CHAPTER 4

DECLINATION IN THADOU

We have looked at length into the phonological aspects of the post-lexical component of Thadou by examining phenomena of downdrift and downstep in it. However, the phonetic aspect of the Thadou post-lexicon also needs a thorough engagement. This is the aim of this chapter which investigates the process of declination in Thadou. This analysis is done through various stages in this chapter. First is an introduction to the process of declination by giving its various definitions, followed by an examination of the process in Thadou, by taking into account, utterances with similar tone sequences.

4.1 Introduction

Declination is the tendency of pitch to drift down across an utterance. Declination studies were initiated well over half a century ago and is still a major topic of discussion among the linguists. The term ‘declination’ was coined by Cohen and ’t Hart (1967) during their work on Dutch intonation to describe the downward trend of F0 observable in many utterances. It is a universal tendency occurring in both tonal and non-tonal languages. Declination has been observed in many languages like Dutch (Collier & ’t Hart 1972; ’t Hart & Cohen, 1973), English (Maeda, 1976; Pierrehumbert, 1980), French (Vaissiere, 1971), Finnish (Hirvonon, 1970), Japanese (Pierrehumbert & Beckman, 1988; Poser, 1984), Mandarin Chinese (Shih, 1997) and in a large number of African languages (Welmers, 1973; Connell, 1999).
4.1.1 Definitions of Declination

As has already been stated, declination is a universal phenomenon found across languages. Hence, many linguists have attempted defining it. A few of the major definitions are listed below.

Recall Bruce Connell’s (1999) definition of it as the gradual modification of the phonetic backdrop of F0 over the course of a phrase or utterance. A simpler approach is given by S. Zerbian and E. Barnard in their article ‘Phonetics of intonation in South African Bantu languages’ (2008) where they define it as the continuous lowering of fundamental frequency (F0) over the course of an utterance. While Caron and Izre’el, in their article ‘Tone and Intonation’ (2011), present declination as a universal tendency by linking it to physiological constraints, taking into account the energy used to expel pulmonic air through vocal organs, occurring in both tone and non-tone languages. Declination is thus considered to be a phonetic effect which is a universal phenomenon at least in the case of declarative sentences. In tonal languages declination can occur regardless of tonal combinations. Carlos Gussenhoven (2004) gives the following explanation for declination.

The explanation has been sought in falling subglottal pressure. After expanding his lungs to take in breath, the speaker will slowly ease up on the tension of the muscles he used for the breath intake (probably the diaphragm, with or without the aid of his chest muscles), so as to slow down the elastic recoil of the lungs and thereby prolong the period of positive pressure below the larynx which is needed for the production of a fluent portion of speech. Unless the speaker uses his muscles to force out the remaining air from his lungs during this slowed down
exhalation phase, the pressure below the larynx will drop. Since lower subglottal pressure will lead to slower vocal fold vibration rates, F0 declination will result.

Taking cues from these definitions, this chapter deals with declination in Thadou and addresses the following questions:

1) Is the phenomenon of declination present in Thadou?
2) Are their effect similar with respect to different tones?
3) Is the rate of declination different among female and male speakers?
4) Is there any correlation between the rate of decline and the utterance length?

In the following sections, we go on address these questions with regard to declination in Thadou.

4.2 Declination in Thadou

Declination is clearly observable in sentence with sequences of identical tone. Hence the database here set to test declination consist of all like tone sequences such as utterances with all H tone syllables and all L tone syllables. Mostly noun phrases with similar tones within an utterance are chosen. However, note that, for the ease of representation the frequency falls in utterances have been illustrated by means of graphs. The fundamental frequency (F0) is represented on the y axis and the number of syllables on the x-axis. The graphs show the actual pitch tract (solid line) and the predicted trendline (dotted line). Trendlines are used here as lines that indicate the average of mean F0s over the number of syllables in an utterance. The trendline equation is also shown in the graph which is represented as:
\[ y = mx + b \]

where \( m \) is the **slope** of the line (how steep or flat the line is) and \( b \) is the **y-intercept** (the value of \( y \) when the line crosses the \( y \) axis). We shall be concentrating more on the slope value, \( m \). Also note that all figures illustrated are instances of averaged F0 values of female speakers. At the outset, analysis of L tone sequences is given below.

### 4.2.1 Declination among L tone sequences

1. sòom gùup
   - ten six
   - ‘sixty’

![Graph](image)

**Figure 26. sòom gùup ‘sixty’**

Figure 26 illustrates the pitch tract in the utterance *sòom gùup ‘sixty’*. Both the pitch tract (solid line) and the trendline (dotted line) are merged together in this graph as there are only two pivot points. Both the syllables have the same phonological tone, but still the second syllable is considerably lowered in frequency than the initial syllable. The pitch tract has a slope value of -10.17. The negative value indicate that the slope is ‘downward’.
Figure 27. kèelʧà lien ‘big goat’

Figure 27 shows the pitch tract and trendline of the utterance kèelʧà lien ‘big goat’. As can be seen, there is a rise in pitch towards the second syllable. Such phenomenon within like toned sequences has been reported in African tonal languages. Bruce Connell (1999) reports of this phenomenon in his investigations on Mambila language. According to him, this occurs early in the sentences: towards second syllable for shorter sentences and the third syllables for longer sentences. As we go on through further examples, we can see that this holds true for Thadou as well. However, the pitch of the utterance kèelʧà lien ‘big goat’ falls towards the final syllable and has an overall slope value of -6.33. Hence, it can be concluded that, even if the pitch goes up within the utterance the utterance declines towards the end.
Figure 28. keelʧà lien guup ‘six big goats’

Figure 28 gives the pitch tract and trendline of an utterance with four syllables. Here again the second syllable slightly rises in pitch than the initial syllable and then falls towards the end. The utterance has a declination slope value of -3.99.

4. zàa lè? sòom guup lè? nìi ‘one hundred and sixty two’

Figure 29. zàa lè? sòom guup lè? nìi ‘one hundred and sixty two’

Pitch tract of an utterance with six syllables is illustrated in figure 29. As seen, there is a steady case of declination throughout except for the second last syllable. Nevertheless, the trendline shows a downward slope of -2.99.
5. kèel ʧə zàa lè? sòom gùup lè? nìi
goat DIM hundred and ten six and two
‘one hundred and sixty two goats’

Figure 30. kèel ʧə zàa lè? sòom gùup lè? nìi ‘one hundred and sixty two goats’

Figure 30 is of an utterance with eight syllables having all L tones. Here again we can see
that the F0 rises towards the second syllable and from there on starts falling towards the
end. The figure shows a declining trendline with a slope of -2.84.

6. kèel ʧə lien zàa lè? sòom gùup lè? nìi
goat DIM big hundred and ten six and two
‘one hundred and sixty two big goats’

Figure 31. kèel ʧə lien zàa lè? sòom gùup lè? nìi ‘one hundred and sixty two big
goats’
As we can see the pitch tract in figure 3 is not a straight line. The utterance has nine syllables. The pitch of the utterance goes up towards the second and third syllables and then falls towards the fourth only to rise again towards the seventh syllable and then fall again. This phenomena of rising in pitch among like tone sequences could be due to ‘declination reset’, which refers to the process where longer utterances are interrupted by a reset in the course of its production, giving a new high start to the pitch of the next chunk of speech. As a person cannot lower his/her pitch beyond a certain point declination reset creates space for further fall by creating a new high start. The trendline in the figure has a slope of -2.77.

7. kèel ʧà lièn zàa lè? sòom guup lè? nii lè? nùmèi zàa lè? sòom nii lè? nii goat DIM big hundred and ten six and two and woman hundred and ten two and two ‘one hundred and sixty two big goats and one hundred and twenty two women’

Figure 32. kèel ʧà lièn zàa lè? sòom guup lè? nii lè? numei zàa lè sòom nii lè nii ‘one hundred and sixty two big goats and one hundred and twenty two women’

Figure 32 illustrates the pitch tract and trendline of a longer sequence. The utterance in the figure is eighteen syllables long. Though all the syllables have L tone, the utterance
can be seen to decline in frequency towards the end. The slope value of the pitch tract is -1.43. There are declination resets as well within the utterance.

All the figures discussed above show steady case of declination. Table 7 presents an analysis of the slope values in utterances with L tone sequences that are discussed above. Slope values of both female and male speech are analyzed.

Table 7

*Slope Value in Utterances with All L tones for Female and Male Speakers*

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Utterance</th>
<th>No. of Syllables</th>
<th>Slope value (Female)</th>
<th>Slope value (Male)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>sōom giup ‘sixty’</td>
<td>2</td>
<td>-10.17</td>
<td>-4.30</td>
</tr>
<tr>
<td>2</td>
<td>kēelfu lien ‘big goat’</td>
<td>3</td>
<td>-6.33</td>
<td>-3.06</td>
</tr>
<tr>
<td>3</td>
<td>kēelfu lien giup ‘six big goats’</td>
<td>4</td>
<td>-3.99</td>
<td>-2.69</td>
</tr>
<tr>
<td>4</td>
<td>zāa lê? sōom giup lê? nii ‘one hundred and sixty two’</td>
<td>6</td>
<td>-2.99</td>
<td>-1.48</td>
</tr>
<tr>
<td>5</td>
<td>kēel fâ zāa lê? sōom giup lê? nii ‘one hundred and sixty two goats’</td>
<td>8</td>
<td>-2.84</td>
<td>-1.44</td>
</tr>
<tr>
<td>6</td>
<td>kēel fâ lien zāa lê? sōom giup lê? nii ‘one hundred and sixty two big goats’</td>
<td>9</td>
<td>-2.77</td>
<td>-1.39</td>
</tr>
<tr>
<td>7</td>
<td>kēel fâ lien zāa lê? sōom giup lê? nii lê? númèi zāa lê sōom nii lê nii ‘one hundred and sixty two big goats and one hundred and twenty two women’</td>
<td>18</td>
<td>-1.43</td>
<td>-1.35</td>
</tr>
</tbody>
</table>

*Note:* There could be declination resets in longer utterances but they are not taken into consideration. Only the slope values are calculated.

Table 7 clearly indicates the correlation between utterance length and the declination rate. The result shows that with increase in the number of syllables the slope value decreases. 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.
Figure 33 compares the pitch tract of all the utterances from 1 to 7, to assess the correlation between the length of the utterance and the rate of declination. It can be seen that the utterance length and the declination rate are inversely proportional to each other as one increases the other decreases. Also, it must be noted that as the number of syllable increases, the height of the initial syllable also increases. From the figure it can be observed that the pitch of the initial syllable is higher in longer utterances than in shorter ones. This fact attests to the findings of Maeda (1976) and Cooper & Sorensen (1981) that longer utterances start higher than shorter utterances. Data from a number of investigations have shown that the slope of declination is less in a longer intonation group than in a shorter one.

Figure 33: Pitch tracts showing the F0 pattern in sequences of all L tone (2, 3, 4, 6, 8, 9 and 18 syllables). (An average of data by four female speakers, three repetitions each).
Table 7 illustrates the slope values for both female and male speakers. By comparing the slope values of female and male speakers we can see that female speakers shows more declination than male speakers. This is obvious as female speakers have a wider pitch range than the male speakers and hence the scope for more declination is possible within female speech. The slope values in female and male speech given in table 7 is shown in a histogram format for better representation and comparison in figure 34.

![Histogram showing the slope values of utterances with 2, 3, 4, 6, 8, 9 and 18 syllables in Male and Female speakers.](image)

**Figure 34.** Histogram showing the slope values of utterances with 2, 3, 4, 6, 8, 9 and 18 syllables in Male and Female speakers.

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.

### 4.2.2 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 study is initiated by analyzing them and through it try to understand the nature of declination among H tones in Thadou.

8. **zóŋ góŋ**  
   monkey thin  
   ‘thin monkey’

![Figure 35. zóŋ góŋ ‘thin monkey’](image)

Figure 35 shows the pitch tract of the utterance **zóŋ góŋ** ‘thin monkey’, with two H tone syllables. It has a slope value of 2.07. The value is positive indicating that the slope is upward. This phrase shows no instance of declination.

9. **zóŋ dóŋ góŋ**  
   monkey young thin  
   ‘young thin monkey’

![Figure 36. zóŋ dóŋ góŋ ‘young thin monkey’](image)
Figure 36 is of an utterance with three H tone syllables. The pitch tract is almost a straight line with hardly any slope. Even though minimal, the trendline shows a slope value of 0.003 which is a positive value indicating a slight upward rise. Here again there is no instance of declination.

10. *zóŋ dóŋ góŋ líi*
   monkey young thin four
   ‘four young thin monkeys’

*Figure 37. zóŋ dóŋ góŋ líi ‘four young thin monkeys’*

The pitch tract in figure 37 shows slight declination. The utterance has four syllables. The trendline is drifting downwards and has a slope value of -1.18.

Figures 35 and 36 show zero declination, while figure 37 shows a slight declination. Table 8 presents an analysis of the slope values in all the H tone utterances, discussed above, in both female and male speech.

Table 8

*Slope value in utterances with all H tones for female and male speakers*
Here again we can see that slope value decreases as the number of syllables in an utterance increases. However, the slope values for male speakers for all the utterances shown here are all positive showing a rise in the pitch, even though the rise is only of a few Hertz. For female speakers, 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).

Having discussed the process of declination in Thadou, a small comparison can be done among disyllabic sequences with similar tones, which is pertinent to the understanding of the differences among the downtrending phenomena discussed so far.
4.3 Comparison of Pitch among disyllables with similar tones

Pitch realization among the following disyllabic sequences with similar tones are compared in Figure 38.

- HL + HL  lam ṭchôm  ‘short road’
- H + H  náosën  ‘infant/baby’
- L + L  mòl sòom  ‘ten sticks’

Figure 38. Comparing F0 lowering in HL + HL (lam ṭchôm ‘short road’), H + H (náosën ‘infant/baby’) and L + L (mòl sòom ‘ten sticks’) two syllable sequences.

When a syllable with an HL tone is followed by another syllable with the same tone the second syllable is downstepped because of the intervening L tone between the Hs. However, the L tone is not realized in the output and remains as a ‘floating’ L between the H tones. When a syllable with an H tone is followed by another syllable with H tone there is no lowering of the frequency but rather a rising can be seen which proves that Thadou does not exhibit declination among H tones. In case of a syllable with an L tone
followed by another syllable also with an L tone, the pitch falls towards the second
syllable showing a clear case of declination. The fact that declination in H tones is
constrained in Thadou raises the question- why and prompts us to look at a neighboring
language, Mizo, to check if declination affects the tones in the same way as in Thadou.
Discussions on declination in Mizo can be seen in chapter 5.

However, before moving on to the discussions of declination in Mizo, a
comparative study of all the downtrending phenomena existing in Thadou has been taken
up as it would facilitate a clear understanding of these phenomena and their differences.

4.4 Comparing declination, downdrift and downstep in Thadou

Having discussed the processes of declination, downdrift and downstep in the
previous sections, we shall now do a comparison to see how they differ with respect to
one another. The following examples are showing instances of downstep, downdrift and
decimation are analyzed in figure 39.

- LH!H!H (Downstep)
  kà + lòu + sâo + gîet → kà lòu !sâo !gîet ‘my eight long fields’
  my field long eight
- LHLH (Downdrift)
  kà + móot + liem +kúo → kà móot liem kúo ‘my nine big bananas’
  my banana big nine
- LLLL (Declination)
  kèel + ŋà +lien +gùup → kèel ŋà lien gùup ‘six big goats’
  goat DIM big six
Figure 39. Pitch tracts of three different utterances with downstep, downdrift and declination.

Figure 39 gives a comprehensive and comparative idea about how pitch is realized in different tones or tonal combinations. In the LH!H!H sequence, the downstepped H (!*H) may seem as low as the initial L tone in the same utterance, but this comparative figure lets us know that an L tone in the third syllable will be realized much lower than the !H in that position. Thus, it is clear that downstep, downdrift and declination are three different phenomena. While downstep and downdrift are not common among languages declination is supposed to be universal- present in both tonal and non-tonal languages. Downstep and downdrift are phonological while declination is phonetic and has phonetic implications.

Talking about the phonetic properties in the post-lexical domain of languages, there is another phenomenon that we have not looked at so far- the final lowering. Final lowering, as the name suggests, is a pitch lowering phenomenon towards the ends of utterances. The next section checks for final lowering in Thadou.
4.5  Final Lowering

According to Bruce Connell (1999), final lowering is an abrupt lowering restricted to the ends of utterances. It is usually restricted to (or extends over) the last 250 ms or so of an utterance (Pierrehumbert, J. & Beckman, M., 1988). Final lowering was first reported by Mark Liberman and Janet Pierrehumbert (1984). They defined it as the ‘lower than expected’ scaling of the final peak in a series of downstepping H tones. According to their berry–list experiment, the final lowering was estimated from the final stressed syllable of an utterance. Final Lowering has the strongest effect on the last syllable of an utterance. This reasonable assumption has been backed by physiological causes (Maeda, 1976; Strik & Boves, 1992). Final Lowering is mostly a characteristic of discrete level languages in Africa (Welmers, 1973). According to Peter Ladefoged (1982) in nearly all languages the completion of a grammatical unit such as a normal sentence is signalled by a falling pitch. The tendency to “go down at the end” is the most widely diffused intonational phenomenon in Dwight Bolinger’s view (1978). Final lowering is documented in Japanese by Poser (1984) and by Pierrehumbert & Beckman (1988); in English by Liberman & Pierrehumbert (1984); in Dutch by Gussenhoven & Rietveld (1988); in Danish by Thorsen (1985); in Yoruba by Connell & Ladd (1990) and by Laniran (1992); and in Kikuyu by Clements & Ford (1981). Final lowering has been documented in many other tonal languages as well.

Interestingly, final lowering seems to be absent in Thadou as is illustrated by the figures given below. Figure 40 illustrates the pitch tracts of the following two utterances with four syllables each:
• sòom gùup lè? nii
ten six and two
‘sixty two’

• kèel ḋà lien gùup
goat DIM big six
‘six big goats’

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**Figure 40.** Sequences of all L (series 1) and all H (series 2) with four syllables each (averaged F0s of Female speakers)

Figure 40 does not show any abrupt lowering towards the final syllable for both the utterances. There is no significant difference in the lowering pattern of the final syllable from the rest of the non-final syllables. The results here show a lack of final lowering effect in Thadou under the assumption that final lowering is restricted towards the last syllable, either stressed or non-stressed. The possibility of existence of final lowering in a series of downstepping H tones is further examined through the instances of following utterances:

• núi ḡ in tsóo !núom !êe
mother NOM buy want DECL
‘mother wants to buy it’

• úi tsàa tsóm !gíet !tsôo
dog DIM short eight buy
‘buy eight short dogs’
Figure 41. Pitch tract in three different sentences in the sequence HLH!H!HL

Figure 41 showcases three different sentences all of which are in the sequence HLH!H!HL. All the utterances end in an HL syllable and the L tone is also realized on them. Still the rate of F0 fall in the last syllable is not more than the previous syllable. According to Liberman and Pierrehumbert’s (1984) definition of final lowering, the rate of fall between the final and penultimate syllable should have been more than that of the previous fall. But the above figure show a lack of difference in the rate of fall. There is no significant difference in the downstepping of the last two H tones. The F0 seems to be falling at the same rate.

Both high tones and low tones do not show effects of final lowering under the above experimental conditions. Also the downstepped H tones do not show final lowering. Hence, we can conclude that there is no final lowering in Thadou.
From the analysis so far, it is clear that downstep and downdrift are phonological properties in the post-lexical domain of Thadou. However, from the analysis of declination, which is a post-lexical phonetic property, it is concluded that declination affects more on L tones and is highly curbed among H tones. This opens up the question as to why the process of declination is affecting only one tone and not the other. Is it because the other tone (here the H tone) is involved in a lot of phonological operations in a complex way? In order to investigate this question, the declination facts of another related language have to be analysed. Hence the language Mizo, spoken in the neighbouring state of Mizoram is chosen. Chapter 5 discusses the declination process in Mizo.