IMPLICATIONS FOR POST-LEXICAL TONAL TYPOLOGY: AN ANALYSIS OF THADOU AND MIZO TONES

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Abstract

This paper focuses on the post-lexical tonal properties in Thadou and Mizo, the two Kuki Chin languages spoken in North-East India, and tries to typologize them based on the interaction of phonetic and phonological modules in the grammar of these languages. The paper investigates the different downtrending phenomenon like the declination, downdrift and downstep and accounts how the pitch is realized differently in each of these languages. The study reveals that the gradient implementation of certain phenomena in the phonetic component may be severely constrained by the nature of the lexical and post-lexical phonological component in a language. The results of this investigation thus reveal two varied types of post-lexical tones among the Kuki-Chin group of languages.

Keywords: *Thadou, Mizo, tone, typology, downtrend, downstep, downdrift, declination*

Introduction

Thadou and Mizo are Tibeto-Burman languages spoken in North-East India, both belonging to the Kuki-Chin sub group of families. Thadou is spoken mainly in Manipur Hills, although a sizeable population speaking Thadou and closely related speech varieties is found in adjoining states of Assam, Nagaland, Mizoram, parts of Meghalaya and Arunachal Pradesh, and across the Indo-Myanmar border. Mizo is the state official language of Mizoram and is also spoken in the adjacent states of Manipur, Tripura, Assam and Nagaland. Even though small in number there are Mizo speakers in Myanmar and Bangladesh as well.

The present study mainly looks into the post-lexical tonal properties of these languages and for the same the three different downtrending phenomena- declination, downstep and downdrift are investigated upon. Declination can be understood as the gradual lowering of the pitch over the course of an utterance. Downstep and downdrift are somewhat similar phenomena in which High (H) tones are lowered in pitch when preceded by Low (L) tone, the only difference being downdrift is a result of overt L tone whereas in downstep these L tones are covert or 'floating'. The term downtrend is being used as a collective term for the entire phenomenon in tonal languages where pitch lowers in an utterance in one way or the other.

The paper is organized as follows: section 2 explains the methodology used for the study; section 3 gives an overview of tones in Thadou and Mizo; section 4, 5 and 6 deals with declination, downdrift and downstep respectively in both the languages. The paper is summarized in section 7.

Data and Method

The aim of the experiments are to examine whether declination, downdrift and downstep are present in Thadou and Mizo.

Speech materials

Four sets of utterances in each languages were designed to be tested. The first and second set, consisting of utterances with like tone sequences (all Ls and all Hs respectively), were used to tests declination. Utterances with all same tones were carefully compiled as it would give more clarity to the data analyzed. The third set consisted of utterances to test downdrift. They were carefully chosen in alternate combinations of HL and L (as HL surfaces as H within utterances we would get an output of H-L-H-L sequence). The fourth set built to test downstep had utterances with a combination of HL-H sequence within them.

Measurement and analysis

For the study, five female native speakers of Thadou and three female native speakers of Mizo were recorded. The subjects read the utterances with a minimum of three

repetitions each. They were recorded using a Sony ICD-UX533F IC recorder. The recordings were then analyzed acoustically using Praat software (ver. 5.2.22). The mean frequency (F0) of the nucleus is taken to be the F0 of that syllable. The average F0 of all the subjects are taken into account while calculating the fall values.

Tones in Thadou and Mizo

Tone is an important feature in distinguishing words in Thadou. In isolation, the words in Thadou take any of the three underlying tones which are realized as high to low falling (HL), low to high rising (LH) and a low (L). LH contour sometimes simplify as L, sometimes as H, and in the latter case, the resulting floating L never triggers downstep. LH is henceforth analyzed as H (Hyman, 2004).

Table 1. Tonal minimal pairs in Thadou adapted from Hyman (2004)

HL	LH	L
saa 'animal'	saa 'hot'	saa 'build'
muu 'seed'	muu 'hawk'	muu 'see'
low 'field'	low 'medicine'	low (negative)
lei 'earth'	lei 'tongue'	lei 'bridge'

However, unlike Thadou, there are four lexical tones in Mizo. They are- High (H), Low (L), Rising (LH) and Falling (HL). Examples of the four tonal contrasts are given in Table 2.

Table 2. Minimal tonal pairs in Mizo (examples adopted from Fanai,1992)

H	L	LH	HL
lei 'tongue'	lei 'bridge'	lei 'to buy/ earth'	-
-	pa: 'male'	pa: 'mushroom'	pa: 'father'
man 'to arrest/ catch'	man 'cost of'	-	-
-	-	maŋ 'dream'	maŋ 'to become extinct'

Declination

The database set to test declination consisted of all like tone sequences such as utterances with all H tone syllables and all L tone syllables. Phrases, compound words as

well as declarative sentences with similar tones within an utterance were chosen. Declination is usually observed as a universally phonetic phenomena occurring in both tonal and non-tonal languages, especially among declaratives. Though, in tonal languages declination can occur regardless of tonal combinations. The phonetic explanation for declination was given by Caron &Izre'El (2011). According to them declination is a result of physiological constraints, linked to the energy used to expel pulmonic air through the vocal organs.

Let us now examine if this phenomena is seen in Thadou and Mizo.

Declination in Thadou

Declination in L tone sequences

Figure 2 illustrates the fall of average F0 of all female speakers in utterances with two, three, four, six, nine and eighteen syllables with the mean frequency of the nucleus running along the y-axis and the number of syllables on the x-axis. As can be seen from the figure there is a significant declination in the frequency from the initial to the final syllable even though all the syllables have the same phonological value. The utterances analyzed in Figure 2 are the following:

Series 1: kèelchà lìenzàalè?sòomgùuplè?nìilè?nùmèyzàalè?sòomnìilè?nìi
'162 big goats and 122 women'

Series 2: kèelchà lìenzàalè?sòomgùuplè?nìi ' 162 big goats'

Series 3: zàalè?sòomgùuplè?nìi 'one hundred and sixty two'

Series 4: kèelchà lìengùup 'six big goats'

Series 5: kèelchà lìen 'big goat'

Series 6: sòomgùup 'sixty'

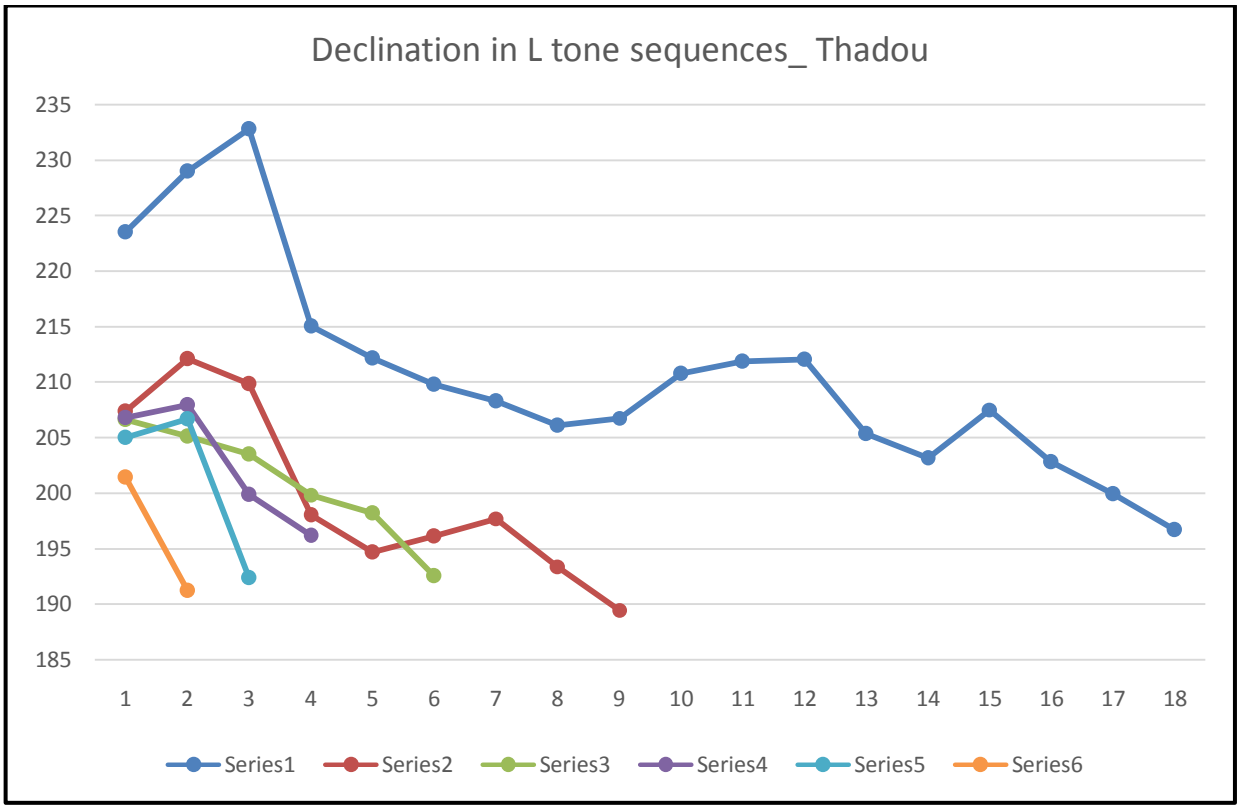

Figure 2: F0 tract showing the F0 pattern in sequences of all L tone (2, 3, 4, 6, 9 and 18 syllables).

As is evident from figure 2, there is pitch declination among all- L tone utterances in Thadou. For further clarification each slopes are measured separately, the values of which are illustrated in table 3. The result shows that with increase in the number of syllables the slope value decreases. Slope values are calculated using the slope formula in Microsoft Excel.

Table 3: Slope values relative to the number of syllables in an utterance.

Utterance	Number of syllables	Slope value
sòomgùup 'sixty'	2	-10.17
kèelchà lìen 'big goat'	3	-6.33
kèelchà lìengùup 'six big goats'	4	-3.99
zàalè?sòomgùuplè?nìi 'one hundred and sixty two'	6	-2.71
kèelchà lìenzàalè?sòomgùuplè?nìi '162 big goats'	9	-2.57
kèelchà lìenzàalè?sòomgùuplè?nìilè?nùmèyzàalè?sòomnìilè?nìi '162 big goats and 122 women'	18	-1.48

Thus, the result suggest that there is a clear correlation between the rate of declination and the utterance length. That is, longer the utterance lesser the declination rate. The slope values are all negative as the slope we have here is a downward slope. Declination being a phonetic phenomenon, there is a tendency to adjust the fall of F0 within the pitch range of the speaker, as a speaker cannot lower the frequency beyond a certain point.

So far we have analyzed declination in utterances with all-L tone syllables. Now we shall move on to analyze declination in H tone sequences.

Declination among H tone sequences

Due to difficulty in constructing sequences with all H tones, the data available for this tone is less than for L tone. However, sequences with two, three and four syllables are available. The utterances analyzed in Figure 3 are the following:

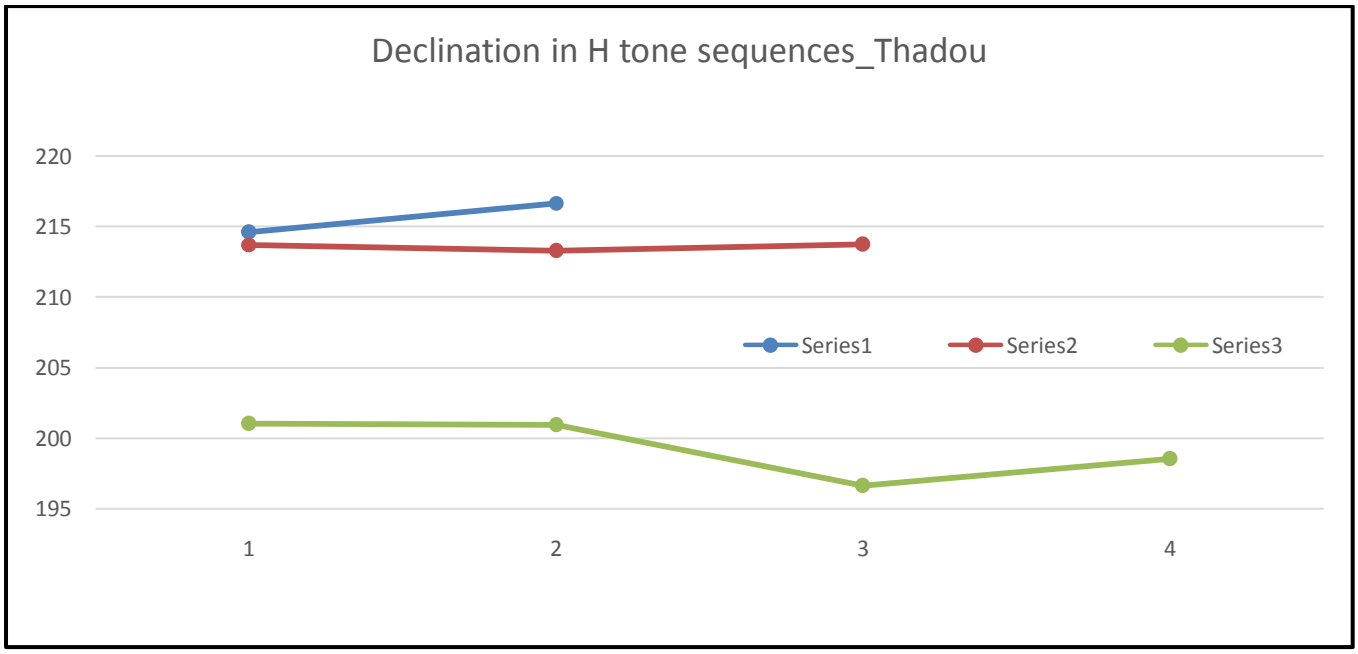

Figure 3: F0 trajectories showing the F0 pattern in sequences of all H tone (2, 3 and 4 syllables).

Series 1: zóŋgóŋ ‘thin monkey’

Series 2: zóŋdóŋgóŋ ‘young thin monkey’

Series 3: zóŋdóŋgóŋlíi ‘four young thin monkeys’

The utterances represented in figure 3 does not seem to be declining much. Table 4 presents an analysis of the slope values in all the H tone utterances, discussed above.

Table 4: Slope value in utterances with all H tones

Utterance	No.of Syllables	Slope value
zóŋgóŋ 'thin monkey'	2	2.07
zóŋdóŋgóŋ 'young thin monkey'	3	0.003
zóŋdóŋgóŋlíi 'four young thin monkeys'	4	-1.18

Here again we can see that slope value decreases as the number of syllables in an utterance increases. The slope value for utterance with two syllables is 2.07 showing an upward rise but as the number of syllables increases the slope value also decreases giving a very insignificant 0.003 rise for three syllables and a downward slope for an utterance with four syllables having a slope value of -1.18. Hence we can hypothesize that there could be declination in all H tone utterances in longer sequences. Declination seems to be variable in Thadou, occurring consistently with L tones but not so consistent and significantly much less with H tones.

Other literatures on declination prove similar tendency for H tones, particularly among African languages. Cases where L tones decline and H tones do not, have been reported in languages such as Mambila (Connell 1999), Igbo (Liberman et.al 1993) and Baule (Leben&Ahoua 1997).

Declination in Mizo

Let us now check for declination in Mizo. All like tone sequences, such as utterances with all L tone syllables and all H tone syllables were prepared to check for declination in Mizo as well. Mostly, phrases with two to five syllables are examined.

Declination in utterances with all L tone

The following sentences are analyzed to check for declination in Mizo. Figure 4 represents the pitch pattern of each of these utterances.

Series 1: pà hnìh 'two'

Series 2: kè pà hnìh 'two legs'

Series 3: sò:mhnìh pà rùk 'twenty - six'

Series 4: kè sò:mhnìh pà rùk 'twenty -six legs'

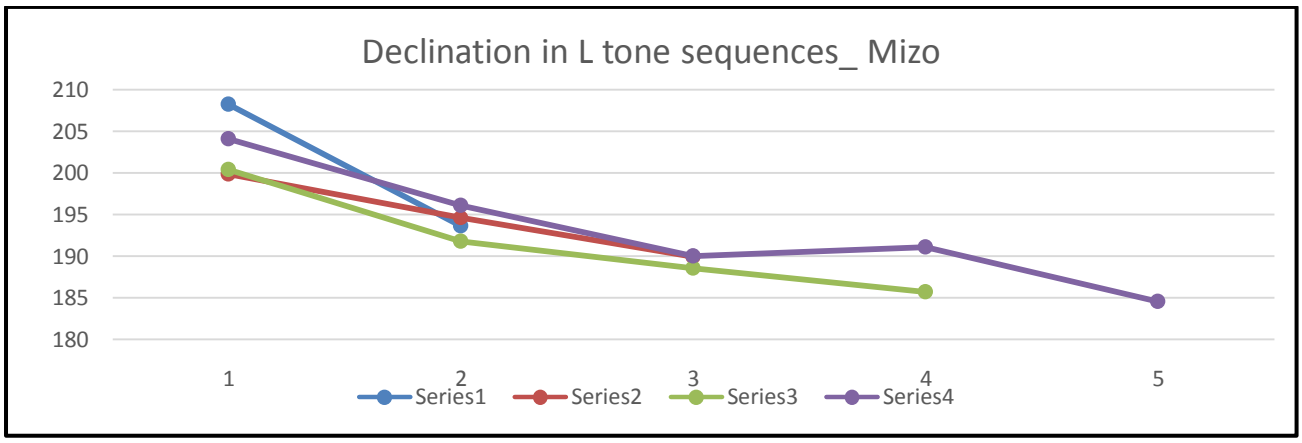

Figure 4: F0 trajectories showing the F0 pattern in sequences of all L tone (2, 3, 4 and 5 syllables).

Figure 4 show declination among L tone sequences. Here again a small calculation can be done to check for the rate of fall. Table 5 shows an analysis of the slope values of the frequency fall among Mizo utterances. The negative value of the slope prove that pitch falls across utterances. From the table it is clear that the slope value decreases as the number of syllables in an utterance increases. Just as in Thadou the utterance length and rate of declination are inversely proportional to each other.

Table 5: Slope values of L tone sequences in Mizo

Utterance	No. of Syllables	Slope value
pà hnìh 'two'	2	-14.65
kè pà hnìh 'two legs'	3	-7.45
sò:m hnìh pà rùk 'twenty - six'	4	-5.65
kè sò :m hnìh pà rùk 'twenty - six legs'	5	-4.41

Having analyzed declination among L tone sequences, the declination facts of H tone sequences can be seen in the next section. Recall that declination among H tones were confined in Thadou. Let us now examine the nature of H tones declination in Mizo.

Declination in utterances with all H tone

Figure 5 illustrates the declination facts for H tone sequences in Mizo. The following utterances are analyzed:

Series 1: béltúŋ ‘tall pot’

Series 2: lálí bélhlúi ‘Lali’s old pot’

Series 3: lálí nú bélhl úi‘ Lali’s mother’s old pot’

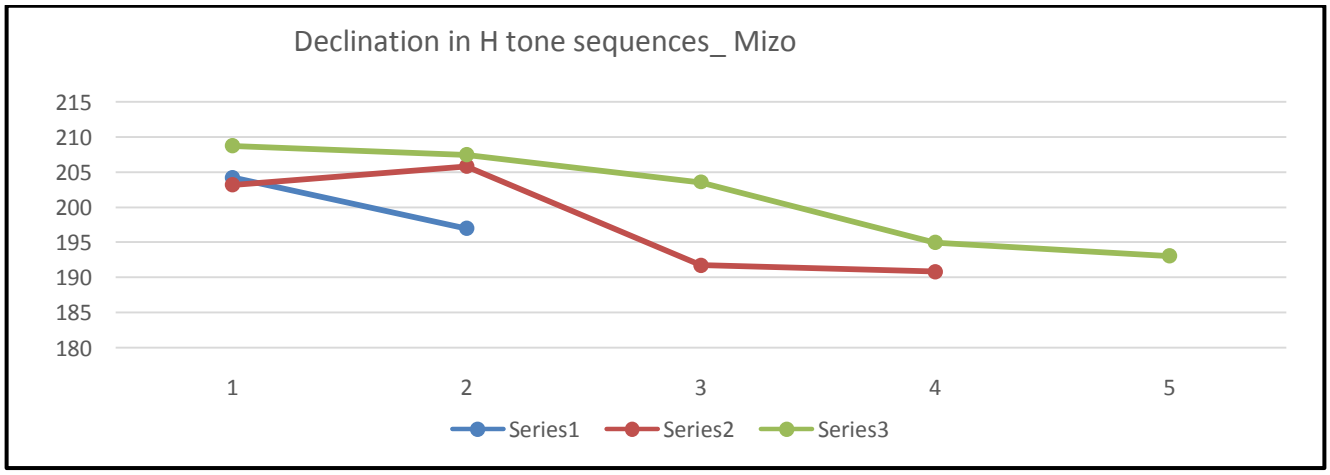

Figure 5: F0 trajectories showing the F0 pattern in sequences of all H tone (2, 4 and 5 syllables).

Figure 5 shows that Mizo has declination among High tones as well. Table 6 gives the slope values of utterances with all H tones.

Table 6. Slope value of pitch tracts in H tone sequences

Utterance	No.of Syllables	Slope value
béltúŋ ‘tall pot’	2	-7.27
lálí bélhlúi ‘Lali’s old pot’	4	-5.12
lálí nú bélhlúi ‘ Lali’s mother’s old pot’	5	-4.38

The slopes have negative values confirming declination in phrases. H tone syllables behave the same way as L tone syllables in Mizo. Just as in the case of L tones, the length of utterance and declination rate are inversely proportionate i.e. longer the utterance lesser the declination rate. Unlike Thadou, declination among L tone and H tone sequences are almost similar and natural processes in Mizo. It is hypothesized that declination of H tones in Thadou is restricted due to the phonological downtrending properties of downdrift and downstep which mostly affects the H tones.

Now that the declination facts are clear, let us examine how the phonological

phenomena like downdrift and downstep affect these languages.

Downdrift

Downdrift, also known as automatic downstep, is a property in which in a sequence of alternating High and Low tones, the subsequent High tones are lowered in frequency than the preceding High tone due to the intervention of Low tone; also the subsequent Low tones are lowered in frequency than the preceding Low tones due to the lowering effect of the H tone.

Downdrift in Thadou

Two utterances (a) and (b) with an alternating sequence of L and H tones are analyzed here to check for declination in Thadou.

(a) ká hùonsáonìi

my garden long two

my two long gardens

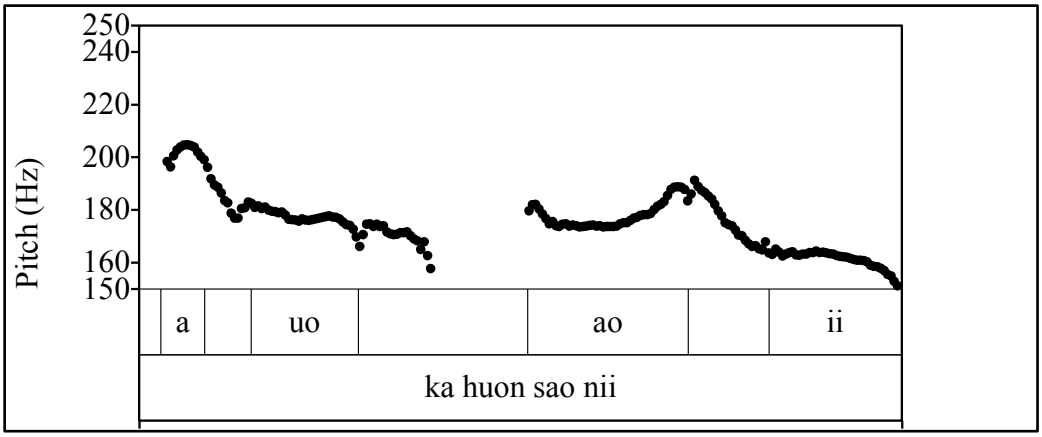

Figure 6: ká hùonsáonìi ‘my two long gardens’

Figure 6 show instance of downdrift in an H-L-H-L sequence. In the utterance the third syllable which has an H tone is realized at a lower pitch than the initial syllable even when they have the same phonological tone. This could be because of the intervening L tone syllable.

(b) kà móotlìenkûo

my banana big nine

my nine big bananas

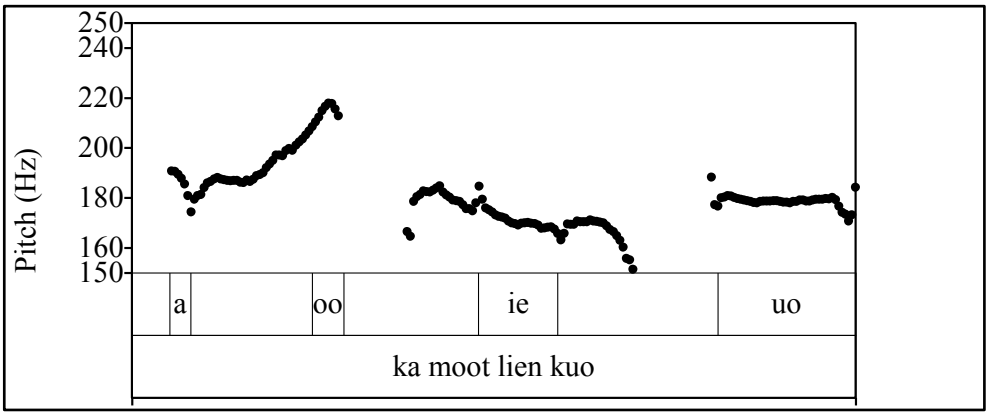

Figure 7: kà móotlìenkûo 'my nine big bananas'

In figure 7 downdrift occurs in an L-H-L-HL sequence. Here again it can be observedthat the H tone on the fourth syllable is realized in a pitch lower to that of the second syllable.

A small calculation was done in order to test the rate of downdrift in utterances , which is represented in table 7 given below . The utterances chosen are ká hùonsáonìi 'my two long gardens' with the H -L-H-L sequence and kà móotlìenkúo 'my nine big bananas' with the L-H-L-H sequence. Table 7 shows difference in pitch drop among H tones in alternate positions. The results show a difference of about 20 Hz between the High tones, which prove the presence of downdrift among H tones in Thadou.

Table 7: F0 values in Hz and the difference among H tones

Sequence	F0 (H_1)	F0 (H_2)	F0 (H_1) -F0 (H_2)
H_L_H_L	192.68	172.04	20.64
L_H_L_H	197.45	172.81	24.64

From the analysis made in the above table, it can thus be stated that H tones do lower in pitch when it is preceded by an overt L tone. Let us now move on to investigate the presence of downdrift in Mizo.

Downdrift in Mizo

Here again two utterances, (a) and (b), with an alternating sequence of H and L tones are analyzed in order to check for downdrift within the language.

(a) zó:ŋ pà thúm

monkey three

'three monkeys'

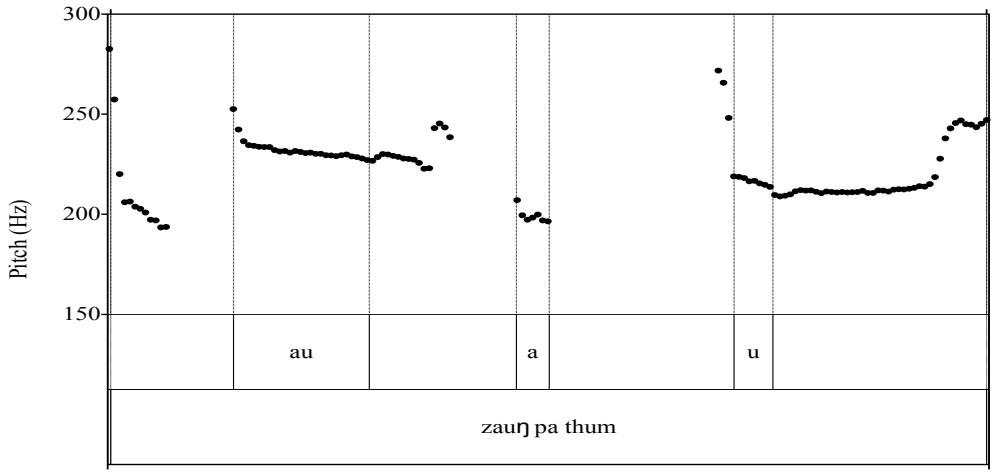

Figure 8. zó:ŋ pà thúm 'three monkeys'

Figure 8 illustrates the pitch tract of the utterance zó :ŋ pà thúm 'three monkeys' with an H-L-H sequence. As can be seen, the third syllable having an H tone has almost the same frequency as the initial syllable, which also has an H tone. This shows that there is no downdrift in the utterance among the H tones even if there is an intervening L tone in it.

(b) lálá hùanzáutàk

lala garden vast EXG

'Lala's vast garden'

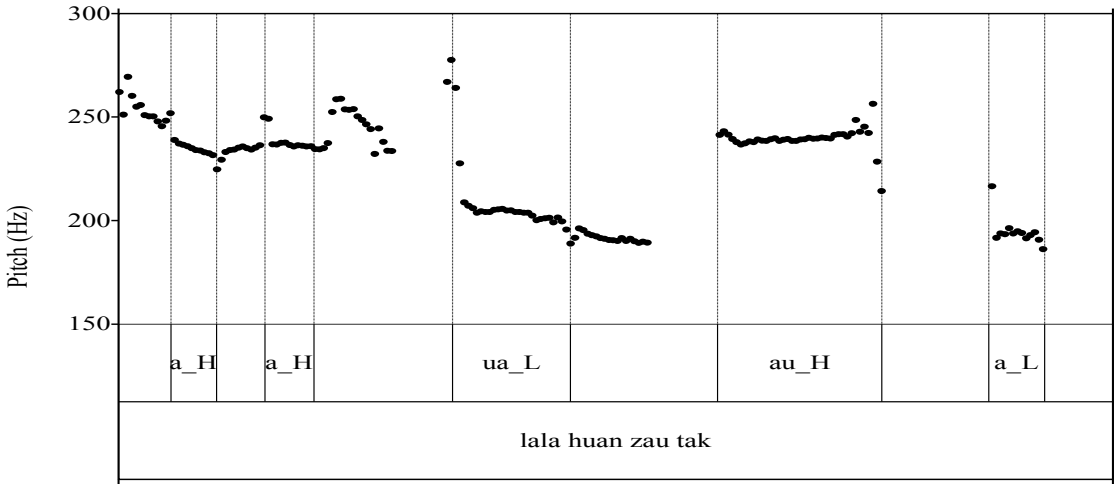

Figure 9. lálá hùanzáutàk 'Lala's vast garden'

Pitch tract of the utterance lálá hùanzáutàk 'Lala's vast garden' is given in figure 9. As seen, in the sequence H-H-L-H-L, the fourth syllable which is an H tone does not downdrift even when there is an L tone preceding it. This figure also shows that there is zero downdrift in the language.

A similar calculation to that in table 7 can be done in order to test the rate of downdrift in utterances in Mizo as well. Table 8 shows that there is no much difference in pitch among H tones in alternate positions. The results show that there is no downdrift among H tones in Mizo.

Table 8: F0 values in Hz and the difference among H tones

Sequence	F0 (H_1)	F0 (H_2)	F0 (H_1) -F0 (H_2)
H_1_L_ H_2	231.56	230.26	1.3
H_H_1_L_H_2_L	236.73	243.97	-7.24

From the analysis made in the above table, it can thus be seen that there is no significant difference between the alternating H tones. Moreover, utterance (b) shows an instance where, irrespective of the intervening L tone H tone seems to rise further in pitch (The negative value of the difference proves this). Hence we can conclude that downdrift is not a feature of Mizo.

Downstep

The dataset to test downstep has been so formed so that a word with an individual HL tone is followed by an H tone. In the output the L tone does not surface but leaves its presence acting upon the following H tone by pulling it down a level lower than the preceding High tone, which ultimately results in what linguists call as - a 'terracing effect' or a 'lowering of the ceiling'. While downdrift is known as automatic downstep, downstep is the non-automatic downstep because of the absence of an overt Low tone preceding the lowered High tone. The phenomenon of downstep is not universal. It is language specific and hence considered phonological. Downstep is widely recognized to occur in tone languages of sub-Saharan Africa, in which it was first identified. It is also attested in several languages of the Americas. Apart from Thadou, the phenomenon has

been reported very rarely among Asian languages.

Downstep in Thadou

Downstep in Thadou can be illustrated with the help of the following utterance (1) having three downsteps. The exclamation mark (!) preceding a word indicates that the H tone on that word is downstepped.

(1) kên + ûy + ʧà + ʧôm + gîet + kà + ʧô + êe → kén !úyʧà ʧóm !gíetkà ʧó !êe
1SG dog DIM short eight 1PRO buy1 DECL 'I buy eight short dogs'

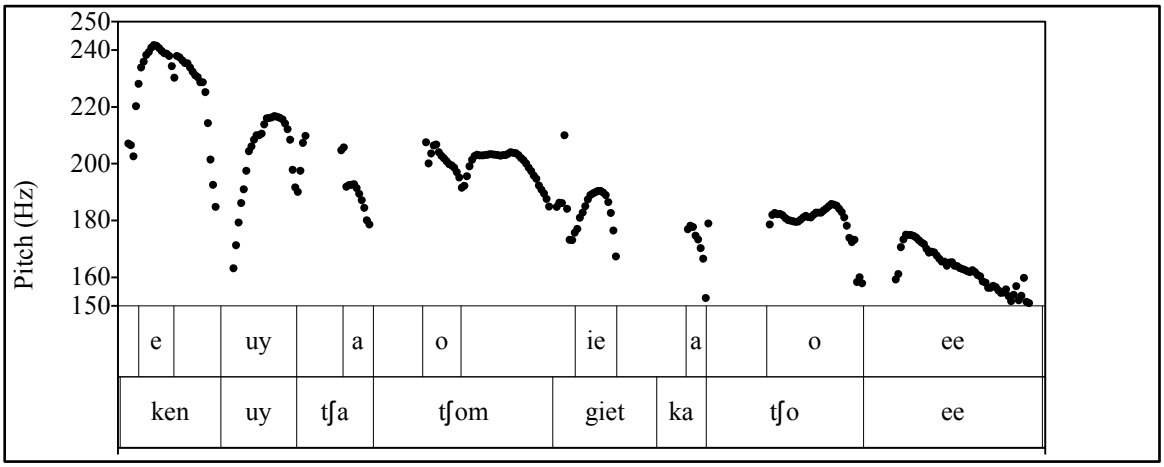

Figure 10: kén !úyʧà ʧóm !gíetkà ʧó !êe 'I buy eight short dogs'.

Figure 10 illustrates the utterance (1) with three downsteps and two downdrifts . As we can see, the second syllable /ûy/ with HL tone is lowered in pitch even when the first syllable shows no traces of L tone on it . /ûy/ is downstepped here . Also the fourth syllable /ʧôm/ is lower in pitch than the preceding H tone . This could be due to downdrift as there is a visible L tone syllable intervening . Similarly, the fifth syllable /gîet/ is downstepped and the seventh syllable /ʧô/ is downdrifted.

In downstep, without an overt intervening low tone, the subsequent high tone is lowered in frequency creating a new high for the following syllables, which ultimately results in creating, what is commonly called in intonational phonology as the 'terracing effect'. As seen from the above discussions, the domain of downstep in Thadou is all phrasal categories including the intonational phrase (IP). In effect, this attests to Connell's (2001) findings that even though downstep results from the local interaction of adjacent tones, it is typically global in its domain as all subsequent tones are affected.

Downstep in Mizo

Mizo do not exhibit properties of downstep. In a combination of HL+ HL tones, there is no downstep but only de-linking. An analysis of the following utterances (1) and (2) proves the same.

(1) ka + pâ: + mî:t → ká pá: mî:t
1PRO father gallbladder 'my father's gallbladder'

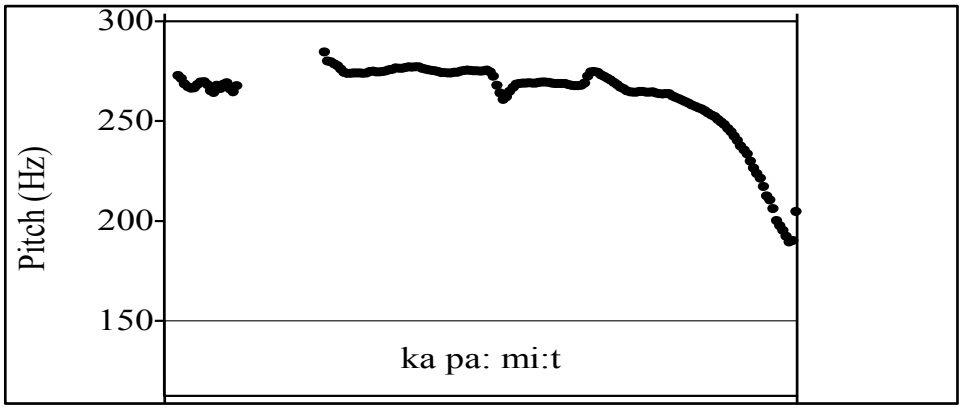

Figure 11. ká pá: mî:t 'my father's gallbladder'

Figure 11 illustrates the pitch tract of the utterance ká pá : mî:t 'my father's gallbladder' . /pâ:/ meaning 'father' has an HL tone in isolation, but only H tone surfaces in the utterance. Moreover, the L tone does not seem to affect the HL tone on the following word /mî:t/ and is not downstepped.

(2) ka + pâ: + bé:l → ká pá: bé:l
1PRO father pot 'my father's pot'

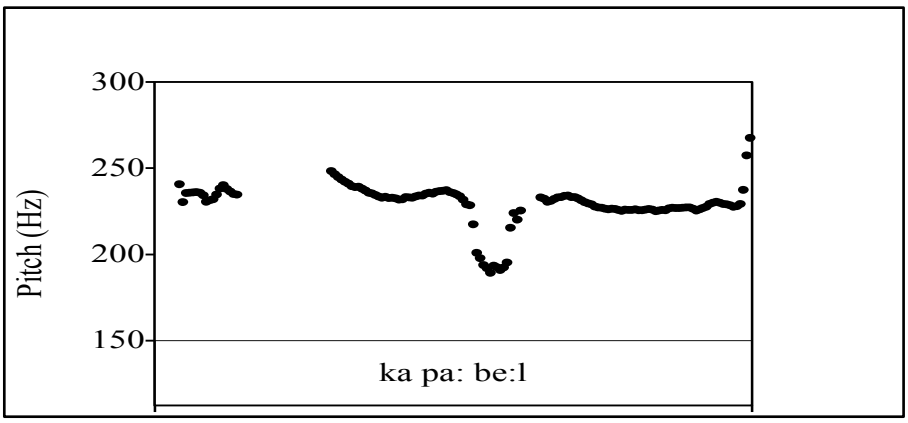

Figure 12. ká pá: bé:l 'my father's pot'

Figure 12 shows yet another instance confirming the absence of downstep in Mizo . This figure shows the pitch tract of the utterance ká pá : bé:l 'my father's pot' having a combination of H+ HL+ H tones. The L tone on the second syllable is not realized nor is its presence felt on the following tone. The H tone following the HL tone does not downstep. Hence we can conclude that downstep is not one of the post-lexical properties of Mizo.

Thus it can be concluded that Mizo has declination among both L and H tones, although it does not show instances of the phonological properties of downdrift or downstep. As Mizo is devoid of phonological downtrending phenomena, declination has full potential to equally affect both L as well as H tones.

Conclusion

Analysis of Thadou has led us to the fact that the phonological properties of downstep and downdrift are present in the post-lexical phonology of Thadou. However, the phonetic property of declination which is a universal phenomenon is restricted to L tones alone and is very rare among the H tones. This phenomenon is attributed to the fact that H tones undergo a lot of phonological reformatting in a complex way through the processes of downdrift and downstep and it is this phonology that constrain the implementation of declination to occur in H tones.

However, it is found that both L tones and H tones decline equally in Mizo. It is also observed that the phonological phenomena of downdrift and downstep are absent in Mizo. This creates ample space for H tones to decline in the language as they are not involved in any complex phonology in the language. In short, it can be concluded that, as Mizo is deprived of post-lexical phonological properties, declination has full potential to affect both L and H tones equally.

The post-lexical tonology of Kuki-Chin languages are scarcely investigated. It would be interesting to find out more languages that behave differently because of their difference in phonetics and phonology of post-lexical tones as we saw in Thadou and Mizo. Languages with complex phonology seem to severely constrain the phonetics of

implementation and vice-versa. It would be worth exploring more tonal languages and typologize them based on the complexities in their phonetics and phonology.

Another issue worth investigating would be the interaction of all the downtrending phenomena. It would be illuminating to develop a model which could account for the interaction of the phonological properties of downstep and downdrift and the phonetic property of declination and predict the pitch trend based on their interactions.

Abbreviations

DECL	Declarative Marker
DIM	Diminutive Marker
EXG	Exaggerative Marker
F0	Fundamental Frequency
H	High Tone
L	Low Tone
PRO	Pronominal Proclitic Marker
SG	Singular Marke

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