TONOGENESIS REVISITED[1]

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The development of tones from the loss of a voicing distinction in prevocalic position is probably the most commonly attested type of tonogenesis. Tones can also develop from post-vocalic, especially laryngeal, consonants. The purpose of this paper is threefold: first, I will discuss the hierarchy of segmentally induced tonal developments (i.e. prevocalic vs. postvocalic conditioning). Second, I will present a number of reasons as to why so-called tonal 'flip-flops' should not necessarily be viewed as counterexamples to phonetically conditioned tonal developments. Finally, I will propose a new type of tonogenesis: the development of more complex tone systems from the interaction between adjacent tones when a tone-carrying syllable is lost.

1 Tonal developments conditioned by prevocalic and post-vocalic segments

The development of tones from the loss of voicing in prevocalic position is widespread In East and South East Asia (e.g., in Sino-Tibetan, Miao-Yao, Tai and Vietnamese). In these languages the merger of a voiced and voiceless series led to the

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historically voiced series giving rise to a relatively louer tone while a relatively higher tone vas found after the historically voiceless series. In Vietnamese, and probably In Archaic Chinese and Sino-Tibetan as well, postvocalic laryngeals also gave rise to tonal developments. Vowels followed by [?] developed a rising or relatively higher tone while vowels followed by [h] developed a falling or relatively louer tone.

Phonetic explanations, both articulatory and perceptual, for this segmentally conditioned developments have been proposed (Hombert 1978; Hombert, Ohala and Ewan 1979). In these studies the data revealed that the intrinsic effect of postvocalic laryngeals on the fundamental frequency of the neighboring vowel was larger and more perceptible than the effect of a prevocalic voiced/voiceless contrast. I now realize that this was an important finding which has historical implications as attested in the chronological order of tonal developments: with very few exceptions, tonal developments from prevocalic consonants only occur in languages which are already tonal. It is as if the fundamental frequency perturbations caused by prevocalic consonants can be perceived and used contrastively only when speakers are already accustomed to heeding pitch differences. However, the loss of a voicing distinction in non-tonal languages can lead to phonation type differences as attested in the Mon-Khmer register systems. But these languages cannot be considered to have tone systems since pitch is not a main characteristic distinguishing the two registers.

2. Tonal flip-flops

It is not uncommon to find languages having tones different from uhat we would expect on the basis of their historical origins (e.g., languages which have relatively higher tones following the historical voiced series and relatively lower tones after the historical voiceless series, or languages which exhibit a falling or relatively lover tone on a vowel preceding an historical glottal stop). Before considering these unexpected developments, sometimes called tonal flip-flops or tone reversals, as counterexamples to phonetically based explanations of tonal development, the following points should be investigated.

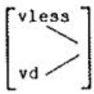
21 The nature of the segments involved at the time of the tonal development. If the proto-segments which are considered as conditioning factors for the tonal development are affected by sound changes just before the tonal development occurs, we should only take into consideration the latest phonetic stage. Earlier stages are irrelevant and lead to wrong predictions. For instance, if the voiced series became implosive (*b > ɓ) we would expect a higher tone to develop after this * voiced series, since we know that implosives have a tendency to raise the fundamental frequency of the following vowel. In a similar fashion, we would not be surprised to find a falling tone or a tone lover than expected on a vowel followed by a glottal stop if we can show that this glottal stop first vent through a stage of creakiness, as creakiness is accompanied by a slowing down of vocal cord vibrations. Another possibility for accounting for a relatively lover or falling tone before an original glottal stop is to show the existence of an intermediate stage where the release sometimes found after glottal stops comes to replace the stop completely before the tonal development takes place:

(maʔʰ > mah > mâh).

2.2 Underdifferentiation of phonetic symbols. It is possible in some instances to reach similar acoustic targets with significantly different articulatory gestures, as in the case of [r] in English or the case of implosives in some West African languages. When this happens, we would expect these acoustically similar but articulatory different phonetic entities to give rise to divergent phonetic changes. This is probably the case with glottal stops, which can be realized with significantly different degrees of vocal cord tension (both in terms of magnitude and timing) and consequently could lead to opposite tonal developments.

2.3 Consistency of phonetic conditioning. Among the languages which developed a three-way split from the voiceless aspirated-voiceless unaspirated-voiced consonant series, the tones corresponding to the voiceless aspirated consonants are higher in some languages and lover in others. Although this might appear to undermine explanations based on phonetic conditioning, a closer look at the phonetic data clarifies the situation. As I showed in earlier papers (see references) there is no consistent intrinsic difference between the effect of voiceless aspirated stops and voiceless unaspirated stops on the fundamental frequency of the following vowel. Consequently, we cannot make a prediction based on phonetic data as to uhich series will give rise to a relatively higher tone. A similar conclusion may be drawn about ejectives on the basis of recent data presented by Kingston (1982). The effect of ejectives on the fundamental frequency of the following vowel is of the same magnitude as the effect of voiceless unaspirated stops. As a result, when these two series of consonants are involved in a tonal development we would expect to find both relatively higher tones after historically voiceless stops in some languages and relatively lover tones after the same consonants in other languages.

2.4 Perceptually conditioned development. There is no reason to assume that the perceptual cues or dimensions used for tone perception are universal across tone languages. Let us consider two languages A and B and let us suppose that at the time of the split conditioned by prevocalic voiced/voiceless stops language A had a tone system in uhich the main perceptual cue used to distinguish tone was the beginning, the end, or the average pitch of the tone. Speakers of language B, on the other hand, were using the direction of pitch change as the main perceptual cue. With these assumptions it becomes easier to understand why speakers of language A would reinterpret the intrinsic fundamental frequency shapes after voiced/voiceless consonants



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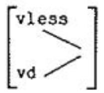
emphasizing that fundamental frequency of vowels after voiced consonants is lover than after voiceless consonants. However, speakers of language B would reinterpret the same intrinsic fundamental frequency shapes



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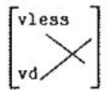

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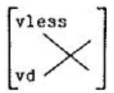
emphasizing the falling contour after voiceless consonants as opposed to the rising contour after voiced consonants. If, in a later development, the end point of the tone becomes the relevant perceptual factor in language B, we could have the following change:



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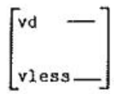

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Notice that languages A and B now have opposite sources for their relatively lover (vs. higher) tones.

2.5 Subsequent tone shift.

a) After a segmentally conditioned tonal development has taken place, tone shapes can change independently of their origin. These tone shifts may result in having some of the tones derived from voiceless consonants vith relatively lover pitch than the corresponding tones developed from voiced consonants.

b) In order to illustrate the second type of tone shift -- which actually looks very much like tone sandhi -- I will consider the case of Ciluba, a two-tone Bantu language of central Africa, well known to Africanists for its unexpected correspondances with the proto-language. The following table shows the tonal correspondences between Proto-Bantu and Ciluba nominal forms. It is clear that Proto-Bantu *High (H) corresponds to Ciluba Low (L) and vice versa. The first tone (always

Low in Proto-Bantu and High in Ciluba) is the tone of the prefix.

Proto-Bantu	Ciluba
1) *L-H	H-L
2) *L-L	H-H
3) *L-H L	H-L H
4) *L-L H	H-H L
5) *L-L L	H-H H
6) *L-H H	H-L L

Table 1. Correspondences between Proto-Bantu and Ciluba tone sequences.

Instead of assuming a tonal 'flip-flop' between Lou and High tones, Maddieson (1976) proposes a more satisfactory solution to this puzzle. He suggests that first a high tone particle was added at the beginning (i.e. to the left) of the proto-tone sequences (left hand column in the table) and that later two types of tone rules very common among Bantu languages, tone spreading and tone contraction, applied to these original tone sequences. In this later stage, the segmental support for this added high tone vas lost. Tone spreading "changes a tone to the same as the preceding tone of opposite value when a tone of the same value or a word boundary follows. ...(The) effect (of this rule which) is essentially to delay the timing of a change in tone (preservative assimilation)" can be formalized as follows:

$$HL \begin{Bmatrix} L \\ \# \end{Bmatrix} \longrightarrow HH \begin{Bmatrix} L \\ \# \end{Bmatrix}$$

$$LH \begin{Bmatrix} H \\ \# \end{Bmatrix} \longrightarrow LL \begin{Bmatrix} H \\ \# \end{Bmatrix}$$

Tone contraction "shortens the word by the loss of the initiai tone-bearing unit and redistributes the tonal pattern over the remaining syllables. In effect the tone of the deleted element and all subsequent tones are moved to the right and the two final tones coalesce".

The application of these two tone rules to the six tone sequences presented in Table 1 is illustrated in the table below (from Maddieson 19761. Note that the upper row corresponds to the left-hand column of Table 1 after a high tone has been added at the beginning of the tone sequence and that the lover row (i.e. tone sequences after tone contraction) corresponds to the right-hand column of Table 1

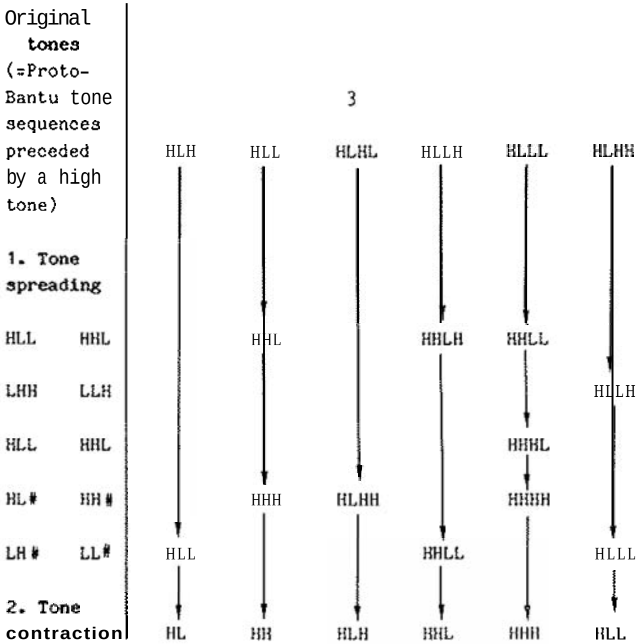
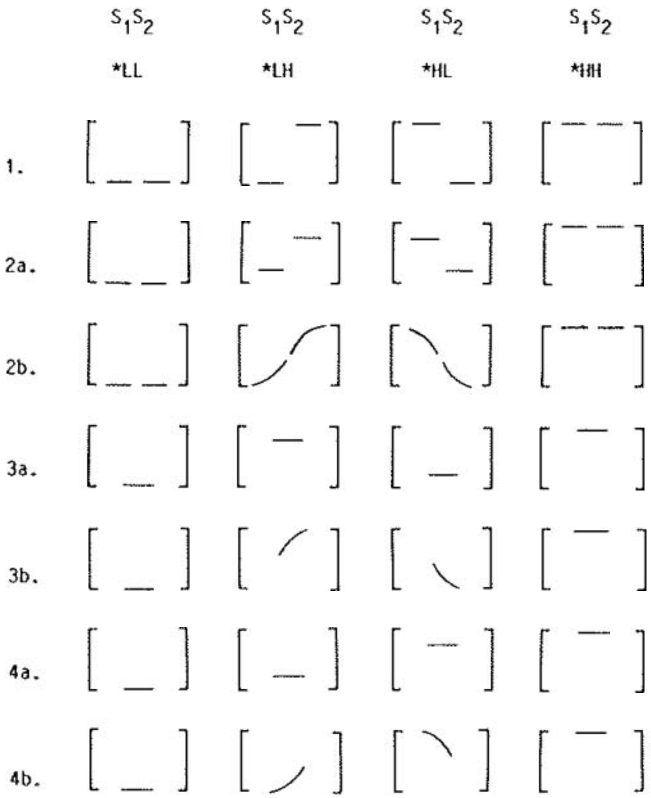


Table 2. Changes in tonal sequences between Proto-Bantu forms and Ciluba reflexes

3. Development of tones from loss or syllables

Segmentally conditioned tonal development of the kind mentioned at the beginning of this paper is widely attested in various linguistic areas. Another possible source of tonal development, which to my knowledge has never been proposed as a possible historical scenario for tonogenesis, stems from the loss of syllables. It is common for a tone to affect the phonetic shape of its neighboring tones through the well known process of assimilation. Just as in the case of segmentally induced tonal development, when the conditioning factor -- in the present case a syllable uith its associated tone -- is lost, these previously intrinsic (i.e. phonetically predictable) perturbations become contrastive (i.e. phonologically relevant). In order to clarify what kind of tonal development can result from different types of tonal assimilations, let us consider the Simple case of the interaction between adjacent tones in the four possible tone sequences found in bisyllabic words of a tuo-tone system (see 11 opposite). The phonetic realizations of these sequences can be influenced by vertical assimilation as in #2a, or by horizontal assimilation as in #2b. If the syllable S_1 is lost after one or the other type of assimilation has taken place, we will have a four-level tone system (as in #3a) or a system with two levels and two contours (as in #3b) depending on the type of assimilation which preceded the loss of S_1. Similar development resulting from the loss of S_2 are presented in #4a and #4b. Note that in all cases (i.e. 3a, 3b, 4a and 4b) we end up with four tones from an original tuo-tone system. Theoretically speaking we could get eight tones from the same original two-tone system if we were to consider interaction between sequences of three tones instead of limiting ourselves to bisyllabic words. Developments of the 4a and 4b types are found in the Grassfields languages of Cameroun (Denue-Congo branch of Niger-Congo) and Songhai (Saharan branch of Nilo-Saharan). I suspect that tonal developments in the Kru languages of West Africa and in the Otomanguean languages of Central Mexico are examples of the 3a and 3b types.


S_1S_2 S_1S_2 S_1S_2 S_1S_2
*LL *LH *HL *HH
1.
2a.
2b.
3a.
3b.
4a.
4b.

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