# 12. Tone: African Languages

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## 0 Introduction

The study of tone in African languages has played a significant role in the development of nonlinear phonology, since the independence of tone and other "segmental" features is most easily demonstrated in the domain of tone, and many African languages have rich systems of morphophonemic tonal alternations. Autosegmental phonology, as presented in Goldsmith (1976a), was motivated primarily by investigation of tonal problems in African languages, and as Yip, in chapter 13 of this volume observes, African languages have received most of the attention in theoretical studies of tone. While it is true that African tone systems are better understood today than they were twenty years ago, it is also true that the vast majority of the more than one thousand languages spoken in Africa are tonal, and are for all intents and purposes undescribed. Much work therefore remains to be done in understanding tone as it is represented in Africa.

## 1 The Autosegmental Analysis of Tone

Drawing on earlier suprasegmental research in tone (Leben 1973; Williams 1976), Goldsmith (1976a) sets forth the theory of autosegmental phonology. The thesis advanced there is that certain feature groups, such as tone versus segmental features, define independent levels of representation (autosegments), and that there is not a one-to-one relationship between the number of tones and the number of segments in a string.

One of the classical problems of tonology which autosegmental phonology resolves is the representation of contour tones. It is widely recognized that falling tones are functionally equivalent to the tone sequence HL, and rising tones to LH. This is apparent when considering the possible (assimilatory) rules that create contour tones. Rules like (1) are common.

(1)

(a) $L \rightarrow Rise \; / \_\_\_\_ \left\{ \begin{matrix} H \\ Fall \end{matrix} \right\}$

(b) $H \rightarrow Fall \; / \_\_\_\_ \left\{ \begin{matrix} L \\ Rise \end{matrix} \right\}$

(c) $L \rightarrow Fall / \left\{ \begin{matrix} H \\ Rise \end{matrix} \right\} \_\_\_\_$

(d) $H \rightarrow Rise \; / \left\{ \begin{matrix} L \\ Fall \end{matrix} \right\} \_\_\_\_$

Other imaginable changes like those in (2) are unattested.

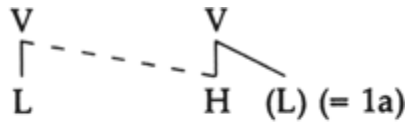
(2)

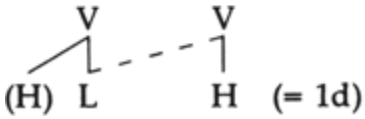
(a) $L \rightarrow Rise / \_\_\_\_ \left\{ \begin{matrix} L \\ Rise \end{matrix} \right\}$

(b) $H \rightarrow Rise / \_\_\_\_ \left\{ \begin{matrix} L \\ Fall \end{matrix} \right\}$

This fact, whose explanation eluded linear phonology, is solved in autosegmental phonology, where contour tones are multiple tones linked to one vowel. The well-attested process expand the domain of a tone to a neighboring vowel.

(3)




The unattested processes, on the other hand, cannot be described in this way.

There are occasional challenges to the view that contour tones are sequences of level tones. An argument for primitive contour tones in Wobe (Kru:Côted'Ivoire) is presented by Bearth and Link (1980). The evidence from Wobe is difficult to evalute; see Singler (1984) and Paradis (1984) for alternative analyses. Grebo (Kru: Liberia), discussed in Newman (1986a), is clearer, though open to reinterpretation. In Grebo, there are four level tones, noted by 1,2,3,4, with 1 indicating the highest and 4 the lowest. Contour tones are indicated as sequences of these four (e.g., 21 for a tone rising from 2 to 1). A 21 contour does not act like a combination of a 2 plus a 1 tone. For instance, the pronoun *na*– "my" has a 2 before a noun with a 1 tone, and has a 1 tone before nouns with a 2 tone or lower. Before a 21 tone, *na* has a 2 tone as it does before a 1 tone – in other words, 21 does not act like it begins with a 2 tone.

(4)

(a) $na^2\ to^1$ "my store"
(b) $na^1\ tu^2$ "my stick"
(c) $na^2\ ta^{21}$ "my salt"

As a second illustration of the difference between simple 2 tone and the 2-tone component of a 21 contour, a 2 tone downsteps to 3 after a 4 tone, so $ɔ^2yi^{21}kla^4fo^2$ becomes $ɔ^2\ yi^{\widetilde{21}}kla^4fo^3$ "She didn't wait for Kla", but the 21 contour of $ɔ^2\ yi^{21}kla^4nyɛ^{21}$" "she doesn't hate Kla" does not downstep. Examples like these, and other problems discussed by Newman, show that rising tones do not act like a combination of level tones, and do act like single tones. The historical cause of the peculiar behavior of 21 and 32 is that they arise from level 1 and 3 tones; synchronically, level 1 and 3 tones do exist in Grebo (*to*[1] "store", *mc*[3] "you" (sg.)).

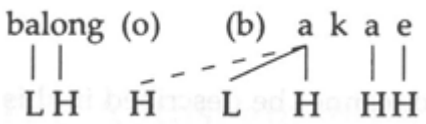
A second classical puzzle of tonology which is solved by autosegmental phonology is *tone preservation,* also known as *stability*. In many languages, when a vowel deletes, the tones which it bore are not deleted. Goldsmith (1976a), drawing on Lovins (1971), illustrates this with the now-classic example of Lomongo (Bantu: Zaire), where phrase-level rules delete (consonants and) vowels, but tones borne by the deleted vowels are preserved and surface on the surviving vowel of the sequence.

(5)

| | | | | | |
|---|---|---|---|---|---|
| (a) | bàlóngó | bǎkáé | → | bàlóngǎkáé | "his book" |
| (b) | bɔ̀mɔ̀ | bòmtámbá | → | bɔ̀mɔ̀támbá | "another tree" |

Given the independence of the tonal and segmental tiers, deletion of a vowel does not entail deletion of tones linked to the vowel.

(6)




The H formerly borne by *o* survives, and by general convention is automatically docked on the following vowel.

Further evidence for autosegmental theory is that it allows abstraction of tonal patterns which are comprehensible only when viewed independently of the syllables and segments bearing the melody. Leben (1973) argues for a suprasegmental representation of tone in Mende (Mande: Mali, Senegal) based on restrictions on tone patterns: there are (supposedly) five tonal classes of nouns.

(7)

| | | | | |
|---|---|---|---|---|
| (a) | L | kpà | bɛ̀lɛ̀ | kpàkàlì |
| (b) | H | kɔ́ | pɛ́lɛ́ | háwámá |
| (c) | LH | mbă | fàndé | ndàvúlá |
| (d) | HL | mbû | ngílà | félàmà |
| (e) | LHL | mbâ | nyàhâ | nìkílì |

The tone melodies may be abstracted away from the syllables which bear them phonetically, mapping tones to vowels from left to right, creating contour tones only at the end of the word when no toneless vowels remain. This separation of tone pattern and segmental content explains a number of facts: (a) the left-to-right mapping of tone to vowels only creates contour tones at the end of the word.(b) The analysis predicts that, since there are no tone melodies*HHL or *HLH, there could be no words like **páwû*or **lákátà* (illustrating *HHL) or **mbálă* or **mánìnká* (illustrating *HLH) – the characterization of possible tone patterns holds irrespective of the number of syllables in the word.

While the tone patterns illustrated in (7) are the most common, Dwyer (1978) and Leben (1978) note that other patterns exist.

(8)

| | | | | | |
|---|---|---|---|---|---|
| (a) | HHL | hókpô | "navel" | kpóngbónì | "palsy" |
| (b) | HLH | tá'tó | "start" | yámbùwú | "tree (species)" |
| (c) | HLHL | gó'niê | "cat" | njégùlû | "tarantula" |
| (d) | LLH | | | làsìmɔ́ | "amulet" |

Furthermore, contrary to the prediction of the left-to-right mapping theory, contour tones can appear in word-medial position, e.g., *klàálì* "clerk". Such word-medial contour tones are controversial; *klăkì* "clerk" could be transcribed as *klàákì.* There is apparently no phonological evidence that decides whether these vowels are long, although it is apparent that they have greater phonetic duration than level-toned syllables.

A fourth problem for the treatment of tone which an autosegmental treatment resolves is floating tones, that is, tones which are independent of vowels. Certain phenomena in (Anlo) Ewe (Kwa: Togo, Ghana) illustrate floating tones (Clements 1978; see also Clements and Ford 1979 and 1981 for floating tones in Kikuyu). Postulating floating H tones for certain words solves various analytic puzzles, even though the floating tone is not directly manifested. For example, word-final M tone in Ewe generally becomes L tone, which then spreads leftward to preceding M tones. By these rules, /ētō/ becomes [ètò] "buffalo". However, some words do not lower final M, e.g., [ētō] "mortar". Failure of lowering is explained by positing that *eto* ends with H not associated to a vowel, i.e., is underlyingly /ētō/. M cannot lower, since it is not word final.

Floating H explains other problems. The locative postposition *me* generally has L (*ètó mè* "in a mountain", *ètó mè* in a buffalo"), but has falling tone after nouns with floating H such as *ētō(ētō mè* "in a mortar"). Finally, there is a rule of Raising (see section 2.2) changing M to R (Raised H), which changes HMH to HRH. This applies to /ētó mĕgbé/ and gives *ētó mĕgbé* (which, because of other rules, surfaces as [ètĕ mĕgbé] "behind a mountain"). The phonological effect of floating H can been seen here: /ētō mĕgbé/ becomes [ētō mĕgbé] "behind a mortar".

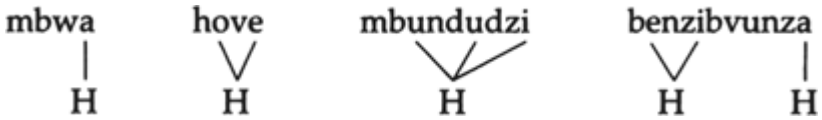
Across-the-board tone changes give more evidence for the model. In Shona (Bantu: Zimbabwe, Mozambique), the first H tone of a noun is lowered after a (morphological) class of H-toned "associative" prefixes (Odden 1980).

(9)

| | | | |
|---|---|---|---|
| (a) mbwá | “dog” | né-mbwa | “with dog” |
| (b) Hóvé | “fish” | né-hove | “with fish” |
| (c) mbúndúdzí | “army worm” | né-mbundudzi | “with army worm” |
| (d) hákáta | “diviner's bones” | né-hakata | “with diviner's bones” |
| (e) bénzíbvunzá | “inquisitive fool” | né-benzibvunzá | “with an inquisitive fool” |

The fact that the rule lowers an unbounded sequences of stem-initial H tones is explained if these words have one H, linked to a sequence of vowels.

(10)




The rule affects the initial H of the stem, which is phonetically transmitted to a number of vowels. The reason why the word-final H in *bénzíbvunzá* does not lower, but the H of the first two syllables does, is that the first two syllables have one H tone which they share, and the final syllable has its own H.

## 2 Tonal Geometry

There are two central questions about the geometry of tones: (a) where do tones link in phonological representations, and (b) what features define tones?

### 2.1 The Tone-bearing Unit

One of the fundamental problems in understanding tone is determining what the *tone-bearing unit (TBU)* is. Goldsmith (1976a) speaks of the vowel as the TBU, but the preface to that work suggests that it would be better to treat the syllable as the tone-bearing unit. The view that tones link to a higher prosodic unit is echoed in Clements and Ford (1979): “There has been some ambiguity in previous uses of the term tone-bearing unit. It is maintained here that tones are not directly associated with vowels or other segments, but rather with higher-level units (‘tone-bearing units’) such as the syllable or syllable-final (rhyme), in which vowels typically function as peaks of prominence (p. 181, n. 3).”

In terms of feature geometry (see chapter 7 this volume), the question of what the TBU is becomes, what do tones link to? There is good evidence that tones link to the mora (on the mora, see chapter 5 this volume). In certain Bantu languages (Odden 1989a), verbs stems are assigned an H in various positions, depending on the tense-aspect of the verb. In Kikuria (Bantu: Kenya, Tanzania), every stem has an H, which appears on one of the first four moras of the stem,[1] which mora takes the H is determined by tense-aspect. H is assigned to the fourth mora in the perfective; a syllable with a long vowel is functionally equivalent to two syllables with short vowels.

(11)

| | |
|---|---|
| (a) n-[tɛrɛk-eré | “I have cooked” |
| (b) n-[ga-tɛrɛk-eré | “I have cooked them” |
| (c) n-[karaang-eré | “I have fried” |
| (d) n-[ga-karaang-eré | “I have fried them” |
| (e) m-[beebeét-eré | “I have sieved” |
| (f) m-[ba-beebéét-éeye | “I have sieved for them” |

H is assigned to the third mora in the subjunctive.

(12)

| | | |
|---|---|---|
| (a) | n-[tɛrɛk-é | "I should cook" |
| (b) | n-[ga-tɛrɛ́k-ɛ | "I should cook them" |
| (c) | n-[karaáng-ɛ | "I should fry" |
| (d) | n-[ga-karááng-ɛ | "I should fry them" |
| (e) | m-[beebéét-ɛ | "I should sieve" |
| (f) | m-[ba-beébéeter-ɛ | "I should sieve for them" |

The second mora receives the H in the recent past.

(13)

| | | |
|---|---|---|
| (a) | nnaaga-[tɛrɛ́kére | "I just cooked" |
| (b) | nnaaga-[karáángére | "I just fried" |
| (c) | nnaaga-[beébéetere | "I just sieved" |

Finally, in the remote past, the H is assigned to the first mora.

(14)

| | | |
|---|---|---|
| (a) | nnaa-[tɛ́rɛ́ka | "I cooked" |
| (b) | nnaa-[káráanga | "I fried" |
| (c) | nnaa-[béébéeta | "I sieved" |

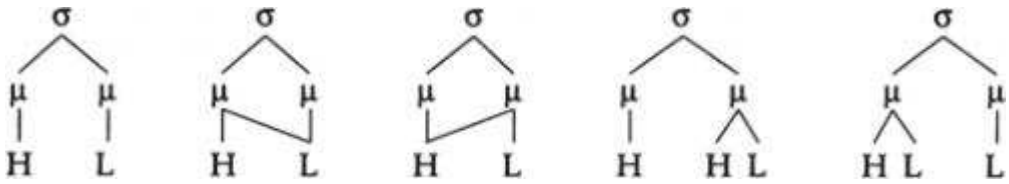
Regardless of how one counts, what is counted are vowel moras, not segments and not syllables. Stated in terms of a mora count, H is simply assigned to the fourth mora in the perfective, but there is no consistent locus of tone assignment if one counts either syllables or segments.

(15)

| | Segment | Syllable |
|---|---|---|
| (a) n-[tɛrɛk-eré | 8 | 4 |
| (b) n-[karaang-ére | 7 | 3 |
| (c) n-[ga-karaáng-ére | 6 | 3 |
| (d) m-[beebeét-ére | 4 | 2 |
| (e) m-[ba-beebéét-éeye | 6 | 3 |

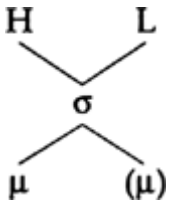
Another possibility is that the syllable is the TBU, a suggestion made for Kikuyu (Bantu: Kenya) in Clements (1984). As pointed out by Hyman (1988a), there is an overgeneration problem in permitting the mora to be the TBU, in that one could have a language with many types of contour-toned syllables. A bimoraic contour-toned syllable could be represented in five ways.

(16)




Yet no language has more than one kind of contour tone. Linking tones to syllables, not to moras within the syllable, solves this problem.

(17)




In the syllabic tone theory, all that can be said is that the whole syllable has a falling tone. In the syllabic TBU theory, there simply is no way phonologically to manipulate the realization of tones relative to the moras of a syllable.[2]

The Chimaraba dialect of Makonde (Bantu: Tanzania, Mozambique) provides evidence for the syllable as the TBU, in the form of rules which refer to the toneless status of syllables. There is a rule that spreads H rightward to the following syllable, provided that the recipient syllable is followed by a toneless syllable (Odden, 1990b).

(18)

(a) /vanachítelekelaána/ →vanachítelekelaála “they will cook it for each other”
(b) /vanachítelekelaéla/ →vanachítélekeéla “they will cook it for”
(c) /vanachítelekelaéka/ →vanachíteleéka “they will cook it”

Failure of H spreading in the last example is explained because the syllable *te* is followed by a syllable with a H tone. But the mora which follows *te* is itself toneless–the blocking H tone stands on the second mora of the syllable.

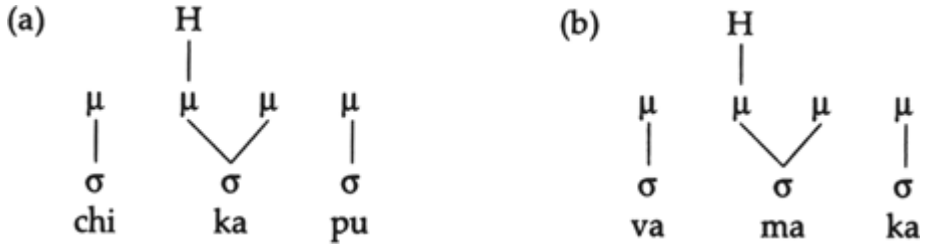
Clements (1984) gives evidence for the syllable as the TBU in Kikuyu, noting that bisyllabic noun stems within a tone class have the same surface tone patterns whether the stem vowel is long or short (HL nouns do not directly manifest the L, which surfaces as a downstep; see Clements and Ford 1979, 1981).

(19)

| | | | |
|---|---|---|---|
| (a) | LH | mo-ɣatɛ̌ | "bread" |
| | | ke-roomǐ | "cheetah" |
| (b) | HL | mo-ɣɛká | "bed" |
| | | mo-raatá | "friend" |

Despite the advantages outlined above which the syllable-as-TBU theory enjoys, there are two problems: (a) It is not clear how languages such as Kikuria which count moras are handled in the syllable-based theory. (b) The syllable theory has no way to represent contour tones when one tone of a contour is phonologically unspecified (see section 5). In Makonde, long syllables display a contrast between rising and falling tones. As discussed in Odden (1990b), L toned moras are represented phonologically with no tone, and surface L tone is assigned by a late rule of default tone assignment. The moraic theory easily represents the contrast between *chikáapu* "basket" and *vamaáka* "cats".

(20)




Since there *are* no L tones in the (early) phonology of Makonde, if tones link to syllables, there is no way to represent this contrast.

Another possibility, suggested in Clark (1990), is that tone features are under the Laryngeal node, and therefore are segmental features. This view runs into many problems, especially that of counting moras in a language like Kikuria, and it is hard to see how tone preservation resulting from vowel deletion would be handled, since by making tone a segmental feature, there is no reason for it and it alone to be preserved when all other features of the vowel delete. However, the laryngeal tone theory draws some support from the fact that tone interacts with laryngeal features in synchronic phonologies. The phonetically expected interaction is for voiceless obstruents to "act like" they have H tone, and for voiced obstruents to "act like" they have L tone. This may be manifested in a number of ways. Spreading of H in Bade (Chadic: Nigeria) is blocked by voiced obstruents (Schuh 1978a).

(21)

| | | | | |
|---|---|---|---|---|
| (a) | nən kàtáw | → | nən ká¦táw | "I returned" |
| (b) | nən làwáw | → | nən lá¦wáw | "I ran" |
| (c) | nən gàfáw | → | nən gàfáw | "I caught" |

In Nupe (Kwa: Nigeria), L spreading is blocked by voiceless obstruents (George 1970).

(22)

| | | | | |
|---|---|---|---|---|
| (a) | /èbé/ | → | èbě | "pumpkin" |
| (b) | /èlé/ | → | èlě | "past" |
| (c) | /èfú/ | → | èfú | "honey" |

If a complete identification of tonal and phonatory features were made, in such a way that the feature for voicing *is* the feature for L tone and the feature for voicelessness is the feature for H tone, then such effects could be explained in terms of the ban against crossing association lines.

(23)


Phonological tone–consonant interactions are actually rare; there are many languages where the phonatory features of consonants are transparent to tone spreading, and only a few where they are not. In Digo (Bantu: Kenya, Tanzania; Kisseberth 1984) and in the Nguni languages (Bantu: South Africa; Khumalo 1987) where interactions between tone and consonant type are found, early rules treat voiced and voiceless consonants alike, making them transparent to tone rules. It is only later in the grammar that voiced obstruents influence tone, blocking rightward spreading of H in Digo (*anafúrukûtâ* → *anafúrúkútâ* "(s)he is moving about restlessly" but *akasúrubîkâ* → *akasúrúbîkâ* "(s)he has thatched with"), and causing insertion of L in Zulu (*ízihlâlo* → *izîhlâlo* "seats").

Certain peculiar cases remain unexplained. As noted in section 3, verb stems in Kanakuru (Chadic: Nigeria) beginning with a voiced obstruent have the tone pattern HL (*bómbə̀lè* "to scrape"), and those beginning with a voiceless obstruent have LH (*ɨə̀kə̀lé* "to trick"). Stems beginning with sonorants take either LH or HL (*lùkùré* "to disperse", *lápə̀rè* "to hold down"). While there is a correlation between tone and phonation, it is not the expected one: voiced obstruents should be followed by L, not H, and voiceless obstruents should be followed by H not L. In Ewe (Stahlke 1971; Clements and Halle 1983) the noun prefix has M tone if the stem begins with a sonorant (*ā-ŋígbá* "floor"), but has L tone if the stem begins with an obstruent, voiced or voiceless (*à-gbádzɛ́* "reed sieve", *à-šíkɛ́* "tail"). At this point, the most that one can say is that there are a number of good candidates for the TBU, and further work is required to give a definitive answer to this question.

## 2.2 Tone Features

The theory of tone features is faced with two problems. The first is stating what the features are for distinctive pitch levels. The second, unique to tone among phonological phenomena, is downstep and upstep.

Yip (1980b) postulates two features, a register feature [upper] and a tone feature [High] which allows the following tonal representations.

(24)

| | Raised H | H | Mid | Low |
|---|---|---|---|---|
| Upper | + | + | − | − |
| High | + | − | + | − |

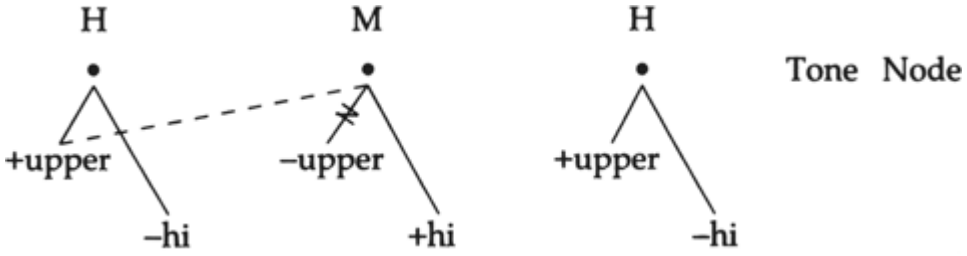
This model predicts that there could be partial tonal assimilation, where tonal register assimilates without making the tones identical. Viewing tone height as a continuous function, such rules would appear to "skip over" a phonetically intermediate tone. Ewe has a rule raising M to R when flanked by H tones.

(25)

| | | | | |
|---|---|---|---|---|
| a. | /ākplɔ̄ mēgbé/ | → | ākplɔ̄ mēgbé | "behind a spear" |
| b. | /ētṓ mēgbé/ | → | ētō mḛ̋gbé | "behind a mortar" |
| c. | /ēkpé mēgbé/ | → | ekpḛ̋ mḛ̋gbé | "behind a stone" |

This spreads the register feature [+upper] from the surrounding [+upper, −high] H tones to the [−upper, +high] M and deletes the existing [−upper] designation, giving not H tone but R tone.

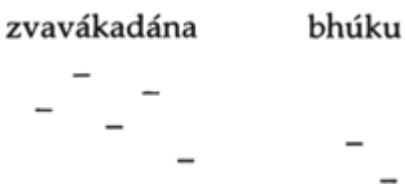
(26)




One problem with this model is that it does not allow more than four tone levels. But languages with five levels do exist: Hollenbach (1984) mentions Copala Trique, Ticuna, Ivory Coast Dan, and Kporo as examples. The greatest number of tone levels in any language is found in Chori (Plateau: Nigeria), with six surface levels. Dihoff (1976) points out that dictionary entries require only three underlying tones, namely level 1 (the highest), 4, and 6 (the lowest). Most cases of tone 2 come from a rule turning a 4 tone into 2 before 1. Tones 3 and 5 can be derived from underlying contour tones, where 16 → 3 and 26 → 5. These systems could be handled by an enrichment of the Yip model, adding a third feature to give distinctions between primary register, secondary register, and tone feature. It would then be possible for a language to distinguish eight levels of tone, though the extreme rarity, if not downright absence, of such systems could be attributed to perceptual problems with maintaining such a rich surface tone system.

Describing downstep and downdrift is more challenging. Downstep and downdrift canonically describe lowering of pitch range at the transition from L to H tones (Welmers 1959). The following Shona example is composed of alternating L and H tones, but the pitch level of the L syllables or of the H syllables is not identical. This is due to downdrift, whereby pitch level is lowered at every transition from L to H. Pitch lowering can progress to the point that a H tone relatively late in the utterance has a lower pitch than an earlier L.

(27)




Pitch lowering can be contrastive (and is then termed downstep), as in Kenyang (Mamfe Bantu: Cameroon), where the site of pitch lowering is notated with ꜜ.

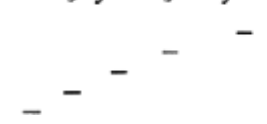
(28)

é'béy 'mé'mwét "it hurts me"

Upstep (pitch raising) also exists. In Kimatuumbi (Bantu: Tanzania), adjacent H tones are separated by upstep (notated with ꜛ).

(29)

baatʃ'ílyá 'kʃ'índyé "they ate the birds"



Earlier literature on downdrift postulated rules performing arithmetic manipulations. In Peters (1973), initial L has the value [3pitch], initial H has [1pitch], and all other vowels have [0pitch]. H toned vowels are given the value [−2pitch] after L, and L toned vowels are given the value [+3pitch] after H; subsequently every vowel is given a pitch value equal to the sum of its own pitch value and that of the preceding syllable.

(30)

| L | H | L | H | L | H | |
|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 0 | 0 | 0 | Initialization |
| 3 | −2 | +3 | −2 | +3 | −2 | Contextual adjustment |
| 3 | 1 | 4 | 2 | 5 | 3 | Surface pitch value |

Clements (1979) points out many problems with this approach. The most cogent, from a contemporary perspective, is that it gives phonologies the power to do integer arithmetic, a level of descriptive power which is unwarranted.

Clements (1981b) proposes a hierarchical account of lexical tone and phrasal pitch readjustments. In this theory, tone levels are represented as tonal matrices containing multiple rows of *h, l*, and Ø.[3] Specifying a tone in the first row with *h* or *l* indicates that the tone is in the upper or lower register respectively; *h* or *l* in the second row indicates the higher or lower tone within that register. Such a two-row system allows four levels of tone.

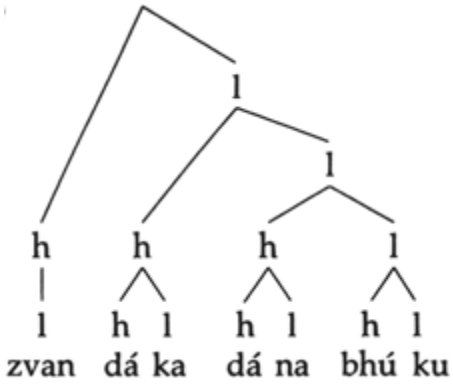
(31)

| Raised | High | High | Mid | Low |
|---|---|---|---|---|
| h | | h | l | l |
| h | | l | h | l |

This is similar to Yip (1980b). By extending the representation in a fashion analogous to metrical trees, the formalism gives a representation for downstep and upstep. The Shona example (27) would be treated as follows. Every *h* after *l* begins a new tonal foot, which includes the maximum string of tones not already in a tonal foot. Any remaining tones are gathered into a foot, and feet are grouped

into a right-branching tree labeled [h, l].

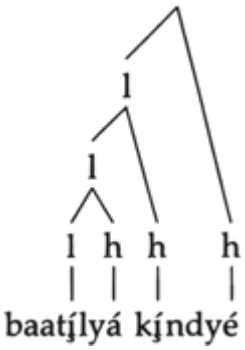
(32)




Starting at the top, tones dominated by *h* on the left branch (the L of *zva*) are produced in a higher register than those dominated by */* (the remaining tones). Within that right branch, tones dominated by *h* (*ndáka*) have a higher pitch register than those dominated by */* (the remaining tones); this interpretation procedes to the bottom of the tree, with any tones dominated by *h* being in a higher register than those dominated by a sister */*.

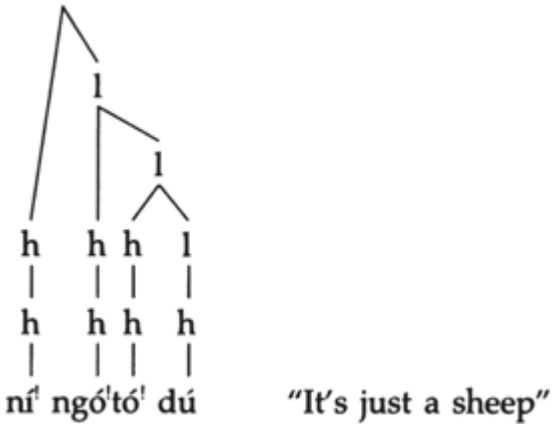
Reversing the direction of the tree and the labeling gives upstep: each *h* forms a tonal foot, and a left-branching tree labeled [l, h] is built.

(33)




Downstep is handled quite naturally in this framework, at least in the majority of cases where it arises because of a floating or linked L tone between H tones. Tree construction operates entirely on the tonal string, where a floating */* serves as the trigger for tonal foot construction just as linked */*s do in (32). Not all phonemic pitch lowering occurs because of floating L tones. In Kishambaa (Bantu: Tanzania; Odden 1982b), Supyire (Gur: Mali; Carlson 1983) and Temne (West Atlantic: Sierra Leone; Nemer and Mountford 1984), any time two H tones are concatenated, a downstep emerges between the H's. The following example from Kishambaa can be accounted for by generalizing the rule for building tonal feet. Each *h* begins a tonal foot, without the requirement for a preceding */*.

(34)




## 3 Wellformedness and the Association Conventions

Autosegmental phonology has put great emphasis on questions of representations. The fundamental principle in Goldsmith (1976a) governing tone–vowel linkages is the Wellformedness Condition in (35).

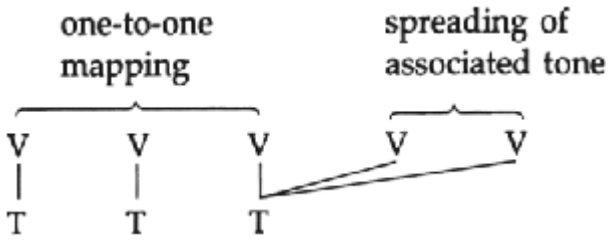
(35) All vowels are associated with at least one tone;

All tones are associated with at least one vowel.

Association lines do not cross.

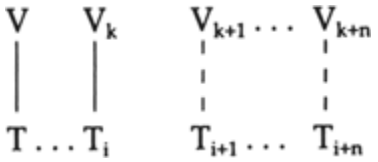
Violation of this condition is repaired in the simplest way possible: insertion or deletion of association lines is simpler than insertion or deletion of autosegments. Multiple ways of satisfying the Wellformedness Condition exist, so it is taken to be preferable to link a tone to a vowel which does not already bear a tone, and it is preferred to link an unassociated tone with a vowel. The theory does not include a universal algorithm for attaining a wellformed state. However, in the vast majority of cases, there is only one simplest way to satisfy the Wellformedness Condition. If there are more vowels than tones in a string, the tones and vowels are linked one-to-one from left to right,[4] until the tonal string is exhausted (given the preference to not reassociate an element already associated). When the last tone is linked to a vowel, that tone spreads to the remaining vowels, since now there is no possibility of satisfying the Wellformedness Condition without reassociating the already associated final tone.

(36)



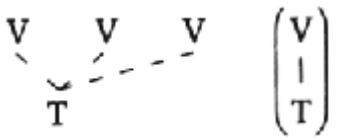

Clements and Ford (1979) propose three explicit association conventions. The first exhaustively matches free tones and free vowels in a one-to-one fashion after an existing tone–vowel link.

(37)



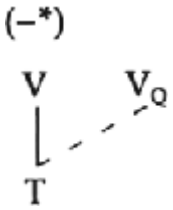
The second links a free tone to the maximal sequence of free vowels providing the tone is neither proceded nor followed by a free tone.

(38)



The third spreads a linked tone to the maximal sequence of free vowels (given a choice, not a tone linked to an accented TBU, and preferably a tone from the left).

(39)



Besides providing an explicit characterization of how the Wellformedness Condition is satisfied, these conventions have empirical differences from Goldsmith's approach.

First, floating tones are not required to automatically dock to a neighboring vowel which already bears a tone. This is motivated in the analysis of Kikuyu downstep, which they argue is a floating L that remains floating throughout the phonology. From this it follows that creating a contour tone comes about by a language-specific rule docking a floating tone to a syllable already bearing a tone.

Second, the one-to-one mapping of tones to vowels is implemented by the first convention (37), which requires that there already be a vowel-tone association. Therefore, one-to-one mapping must be preceded by a language-specific rule, the Initial Tone Association Rule, which associates some tone with some vowel. Generally, the first tone associates with the first vowel, but in Kikuyu, the first tone associates with the second vowel. It is claimed that the conventions come into effect immediately after application of the Initial Tone Association Rule.[6]

Finally, the conventions resolve an ambiguity in Goldsmith's approach. In a structure such as (40), either tone could spread to the free vowel, given that both tones are already associated (and therefore the preference to not spread associated material has no effect). The Clements and Ford conventions state that the tone on the left will spread.

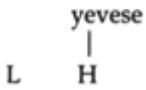
(40)

Although Clements and Ford reject the assumption that floating tones automatically link to vowels already bearing a tone, such a convention was at the heart of the autosegmental analysis of tone preservation. Clements and Ford offer an alternative convention which reassociates *floated* tones without incorrectly requiring that all floating tones dock to a vowel. In Lomongo the first of two vowels deletes, and tones thereby freed shift to the following vowel (so *balón□o bâkáé → balóng' âkáé → balóng ãkáé*), but in Ewe, the second of two vowels deletes and the resulting floating tones shift to the preceding vowel (mēkpɔ́ ètú → mēkpɔ́ → mēkpɔ́ tú). To account for such patterns of tone preservation, Clements and Ford propose that "given two related levels (tiers) $L_j$, $L_k$, a segment of level $L_j$ that is 'set afloat' due to a process affecting the segment of level $L_k$ with which it was associated, reassociates to the segment of $L_k$ that conditioned the deletion." (1979, p. 207, n. 18).

Halle and Vergnaud (1982) further restrict the Wellformedness Condition, proposing that automatic spreading only applies to free tones, simultaneously linking a floating tone to all available toneless vowels. Pulleyblank (1986a) argues that the Association Conventions should be further restricted to one-to-one left-to-right linkage of free tones and free vowels. All forms of automatic spreading are rejected, and where spreading exists, it results from language-specific rule. The argument for rejecting automatic spreading of tones to free vowels is that there are languages such as Tiv (Bantoid: Nigeria) which allow linked tones before toneless vowels throughout the phonology.

The underlying representation of the General Past tense *!yévèsè* "fled" is as follows.

(41)




By (39), the H tone should spread to all vowels, giving **!yévésé*. But since there is no rule in Tiv which spreads H here, and by hypothesis there is no universal convention spreading tones, we do not derive the incorrect form.[7]

There is evidence that even one-to-one docking of free tones to free vowels is not universal, since there are languages with words having free vowels and floating tones persisting into the pharasal phonology. such cases arise in Kikuria (Odden 1987c) and Chiyao (Bantu: East Africa). In Chiyao, every verb stem is assigned a floating H, which is mapped either to the first or to the second stem vowel, as determined by the tense-aspect of the verb (see section 2.1 for a similar system in Kikuria). In the far past negative, the H is linked to the second stem vowel (that H may spread to the following nonfinal syllable). If there is no second stem vowel, the H just floats, and the stem surfaces as toneless.

(42)

(a) nganina-[ga-lyá "I didn't eat them"
(b) nganiin-[deléka "I didn't cook"
(c) nganiim-[bilíkána "I didn't hear"
(d) nganiin-[dya "I didn't eat"

There is evidence that this floating H is present postlexically. There is a rule in Chiyao assigning H to the first vowel of any word preceded by a toneless stem.

(43)

| | | |
|---|---|---|
| (a) | mandaanda | “eggs” |
| (b) | a-[suume mándaanda | “he should buy eggs” |
| (c) | cháá-[teleche mándaanda | “he will cook eggs” |
| (d) | a-[telééche mandaanda | “cooked eggs” |
| (e) | aka-[téléche mandaanda | “he should go cook eggs” |

We saw that in the far past negative (42), the H is linked to the second stem vowel, and if there is only a single vowel in the stem, there is no H on the surface. The phrasal insertion of H after a toneless stem gives us a way of detecting the floating stem H tone. In (44) we see that the floating H of monomoraic stems blocks phrasal assignment of H.

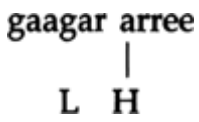
(44)

nganaa-[ng'wa mandaanda “he didn't drink the eggs”
H

This suggests that one-to-one docking of free tones and vowels is also governed by language-specific rules. Mende-style floating tone melodies, which depend on one-to-one linking of tones to vowels, are rare and even the celebrated Mende case can be reanalyzed with tones all lexically prelinked.[8]

Some languages have been claimed to employ right-to-left linking of tones and vowels, rather than left-to-right linking. Newman (1986b) proposes this for Hausa, based on the fact that certain suffixes seem to expand their tone to the left, not the right, as left-to-right mapping would predict. Illustrating the LLH pattern of the suffix *-aCCee* mapped right-to-left, we find *dàf-áffée* “cooked” and *gàagàr-árrée* “unmanageable”. However, Leben (1985) reanalyses these suffixes as having a floating L tone preceding a lexically linked H on the initial vowel.

(45)




Hausa, then, does not seem to make a case for right-to-left linking.

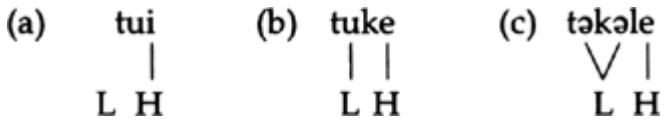
Kanakuru (Newman 1974) provides better evidence for right-to-left linking. Stems either have the tone pattern HL or LH subject to the condition that if the stem begins with a voiced stop the stem selects the pattern HL, and if the initial is voiceless, the pattern LH is selected. Stems with an initial vowel or sonorant unpredictably select either HL or LH.

(46)

| | | | | |
|---|---|---|---|---|
| (a) | `túi | "to eat" | `wái | "to get" |
| (b) | ´bùi | "to shoot" | ´yài | "to arrive at" |
| (c) | tùké | "to hide" | wùpé | "to sell" |
| (d) | górè | "to leave" | lákè | "to untie" |
| (e) | tàkàlé | "to trick" | lùkúré | "to disperse" |
| (f) | bómbálè | "to scrape" | lápárè | "to hold down" |

In monosyllabic verbs, the stem is preceded by the first tone of the pattern: floating L is realized as a downstep (mə̀n 'úa → mə̀n ꜜtúa "we ate it"), and floating H docks to the word creating a falling tone, or else docks to the preceding word (nà' gài → ná gái → nà gâi "I entered it"). In trisyllabic words, the first two syllables always bear the first tone of the melody, and the last vowel alone bears the final tone of the melody. In short, the distribution of tones in Kanakuru is the mirror image of Mende. This falls out from assuming that Kanakuru selects the marked option of right-to-left mapping.

(47)




## 4 The Obligatory Contour Principle

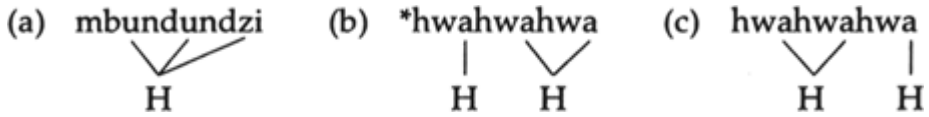
One of the most controversial principles relating to representations in phonology, a principle later called the Obligatory Contour Principle (OCP) is assumed in Leben (1973, 1978) and is formulated in Goldsmith (1976a) as "at the melodic level of the grammar, any two adjacent tonemes must be distinct. Thus HHL is not a possible melodic pattern; it automatically simplifies to HL."

The OCP is at the heart of Leben's explanation for the (supposed) lack of words in Mende with the tone patterns CV́CV̌ or CV́CV̌ (see section 1), which would have the underlying tone melodies HHL and LLH. The OCP prohibits HH and LL, so words with the patterns CV́CV̌ and CV́CV̌ would not exist.

Actually, the tone patterns CV́CV̌ and CV́CV̌ do exist in Mende, as pointed out in Dwyer (1978), Leben (1978), Conteh et al. (1983), and Singler (1985), for example *hókpô* "navel" and (in some analyses) *fàndê* (which becomes *fàndé* "cotton" by an independent rule). Different conclusions can be drawn from these examples: Leben (1978) argues for lexical prelinkage of the first tone of the melody to the last vowel for such words; the melodies still obey the OCP. Conteh et al. and Singler conclude that these words have the melodies LLH and HHL, violating the OCP. Mende has no phonological processes which can be called on to arbitrate this dispute, so it is not certain what the correct representation of such words is.

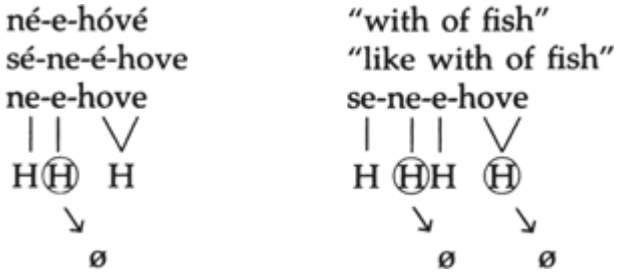
Odden (1986a) surveys a number of cases relevant to the OCP, showing that a blanket prohibition against adjacent identical tones is untenable. In Shona, the OCP holds of underlying representations, but not of derived representations. In section 1 it was seen that there is a rule lowering the first H of a stem (which may be linked to a number of vowels) after "associative" prefixes, whereby /né-mbúndúdzí/ becomes *né-mbundudzi* "with army worms". All nouns beginning with a string of H tones lower the entire initial string of H's: we do not find nouns such as hypothetical **hwáhwáhwá* which lower only the H's of the first, or first two, syllables of the stem, giving **né-hwahwáhwá* or **né-hwahwahwá*. In short, representations such as (48a), which obeys the OCP, are allowed, but ones such as (48b)and (48c), which violate the OCP, are not.

(48)




While we do not find multiple adjacent H's within morphemes, we do find them across morphemes. An associative prefix may prefix may precede an associative prefix (which has an underlying H tone), resulting in multiple H tones. The examples in (49) show that the Lowering rule iterates from left to right through the string of H's. If a prefix has a H tone, it lowers the following H, which may be the H of another prefix; if the prefix has a L tone (because its underlying H has been lowered), then the prefix does not lower the following H.

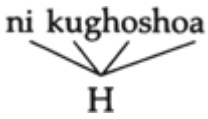
(49)




Were the OCP an active derivational constraint in Shona, such representations would be impossible – we would expect the multiple H tone autosegments to fuse into a single H associated with a multitude of vowels. Instead, it serves as a filter defining well-formed underlying lexical entries.

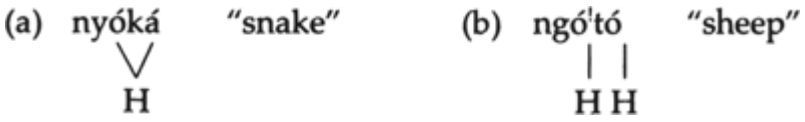
In some languages, such as Kishambaa, the OCP does not even hold for underlying representations. It was seen in section 2.2 that adjacent H's in Kishambaa are separated by a downstep. For instance, we find that / ní kúi/surfaces as *ní*$^{!}$ *kúi* "it is a dog", and / a-ngé-lyá/ surfaces as *angé*$^{!}$*lyá* "he should eat". However, we do not find downstep between every two syllables with H tones. One place where adjacent H's persist not separated by downstep is in the output of H tone spreading, whereby / ní kughoshoa/ becomes *ní kúghóshóa* "it is to do". The lack of downsteps between these H tones is expected, since in reality, there is a single H, linked to multiple vowels.

(50)




The significance of Kishambaa for the OCP is that there is a contrast within stems between a multiply-attached H tone (obeying the OCP) which surfaces as CV́CV́A and a sequence of H's (violating the OCP) which surfaces as CV́A$^{!}$CV́A.

(51)



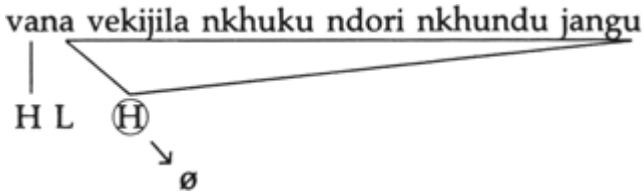
In other languages, such as Kipare (Bantu: Tanzania), there is an active tonefusing version of the OCP which combines adjacent H's arising even at the phrasal level into one multiply-linked H. A prepausal sequence of H's becomes L after a floating L (otherwise realized as a downstep).

(52) /vá!ná vékíjílá nkhúkú ndórí nkhúndú jángú/
[vána vekijila nkhuku ndori nkhundu jangu]
"while the children eat those little red chickens of mine"

[vá!ná vékíjílá nkhúkú ndórí nkhúndú jángú θáno]
"while the children eat those fice little red chickens of mine"

We can explain the across-the-board lowering of multiple H's by postulating that there is one H in such cases.

(53)




Underlyingly, however, there are multiple H's: each word (*nkhúkú* "chickens", *nkhúndú* "red" and *ndórí* "little") contributes an H, and in some words (*vé-kí-lá* "while they eat", *já-ngú* "my"), each morpheme contributes an H. The situation in Kipare, while similar to Shona in illustrating multiply-attached tones, is different since we find across-the-board lowering of H's standing in different morphemes or even different words. The explanation for this is that a phrase-level rule in Kipare fuses multiple adjacent H tones. Such a rule can be seen as a way of satisfying the OCP in a derivation; Shona does not exploit this option.

An OCP based explanation for other tonal phenomena may be considered. A common rule in Bantu languages, Meeussen's Rule (Goldsmith 1984a), deletes H after H. An example will be considered from the Chimahuta dialect of Makonde. In the future tense, the penultimate syllable has a H tone. If the verb is inflected for 3rd person subject, the initial stem syllable also has H.

(54)

(a) tuna-[chi-kaláánga "we will fry it"
(b) vana-[chí-kaláánga "they will fry it"
(c) nna-[teléeka "I will cook"

When the stem-initial and penultimate H's are on adjacent syllables, for example / vanatéleéka/, the second H tone deletes, giving the surface form *vanatéleeka* "they will cook". This is consistent with the OCP, since the input contains two adjacent H's and thus violates the OCP. Not all languages have such H tone deletion rules, and even languages which exhibit some OCP symptoms (e.g., Karanga Shona, with its Associative Lowering rule and morpheme-internal version of the OCP) may still leave sequences of H tones undisturbed, for example *nda-ká-tórá* "I took", where the H of the prefix *ka* stands before the H of the verb root *tórú* without causing lowering of any tones. Interestingly, in the Zezuru dialect, there is lowering of the verbal H, so we get *ndakátora*. And in Arusa (Nilotic: Tanzania; Levergood 1989) there is long-distance phrase-final lowering of H if a H precedes, no matter how far apart the H's stand.

(55)

(a) /en-ker sida-y/ → ènkér sìdày "good ewe"

H H

(b) /ol-orika sida-y/ → òlórìkà sìdày "good chair"

H H

We have the same dissimilative deletion of H after H which looks like an OCP effect, though the H's are not on adjacent TBU's. A similar long-distance dissimilative effect is found in versions of Meeussen's Rule in some Bantu languages, so for example Kimatuumbi has a rule deleting final H in phrase-medial verbs when a H stands somewhere in the stem; thus / paníin-tyátyakiyé ñụụ́mba/ becomes *paníin-tyátyakikiye* ñụụ́mba "when I plastered a house for him". Kihunde (Bantu: Zaire) has a similar rule deleting word-final H when the second stem vowel has H tone – in both cases, the target H and the triggering H to the left may be nonadjacent. But again, long-distance versions of Meeussen's Rule are the exception rather than the rule.

Another phenomenon which may be related to the OCP is blockage of rules that spread or assign H, in case the target syllable is adjacent to a H tone. This can be seen in Karanga Shona, which has a phrase-level rule spreading H from one word into the next word, provided that the initial vowel of the second word is not itself followed by a H toned syllable. In other words, H spreading maintains a buffer syllable between H's, as dictated by the OCP.

(56)

(a) ákapá chirongo → ákapá chírongo "he gave a pot"
(b) ákapá mapadzá → ákapá mápadzá "he gave a hoes"
(c) ákapá murúmé → ákapá murúmé "he gave a man"

This could be explained in terms of the OCP; spreading in the last case would have made H tones stand on adjacent syllables. However, there are just as many languages which allow spreading with no OCP blockage. For example, there are H spreading rules in Kikuria that turn underlying / oko-beebeeta/ first into *okobéébeéta*, then into the phonetic form *okobéébééta* "to sieve": if OCP blockage of spreading were universal, we would expect **okobéébeéta*. Spreading or assignment of H in violation of the OCP also occurs in Kihunde (Goldsmith 1986), Kikongo (Bantu: Zaire), Kimatuumbi, and Bukusu (Bantu: Kenya), to name a few examples.

The strongest possible version of the OCP at this point is that there may be a dispreference for adjacent identical tones; languages are free to express this dispreference by constraining lexical representations, by adding rules of tone fusion or tone deletion, or by putting conditions on tone spreading rules. Ultimately, languages retain the option of doing nothing about OCP violations.

## 5 Underspecification

There has been a significant sentiment in the study of Bantu tone that H and L tones do not have equal status in the grammar. Meeussen (1954), Stevick (1969), Carter (1972), Odden (1981), and many others subsequently have proposed in different ways that the contrast is not between two equal members of a two-way opposition, but between a tone – H tone – and lack of tone. L is assigned at some point in the phonology to any vowel which is toneless. This notion is echoed in Pulleyblank

(1986a), who grounds this viewpoint in a general theory of feature underspecification and defaults (see chapter 4, this volume).

Pulleyblank proposes two default tone specification rules. One assigns [-upper] to vowels not having a specification for the register feature, and the other assigns [+raised] (=Yip's [+High]) to vowels lacking specification for [raised]. In the context of the underspecification theory adopted there, only [+upper] and [-raised] can be specified in lexical entries; in a four-tone language, underlying representations would be as in (57).

(57)

| Raised H | High | Mid | Low |
|---|---|---|---|
| [+upper] | [+upper, -raised] | | [-raised] |

In this system (as well as in a three-tone system), M has a special status – it lacks tonal specifications. In a two-tone system, the feature [raised] is superfluous, so the contrast between H and L is expressed as the contrast between H(=[+upper]) and L(= ø, by default, [-upper]), so in a two-tone system L has properties like those of M in three- and four-tone languages.[9]

Four arguments support tonal underspecification and default rules. First, in a three-tone language, neutralization of tonal contrasts by tone deletion will be to M. An example of this can be seen in Nama (Khoisan: South Africa; Hagman 1977). Reduplication of the root in the causative has the tonal effect that the tones of the second copy of the root all become M.

(58)

| | | | | |
|---|---|---|---|---|
| (a) | !óḿ | "difficult" | !óḿ!ōm̄ | "make difficult" |
| (b) | pùrú | "wonder" | pùrúpūrū | "cause to wonder" |

This can be explained by letting reduplication copy the segmental tier, but not the tonal tier. The copy is unspecified for tone, so its vowels receive M by applying the default rules for tone.

Margi (Chadic: Nigeria; Hoffman 1963) points to further motivation for context-free rules assigning tone feature values to toneless vowels. Verb roots and suffixes in this language fall into three tonal groups: H, L and "changing."[10] Changing roots and suffixes are suffixes are simply toneless, and assimilate the tone of the neighboring morpheme.

(59)

| | H suffix | |
|---|---|---|
| H root | tá + bá → tábá | "cook all" |
| L root | ndàl + bá → ndàlbá | "throw out" |
| Toneless root | ɗəl + bá → ɗə́lbá | "buy" |
| | L suffix | |
| H root | ná + ɗà → náɗà | "give me" |
| L root | hài + ɗà → hàrɗà | "bring me" |
| Toneless root | skə + ɗà → skə̀ɗà | "wait for me" |
| | Toneless suffix | |
| H root | tá + na → táná | "cook and put aside" |
| L root | ndàl + na → ndàlnà | "throw away" |

These patterns follow from postulating that the underlyingly toneless "changing" morphemes undergo a rule spreading tone from one vowel to a neighboring toneless vowel. But once we grant that can be toneless morphemes, there is no guarantee that a toneless morpheme such as *дə*/will always be joined with a morpheme having an underlying tone. Systematically, toneless roots combined with toneless suffixes result in words with all L tones, so / дəl+na/ surfaces as *ə̀lnà* "to sell". The existence of default rules for tone assignment serves as a guarantee that such words will be pronounceable.

An argument for default rules assigning M tone to toneless vowels, and for treating M as the lack of tonal specification underlyingly, derives from the phonologically asymmetrical status of M in Yoruba (Kwa: Nigeria). Although there are rightward spreading rules creating contour tones out of H and L tones, M tones can never be the first or second member of a contour tone.

(60)

| | | | | |
|---|---|---|---|---|
| (a) | ó pọ̀ | → | ó pộ | "it is plentiful" |
| (b) | ọ̀rẹ́ | → | ọ̀rẹ̌ | "friendship" |
| (c) | ọ̀bẹ̄ | ↛ | *ọ̀bẹ̀ | "knife" |
| (d) | ōjú | ↛ | *ōjú́ | "eye" |

If M is phonologically the lack of tone specification, then it follows that one cannot create a contour tone composed of some tone plus nothing, hence the lack of contours involving M tone is explained.[11]

The final and most powerful argument for leaving some tones unspecified is the phonological transparency of L in a number of languages (under the assumption that L and H are characterized by the same feature(s) and are on the same tier). As noted in section 4, Arusa has a rule lowering a prepausal H tone preceded by a H tone anywhere in the phrase. The H tones may be separated by syllables which have surface L tones. In the following examples, a sequence of H tones within a word is represented as a single H tone linked to multiple vowels, hence the across-the-board lowering of what seem to be multiple H tones.

(61)

| | | | | |
|---|---|---|---|---|
| (a) | /ènkér sídáy/ | → | ènkér sìdày | "good ewe" |
| (b) | /òl-órìkà sídáy/ | → | òlórìkà sìdày | "good chair" |

If the L toned syllables of *òlórìkà* have L tones when Lowering applies, then the L standing between the two H's in the last example should block lowering. A

further interesting point about the specification of L tones in Arusa is that the L component of a falling tone (which is contrastive in Arusa) is *not* underspecified. For example, if the phrase-final word ends in a falling tone, lowering does not apply (*ènkér kùrêt* "cowardly ewe"). Second, if the preceding H is part of a falling tone, there is no lowering (*òl-kìlâigrave;éjúk* "new garment"). In precisely these two cases, L cannot be assigned by a default rule, since a contour-toned syllable would already bear a H tone, and would therefore be ineligible to undergo a tonal default rule. Hence L is not unspecified when it is part of a contour tone.

## 6 Accent

The notion that "tone languages" are distinct from "accent languages" is a rather old one. Trubetzkoy (1969, p. 184) states that "distinctive oppositions of tone register must not be confused with the so-called musical accent." In the preautosegmental period, as exemplified by McCawley (1970, 1978) and Hyman (1978a, 1978b), attempts were made to formalize the difference between tone and accent,

drawing initially on Japanese, Tonga (Bantu: Zambia) and Luganda (Bantu: Uganda). Accent is treated as a distinctive feature, which in McCawley (1968) is directly translated into pitch integers. Hyman (1981) similarly translates accents in Somali (Cushitic: East Africa) directly into pitch integers, by-passing tones entirely.

It has been a matter of controversy whether there is a legitimate distinction between tone and accent languages, and if there is such a distinction, what the criteria are for treating a language tonally versus accentually – in fact, there are languages which have been analyzed as tonal and accentual by the same authors. In the earlier typological studies of Hyman and McCawley, it was noted that languages tend to exhibit different properties, depending on whether they are accentual or tonal. A sharp dichotomy between tone and accent emerged relatively early in the history of this study, based largely on McCawley's contrasts between Chinese and Japanese. The most widely accepted differences between tone and accent were the following.

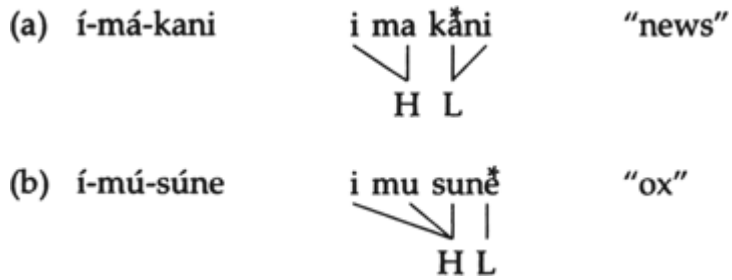
| Tone | Accent |
|---|---|
| For a language with *n* tones, the number of contrasting tonal patterns in words with *k* syllables approaches $k^n$ : each syllables has its own tone, with no regard for the tone of other syllables of the word. | The number of cntrasts in words with *k* syllables approaches *k+1*: at syllable) in the morpheme is identified as bearing an accent. |
| Phonological rulas are triggered by tones of an immediately adjacent syllable. | Phonological rules may apply over great distances. |
| Rules are assimilatory or dissimilatory (as discussed in Hyman and Schuh 1974) | Rules are primarily are primarily insertion, deletion, and movement of accents. |

But as noted in later works, especially McCawley (1978), languages are not wholely tonal or wholely accentual. Rather, certain earlier stages of a derivation are accentual, and later stages are tonal.

The “autosegmental accent” theory is set forth for Tonga in Goldsmith (1976a) and worked out in more detail in Goldsmith (1984b). In this framework, accent (notated with a star) is not an intrinsic phonetic property, and therefore is not represented as a distinctive feature. Rather, accent is a formal structural object which governs the autosegmental derivation. Vowels may be unaccented, or have an accent.[12] An accent language defines a particular tone melody, one tone of which is starred. One copy of this tone melody is inserted for each accent, and accented vowels and accented tones are linked (one-to-one, left-to-right), whereupon the normal association conventions apply.

The view that tones and segments are underlyingly separated was pursued in early autosegmental phonology to the point that in Goldsmith (1976a) there are no lexical linkings between tones and vowels.[13] In many cases where tone-vowel linkages cannot be predicted, the unpredictable linkage is encoded by accenting the relevant vowel, so that the Wellformedness Condition will link the starred tone and vowel. For example, under Goldsmith's analysis of Tonga, words have the melody HL, where L is associated with a lexically specified vowel of the stem (and all vowels thereafter), and H is associated with preceding vowels.

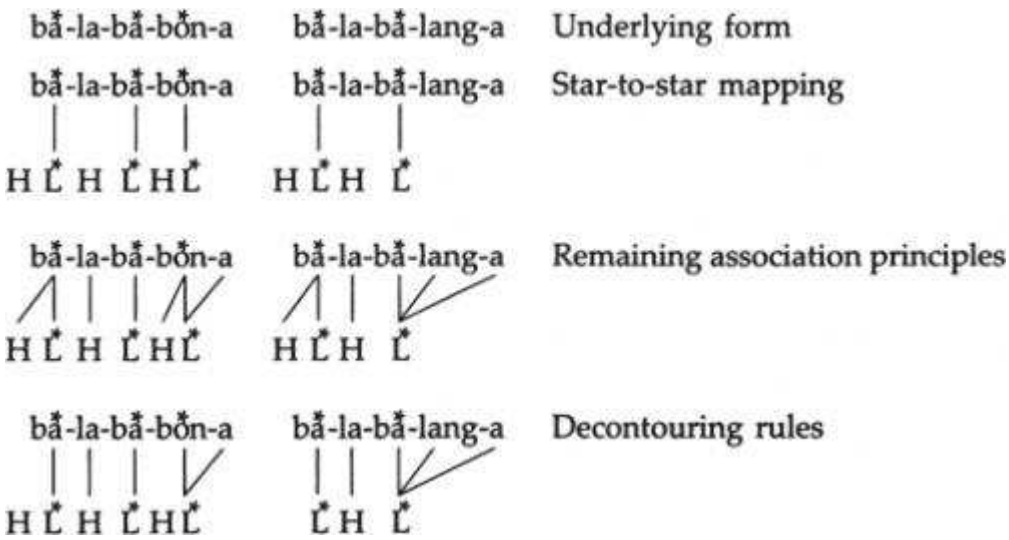
(62)



In this account, rather than shifting, inserting, or deleting tones, one shifts, inserts, or deletes accents; since presence of accent usually entails presence of H tone, these manipulations result indirectly in changes in tone. For instance, certain stems (*i-ma-tongo* "ruins") are underlyingly unaccented - on the surface they lack H tone. Since surface L (and H) tones arise only when an accentually-driven tone melody is inserted, there is no apparent source for the surface L tones. An accent is therefore assigned by rule to the word-initial vowel, allowing the tonal sequence HL to be inserted (giving *i-ma-tongo* - however there being no contour-toned vowels in Tonga, this surfaces as *i-ma-tongo*, with all low toned vowels.).

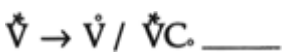
Another operation, accent deletion (Meeussen's Rule; see section 4), deletes an accent after an accent. Underlying /bá-la-bá-bóna/ surfaces as *balábabona* "they see them". Inserting one copy of the tone melody for each accent, mapping L to the accented vowel and linking H to vowels by the WFC, we would expect **balá bábona* (derived from *bâlábâbona* by a rule deleting the first H in verbs and by decontouring rules of the language).[14]

(63)




The surface form is analogous to *balábalanga* "they look at them" which derives from /bá-la-bá-bóna/. Yet the two stems are accentually distinct: *lang* is unaccented (cf. *balalanga* "they look" from /ba-la-langa/) and *bon* is accented (cf. *balábona* "they see" from /bá-la-bóna/). This surface neutralization in tone pattern is explained by Meeussen's Rule, which deletes an accent after an accent.

(64)




By this rule expected /bá-la-bá-bóna/ becomes /bá-la-bá-bona/ prior to insertion of the HL tonal melody: inserting two copies of the tone melody and mapping L tones to the accented vowels, we arrive at the surface form.

Accentual analyses are proposed for Somali (Hyman 1981; Banti 1988), Oromo (Cushitic: Ethiopia, Kenya; Banti 1987), Ci-Ruri (Bantu: Tanzania; Massamba 1982, 1984; Goldsmith 1982), Haya (Bantu: Tanzania; Hyman and Byarushengo 1980), Luganda (Hyman 1982a), and Kimatuumbi (Odden 1982b, 1985). The last two languages provided what seemed to be compelling evidence for accents

independent of tones, since these languages taken together make a four-way contrast between accented and unaccented H, and accented and unaccented L.

In Luganda, the accentual melody is HL, and the H links to the accented syllable. The H tone of a noun object associates with unaccented vowels of the preceding verb (save for the unaccented initial vowel of *abálá ébíkópo*, which bears an obligatory boundary L).

(65)

| | | |
|---|---|---|
| (a) /a-bal-a/ | abala | "he counts" |
| (b) /e-bi-kǒpo/ | ebikópo | "cups" |
| (c) /abala e-bi-kǒpo/ | abálá ébíkópo | "he counts cups" |
| (d) /a-bǎ-tǎ-lǐ-lǎb-il-a a-ba-pǎkasi/ | abátalilabílílá ábápákasi | "they who will not look after porters" |

H spreads to unaccented syllables, but it does not spread to accented syllables (the final example), even though the accented syllables have L tone.

It is claimed that in Kimatuumbi (Odden 1982a, 1985) nouns may accent a single syllable. This syllable receives a H tone and all others receive L. In this account, all underlying H tones are accents, and all derived H tones are inserted as tones, not accents. Thus, /ngalibá/ becomes *ngalibá* "circumciser" and /ki-píingili/ becomes *kịpíingili*. A tone shift rule, Nominal Retraction refers to "unaccented H," which should show the autonomy of tone and accent. By a general rule, a H is assigned to the second vowel of a prepausal unaccented word, so prepausal /lụ-bagalo/ becomes *lu-bágalo* "lath" and /mbagalo/ becomes *m-bagálo* "laths". Nominal Retraction shifts word-final H of CVCV noun stems to the stem-initial syllable, as long as the final syllable is unaccented. This means that a shiftable H is assigned by secondary tone rules, and is not an underlying (hence accented) H. Unaccented nouns of the type CVCV unexpectedly manifest their prepausal H on the initial vowel of the word, so /ñama/ surfaces as *ñáma* "meat", not **ñamá*. But final accented H does not shift: /mbaká/ becomes *mbaká* "cat", not **mbáka*.[15] Hence the retraction rule only targets unaccented H's, as distinct from accented H's.

The validity of "autosegmental accent" is questioned in Hyman (1982b), Pulleyblank (1984) and (1986), and Hyman and Byarushengo (1984). Rather than specifying a vowel with an accent, one could link the vowel to its tone in underlying representations. The argument against accent is its excess power, in comparison to lexical prelinking of tones. In an accentual system, it would be possible for the tonal melody of one morpheme to link to an accented vowel of another morpheme. In a prelinked-tone system (i.e., where "accented" vowels are lexically prelinked to their tones), this is an impossibility. Such "cross-morpheme prelinking" appears to be unattested.[16] Second, rules in an accent system can refer to tones, accents, or tones and accents. Rules in a strictly tonal grammar can only refer to tones, so are more constrained. Finally, there is no parallelism between accents and tone melodies in the segmental domain; we do not find "continuant melodies" centering around "accented consonants."

Pulleyblank points out that the argument for accent based on limited distribution of tone is not compelling.[17] First, it is arbitrary to attribute a limit of one locus of pitch contrast per morpheme to accent but not tone. Such limitations, though not common, are known from segmental phonology (e.g., Japanese only allows one specification [+voice]; see Itô and Mester 1986) but such facts have not generally caused segmental phonology to be treated accentually.[18] The accentual accounts of Kimatuumbi and Haya actually overgenerate, in the sense that in Kimatuumbi one would expect four syllable stems to have five surface tone patterns (any syllables could have accent, or the stem could be unaccented), but in fact there are only three tone patterns. The accentual analysis must still stipulate restrictions on the location of accent. Finally, while a restriction of one main stress per word falls out of the formal properties of a metrical word tree, autosegmental accent does not have those properties, so there is no theoretical basis for the supposed one-per-morpheme restriction.

Pulleyblank reanalyzes Goldsmith's accentual account of Tonga. Earlier accentual analyses have been reanalyzed (by the authors of th eoriginal accentual analyses), namely Haya (Hyman and Byarushengo 1984), Luganda (Hyman 1982b) and Kimatuumbi (Odden 1989a). It is shown there that the accented L and unaccented H phenomena of Luganda and Kimatuumbi can be handled without recourse to accents independent of tones.

More recently, a number of "accentual" analyses of tone in Bantu languages have been set forth. These analyses differ from the earlier analyses, in that accent is construed as metrical prominence. The earliest analysis within that framework is an analysis of Kimatuumbi in Pulleyblank (1983b). Subsequent analyses within the metrical accent approach include Goldsmith (1987a, 1987b, 1992b), Goldsmith, Peterson and Drogo (1989), Peterson (1989), and Downing (1990) for Nguni; Kenstowicz (1987) and Kisseberth (1991) for Chizigua (Bantu: Tanzania), Cassimjee and Kisseberth (1989) for Shingazidja (Bantu: Comoros); Sietsema (1989) for Kimatuumbi, Ciruri, Digo, and Sukuma (Bantu: Tanzania), and Bickmore (1989) for Runyambo (Bantu: Tanzania). In this approach, formal analogies between metrical systems and tone are sought: these include long-distance operation, binary groupings, and quantity sensitivity.

The fundamental question which arises in these recent discussions of (metrical) accent and tone is why H is attracted to certain positions. For example, in Chizigua (Kisseberth 1991), the rightmost H in a word is assigned to the penultimate syllable, no matter where the H arose.

(66)

| | | | | |
|---|---|---|---|---|
| (a) | /ku-lómbez-a/ | → | ku-lombéza | "to request" |
| (b) | /ku-lómbez-ez-a/ | → | ku-lombez-éz-a | "to request for" |
| (c) | /ku-lómbez-ez-an-a/ | → | ku-lombez-ez-án-a | "to request for each other" |
| (d) | /n-a-wá-tohol-a/ | → | n-a-wa-tohóla | "I am loosening them" |

What makes the shift to penult suspicious is that the penultimate syllable is a common position for metrical stress, inviting the inference that H is attracted to a metrically prominent syllable. Spreading of H to the antepenultimate syllable is found in the Nguni languages (Goldsmith, Peterson and Drogo 1989; Downing 1990), by which underlying /ú-ku-namathelisa/ becomes *úkúnámáthélisa* (and in Zulu, *ukunamathélisa* by a later rule of tone delinking). Again, antepenultimate position is a known target for stress assignment.

Van der Hulst and Smith (1988) observe that in some languages, tones are attracted to accented syllables (Eastern Norwegian, Copala Trique), and H toned syllables receive accent (Fasu; see Hyman 1978b). This correlation is recognized in the Tone-Accent Attraction Condition (Goldsmith 1987b, 1992b):

> A tone-to-grid structure is well-formed if and only if there is no tone-bearing syllable which has a lower level of accent than a toneless syllable. [Thus, if a syllable S has a tone, all syllables with a greater level of accent than S must also bear tone.]

Accounting for tone spreading in a principled way is even more important when one considers the descriptive apparatus which seems to be required using strictly tonal devices. Spread of H to the antepenultimate syllable in the Nguni languages would necessitate a rule such as the following.

(67)


This rule would iterate through the word, reapplying as long as there are at least two vowels following the syllable taking the H. The operation terminates at the antepenult (*úkúnámáthélisa*), since there are no longer the requisite number of syllables after that point.

A widely held desideratum in phonological theory – indeed much of the motivation for nonlinear phonology and one of the outstanding problems of linear phonology – is that rules should be "local." Though there are many unresolved problems in the locality issue, it is generally agreed that a local rule formulation would only allow specification of one element to the right and/or left of the focus. Formulations such as (67) are patently nonlocal.

In the analyses of Nguni in Goldsmith, Peterson, and Drogo (1989), Peterson (1989), and Downing (1990), the antepenultimate syllable is made metrically prominent by rendering the final syllable extrametrical, and constructing a left-headed binary foot at the end of the word. The Zulu form /ú-ku-namathelisa/ is accented as /ú-ku-namathélisa/. Subsequently the H tone spreads to the accented syllable (because of the Tone-Accent Attraction Condition) giving /ú-ku-namathélisa/, and after deleting all but the last branch of a multi-attached H, we arrive at *ukunamathélisa* "to make stick".[19]

A second – and, though less well documented, potentially more compelling argument – for interaction between tone and metrical structure comes from tone alternations where one must parse syllables or moras into groups of two to get the correct forms. Note that the only mechanism for grouping prosodic elements into binary units is metrical structure. One way in which binary grouping might be detected would be to find a language where H is assigned to every other syllable. Pulleyblank (1983b) makes the claim that Kimatuumbi acts in this way: starting leftward from the lexically specified accent, binary tone feet are formed on the mora, and H tone is assigned to the head of each foot. Starting from /ka-lų-tebeelų/, binary right-headed feet are built, giving /ka-lų-tebéelé/, which is interpreted tonally as *ų* "little amaranthus".[20]

As it turns out, "binary alternating H" is the wrong characterization of Kimatuumbi. Odden (1985) shows that the penultimate H of *ka-ló-tebéelé* is the "accented" H (underlying H), so this word is underlyingly /ka-lų-tebéle/. The final H derives by a rule assigning H to the last vowel of a word with penultimate H, and the initial H comes from a rule assigning H to a syllable after a noun class prefix (subject to the condition that assignment of H cannot bring two H tones together). Inspection of sufficiently long stems shows that there is no tendency to binary alternating H's, cf. *i* "hospitals", *mabwánaankụbwá* "bossess".

Sietsema (1989) claims that binary feet are required in Sukuma to account for the shift of H two syllables to the right, whereby /ku-tónol-anij-a/ surfaces as *kutonolánija*. Again we encounter the problem of locality; H cannot shift two syllables to the right without running afoul of various theoretical strictures. In Sietsema's analysis, binary feet are built starting with the underlying H, giving (ku)(tóno)(lani)(ja); H then spreads from the head of one foot to the head of the following foot, giving (ku)(tónó)(láni)(ja). This is followed by a delinking rule (exactly like that required for Zulu), giving the surface form. However, Sietsema's analysis requires a number of devices whose theoretical status is suspect (phrase-internal extrametricality and improperly bracketed metrical constituents); Roberts (1991) shows that the apparent tone shift by two syllables arises from two quite independent processes, each of which spreads H tone to the immediately following syllable. So, /kutónolanija/ spreads H once lexically giving /kutónólanija/, and then because of a later postlexical spreading rule becomes /kutónólánija/ (then *kutonolánija*).

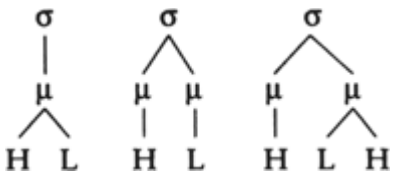
A final phenomenon which suggests a connection with metrical structure, quantity sensitivity, has been noted (Goldsmith 1987b, 1992b): H tones resist being moved off of heavy syllables, and may move from light syllables to heavy syllables. This is another case of tone-accent attraction: heavey

syllables tend to be accented and vice versa, and H toned syllables tend to be accented and vice versa. Work in this area of tone and metrical structure is less well developed, but attraction of H to heavy syllables is well attested, appearing in a number of languages such as Yao, Kimatuumbi, and Chichewa (Bantu: Malawi).

I would like to thank Jill Beckman, John Goldsmith, Beth Hume, and Larry Hyman for helpful comments on an earlier draft of this paper. Data used here derive either from the cited source, or from my own field notes on the language. Tone transcriptions will follow the convention that Raised H tone is transcribed with a double acute accent, H tone with an acute accent, M tone with a macron, and L tone with a grave; or, following the conventions of the original sources for Chori and Grebo, raised numbers are used, with 1 indicating the highest pitch. Following the practice of Bantu linguistics, L toned vowels in Bantu languages are generally transcribed with no accent, rather than with a grave.

1 In addition, a number of separate tone rule sprimarily sensitive to vowel length will spread the stem H rightward by as many as three moras.

2 It is an open question whether phonetic implementation provides finer control over the timing of pitch changes: it might be that in some languages pitch changes are timed relatively early in the syllable, and in other languages they are timed relatively late. Such control would only be phonetic, never phonological. There is a way around the excessive-power objection to moraic linkage of tones, which is to allow only the final mora to bear multiple tones. Possible representations of contour tones would be:




Or, following Hyman (1988a), multiple linking of tones to moras could be restricted to the first mora of the syllable.

3 There is no substantial difference between representing the tonal elements with *h* and */* on the one hand, or with [+H] and [-H] on the other.

4 The left-to-right application of linking is observed almost universally – though see the discussion of Hausa and Kanakuru below. The theory does not contain any provisions which would explain this.

5 The Q-subscript notation expands to an infinite set of subrules applied conjunctively, similar to the star-parenthesis notation of linear phonology.

6 Odden (1984) argues that the Wellformedness Condition must not take effect until after application of the last rule referring to free vowels. Since the Wellformedness Condition would map some tone to any free vowel, no toneless vowels could persist in the grammar, and therefore rules which refer to toneless vowels could not exist, unless the Wellformedness Condition is suspended until after such rules.

7 The final two syllables take L tone phonetically, due to a rule assigning L to any toneless syllable – see section 5.

8 The convention – or rule – which maps tones to vowel one-to-one either left-to-right or right-to-left might appear to require that vowels and tones be underlyingly unassociated. But there is a different way to interpret this convention, namely as a static filter on well-formed underlying representations, rather than as a derivational instruction to link floating tones with free vowels.

9 However, Clark (1990) argues that the default tone in the two-tone language Igbo is not L but rather H.

10 A fourth class, the "rising" class, has the tone pattern LH. These are not relevant here.

11 The theory does not claim that languages cannot have contours involving M tones. The three-tone language Lulubo allows all possible two-tone contours including those with M, viz., ā "it is Tombe", ? āprime;' "in the stomach", *ízí* "his wife" (Andersen 1987). In such cases the default rules have applied to supply features for the M tone before creating the relevant contours. Another possibility would be that in such a language, all tonal features are specified underlyingly, in which case we would not find any

phonological asymmetries.

12 Vowels may also have preaccent or postaccent: preaccent is realized as accent on the previous vowel, and postaccent is realized as accent on the following vowel.

13 In Clements (1981b) and Leben (1978), underlying representations do contain links between autosegments and the segmental core.

14 Goldsmith's analysis is carried out in the context of a framework where all tones link to some vowel, hence the necessity of creating the initial falling and medial rising tones.

15 Besides resisting the retraction rule, a host of other tone rules discussed in Odden (1985) can be used to determine that this word has a final accent; for example, it retains its final H tone phrase-medially (*mbaká ywaángu* "my cat") whereas unaccented final H's phrase-medially are lost (*n'oombé* "cow", *n'ombe ywaángu* "my cow").

16 To be sure, a tone in one morpheme can link to a vowel of another morpheme – such tone shifts happen in Nguni languages – but the target vowel is always in a constant location, such as the penultimate or stem-initial syllable. What the prelinked tone theory could not handle would be a language where the melody shifts to a lexically unpredictable location in a different morpheme.

17 In fact, Goldsmith (1984b) rejects "one-per-morpheme" as being criterial for accent, and his analysis of Tonga has noun stems with multiple accents.

18 An important exception is that Guarani, which allows a single nasal specification, is treated accentually in Goldsmith (1976a).

19 Nguni languages also have phonetic stress on the penultimate syllable. It is not clear how the antepenultimate tonal accent is to be reconciled with penultimate stress accent – perhaps there are multiple planes of metrical organization, or perhaps the antepenultimate accent is shifted to the penult after tone attraction.

20 Sietsema (1989) provides an alternative metrical formalism which expresses the same generalizations as Pulleyblank's analysis.

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