
dâbbá:	'animal'			

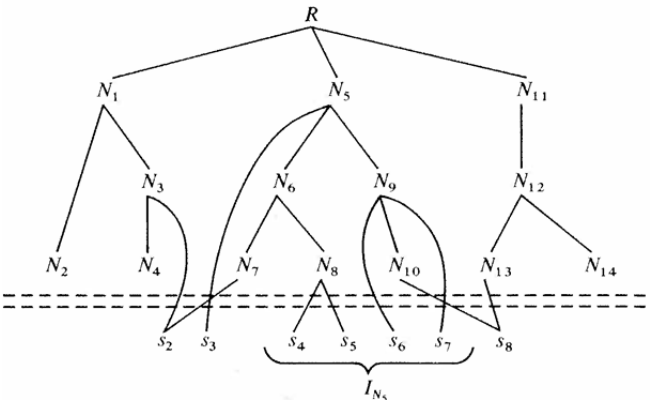
- In other languages, however, this restriction is not in force, or there are more subtle effects of features like sonority at work in contour tone licensing, beyond what is predicted by a mora-based analysis.
  - e.g., Luganda (Gordon 2001; following Tucker 1967), in which $CVC_{[+voice]}$ and CVR syllables allow contours, but $CVC_{[-voice]}$ syllables do not.

  ↳ What is the TBU in these cases?

3.2.4 Status of mora/syllable as TBU?

- Hyman (2001:1368): "The (Vocalic) mora is 'clearly' the TBU in Somali… However, in other languages with a vowel length opposition the syllable has sometimes been said to be the TBU, e.g. Kikuyu, Hausa. In languages lacking a length or syllable weight distinction, each syllable is one mora, and one can often speak of either as the TBU. Finally, in Chinese and other Asian languages, where lexical morphemes and words tend to be monosyllabic, tones have normally been seen to be the property of syllables."
- Pierrehumbert & Beckman (1988:119, 159): Autosegments (i.e., tones) link to either the minimal TBU or to any higher node in the structure. Autosegments are linearized. For the purposes of realization, tones 'percolate' downwards from higher nodes to minimal TBUs.

(35)



⇨ Our claim in this paper: tone always 'links' or is a featural attribute of the subsegment; grammatical domain of tone constraints—previously packed into the concept of 'TBU'—can be larger.

- e.g., tone processes occur on subsegments that share membership within featural/structural similarity and proximity sets (cf. also Zuraw 2002; Yu 2005 w/r/t string-to-string correspondences).
- Restrictions that limit tone and tonal complexity of segments, moras, syllables, or words are mostly grammatical in nature, comparable to distributional restrictions on other elements.

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5 APPENDIX

5.1 Typical consonant-tone depressor phenomenon

- Suma (Gbaya, Central African Republic): Imperfective form of verb has a grammatical H when there is no depressor consonant present. When there is a depressor consonant present (i.e., voiced obstruent, usu. at the onset of the word), L tone insertion results in either a rising contour in monosyllabic verbs or a L H sequence on multisyllabic verbs. (Data from Bradshaw 1999:8–9).

(36) a. Non-depressors

ɓúk	‘applaud’
éé	‘leave behind’
kírí	‘look for’
rɛ́m	‘be able to’
fɔ́dí	‘stir briskly’
yárí	‘unravel’
dǎŋ	‘mount’

b. Depressors

bǒm	‘be blind’
dǐk	‘be sonorous’
gǎy	‘reprimand’
gbǎk	‘borrow’
vǎy	‘bet’
dɛ̀ɛ̌	‘swell’

5.2 Tones affecting consonant quality

- Wuyi (Wu, China): H tone spread causes devoicing. (Yip 2002:34)

(37) /sa^{24} – **v**uo^{31}/ → [sa^{24} **f**uo^{53}]

- Yabem (Melanesian, Papua New Guinea): leftwards L tone spread from root causes voicing of underlying voiceless obstruents on underlyingly H prefix. (data from Yip 2002:34; Bradshaw 1999; Hansson 2004)

(38) /ká-wìŋ/ → [gàwìŋ] 'accompany, 1 sg. realis'

- Additional examples of changes in consonant quality triggered by tone cross-linguistically are collected in Lee 2008:56–58).