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Professor Akinbiyi Akinlabi

A toneless theory of 2-and-a-half tonemes in Gbè

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Typo corrected in .pdf: "sternohyroid" > *sternohyoid* (thrice)

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A Toneless Theory of 2-and-a-Half Tonemes in Gbè*

Victor Manfredi

Abstract Akinlabi (1985) pioneered a path away from treating tones as primes of natural language. By reanalyzing surface **M** as “underlyingly toneless” he trimmed the synchronic inventory of Yorùbá from ternary **H,M,L** to binary **H,L**, tuning up Galilean elegance, toning down exotic typology, capturing synchronic generalizations and clarifying diachronic developments (cf. Bámǹgbósé 1965, Oyèláràn 1970, Maddieson 1974a, Stahlke 1974). Further progress of tonal underspecification was stalled by technical blips of derivational rules and output filters (Pulleyblank 1983; 2004) but the proposal was vindicated belatedly, when top tonologists came to reject “universal tone features” in favor of “monodimensional... scales... interpreted in the phonetics” (Clements & al. 2010, 20, cf. Hyman 2010). The prospect of obtaining tones without tonology flows from the conjunction of two well-supported, independent hypotheses. (i) Underlying pitch-accent (McCawley 1970) opens the possibility that “metrical structures alone would be sufficient for pitch interpretation” (Clements 1990, 61, cf. Clements & Ford 1979, 198) and permits “a non-tonal analysis of tonal mapping” (Köhnlein 2016, cf. Clark 1978, Bamba 1991, Manfredi 1995, Idsardi & Purnell 1997, Akinlabi & Liberman 2001, Kimenyi 2002, Dilley 2005). (ii) Cyclic spellout at PF entails default constituent prominence alias “nuclear stress” (Chomsky & Halle 1968, Bresnan 1971, Cinque 1993, Kahnemuyipour 2004, Zwart 2004, Wagner 2005, Zubizarreta & Vergnaud 2006, Sato 2009), allowing morphosyntactic, “floating” tones to be demystified as phrasal accents (Manfredi 2008, 2018, *in press*). The Gbè **M~L** alternation falls out neatly. In Gbè, iambic [*vs*] footing is diagnosed from the systematic absence of trochaic [*sw*] cues like nonautomatic downstep and initial **L** raising (Manfredi 2003), by a Westafrican (quantity insensitive) version of the iambic-trochaic law that holds in languages with moraic (quantity sensitive) stress (Allen 1975, 78, Hayes 1985, 438, Ramus & al. 1999). Foot-initial *w*, denoting a sternohyoid laryngeal gesture, maps to the CV skeleton at the “beginning of the word” i.e. the DP phase (Lowenstamm 1999, Scheer 2012) where it’s checked by a sonorant onset if any and otherwise governs the initial vowel if any plus the following rime in case the onset is a voiced obstruent—inherently transparent to sternohyoid articulation. When mapped to a vowel, the same gesture yields low perceived pitch/ F_0 (Halle & Stevens 1971, Nissenbaum & al. 2002). The distribution of audible **H** is much simpler: lexically prelinked *s* denotes a cricothyroid gesture and yields a high F_0 correlate. In this way, Gbè’s core tonal data (Ansre 1961, Stahlke 1971) reduce to automatic e-language performance, without rule-based reference to taxonomic tones.

1. Destroying the toneme in order to save it

[O]ne group of language learners in Africa asked a trained linguist to come and try to “get rid of tone” in the local language. (Welmers 1973, 77)

In its half century of existence, phonemic tone notation has missed many chances to upgrade from raw data to descriptive adequacy. In Yorùbá, to capture distributional asymmetries with respect to **H** and **L** (Bámǹgbósé 1965, Oyèláràn 1970), Akinlabi (1985) proposed to eliminate the **M** toneme, but tonal underspecification fell out of mainstream favor due to technical glitches: it blurs autosegmental geometry and needs *ad hoc* scales of markedness in order to be emulated by output filter procedures (Pulleyblank 1983, 142; 2004, 417f.). Full specification fares no better: early hopes to find Greenbergian “universals of tone rules” (Hyman & Schuh 1974) crashed on the fact that “observed patterns of [tone] alternation... are typically random and arbitrary” (Clements & al. 2010, 20). In sum, specified tones are both too abstract, and at the same time not abstract enough, to express linguistically significant generalizations.

How did tonology get bogged down in this quagmire?¹ Minimal lexical contrasts of perceived pitch (F_0), first notated in colonial research (Jones & Woo 1912, Jones & Plaatje 1916), were codified as “tonemes” by a mid-century middle-American behaviorist who trained an anticommunist missionary brigade (Pike 1948, cf. Calvet 1981). Retooled as generative “autosegments” (Goldsmith 1976) in Building 20, MIT’s “magical incubator” of Cold War spinoffs (Penfield 1997), tonemes should have been summarily dismissed by the critique of inductive discovery procedures (Halle 1959, Chomsky 1964). Instead, the more coherent alternative of pitch accent (McCawley 1965, 1970, 1978, Clark 1978) was shunned beyond the pale (Clements & Goldsmith 1980, Poser 1984, Hyman 2009), conveniently enough, avoiding arduous reanalysis of decades worth of impressionistic tonal data compiled by legions of semiamateur Bible scribes (cf. Williamson 2002, Epps & Ladley 2009). To further compound the formal inconsistencies, tones and accents were blended together nonrestrictively, whether in ToBI transcription (Pierrehumbert 1980, Goldsmith 1978, Breen & al. 2012) recapping Pike (1945) or in the parallel representational tiers of “laboratory phonology” (Clements 1990, Ladd 1996).

But the toneme has worse faults than nontrivial redundancy (Dilley 2005). Belying rapid coverage of the nonwestern world, better studied languages yielded diminishing returns. In Japanese, “sparse tone” needs nonlinear, “context-dependent” interpolation (Pierrehumbert & Beckman 1988, 34, 52f., cf. Haraguchi 1988, 134-38, Akinlabi & Liberman 2001, 16f.). In Kinande-Luyiira, binary **H/L** contrasts of nominal roots are unrecoverable without invoking ‘global’ rules, diacritic ternary **H/L/∅** oppositions or

indeed both at once (Hyman & Valinande 1985, Mutaka & al. 2008, Jones 2014). In Gbè, the semi-complementarity of **M** and **L** has spawned an inconclusive literature (Welmers & Ansre 1960, Ansre 1961, Rouget 1963, Sprigge 1967, Smith 1968, Stahlke 1971, Hyman 1973, Clements 1977, 1978, Fréchet 1994). Reviewing assorted quandaries of this kind, Clements & al. reluctantly abandon “universal tone features” in favor of “monodimensional... scales... interpreted in the phonetics” (2010, 20*f.*, citing Láníran & Clements 2003, cf. Hyman 2010). Repeating the history of the Vietnam War, tonal phonologists are obliged ‘to destroy the town [sc. toneme] in order to save it’ (cf. Arnett 1968) and then withdraw, declaring *Peace with Honor*.²

Tonology’s unceremonious retreat invites a less adventurist approach from firmer premises like the following. (i) In languages that lack moraic contrasts of syllable weight, metrical features are available to encode pitch contrasts by lexical prelinking (Haraguchi 1988, Manfredi 1991, 93, Pöchtrager 2006, Köhnlein 2016). The device of underlying foot structure adds no cost, assuming that lexical ‘words’ are not X^0 atoms (heads) but contain branching phrasal constituents (Kaye 1988, Hale & Keyser 1993). (ii) Nonlexical pitch excursions, traditionally blamed on ghostly interventions by morphosyntactic ‘floating’ tones, straightforwardly default PF prominence assigned by cyclic spellout under derivation-by-phase (Chomsky 2001, cf. Chomsky & Halle 1968, Bresnan 1971, Cinque 1993, Zwart 2004, Kahnemuyipour 2004, Wagner 2005, Zubizarreta & Vergnaud 2006, Sato 2009, Richards 2010). The only objection to such a procedure is a methodological ban on audible syntactic boundaries (Selkirk 1984, Nespor & Vogel 1976), a “fatalistic and slightly empty” taboo “inherited from American structuralism” (Rotenberg 1974, 16, 73, cf. Scheer 2012). Analyses of Gbè, with tones (§2) and without (§3), can now be compared.

2. Tones in the Saussurean gulf

In Vietnamese and nearby languages, minimal lexical F_0 contrasts emerged from historic differences in consonant phonation (Haudricourt 1954, Matisoff 1973), and similar effects hold synchronically in Korean (Kim & Duanmu 2004). Some of these patterns may reduce to shared laryngeal gestures (Halle & Stevens 1971, 208*f.*, Kaye & al. 1990, 216, Cyran 2014, 9*f.*), but **M**~**L** alternations of the Gbè cluster of Benue-Kwa (Niger-Congo) go further to implicate categorial structures of morphosyntax.³

In Pecígè, a NW Èwè variety (Ansre 1961, cf. Westermann 1930, Capo 1991), a nominal stem takes either **L** or **LH** (a lexical choice) if the onset is a voiced obstruent, otherwise **M** or **H**. The initial vowel if any (another lexical choice) is always *a-* and its F_0 is similarly predictable: **M** before a sonorant, otherwise **L**, never **H**.⁴

	<i>voiced obstruent onset</i>	<i>voiceless obstruent onset</i>	<i>sonorant onset</i>
(1)a.	gà lá ‘the metal/money’ à-gò lá ‘the palm-tree/-fruit’	te lá ‘the yam’ à-si lá ‘the market’	nyi lá ‘the cow’ a-wu lá ‘the dress’
b.	vii ‘child’ à-vùù ‘dog’	fyá ‘axe’ à-ti ‘tree’	ɲó ‘worm’ a-nyí ‘bee’

Stahke (1971) observes that three subcases of the **M**~**L** alternation converge on one syntactic slot. (i) The **L** that follows a stem-initial voiced obstruent is absent stem-internally, whether the nominal is opaque or transparently compounded:⁵

(2)	àtádi ‘pepper’ *àtádi	àdè-vú ‘hunting dog’ *àdè-vùù	nú-flè-ga ‘shopping money’ *nú-flè-gà
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(ii) A transitive non-**H** verbroot is pronounced **M** iff the direct object’s first onset is a sonorant, otherwise **L**, (3a). (iii) A pitch drop occurs between a transitive **H**-bearing verbroot and a consonant-initial direct object unless the onset is a voiced obstruent, falling to the same **M** or **L** that would begin a vowel-initial counterpart, (3b).⁶

(3)a.	flè gà lá ‘bought the metal’ flè à-gò ‘bought coconuts’	flè te lá ‘bought the yam’ flè fyá ‘bought an axe’	fle nyi lá ‘bought the cow’ fle a-wu lá ‘bought the dress’
b.	kpó gà lá ‘saw the metal’ kpó vii ‘saw a child’ kpó à-gò ‘saw coconuts’	kpó-ò te lá ‘saw the yam’ kpó-ò fyá ‘saw an axe’ kpó à-ti ‘saw a tree’	kpó-ò nyi lá ‘saw the cow’ kpó-ò ɲó ‘saw a worm’ kpó a-nyí ‘saw a bee’

Unifying these contexts, Stahlke posits a segmentally null (floating) **L** to the left of a consonant-initial nominal, triggering the same phonation rules that apply with an initial vowel. But what are these rules and why do they care about this position? A tonal framework necessarily assumes that phonation and tones can be distinguished analytically/*on a priori* grounds:

[C]onsonants affect tone but tone does not affect consonants. Thus...
consonants interfere with natural tonal assimilations.

(Hyman 1973, 171, emphasis original)

[C]onsonants interfere with natural tone rules...

(Hyman & Schuh 1974, 106).

If this claim is not circular, it’s a promise to demonstrate the existence of tone rules independent of phonation. But if such evidence is not eventually forthcoming, the only remaining possibility within the reach of standard generative phonology is to conclude that “tone behaves like a segmental feature” (Leben 1973, 126).

Currently however the choices look different. For “OT”⁷, formerly phonological distinctions dissolve in the welter of e-language output, a big-data manifold that “integrates linguistic change with phonetics, phonological

theory and sociolinguistics, resolutely rejecting even the least vestige of any Saussur[e]an gulf between them” (Kiparsky 2016, 464).

By contrast, an i-language perspective gives abstract analyses like Saussure’s (1879) decomposition of Indo-European ablaut into schwa plus a laryngeal on-/off-glide.⁸ The conceptual distance from Jakobsonian features is illustrated by Verner’s Law, a rule of Proto-Germanic that blocked voicing of an inherited voiceless spirant after an accented vowel.⁹ Generative phonology can express this as coarticulation, spreading a laryngeal feature from a vowel to a following continuant (Calabrese & Halle 1998, 59f., Iverson & Salmons 2003).¹⁰ Treated as assimilation, Verner joins other apparent counterexamples to Hyman’s claim that “tone does not affect consonants” (cf. Maddieson 1974b, Poser 1981) but the progress is pyrrhic, because if tone-voicing causality is truly bidirectional *contra* Hyman, then the autonomy of tone *vis-a-vis* phonation is undermined. Instead, the Saussurean/i-language take on Verner denies that any assimilation is involved and instead treats intervocalic voicing as lenition:

The segmental properties do not play any role because the triggering factor is purely positional... It is therefore inconsistent to say that a process is an instance of lenition but in fact involves the transmission of some property from an item to another. (Scheer 2015, 228)

Then the crux of the matter is how to define “position” – the lenition context. If tones are phonemes not positions their relevance to Verner is less than clear, but if tones are positions they’re not paradigmatic phonemes, and tonology is out of business.

Handling tones as autonomous phonological units, Hyman infers a “tendency of **L-H** to become **M-H**” (1973, 168) but notices that this “natural rule” of “vertical tonal assimilation” is blocked in Gbè either by a preceding voiced obstruent, cf. *dà lá* (1a), or by an intervening nonsonorant regardless of voice, cf. *à-tí* (1b). In general:

L becomes **M** before a **H** if 1) any intervening consonant is a sonorant, and 2) the **L** syllable does not begin with a voiced obstruent. If there is no intervening consonant, i.e. there is an underlying **LH** (rising tone) sequence in the same syllable, this **LH** is modified to a **MH** rise unless the syllable which it is in begins with a voiced obstruent... (Hyman 1973, 170)

The proximity of this rule – scarcely shorter than the paradigms to be explained – matches, point for point, an intricately stated mechanism of laryngeal interference:

[B]oth voiceless and voiced obstruents exert a lowering influence on preceding vowels... [whereas] voiceless obstruents have a raising effect

and voiced obstruents a lowering effect on the F₀ of following vowels. (1973, 169, original italics)

For all its richness, the foregoing formula must be supplemented by “a rule of **L**-spreading that depends on consonant type” to ensure that *à-vùú* ‘dog’ contrasts prosodically with *à-tí* ‘tree’ (1b), and the new sub-domain must exclude sonorants, because the assumed underlying form of ‘bee’ is **à-nyí* sonorants like *ny* are normally a permissive context for “natural horizontal assimilation” (1973, 165f).¹¹ But to add the anti-sonorant restriction guaranteeing the opaque outcome *a-nyí* (1b), application of horizontal **L**-spreading must be bled by vertical **L-H** raising: “tone spreading applies only to a *phonetic L-H* sequence” (1973, 172, original italics). And if this condition is not theory-internal (circular), it can only be justified on grammar-external grounds:¹²

Thus in Standard Èwè, tone spreading applies only to a *phonetic... L-H* sequence. It *has not yet reached* phonetic **M-H** sequences. (1973, 170, second italics added)

Reducing extrinsic order to an uncompleted grammaticalization cline predicts that the opaque rule interaction will wither away someday, because “Bleeding order tends to be minimized” (Kiparsky 1968, 199). But even if this Godot does eventually arrive, the mystery will persist why both of the “natural” tone rules (**L**-spreading, **L-H** raising) should be restricted to a grammatical (non-“natural”) context – the same context that hosts an otherwise unmotivated pitch drop (3b). Nor does the treatment of **L**-raising as assimilation address the regular stem-medial appearance of **M** instead of **L** in compounds like *nú-fle-ga* (2), an environment with no raising trigger at hand. And the stem-medial absence of a supposedly natural phonation effect can’t be brushed off as a local quirk of Gbè, because the same synchronic limitation also holds in far-flung Tibetan, Korean and Wu Chinese (Duanmu 1992, Kim & Duanmu 2004, 62, 89).

In sum, saving the toneme by dumping the competence/performance distinction into Kiparsky’s “Saussurean gulf” doesn’t make any of these problems disappear. The remaining possibility is to throw the tonal baggage overboard instead. Consider how.

3. The remaining possibility

What matters seems to be... whether the tone is ‘level’, ‘above-level’ or ‘below-level’. (Siertsema 1958, 583)

No low tone: L is not present in Yorùbá nuclei; what has hitherto been considered as the perception of [L] is in fact the perception of a prosodic constituent. (Harrison 2000, 595)

In Hyman's account of Gbè consonant-tone effects reprised above, the extrinsic ordering of vertical before horizontal tone assimilation contradicts a declared doctrine of his own contemporaneous handbook:

In a stress language prominence is *syntagmatic*; in a tone language prominence is *paradigmatic*. (1975, 229, italics original)

Taken at face value, a syntagmatic rule like Hyman's "horizontal assimilation" should refer to non-tonal entities, such as Akinlabí & Liberman's (2001) "tonal complexes" which ascribe branching structure to both **H** and **L** to rescue Yorùbá's underspecified **M** from Pulleyblank's methodological critiques.¹³ Similar results can be had from less extraordinary metrical formats: headed trees (Liberman 1975, 49, Giegerich 1985, 3) alias "register tones" (Clements 1981), bracketed projections of the timing skeleton (Halle & Vergnaud 1987, Idsardi 1992) or "flat/lateral" CVCV strings respecting "interconstituent government" (Kaye & al. 1990, 210, Scheer 2004, 2013).¹⁴

Without some independent support, foot structure by any other name would be little more than a *pēs (deus) ex mächinā* descending to save tonology from itself. Fortunately, however, motivation is at hand. The following sample of West African languages divides by a cluster of cues diagnosing a [s w] trochaic type, with iambic [w s] as the unmarked default.

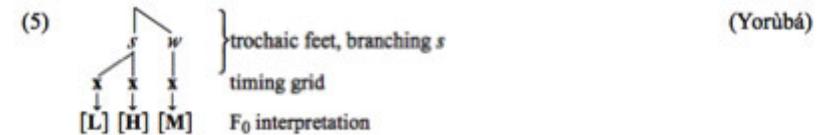
	Àkan ¹⁵	Hausa ¹⁶	Gbè ¹⁷	Yorùbá ¹⁸	Èdó ¹⁹	Ìgbo ²⁰
(4)a. automatic raising of phrase-initial L				+	+	+
b. automatic H -spreading onto L				+	+	(+)
c. some downsteps unrecoverable to latent L				(+)	+	+

The respective clustering of trochaic properties of primary language data, as compiled in (4), can be compared to the bootstrappable correlates of the so-called iambic-trochaic law in languages which—unlike Benue-Kwa—pronounce moraic (quantity sensitive) stress (Allen 1975, 78, Hayes 1985, 438, Ramus & al. 1999).²¹

As illustrated in the Appendix, initial **L** is much nearer in pitch to the following **H** in Èdó and Ìgbo than it is in Àkan, Hausa, Gbè or Yorùbá (4a).²² Yorùbá fails (4a) for independent reasons noted below, but trochaic footing of Yorùbá is still required by the cue of automatic **H**-spread (4b) assuming that "spreading does not cross metrical constituents" [sc feet] (Manfredi 1991, 71), treating **L** as a foot-initial adjunct, cf. (5). Yorùbá presents a second trochaic cue (4c) with cases of unrecoverably elided **L**.²³ (4c) rests on two premises: (i) tone terracing (alias \pm automatic downstep) is a right-branching cascade (Manfredi 1979, Huang 1980, Clements 1981) and (ii) in a head/complement structure, the head is obligatory, the non-head optional. For iambic feet, a downstep caused by an empty [w] between two [s]

terminals would be anti-cyclic (Liberman 1975, 200), hence it follows as a theorem that only trochaic feet can encode underived downsteps.

Granting Yorùbá as trochaic, there are multiple reasons not to analyze Yorùbá **L** as metrically weak: not only does it spread to a local **H** (Ward 1952, 54) as noted above, it also replaces **M** in vowel elision (Bámgbósé 1965, 23) and raises a locally preceding **H** (Lání.ran 1992, 176f.). Given strong **H** and weak **M** and constrained to binary feet, the only solution for strong **L** is left-adjunction to the head of the foot:



The template in (5) fits two additional facts that lie beyond the reach of tonal analysis: the pitch excursion for **LH** is steeper than for **HL** (Manfredi 1995, 175) and stranded **L** systematically fails to parse before a complement phrase (Déchaine 2001).

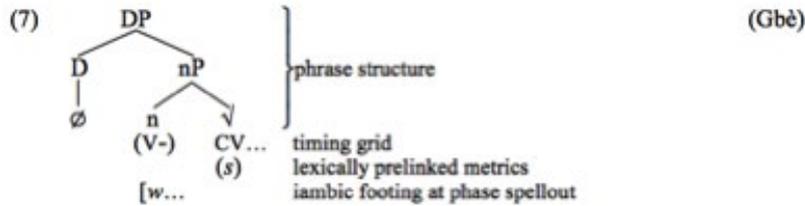
Although (4) refers just to F_0 restrictions, there's no reason to exclude phonation as evidence for footing. Encouragingly, Harris argues for trochaic feet in Ìbibio based not on pitch but on the distribution of root-initial onsets (2004, 120-28). His finding supports (4) if Èfik-Ibibio and Ìgbo are prosodically isomorphic (Green 1949).²⁴

Displaying neither the strong **L** cues of Yorùbá nor any of the trochaic cues in (4), Gbè is parsed by default in iambic feet [w s] corresponding respectively to **L** and **H** F_0 spans, leaving unfooted rimes with neutral F_0 alias **M**. Thus Gbè is not the prosodic mirror image of Yorùbá, and taxonomic **M** has different metrical status in the two languages—unfooted in Gbè, w in Yorùbá—despite its elsewhere distribution in both.



If Gbè is iambic, foot-initial w maps to the CV skeleton at "the beginning of the word" to spell out the DP phase at PF (Lowenstamm 1999, cf. Scheer 2012, 2014).²⁵ The left edge of the domain is the closed-class item identified by Stahlke: the traditional "noun prefix" which is underlyingly

toneless i.e. incapable of bearing accent, and empty also segmentally, apart from epenthetic *n*- arbitrarily attached to some lexical items. A current label for this slot is “little *n*” (Lowenstamm 2007). The other lexically arbitrary choice is whether an accent (*s*) is prelinked to the root (\checkmark).



In order to obtain the surface forms in (1) - (3) from (7), it's enough that *w* denotes a sternohyo id laryngeal gesture with predictably diverse realization on vowels versus consonants (Halle & Stevens 1971, Nissenbaum & al. 2002). The paradigms follow if:

- (8)a. Phase-initial *w* is checked by a root-initial sonorant, leaving the string completely unfooted as M (*a-wu* 'dress') unless an accent is prelinked to the root (*a-nyí* 'bee').
- b. Absent a root-initial sonorant, *w* links to *n* and is realized as L on the initial vowel if any (*á-sí* 'market', *á-tí* 'tree'), spreading to the root if the onset is a voiced obstruent (*gá* 'money', *á-gá* 'palm-tree/-fruit', *ví* 'child', *á-víú* 'dog').
- c. Nonsegmental *n* is footed as a last resort (*kpá* → *te lá* 'saw the yam' etc.).
- d. Stem-internal *w* is not expected (2) because footing applies to phases.

Q.e.d.

4. External evidence

Rouget considers Gùngbè drummed surrogate speech as evidence for the “perception if not mental representation” of spoken pitch:

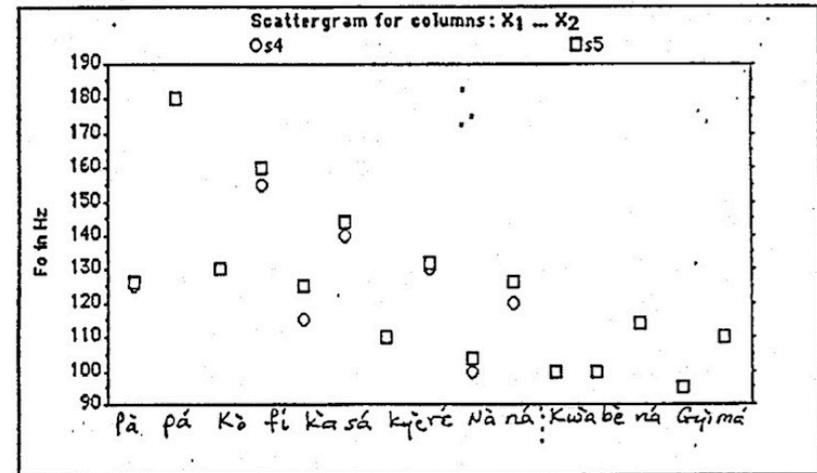
[L]es énoncés tambourinés peuvent être à bon droit considérés comme traduisent la manière dont les locuteurs ressentent, sinon conçoivent, en tout cas interprètent le système des tons tel qu'il fonctionne lorsqu'ils parlent. (1964, 3)²⁶

Unlike the Yorùbá *dùn-dún* tradition, where linguistic F_0 maps iconically to musical pitch (Adégbolá 2003), Gùngbè percussionists distinguish the three tonal outcomes of speech with three distinct attacks on the drumhead based on place and manner of articulation (Rouget 1964, 9f, cf. 1965, 1975, 224).

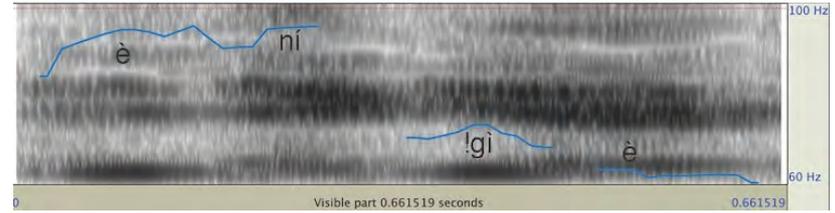
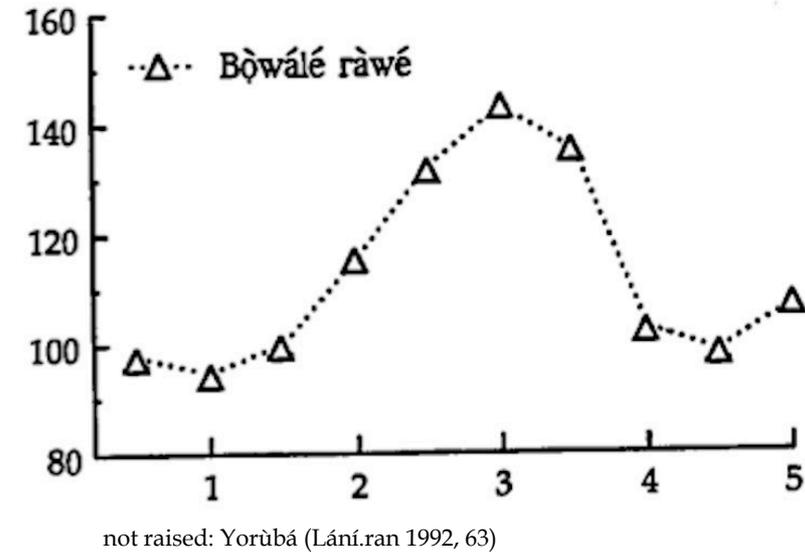
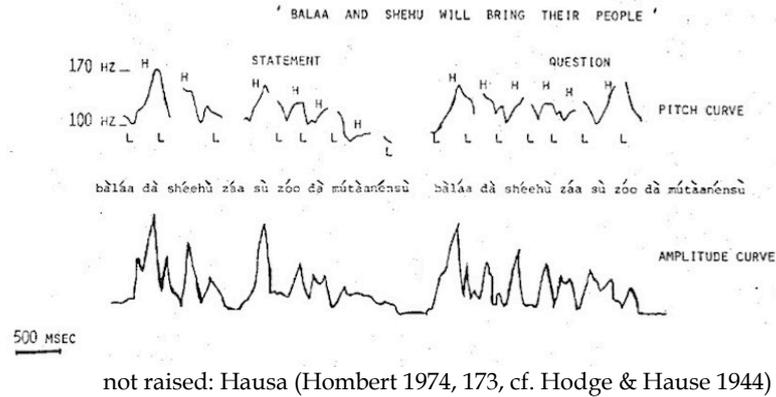
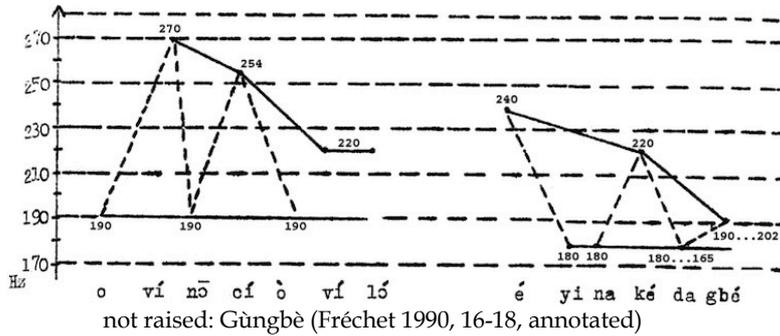
	[place]	[manner]
(9)a. H	edge	blocked
b. M	edge	nonblocked
c. L	centre	blocked

Strikingly in this translation table, drummed **L** and **m** don't form a natural class, although tonal phonology would have expected them to share some feature in order to capture the fact that they undergo productive alternations. Instead, drummed **L** and **M** are specified precisely opposite in terms of both of the production features. The same features define **M** as unmarked, consistent with an Akinlabean underspecification analysis as rescued by metrical feet. Acoustic observations are less clear, but Rouget finds that “les variations d'intensité sont beaucoup plus caractéristiques des faits d'accentuation et d'intonation que des faits de ton” (1975, 225).²⁷

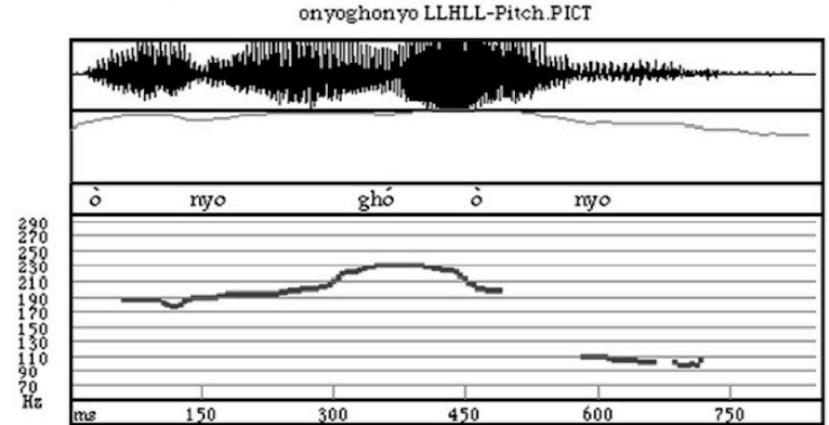
Appendix: comparing the relative pitch of initial L in LHL



not raised: Àkan (Dolphyne 1994, 5)



raised: Èdó ènìgì [LH! LL] 'lineage heads' (Éwuarè 2016, 0'38")
 N.b. downstep before L, derived from deleted L, blocks H>L spread (Ámayo 1983, 186)



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Tonemarking: [́] = high, [̀] = low. For Àkan, Èḍó and Ìgbo, no mark = same perceived pitch as preceding syllable (this is Christaller's 1875 convention for Àkan). For Gbè and Yorùbá, no mark = mid (this is Crowther's 1875 convention for Yorùbá, cf. Àjàyí 1960).

1. This question is necessary – apologies to the editors – because research paradigms are not immune to zeitgeist (Kuhn 1962), and when something is thoroughly lost, we can't neglect any avenue of recovery: *Ìnùkínù ní ñ mú ìwákúwáá wá* (Owómoyèlà 2005, 373).
2. Some unchastened tonologists escalate the war and vaunt 'big data' correlations with biochemistry and climate (Dediu & Ladd 2007, Everett & al. 2015, cf. Manfredi 2015).
3. Benue-Kwa, alias Tano-Congo (Stewart 1983, 20) and East Volta-Congo, is a "dialect continuum" (Williamson & Blench 2000, 17f.) combining the Kwa and Benue-Congo branches of standard Niger-Congo (Greenberg 1963). To refine this historical subgrouping will require stronger evidence than lexicostatistics (Bennett & Sterk 1977a,b, Schadeberg 1986, Williamson 1989), a speculative method that "should be rejected" (Campbell 1998, 186, cf. Armstrong 1983, 146f., Capo 1985, Manfredi 2009, Kropp-Dakubu 2012).
4. Fréchet (1994, 39) cites analogous forms in Gùngbè; further variations across the cluster are reported by Clements (1977) and GbèṬ (1995 & seqq.). In Gùngbè some tokens of the initial vowel are pronounced [o] (Fréchet 1994, 32). In (1a), nominals that lack stem H are cited in nonfinal position (before *lá*) to control for phrase-final lowering M>L.
5. Although Èwè *átádí* is synchronically opaque, its historic derivation by compounding can be inferred from the variant *atakui* (Westermann 1905, 451, no tones given) as well as Fǝngbè *àtakín* (Seguroła & Rassinoux 2000, 75), compared with Yorùbá *ata* (Abraham 1958, 73), all meaning 'pepper'.
6. Data in the left column of (3b), omitted by Ansre, are supplied by Stahlke (1971, 161ff.).
7. E.g. Archangeli & Pulleyblank (2015), Flemming & Cho (2017). *Optimality Theory* is however a misnomer: a theory is falsifiable but OT is a *procedure* – a compiling technique to emulate any given theory (E. Keenan *p.c.*, cf. Fodor & Pylyshyn 1988, Idsardi 2006, Scheer 2010, 214). "Stratal" OT straddles the two worlds, bolting OT's parallel calculus onto lexical phonology's extrinsic order (Kiparsky 1982, 2015, cf. Pesetsky 1979), but the hybrid is stuck with an unsustainable separation of phrasal grammar from listed 'words' (Kaye 1988, Lowenstamm 2013, Giegerich 2015).
8. Eventually the offglide components were attested in inscriptions of extinct Anatolian languages (Kuryłowicz 1935), but in 1879 they were completely abstract. Saussure's ablaunt theory implicitly inspired Government Phonology (Kaye & al. 1985). On the e-language/i-language distinction, see Chomsky (1986).

9. For example, the *t* of Sanskrit *pitár* 'father' and *bhrátar* 'brother' receives divergent treatment in the Germanic cognates, as *d* (<*d*) and *ǵ* (spelled *þ*) respectively (Collinge 1985, 205). But the rule also applies in root-initial position – a clue that footing is responsible rather than progressive assimilation, cf. discussion below.

10. For this to work, Calabrese & Halle must equate "stress" to "High tone" as far as laryngeal articulation is concerned (1998, 60) while dismissing Kortlandt's idea that Indo-European roots contrasted in "tone" (1986, 158f., cf. Halle 1997, 310). The tonal view is more plausible if, as it seems, Verner's Law applied *before* Germanic accent shift potentiated Grimm's Law (Iverson & Salmóns 2003, 71). Nissenbaum (2005) extends Halle-Stevens' framework to Japanese *rendaku*: lexical L is suppressed in the deaccented right branch of a nominal compound but remains laryngeally 'stable' as shown by the appearance of otherwise unexpected consonant voicing in the deaccented constituent:

hòshí-[j]írušhí LH-HLL 'asterisk' < *hòshí* 'star' LH, *shírušhí* LHH 'symbol'

11. As would have been expected in trademark "natural phonology" (Dressler 1984, 38f.).
12. Pre-OT, a Saussurean Kiparsky treated historical data as "external" to grammar (1973, 87).
13. For Akinlabí & Liberman (2001, 18), both H and L have abstract branching structure.
14. Adopting linear ("string-based") as opposed to autosegmental representation doesn't alter the conclusion that tone rules are computationally closer, within standard hierarchies of complexity, to syntax than segmental phonology is (Jardine 2016, 263, 276).
15. Stewart (1965, 21), Schachter & Fromkin (1968, 110-15).
16. "I have not included Hausa among my 'terraced level' languages simply because Hausa has no contrast, at any point, between 'same' and 'drop' (Welmers 1965, 57).
17. GbèṬ (1997, 114; 1999, 18). Fréchet (1990) treats Gùngbè as trochaic but does not discuss the headedness cues in (4). In some phrasal contexts of Àṅlǝ-Èwè, Clements observes emergent downstep and the raising of lexical M to superhigh pitch – effects which in taxonomic terms can only be understood as "a case of tone split" (1977, 178) but which seem less exotic as consequences of re-footing stray syllables from iambic (left-branching) prosody in right-branching phrases. Similar super-raising phenomena in Mawukakan (Mande, Niger-Congo) are convincingly analyzed in metrical terms by Bamba (1991).
18. L-deletion, which blocks H-spread (Bámgbòsé 1966b), is productive and recoverable at phrase boundaries, as in these minimal contrasts where [] indicates the elided L syllable:

<i>oló.dù</i> MHL	'possessor of a clay cauldron'	< <i>ní òdù</i> HLL
<i>olódù</i> MHĪL	'possessor of an oracle sign'	< <i>ní odù</i> HML

L-deletion is however reported to cause lexical opacity in the *oríkì* (proper name epithet) *Oló.dùmarè* (Bámgbòsé 1972, critiquing folk etymologies by Idowú 1962). Secondly, as noted by 'S. Oyèláràń (*p.c.*), L-deletion also yields unrecoverable restructuring in certain lexicalized expressions, whose stem-initial syllable should compositionally bear the H of the transparently related verbroot, but which is instead pronounced as toneless/M.

<i>ì-bejì</i> LML	'twins'	< -bí èjì HLL'give birth to two'
<i>ì-tanràn</i> LML	'settlement of a case'	< -tàn òràn HLL 'finish dispute'

To my knowledge, Àkan, Hausa and Gbè lack comparable examples.

19. Ámayo's pitch notation (e.g. 1983, 185) does not show initial L-raising, but Melzian pointedly apologises for a "simplification of tone marking" obscuring the fact that "[a] low tone is frequently raised before a high tone..." (1937, xiii). Cf. also Elugbe (1977).
20. The [+] of (4b) is attested in many western Ìgbo varieties (e.g. Hyman & Schuh 1974, 89).
21. Thanks to A. Nevins for this comparison.
22. The samples compared are not controlled and the generalization is stated informally but the contrast is undeniable.
23. Cf. note 17 above.
24. A conversation overheard in a quiet *búkà* in downtown Òweré (= colonial "Owerri") in 1984 produced in me the uncanny impression that Ìgbo was being spoken with non-Ìgbo words, but my fellow diners' eavesdropped language turned out to be Ìbibio. A test for the phonation of trochaic footing can perhaps be devised in those Ìgbo varieties with the richest consonantal inventories (Ladefoged & al. 1976).
25. The lexicalization of D in these 'bare noun' languages is arguably null but its referential content is reinforced periphrastically by adjoined, phrase-final appositive modifiers like *lá* in (1), as in Ajíbóyè's analysis of Yorùbá *náú* (2005, 218). Alternatively, Aboh generates *lɔ* – the Gùngbè counterpart of Èwè *lá* – directly in D (2004, 83), but then the only way to obtain observed linear orders like *távò lɛ* 'the tables' (2004, 77) from the assumed [*lɔ* [*lɛ* [*távò*]]] is by raising different cartographic layers by arbitrarily different types of linearization, whose status in minimalism is anyway unclear. Consistent Kaynean antisymmetric movements alias snowballs would have been expected to strand D in final position, giving ungrammatical **távò lɛ lɔ* unless the last step is diacritically marked as SPEC-to-SPEC excorporation, and such a kludge merely restates the problem without added insight.
26. *translation*: Drummed utterances can rightly be held to express how speakers perceive, if not conceive, and in any event interpret, the system of tones in operation when they speak.
27. *translation*: variations of intensity are more typical of stress and intonation than they are of tone.