FO BEHAVIOR OF VOWELS INFLUENCED BY ASPIRATED AND UNASPIRATED INITIALS IN SOUTHEAST ASIAN LANGUAGES : IMPLICATIONS FOR TONOGENESIS THEORIES

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1. Introduction[1]

How voicing and aspiration associated with certain speech sounds are produced has been a subject of considerable interest for over 2,500 years (Dixit 1987: 77). Consonantal perturbations of Fo associated with obstruents have been well attested in many languages (Hombert et al 1979: 38) but previous work has concentrated mostly on the effect of voiced versus voiceless intials on Fo values. However, the correlation between aspiration and fundamental frequency has not been investigated seriously. Though linguists had put some remarks on the connection between aspirated initials and tones the picture is somewhat confused. In some languages aspirated initial is related to higher tone whereas in other languages aspirated initial is related to lower tone. For example, in Lungchow aspiration has a lowering effect (Li, 1977: 21) where as in Southern Thai aspiration seems to be associated with a high tone. For "Wu Chiang" Chinese (Ho 1976, Ballard 1975 cited in Hombert 1978) it is found that aspiration is related to a low tone: on the contrary, aspiration is associated with a high tone in Saek (Sarawit 1973 cited in Hombert 1978). According to the confused patterns of a correlation between aspirated initials and tones, no plausible explanation for such inconsistency can be stated.

On experimental basis, Hombert and Ladefoged (1976, cited in Henderson, 1982) have set up experiments to test the effect of aspiration on Fo of following vowels but could find no appreciable differences between the effect of voiceless aspirated stops compared with voiceless unaspirated stops. Consequently, Hombert comes to the conclusion that,

We cannot make a prediction based on phonetic data as to which series will give rise to a relatively high tone.

As I myself have been working with Southeast Asian minority languages for several years and many languages I worked with have a nice contrastive set of aspirated and unaspirated stops in their inventory, I really want to know how aspirated and unaspirated initial stops in those Southeast Asian languages, particularly the non-tonal ones, reflect their effect on Fo values of following vowels. In addition, I also want to see if the perturbation patterns obtaining from the measurements will shed some light on tonogenesis.

In order to get a clearer picture of Fo behavior resulting from the effect of aspirated and unaspirated stops, acoustical measurements of Fo in several Southeast Asian non-tonal languages have been conducted.

2. Procedure

In this study, the languages chosen as sources of the data are 6 Southeast Asian non-tonal languages: Bru, Khmu, Mon, So, Lavue and Moken. Five subjects from each language participated in the study. The wordlist in each language consisted of 4 real word tokens. The wordlists for this study will be shown below.

Bru:

/paːy/	'coil, ring'	vs	/phɔːy/	'broom'
/tɒːn/	'piece'	vs	/thɒːn/	'to give change (money)'

Khmu:

/tɔːk/	'to roof'	vs	/thɔːk/	'to pick up'
/pɔːk/	'to roast'	vs	/phaːk/	'to deposit'

Mon:

/tɔː/	'handle'	vs	/thɔː/	'gold'
/tạːt/	'to pat'	vs	/thạːt/	'element'

So:

/tɔː/	'to continue'	vs	/thɛː/	'to shave'
/pɔːt/	'to hold in the hand'	vs	/phɔːt/	'to release'

Lavue:

/kam/ 'husk of rice vs /(phui) kham/ 'bullet resistant'
/tɔ:/ 'run, run away' vs /thɔ:/ 'a kind of basket'

Moken :

/tipa: / 'water dipper' vs /kapha:/ 'orphan'
/pa:t/ 'four' vs /pha:k/. 'wet'

Each token was spoken as a word in isolation after the reading of its meaning in Thai by the author. Each speaker recorded 4 repetitions of the token sets. Fo was measured using the pitch tracking program in WinCECIL, a speech analysis produced by the Summer Institute of Linguistics (SIL). Measurements were made at the starting point of each Fo curve (point S) and measured into the Fo curve for 100 ms^2 at 50 ms intervals, i.e., at S+50 and S+100. The normalized Fo contours indicating the mean Fo values of the vowels following aspirated and unaspirated initials were plotted. Microsoft Excel was used for averaging and plotting the average Fo contours.

3. Results and Discussion

The results of the acoustical measurements of Fo contours as influenced by aspirated and unaspirated initial stops in the 6 SEA non-tonal languages will be illustrated in table 1 and figures 1-7 below.

LGS.	INITIALS	Fo VALUES	Fo CONTOUR
MOKEN	p-VS ph-	p> ph	p=*F*; ph=*R*
LAVUE	k-VS kh-	k>kh	k=*FR* ;kh=*F*
KHMU	k-VS kh-	k>kh	k &kh=*FR*
	t-VS th-	th>t	t &th=*FR*
SO	p-VS ph-	ph>p	p &ph=*FR*
MON	t-VS th-	th>t	t=*RF*;th=*F*
BRU	ph-VS p-	p> ph	p=*R*;ph=*F*

Table 1 Fo Behavior of Vowels Influenced by Aspirated and Unaspirated Initials in Southeast Asian Languages **(F** = falling **R** = rising **FR** = falling-rising**)**

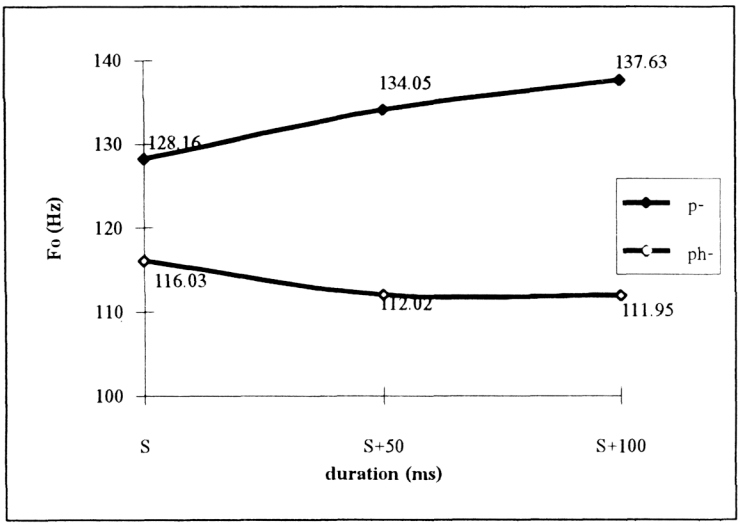

Figure 1 Fo of p- VS ph- in Bru

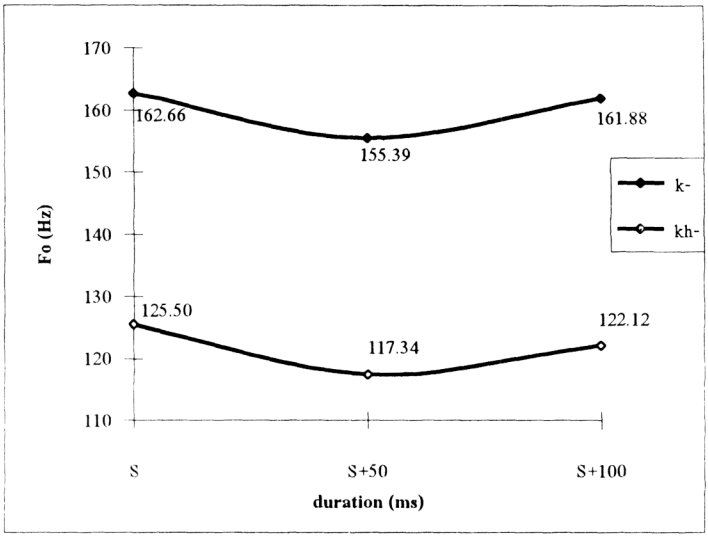

Figure 2 Fo of k- VS kh- in Khmu

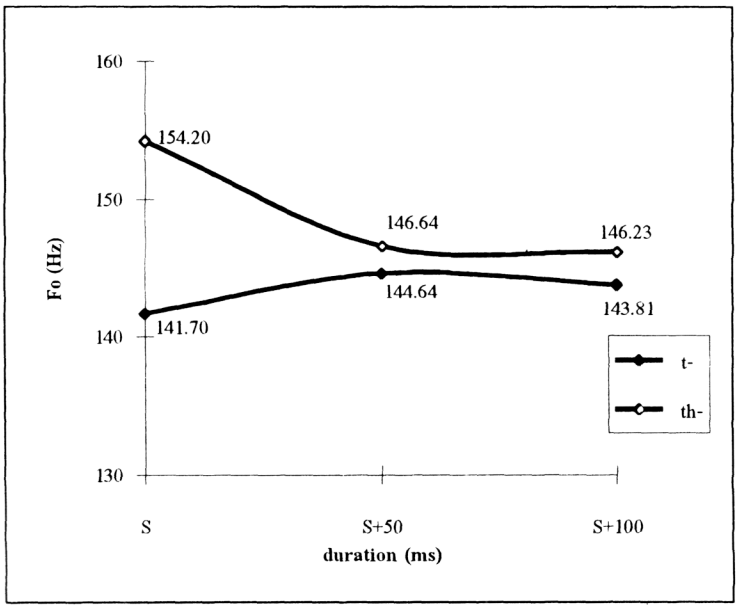

Figure 3 Fo of t- VS th- in Mon

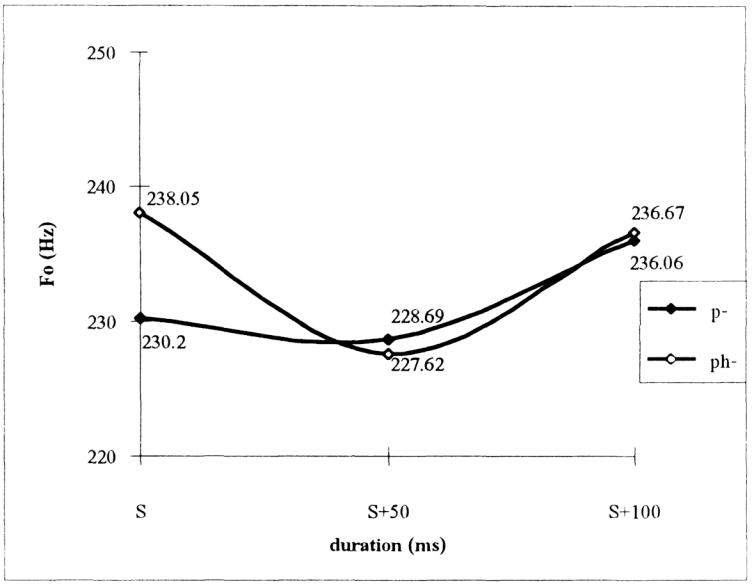

Figure 4 Fo of p- VS ph- in So

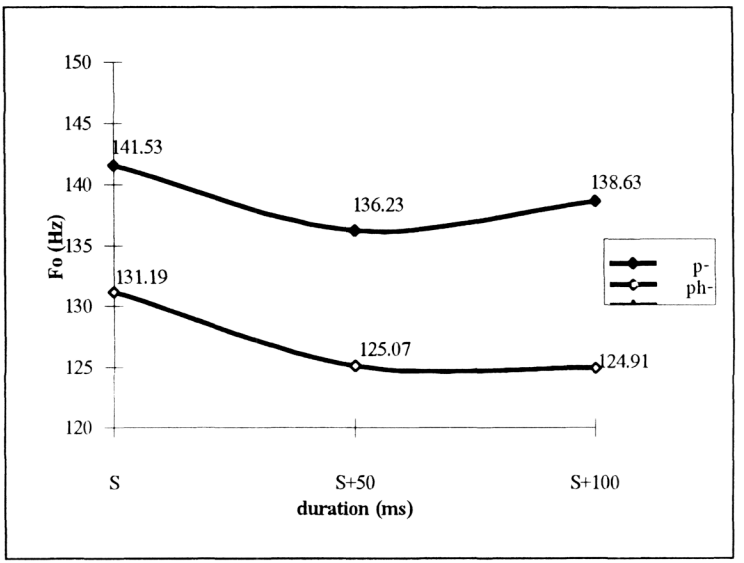

Figure 5 Fo of p- VS ph- in Lavue

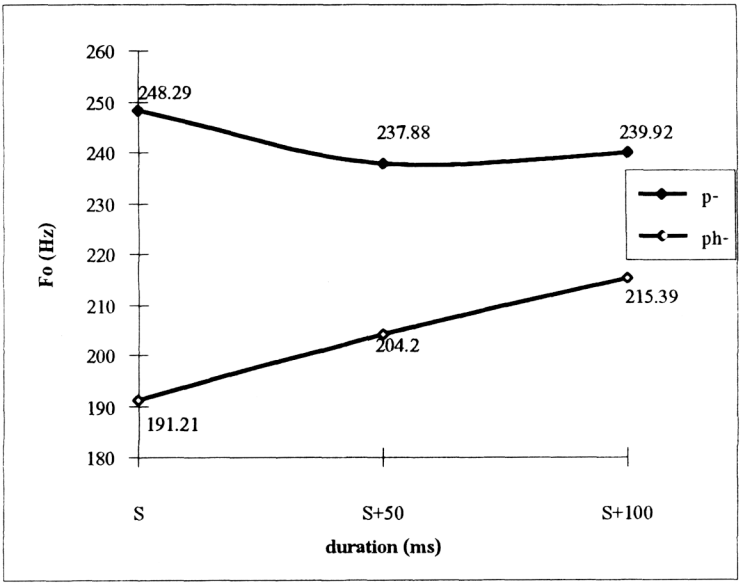

Figure 6 Fo of p- VS ph- in Moken

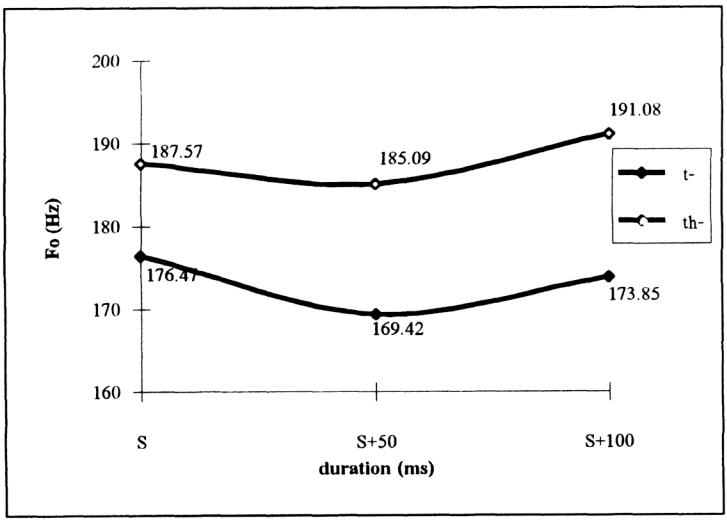

Figure 7 Fo of t- and th- in Khmu

From this study, it is shown that the Fo difference resulting from the effect of aspirated and unaspirated stops is statistically significant in all languages. From table 1, it is observed that in Bru, Khmu, Lavue and Moken Fo values of vowels preceded by unaspirated stops are higher than those of vowels preceded by aspirated stops (see figure 1, figure 2, figure 5 and figure 6). This pattern seems to be more common than the opposite pattern observed in Mon where Fo values of vowels preceded by aspirated stops are higher than those of vowels preceded by unaspirated stops (see figure 3 and figure 4). It is of interest that in Khmu two completely different patterns of Fo behavior resulting from aspirated stops occur within the same language (see figure 7).

As far as Fo contour is concerned, no regular pattern resulting from aspirated or unaspirated stops is found in this study (see table 1). The most interested point to be considered is that in Khmu both aspirated and unaspirated stops yield the same Fo contour, i.e., a falling-rising contour.

The findings from this study confirm the result of a study reported by Hombert and Ladefoged, I mentioned earlier, that

> There is no consistent intrinsic different between the effect of voiceless stops and voiceless unaspirated stops on Fo values of the following vowels.

Though the perturbation pattern is not consistent, it is obvious that aspiration plays an important role in tonogenesis. Fo curves of all languages especially those of Bru, Khmu, Lavue and Moken are statistically significant. The Fo difference resulting from the existence or non-existence of aspiration in initial stops might possibly obtain a contrastive status in the future. According to my observation, it is convincing that the Khmu dialect investigated in this study[3] is becoming a tone language in the near future since I found several pitch-different minimal pairs in this variety.

Based on Ladefoged's definition (Ladefoged, 1971), I would like to suggest that in dealing with tonogenetic matter what one should always take into consideration is phonation

type[4] (Ladefoged considers aspiration as one category of phonation types.) By this I mean the phonation types of both vowels and consonants i.e. phonation types of the whole syllable. The findings from this study reveal that the degree of fundamental frequency modification after aspirated and unaspirated initial stops tend to be language-specific rather than universal. I wish to conclude that, though the acoustical measurements obtaining from the study show that Fo values influenced by aspirated and unaspirated initials tend to behave differently in different languages, it is evident that aspiration plays a significant role in tonogenesis.

Notes

[1] This paper is part of my Ph.D. dissertation entitled "Fundamental Frequency Behavior of Vowels Influenced by Initials and Finals in Southeast Asian Languages: Implications for Tonogenesis Theories" at Chulalongkorn University. I would like to thank Associate Professor Dr. Theraphan L. Thongkum for her hardworking in guiding and supporting me during my study at Chulalongkorn University.

[2] It has been found that the effect of initial consonants will last at least 100 ms (Hombert 1978 cited in Ohala 1978).

[3] Khmu dialect at Nampan Village, Chiang Klang District, Nan Province.

[4] Ladefoged considers aspiration as one category of phonation types.

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