THE DOMAIN OF TONES IN BURMESE

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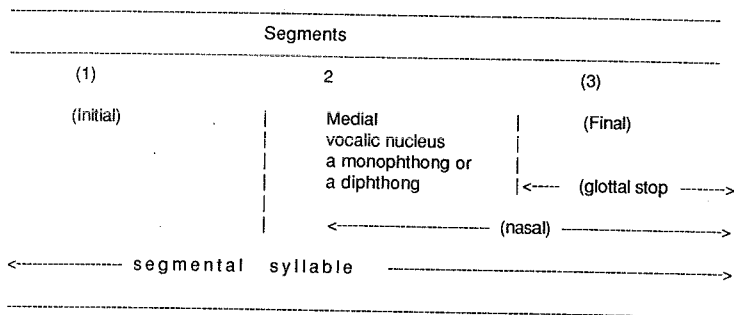Department of Communication Disorders
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ABSTRACT - The fundamental frequency patterns and the duration of the phonological tones in Burmese were analysed firstly with the neutral initial consonant [h] and secondly in four major syllable types. The Fo patterns of the four tones influenced by the preceding initial consonants in the four syllable types were compared with their counterparts preceded by the initial [h] and an attempt was made to determine the tone domain on the basis of the comparison.

INTRODUCTION

The fact that the Fo patterns of phonological tones in most languages of the world, especially in the East and South-East Asian region, are influenced by the type of preceding consonant has been well documented. Several studies of the tonal features of those languages have provided us with two pieces of valuable information. Firstly that a phonological tone is an ensemble of a number of acoustic properties such as Fo, intensity and duration and secondly that all these acoustic properties, especially Fo and intensity, can be greatly influenced by the type of syllable in which the tones occur (e.g. Howie, 1974 and 1976; Rose, 1982; and Vu Tranh Pho'u'ng, 1982). In this regard the most influential portion in a syllable in Mandarin is found to be the type of initial segment which precedes the vocalic nucleus of the tone. Howie (1974) observed that the tone domain in Mandarin lies in the rhyming portion of the voice pitch and hence the initial portion of the voice pitch influenced by the preceding initial segment(s) of the syllable is not per se a part of the tone. The tonal features of the languages in which these studies were conducted basically conform to the contour system where Fo and intensity contours are the dominant features of the tones. It is more than likely that Howie's (1974) finding is applicable to other contour systems in Asia and beyond. The issue here is whether the same rhyme-based tone domain argument is valid for the tones in other languages whose features are more closely related to the register than the contour system. The objective of this study is to investigate the behaviour of tonal Fo pattern and duration in relation to the type of initial segment in different syllable types in Burmese, the major Tibeto-Burmese language with about forty million speakers.

Syllables and tones in Burmese

The tone system in Burmese is more closely related to register than contour (see Bradley (1982) for details). The classification of Burmese phonolgical tones can vary from three to five depending on the way its phonological syllable structure is analysed (see Thein-Tun (1982) for details). Whatever phonological analysis one may follow, if the syllable final glottal stop is regarded as a tonal feature and the non-final neutral vowel [a] is left aside as an atonic vowel, there are four phonological tones in Burmese. All the fifty vocalic nuclei that occur in Burmese are described in Table 1 together with the tones that they can take. The diacritical tonal signs used in this paper are somewhat different from Okell (1969) but the same as Cornyn and Roop (1968). The impressionistic signs of the latter are more in agreement with the actual Fo patterns of the tones except that for tone I, whose Fo pattern is in fact low level falling. The following is the citation syllable structure of Burmese. Optional segments are placed in parentheses.

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-----------------------------------------------------------------------
                              Segments
-----------------------------------------------------------------------
      (1)                        2                        (3)

   (Initial)              |   Medial              |       (Final)
                          |   vocalic nucleus     |
                          |   a monophthong or    |
                          |   a diphthong         | <----- (glottal stop ------->
                          |
                          |   <--------------------- (nasal) --------------------->
 <------------------ segmental  syllable    --------------------------------------->

-----------------------------------------------------------------------
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The nasalised syllables are treated as closed syllables in the same category as the glottalised ones because the nasalisation imposed on vowels conveniently changes to the homorganic nasal of the following consonant. This arrangement is aimed at clarifying the fact that nasalised syllables are mainly spoken as closed syllables as with glottalised syllables in tone IV (if there is a consonant following it) and non-nasalised syllables in tones I to III are open syllables. The following is an example of the four phonological tones in the non-nasal environment:

lá	"to come"	tone I
lâ	"donkey"	tone II
là	"moon"	tone III
la?	"to lack" , "to be fresh", "middle"	tone IV

Basic symbol	non-nasalised				nasalised		
	Tone I	Tone II	Tone III	Tone IV	Tone I	Tone II	Tone III
ɪ	1. ſ	2. ᵎ	3. ᵎ	4. ɪ?	5. ſ	6. ᵎ	7. ᵎ
ə	8. ə́	9. ə̂	10. ə̀	11. əɪ?	12. ə́ɪ	13. ə̂ɪ	14. ə̀ɪ
ɛ	15. ɛ́	16. ɛ̂	17. ɛ̀	18. ɛ?			
aɪ				19. aɪ?	20. áɪ	21. âɪ	22. àɪ
ɐ	23. ɐ́	24. ɐ̂	25. ɐ̀	26. ɐ?	27. ɐ́	28. ɐ̂	29. ɐ̀
ɔ	30. ɔ́	31. ɔ̂	32. ɔ̀	33. ɐu?	34. ɐ́u	35. ɐ̂u	36. ɐ̀u
o	37. ó	38. ô	39. ò	40. ou?	41. óu	42. ôu	43. òu
u	44. ú	45. û	46. ù	47. u?	48. ú	49. û	50. ù
	open syllables			treated as closed syllables			

TABLE 1. FIFTY VOCALIC NUCLEI

FIGURE 1
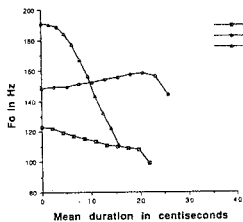The group means of Fo and duration of three tones in open syllables by three male speakers

FIGURE 2
The group means of Fo and duration of four tones in closed syllables by three male speakers
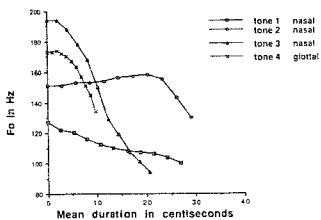
FIGURE 3
The mean Fo at 10% duration points of tone one in the four syllable types by one male speaker
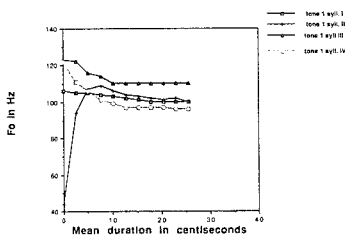
FIGURE 4
The mean Fo at 10% duration points of tone two in the four syllable types by one male speaker
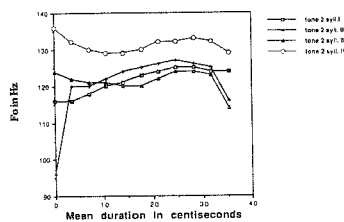
FIGURE 5
The mean Fo at 10% duration points of tone three in the four syllable types by one male speaker
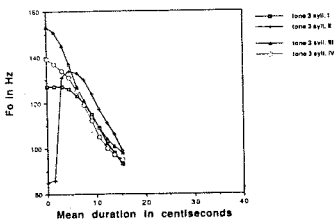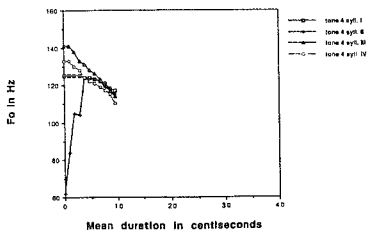
FIGURE 6
The mean Fo at 10% duration points of tone four in the four syllable types by one male speaker

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DATA AND ANALYSIS

The first stage

The data were collected and analysed in two stages. In the first stage all the fifty vocalic nuclei were placed in the first CV slot of the /hVda/ citation frame where V = (v)v either in the [hVdá] or nasalised [hṼndá] or glottalised [hV?dá] frame. The frames were then written down as forming a list of words or utterances. The syllable initial segment [h] was selected as an appropriate neutral consonant so that whatever acoustic influence it may exercise on the following vowel would be minimal. The second syllable [dá] either as a nominaliser or a particle had to be added to the target syllable because it is rather unnatural for Burmese native speakers to articulate words as monosyllables in isolation. The /hV/ syllables with the following syllable [dá] sound very natural as derived nouns in Burmese. For instance, sâ = "to eat" and /sâdá/ = "eating", /tʰ aĩ/ = "to sit" and /tʰ aĩdá/ [tʰ aĩndá] = "sitting" and so on. Although some of the /hV/ syllables lack distinct meaning, native speakers can read them out naturally in the Burmese syllabic writing system which includes systematic tonal symbols. The objective of the first stage was to establish the duration and Fo pattern of the tones, especially the first three, in the non-nasalised and nasalised environments and to verify whether the first three tones in one environment differ from their counterparts in the other.

Three male Burmese native speakers who have spent most of their lives in Rangoon, aged 30, 46 and 50, participated in this study. Each participant read out the list at his normal speaking rate in a sound treated room. The recording was made with a Marantz cassette recorder CP230 using TDK IECI type I tapes and an Electro Voice Inc. BK 1 microphone. The recording obtained was of good quality. The Fo and duration of all 50 /hV/ syllable portions of each participant (the [dá] portion was not analysed) were analysed using the Mac Speech Lab. II pitch tracking program on a Macintosh II microcomputer. The recorder used for the analysis was a Macintosh Revox B710 controlled by the computer. The program is capable of detecting the Fo value at every 1/1000 second of the duration of the sound fed into the computer. In the analysis, only the Fo values at every 10% duration point of the /hV/ syllables were used. This procedure of analysis of the tones in the open and closed syllable types by the three male speakers yielded the mean Fo patterns described in Figures 1 and 2. A comparison of tones I to III in these two figures confirms that these three tones in the two environments are virtually the same. This comparison eliminates the formal necessity of having to investigate these three tones in both the nasalised and non-nasalised environments.

The second stage.

In the second stage which was meant to fulfil the primary objective of this study, non-nasalised CV words (1) where C = c and V = (v)v were compiled and classified into four syllable types that can be described in the following format:

Syllable type (I) where the voiced sonorants [m, n, l, z, w and j] filled the C slot.
Syllable type (II) where two voiced stops and one affricate [b, d and dz]........slot.
Syllable type (III) where voiceless stops and affricates [p, pʰ, t, tʰ, tc and tcʰ].......
Syllable type (IV) where voiceless fricatives [s, sʰ and ʃ] filled the C slot.

The word list thus consisted of 18 syllables each occurring in all four tones. One of the three who participated in the first stage read out the list. The procedure of recording, analysis and the instruments used were exactly the same as those in the first stage.

RESULTS AND DISCUSSION

As stated earlier, the Fo patterns of tones I to III in the non-nasalised syllables are almost identical to their counterparts in the nasalised syllables (see Figures 1 and 2), but the tonal durations in the nasalised environment tend to be longer. This duration difference can be easily understood by the

existence of the final nasal and diphthongs such as [ai, au, ou and ei] in the nasalised environment (see Table 1). Due to the use of the computerised facilities, the numerical data and the results obtained in this study are much more accurate than those of Thein-Tun (1982). Nevertheless, the results of the first stage in the present study merely confirm the contrastive tonal features of Thein-Tun (1982) that can be summarised as follows:

Tone I	Low, Level (falling)	and medium length
Tone II	Mid, Rising (and falling)	and long
Tone III	High (falling)	and short
Tone IV	High (falling)	and the shortest

The results of the second analysis show that the influence of the voiced sonorant initials on the following Fo pattern (in syllable type I) is almost negligible whereas the influence of the voiced stops and affricate in syllable type II is most erratic where the Fo starts from extremely low values (see Figures 3 - 6 in comparison with their counterparts in Figures 1 and 2). The initial Fo pattern influenced by the preceding initials in syllable types III and IV are not as erratic as in type II. As with the Mandarin tones observed by Howie (1974) the data in this study suggest that the tone domains in Burmese are also confined to the rhyming portion of the syllable but not the entire voice pitch of the segmental syllable. The present Burmese data also indicate that the shorter the tonal duration, the stronger the influence of the initial segment on the following Fo pattern (see Figures 5 and 6) where the normal rhyming portion of the tones starts only at the 4th duration point.

Note

(1) Some of the words thus formulated were not verbs but nouns in the case of which the addition of the nominaliser [da] did not provide any distinct meaning, e.g., [dzoda], [dzoda] etc. These grammatical anomalies had to be tolerated because of the phonological and phonotactic nature of the language.

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