

# Metrical tone and the Elsewhere Condition

William J. Idsardi & Thomas C. Purnell

We argue in this paper that metrical organization in phonology extends beyond stress systems and provides the basic phonological organization in pitch-accent systems as well. We show that cases of tone shift as exemplified in Shingazidja and Tokyo Japanese provides strong support for a metrical analysis where metrical constituents are grouped into domains and the surface location of tones is contingent upon the location of the heads of these metrical domains. As Goldsmith (1990) observes, the extrinsic ordering of a tone spreading rule preceding a tone delinking rule yields an interesting consequence with respect to the location of a tone's underlying position: it predicts that tones can shift some distance over a phonological string. However, we show that general grammatical principles, most notably Kiparsky's (1973, 1982) Elsewhere Condition, impose an intrinsic prohibition against such tone shifting analyses.

## 1. Introduction

The metrical organization of phonology for stress is now generally accepted. In this paper we argue that the same metrical organization extends to non-stress languages, in particular we examine two pitch-accent languages, Shingazidja and Tokyo Japanese. We argue that the tone-shift patterns are best handled by appealing to metrical constituent structure, rather than manipulating tonal associations alone. The traditional identification of two accent classes in Tokyo Japanese, which have recently been discovered to be phonetically distinct, provides another argument for the existence and even the primacy of the metrical groupings. This suggests that the prominent features of stress are not the principal determinant of the phonological organization of stress information. Rather, the phonology provides the metrical constituent system which builds headed constituents and rules assign phonetic features to designated metrical positions. Thus, the principal phonological representation is metrical constituency and headedness, the phonetic manifestation of the constituency by tone or by stress is a shallow, surface reflection of rules aligning phonetic features with special metrical positions.

Tone shift phenomena have prompted a substantial discussion in

the linguistic literature. Some linguists advocate a purely tonal analysis (Goldsmith 1985, Roberts 1992, Carleton & Myers 1994).<sup>1</sup> Other researchers, believing that tones interact in non-trivial ways with accentual systems, either provide accounts where tones follow a language's stress pattern (Sietsema 1989, Kisseberth 1994, Bickmore 1995, Duanmu 1995) or account for shifting tones using an accentual or metrical approach (Cassimjee & Kisseberth 1992, Idsardi & Purnell 1995). In this paper we analyze both metrical and tonal arguments relating to tone shift phenomena showing how general grammatical principles, specifically the Elsewhere Condition, are brought to bear on rule interactions. These principles serve to organize the grammar in a general manner. For example, since the Elsewhere Condition's efficacy as a constraint on rules was one of Kiparsky's original observations, specifically constraining the use of absolute neutralization rules, it ensures that intrinsic rule evaluation takes precedence over extrinsic evaluation. Shingazidja tone shift analyses are compared in § 2, while in § 3 we illustrate a tone shift in Tokyo Japanese resulting from vowel devoicing. We conclude that the tonal phenomena examined are manifestations of metrical organization because the tonal accounts are effectively ruled out by the Elsewhere Condition.

## 2. Shingazidja

In this section we review the tone shift phenomena in Shingazidja, a Bantu language spoken in the Comorro Islands. The data are accessible and yet complex enough to evaluate competing theories and theory-internal analyses. Shingazidja is discussed in Cassimjee & Kisseberth (1989, 1992) where metrical principles and parameters proposed by Idsardi (1992) and Halle & Idsardi (1992) are shown to be operable in building metrical grids which then receive tonal interpretation. Below we amplify the Cassimjee and Kisseberth analyses along the lines of revised metrical principles in Halle & Idsardi (1995), and present hypothetical non-metrical, autosegmental analyses for comparative purposes. The reader is encouraged to consult Cassimjee and Kisseberth for further information and background on Shingazidja.

The grammar of Shingazidja seems to allow a tone to move rightward across a word, up to the next underlying tonal position, shown in (1). Throughout the paper surface H tones are indicated by an acute accent. Underlining represents the leftmost possible position of the tone's realization (sometimes equated with the

underlying position of the H tone). At times the tone in Shingazidja surfaces in exactly this leftmost possible position (1a), while at other times the tone surfaces some distance to the right of this position (1b). The specific status of the underlined vowel depends on which approach is chosen to account for the shifting tone: in tonal analyses, the leftmost position identifies an underlying H tone position; in metrical analyses, the leftmost position is the left boundary of a metrical domain.

- (1) a.    mezá                    'table'  
          hi-rí                    'chair'  
          ma-sohá                'axe'  
          i-tsawazí               'a kind of plate'  
          godoró                 'mattress'  
          djuúú                    'on'  
          -ilí                      'two'  
          ndé<sup>2</sup>                    'it is'
- b.    meza djúú                'on a table'  
          hi-rí djúú               'on a chair'  
          ma-sohá ma-ilí        'two axes'  
          meza m-bíli            'two tables'  
          zi-tsawazí zi-ilí        'two plates'  
          ndé e mézá             'it is the table'  
          ndé le godoró         'it is the mattress'  
          ndé e m-bíya          'it is the plate'

The relevant characteristic of the words in (1) is the surface H tone. In isolation, as in (1a), the tone falls on the final mora. When combined with other similar words in (1b), the tones exhibit a rightward tone shift to the vowel preceding another underlined vowel. The operative generalization, Cassimjee and Kisseberth explain, is that the H tones move no further than the vowel immediately preceding the next H tone's "underlying" position (i.e., leftmost possible position).

### 2.1. A metrical account

Cassimjee and Kisseberth's metrical account of the Shingazidja tone shift phenomena represents prosodic structure by building Simplified Bracketed Grids (SBG) (Idsardi 1992, Halle & Idsardi 1992). The application of the parameterized rules in (2) generates the appropriate metrical structure. Italics mark the parameterized choices in each rule.<sup>3</sup>

- (2) a. Line 0 Projection:  
Project a line 0 element for each *stress-bearing element*.  
b. Edge Marking:  
Insert a *left/right* parenthesis to the *left/right* of the *left/right-most element*.  
c. Iterative Constituent Construction:  
Insert *left/right* parentheses every two elements moving *left/right-ward*.  
d. Head Projection:  
Project the *left/right-most element* of *each* constituent.

Applying specific parameters identifies the surface location of the H tones for some of the forms in (1), shown in the derivations in (3). Cassimjee and Kisseberth propose a metrical grammar for Shingazidja beginning with each moraic element projecting a line 0 grid mark.<sup>4</sup>

- (3) Line 0      x x    xx    x x x    x x x x    x x x x x  
                  | |    | |    | | |    | | | |    | | | | |  
                  meza dju ma-soha ma-ili nde le godoro

Some of the moras are lexically specified to begin a metrical domain, indicated by the left parentheses in (4).

- (4) Line 0    x(x)    x(x)    x(x)    x x(x)    (x x x x) (x  
                  | |    | |    | |    | | |    | | | | |  
                  meza dju ma-soha ma-ili nde le godoro

Notice that these domain boundary positions correspond to what are usually considered in tonal analyses to be the moras pre-attached to an underlying H tone.<sup>5</sup> Despite being delimited by left domain boundaries, the domains on (line 0) are right headed.

- (5) Line 1            x            x            x x            x x  
Line 0    x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                  | |    | |    | |    | | |    | | | | |  
                  meza dju ma-soha ma-ili nde le godoro

These heads are grouped into binary constituents on (line 1) (by the ICC moving left to right, inserting a left parenthesis before every two grid marks).<sup>6</sup>

- (6) Line 1            (x x)            (x x)            (x x)  
Line 0    x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                  | |    | |    | |    | | |    | | | | |  
                  meza dju ma-soha ma-ili nde le godoro

The (line 1) domains are left headed even though (line 0) domains are right headed, as in (7).

- (7) Line 2            x            x            x  
Line 1            (x x)            (x x)            (x x)  
Line 0    x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                  | |    | |    | |    | | |    | | | | |  
                  meza dju ma-soha ma-ili nde le godoro

Notice that vowels with (line 2) marks carry the surface H tones. In (3) through (7) we have shown how the metrical structure is built from parameter settings in (2), summarized in (8).

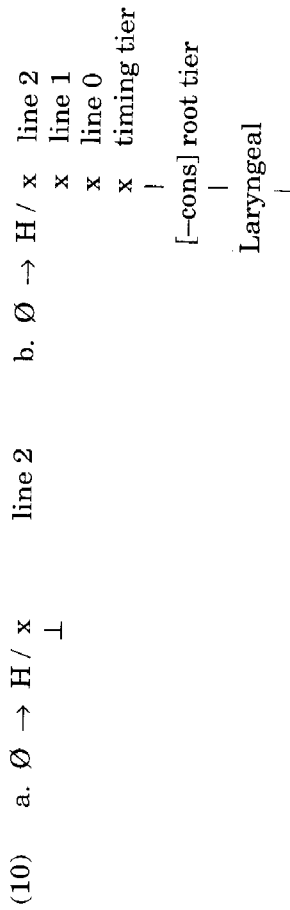
- (8) a. Line 0 Projection: every mora, marked moras also have (  
b. Line 0 Head: R  
c. Line 1 ICC: (, L → R  
d. Line 1 Head: L

The parameter settings are not readily apparent when examining the metrical structure in (7) alone, for the remainder of the paper we decompose the metrical structure into stages created by each relevant parameter. Thus, the settings generating (7) are displayed as (9) below.

- (9) Line 0: Projection      meza dju ma-soha ma-ili nde le godoro  
Head: R                    x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                                  x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                                  x x            x x            x x  
Line 1: ICC:(, L → R      x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                                  (x x)            (x x)            (x x)  
Head:L x(x)                x(x)    x(x)    x(x)    x x(x)    (x x)    x x(x)  
                                  (x x)            (x x)            (x x)  
                                  x                    x                    x

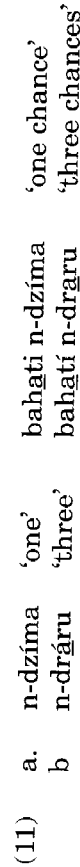
Additionally, to correctly place the tone in the words of Shingazidja, that is to capture the fact that metrical prominence is signal-

led by H tone, (10a) makes explicit Cassimjee and Kisseberth's assumption that a rule supplies all vowels connected to (line 2) marks with a H tone.

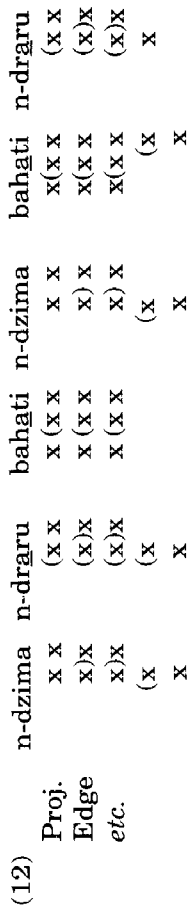


We do not intend (10a) to link the H tones directly to the grid positions, rather they are connected to their usual place in the feature geometry. The association mandated by (10a) is indirect, that is a path must be established from a (line 2) mark to a supplied H tone. In other words, (10a) omits the implicit intervening structure, which if spelled out completely would give (10b). Since the intervening structure is necessary given the rest of phonological theory, we propose that standardly employed notational conventions are correct and that the actual specification of the rule can ignore intervening structure. In general, therefore, rules mandate paths between elements rather than necessarily establishing direct links (Archangeli & Pulleyblank 1994).

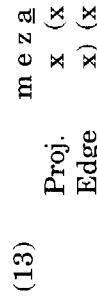
There are a few more facts of Shingazidja which motivate some further parameter settings. The behavior of unaccented words is intriguing because these words show penultimate H tone in isolation, in (11a).



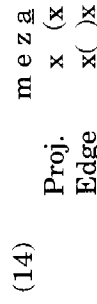
There are two things to notice about the examples in (11). The first is that the penult-accented form in (11b) in isolation does not “shift” H tone onto the final syllable (for example, *n-draru* instead of *\*n-draru*). The second is that the two words with penultimate accent in isolation behave differently when in combination. Cassimjee and Kisseberth account for these facts by distinguishing between accented (11b) and unaccented (11a) forms, and using the rule Edge:RLR, that is  $\emptyset \rightarrow / \_ x \#$ , on (line 0). Like the other metrical rules, Edge:RLR applies at the phrase level in Shingazidja, resulting in the derivations in (12).



But now we must again consider the words with final H tone in isolation in (1a). Cassimjee and Kisseberth note the problematic nature of these words evident in the partial derivation in (13) with respect to Edge Marking, namely the fact that two opposite parentheses abut, establishing two separate unary domains (cf. Cassimjee and Kisseberth's (35)).



Cassimjee and Kisseberth appear to assume that the right parenthesis inserted by Edge:RLR is placed to the left of the lexical parenthesis. Suppose, instead, that we adopt a strict interpretation of the (line 0) Edge rule so that the right parenthesis is inserted immediately to the left of the grid mark exactly as specified by the Edge Marking rule, yielding (14).



If Edge:RLR applies literally in the form in (14) then a “vacuous” constituent will be created – a constituent containing no elements. Halle & Idsardi (1995) propose that Universal Grammar prohibits such vacuous constituents. We believe that universal constraints (such as the prohibition on crossing association lines) are violable at all levels of representation, and further that rules are consistently prevented from creating such configurations.<sup>7</sup> Thus, Edge:RLR is prevented from occurring in this form, and the derivation of *mezá* works correctly.<sup>8</sup>

Cassimjee and Kisseberth note another class of accented/unaccented word pairs, namely monosyllabic words. All monosyllabic words display a H tone in isolation, but not all do when in combination with the definite proclitic *ye*, shown in (15a).

- (15) a. n-dzi 'fly' yé n-dzi 'the fly'  
 b. [n]-tsí 'land' ye n-tsí 'the land'

Notice that Edge:RLR applied to monosyllabic unaccented words (15a) also results in a vacuous constituent although different from a that displayed in (14). In (16) the vacuous constituent results from a right parenthesis dangling off the front edge of the word.

- (16) Proj. n-dzi  
 Edge:RLR x  
 )x

Edge:RLR will be prevented from occurring in this form because its application would create the vacuous constituent.<sup>9</sup> However, it is insufficient to just prevent Edge:RLR from applying in this form; for if no parenthesis enters into the metrical structure in (16), then no means exist for a head (and likewise a tone) to surface in *n-dzi*. The word indeed manifests a H tone in isolation, and since it is underlyingly unaccented, the creation of a metrical domain by some form of parenthesis insertion must be effected by the grammar.

The failure of Edge:RLR to apply because of the constraint against vacuous constituents combined with the obligatory surfacing of a tone on monomoraic words leads us to claim that the more general parameter setting Edge:RRR applies.

- (17) Proj. n-dzi  
 Edge:RLR x  
 Edge:RRR Blocked  
 etc. x  
 (x  
 x

As (17) shows, the right parenthesis creates a suitable metrical constituency for the head projection onto (line 1). We further observe that in (18) Edge:RRR can also apply to (16) and (9).

- (18) Proj. dzi meza dju u  
 Edge:RLR x x(x x(x  
 Edge:RRR Blocked—*vacuous constituent*  
 etc. x) x(x x(x)  
 x) x(x x(x)  
 (x (x x  
 x x

But now we must ask why both Edge Marking rules (Edge:RLR and Edge:RRR) do not both apply to the words in (12). Notice that if they did, we would incorrectly derive an additional H tone on the final vowel of *\*bahati n-drarú*.

- (19) bahati n-draru  
 Lex. x(x x (x x  
 Edge:RLR x(x x (x)x  
 Edge:RRR x(x x (x)x  
 etc. x(x x (x)x  
 (x x(x x  
 x x

To answer this question we must examine the two Edge Marking rules in detail. The two rules are shown in (20), emphasizing the structural descriptions (SD) and changes (SC) of the rules.

- (20) a. Edge:RRR = # → ) # b. Edge:RLR = x # → ) x #  
 SD SC SD SC

It is clear that the structural changes are distinct, and that they fall under the identical function clause in the formulation of the Elsewhere Condition of Kiparsky (1973, 1982) in (21).

- (21) Rules A, B in the same component apply disjunctively to a form  $\phi$  iff  
 (i) The structural description of A (the special rule) properly includes the structural description of B (the general rule).  
 (ii) The result of applying A to  $\phi$  is distinct from the result of applying B to  $\phi$ . In that case, A is applied first, and if it takes effect, then B is not applied. (Kiparsky 1982:136-137)

It is also clear that the structural description of Edge:RRR is wholly contained in the structural description of Edge:RLR (20b). Therefore, the two rules fall under the purview of the Elsewhere Condition and must apply disjunctively. In representations where both rules could apply such as *bahati n-draru*, Edge:RLR applies and blocks the application of Edge:RRR, seen in (22) below. Only when Edge:RLR is itself blocked from applying (for example, by universal principles against vacuous constituents) does Edge:RRR emerge out of the shadow of the more specific rule, seen in (17) above.<sup>10</sup>

- (22)                    bahati n-draru  
 Lex.                    x(x x    (x x  
 Edge:RLR            x(x x    (x)x  
 Edge:RRR            Blocked—Elsewhere Condition  
 etc.                    x(x x    (x)x  
                           (x    x(x  
                           x    x

In sum, we have shown how prosodic structure mediates tone shift. Using the metrical principles in (2), tone shift of accented and unaccented, monosyllabic and polysyllabic words are computable. Furthermore, principles like the ICC facilitate capturing Meeussen's generalization that Bantu languages like Shingazidja suppress every other tone. Additionally, our present analysis agrees with Idsardi (1992) and Halle & Idsardi (1995) that the Edge Marking principle subsumes any other mechanism handling extrametricality. Cassimjee and Kisseberth, on the other hand, suggest that the mechanism contributing to extrametricality coexists with Edge Marking in Shingazidja. Examples like *n-dzi* in (17) show that Shingazidja does not require any mechanisms other than Edge Marking to identify extrametrical constituents. In this case, we are able to show as well that a general principle of grammar, the Elsewhere Condition, mediates competition between metrical rules. Edge:RLR fails to apply because of the constraint against vacuous constituents noted above. As a result, the more general parameter setting Edge:RRR then applies creating suitable constituency for a head.

## 2.2. Tonal accounts

### 2.2.1. Tonal account using LH tonal pattern

We have seen in the preceding section how the Shingazidja tone shift phenomena might be accounted for by primarily referring to the accentual system of the language. Given that the tones in Shingazidja appear on the surface and appear to shift rightward from their underlying position up to the next underlying tone position, a proposal could be made (resembling Goldsmith's 1985 account of Sukuma) that the underlined vowels possess a lexical LH tonal melody. Specifically, the L tone of the melody would be pre-associated to the vowel while the H tone floats to the right of the L tone. The forms in (1a,b) above are shown in (23) employing this underlying tonal melody.

- (23) a. mesa                    b. djuu                    c. [mesa djuu]  
       |                        |                        |  
       LH                    LH                    LH LH

According to a universal association principle, namely the Initial Association rule (Williams 1976, Goldsmith 1976, 1990), the H tone will associate to the first available vowel to the right of the existing association line connected to the L tone. In other words, the tones link to the leftmost vowel without violating No Crossing Lines.

- (24) ⑦  
       |  
       H

- (25) a. mesa djuu                    b. zi-t sawazi zi-ili  
       | / |                        | / |  
       LH LH                    LH LH

A High Shift rule would then apply shifting the H tone until it reaches another association line and can spread no further.

- (26)                    zi-t sawazi zi-ili  
                           | # / |  
                           L H LH

In a subsequent section, we discuss possible formulations of High Shift. For now, though, we will employ a formulation resembling the rule in Goldsmith (1985) where the H tone shifts and delinks in one step. Superficially, applying the rule in (27) to words in (1) generates the proper placement of surface tone, seen in (25) and (26).

- (27) V ⑦ → V V  
       |                    # /  
       H                    H

We notice, however, that to account for larger phrases with several underlying tones, for example *nde e ma-séa ma-ráru*, we need to invoke a version of Meeussen's Rule deleting every other H tone. The generalization of Meeussen's Rule in Bantu languages is that one of two adjacent H tones deletes or changes to a L tone (Goldsmith 1984). Two points should be made regarding the relation of Meeussen's Rule in general and the specific instantiation that the present analysis requires. First, the focus of the generalization is the

adjacency of identical tones of a particular type, namely H tones. This focus is wanting in an analysis relying on a nonprivative inventory of tones since the requisite formulation of Meeussen's Rule must refer to intervening L tones. Specifically, then, Meeussen's Rule changes a H tone to a L tone when the H tone occurs after a L tone which is preceded by another H tone. Two instantiations of the same rule are shown in (28a,b), each applying iteratively, left to right.

- (28) a.  $H \rightarrow L / HL \_$       b.  $H \ L \ H \rightarrow H \ L \ L$   
           | | | |                   | | | |  
           V V V                   V V V   V V V

Secondly, in terms of the Obligatory Contour Principle (OCP), Meeussen's Rule repairs OCP violations. The result of Meeussen's Rule applying to a string of H tones is an alternating HL pattern. The output of the rule (28), however, is noticeably worse than the input to the rule, a LLL creating pattern. In the partial derivation in (29) we observe that the second H tone ( $H_j$ ) becomes a L tone by the rule in (28).

- (29) nde e ma-sera ma-raru   →  nde e ma-sera ma-raru  
       | | | | |                   | | | | |  
       L  $H_i$ L  $H_j$  L  $H_k$            L  $H_i$ L L L  $H_k$

In the input of (29) the alternating H and L tones are configured so that they appear to satisfy the OCP, and other formulations of Meeussen's Rule. After applying the specific formulation of Meeussen's Rule in (28), this satisfactory configuration is destroyed.

We might ask how the final H ( $H_k$ ) in (29) comes to be associated to the penultimate vowel and not the final vowel. When a penultimate vowel is underlyingly linked to the L tone of a LH melody (29), we need a rule, High Retraction (30), to put the H tone on the penultimate vowel (and not on the final vowel).

- (30)  $L \textcircled{H} \rightarrow L \ H$   
       |           | /  
       V (V) #   V (V) #

On the other hand, since a vowel underlyingly linked to the L in a LH melody may occur on the final syllable of the word (15b), we note the final vowel's optionality in the rule. This results in the tone surfacing on the final vowel (and not on the penultimate vowel). Under the Elsewhere Condition, High Retraction will block the application of

the Initial Association rule (24). The structural description of High Retraction includes the structural description of Initial Association, and the structural changes of the two rules are distinct. If High Retraction and Initial Association are extrinsically and conjunctively ordered, then we would expect an unattested H plateau to occur over the last two vowels of the word.

Once the H tone has docked onto the vowel, the ensuing rising tone must be leveled by deleting the L tone. Rising Tone Elimination is shown in (31).

- (31)  $L \ H \rightarrow H$   
       | /           | /  
       V            V

Another rule, High Insertion, necessary to get the correct surface tones, inserts a H tone on the penultimate vowel in words similar to *nyáma* where there are no underlying H tones. We show in (32a,b) two different ways of writing the same rule. Again (32b) is a restatement of (32a) displaying the structural description and change of the rule more clearly.<sup>11</sup>

- (32) a.  $\emptyset \rightarrow H / \_$                    b.  $H$   
           |                                |  
           V (V) #                        V (V) #  $\rightarrow$  V (V) #

Like High Retraction, when monomoraic words are without underlying tones (15a), we note the optionality of the second vowel in (32).

Our first tonal analysis is completed by proposing the insertion of a L tone in all positions where there is no existing H or L tone by a Default Low rule (33).

- (33)  $L$   
       |  
       V

In sum, we have seen what the grammar would have to look like having an underlying LH contour. The advantage of this LH contour is its ability to block the spreading of a preceding floating H tone. Additionally, we see beneficial effects of the Elsewhere Condition, ultimately disjunctively ordering the Default Low rule (33) with respect to Initial Association (24), High Shift (27), High Retraction (30), and High Insertion (32). As a result, (33) will insert L tones only on vowels that are unaffected by any other rule. Unfortunately, the formalization

of Meeussen's Rule in (28) varies from other Bantu languages. Also this analysis makes crucial use of both H and L tones even though the language does not have contour tones.

### 2.2.2. Tonal account using privative H tone

A more current tonal analysis could claim that instead of a LH contour on lexically specified positions, a pre-attached privative H tone is lexically attached to certain vowels (similar to Roberts' 1992 analysis of Sukuma). We can see in (34) how the forms in (23) would be lexically represented in this approach.

- (34) a. mesa      b. djuu      c. [mesa djuu]
- |   |   |   |
|---|---|---|
|   |   |   |
| H | H | H |

Adopting this lexical representation, we could assume that the H tones would shift across the word using the High Shift rule in (27) above, repeated in (35).

- (35) V  $\odot$  → V V  
 |        #/  
 H        H

If this were the case, all of the tones would pile up at the end of the word and there would be no association lines to prevent a total shift in \**mesa djuú*. In the previous account the association lines connected to L tones blocked the total spread of H tones (see (21)). In order to attain the generalization that positions specified for an underlying tone block the spread of surface tone, a rule (36) is required to spread the tones across the form until either another association line or the end of the word is encountered.

- (36) V  $\odot$  → V V  
 |        |/  
 H        H

An example follows in (37).

- (37) zi-tstawazi zi - ili  
 |        |/  
 H        H

Another rule is then required to remove all of the association lines except the final one. To achieve this effect, we posit a rule (38).

- (38) V V → V V  
 |        |/  
 H        H

An example follows in (39).

- (39) zi-tstawazi zi - ili  
 |        |/  
 HH

This rule applies iteratively across the form, left to right, delinking the left of two association lines from a high tone.

Meeussen's Rule, in this second tonal analysis, can be formulated in accordance with other proposals of the rule where the second H tone is removed if two H tones are strictly adjacent. The rule stated in (40) must apply iteratively left to right. Goldsmith 1984 has several cases where all but the first (or last) H tone is eliminated by other versions of Meeussen's Rule in other Bantu languages.

- (40) H H → H  
 |        |/  
 V V     V V

An example follows in (41).

- (41) zi-tstawazi zi - ili  
 |        |/  
 H

To account then for words in which the tone stops on the penultimate vowel and not the final vowel, we need to posit a retraction rule disassociating the final vowel from the doubly linked H tone. Note that the structural description includes the structural description of the delinking rule (38) and that the structural changes of the two rules are distinct. Thus, the two rules are disjunctively ordered such that (38) applies only if (42) fails to apply.

- (42) V V # → V V #  
 |        |/  
 H

Finally, High Insertion (32) can be borrowed from the first tonal analysis so that a H tone is inserted on the penultimate vowel in



cases where there are no underlying H tones. In addition, the Default Low rule (33) would also apply, filling in L tones on vowels without any tones.

In sum, we notice that the problems with the first analysis, namely the formalization of Meeussen's Rule and the nonprivativity of tone features, are better handled by the second analysis. Recall that since the H tones in (28) are not strictly adjacent on either the tonal or segmental tiers (Myers 1987), it runs counter to the generalization that the second of adjacent H tones deletes. In addition, (28) also destroys a perfectly good LH contour representation that is claimed to exist in the speaker's inventory. The formalization in (40), in contrast, satisfies the adjacency requirement and preserves underlying contrasts. Additionally, the first tonal analysis is less preferable to the second analysis which only inserts a noncontrastive L tone by a default redundancy rule (33). One problem, however, with this second analysis that the first analysis does not suffer from, is the intermediate violations of the underlying and surface constraint that a tone in Shingazidja not be associated to more than one vowel. This problem is symptomatic of a more general problem to which we now turn.

### 2.2.3. Evaluation of tonal accounts of tone shift

Both tonal analyses employ some kind of spreading rule in order to capture the phenomenon in (1). These rules are not uncommon. In fact, phonological analyses of tone shift typically employ two conjunctively ordered rules: one rule which spreads tone (43a) and another rule which delinks the original association (43b). We have seen instantiations of these rules already, presented above in (36) and (38), respectively.

$$(43) \quad \text{a.} \quad \begin{array}{c} V \quad C_0 \quad V \\ | \quad \dots \\ T \end{array} \quad \text{b.} \quad \begin{array}{c} V \quad C_0 \quad V \\ \# \quad \diagdown \\ T \end{array}$$

The desired effect of first applying (43a) followed by (43b) is tone shift, moving the H tone from an association with the first vowel to an association with the second vowel. Iterative application creates the appearance of a tone moving across a word, up to the next established tonal association.

While derivations combining spreading and delinking rules resembling (43) represent the prevailing interpretation of tone-shift, there have been glimmers of protest. Goldsmith (1990) notes a conceptual problem with derivations where an intermediate stage con-

tains multiply associated tones (see (37)). Notice that representations with multiply linked tones are systematically excluded at both the lexical and surface levels in Shingazidja. Thus, it seems peculiar that intermediate representations would allow multiply associated tones if the underlying and surface levels do not permit the multiple associations. But the representations with multiple associations are necessary if Meeussen's Rule (40) is to apply correctly in Shingazidja while preventing tone spread beyond the next underlying association.

Goldsmith's response to such cases is to posit a universal repair convention where "the tone assigned by the [spreading] rule is maintained, but the earlier tone is disassociated" (1990:19). Goldsmith expresses (43) in a single rule (44), seemingly performing both operations at once.<sup>12</sup> High Shift (27), proposed above, is a variant of (44).

$$(44) \quad \begin{array}{c} V \quad C_0 \quad V \\ \# \quad \dots \\ H \end{array}$$

(44) is inconsistent with the postulation of a universal repair convention in that it incorporates the repair into the rule. Furthermore, under the reasonable assumption that rules can effect only one change at a time,<sup>13</sup> notations like (44) are just abbreviation conventions for spreading followed by delinking.

Postulating a universal repair still does not solve the problem of creating intermediate representations that violate general principles true of both surface and underlying representations which is the complaint leveled against the second analysis applying (36) across the form. Rather, the general repair stipulates that these intermediate representations are "fleeting" in that they are immediately brought back into line. A better position contends that general principles governing tone complexity on individual vowels block any spreading rule from applying in the event it creates an overly complex tone in the same way the prohibition on crossing association lines prevents any spreading rule from spreading across an existing tonal association. Of course, this interpretation would effectively prevent any analysis of Shingazidja tone shift resulting from spreading and delinking where multiply linked tones are disallowed at either the underlying or surface levels. Thus, this line of reasoning regarding general parameterized principles of tone-vowel associations in languages ultimately leads to the conclusion that tone-shift in Shingazidja (and any language) cannot be implemented by rules of spreading and delinking.

We will now show that the argument against representing tone-

shift with spreading and delinking rules is even more severe since the rule interactions under discussion violate the Elsewhere Condition cited above in (21). For clarity in evaluating the spreading and delinking rules with respect to the Elsewhere Condition, (43) is rewritten in (45a,b) emphasizing the structural descriptions and structural changes in the rules.

$$(45) \quad \begin{array}{l} \text{a. } V C_0 V \quad V C_0 V \\ | \quad \rightarrow | \quad / \\ H \quad H \quad SC \\ SD \quad SC \end{array} \quad \begin{array}{l} \text{b. } V C_0 V \quad V C_0 V \\ | \quad / \quad \rightarrow | \\ H \quad H \\ SD \quad SC \end{array}$$

It is clear that the structural changes of the two rules in (45) are distinct, antagonistic and incompatible in Kiparsky's sense. The rule (45a) increases tonal associations while (45b) decreases tonal associations. That is, (45a) adds association lines; (45b) deletes association lines. They are also incompatible with respect to the association line between the first vowel and the H tone. Rule (45b) necessarily removes that association (that is the change effected by that rule), whereas rule (45a) maintains the association between the H tone and the first vowel. Therefore, the structural changes of the two rules make opposite demands regarding the association of the H tone with the first vowel. This fact also makes the rules incompatible. It is also clear that the structural descriptions in (45) are nondistinct, that is the structural description of (45a) matches all representations that match the structural description of (45b). In other words, the structural description of (45a) is wholly contained in the structural description of (45b). Thus (45b) is the more specific of the two rules. Therefore, the Elsewhere Condition governs the application of these rules and the rules must apply disjunctively. General principles of UG, then, rule out the standard analysis of tone-shift, the conjunctive mode of application where (45a) feeds (45b).<sup>14</sup>

The Elsewhere Condition also effectively disallows certain analyses, for example some "Duke of York" (Pullum 1976) and "False Step" gambits (Zwicky 1974). By way of example, suppose some language had a rule iteratively spreading a tone to the right (for example, (45a)), and a rule iteratively deleting the rightmost of a multiply linked configuration (for example, the reverse of (38b) in (46b)).

$$(46) \quad \begin{array}{l} \text{a. } V C_0 V \\ | \quad \dots \\ H \end{array} \quad \begin{array}{l} \text{b. } V C_0 V \\ | \quad / \quad \neq \\ H \end{array}$$

The conjunctive application (46a) followed by (46b) results in derivations such as (47).

$$(47) \quad \begin{array}{l} UR \quad V V V V V \\ | \\ H \end{array}$$

$$(46a) \quad \begin{array}{l} V V V V V \\ | \quad / \quad / \quad / \\ H \end{array}$$

$$(46b) \quad \begin{array}{l} V V V V V \\ | \\ H \end{array}$$

Note that in (47) the underlying and surface representations are the same, while the intermediate stage is vastly different.

No one would seriously propose analyses resembling (47) that involve intermediate representations lacking any clear purpose. Ruling out such rule interactions is not an entirely trivial matter, however, and meta-theoretical principles are often invoked to eliminate such analyses from consideration. Again, the Elsewhere Condition does exactly the required work, ruling out analyses such as (47) on general principles. The rules in (46) are not allowed to apply conjunctively because, as in the previous case, the structural descriptions of the two rules are nondistinct while the structural changes of the rules are incompatible.

We have shown that analyzing tone-shift by means of a conjunctive application of spreading and delinking rules is impossible because it contravenes the Elsewhere Condition. Furthermore, such analyses are also suspect on the grounds that these analyses create intermediate representations which violate what seem to be general principles of tonal associations in languages. Therefore, we are left with the problem of proposing an analysis which does obey general principles, specifically the metrical analysis presented in section 2.1.

### 2.3 Summary

Previously the metrical account has been argued to be an alternative to the spreading-delinking account. We agree with Cassimjee and Kisseberth that the metrical account is to be preferred on grounds of simplicity and also on the grounds that there are no intermediate representations which violate principles true at both

underlying and surface representations. In addition, we have shown that choosing a metrical analysis is not merely a question of preference, but in fact autosegmental analyses involving spreading and delinking tones are untenable by virtue of the Elsewhere Condition. Regardless of whether the representation of Meeussen's Rule in (40) is preferable to the representation in (28), we speculate that Meeussen's Rule is clash resolution.

### 3. Tokyo Japanese

Tokyo Japanese also exhibits a shift in tone (or pitch accent) when an accented vowel is devoiced by a vowel devoicing rule. Various explanations for this shift have been offered, from extrinsic rule ordering of H tone spread and devoicing (as in Haraguchi 1977) to mainly phonetic explanations (as in Prince 1983). There is a vast literature on Japanese tone, and we will not examine or even enumerate the various approaches that have been explored. For an introduction to Japanese tone, see, for example Tsujimura (1996).

As the reader can by now anticipate, we will analyze Japanese accent and tone as the interaction of metrical and tonal rules. In our analysis we will combine the insights of Haraguchi (1991) (a metrical theory of Tokyo Japanese in the framework of Halle & Vergnaud 1987) with those of Pierrehumbert & Beckman (1988). Pierrehumbert and Beckman argue extensively against the view that Tokyo Japanese contains a phonological rule of H tone spread. They argue that phonetic examination of the pitch contours reveals systematic differences between accented and unaccented words, and they argue that phonetic interpolation of pitch between sparse pitch targets best explains the fundamental frequency contours. We agree with their findings, and present here a fragment of the phonology that will generate the sparse pitch targets which are required for Pierrehumbert and Beckman's phonetic implementation component.

As McCawley (1968) has pointed out, the (approximate) tonal patterns of Tokyo Japanese can be predicted on the basis of the assumption that at most one of the moras in the word is accented. The first mora in the word has L tone (unless it is accented), the second mora through to the accented mora all have H tone, and all moras following the accented mora have L tone. Unaccented words have a tone pattern similar to final-accented words: a L first mora and H tone throughout the rest of the word. However, Pierrehumbert and Beckman demonstrate some systematic phonetic differences:

there is a sharp fall in fundamental frequency following the accented mora, and a steady, slow fall in fundamental frequency after an unaccented second-mora H tone. They argue that the best explanation for this is a sparse representation of pitch targets: L on the first mora, H on the second, H on the accented mora, and L on the mora following the accented mora, as shown in (48) (where the apostrophe marks the accented mora).

(48) Word-type Tone-spreading analysis Pierrehumbert and Beckman 1988  
(e.g. Haraguchi 1977) kamisori'-ga 'razor'

accented kamisori'-ga  
| / | | |  
L H L L

unaccented kamaboko-ga kamaboko-ga 'fish  
| | | |  
L H L H pudding'

As we can see, Haraguchi's analysis maps the tone pattern (L)H(L) around the accented mora, while Pierrehumbert and Beckman's analysis provides only a sparse phonological tone representation, with only a few tonal targets. The phonetic implementation component then interpolates tonal values for the phonologically unspecified moras. Given the general downward trend (declination) of pitch, this proposal very neatly accounts for the measured pitch data.

In (49) we give a set of parameterized metrical rules that, along with the tone insertion rules in (50) will generate the Pierrehumbert and Beckman sparse tonal targets.

- (49) a. Line 0 Projection: every mora, marked moras also have )  
b. Line 0 Edge: LRL  
c. Line 0 Edge: LLL  
d. Line 0 Head: R

- (50) a.  $\emptyset \rightarrow H / (x \text{ and } x)$   
b.  $\emptyset \rightarrow L / x(x \text{ and } x) x$

These rules entail that a left metrical boundary is marked by a rise in tone, and a right metrical boundary is marked by a fall in tone. Thus, we generate a representation equivalent to Pierrehumbert and Beckman's, as shown in (51).



- (56) x) x x (x)x x  
 | | | \ | |  
 ti'kaku → ṭj̣ka'ku 'near' (Haraguchi 1977:42)  
 ^  
 HL

This analysis thus far predicts a difference in the tonal assignment in such words, with the shifted accent resulting in a new kind of falling tone on the now accented vowel. We have not been able to confirm or disconfirm this prediction from existing phonetic studies; if this is *not* the case, we would then require a rule eliminating the second grid mark on the vowel.

One last situation remains to be examined: words that have accent on the second vowel. Haraguchi (1977) claims that in such words the accent shifts rightward, giving examples such as *atu'ku-wa* → *aṭỵku'wa* 'be thick'. However, dictionaries such as Martin 1994 show a pattern of leftward shift in such cases, as illustrated in (57).

- (57) ak'iru 'wearies of' a'ḳj̣te *ibid.*  
 atu'i 'hot' a'ṭỵsa 'heat'

Since we are not in a position to resolve this problem with the data judgements at this time, we will simply note that these two results would be predicted, depending on the ordering of the delinking rule, (53), with respect to Edge:LRL, (49b). If delinking precedes Edge:LRL, then accent will shift leftward. If delinking follows Edge:LRL, however, then the second mark will constitute the entire constituent, (x), and stray erasure will be prevented. The grid mark must then dock to a neighboring vowel. The direction of the docking might be different for different speakers, resulting in rightward shift some of the time (as reported by Haraguchi) and leftward shift at other times. Unfortunately, we must leave these questions open at this time.

The metrical analysis of Japanese tone and accent thus provides new insights into two problems: tone shift and the perceptual identity of unaccented and final-accented words. We predict that tone should shift within a constituent whenever possible, the same phenomena observed in Shingazidja. Thus, the metrical constituent structure is more basic than the tonal structure (Bamba 1991), and the correct view is to derive the tonal structure from the constituent structure. Likewise, speakers of Japanese seem to attend more to the abstract constituent structure than to the phonetic facts of tone, and perceive final accented and unaccented words to be alike, even

though they differ phonetically. In the present analysis, this misperception receives a ready explanation in terms of the calculated constituents and their heads, which diverge from the tonal patterns in exactly these cases. Thus, these two phenomena of Japanese accent argue for the primacy of metrical constituents as the phonological representation of Japanese accent.

#### 4. Conclusion

To conclude, we have argued that general grammatical principles, such as the Elsewhere Condition, govern tonal rule interactions and thereby partially determine the validity of various analyses. Analyses of tone shift employing spreading followed by delinking are ruled out by the Elsewhere Condition. The alternative is a metrical analysis, whereby metrical constituents are created, and tones are added based on the metrical structure. This type of analysis provides a simple explanation of pitch-accent phenomena that are representative of stress systems (e.g. culminativity), while still allowing the usual tone phenomena (e.g. spreading).

#### Addresses of the authors:

William J. Idsardi: Department of Linguistics, University of Delaware,  
 46 East Delaware Avenue, Newark, Delaware 19716, e-mail:  
*idsardi@udel.edu*  
 Thomas C. Purnell: Department of Linguistics, University of Delaware,  
 46 East Delaware Avenue, Newark, Delaware 19716, e-mail:  
*tpurnell@udel.edu*

#### Notes

We gratefully acknowledge the helpful comments of Irene Vogel and an anonymous reviewer. All errors are our own.

- <sup>1</sup> This list is not extensive, but exemplary. While the works noted are primarily Bantu studies, other language families also exhibit tone shift (e.g. Yip 1980 and Duanmu 1995).
- <sup>2</sup> Cassimjee and Kisseberth note that this word is a form used only with a complement.
- <sup>3</sup> Since the (line 0) Projection parameters interface with the rest of the phonology, they depend on the exact nature of syllable theory. Moreover, a parameter to Head Projection limits heads in some languages to closed constituents. Further information about the parameters in the rules is found in Idsardi (1994).
- <sup>4</sup> In subsequent derivations, we will suppress the association lines between elements on different lines of the grid, and those from the timing tier to (line 0).

<sup>5</sup> We adopt the convention in Idsardi (1992, 1994) and Halle & Idsardi (1995) that domains are minimally constituted by one parenthesis and that grammars can distinguish between an open and closed domain (e.g., Old English). One offshoot of the finding that brackets do not necessarily have to be matched, and in some grammars are not matched, is that the Bracket Matching Convention assumed in early versions of Halle & Idsardi (1995) is unnecessary.

<sup>6</sup> Cassimjee and Kisseberth employ the earlier conception of the ICC in Halle & Idsardi (1992).

<sup>7</sup> The situation with vacuous constituents is somewhat different than No Crossing Lines in that it is possible to concatenate two potentially empty constituents. Those with dangling parentheses create an actually empty constituent (see Idsardi's (1992) treatment of Russian). In the event that such configurations arise through morpheme concatenation they must be dealt with overtly in the phonology.

<sup>8</sup> Alternatively, *mezá* could be accounted for by using two disjunctive Edge rules:  $x \ x \# \rightarrow x \#$  and  $x \# \rightarrow x \#$ . Since the first rule fails to apply in cases like *mezá* because of the lexical parenthesis between the two grid marks, the less specific (or more general) rule applies generating a unary domain,  $x(x)$ , in which the tone surfaces on the appropriate grid mark, that is, the rightmost mark.

<sup>9</sup> Notice that the prohibition against vacuous constituents also entails that the Edge Marking rules Edge:LR and Edge:RL are universally unusable.

<sup>10</sup> Notice that the disjunctive operation of the two Edge Markings, with Edge:RRR visible only when Edge:RLR is blocked, is similar to the "Emergence of the Unmarked" phenomenon in McCarthy & Prince (1994). This emergence of Edge:RRR in languages with Edge:RLR also provides an immediate account of the Nonexhaustivity condition on extrametricality (see Hayes 1995:58).

<sup>11</sup> Although not represented explicitly in (30), a further condition on the rule is that the final vowel cannot be associated with a tone.

<sup>12</sup> It is sometimes claimed that the tone is first delinked and then relinked, but all such analyses suffer from severe problems of indeterminacy in the relinking process, for once the tonal association is severed, the relative position of the tone with respect to the associated tier is severely undetermined.

<sup>13</sup> See Archangeli & Pulleyblank (1994) for arguments that rules modify only one feature at a time.

<sup>14</sup> See Pulleyblank (1986) for further examples of the Elsewhere Condition governing the application of tone rules.

### Bibliographic references

- Anderson, Stephen & Paul Kiparsky, eds. (1973), *A festschrift for Morris Halle*, New York, Holt, Rinehart and Winston.
- Archangeli, Diana & Douglas Pulleyblank (1994), *Grounded phonology*, Cambridge, MA, MIT Press.
- Aronoff, Mark & Richard Oehrle, eds. (1984), *Language sound structure*, Cambridge, MA, MIT Press.
- Bamba, Moussa (1991), *De l'interaction entre tons et accent*, doctoral dissertation, UQAM, Montréal, Québec.
- Bickmore, Lee (1995), "Tone and stress in Lamba", *Phonology* 12:307-341.
- Carleton, Troi & Scott Myers (1994), "On tonal transfer", Ms, University of Texas, Austin.
- Cassimjee, Farida & Charles Kisseberth (1989), "Shingazidja nominal accent", *Studies in the Linguistic Sciences* 19:33-62.
- Cassimjee, Farida & Charles Kisseberth (1992), "Metrical structure in Shingazidja", *Proceedings of the Chicago Linguistic Society* 28:72-93.
- Cole, Jennifer & Charles Kisseberth, eds. (1994), *Perspectives in phonology*, Stanford, CA, CSLI, Stanford University.
- Duanmu, San (1995), "Metrical and tonal phonology of compounds in two Chinese dialects", *Language* 71:225-259.
- Goldsmith, John (1976), *Autosegmental phonology*, doctoral dissertation, MIT, Cambridge, MA.
- Goldsmith, John (1984), "Meeussen's rule", in Aronoff & Oehrle (1984:245-259).
- Goldsmith, John (1985), "On tone in Sukuma", in Goyvaerts (1985:167-187).
- Goldsmith, John (1990), *Autosegmental and metrical phonology*, Oxford, Blackwell.
- Goldsmith, John, ed. (1995), *The handbook of phonological theory*, Oxford, Blackwell.
- Goyvaerts, D., ed. (1985), *African linguistics: Essays in memory of M.W.K. Semikente*, Philadelphia, John Benjamins.
- Halle, Morris & William Idsardi (1992), "General properties of stress and metrical structure", presentation at the DIMACS Workshop on Human Language.
- Halle, Morris & William Idsardi (1995), "General properties of stress and metrical structure", in Goldsmith (1995:403-443).
- Halle, Morris & Jean-Roger Vergnaud (1987), *An Essay on stress*, Cambridge, MA, MIT Press.
- Haraguchi, Shosuke (1977), *The tone pattern of Japanese: An autosegmental theory of Tonology*, Tokyo, Kaitakusha.
- Haraguchi, Shosuke (1991), *A theory of stress and accent*, Dordrecht, Foris.
- Hayes, Bruce (1995), *Metrical stress theory*, Chicago, Chicago University Press.
- Hulst, Harry van der & Norval Smith, eds. (1982), *The structure of phonological representations*, Part I, Dordrecht, Foris.
- Idsardi, William (1992), *The computation of prosody*, doctoral dissertation, MIT, Cambridge, MA.
- Idsardi, William (1994), "Open and closed feet in Old English", *Linguistic Inquiry* 25:522-533.
- Idsardi, William, & Thomas Purnell (1995), "Sukuma accent", *Proceedings of the Chicago Linguistic Society* 31:217-230.
- Kiparsky, Paul (1973), "Elsewhere in phonology", in Anderson & Kiparsky (1973:93-106).
- Kiparsky, Paul (1982), "From cyclic phonology to lexical phonology", in Hulst & Smith (1982: 131-175).
- Kisseberth, Charles (1994), "On domains", in Cole & Kisseberth (1994:133-166).
- McCarthy, John & Alan Prince (1994), "The emergence of the unmarked: Optimality in prosodic morphology", Ms, University of Massachusetts, Amherst, MA, and Rutgers University, New Brunswick, NJ.
- McCawley, James (1968), *The phonological component of a grammar of Japanese*, The Hague, Mouton.

- Martin, Samuel (1994), *Martin's concise Japanese dictionary*, Rutland, VT, Charles E. Tuttle Co.
- Myers, Scott (1987), *Tone and the structure of words in Shona*, doctoral dissertation, University of Massachusetts, Amherst, MA.
- Pierrehumbert, Janet & Mary Beckman (1988), *Japanese Tone Structure*, Cambridge, MA, MIT Press.
- Prince, Alan (1983), "Relating to the grid", *Linguistic Inquiry* 14:19-100.
- Pulleyblank, Douglas (1986), *Tone in lexical phonology*, Dordrecht, Reidel.
- Pullum, Geoffrey (1976), "The Duke of York gambit", *Journal of Linguistics* 12:83-102.
- Roberts, Ruth (1992), "A non-metrical theory of Sukuma tone", *Ohio State University Working Papers in Linguistics* 41:135-148.
- Sietsema, Brian (1989), *Metrical dependencies in tone assignment*, doctoral dissertation, MIT, Cambridge, MA.
- Tsujimura, Natsuko (1996), *An introduction to Japanese linguistics*, Oxford, Blackwell.
- Vance, Timothy (1995), "Final accent vs. no accent: Utterance-final neutralization in Tokyo Japanese", *Journal of Phonetics* 23:487-499.
- William, Edwin (1976), "Underlying tone in Margi and Igbo", *Linguistic Inquiry* 7:463-484.
- Yip, Moira (1980), *Tonal phonology of Chinese*, doctoral dissertation, MIT, Cambridge, MA.
- Zwicky, Arnold (1974), "Taking a false step", *Language* 50:215-224.