PROTO-LOLOISH TONES

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ABSTRACT

Recent discussion of tonogenesis has shown what kinds of development in the pitch and contour realization of tone are likely or possible. It is now possible to make hypotheses about the phonetic values of reconstructed tone categories. In this paper, pitch values are proposed for Proto-Loloish tone categories, and the developments from the Proto-Loloish tone system to those of various attested Loloish languages are traced. Some insights into the process of tonogenesis, and the Proto-Sino-Tibetan tone system, are gained.

1. TONOGENESIS

In this paper, the relative pitch values of tones are represented with Chao (1930) tone-letters. These allow a five-step division of the pitch range, 1 (lowest) to 5 (highest). Level tones can be represented with two identical pitch-numbers; e.g. 55, high-level. Contour tones can be represented with pitch-numbers giving beginning, middle if necessary, and final pitches; e.g. 51, high-to-low falling; 313, mid falling-rising. In most tone systems, this transcription is narrower than necessary; but languages contrasting five level tones do exist. Chao proposes that short tones should be represented with one pitch-number, e.g. 1, short-low (level). In the area under consideration, short vs. long distinctions are usually correlated with other supresegmental or segmental distinctions: short tones occur in stop-final, laryngealized, or otherwise constricted syllables. There are also short contour tones, difficult to represent with one pitch-number.

Therefore, I use two pitch-numbers, and indicate with a postscript -s a final stop; and -c a constriction or laryngealization of the vowel; e.g. 21s, half-low-to-low-falling with final stop; 33c, mid-level with vowel constriction.

Many excellent articles on tonogenesis, the process of tone development, have appeared – especially in the last few years. Haudricourt, in several pioneering articles (1954, 1961), suggests two basic conditioning factors that may lead to the development of tone: syllable-initial consonants condition pitch differences, and syllable-final consonants of some kinds condition contour differences. Then, if the segmental conditioning factors are lost, the pitch and contour differences may remain and become solely tone differences. Specifically, syllables with voiced initials may develop lower pitch, and syllables with voiceless initials may develop higher pitch. Syllables with glottal-stop finals may develop rising contour, and syllables with fricative finals, especially [h], may develop falling contour.

There are many examples of tone developments conditioned by larynx activity during syllable-initial consonants.[1] Even non-tonal languages show a tendency to higher pitch in voiceless-initial syllables, and lower pitch in voiceless-initial syllables.[2] The articulatory reasons for this correlation are fairly clear. Many languages have become tonal when the voicing/voicelessness conditioning factor ceased to be the main contrastive one, as in various Tibetan dialects. A two-way split can also occur in a language that already has tones, as in Chinese. Rearrangement of the tone system is then likely. Less common, and less universal in the details of their conditioning, are three-way splits. Voiced, glottalized, and voiceless aspirated syllable-initials have been reported to condition the development of low, mid, and high tones in Maru, a Burmish Tibeto-Burman language (Burling 1967).[3] In languages that have tone systems, one or several of the tones may undergo a split conditioned by syllable-initials without all of the tones splitting; in such a case, the tone system may also be further rearranged, possibly by mergers. This last kind of process, conditioned split of some tones, is particularly frequent in Central Loloish languages. The basic conditioning factors are similar: voiced initials condition lower-pitched tones, and voiceless initials, especially glottalized or unaspirated, condition higher-pitched tones.

The development of contour conditioned by syllable-finals is not as universal as the developments conditioned by initials, but it is frequently encountered. Haudricourt (1954) suggests that the two processes combined to produce the six tones of most dialects of Vietnamese. Matisoff (1970) gives a clear example of the development of a rising

tone in Lahu conditioned by a final glottal-stop.[4] Fewer changes conditioned by finals would in any case be predictable, as there are usually fewer oppositions in final position.

Other processes of tonogenesis are likely to occur only in languages that already have tone systems. These are called rearrangement above. Some such processes are discrete; others may be continuous. The most spectacular discrete process is flip-flop: two or more tones exchange phonetic values; Hashimoto (1972) cites some examples from Chinese. Brown (1965) attempts to explain flip-flop as an articulatory process. Another possibility is hopping: one tone's phonetic value changes to a value opposite to that it previously had relative to another tone, without the other tone undergoing a change.[5] Baron (1975) cites some examples, again from Chinese. One subtype of tone sandhi may also be discrete: in a specific environment, often determined by the tones of adjacent syllables, a particular tone has a phonetic value unlike its own realization elsewhere, but identical or similar to the realization of another tone.[6]

Continuous tonal rearrangement processes are less unlike developments in segmental phonology. There is assimilation; there are chain shifts within a continuously variable range of pitch; and there are changes in the direction of ease of articulation. Assimilation changes are also called tone sandhi in Asia, but the word 'spreading' could instead be borrowed from African linguistic usage: a tone becomes more similar to an adjacent tone. Ballard (1973, 1975) gives examples of both progressive and regressive spreading, again from Chinese. Chain shifts usually occur *after* another process, often discrete or universal, has caused instability in the tone system. Part of the instability may be resolved by mergers of tones with similar realizations, but Loloish data provide several instances, different in detail, of apparent push-type chain shifts. For example, in Northern Loloish, the hopping of the Proto-Loloish low tones to high pushes the Proto-Loloish high tone to mid, and mid tone to low.[7]

Ease of articulation considerations can be seen in the spreading subtype of tone sandhi, and in chain shifts which increase phonetic distinctness between tones when other processes have made them more similar. Another kind of change which reduces muscular effort is the elimination of phonation differences, such as laryngealization or other forms of constriction – which often result from the presence of final consonants, and then become contrastive when the final is lost. Thus, in a sense, there is a cyclical process – the final disappears, leaving phonation differences; then the phonation disappears, possibly leaving pitch and contour differences and hence a new tone. Of course,

when the final or phonation difference is lost, the result could also be a merger with an otherwise similar unconstricted tone.[8]

Another kind of least-effort change, not previously suggested but widespread in languages that are already tonal, is the development of a mid-pitch tone from high- or low-pitch tones. Various measurements of muscle activity[9] show that more effort is involved in the production of high or low pitches than mid pitches. We may thus account for the widespread tendency to develop mid tones, despite the possible resulting increase in the number of contrastive pitch-levels. This hypothesis may account for changes in Proto-Loloish and elsewhere.

Tone systems operate as systems, with each member opposed to all other members. Of course, the above kinds of change may result in extensive rearrangement of oppositions, adding more and more contrasts — up to five pitch levels; contour, possibly including rising, falling, concave (falling-rising) and convex (rising-falling); and other suprasegmental factors, such as length, constriction or phonation generally. Segmental factors, such as final glottal-stop or other stops with short tones, may also be considered part of the realization of certain tones. However, few if any languages have more than eight tones. When tone change processes result in excessive numbers of tone oppositions, mergers can be expected. In fact, in languages with many tones, we can usually account for some tones in terms of the processes outlined above. Given data from enough languages, and using the usual principles of historical linguistics[10] we can make and verify hypotheses about the phonetic values of reconstructed tone categories; provide further evidence for subgrouping based on shared tone changes; and show more instances of general tonogenetic processes.

2. LOLOISH TONES

Data are given from languages in the three major subgroups of Proto-Loloish.[11] Southern Loloish is represented by Akha (Lewis 1968; two dialects); other Southern Loloish languages such as Bisu, Phunoi and Mpi have identical pitch systems, but have no distinction between constricted and fully-voiced phonation. Northern Loloish is represented by 'Lu-ch'üan Lolo' (Ma 1948, cited in Matisoff 1973). Central Loloish is represented by Lisu (Fraser 1922), Sani (Ma 1951, cited in Matisoff 1973), and Lahu (Bradley 1975a; three dialects). Central Loloish languages have the most complex tonal systems: Lisu has a tone contrast maintained by contour alone and a tone contrast maintained by phonation alone; Sani has five contrasting level tones.[12] Lahu (two dialects) has the most tones, seven; it uses syllable-type contrast, two or three pitch-levels, and rising vs. falling contour in various

combinations. Two Tibeto-Burman languages close to, but not part of, Proto-Loloish are also cited to carry the reconstruction back towards Proto-Tibeto-Burman. Burmese (Bradley 1975a) is a member of the Burmese-Lolo division, the group of which Loloish is a subdivision; Naxi (Bradley 1975b) is the other modern member of the Naxi/Burmese-Lolo subfamily, the group of which Burmese-Lolo is a division.

Akha (A) fully voiced vs. laryngealized phonation

55		
33	33c	
21	21c	

Lu Ch'üan (LC) fully voiced vs. constricted/short, glottal-stop final

55	55c	
33		
11	22s	

Lisu (Ls) fully voiced vs. constricted

55			
44			
33	f	33c	(dialectal)
35			
21		21cs	often glottal-stop final

Sani (S) long short

55		
44		
33		
11	22s	

Lahu (Black) long short, glottal-stop final

(L-B) 54		
35	35s	
33		
21	21s	
11(2)		rise is optional

(Yellow) long short, *optional* glottal-stop final

55		
54	35s	
33		
11	11s	merger in rapid speech
13		

(Shehleh) long short, glottal-stop final

(L-S) 44		
45	45s	
22		
21	21s	

Burmese (B)	long	laryngealized	short, glottal-stop final
	43	44c	55s
	11		

Naxi (Nx) (no phonation contrast)

55
33
21

3. PROTO-LOLOISH TONES

Burling (1967) very insightfully reconstructed the tones of Proto-Burmese-Lolo, using Akha, Lisu, and Lahu data for Proto-Loloish, and Burmese among other data for Proto-Burmish. While various scholars, especially Matisoff, have made considerable advances on Burling in the reconstruction of segmental phonology, only one major change is necessary in Burling's reconstructed tone categories. Burling reconstructed three tones, Proto-Tone 1 (*1), Proto-Tone 2 (*2), and Proto-Tone 3 (*3) in vowel- or nasal-final syllables; and two tones, herein Proto-High Stopped Tone (*HS) and Proto-Low Stopped Tone (*LS), in stop-final syllables. The correspondences are as follows: (changes shown by lines)

*L	A	LC	Ls	S	L-B	L-S	L-Y	environment
*1	55	33	33	44	33	44	33	*?- prefix voiceless
	55	33	33	44	21	21	54	*?- prefix voiced
	55	33	44	33	33	44	33	(non-?-prefix)*voiceless
	55	11	44	33	21	21	54	(non-?-prefix)*voiced
*2	21	33~11	55	55	11(2)	22	11	*?- prefix
	21	55	21	11	11(2)~54	22~21	11~55	*C- prefix voiceless
	21	55	21	11	54	21	55	*voiceless (unprefixed)
	21	33	21	11	11(2)~54	22~21	11~55	*C- prefix voiced
	21	33	21	11	54	21	55	elsewhere
*3	33	11	33(c)	44	33	44	33	*voiceless
	33	11	33(c)	33	33	44	33	*voiced
*HS	33c	22s	35	44	35s	45s	35(s)	*voiceless (unprefixed)
(*S^2)	33c	22s	33(c)	44	35s	45s	35(s)	*prefixed or *voiced
*LS	21c	55c	55	55	35	45	13	*?- prefixed
(*S^1)	21c	55c	21cs	22s	21s	21s	11(s)	elsewhere

The *HS and *LS tones of Proto-Loloish do not correspond to any tonal distinction outside Loloish, not even in closely-related Proto-Burmish. Matisoff (1972) elegantly demonstrates that this Proto-Loloish tonal distinction was conditioned by *voicelessness/*voicing of initials — *HS/*LS. When the conditioning environment was disrupted by changed in *initials, a pitch distinction became tonal.

The preponderating reflex of *HS is a mid-level tone, apart from Lahu which has added contour — possibly conditioned by a final glottal-stop. The preponderating reflex of *LS is a low-falling tone. In Central Loloish, a *?-prefix and a final glottal-stop together produce a high (rising) tone, and the final glottal-stop is lost. In Northern Loloish, *LS has hopped past *HS to high level, producing rearrangements in other parts of the tone system — including a downwards push for the reflex of *HS in this language.[13] Having thus accounted for differences from the preponderating reflexes, mid-level pitch can be postulated for *HS, and low-(falling) pitch — contour not contrastive — for *LS. At the Proto-Loloish stage, this contrast was a two-way split conditioned by *initial-consonant larynx activity; at an earlier stage, Proto-Burmese-Lolo, no tone contrast is reconstructed in *-stop syllables.

Different Loloish languages have reached different stages in the reduction of the *-stops. Some Southern Loloish languages retain /-p/ and /-t/;[14] some Central and Northern Loloish languages have glottal-stop finals reflecting *-stops in some reflexes of *HS, *LS, or both. Loloish languages in all divisions have constriction or laryngealization of the vowel as a reflex of *-stops in some or all reflexes of *HS, *LS, or both. And in some cases, all trace of the *-stop is lost — in Central Loloish, which is precisely the division which has developed contrastive use of contour.

The presence of final glottal-stop or constriction in reflexes of syllables with tones *1, *2 or *3 — and no *-stop — is rare, and limited to reflexes of *3 in some dialects of Lisu and Nasu. There is greater effort involved in producing final glottal-stop or constriction; also, the addition of such features appears to be contrary to the general tendency observed above to eliminate them. So why do they appear in reflexes of *3? The answer appears to be that, at the Proto-Burmese Lolo stage, *3 split form *2, conditioned partly by *s- prefixes and various suffixes including *-d and a morphological *-?;[15] and that these segmental items left a phonation difference which persisted to the Proto-Loloish stage. This tone is by far the least frequent in the etyma reconstructed for Proto-Loloish. Most reflexes are mid-level unconstricted; but in Northern Loloish, *3 has chain-shifted down to

11; Sani is the only language to split *3: a higher tone results with a *voiceless initial, but a mid-level tone is the reflex with a *voiced initial. Thus, we can postulate mid-level pitch for *3 at the Proto-Loloish stage, with a possibly noncontrastive constriction that differed from the *-stop in *HS syllables.

When developments of the tone systems of Lu Ch'üan, Lisu/Sani, and Lahu are considered individually, the basis for the hypothesis of pitch-values for *1 and *2 will become clearer. I propose that the pitch-values of reflexes in Southern Loloish be considered conservative — as in fact they have been shown to be for *HS, *LS, and *3. That is, *1 was high level, and *2 was low (falling). In other words, Akha may have kept the Proto-Loloish tonal system intact in terms of pitch — along with most other Southern Loloish languages. Thus the system was

Proto Loloish	vowel/nasal final	stop final
*1	55	
*3/*HS	33(c)	33s
*2/*LS	21	21s

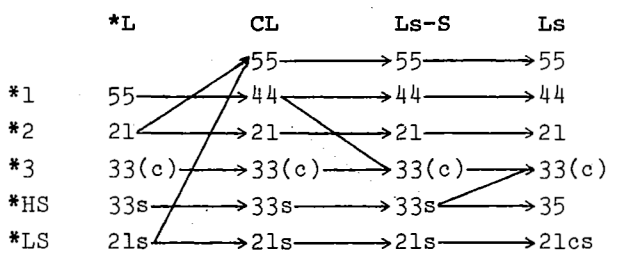
Some Southern Loloish languages show interesting tone phenomena. The Akeu dialect of Akha (Bradley 1976) shows a flip-flop of high-level and low-falling fully-voiced tones, leaving the mid fully-voiced and the two constricted tones unaffected. Mpi (Duanghom 1976) has rising allophones of its three tones, low, mid, and high, which occur with non-negated verb-phrase final verbs. The rise appears to be conditioned by some verb particle which has subsequently been lost; possibly the particle had an initial glottal-stop, leading to the rising allotones.

The main change in the tonal systems of the Northern Loloish languages is the hopping from low to high pitch of *LS, and in parallel fashion of *2. A push chain then moves *HS down in some languages, and *1 and *3 in all languages. The exact details of the conditioning of the push chain differ in different languages. In the Nasu language recorded in Hú/Dài (1964), the raised tone *2 merges with tone *1 as mid-level tone, 33; while tone *3 is pushed down to low-falling tone, 21. The resulting tonal system has two constricted tones, 55c and 33c; and two fully-voiced tones, 33 and 21; similar languages, such as the one recorded by Fu (1950), then make ease-of-articulation changes that eliminate constriction when the syllable-initial is a resonant; then, a three-way distinction reappears in fully-voiced syllables. In the Lu-Ch'üan language recorded in Ma (1948) and analyzed in Matisoff (1973), the hopping results in the pushing of the reflex of *HS down to 22s. In this language, the merger of the raised *2 and the high *1 is only

partial; the details suggest a stage at which the raised *2 was higher than the original high *1, as *2 but not *1 has a high-level reflex, 55, after voiceless initials; also, the development of *1 but not *2 to low-level, 11 after voiced initials suggests that the original high *1 was lower than the raised *2. Otherwise, *1 and *2 are merged to mid-level, 33. There is also a sandhi phenomenon, which lowers the first of two mid-level tones – to low-falling in Nasu (Hú/Dài 1964), and to low-level in Lu Ch'üan.

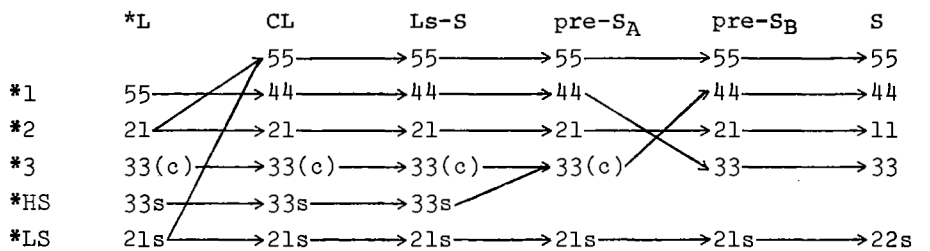
The Central Loloish languages share one major instance of conditioned hopping: *LS and *2 became high when the *initial had a *?- prefix. This partial change is similar to the unconditioned development of the same tones in Northern Loloish. Lisu and Sani share a split of *1 which can be seen as a chain shift downwards in reaction to the raised *2, but although the conditioning is the same, a *?-prefix, the results are opposite in pitch. With *?-prefix, Sani has a half-high level reflex for *1, while Lisu has a mid-level reflex. Without *?-prefix, Sani has a mid-level reflex for *1, and Lisu has a half-high level reflex.

Lisu has one further split that does not occur elsewhere: *HS becomes high-rising with unprefixed *voiceless (aspirated) initials, and the final glottal-stop is lost; with other *initials, prefixed or voiced, *HS remains mid-level as in Proto-Loloish, but loses its final glottal-stop and in most dialects its constriction. The former development may have been caused by initial aspiration and final glottal-stop. The latter development results in a merger of some *HS with *3 and the *?-prefixed *1 syllables also lowered to mid-level. Also, a *contour* contrast becomes contrastive, to keep the new high-rising tone distinct from the high-level, half-high-level, and other tones. The *LS tone reflex also acquires constriction. Schematically,



The Sani developments, as in some Northern Loloish languages, tend to produce exclusively level tones, with five pitches and possibly also phonation, but no contour. As noted above, the split of *1 is the same, but opposite pitches result from the conditioning factors. There is no *HS split, but there is a split of *3, merging with the reflexes of *1:

a higher, half-high-level pitch results with voiceless initials, and a mid-level pitch results with voiced initials. In addition, the non-contrastive contour of *2 (not *?-prefixed) is eliminated in favour of low-level; the noncontrastive contour of *LS (not *?-prefixed) is eliminated in favour of a half-low level; thus, the final glottal-stop seems to condition a higher pitch. The *HS has a half-high-level pitch, and has thus also been raised in pitch; as in Lisu, it merges with the *?-prefixed *1 and some (but unlike Lisu, not all) *3. Perhaps there has been a flip-flop between half-high and mid-level in Sani, preceding the unique split of *3, but following the Lisu-Sani split of *1 and the merger of *HS with the lower-pitch reflex of *1. Schematically,



The developments in Lahu are far the most complex, and the resulting tone systems also have the most contrasts, including contour; length and final; and three (or two) contrasting pitch levels. Also, developments in different dialects produce very different pitch and contour realizations for underlyingly similar tone systems. I consider the Black Lahu dialect, the standard and probably the most conservative, first.

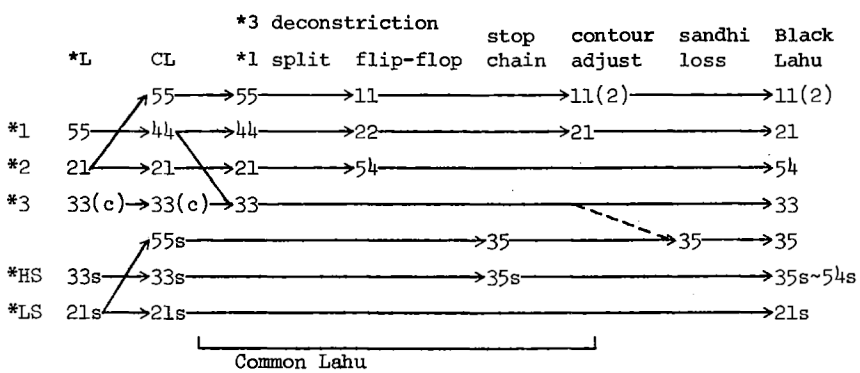
The Central Loloish hopping of *2 and *LS, contrary to the above diagrams for Lisu and Sani, must have maintained a distinction between the high reflexes of *2 and those of *LS; the distinction was then merged in Lisu-Sani. In Lahu, however, the distinction is maintained to the present. The modern distinction in Lahu is rising contour in reflexes of *LS, and level in reflexes of *2 in most dialects; thus the Central Loloish distinction lost in Sani-Lisu was probably a glottal-stop in *LS reflexes, which conditioned the Lahu rising tone and was then lost; and was lost without trace in Sani-Lisu.

The Reflex of *3 has lost its constriction, as in most Central Loloish languages. There is a split of *1 as elsewhere, in a chain-shift reaction to the raising of some *2. However, the split is conditioned by *voicelessness (higher-pitched tone results) vs. *voicing (lower-pitched tone, which merges with *3, results) and not *?-prefix. Thus,

as in the case of the *LS/*2 hopping, a similar change with different conditioning occurs in separate, but close subgroups of Proto-Loloish; in this case, Lisu-Sani vs. Lahu.

There was then a flip-flop of all pitch values in fully-voiced syllables – not including the raised *LS, which must thus have kept its final *-stops at this stage. As frequently occurs, the flip-flop leaves the mid-level tone unaffected, but reverses all other values. In this case, the raised *2, 55, is reversed to 11; the *voiceless-initial *1, 44, is reversed to 22; and the non-raised *2, 21, is reversed to 54.

After this flip-flop, various rearrangements are introduced which produce a rising vs. falling contour contrast. The reflexes of stop-final syllable tones are adjusted in a chain shift: the raised (*?-prefixed) *LS becomes high rising and then loses the final glottal-stop that conditioned the rise; then the *HS develops a rise – and in some dialects, later a fall.[16] Also, the low-level and half-low-level tones develop contour, possibly by analogy with the high-falling vs. high-rising contrast that occurs after the stop-syllable chain shift. In Black Lahu, the low level tone develops an optional rise that does not occur in all dialects and may thus be a separate development; and the half-low-level tone develops a fall. A sandhi process which produces rising allotones of the mid tone ceases to be productive, and some instances of the sandhi allotone are reinterpreted as the new high-rising tone. Schematically,

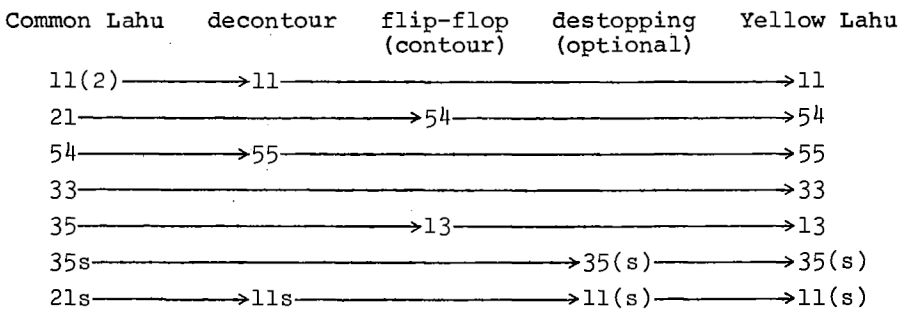


The developments suggested seem to have occurred in the order cited. Alternative ways of accounting for the development of Lahu tones are possible, but this schema seems to fit best with developments in closely-related languages, and with likely processes of tonogenesis.

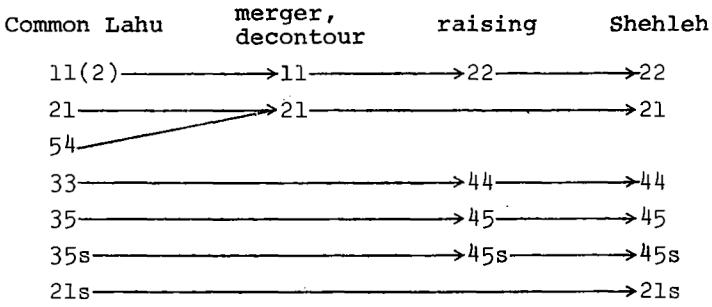
Other dialects of Lahu have undergone further developments; once a system is as complex and unstable as the Lahu tone system, further

developments are likely. Yellow Lahu (Bradley 1974, 1975a) seems to have begun its separate development some time ago, at the Common Lahu stage. A decontour rule shifts the Common Lahu high-falling tone to high-level; also, the low-level tone does not have a possible contour in Yellow Lahu; and the lowest stop-final tone also loses its contour. Thus, pre-Yellow Lahu avoids a rising vs. falling distinction; but it keeps a contour contrast, with high-level vs. high-rising, and low-level vs. low-falling tones. This can be seen as a rearrangement after the stop chain and contour adjust rules of Common Lahu. Subsequent to this rearrangement, a flip-flop occurs with non-stop final contour tones: low-falling becomes high-falling, and high-rising becomes low-rising. After this flip-flop, a destopping change in certain juncture environments permits the two Common Lahu glottal-stop final tones to occur without the glottal-stops. No contrast is lost with the loss of the final in the high-rising tone as a result of the previous flip-flop, but there is partial neutralization of the low level stopped and unstopped tones.

The resulting tonal system for Yellow Lahu contrasts three pitch-levels, and has a contour contrast in unstopped tones; the two contour tones move from the extremes towards mid pitch. Tones which may be stopped are high, with rising contour, and low, usually without contour. Schematically,

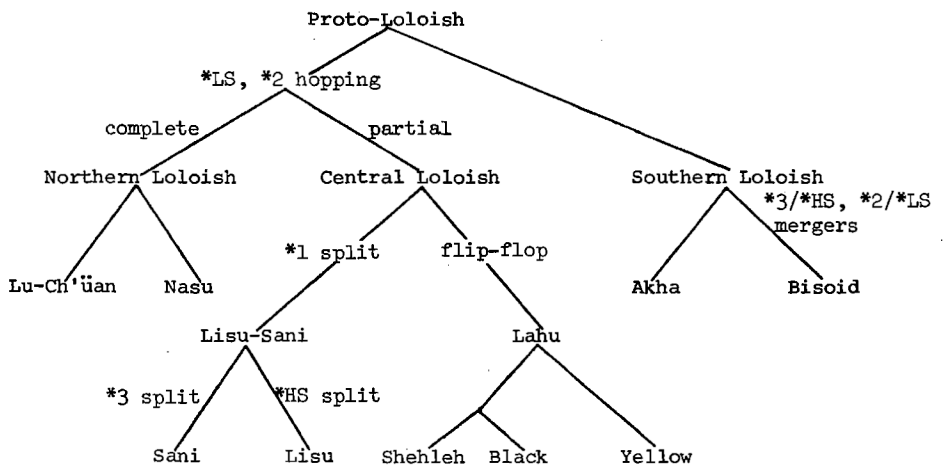


Shehleh, which is somewhat more closely related to Black Lahu, also shows considerable rearrangement of its tone system. Like Yellow Lahu, it eliminates the rising vs. falling contrast, but by merging the high-falling tone to low, and decontouring the low (rising) tone to level. The result is a contour contrast, with a low-falling and a high-rising tone. Then, a chain-shift adjusts the pitches of the various tones upwards so that only two pitches are contrasted.
Schematically,



The resulting system has contour which moves away from the contrasting pitch, and is redundant in stop-final syllables.

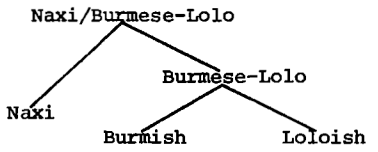
Using the above tonal developments to subgroup within Proto-Loloish, we find a tree diagram as follows.



4. PROTO-LOLOISH AND PROTO-SINO-TIBETAN

Benedict (1972) has reconstructed a two-tone system, Tones *A and *B, for Proto-Sino-Tibetan, with correspondences in Chinese, Karen, and in various subgroups of Proto-Tibeto-Burman including Burmese-Lolo. It seems likely that this system contrasted higher and lower pitches; but the likelihood of flip-flops at any stage makes it very difficult to say which tone had which value at what stage. At the Proto-Loloish stage, *A corresponds to *1, and hence a high-pitch value, while *B corresponds to *2, or a low (falling) value. Attempts to compare the Proto-Loloish tone system with those of Burmese and Naxi follow. First, a correspondence table:

*BL	*L	B	Nx
*1	55	11	21
*2	21	43	33
*3	33c	44c	does not occur



As noted above, Proto-Burmish developments of *-stop syllables do not correspond to the Proto-Loloish *HS/*LS split. The Naxi spit is also separate, as shown in Bradley 1975b. Also as noted above, *3 is a unique Burmese-Lolo development; the non-occurrence of a separate tone corresponding to *3 is a major criterion for separating Naxi from Proto-Burmese Lolo. The above tree diagram thus indicates the genetic relations between the three as suggested by tone correspondences.

When Burmese is compared to Proto-Loloish, various differences can be seen. The Burmese reflex of Proto-Burmish *1 is low level, and of *2, falling and higher than that of *1. Thus, we must postulate a flip-flop in the values of *1 and *2 either in Proto-Burmish or in Proto-Loloish. A look further afield, at Naxi, reveals agreement with Burmese about the relative pitches of *1 and *2: *2 was higher than *1. Hence, we may postulate a flip-flop in Proto-Loloish, as well as the split in *-stop syllables discussed earlier.

Checking pitch and contour of tonal reflexes in Burmish languages other than Burmese suggests that the three tones which contrasted in *vowel- or *nasal-final syllables in Proto-Burmish were: *1 low, more or less level; *2 falling, usually thus higher than *1 in pitch; and *3, high, often constricted or with glottal-stop final.[17] Much more work is necessary to allow secure internal reconstruction of the history of Proto-Burmish.

The development of *3 in Proto-Burmese-Lolo from *2 when certain *prefixes or *suffixes were present accounts for the fact that reflexes of *3 often show laryngealization, constriction, or even final glottal-stop. Presumably, *3 was similar to *2 in pitch and contour when it first developed, and the distinction was one of phonation. In Proto-Loloish, ease of articulation considerations moved *3 to mid pitch, and subsequently the phonation difference was lost in most languages – producing three distinctive pitch levels for tone. In Proto-Burmish, the phonation difference is often kept, as in Burmese; but languages which have lost the phonation difference have often kept the reflex of *3 as a high pitch, usually level; while they have a reflex of *2 which is lower in pitch than that of *3, and which usually falls. This tendency can be seen to a small extent even in Burmese, but languages like Atsi and Maru (Burling 1967) seem to show the development of contrastive falling contour and lower pitch for reflexes of *2 –

another instance of a possible chain shift, with a phonation loss initiating the downward movement of pitch of a tone that had the unmarked, fully-voiced phonation.

In Naxi, there are several tonal splits separate from those of Burmese-Lolo. Syllables with *-stops show a three-way split, low (falling), mid, or high tones resulting depending on the initial. Syllables with Proto-Naxi/Burmese-Lolo tone *2, Proto-Sino-Tibetan tone *B also sometimes have reflexes with high tones instead of mid tones; this split is morphologically conditioned. However, both splits are separate from the similar splits in Proto-Burmese-Lolo, with different conditioning environments.[18] The resulting system contrasts three pitches, with no contour or phonation contrasts.

5. IMPLICATIONS

Now that it is possible to reconstruct possible pitch values for reconstructed tones, further insights can be gained into the process of tonogenesis. For example, the tendency towards mid pitch and the relative stability of mid tones in flip-flops had not previously been suggested for pitch-tone languages. Also, many more examples of processes like flip-flop and hopping can be discovered. Moreover, insights for the reconstruction of segmental phonology may also arise. It is no longer necessary to resort to proto-tone-stuffing, as in Brown (1965), once tone, phonation, and segmental systems are seen to interact in relatively systematic ways. And genetic subgrouping is also aided.

Attempts to rewrite the relatively simple development processes above with binary features (Wang 1967, Woo 1969 or others) will demonstrate the extreme complexity which arises when trying to use such features, the sacrifice of clarity and insight which can result, and especially the massive redundancy required: 2^7 (128) possible tones could be represented with Wang's seven features, if they were really binary, privative oppositions.[19] It would appear that language-specific n-ary features expressing the actual oppositions used would be much clearer, more economical, and would reflect the phonology of tone better.

The kinds of changes that seem to be frequent in suprasegmental phonology are much rarer in segmental phonology. Discrete changes, regressive assimilation to syllable-initial features, and push-chain shifts seem to be common in suprasegmental developments. Gradual changes, progressive assimilation, and drag-chain shifts are much more usual in segmental developments. Tones, perhaps even more than segments, seem to operate within closed systems which react in various ways when a change occurs in one tone.

NOTES

1. Hyman (ed.) 1973, Maddieson (ed.) 1974, and various other works.

2. Hombert, Ewan and Ohala 1975.

3. Burling 1967 p.65, in *-stop syllables only. Gandour 1974 suggests a similar but more detailed hierarchy in Dai languages. The highest pitches result from aspirated initials, next highest from voiceless fricatives, then voiceless unaspirated, next glottalized, and lowest pitches in voiced-initial syllables. Loloish data, on the other hand, imply that unaspirated or glottalized initials can result in higher pitches than aspirated initials; thus the data are somewhat contradictory.

4. In Lahu, this development is conditioned by two glottal incidents in the syllable: initial and final. After the rising contour developed in Central Loloish, the second glottal incident, the final glottal-stop, was lost.

5. That is, low > high while mid remains mid. The Northern Loloish development of *LS, below, is an instance of hopping.

6. This kind of tone sandhi is analogous to neutralization in segmental phonology. Such a process may also be nondiscrete, if the environment could condition the resulting allotone:

33 > 35 |___5 nondiscrete, assimilatory; Lahu (one dialect)

33 > 11 |___33 may be nondiscrete; Northern Loloish (one dialect)

Wang 1967 cites a spectacular example of a discrete sandhi process which shifts a number of tones in a circle, each taking the value of another. There are various possible consequences of tone sandhi. A process may cease to be productive; it will then be restricted to

certain forms. These may be eliminated through recompounding; but a residue may be left. Such lexical items would then be likely to be reinterpreted with the tone most similar. Internal reconstruction may then be necessary to identify these forms; see Bradley 1975a pp.86-9 for an instance in Lahu (one dialect).

7. Push chains are of course rare in segmental phonology; but then, so are flip-flops. This instance could also be analyzed as a shift of phonetic values in a circular fashion.

8. As in Bisoid Loloish languages, below. Incidentally, there are various counterexamples in Proto-Burmese-Lolo and Proto-Loloish to Wang's (1967) claim that laryngealized tones tend to be low-pitched. See, for example, Proto-Burmese-Lolo tone *3 below.

9. The following are cited in Sawashima 1974:
Faaborg-Andersen and Sonninen, 'The function of the extrinsic larynx muscles at different pitch' *Acta Oto-Lary* 51:89-93 1960.
Hirano, Koike and von Leden, 'The sternohyoid muscle during phonation' *Acta Oto-Lary* 64:500-7 1967.
Zenker and Zenker, 'Uber die Regierung der Stimmlippenspannung durch von aussen eingreifende Mechanismen' *Folia Phoniatrica* 12:1-36 1960.

10. E.g. statistical preponderance of reflexes; low probability of parallel independent changes; and phonetic reasonableness of postulated changes.

11. Subgrouping criteria (Bradley 1975a) were shared segmental sound changes, and shared vocabulary.

12. Thurgood 1975 points out that at least one of these is also distinguished by phonation from the others: 22s.

13. This downward shift of *HS does not occur in all Northern Loloish languages; for example, in standard Nasu as cited in Hú and Dài 1964, analyzed in Bradley 1975a, the reflex of *HS is 33c, and of *LS 55c.

14. It is certainly no accident that the languages which have preserved the *-stops best, the Bisoid languages Phunoi and Bisu, are also the ones which have merged the tones of *-stop syllables with other tones: *HS with 3, and *LS with *2. Since most of the segmental

distinctions are preserved, not much ambiguity is caused by a tonal merger. The result is a three-tone system.

15. Bradley 1971.

16. Matisoff describes such a dialect.

17. Bradley 1975a p.318.

18. For more details, see Bradley 1975b.

19. Some, of course, are not; Wang also uses marking conventions to further reduce the redundancy; but why use excessively powerful mechanisms and then constrain them? Binary features with α-rules can be used very effectively to represent discrete changes of some kinds; but so can n-ary features. The fact that the mechanics of using binary features are well-developed is no reason to reject alternatives which have been less fully-explored.

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BIBLIOGRAPHY

BALLARD, W.L.

1973 Wenzhou Tone Sandhi Revisited. Paper delivered at the Sixth International Sino-Tibetan Conference, San Diego.

1975 Wu Tone Sandhi. Paper delivered at the Eighth International Sino-Tibetan Conference, Berkeley.

BARON, S.P.

1975 Beyond Tonogenesis. Paper delivered at the Eighth International Sino-Tibetan Conference, Berkeley.

BENEDICT, P.K.

1972 'The Sino-Tibetan Tonal System'. *Langues et Techniques, Nature et Société 1. Approche Linguistique.* In: Thomas and Bernot, eds. 1972:25-33. Paris: Klincksieck.

BRADLEY, D.

1971 Prefixes and Suffixes in Burmese-Lolo. Paper delivered at the Fourth International Sino-Tibetan Conference, Bloomington.

1974 'La˘hu_ shi: Ban_lan^'. Paper delivered at the Seventh International Sino-Tibetan Conference, Atlanta.

1975a Lahu Dialects and Proto-Loloish. Ph.D. thesis, School of Oriental and African Studies, University of London.

1975b 'Nahsi and Proto-Burmese-Lolo'. *Linguistics of the Tibeto-Burman Area* 2.1:93-150. Berkeley.

BROWN, J.M.
1965 *From Ancient Thai to Modern Dialects*. Bangkok: Social Science Association Press of Thailand.

BURLING, R.
1967 *Proto-Lolo-Burmese*. *International Journal of American Linguistics* 33.1 part 2.

CHAO, Y.R.
1930 'ə sɪstəm əv "toun ietəz"'. *Maître Phonétique* 30:24-7.

DUANGHOM, S.
1976 *An Mpi Dictionary*. *Working Papers in Phonetics and Phonology* 1, 1. Bangkok: Indigenous Languages of Thailand Research Project.

FRASER, J.
1922 *A Handbook of the Lisu (Yawyin) Language*. Rangoon: Government Printing Office.

FU, M.-C.
1950 A Descriptive Grammar of the Lolo Language. Ph.D. thesis, Cambridge University.

GANDOUR, J.
1974 'Consonant Types and Tone in Siamese'. In: Maddieson, ed. 1974:92-117.

HASHIMOTO, M.
1972 'The Linguistic Mechanism of Flip-flop'. *Chi-lin* 19:1-19.

HAUDRICOURT, A.-G.
1954 'de l'origine des tons en viêtnamien'. *Journal Asiatique* 242:68-82.

1961 'Bipartition et tripartition des systèmes de tons dans quelques langues d'Extrême-Orient'. *Bulletin de la Societe de Linguistique de Paris* 56:163-80.

HOMBERT, J.-M., W.E. EWAN and J.J. OHALA
1975 Tonogenesis: Theories and Queries. Paper delivered at the Eighth International Sino-Tibetan Conference, Berkeley.

HÚ, T. and Q.-S. DÀI
1964 'Vowels with and without Stricture in the Hānǐ Language'. *Zhongguo Yüwen* (Chinese Linguistics) 128:76-87.

HYMAN, L., ed.
1973 *Consonant Types and Tone. Southern California Occasional Papers in Linguistics* 1. Los Angeles: University of Southern California.

KOVITZ, J.
1970 Chinese Tone Sandhi and the Phonology of Tone. M.I.T. MS.

LEWIS, P.W.
1968 *Akha-English Dictionary. Cornell University Southeast Asia Program, Data Paper* 70. Ithaca.

MA, S.-L.
1948 'Annotated Translation of the Lolo Sacred Book "Performing Rites, Offering Medicines, and Sacrificing Beasts"'. *Bulletin of the Institute of History and Philology*. Taipei.

1951 *A Study of Sani, a Yi Dialect*. Peking: Academy of Sciences.

MADDIESON, I., ed.
1974 *The Tone Tome. UCLA Working Papers in Phonetics* 27. Los Angeles.

MATISOFF, J.A.
1970 'Glottal Dissimilation and the Lahu High-rising Tone: a Tonogenetic Case Study'. *Journal of the American Oriental Society* 90:1-13-44. Boston.

1972 *The Loloish Tonal Split Revisited*. Center for South and Southeast Asia Studies, University of California at Berkeley. *Research Monograph* 7.

1973 Problems and Progress in Lolo-Burmese: Quo Vadimus? Paper delivered at the Sixth International Sino-Tibetan Conference, San Diego.

SAWASHIMA, M.
1974 'Laryngeal Research in Experimental Phonetics'. *Current Trends in Linguistics* 12.4:2303-48. The Hague.

SHORTO, H.L., ed.
1963 *Linguistic Comparison in South-East Asia and the Pacific.* School of Oriental and African Studies, University of London.

SPRIGG, R.K.
1963 'Prosodic Analysis, and Phonological Formulae, in Tibeto-Burman Linguistic Comparison'. In: Shorto, ed. 1963:79-108.

1966 'Lepcha and Balti Tibetan: Tonal or Non-tonal Languages'. *Asia Major* n.s. 12.2:185-201.

1975 'The Inefficiency of "Tone Change" in Sino-Tibetan Descriptive Linguistics'. *Linguistics of the Tibeto-Burman Area* 2.2:173-81.

WANG, W.S.-Y.
1967 'Phonological Features of Tone'. *International Journal of American Linguistics* 33:93-195

WOO, N.
1969 Prosody and Phonology. Ph.D. thesis, M.I.T.