

Autosegmental Studies in Bantu Tone: Introduction

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1. INTRODUCTION

1. This book introduces a new approach to the description of tone and accent in Bantu languages, based upon the theory of autosegmental phonology. The seven languages presented here vary in their degree of familiarity to linguists. Zulu and Kikuyu (and to a lesser extent, Tonga and Shona) have been the subject of an extensive descriptive literature, while Digo, Haya, and Ci-Ruri are relatively unfamiliar. It seems fair to say, however, that while a few Bantu languages have been described in considerable detail, none of them is well understood. Existing descriptions, while exemplary in many respects, present a confused and at times contradictory picture of the nature of Bantu tone systems as a whole, due largely to the absence, until now, of a unified, theoretically consistent framework for describing tone and accent. This book takes a first step toward remedying this situation. Each chapter presents a detailed analysis of the tone system of a particular Bantu language from a single point of view, that of autosegmental phonology. Taken together, these studies present a panoramic picture suggestive of the variety of tone and accent systems found in this linguistic area.

2. As anyone who has worked on this problem is well aware, the challenge raised for linguistic analysis by Bantu tone and accent systems is far from trivial. This is due not only to the richness and complexity of the rule systems of individual languages, but also, and more significantly, to the typological variety found throughout this area. The handful of detailed, reliable descriptions so far available suggest that a given Bantu language may fall anywhere along a scale from fully tonal systems (as in Kikuyu) to systems with no trace of linguistically distinctive tone (as in Swahili). In between fall a bewildering variety of intermediate types, most of which exhibit properties of both tone and accent languages in varying degrees.

Two major approaches have been offered in the earlier descriptive literature for describing Bantu tone and accent. The first, or tonal model, is exemplified in, for example, the work of Armstrong on Kikuyu (1940), Rycroft and Cope on Zulu (Rycroft 1963, 1979, Cope 1970), or Cole on Luganda (1967). In this approach, noun and verb stems are assigned to

one of a small number of tone classes defined in terms of a pattern of tonal allomorphy found in a certain range of contexts, chosen to exemplify the full range of contexts in which any item may occur. Within each tone class subclasses may be recognized, varying according to the length or canonic structure of the stem, or certain other idiosyncratic properties.

The second model, an accentual one, derives essentially from the influential work of Meeussen (1954, 1963), and is further exemplified in the work of Carter (1971, 1972), Van Spaendonck (1967), Stevick (1969a), and others. This model, which is examined more closely in Goldsmith's chapter on Tonga, consists of a system which predicts surface tones on the basis of diacritic markings which designate certain vowels as "determinant" as opposed to others which are unmarked or "neutral". "Representation" or "realization" rules provide principles for assigning tones to words on the basis of the location of determinant and neutral syllables, as well as tonal information as it is introduced. Typically (although not as a matter of principle), such descriptions have the effect of "filling in" rather than changing tones. In this view, the diacritic marks used to identify determinant vowels function similarly to the traditional notion of accent, except that they are purely abstract features, permitting the prediction of observed tone patterns but having no intrinsic phonetic properties themselves.

These two descriptive models suggest a rigid dichotomy between tonal and accentual systems which does not exist in the languages themselves. The ambiguous status of some languages with respect to this principle of classification – Luganda is the best-known example – is reflected in the fact that they seem to be equally well (or poorly) treated in both models. It would seem, then, that a fully adequate model for describing Bantu prosodic systems should provide a natural way of describing the intermediate status of some languages between "fully tonal" and "fully accentual" systems.

A step in this direction has been taken by McCawley (1970, 1978). McCawley suggests that while the distinction between tone and accent languages may be well-defined in underlying representations (where accent is either present or not), it need not be well-defined in the phonological component itself, where rules of tonal assimilation and dissimilation, sometimes thought to characterize tone languages exclusively, may characterize languages with underlying pitch-accent as well. "Mixed" systems having both accent and tone rules may be distinguished according to how early in derivations tone rules are introduced. This model is proposed for languages as superficially diverse as Japanese and Luganda. We return below to the question of how McCawley's conception might be integrated into an autosegmental theory of Bantu tone.

It is quite pertinent to ask whether these conflicting analytical approaches reflect a genuine indeterminacy in the linguistic data, or whether they are simply a consequence of the theoretical experimentation which necessarily (and quite appropriately) arises in a field which has not yet developed a widely-agreed upon model. It is possible that both of these explanations are partly correct. Many Bantu languages can properly be regarded as transitional between "pure" tone languages – those requiring only tonal information in their lexical entries – and "pure" accent languages, in which surface tonal contours are determined at least partly by accentual information present in lexical representations. We do not believe that the conceptually well-defined opposition between tonal and accentual systems, each of which is independently well-attested, is weakened by the existence of such "transitional" systems. Much of the diversity in modern Bantu prosodic systems is due to the historical effect of such analytical indeterminacy, and can be plausibly explained in terms of it, as we shall argue below. On the other hand, it is also true that earlier phonological theory has not provided fully satisfactory models for tonal description, and that this field has been characterized by a wide variety of approaches (see, for example, the comprehensive overviews of the earlier literature given in Fromkin (1978) and Weidert (1981)). It is not unreasonable to think that at least some of the indeterminacy suggested by a reading of earlier descriptions results from inadequacies in the phonological models chosen. The only way of factoring out the respective contributions of data and theory to the problem of indeterminacy is to extend the data base, while at the same time reexamining already-available data from a theoretical perspective that offers some potential of consistency and unification.

It has been convincingly demonstrated that Proto-Bantu was a tone language with two distinctive tone levels, high (H) and low (L); see Greenberg (1948), Kähler-Meyer (1967/8), Guthrie (1967/71), Meeussen (1967, 1980) (and, for a dissenting view, Stevick (1969b)). Certain details of the system are well established. Noun stems were generally bisyllabic and were characterized by one of the four tone melodies HH, HL, LH, or LL. Verb stems consisted of a monosyllabic radical characterized by H or L tone, and zero or more toneless (or, in an alternative analysis, L-toned) extensions, terminating in a final vowel with variable tone. On the basis of evidence from the verb alone, one could not conclusively identify Proto-Bantu as a tone language, since the verb could be described in terms of a system which assigns an underlying feature of accent to certain formatives but not to others. The evidence that Proto-Bantu was tonal rather than accentual resides largely in the nominals (nouns and adjectives); in the existence of a reconstructed tone assimilation rule which causes all extension syllables to acquire H tone preceding an inflectional suffix bearing H

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tone; and in the extensive comparative evidence showing that the closest relatives of Proto-Bantu were themselves tone languages (compare, for example, the tonal reconstructions given for Bantu by Guthrie (1967/71) with those proposed for the cognate forms in Western Nigritic (a term loosely co-extensive with Niger-Congo) by Mukarovsky (1976/7)). Thus it must be assumed that the direction of change in the evolution of modern Bantu has been from tone languages to systems approaching accent languages, in varying degrees.

The details of this development are still unknown, due in large part to the lack of adequate descriptions (for a short bibliography of works on Bantu tone and accent see Hyman (1976)). It seems unlikely, however, that the drift from tone to accent is a regional or diffusional phenomenon. Even though the complex and, at least in part, irrecoverable patterns of historical migration within the Bantu-speaking area (Phillipson 1977a, 1977b, Bouquiaux et. al. 1980) make firm conclusions difficult, there is no evidence to suggest that the drift from tone to accent can be traced to an origin in one language or one language group from whence it would have spread to other areas. The effect of the loss of tonal distinctiveness is greatest in the western and eastern Bantu-speaking areas as opposed to the north, south, and center (see Guthrie, volume 1, topogram 4), and the mechanics of this loss present no coherent picture. Again, it is unclear to what extent this is an inherent feature of the data or the result of different and conflicting models of analysis. Nevertheless, one is forced to conclude on the basis of the available data that the loss of tonal distinctiveness is due at least in part to separate innovations and independent parallel development, with perhaps the added but localized contribution of certain common innovations. If this view is correct, then we are presented with the following challenging puzzle: what are the structural features of the Proto-Bantu linguistic system or of its immediate descendants that made it prey to an increasing tendency toward reanalysis as an accent system?

The fullest discussion of this problem to date is that of Carter (1973), who isolates a number of the recurrent types of tone change that define various degrees of deviation from the proto-model. Carter, drawing upon a tradition established in Van Spaandonck (1967) and earlier works, proposes the following rule-based typology of Bantu tone systems:

- i. "etymological" or "clear tone" systems, which show a point-for-point correspondence with Proto-Bantu.
- ii. "reversive" systems in which H replaces etymological L and L replaces etymological H.
- iii. "tone doubling" systems in which a H tone is copied onto a following syllable.

- iv. "tone anticipation" systems in which a H tone is copied onto a preceding syllable.
- v. "displacement" or delayed realization systems in which basic H tone is realized on a tone-bearing element later than that with which it is lexically associated.

Several of these systems are found in combination; furthermore, some languages have, as noted earlier, lost all tonal distinctiveness. Carter's typology differs from Guthrie's functional classification mainly in that it is based upon an examination of tone rules of a fairly specific nature. Nevertheless, this system has not so far permitted the discovery of any general patterns of evolution. Carter drew the following conclusion, which is still valid at the present time:

It may eventually be possible to construct a hypothesis of developments within particular languages, and of typical development of tonal to intonational system, or at least to isolate some feature or features which render a tonal system vulnerable to breakdown. At the moment there seems to be little association between e.g. the relative simplicity of a system, in terms of the number of rules operating, and the tendency to intonational development. The area where complete loss occurs shows *variety* of systems in surrounding languages, rather than a particular type of system. (Carter 1973, 47)

It is quite possible, of course, that the principles identified by Carter are not yet specific enough, and available descriptions not yet detailed enough, to permit a determination of linguistic groupings or of diffusional features based upon shared tone rules. It is also possible that the conditions leading to "tonal breakdown" are not only formal, but also functional in nature, having to do with the nature of the difficulties posed for acquisition (see for example Kiparsky (1973a, 1982)). But we must also consider the possibility that it is not the nature of the phonological rule system *per se* that is involved, but rather characteristics of the morphological structure shared by all Bantu languages, regardless of their specific tone rules.

It is tempting in this regard to speculate that a major source of the peculiarly Bantu penchant for accentual reanalysis lies in the morphological make-up of the verb. In most of the better-known tone languages, especially those of Asia and West Africa, morphological structure tends to be isolating, and there are fewer morphologically complex words. Bantu verbs, on the other hand, normally consist of a subject prefix, one or two tense prefixes, one or more object prefixes, a radical, one or

more extensions, and a final vowel; further formatives may be present as well. All but the extensions typically have an independent, underlying tonal characterization.

The two most striking characteristics of the Bantu tone systems discussed in this book may be derived in some measure from this complex lexical structure. The first of these is the remarkable *mobility* of the tones. Considering Bantu languages of a wide variety of prosodic types, we see strong reason to believe that the domain of tone mapping in these languages is not the morpheme – as is the case with most other better-known tone languages – but rather the word as a whole. Thus typically, the statements that determine where a specific tone is to be placed or where an accent is to be realized are not local to the morpheme – in which case tone mapping would be trivial – but rather span domains consisting of two or several morphemes. Indeed, in one language considered in this collection, Digo, the domain of tone mapping is, in part, larger than the word, comprising verb-object sequences. The fact that the domain of tone mapping is typically the word, together with the rich morphological structure of the verb, opens up possibilities for tonal mobility that are not available in languages with a simpler morphological structure.

The second characteristic that is widely shared among Bantu languages, regardless of whether they are tonal or accentual, is the frequent occurrence of processes of tone spreading onto morphemes that bear no intrinsic tonal or accentual characteristics. A major source of this property lies once again in the structure of the verb, in this case in the presence of what may be potentially very long sequences of toneless (or accentless) extensions following the radical. These extensions acquire their tone from the tonal or accentual specifications of neighboring formatives, both in the most conservative Bantu tone systems as well as in the most innovative accentual systems. The property of free spreading, as we shall see below, is determined by the Well-formedness Condition of autosegmental phonology, and is a characteristic formal feature of accentual systems. Thus the presence of free spreading in a Bantu tone system is consistent with an analysis as an accent system, and could plausibly be taken as diagnostic of such a system. We note that here, once again, the formation of morphologically complex words is an important precondition for evidence that could point to an accentual analysis.

In our later discussion, we turn to the question of why a *potential* for accentual reanalysis should lead to *actual* reanalysis. For the present we merely point out that the two properties noted above, the tonal mobility resulting from taking long, morphologically complex words as the mapping domain together with the free spreading associated with toneless morphemes, are widely typical of Bantu languages but are much more limited in their appearance in the languages of West Africa, which in general show

no propensity to accentual reanalysis. An interesting exception in this respect is Igbo, a language atypical of this area in having verbal extensions of the Bantu type. These extensions are of two types: a toneless class (Class 1 suffixes, in the terminology of Goldsmith 1976), and a low-toned class created from other verb stems (Class 2 suffixes). As Clark (1982) has pointed out, the addition of this new class of verbal elements creates a number of effects that are reminiscent of accentual systems such as that of Tonga. Clark suggests, in fact, that Igbo has already arrived at such an accentual analysis in the verbal system, consistently with our view that accentual reanalysis will arise first in the morphologically complex verb before extending to the noun.

It seems likely that the characteristics that we have attributed to the Bantu verb can be traced back to the ancestral system itself – or at least, to the latest common ancestor of what Heine (1973) terms the Eastern Highland Group, including all the languages discussed in this collection. If this is true, then the only substantial obstacle to the historical drift toward a wholesale reanalysis of Bantu as an accentual system is the nominal, which, as we have seen, offers a convincingly reconstructed four-way opposition among HH, HL, LH, and LL tone classes in bisyllabic stems. But it will be noted that even this obstacle is a fragile one. It suffices for a Bantu language having the four-way opposition just described to acquire a rule reducing this opposition to a three-way one for the nominal system to become open to a reanalysis as an accentual one, in which the three remaining classes of bisyllabic stems will be treated as initial-accented, final-accented and unaccented. In fact, we know that Bantu languages have quite widely acquired such a rule (see the studies to follow), often consisting of one form or another of what we have termed Meeussen's Rule, which turns a HH sequence into a HL one, thereby eliminating the opposition between the Proto-Bantu *HH and *HL classes. Present information suggests that the addition of Meeussen's Rule or its equivalent to a grammar may be a necessary precondition for accentual reanalysis. It is not, however, a sufficient condition. In Zulu, as Laughren shows in her contribution to this volume, a very early rule of tonal metathesis survives as evidence that this language, while having undergone the historical neutralization of the contrast between *HH and *HL and showing several other traits of an accentual system, remains tonal all the way back to its underlying representations.

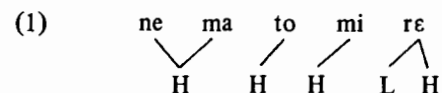
3. In the years following the publication of Chomsky and Halle's *The Sound Pattern of English* (1968), generative phonology could count a large number of successes in its program. Notions such as the phonological cycle, rule ordering and disjunctive application, and synchronically-moti-

vated abstract analyses gave the enterprise a vitality and an excitement that is still very much alive today.

The SPE framework enjoyed great successes in certain areas, but other traditional problems in phonology proved more intractable. The treatment of tone in African and Asian languages, for example, had long been viewed as an important area for phonology – indeed, a central issue, for the later London school – but remarkably little insight was produced by the SPE framework into the behavior of tone. The central tools in the generative framework at this point were rules that modified feature specifications and rules that deleted or inserted segments. Despite impressive attempts (Wang 1967, Smith 1968, Schachter and Fromkin 1968, Woo 1969), generative treatments of tonal problems remained generally unconvincing. SPE itself, notably, eschewed all discussion of the problem, as if in silent respect for Wittgenstein's dictum, "Wovon man nicht sprechen kann, darüber muss man schweigen."

The modification that was necessary in the SPE conception of phonology is one which, in retrospect, seems so compatible with the generative-transformational program that its late arrival is surprising. The fundamental insight that lay at the origin of autosegmental phonology was the proposal that phonological processes might not simply add or delete segments, or change the feature specification of those present in the representation; but that also, and perhaps primarily, phonological processes could modify the structure or *organization* of the representation. Within the SPE framework, phonological representations were extremely simple, as simple as earlier structuralist representations in fact (see e.g. Jakobson 1971). This was in striking contrast to the situation in generative syntax, where new notions of structure were being developed and refined.

The autosegmental proposal was to enrich the geometry of phonological representations, and in particular, to relax the assumption that these representations consist of single linear sequences of segments. Representations are instead multilinear sequences composed of several rows, or tiers, of segments:



The separate, autonomous tiers contain sequences of segments specified for certain subsets of phonological features, and segments on one tier are related to segments on the adjacent tier by association lines. A single tone can be associated with more than one vowel, and similarly a vowel can be associated with more than one tone; furthermore, rules can modify associations, and not just affect the segments themselves. Thus in (1), which

represents a verb in Kikuyu, the first tone is associated with two vowels, the second and third tone with one vowel each, and the final two tones with a single vowel, defining a tone pattern represented conventionally as [némátómírě].

The development of a formal system that permits co-equal and autonomous sequences of segments, as in (1), is a natural consequence of a number of earlier studies emphasizing what Gilbert Ansre has termed "tonal liberation". In particular, Williams (1971), in a study of tone mapping processes in Margi and Igbo, and Leben (1971, 1973), in studies of tonal processes in Hausa and Mende, brought out clearly several of the problems and paradoxes inherent in the treatment of tone systems within the generative framework available in the early 1970's. These studies showed that distributional constraints on underlying tone melodies and the regular principles of tone mapping could be most elegantly stated if tones were thought of as "suprasegmental" elements, rather than features of vowels. In Leben's more specific formulation of this model, it was claimed that tones were features of the morpheme with an equal status to that of consonants or vowels, but formally independent of them. Consequently, phonological rules could make reference to tones without referring to vowels and consonants, just as they could refer to consonants and vowels without mentioning tones. At a given point in a derivation, which must be idiosyncratically specified for each language, tones were "mapped" into individual tone-bearing segments, such as vowels; from that point onward in derivations they behaved just like other features of vowels with regard to phonological rules. Note that in this approach, rules referring both to tones and to non-tonal features were "intrinsically" ordered after rules that referred to tone "melodies" alone, due to the independent assumption that prior to mapping, tone rules could make only restricted reference (Williams) or no reference at all (Leben) to other phonological features of the morpheme.

This approach achieved striking solutions to problems that had remained intractable in earlier phonological theories. However, a number of problems remained. For example, the theory was unable to characterize the distinction between floating tones and associated tones in those (numerous) languages where floating tones do not constitute morphemes by themselves; see, for examples, the studies of Tonga, Zulu and Kikuyu in the present volume. It offered no formally coherent and empirically adequate way of characterizing contour tones as features of single short vowels. It was furthermore unable to account properly for the phenomenon of "tone stability" according to which phonological rules, applying after "tone mapping", delete vowels while leaving their tones behind. And it offered no way of characterizing systems in which "mapped" tones become "remapped" by later rules having the effect of altering the initial-

ly-assigned allocation of tones to tone-bearing units (see Kisseberth's treatment of Digo, below). All of the problems resulted from the single assumption that tonal representations and segmental representations are merged into single feature columns by the process of tone mapping. It is somehow necessary to express the fact that tones retain their autonomous status after the rules that assign tones to particular vowels have applied. As Leben has elsewhere pointed out (1978), the "suprasegmental" model had no way of expressing this generalization.

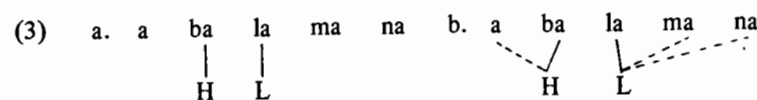
This problem finds a solution in the recognition that tone mapping rules do not merge tonal and segmental representations, but rather *associate* their elements by means of formal entities termed "association lines". The autosegmental framework, as first formulated in Goldsmith (1974a-d), posits phonological representations consisting of parallel tiers of phonological segments (both tonal and nontonal), as noted above. Separate autosegmental tiers remain independent of each other throughout derivations; thus, for example, (1) is a well-formed surface representation. Phonological rules may carry out operations on single tiers alone, or they may carry out operations affecting the set of associations between tiers; furthermore, phonological rules operating on single tiers may make reference, when necessary, to information available on other tiers.

A further innovation of autosegmental phonology is the notion of "Well-formedness Condition" governing autosegmental representations, originally formulated as below:

- (2) Well-formedness Condition (WFC):
- i. All vowels are associated with at least one tone.
 - ii. All tones are associated with at least one vowel.
 - iii. Association lines do not cross.

This condition is not interpreted as a principle ruling out representations that do not conform to it, but rather as defining a neutral state from which any deviation is automatically corrected by convention. In subsequent formulations of the theory (see in particular Goldsmith 1976, 1979, 1981; Clements 1976, 1981a; Haraguchi 1977, 1979; Leben 1976, 1978; Clements and Ford 1979; Yip 1980; Halle and Kiparsky 1981; and McCarthy 1981, 1982, among others), it has been proposed that the mechanisms used to satisfy the Well-formedness Condition are universal (that is, invariant from language to language), and persist throughout the derivation, in the sense that they can and must apply immediately after each rule application. These mechanisms, termed Association Conventions by Haraguchi and later writers, add or delete association lines in order to bring any representation that deviates from the neutral state defined by the WFC into agreement with it. For example, in the hypothetical example

(3a) there are three unassociated or toneless vowels, thus creating a violation of condition (2i):



As shown by the dashed lines in (3b), the addition of three association lines is sufficient to bring the representation into conformity with the WFC. In cases where there is more than one way to satisfy the WFC, several specific principles have been proposed (for discussion see in particular Goldsmith 1976, Clements and Ford 1979):

- (4) i. Associate free tones to free tone-bearing units from left to right;
- ii. Associate free (unassociated) segments in preference to bound (associated) segments, (a) giving precedence to segments linked to unaccented elements, otherwise (b) giving precedence to segments on the left;
- iii. Add the minimal number of association lines necessary to eliminate the violation.

These principles, applied in the order given, are sufficient to eliminate all cases of indeterminacy in the implementation of the WFC. The empirical motivation underlying the WFC should be clear. Its aim is to isolate the effects of rule application that are determined by general, language-independent conditions on phonological representation in such a way that the formulation of language-particular rules can be maximally free of superfluous (universally-determined) information.

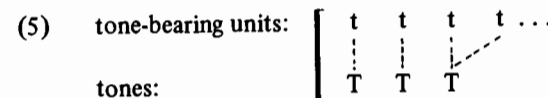
Recent research has led to suggested modifications of some of the proposals mentioned above, all well within the spirit of the theory. Several of the chapters in this volume include discussion along these lines. As regards the Well-formedness Condition (2), the universality of one of its provisions, (2ii), has been called into question by Clements and Ford (1979), who argue that in Kikuyu, at least, floating tones must be allowed to remain afloat throughout the course of derivations. A more far-reaching proposal is that of Halle and Vergnaud (1982), who suggest that (2i) be replaced by a tone mapping rule which maps the first member of a sequence of free tones onto the first vowel of the domain, the second member onto the second vowel, and so on, finally associating the last tone in the sequence with any remaining toneless vowels to the right. Under this proposal, (2ii) remains in force but may be supplemented by language-particular well-formedness conditions of the type "no vowel

may be associated with more than n tones," for some value n . One consequence of this proposal is that some vowels may remain toneless, in which case they surface with a "default" tone which is specified in their segmental matrix. Other alternative proposals have been made concerning not the statement of the WFC itself, but rather mechanisms of association such as those given in (4).

Many of these questions seem to be resolved by an observation made by Odden, in his contribution to this volume. Much work in the autosegmental framework has assumed that the mechanisms for removing violations of the WFC are in effect at all points in the derivation. In some languages, however, it is necessary to assume the existence of initial tone association rules which assign specific tones to specific tone-bearing units prior to the implementation of the WFC. This component may indeed be of major importance in the tonal phonology of some languages, as shown in the contributions by Kisseberth and by Hyman and Byarushengo. Odden points out that if violations of the WFC were everywhere resolved as soon as they arise, there would under most circumstances be no free vowels for such rules to assign tones to. It is thus within the logic of the theory that rules making reference to free tone-bearing units must take precedence over the implementation of the WFC, which thus serves to implement the "default" case. In fact, we may further observe that if Kiparsky's Elsewhere Condition (1973b) is understood as a regulative principle governing the operation of rule systems, then initial tone association rules and the WFC will always stand in the appropriate "elsewhere" relationship, and the rules, being more specific, will take precedence over the general mechanisms resolving the violations of the WFC. Odden concludes, therefore, that grammars need not specifically state the point in derivations at which the WFC comes into effect; it will always be applicable after the operation of the last rule which makes specific reference to a "free" tone-bearing unit.

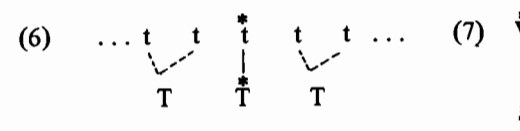
One of the central claims of autosegmental phonology, then, is the proposal that there is a neutral or "well-formed" state, defined by the theory, from which representations may deviate. Language-particular rules may create violations of this well-formed state, but universal principles will automatically modify the geometry of the representation so as to restore it. This division of labor between language-specific rules and the universal WFC plays an important role in the studies which follow.

4. We have so far discussed the treatment of true "tone languages", that is, languages in which tonal information is part of the lexical representation of words and morphemes and in which accent plays no lexical role. In languages of this kind, we find a "Basic Mapping Principle" applying in case after case whose effect can be schematized as follows:



This principle is of course formally derived from the WFC (2) as implemented by the principles stated in (4). Regardless of the extent of language-specific variation in the details of this initial association procedure, it has long been clear that languages using such a procedure include all those whose underlying tone melodies are "unrestricted" (in the sense of Voorhoeve 1973), that is, the true tone languages.

On the other hand, other languages, often called "accent" languages, typically have a fixed, predictable tone melody which need not be specified in lexical representations but which is assigned to tone-bearing units in phonologically unpredictable ways. This "Basic Tone Melody" consists of a fixed sequence of two or three tones which are spread over a domain which is typically the word but which, in some languages, may be larger or smaller than the word. Tones associate with tone-bearing units not in the left-to-right fashion sketched in (5) but rather in the manner indicated in (6). As this figure shows, one of the tones in the melody is designated as accented, and is associated with the accented vowel as shown in (7). (Here and elsewhere we indicate the presence of an accent by the asterisk.)

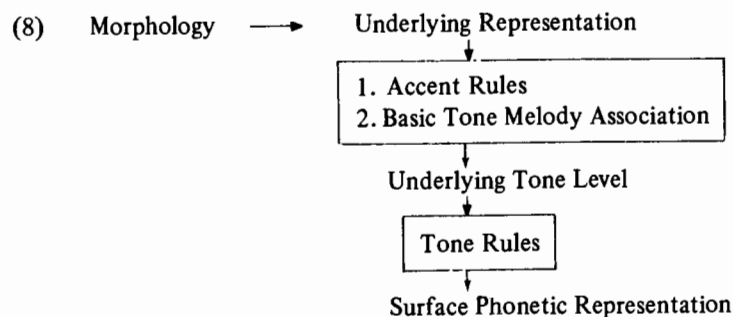


Principle (7) applies only to as-yet unassociated tones and tone-bearing units and thus takes precedence over the WFC. Tones and tone-bearing units unaffected by (7) are submitted to the mechanisms that implement the WFC. It should be borne in mind that this concept of accent bears no relation to particular phonetic properties such as stress or amplitude; it involves no more and no less than the association of basic tone melodies to the tone-bearing units of a word.

In this view, then, an accent language is identified as one in which a fixed Basic Tone Melody (or more rarely, two: see Haraguchi 1977) can be specified for all words, and in which the melody is assigned by rule (7) and the WFC. If the Basic Tone Melody of a language is, for example, HL (with either tone accented), then the underlying tonal tier of this language will consist of n copies of this melody: $(HL)^n$, where the number of copies (that is, the value of n) equals the number of accents in the representation at the point when (7) applies.

This view of accent systems, further elaborated upon in Goldsmith

(1982), can be summarized as in (8), which characterizes the accentual component of the system as feeding into the tonal component (see McCawley 1978 for an earlier statement of this view):



In this model the accent rule component consists of rules which insert, delete, or shift accents. The underlying tone level is created by associating one copy of the Basic Tone Melody with each of the vowels that continue to bear accent after the operation of the accent rules, by the rule of Basic Tone Melody Association (7). The remainder of the tone rules then apply. The validity of this point of view, which conceives of an independent "accentual" part of the derivation preceding the tone rule component, clearly rests on the extent to which the concept of accent can simplify our account of tone systems and tone rules. We suggest, that is, that there are certain processes in languages that may ultimately have their surface manifestation in the tonal pattern of a word or phrase but which should best be viewed as involving a nontonal element – accent – which "sets the stage" for the tonal derivation to follow.

On this view, accent is not an element on a separate autosegmental tier; if it were, it would be no different formally from a tonal segment, and there would be little point in setting up an entity distinct from tone in underlying representations. Moreover, accent is not a binary feature: the notion of "[+/-accent]" (that is, "non-accent") plays no role in this account. We suggest that an accent is an element of the same type as a segment, but which can only exist as a feature or mark on another segment. Thus accent can be assigned, deleted, copied, or shifted, but it cannot "float", nor can it "associate", in the technical sense, since it is not assigned to an independent autosegmental tier.

It remains an open question at this point what constraints can be placed upon rule sensitivity to accents. Among several hypotheses that have at some time been envisaged are the following:

- (9) i. Accents are erased after tone assignment.
 ii. Accents are not erased, but cannot be introduced, shifted, or deleted after tone assignment.

Under the first of these hypotheses, tone rules would be unable to refer to accent. This hypothesis is difficult to reconcile with the recent studies of Luganda by Hyman (1982) and of Kimatuumbi by Odden (1982), where in both cases, the operation of tone rules appears to be crucially dependent upon the presence or absence of accents. The second, weaker hypothesis views accents as present after tones are introduced but as "immune" to the operation of further rules; that is, accents can be "looked at" but not affected. This view seems consistent with what is currently known about the operation of accentual systems and, if correct, imposes an intrinsic ordering between the accent rules and the tone rules. In sum, these remain interesting questions for further exploration, but will not be pursued further here.

5. As we have seen, an accentual system is more complex than a purely tonal one in one sense: an accentual system contains, in addition to the tonal derivation, an earlier accentual stage. Would considerations of simplicity, then, tend to weigh against accentual analyses of what superficially seem to be tone languages?

As noted above, the historical evidence shows that there has in fact been a distinct drift toward accentual reanalysis in Bantu languages. This evidence suggests that rather than being more complex linguistically, accentual systems may be simpler. In fact, one might conclude that it is just to the extent that an accentual analysis proves simpler than the best available tonal analysis that an accentual analysis will prevail.

A simple hypothetical illustration may help to make this point clear. Let us say that a tonal representation is *factorizable* if it can be analyzed as derived, by well-motivated rules, from a deeper level at which the tonal tier can be uniquely factored into a sequence of copies of a fixed tone melody. If we assume that such a basic tone melody must have at least two tones, then only a small set of tone languages will have the factorization property; well-studied languages like Igbo, Ewe or Yoruba can easily be seen not to have this property. In general, any language with few or no restrictions on underlying tone melodies will not be factorizable.

Suppose, however, that we encounter a case in which a factorization is possible into, say, a sequence of basic tone melodies of the form HL, and that moreover, we find one or more tone rules operating on certain instances of this melody as a unit, for example, deleting the second of two HL melodies occurring on successive syllables within the word. Two analyses are then possible, as summarized below:

- | | | |
|------|------------------|-----------------------------------|
| (10) | tonal analysis: | accentual analysis: |
| | a. basic: HL | a. basic: * |
| | b. HL → ∅ / HL__ | b. * → ∅ / *__ |
| | | c. Insert HL and associate by (7) |

In underlying representations (10a), the tonal analysis postulates sequences of the tone melody HL while the accentual analysis postulates accents. As (10b) shows, the tonal analysis has a rule deleting HL after HL while the accentual analysis has a rule deleting accent after accent. Finally (10c), under the accentual analysis the Basic Tone Melody HL is introduced, once for each remaining accented vowel, and associated by rule (7); this latter step, as it is determined by universal convention rather than being a language-specific rule, is cost-free in the grammar. It thus follows that the accentual analysis is simpler than the tonal analysis, on two counts: it has a simpler lexicon (requiring only one element, the accent, for every two tones required in the tonal analysis) and a simpler rule system (specifying only two units of information rather than four, for each such rule).

We may now express our view as follows: the language learner seeks to impose a factorization upon the tonal system wherever possible. What is meant by "seeks to impose?" The question is best answered by indirection. The construction, or acquisition of a grammar consists in developing analyses that maximize certain kinds of regularities. In particular, following a suggestion in Goldsmith (1976), chapter 4, we may propose that a system is more highly valued to the extent that its underlying representations consist of uniformly linear sequences in which all segments are fully specified for all features. Any departure from this type of regularity comes at a cost, in the sense that the learner must discover each instance of nonlinearity and enter it as a special condition on word structure in the developing grammar. Tone languages are typically systems in which this condition of linearity is not satisfied. Hence, at the point where the learner discovers any failure of one-to-one linkage between tones and tone-bearing units, in the form of floating tones, toneless vowels and the like, the learner will adopt the hypothesis that the system is underlyingly an accentual one and attempt to impose a factorization as described above. Lexical representations in accentual systems are of course fully linear as far as accent is concerned, since each segment either bears accent, or does not, and accents do not have the property of being able to "float", as noted in section 4.

In this view, "transitional" systems are precisely those which are susceptible to both tonal and accentual analysis, and in such cases we propose that the learner is biased toward the accentual account. Note in particular that the presence of toneless verbal suffixes, reconstructed at the level of Proto-Bantu, make linearization strictly impossible under a tonal analysis. Accentual reanalysis will be all the more compelling to the extent that no "counterevidence" exists in the form of tonal sequences that resist factorization, and even here, it seems reasonable to allow that learners may be inattentive to such counterevidence to the extent that it remains at the margins of the system.

6. This, then is our response to the question with which we began: how can we explain the widespread analytical indeterminacy which we encounter so frequently in Bantu tone and accent systems, and their apparent historical drift toward fully accentual systems? If we are correct, the problem of indeterminacy is not an artifact of inadequate linguistic models but on the contrary an inherent feature of the Bantu proto-system itself, which lent itself to dual analysis and gave rise to differing interpretations in the course of its later development. We have attributed this duality to the dynamics involved in the interplay of two opposed factors: the pressure toward factorization and linearization characterizing the language acquisition process itself, and the built-in nonlinearity of the proto-system, in which tones and tone-bearing units did not stand in a one-to-one relationship and where the domain of tone mapping, involving the morphologically complex, agglutinative structure of the verb, provided fertile ground for the increasing autonomy of the tonal and segmental tiers.