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The View from Building 20

Essays in Linguistics in Honor of Sylvain Bromberger

edited by
Kenneth Hale and
Samuel Jay Keyser

The MIT Press
Cambridge, Massachusetts
London, England

This book was set in Times Roman by Asco Trade Typesetting Ltd., Hong Kong, and was printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

The View from building 20: essays in linguistics in honor of Sylvain Bromberger / edited by Kenneth Hale and Samuel Jay Keyser.
p. cm.—(Current studies in linguistics; 24)
Includes bibliographical references.
Contents: A minimalist program for linguistic theory / Noam Chomsky—On argument structure and the lexical expression of syntactic relations / Kenneth Hale and Samuel Jay Keyser—Distributed morphology and the pieces of inflection / Morris Halle and Alec Marantz—Integrity of prosodic constituents and the domain of syllabification rules in Spanish and Catalan / James W. Harris—Interrogatives / James Higginbotham—Triggering science-forming capacity through linguistic inquiry / Maya Honda and Wayne O'Neil—Evidence for metrical constituency / Michael Kenstowicz.
ISBN 0-262-08223-3.—ISBN 0-262-58124-8 (pbk.)
1. Linguistics. I. Hale, Kenneth L. (Kenneth Locke), 1934– . II. Keyser, Samuel Jay, 1935– . III. Bromberger, Sylvain. IV. Title: View from building twenty. V. Title: Essays in linguistics in honor of Sylvain Bromberger. VI. Series: Current studies in linguistics series; 24.
P26.B768V54 1993
410—dc20 92-38255
CIP

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Chapter 7

Evidence for Metrical Constituency

Michael Kenstowicz

The study of stress has always occupied a central position in generative grammar. It was the focus of one of the first generative publications (Chomsky, Halle, and Lukoff 1956). A good half of Chomsky and Halle's (1968) landmark book *The Sound Pattern of English (SPE)* was devoted to working out the stress contours of English. In the ensuing twenty years the study of stress has engendered some of the most fruitful and influential concepts in phonological theory. One of the reasons stress has proved so challenging is that unlike other phonological properties, it has no fixed or uniform phonetic interpretation. Rather, it is an abstract phonological category that is phonetically manifested through genuine features—principally the prosodic features of pitch and length and sometimes more subtle aspects of vowel and consonantal quality. This fact as well as others suggested to researchers in the early 1970s that the *SPE* treatment of stress as a feature [±stress], parallel to other distinctive features such as [±nasal] or [±voice], was misguided. In their work on the topic, Liberman and Prince inaugurated a new approach that has become known as Metrical Phonology (Liberman 1975, Prince 1975, Liberman and Prince 1977). They introduced two ideas upon which all later research has built: the metrical grid and metrical constituency. Liberman and Prince's leading idea was that stress reflects a grouping or chunking of the phonemic string at various levels such that one element of each group is singled out as more salient than the others. The hierarchical grouping was represented by a tree structure and the scaling of the salient positions was represented in the metrical grid. Liberman and Prince demonstrated that many of the generalizations discovered in *SPE* are more insightfully interpreted when viewed in metrical terms. Hayes (1981) applied and extended the metrical model beyond English. He resolved the myriad stress patterns reported in the descriptive literature into a small number of parameters for building up the metrical trees. A central topic of Hayes's study were alternating stress contours. In his survey of the literature, he identified four major types, schematized in (1).

```
(1) a. 'V V 'V V    'V V 'V V 'V    (e.g., Maranungku)
    b. V 'V V 'V    'V V 'V V 'V    (e.g., Weri)
    c. 'V V 'V V    V 'V V 'V V     (e.g., Warao)
    d. V 'V V 'V    V 'V V 'V V     (e.g., Araucanian)
```

Hayes showed that these stress contours could be generated from a parsing procedure whose principal parameters are direction of iteration (left to right or right to left) and whether the resultant groupings are metrically strong-weak (SW, left-headed) or weak-strong (WS, right-headed) constituents.

Prince (1983) streamlined the emerging metrical theory. He was able to describe the central data in Hayes's study without appeal to grouping. The basic idea was that alternating stress patterns instantiate a primitive rhythmic structure of alternating strong and weak positions (2a).

```
(2) a.        *     *     *     *
         ...*  *  *  *  *  *  *  *  *...

    b. Maranungku     peak first, LR
       Weri           peak first, RL
       Warao          trough first, RL
       Araucanian     trough first, LR

    c.          *        *        *        *
         ...*   *   *    *   *    *   *    *   *...
                ↑   :    :   :    :   :
               'V   V   'V   V   'V   V
```

The stress patterns of (1) can be generated by fixing two binary parameters: whether the mapping starts (i) with a rhythmic peak or trough (ii) at the left or right edge of the word (see (2b)). Once this determination has been made, the rest of the stress contour derives from simply matching the remaining syllables of the word one-to-one with positions on the bottom line of the grid. A six-syllable word from Maranungku receives the analysis in (2c).

While Prince's (1983) "grid-only" thesis simplified the model, it nullified one of the original tenets of the metrical approach. Much of the research in the ensuing period has been devoted to shoring up the original intuition that stress reflects a metrical grouping. In this paper I survey the kinds of evidence that has emerged to support this hypothesis.

1 Deletion of Stressed Vowel

Halle and Vergnaud (1987) report a number of cases in which the deletion of a vowel occasions a shift of stress. The position to which the stress shifts systematically correlates with the metrical grouping required to establish the original nondisturbed stress contours. The metrical structure of an Arawakan language of the Amazon discussed by Payne (1990) provides another example of this phenomenon. Like many of the indigenous languages of the Americas, Asheninca parses the word into binary right-headed constituents from left to right. The final syllable is systematically unstressed, an extrametricality effect that we will ignore. An Asheninca word such as *nok'owaw'etaka* 'I wanted it in vain' receives the analysis in (3a) under the grouping theory.

```
(3) a. nokowawetaka
        |  |  |  | | |
       (*  *)(*  *)*<*>
           *     *

    b. haci kawe taka na
       |  |  |  |  |  |  |
       (* *)(*  *)(*  *)<*>
          *     *     *

    c. (*  *) → (*  . ) → (*)
           *        *      *
```

Payne describes a process that deletes [i] after [s,c] before a voiceless consonant. When [i] occupies a metrically strong position, the stress retracts to the preceding syllable. Underlying [hacikawetakana] (3b) 'he almost bit me' is realized as *h'ackaw'etak'ana* with initial stress. Payne stipulates a rule to retract the stress one syllable backward from such deletion sites. No such rule is needed, however, if a principle of Constituent Conservation is accepted. In the Halle-Vergnaud theory, stress (a line 1 asterisk in the grid) marks the head of a constituent. Since every constituent has a head, when this position is removed headship is transferred to the remaining position in the foot; the line 1 asterisk marking the head then shifts to the newly designated head (3c). In the theory of Hayes (1991), deletion of the line 0 asterisk violates the Continuous Column Constraint, according to which each asterisk in the grid must be supported by an asterisk on the immediately lower line. In order to maintain the stress, the stranded line 1 asterisk shifts to the closest available position: the adjacent position in the foot. Under either interpretation, metrical grouping is fundamental to determining the direction in which the stress shifts. But in a "grid-only" analysis of Asheninca there is no particular reason to expect the stress to shift to the left or to the right—precisely because any position is equally related to its neighbor on either side.

When presented with the case from Asheninca, the skeptic might argue that stress shifts towards the edge of the word in order to avoid a clash with the interior stress and thus does not reveal anything about the postulated grouping. While this explanation would suffice for Asheninca, there are other examples on record where it fails. For instance, stress in Yupik Eskimo has the same gross properties as stress in Asheninca: left-to-right, right-headed (iambic) grouping, as in *aŋyáXłaXłáŋyuxtúq* 'he wants to make a big boat'. The Central Alaskan dialect has a rule that syncopates syllables whose nucleus is schwa. When the schwa is located in a strong metrical position, the stress shifts to the preceding syllable—just as in Asheninca. In his discussion of the phenomenon Hayes (1991), following Jacobson (1985), cites underlying [qanRutəkaxka] 'I talk about them'. Like a number of other dialects, Central Alaskan counts underlying closed syllables as heavy when they begin the word. Consequently, the schwa occupies a metrically strong position: [qánRutə́kaxka]. Upon schwa deletion, stress steps leftward to abut the initial stress: *qánRútkaxka*.

It is clear that avoidance of clash is not sufficient to determine the direction of stress shift in Yupik. But preservation of constituency explains both the Yupik and Asheninca cases. In sum, as more examples of stress shift under deletion are identified and continue to behave as predicted, the postulated metrical grouping is strongly supported.

2 Initial Strengthening, Medial Weakening

Another line of evidence for metrical grouping proceeds from the premise that certain types of sound change typically arise in initial versus medial positions in the constituent. For example, it is well known that English implements its consonant phonemes differently depending on the location of the stressed vowel. Prestress is a "strong" position characterized by aspiration, while V́_V is a "weak" position marked by voicing, sonorization, and deletion: compare *á*[D]*om*, *a*[tʰ]*ómic*; *vé*[ ]*icle*, *ve*[h]*ícular*. Forms such as *Àpalàchicóla*, *Winnipesáukee*, and more generally the reflexes of the Latin stress rule in the core vocabulary argue that English groups syllables into left-headed (trochaic) metrical constituents. The aspiration of *a*[tʰ]*ómic* and the flapping of *á*[D]*om* are thus assigned in

foot-initial versus foot-medial position: *a*(tómic) versus (átom). In an iambic-parsing language that groups unstressed-stressed, weak and strong positions are inverted: the consonant preceding the stressed vowel is foot-medial and the one following a stressed vowel occupies a strong position. Certain sound changes in Yupik furnish evidence that this is the correct grouping. A process found in a number of dialects is fortition of foot-initial consonants (Leer 1985). Word-initial consonants are systematically fortis. So are some word-medial consonants. For example, in *akúṯamék* 'a dessert (abl.sg.)' [t] is fortis while [k] is not. The difference follows as a function of the metrical grouping, shown in (4): [t] onsets the first syllable of the foot while [k] is buried inside the foot.

(4)
```
aku  tamek
|\   |\/
(* *)(* *)
   *    *
```

Leer also describes a number of processes that weaken foot-internal consonants. In the Alutiq dialect, for example, [r] and [g] drop from syllable codas: [kégturyáq] 'mosquito' is realized as *kégtuyáq* or *kegtu'aq*. Since Alutiq counts closed syllables as heavy only in word-initial position, this word parses as (keg)(turyaq), with [ry] in the middle of the foot.

The hypothesis that fortition and lenition discriminate foot-initial from foot-medial position requires further testing. If it continues to hold up, then inputs to these sound changes cannot be determined merely by the location of the stressed syllable. Reference to the metrical grouping is required, as depicted in (5).

(5)

	...CVC'VCVC'V...	
iambic	w s w	w = "weak" s = "strong"
trochaic	s w s	

3 Iambic versus Trochaic Asymmetries

A third argument for metrical constituency derives from Hayes's (1985) discovery of a statistical skewing in the distribution of SW (trochaic) versus WS (iambic) feet with respect to quantity sensitivity. In quantity-sensitive languages, a heavy syllable attracts a stress independent of its odd/even position in the string. In his survey of over 100 languages, Hayes found that quantity-insensitive systems tend to group trochaically: in the original typology of (1), Maranungku and Warao thus exhibit common patterns while Weri and Araucanian do not. Furthermore, while both SW and WS grouping are found among languages that distinguish long and short vowels, there is still a difference. A number of systems that group SW (e.g., Finnish) allow a long CVV syllable to occupy the weak position (in effect defining a quantity-insensitive system even though they have long vowels). But Hayes finds no case of iambic (WS) grouping that allows a heavy CVV syllable in the W position. In other words, while trochaic systems can ignore quantity, iambic systems cannot. They must place a heavy syllable in a strong position.

Hayes explains the affinity of quantity and iambism for each other as reflecting a general law of rhythmic perception, brought out in experiments like the following (Bell 1977). Imagine a series of evenly spaced auditory pulses, as at the beginning of (6a) and (6b). A modulation is then introduced by enhancing every other pulse. Subjects impose a different grouping on the pulses depending on the nature of the enhancement.

```
(6) a. ..... ⇒ ...-.-.-... ⇒ ...(. -)(. -)(. -). ...
    b. ..... ⇒ ...o.o.o... ⇒ ... .(o .)(o .)(o .)...
```

If a pulse is enhanced by increasing its duration (6a), it groups with a preceding unenhanced element. But if the pulse is enhanced by increasing its intensity (6b), it groups with a following unenhanced element. In other words, contrasts in duration (quantity) favor iambic grouping while contrasts in intensity favor trochaic grouping.

If this law truly underlies the statistical asymmetries, it strongly supports the thesis of metrical constituency. Rhythmic theorists have argued that the iambic-trochaic asymmetry plays an active role in the phonology, encouraging quantitative changes that enhance the system's stress rhythm. For example, in many iambic languages such as Yupik, a light syllable is made heavy when it occupies the head of a binary foot: underlying [qayani] 'in his kayak' is realized as [qayá:ni]. The lengthening reinforces the (WS) stress contrast. Since trochaic systems shun contrasts based on length, we expect (SW) grouping to minimize quantitative differences within the foot. At least a few cases are reported where a (heavy-light) grouping becomes (light-light). However, their interpretation is less straightforward and so quantitative optimization of trochaism is more controversial (see Kenstowicz 1991 for discussion).

While more study and documentation are required, the iambic-trochaic law promises the most powerful evidence for metrical constituency—a kind of "interface constraint" between the linguistic and perceptual systems.

4 Bidirectional Parsing

Languages that parse the string of phonemes from both edges furnish another argument for metrical grouping (Levin 1988, Hayes 1991). Pike (1964) was the first to detect this phenomenon in his analysis of the "stress trains" in the Ecuadorian language Auca. In Auca stems group (SW) from left to right while suffixal material groups (SW) from right to left. The parses must be separate, as shown by words of odd length: *g'o#t'amõn'apa* 'we two went', *y'iwæ̃m'õ#ŋ'ãmba* 'he carves, writes'. These systems yield to a straightforward trochaic analysis on the assumption that the metrification process is distributed over two strata in the sense of Lexical Phonology (see discussion in Halle and Kenstowicz 1991, Hayes 1991). As illustrated in (7), in the first (cyclic) stratum the stem parses left to right; suffixes then metrify right to left as a block in the second (noncyclic) stratum.

```
(7) yiwæ̃mõ#ŋãmba     →  yiwæ̃mõ#ŋãmba        →  yiwæ̃mõ#ŋãmba
    | | |   |  |         |  |  |    |  |          |  |  |    |   |
    * * *   *  *        (*  *)(*)   *  *         (*  *)(*)  (*   *)
                         *     *                  *     *    *
```

Halle and Kenstowicz (1991) propose a constraint that blocks the parse from jumping across previously established structure. The Crossover Constraint thus forces the metrification in the second stratum to proceed from the opposite direction. In any case, the point to be made here is that the grouping type (SW) is the same in both parses—the unmarked state of affairs, to judge by the number of cases in which bidirectionality has been identified. This makes sense if stress is assigned by metrical grouping: just a single parameter must be switched, namely, directionality (which in turn follows from the Crossover Constraint). But if stress is assigned by fixing a peak or a trough at one of the edges, then exactly the opposite prediction ensues: left-to-right (SW) parsing should combine with right-to-left (WS) parsing. The resultant mixed footing is contradicted by virtually every example in which bidirectionality has been detected. Finally, antepenultimate-stressing Latin and penultimate-stressing Polish furnish a diachronic variant of this argument. Each is commonly assumed to derive from an earlier stage with initial stress. With trochaic grouping, the diachronic change is simply enhancement of the final foot instead of the initial one: *('V V)... V V V > V V... V('V V). These cases suggest that iambic/trochaic grouping has more the character of a pervasive, system-wide parameter than simply a rule defining one step in the derivation.

5 Prosodic Minimality

Many languages require free-standing (nonclitic) words to be of a minimal prosodic size (typically disyllabic or bimoraic). Subminimal items are either barred from the lexicon entirely or brought up to code through various augmentation processes. For example, in the Australian language Yidin^y all roots conform to a CVCV(CV)$_0$ template (Dixon 1977a) and hence are minimally disyllabic. Yidin^y stress, as well as several other aspects of the phonology, crucially depends on a binary grouping of syllables (see Dixon 1977b, Hayes 1982 for discussion). McCarthy and Prince (1990) have interpreted minimality in terms of a prosodic hierarchy. The idea is that a phonological word (PWd) is composed of metrical Feet (which in turn are composed of Syllables built from Moras). By this prosodic syntax, expansion of the category PWd entails at least one metrical foot. Assuming that the metrical foot in this sense diagnoses the same structure as that required in the analysis of stress, it becomes clear why minimality requires two positions: it reflects the metrical foot as the composition of a strong element with a weak one.

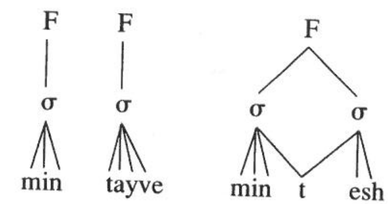
6 Opacity

In a number of languages clitics occasion a shift of stress on their hosts, reflecting a (re)metrification of the host#clitic string. In their study of the phenomenon, Halle and Kenstowicz (1991) identify an opacity in which the poststress syllable of the base is inaccessible to remetrification. For example, Latin (Steriade 1988) *úbi* 'where' but *ubí#libet* 'wherever' suggests that the host#clitic structure undergoes the antepenultimate stress rule. But in trisyllabic bases such as *lí:mina* 'thresholds' the poststress syllable is inaccessible, and enclitic stress must lodge on the base's final syllable: *li:miná#que*. Given that final syllables are extrametrical in Latin, the bases contrast as (ú)⟨bi⟩ versus (lí:mi)⟨na⟩. The stress contrast on the host#clitic string follows if the antepenultimate stress rule applies twice—once to the base and again to the base#clitic combination—and also respects Prince's (1985) Free Element Condition that only unparsed positions are accessible to the metrification rules: (u)⟨bi⟩ → (u)*bi#libet* → (u)(bí#li)⟨bet⟩ versus (li:mi)⟨na⟩ → (li:mi)*na#que* → (li:mi)(ná)#⟨que⟩. This explanation is premised on the idea that the assignment of antepenultimate stress involves grouping the antepenult and the penult into a (SW) metrical constituent.

7 Speech Perception

Finally, there is suggestive but incomplete evidence that metrical grouping can be detected experimentally. Cutler and Norris (1988) report experiments in which subjects are presented aurally with strings of nonsense syllables containing hidden words. For example, [mintesh] and [mintayve] contain the word *mint*. Subjects are tested for the amount of time required to recover the hidden word. In a carefully controlled experiment Cutler and Norris found a significant difference in recovery time depending on whether or not the substring was interrupted by a metrical bracket. Specifically, recognition of *mint* took longer in SS [mintayve] than in SW [mintesh]. This makes sense if a stressed syllable starts a new constituent and if metrical grouping provides a preliminary analysis of the speech signal. Given that feet are composed of syllables, recovery of [mint] will take more processing time in [mintayve] since [t] belongs to a separate metrical constituent, as shown in (8).

(8)



Unfortunately, since consonants in the context V́_V are ambisyllabic in English, subjects may simply be responding with the first syllable, in which case the experiment would show nothing directly about metrical as opposed to syllabic constituency. Depoux and Hammond (1991) report a longer monitoring latency for the substring [clim] in SS *climax* than in SW *climate*. They conclude from this result that the syllable functions as a perceptual unit in English.

Assuming that the issue of syllabic versus metrical constituency can be resolved, an equally important question is how iambic systems might be expected to work in similar experiments. If parsing respects metrical structure, then we expect a difference in the processing of a WSW string such as [tom'ato]. [tom'a] should be easier to recover than [m'ato] in an iambic system while the inverse relation should hold in a trochaic system. If this result were not obtained and the iambic system showed no difference between [tom'a] and [m'ato] or ranked [m'ato] faster than [tom'a], it would imply that the perceptual parsing strategy is not completely determined by the grammar and operates as an independent module. I know of no evidence bearing on this question. It is true that Bell (1977) tested speakers of different languages on nonlinguistic stimuli such as those in (6). He found no differences and concluded that linguistic rhythm has no influence on the perception of other auditory stimuli. The crucial question is whether grouping plays a role in the perception of one's own language. If it does, then we might envision experiments that could help resolve controversial questions of metrical grouping for which the system-internal evidence is inconclusive or contradictory.

8 Bracket Matching

Earlier I cited fortition and lenition as targeting the initial versus medial positions in the metrical constituent. The evolution of tone in certain Eastern Bantu languages marks both the beginning and the end of the constituent; it graphically illustrates the chunking of the phonemic string. Downing (1988) documents in great detail a rule that shifts high tone one syllable to the right of its etymological source in the Tanzanian Lacustrine language Jita (E-20). Tone shift applies both within the word and between words at the phrasal level. The paradigms of trisyllabic nouns in (9) illustrate. Nouns with a final high (H) in the isolation form like *i:ndará* 'leopard' transpose their tone to the initial syllable of the following word. Nouns with a high on the penult break down into two subclasses: a constant one such as *tu:ngúru* 'onions' and an alternating one such as *nanáji* 'pineapple' where the high tone shifts to the ultima when the word is embedded in a phrase.

(9) omu-lamusi 'judge'

i:ndará 'leopard'

ya:Bilima 'ran'
i:ndara yá:Bilima 'the leopard ran'

eBi-tu:ngúru 'onions'
mucikápo 'in the basket'
eBitu:ngúru mucikápo 'onions in the basket'

li-nanáji 'pineapple'
lya:malí:Bwa 'was eaten'
linanají lya:malí:Bwa 'the pineapple was eaten'

Downing resolves the paradigm into underlying representations in which a high tone freely appears on any syllable (10a), accompanied by a tone-

shifting process (10b) that autosegmentally spreads high tone to the following syllable, simultaneously delinking it from its source.

(10) a. lamusi i:ndara nanaji tu:nguru
H H H

b. V V
H

The rule does not target phrase-final syllables (possibly reflecting extratonality). An alternating stem such as *nanáji* thus shows its underlying form in pause and shifts its high in a phrasal context.

Spreading of high tone to the following syllable is of course a paradigm case of assimilation of a marked feature. What is odd from an autosegmental perspective is the second step, in which the spreading feature detaches from its source. Other cases of feature spread typically do not display such delinking: for example, *CãCa* → *CãCã* (→ *CaCã*?). Recent advances in metrical theory allow an alternative accentual interpretation of Jita tone shift that is not subject to this objection. Working within the Halle-Vergnaud framework, Idsardi (1991) proposes two revisions of the model that bear on Jita. First, he suggests that unpredictable lexical accent in languages such as Russian be represented not by marking of line 1 asterisks but instead by metrical brackets, extending the device introduced by Halle (1990) to do the work of line 1 asterisks in the original Halle-Vergnaud (1987) model. The metrical parse constructs constituents that respect these lexically assigned brackets. Second, Idsardi drops the assumption that metrification always sweeps from one end of the word or phrase to the other, exhaustively assigning every position to some constituent. Specifically, he allows for systems in which metrical constituents arise only from the lexically assigned brackets. Furthermore, in contrast to the original model in which line 1 asterisks necessarily imply heads, these brackets need not mark the head of the constituent. Headship is determined separately, once the constituents have been formed by assigning a matching closing bracket. This proposal accommodates the representation of pre- and postaccenting morphemes in a maximally simple fashion.

Accepting Idsardi's proposals, Jita tone shift may now be analyzed in metrical terms. I suggest that the system has been reinterpreted in such a way that syllables that bore the etymological high tone are now regarded as marking the beginning of binary, right-headed metrical constituents. High tone now enters the system only at the phonetic level to mark the head of the metrical constituent. On this interpretation, the derivations in (11) ensue.

```
(11) lamu si     i:ndara     nana ji        tu:ngu ru
     |  |  |     |   ||      |  |  |        |    |  |
     *  *  *     *   *(*     * (*  *        (*   *  *        underlying
     *  *<*>     *   *(*     * (* <*>       (*   * <*>       extrametricality
     inappl.     *   *(*)    * (*)<*>       (*   *)<*>       parsing
     inappl.     *   *(*)    * (*)<*>       (*   *)<*>       head marking
                     |         |                 |
                     H         H                 H
```

Tone is not shifted in the course of the derivation. Rather, a binary metrical constituent is constructed in stages: one side is erected in the lexicon and the other is attached later in the phonology by the metrical parse. No autosegmental delinking is required. In sum, tone shift in Jita is an epiphenomenon arising from a particular selection among the parameters provided by Universal Grammar metrical theory.

Our discussion of metrical constituency has so far focused on binary constituents—metrical feet. In the Halle-Vergnaud model all instances of stress reflect a metrical grouping. Consequently, initial- and final-stress languages such as Latvian and French are regarded as constructing unbounded left-/right-headed constituents that encompass the entire word, as in (12).

```
(12) a. Latvija        b. originalité
        |  ||             ||||||
        (* **)            (******)
         *                       *
```

Is there any independent evidence that such grouping takes in the entire word? Couldn't we simply say that stress is assigned to the initial/final syllable? Some light is shed on this question by a phenomenon that parallels the Jita tone shift but operates over an unbounded distance. It is found in Shingazidja, a dialect of Swahili spoken on the Comorian Islands off the Tanzanian-Mozambique coast. The discussion closely follows the analysis of Cassimjee and Kisseberth (1989). Paradigms such as (13) exhibit the following peculiar generalization. When a pair of words are combined into a phrase, two high tones are replaced by a single high on

the syllable immediately preceding the one that bears the high tone of the second word in its isolation form.

(13) nyumbá	'house'
djuú	'on'
nyumba djúu	'on a house'
ma-sohá	'axes'
-(b)ilí	'two'
ma-soha ma-íli	'two axes'

Cassimjee and Kisseberth suggest a metrical analysis having the following ingredients: syllables bearing etymological high tones count as "heavy"; unbounded, left-headed constituents are constructed from heads dominating heavy syllables; phrase-final syllables are extrametrical; a special rule realizes the high tone on the final syllable of the foot, in effect shifting it from the left to the right edge. Finally, the ubiquitous Bantu process dissimilating adjacent high tones (Meeussen's Rule) deletes the second of two abutting highs. On this analysis, *ma-soha ma-ili* receives the derivation sketched in (14).

```
         H    H                H     H                  H
         |    |                |     |                  |
(14) ma-soha ma-ili  →   ma-sohama-i li   →   ma-soha ma-ili
                          | |  |  || |
                          * * (*  **)(*)
                               *
```

We may simplify Cassimjee and Kisseberth's analysis if we say that syllables bearing the etymological high tones have been reinterpreted as initiating unbounded, right-headed constituents. Once again high tone is a phonetic reflex of the metrical head. Finally, Meeussen's Rule can be expressed metrically as deletion of an accent clash. On this analysis, *ma-soha ma-íli* receives the derivation in (15).

```
                                                            H
                                                            |
(15) ma-soha ma-i li     ma-soha ma-i li        ma-soha ma-i li
     | |  |  |  | |      | |  |  |  | |         | |  |  |  | |
     * * (*  * *(*   →   * * (*  * *)(*)   →    * * (*  * *)*
                                 *   *                      *
```

The analysis is corroborated by particles such as *nde* 'it is' that cause a high tone to appear on the following noun—one syllable before the noun's underlying high tone. The derivation in (16b) illustrates.

(16) a. mezá 'table'
nde méza 'it is the table'

godoró 'mattress'
nde le godóro 'it is the mattress'

```
b. nde le godoro         nde le godo ro          nde le godoro
       |  |  |  | |          |  |  |  |  |           |  |  |  | |
      (*  *  *  *(*   →     (*  *  *  *)(*)   →     (*  *  *  *)*
                                      *  *                     *
```

Shingazidja nominals with high tone on the penult in the isolation form break down into two tonal classes in a phrasal context. The paradigms in (17) illustrate the first class.

(17) i-tránda 'bed'
i-tranda djúu 'on a bed'

kofiya 'hat'
kofiya djúu 'on a hat'

nyóha 'snake'
nde zé nyoha 'it is the snakes'

masikíni 'poor person'
nde masíkini 'it is the poor person'

Nouns such as *tránda* 'bed' and *masikíni* 'poor person' shown in (18) behave as if their penultimate syllable initiates a metrical constituent. This constituent extends up to the start of the next constituent contributed by the following word: *i-tranda djúu*. When they are phrase-final, a preceding constituent stretches to the antepenult. Given that phrase-final syllables are extrametrical, the foot opens and closes on the penult. The resultant degenerate constituent then deletes under clashing accents: *nde masíkini*.

```
(18) i-tranda dju  u      nde masi ki  ni
     |  |     |    | |     |   | |  |   |
     *  (*    *    * (*    (*   * * (*  *       underlying
     inappl.               (*   * * (* <*>      extrametricality
     *  (*    *    *)(*)   (*   * *)(*)<*>      parsing
                   *  *           *  *
     *  (*    *    *) *    (*   * *) * <*>      clash resolution
                   *                 *
```


Nouns in the second class behave differently in a phrasal context, as shown in (19). They allow high tone to surface on the final syllable of *djuú* and *-(b)ilí*; and when preceded by the focalizer particle *nde*, high tone appears on the penult—not the antepenult.

(19) u-pándo 'wall'
u-pando djuú 'on the wall'
nde u-pándo 'it is the wall'

ŋ-góma 'drum'
ŋ-goma m-bilí 'two drums'
nde ze ŋ-góma 'it is the drums'

Cassimjee and Kisseberth suggest that these nouns lack an underlying high tone. They derive from Proto-Bantu disyllabic low-toned stems and thus lack the etymological high tone that developed into an opening metrical bracket. As a result, as shown in (20), they fail to initiate a metrical parse and thus allow the degenerate constituent of *djuú* to surface. For the very same reason, they do not block construction of the unbounded constituent started by *nde*.

```
(20) u-pando dju  u       nde ze ŋ-goma
     | |     |    | |      |   |   |  |
     * *     *    * (*    (*   *   * <*>
```

To account for the isolation form with a high on the penult, let us suppose that Shingazidja follows Indo-European and Slavic in invoking Halle and Vergnaud's (1987) Basic Accentuation Principle, according to which if a word lacks an accent, then the entire word is wrapped in metrical brackets. Modulo extrametricality, this delivers representations of the form (12b): VV... VVVV → (VV... VV'V)⟨V⟩.[1]

To summarize, the evidence from Jita and Shingazidja indicates that both edges of a metrical constituent are singled out by the phonology: the left edges are marked lexically while the right edges are computed by binary or unbounded metrical parses. These languages strongly confirm the basic intuition that motivated the metrical approach to accent some fifteen years ago: that metrical structure reflects a chunking of the string of phonemes.

Notes

I am pleased to dedicate this paper to Sylvain Bromberger, especially in view of his long-standing interest in phonology.

1. See Cassimjee and Kisseberth 1992 for much additional data and analysis supporting the metrical reinterpretation of the Shingazidja tone shift.

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