Taiwan Journal of Linguistics
Vol. 5.2, 45-64, 2007
doi:10.6519/TJL.2007.5(2).2

THE PLAUSIBILITY OF TONAL EVOLUTION IN THE MALAY DIALECT SPOKEN IN THAILAND: EVIDENCE FROM AN ACOUSTIC STUDY*

Phanintra Teeranon

ABSTRACT

The F_0 values of vowels following voiceless consonants are higher than those of vowels following voiced consonants; high vowels have a higher F_0 than low vowels. It has also been found that when high vowels follow voiced consonants, the F_0 values decrease. In contrast, low vowels following voiceless consonants show increasing F_0 values. In other words, the voicing of initial consonants has been found to counterbalance the intrinsic F_0 values of high and low vowels (House and Fairbanks 1953, Lehiste and Peterson 1961, Lehiste 1970, Laver 1994, Teeranon 2006). To test whether these three findings are applicable to a disyllabic language, the F_0 values of high and low vowels following voiceless and voiced consonants were studied in a Malay dialect of the Austronesian language family spoken in Pathumthani Province, Thailand. The data was collected from three male informants, aged 30-35. The Praat program was used for acoustic analysis. The findings revealed the influence of the voicing of initial consonants on the F_0 of vowels to be greater than that of the influence of vowel height. Evidence from this acoustic study shows the plausibility for the Malay dialect spoken in Pathumthani to become a tonal language by the influence of initial consonants rather by the influence of the high-low vowel dimension.

Key words: Tonal Evolution, the Malay Dialect

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* This paper is a revised version of a paper presented at the 13th Annual Meeting of the Austronesian Formal Linguistics Association, 24-26 March 2006, Graduate Institute of Linguistics, National Tsing Hua University, Hsinchu, Taiwan. I would like to thank participants at the conference for their commons and also the anonymous reviewers of the Taiwan Journal of Linguistics. I would also like to give my special thanks to Mr. Chaiyathip Katsura and Mr. Bovornpong Vathanathanakul for their suggestions on the final draft.

1. INTRODUCTION

In the theory of tonal evolution or tonogenesis, linguists have discovered various influences of consonants and vowel quality on the F_0 (fundamental frequency; Hz) values of vowels. At least two of these influences are most-documented and claimed as universal phenomena.

First, the effect from initial consonant voicing on the F_0 values of the following vowels has been shown to give rise to tones. Voiceless initial consonants (vl) increase the F_0 values, while voiced initial consonants (vd) decrease the F_0 values, resulting in a high pitch and a low pitch, respectively. These findings have been attested in many non-tonal and tonal languages all over the world (e.g., House and Fairbanks 1953, Lehiste and Peterson 1961, Hombert et al. 1979, Thavisak 2000, Teeranon 2006). This leads to the conclusion that voiceless consonants give birth to high tones and voiced consonants give birth to low tones.

Second, vowel height (high-low vowel dimension) has been verified for its universal relationship with F_0 values (Whalen and Levitt 1995). High vowels, [i] and [u], tend to have a higher F_0 than the low vowel [a]. So far, more than thirty languages representing the world's twenty-nine language families (Whalen and Levitt 1995: 349) have been proven to an extent for this phenomenon, the intrinsic pitch. It is also indirectly stated that intrinsic pitch can give birth to tones (Whalen, et al. 1999) and research has been conducted in relation to the interaction between the voicing of initial consonants and intrinsic pitch. The findings confirm that the influence of initial consonants on the F_0 values is greater than that of intrinsic pitch or vowel height (House and Fairbanks, 1953, Lehiste and Peterson, 1961, Lehiste 1970, Hombert 1977, Laver 1994, Teeranon 2006). However, no direct discovery has been made to ascertain that the interaction of the voicing of initial consonants and intrinsic pitches might give rise to tones.

In this research, the questions are whether 1) the initial consonant is a factor in tonogenesis; 2) the high-low dimension of vowels is another important factor in tonogenisis; and 3) the interaction between the voicing of initial consonants and intrinsic pitch is corroborated by a particular Malay dialect. The reason in choosing this dialect is related to its characteristics as a non-tonal language. In addition, its basic syllable structure appears in disyllabic form, and so it is a disyllabic language. Previous studies of tonogenesis have revealed that languages with monosyllabic form are more likely to develop tones (Matisoff 1973,

Thach 1996, Thurgood, 2002). A number of research reports on tonogenesis are apparently found to deal with disyllabic language (Yupho 1989, Teeranon 2006). It is interesting to consider whether the tonogenesis theory is applicable to a disyllabic language like the Malay dialect in Pathumthani Province.

2. PRELIMINARY BACKGROUND

2.1 Tonal Evolution or Tonogenesis; How do tones in a language originate and develop?

Linguists have long been interested in questions about the origin of tones, especially in Southeast Asian languages. Prior to the published results, many comparativists tried to reconstruct a proto-language to demonstrate that languages might form more contrastive tones—through changes in the initial and final consonant features in their parent languages. This concept was first introduced by Przyluski (1924). A classical case of tonal evolution was proven with Vietnamese by Haudricout (1954) and was later clarified by Matisoff (1973).

Table 1 Vietnamese tonal development in the early 6th century

		Final consonants		
		/*-∅/, /*-N/	/*-h/	/*-ʔ/
Initial consonants	Voiceless /*p-/	pa, paN	pah	paʔ
	Voiced /*b-/	ba, baN	bah	baʔ

(Adapted from Haudricourt 1954 and Matisoff 1973)

According to Table 1, Vietnamese of the early 6th century was a non-tonal language. Its syllables during this period were of (i) open types, ending in a vowel /*-∅/ or a nasal consonant /*-N/, and (ii) closed types, ending in a fricative /*-h/ or a glottal stop /*-ʔ/. There were, in addition, two types of voicing distinction for the initial consonants: voiceless /p-/

and voiced /b-/. The loss of final consonants, /*-ɴ/, /*-h/, /*-ʔ/, have caused phonologically distinctive pitches or tones to emerge, namely level, falling and rising tones, as shown in Table 2.

Table 2 Three tones of Vietnamese around the 12th century

		Tones		
		Level	Falling	Rising
Initial consonants	Voiceless /*p-/	pa	pa	pa
	Voiced /*b-/	ba	ba	ba

(Adapted from Haudricourt 1954 and Matisoff 1973)

At the end of the 12th century, the number of tones had increased to six through the loss of the voicing of initial consonants, as shown in Table 3. When the voiced initial consonants lose their voicing, /*b-/ > /*p-/, low and high tones emerged to avoid homophones. Tones emerge to replace consonant voicing and to differentiate word meanings. That is to say, when /*p-/ becomes /pa/, a high tone results, and when /*b-/ becomes /pa/, a low tone results.

Table 3 Six tones in Vietnamese by the end of the 12th century

Tones	Level	Falling	Rising
/*p-/ > /*p-/ > High tone	pa	pa	pa
/*b-/ > /*p-/ > Low tone	pa	pa	pa

(Adapted from Haudricourt 1954 and Matisoff 1973)

Following the initial work on the theory of the development of contrastive tones in Vietnamese, further work on the acoustic study of tonal evolution or tonogenesis has revealed many universal phenomena that might give birth to tones: the influence of initial consonants on the F_0 of the following vowels; the influence of final consonants on the F_0 of the preceding vowels; the influence of high-low vowel dimension on the

F_0 of the vowels; etc. According to the aim of this study, only two phenomena are discussed.

2.2 Tonal evolution from the influence of initial consonants: voiceless consonants vs. voiced consonants

The influence of initial voicing distinction on the F0 of the following vowels is one of the most documented areas in acoustic studies for the theory of tonogenesis. Many studies have been carried out to explain the loss of initial consonant voicing distinction as a cause of the development of high and low tones (House and Fairbanks 1953, Lehiste and Peterson 1961, Lehiste 1970, Gandour 1974, Erickson 1975, Hombert et al. 1979, Maddieson 1984, L-Thongkum 1990, Watkins 2002). The emergence of a high tone was presumably through the loss of voiceless initial consonants, while a low tone was developed through the loss of voiced initial consonants. The most convincing explanation from a physiological basis is the mechanism involving the cricothyroid muscles of the larynx to stiffen the vocal folds for the voiceless state or to slacken the vocal folds for the voiced state (Hirose and Gay 1972, Löfqvist et al. 1989).

In earlier researches of acoustic studies, two types of languages have been proven; non-tonal languages and tonal languages. The study of House and Fairbanks (1953) on American English is regarded as the pioneer studies in this area. The data was collected from monosyllabic words bearing the same beginning and ending type of consonants, e.g., [pap], [bab]. The study reveals that vowels following voiced consonants have a lower F_0 than those which follow voiceless consonants.

Other clear cases were synthesized in the study of Hombert et al. (1979). The evidence of the plausibility of tonal development through a voicing distinction in non-tonal languages (e.g., American English) and tonal ones (e.g., Yuroba) was presented. The data of English was gathered by House and Fairbanks (1953), Lehsite and Peterson (1961), and Mohr (1968). The Yuroba data was gathered by J-M Hombert in 1975 and 1977. Although a number of data was recorded in monosyllabic words alone and some with monosyllabic words in sentence frames, the results were similar in that a higher F_0 was apparently caused by voiceless initial consonants and a lower F_0 was apparently caused by voiced initial consonants. In Southeast Asian languages, many studies have also been conducted to seek for the effect

of the voicing of initial consonants on the development of tones (Gandour 1974, L-Thongkum 1990, etc.).

According to Matisoff (1973), languages whose basic syllable structures take monosyllabic forms are likely to develop tones. Syllable structures of the Austronesian, especially the Malay dialects, are in disyllabic forms. In other words, the Malay dialects are disyllabic languages. This might explain why few studies, with Thurgood's (1999) and Thavisak's (2000) among them, have been conducted to attest the tonogenesis theory in the Malay dialects.

One of the studies is of Thavisak (2000) who aims to test the effect of voicing distinction on the following vowels in the Malay dialect spoken in Pathumthani Province. The data was recorded from monosyllabic words and then measured with the WINCECIL program. The data of the study, like in previous studies, was measured for F_0 values at 100 milliseconds after the onset. The studies can conclude that vowels following voiceless initials yield a higher F_0 than those following voiced initials. It can be interpreted that the small effects of voicing, which occur around 100 milliseconds after the onset of vowels, are not under the control of the speaker (Abramson 2004).

2.3 Tonal evolution through the influence of intrinsic pitch: high vowels vs. low vowels

Intrinsic pitch first began to be recognized in 1896-1897, when Meyer (cited in Whalen and Levitt 1995) observed high vowels in German to be higher pitched than low vowels. Following Mayer (1896-1897), there were a number of studies of this phenomenon. Whalen and Levitt (1995) synthesized more than thirty languages of eleven of the world's language families to show intrinsic pitch. Based on this research, they conclude that the influence of intrinsic pitch is universal. However, studies on the phenomenon in Southeast Asian languages have been relatively small in number when compared with similar studies conducted with European languages.

In Southeast Asian languages, high vowels have a higher pitch than low vowels in non-tonal languages such as Malagasy (Rakotofiringa 1968, 1982, cited in Whalen and Levitt 1995), an Austronesian language; in register languages such as Paroak (Svantesson 1993, Watkins 2002), a Mon-Khmer language; and in tonal languages such as Thai (Han 1969, Mohr 1971, Zee 1980, Bunphan et al. 1982, Shi and Zhang 1987,

Svantesson 1988, Rose 1997). Through the application of different methodologies, generally using both sexes as informants, the fundamental frequency values were measured at different points of the syllables, e.g., the onset (Mohr 1971), the first half of the syllable (Rose 1997), and the whole syllable (Bunphan et al. 1982). All of the results show that, as in European languages, the fundamental frequency values of high vowels are higher than those of low vowels.

2.4 The interaction between voicing of initial consonants and intrinsic pitch

Linguists have confirmed, through comparative and acoustic studies, that the voicing states of initial consonants change diachronically to give rise to tones (House and Fairbanks 1953, Lehiste and Peterson 1961, Lehiste 1970, Matisoff 1973, Gandour 1974, Erickson 1975, Hombert et al. 1979, Maddieson 1984, L-Thongkum 1990, Watkins, 2002). However, only a few studies, among which is one by Whalen, et al. (1999), have been presented to argue that the high-low dimension of vowels or the intrinsic pitch is another important factor in tone birth (tonogenesis or tonal evolution). Yet, certain studies do deal indirectly with the interaction between the voicing of initial consonants and intrinsic pitch (Hombert 1977). The results apparently indicate that the influence of initial consonants on pitch is greater than that of the influence of intrinsic pitch.

One noteworthy research dealing with the interaction between the voicing of initial consonants and intrinsic pitch is that of Lehiste and Peterson (1961). The study aimed to identify the phonetic conditioning factors that should be considered when studying intonation patterns. The data was elicited from a Serbo-Croatian native-speaking informant, through words in sentence frames. The study showed one segmental conditioning factor for studying intonation, that is, the F_0 values of high vowels are likely to be influenced by voiced consonants and the F_0 values of low vowels by voiceless consonants. That is to say, F_0 values of the same quality of vowels are higher when following voiceless consonants, but lower when following voiced consonants. The study stated clearly that when high vowels are preceded by voiced consonants and low vowels by voiceless consonants, the high vowels tend to have lower F_0 values than low the vowels do. In other words, initial consonants can counterbalance the effect of intrinsic pitch.

To explain this more clearly, the following is an example from Lehiste (1970: 73-74). Lehiste states that, “The influence of an initial

consonant could counterbalance the influence of intrinsic pitch: the average of /kæ/ sequences was 171 Hz, while that of /gi/ sequences amounted to 170 Hz." What this statement means is that, generally, the high vowel /i/ has higher F_0 values than the low vowel /æ/; however, when the high vowel /i/ is preceded by voiced initial consonants as in /gi/, and when the low vowel /æ/ is preceded by voiceless initial consonants, as in /kæ/, then the high vowel /i/ has a lower F_0 value than the low vowel /æ/. The method of measuring the F_0 values in this study was implemented using the peak of F_0, because the focus of the study concerned intonation. This was unlike Thavisak (2000), and others, who tried to prove that a small perturbation of initial consonants could give birth to tones by measuring the F_0 values within 100 milliseconds after the vowel onset. And most of studies used monosyllabic words, not sentence frames, to provide proof of tonal evolution theory as they wanted to avoid an intonation pattern effect. For this study, Lehiste's (1970) concept of the counterbalance effect and Thavisak's (2000) techniques of using monosyllabic words as test tokens were used to conduct the research.

2.5 The physiological explanations

In the physiological aspect, the F_0 values relate to the vibration of the vocal fold in the larynx to the auditory pitch. It has been found that the speaker seems to have no deliberate control over either the influence of initial consonants or the high-low vowel dimension (tongue height). They are rather physiological mechanisms. A number of studies have attempted to explain such mechanisms and the most recognized studies concerning the influence of initial consonant describe a mechanism whereby the cricothyroid muscles of the larynx stiffen the vocal folds for the voiceless state and slacken the vocal folds for the voiced state (Hirose and Gay 1972, Löfqvist et al. 1989). As for the influence of the high-low dimension of vowels, it has been suggested that, in the production of high vowels, vocal-fold tension is caused by the tongue-root—the movement of the tongue root up toward the palate raises the larynx; and thus, increases vocal-fold tension (Gregerson 1976).

3. METHODOLOGY

The Malay dialect spoken in Thailand is a lingua franca of three provinces in the southernmost part of Thailand, namely Pattani (or Patani), Yala, and Narathiwat Provinces. However, there are a number of villages in the central part of Thailand (i.e., Nonthaburi and Pathumthani Provinces) where the inhabitants, most of whom have migrated from those three provinces, communicate among themselves in this dialect.

In this study, several methods were used to analyze the test tokens which were drawn from the Malay dialect of Pathumthani[1] spoken in Ban Khlong Bang Pho Village, Khu Bang Luang Subdistrict, and Lad Lum Kaew District, Pathumthani Province. As stated in the preliminary background section, there are only a few studies concerned with tonal evolution in the Austronesian languages, especially the Malay dialect spoken in Thailand. As Matisoff (1973) mentioned that one of the seeds which make Southeast Asia an area of "Tone Prone" languages is that the syllable structure in the area is basically monosyllabic form. However, the Malay dialect is an exception. The most favoured form of the language is disyllabic with a stress on the first or the second syllable /ˈCV.CV/ or /CV.ˈCV/[2]. In the Malay dialect spoken in Pattani, the language can have germinated initial consonants or long consonants, e.g., [bulu] 'hair' vs. [bːulu] 'hairy'.

The Malay language, including the dialect under study, comprises 24 consonants, /p, t, c, k, ʔ, ph, th, ch, kh, b, d, ɟ, g, s, h, ɣ, m, n, ɲ, ŋ, r, l, w, j/. All consonants can occur as initial consonants but only three consonants, /ʔ, h, ŋ/, can occur as final consonants (Lohde 2003). The dialect in Pathumthani has a repertoire of seven monophthongs /i, e, u, ə, a, ɛ, ɔ/ with no vowel-length distinction, the three vowels representing the high and low vowels selected for this study are /i/, /u/ and /a/. The reason for restricting the analysis to these three vowels is because they were the ones most typically selected for study in the previous research. Moreover, the vowel /ə/, which should be compared with the vowel /a/, occurs only in unstressed syllables (Lohde, 2003). Following that, a number of words were selected from dictionaries, research reports, and

[1] In Thailand, dialects of Malay are mainly spoken in six communities: Khlong Bang Pho, Tha-it, Khlongnung, Bang Bua Thong, Krathumrai, and Sai Kong Din. The informants for this study are from one of the twelve villages of Ban Khlong Bang Pho.

[2] In /ˈCV.CV/ or /CV.ˈCV/, /C/ represents a consonant, /V/ represents a vowel, and /ˈ/ represents stress.

other relevant documents. Subsequently, based on the assumption that the point of articulation has no effect on the F_0 of vowels (Maddieson 1984, L-Thongkum 1992), four test tokens were selected for each of the vowels (/i/, /a/ and /u/), preceded by voiceless (/p/, /t/, /k/) and voiced (/b/, /d/, /g/) consonants with the same manner of articulation. For each voicing state, four words were chosen to appear before each vowel, as shown below:

Voiceless initials

/i/	/a/	/u/
ʔapi ‘fire’	ʔipa ‘daughter-in-law’	sapu ‘to sweep’
hati ‘heart’	bata ‘pillow’	satu ‘one’
mati ‘to die’	tika ‘mat’	mutu ‘motorcycle’
kaki ‘foot’	sika ‘bicycle’	hatu ‘ghost’

Voiced initials

/i/	/a/	/u/
hubi ‘potato’	təba ‘thick’	dəbu ‘dust’
babi ‘pig’	kuba ‘buffalo’	labu ‘pumpkin’
ɟadi ‘to be’	kəda ‘market’	budu ‘a kind of fish sauce’
pagi ‘morning’	pəda ‘stomach’	madu ‘bee’

Before the speech was recorded, every word on the list was carefully checked with a Malay informant. After that, three male informants aged between 30 and 35 were asked to pronounce each test-word in isolation five times. The first three words were selected in order to avoid any intonation effects that might occur. The number of total test tokens was 162 (3 informants x 2 initial voicing states x 3 vowels x 3 words x 3 repetitions). The Praat program, Version 4.2.05, was used for analysis. This is because the pre-syllables in this language are unstressed. The fundamental frequency was measured at the onset, the mid-point, and the offset of each vowel, and then the overall mean values were calculated. The mean values of the vowels /i/ and /u/ (high), and /a/ (low) were

analyzed statistically using a *t*-test and analysis of variance (ANOVA) with a 95% level of confidence. Line graphs were drawn using Microsoft Excel.

4. RESULTS

4.1 The influence of initial consonants on the F_0 of high (/i, u/) and low vowel (/a/)

The data shows that the high vowels, /i, u/, following voiceless consonants had a higher F_0 than the high vowels following voiced consonants (Table 4 and Figure 1). The overall means show that the F_0 difference amounted to 7.21 Hz. The *t*-test ($\alpha = .05$) showed a significant difference for the overall means ($p = .015$).

The low vowel, /a/, following voiceless consonants and voiced consonants show the same result; the F_0 of low vowel following voiceless consonants had a higher F_0 than the high vowels following voiced consonants (Table 4 and Figure 1). The overall means show that the F_0 difference amounted to 9.38 Hz. The *t*-test ($\alpha = .05$) showed a significant difference for the overall means ($p = .009$).

Table 4 F_0 (Hz) of high vowels following voiceless and voiced consonants and F_0 (Hz) of low vowel following voiceless and voiced consonants

Vowels / Initial consonants	High /i, u/	Low /a/
Voiceless	135.17	131.66
Voiced	127.96	122.28
Mean difference	7.21	9.38
Sig[3]	*	*

[3] In the last row (Sig);
- represents insignificant difference
* represents significant difference

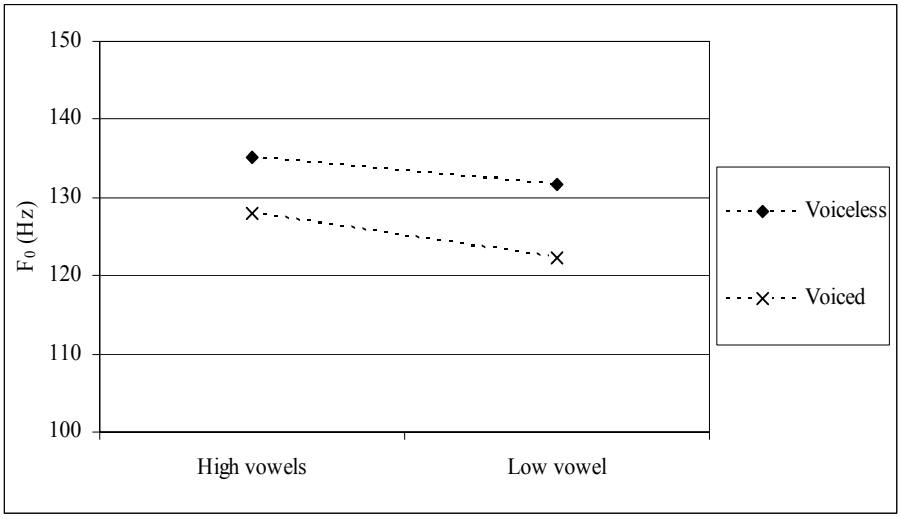

Figure 1 F_0 (Hz) of high and low vowels following voiceless and voiced consonants

4.2 Intrinsic pitch of high and low vowels

The data shows that the high vowels /i, u/ had a higher F_0 than the low vowel /a/ (Table 5 and Figure 1). The difference in intrinsic F_0 between high and low vowels following voiceless consonants amounted to 3.51 Hz. And the difference in intrinsic F_0 between high and low vowels following voiceless consonants amounted to 5.68 Hz. However, the *t*-test (α = .05) showed no significant difference for the means (p = .792, p=.095).

Table 5 Intrinsic F_0 (Hz) of high and low vowels following voiceless and voiced consonants

Vowels / Initial consonants	High /i, u/	Low /a/	Mean difference	Sig
Voiceless	135.17	131.66	3.51	-
Voiced	127.96	122.28	5.68	-

4.3 The interaction between initial consonants and intrinsic pitch

The findings show that when high vowels, /i, u/, follow voiced consonants (-C_{vd}-), they have a lower F_0 at the onset than the low vowel, /a/, following voiceless consonants (-C_{vl}-) (Table 6 and Figure 2). The mean difference of the average intrinsic F_0 values of high vowels following voiced consonants and the low vowel /a/ following voiceless consonants was not significant (p = .256).

Table 6 F_0 (Hz) of high vowels following voiced initial consonants (-C_{vd}-) and low vowel following voiceless initial consonants (-C_{vl}-)

F_0 (Hz) of vowels	High vowels following voiced consonants (-C_{vd}-high vowels)	Low vowel following voiceless consonants (-C_{vl}-low vowel)	Mean difference	Sig
	127.96	131.66	-3.67	-

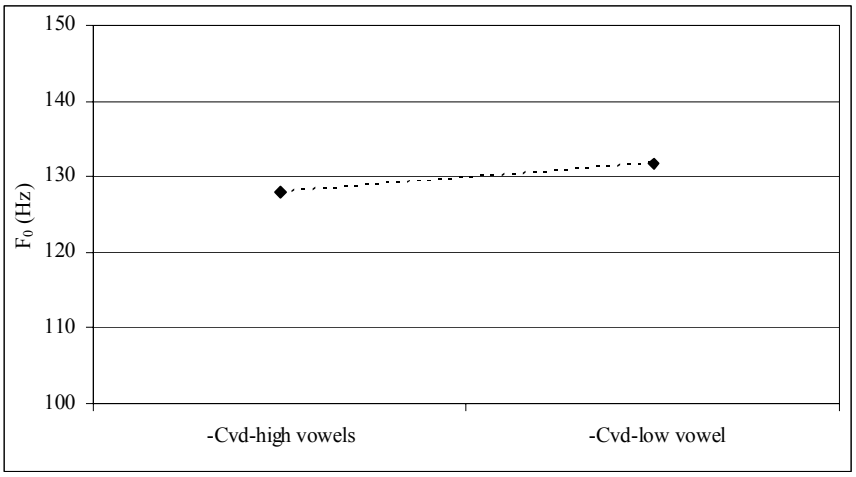

Figure 2 Intrinsic F_0 (Hz) of high vowels following voiced consonants and low vowel following voiceless initial consonants

5. DISCUSSION

5.1 The influence of initial consonants; voiceless consonants vs. voiced consonants

In the Malay dialect spoken in Pathumthani Province, Thailand, there is a tendency for vowels following voiceless consonants to have a higher F_0 than the vowels following voiced consonants. It is plausible that voiceless initial consonants (vl) increase F_0 values and voiced initial consonants (vd) decrease F_0 values, which may relate to auditory high pitch and low pitch, respectively. It has been shown the results for disyllabic languages corroborate with those for monosyllabic languages (Haudricourt 1954, Matisoff 1973, Hombert 1978, Hombert et al. 1979, Thurgood 2002). This corroborates the universality of the influence of initial voicing upon the vowels in the tonogenesis theory (Gandour 1974, Hombert et al. 1979, Maddieson 1984, L-Thongkum 1992, Abramson 2004).

Though this study was conducted by having the informants pronounce all of the tokens in monosyllabic words, the results are not different from those of other studies that use sentence frames. It can therefore be implied that contexts are not relevant to the influence of initial consonants on the following vowels. This might be due to the effect that the voicing contrast distinction derives from the physiological mechanism and is not under the deliberate control (Abramson 2004).

5.2 The influence of intrinsic pitch; high vowels vs. low vowel

The results for intrinsic pitch also show the plausibility of giving birth to tones. High vowels tend to have a higher intrinsic F_0 (pitch) than low vowels (e.g., Lehiste 1970, Whalen and Levitt 1995). The results here show much smaller values when compared with the 15.3 Hz average difference in intrinsic F_0 across the world's languages and with the 13.9 Hz average difference in intrinsic F_0 for all male speakers of the world's languages as determined by Whalen and Levitt (1995). When compared with 1.5 Hz (Rakotofiringa, 1968, cited in Whalen and Levitt 1995) and 4.5 Hz (Rakotofiringa 1982, cited in Whalen and Levitt 1995) for Malagasy of the Austronesian language family, these results are much closer (3.51 Hz to 5.68 Hz) to the Malagasy. This might

indicate that the size of the effect is not universal, but rather that it is more likely to be specific for each language family.

5.3 The interaction between voicing of initial consonants and intrinsic pitch

The interaction between initial consonants and intrinsic pitch shows that when high vowels follow voiced consonants and when low vowels follow voiceless consonants, the effect of intrinsic pitch is diminished. In other words, the influence of intrinsic pitch on the F_0 value of vowels is less than the influence of the voicing states of initial consonants. It is obvious that voiceless and voiced consonants can counterbalance the effect of intrinsic pitch in that voiced initial consonants can lower the intrinsic pitch of high vowels and that voiced initial consonants can raise the intrinsic pitch of low vowel. This finding supports the counterbalance effect (House and Fairbanks 1953, Lehiste and Peterson 1961, Lehiste 1970, Laver 1994, Teeranon 2006).

The corroboration of the counterbalance effect suggests that the voicing states of initial consonants seem to be a more important factor for tonogenesis, but that a change in the high-low dimensions of the tongue might not be an important factor for phonological pitch in a disyllabic language. Thus, the intrinsic F_0 differences caused by vowel height or intrinsic pitch could not have given rise to the birth of tone in the same way in which the voicing states of initial consonants apparently have. The results of this study are congruent with the previous research of Hombert (1977), Hombert et al. (1979), and Fischer-Jørgensen (1990).

5.4 The plausibility of tonal evolution in the Malay dialect spoken in Pathumthani Province of Thailand

The acoustic findings suggest that if the Malay dialect under investigation, a disyllabic language, develops into a tonal language in the future, there at least two factors which give rise to tones, that is, initial consonant voicing and intrinsic pitch. However, the effect of initial consonant voicing on the following vowels is much greater than the effect of the high-low vowels dimension. Thus it can be inferred that a disyllabic non-tonal language might become a tonal language after the monosyllabicisation process (the change of syllabic structure to

monosyllable) (Matisoff 1973). Then tones occur as the voicing states of initial consonants influence the following vowels.

This study also supports the observation of Court (1995) who predicts the monosyllabicisation and other ongoing change, e.g., tone birth, which might occur in the Pattani Malay dialect spoken in the Southern part of Thailand.

6. CONCLUSION

In conclusion, this study confirms the two apparently universal phenomena in the theory of tonal evolution (tonogenesis) from examples that can be drawn from the Malay dialect spoken in Pathumthani, a disyllabic language of the Austronesian language family. One is the influence of the voicing states of initial consonants on the following vowels, and the other one is the influence of intrinsic pitch. The study also discovered an interaction between the voicing of initial consonants and intrinsic pitch in the Malay dialect. This interaction could be termed a 'counterbalance effect', which is likely to be a universal phenomenon. It is plausible that the Malay dialect spoken in Pathumthani, which is now surrounded by Thai, a tonal language, will also become a tonal language because of the influence of initial consonants on the audible pitch of vowels.

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Phanintra Teeranon
School of Liberal Arts
Mae Fah Luang University
Chiangrai 57100, Thailand
tphanintra@yahoo.com