

THE FUNDAMENTAL FREQUENCIES OF TAI YUAN TONES SPOKEN BY LUA' (MAL) SPEAKERS IN NAN PROVINCE, THAILAND¹

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Abstract

Lua' (Mal), a Mon-Khmer language, has been reconstructed as a non-tonal language. However, it has been found that the Lua' (Mal) spoken in Ta Luang Village in the Pua District of Nan Province is becoming a tonal language due to contact with Tai Yuan, the majority language of Nan Province. There are two groups of lexical pitches in the Ta Luang variety: high and low. This paper aims to analyze and compare the fundamental frequencies of the Tai Yuan tones as spoken by female Lua' (Mal) speakers in Ta Luang Village and those of female native speakers of Tai Yuan from Pua District.

A wordlist covering the full complement of Tai Yuan tones was recorded directly on

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Theraphan Luangthongkum (รวมบทความภาษาศาสตร์เอเชียตะวันออกเฉียงใต้ เนื่องในโอกาสศาสตราจารย์ ดร.ธีระพันธ์ เหลืองทองคำ มีอายุครบ 60 ปี).

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computer using Adobe Audition, version 2. The informants were three female Lua' (Mal) speakers in Ta Luang Village and three female native speakers of Tai Yuan in Pua District. Fundamental frequencies were measured at 0%, 25%, 50%, 75%, and 100% of tone duration using Praat, version 4.5.24. The results show that Tai Yuan as spoken by native speakers has six tones, namely, low-rising, mid-rising, mid-level, mid-falling, high-level, and high-falling, while the Tai Yuan spoken by Lua' (Mal) speakers contains only five tones due to a merger of the mid-level and mid-falling tones. The pitch contour of the Tai Yuan tones spoken by the two groups of speakers is obviously different. The range of fundamental frequencies in the dynamic tones (low-rising, mid-falling, and high-falling) spoken by Tai Yuan native speakers is wider than that of Lua' (Mal) speakers.

It appears that Tai Yuan tones are interfered with by the native language, Lua' (Mal). The differences in number of tones and in the acoustic characteristics of tones influence how non-tonal speakers produce a tone language. Moreover, the fundamental frequencies of the Tai Yuan tones spoken by Lua' (Mal) speakers in Ta Luang Village show that they can be distinguished into two groups: High and Low.

Introduction

The Lua' people have settled in many districts of Nan Province, for example Bo Kluea, Thung Chang, Pua, and Chiang Klang. They normally live together with other ethnic groups, e.g., Tai Lue, Hmong, Mien, and also Tai Yuan. The most recent data shows that there are, currently, more than 34,600 speakers of Lua' (L-Thongkum et al. 2007a). According to Filbeck (1978),

the Lua' language can be divided into two main dialects, Mal and Pray. The Lua' are bilingual in either Mal or Pray and Tai Yuan, the majority language of Nan Province. Moreover, the younger generation can also speak Standard Thai very well.

Mal has been reconstructed as a non-tonal language (Filbeck 1978). However, the Mal spoken in Ta Luang Village in the Pua District of Nan Province (Ta Luang Mal) is becoming a tonal language due to contact with Tai Yuan. L-Thongkum and Intajamornrak (2009) found that the Mal spoken in Yot Doi Wattana Village has already become a tonal language with two tones: a high tone and a low tone. The Ta Luang variety has two pitches which can distinguish word meaning: a high pitch and a low pitch. The high pitch can vary with regard to syllable structures and intonation. In the examples given below, low pitch is indicated with a grave accent, while high pitch is left unmarked.

kàan	'job'	kaan	'defeated'
sòt	'to hunt'	sòt	'sticky'
càaŋ	'able'	caan	'to hire'

On the other hand, the Mal spoken in Kwet Village, Chiang Klang District, does not have contrastive tones or pitches. Consequently, it can be broadly said that varieties of Mal can be classified into three groups: non-tonal, incipient-tonal, and tonal.

Contact with Tai Yuan, the majority language of Nan Province, has been identified as a factor in certain varieties of Mal becoming tonal languages (L-Thongkum and Intajamornrak 2009). Language contact is a natural linguistic phenomenon occurring in any setting with bilingual or multilingual speakers. When

multilinguals speak, their languages tend to influence each other, and this language contact situation leads to language variation and change (Prasithratsint 2002: 92).

Tai Yuan has six tones, while Ta Luang Mal has only two pitches. Thus, it is worth investigating what happens to the tone system and acoustic characteristics of the six Tai Yuan tones when they are produced by Mal speakers. This paper studies the fundamental frequencies of the Tai Yuan tones as spoken by Ta Luang Mal and compares their acoustic characteristics with the Tai Yuan tones of native Tai Yuan speakers.

Method

The informants were six females aged between 25 and 40. Three of them were Ta Luang Mal speakers, and the other three were native Tai Yuan speakers living in Pua District.

The informants were asked to pronounce each test-word three times randomly, with a three-to-five second break between each word. The total number of test tokens was 180, or 30 test tokens for each informant. The data was recorded directly on a notebook computer using Adobe Audition, version 2. The fundamental frequencies were measured at 0%, 25%, 50%, 75%, and 100% of normalized duration³ using Praat, version 4.5.24.⁴

The wordlist consisting of the six tones of Tai Yuan (L-Thongkum et al. 2007b) is shown below.

³ The duration in real time is shown in the appendix.

⁴ Visit www.praat.org for more information on how to use the program.

Syllable structure	Tones (T)	Tai Yuan ⁵	Gloss
Non-checked syllable	T1	kaa	‘crow’
	T2	?aa	‘uncle’
	T3	paa	‘forest’
	T4	kaa	‘valuable’
	T5	paa	‘aunt’
	T6	kaa	‘merchandise’
Checked syllable	T2	pak	‘to plunge down’
	T3	paak	‘mouth’
	T4	kaap	‘to hold between lips’
	T5	kap	‘tight’

Results

The fundamental frequencies of the Tai Yuan tones were divided into two groups, non-checked syllables and checked syllables, as shown in tables 1, 2, 3, and 4 and figures 1, 2, 3, and 4.

Non-checked syllables

Table 1 shows that the fundamental frequencies of the Tai Yuan tones in non-checked syllables as spoken by native Tai Yuan speakers lay between 184.03 and 299.60 Hz, a range of 115.57 Hz (maximum Hz minus minimum Hz).⁶ Classified by pitch contour, the differences between the highest and lowest fundamental frequencies (F0 differentials) of the four contour tones (T1, T2, T4, and T6) were 76.03, 74.55, 56.47 and 82.46 Hz respectively, while the F0 differentials for the level tones (T3 and T5) were 22.30 and 18.27 Hz.

Figure 1 clearly reveals the six tones of Tai Yuan: 1) low-rising, 2) mid-rising, 3) mid-level, 4) mid-falling, 5) high-level and 6) high-falling.

There are four contour tones: low-rising (T1), mid-rising (T2), mid-falling (T4), and high-falling (T6). The low-rising tone (T1) begins at a low pitch and then rises sharply to a high point. The mid-rising (T2) has the same general contour as the low-rising (T1) but lies in a different vocal range. It starts from a mid-point and then rises to the highest point of the scale. The mid-falling (T4) begins at a mid-point and then falls to a low pitch, while the high-falling (T6) starts at a high pitch and then rises before falling sharply at the end.

For the level tones, the mid-level (T3) begins at mid pitch and then falls slightly over the first 75% of the duration. The high-level (T5) has a contour similar to the mid-level (T3), but it starts at a higher pitch and falls slightly at the end.

⁵ The tone marking will be given when the fundamental frequencies are analyzed.

⁶ The pitch range of each individual speaker is shown in the appendix.

Table 1 Mean Fundamental Frequencies (Hz) of Tai Yuan Tones in Non-Checked Syllables as Spoken by Three Native Tai Yuan Speakers

Tone	F0				
	0%	25%	50%	75%	100%
T1	204.62	192.09	193.75	212.67	268.12
S.D.	27.72	23.45	25.93	34.44	42.78
T2	225.05	226.93	230.09	249.62	299.60
S.D.	21.24	20.15	19.30	22.97	30.06
T3	234.21	224.43	218.99	211.91	212.34
S.D.	26.13	26.70	26.89	26.94	23.01
T4	240.50	233.42	227.18	209.58	184.03
S.D.	31.55	29.17	35.28	43.19	29.87
T5	248.70	247.97	245.43	240.15	230.43
S.D.	29.04	25.86	27.82	29.55	38.31
T6	260.12	279.29	280.23	231.24	197.77
S.D.	27.72	34.91	38.97	35.02	17.28

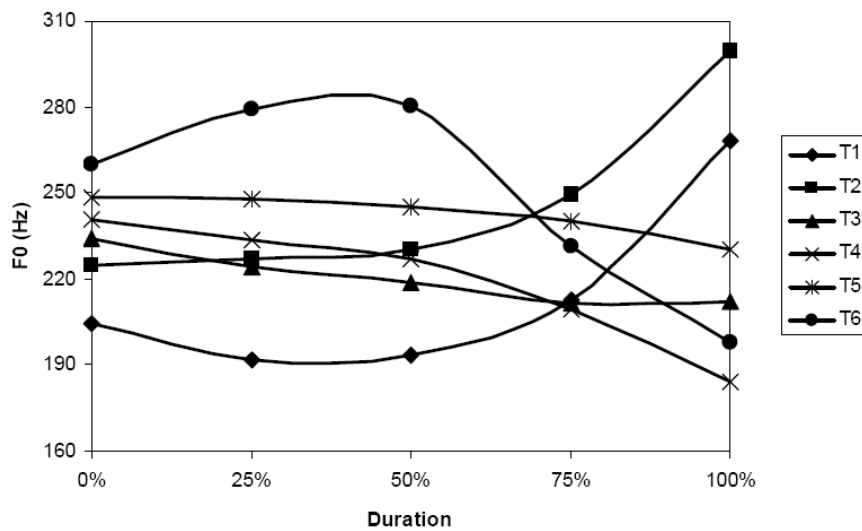


Figure 1 Mean fundamental frequencies (Hz) of Tai Yuan tones in non-checked syllables as spoken by three Tai Yuan native speakers

Table 2 shows that the fundamental frequencies of the Tai Yuan tones in non-checked syllable as spoken by the Ta Luang Mal speakers lay between 197.97 and 304.47 Hz, a range of 106.5 Hz (maximum Hz minus minimum Hz). The F0 differential in T4 was only 9.66 Hz. It could thus be placed in the same group as the two level tones (T3 and T5), with F0

differentials of 8.39 and 21.87 Hz, respectively.

The F0 differentials of the contour tones (T1, T2, and T6) were 84.08, 66.64, and 67.07 Hz, respectively.

Table 2 Mean Fundamental Frequencies (Hz) of Tai Yuan Tones in Non-Checked Syllables as Spoken by Three Ta Luang Mal Speakers

Tone	F0				
	0%	25%	50%	75%	100%
T1	214.11	210.27	216.60	242.83	294.35
S.D.	19.42	14.25	15.51	17.03	21.23
T2	237.83	254.06	264.07	279.37	304.47
S.D.	37.45	22.72	19.39	14.28	12.39
T3	223.77	219.72	216.46	215.38	222.61
S.D.	21.14	12.54	11.77	14.46	15.46
T4	223.94	220.66	216.37	214.28	220.58
S.D.	12.72	11.34	13.55	14.46	16.97
T5	243.53	250.61	247.65	245.85	228.74
S.D.	15.41	8.74	13.66	16.27	22.38
T6	250.55	265.04	262.19	238.33	197.97
S.D.	17.65	19.00	15.87	21.23	11.40

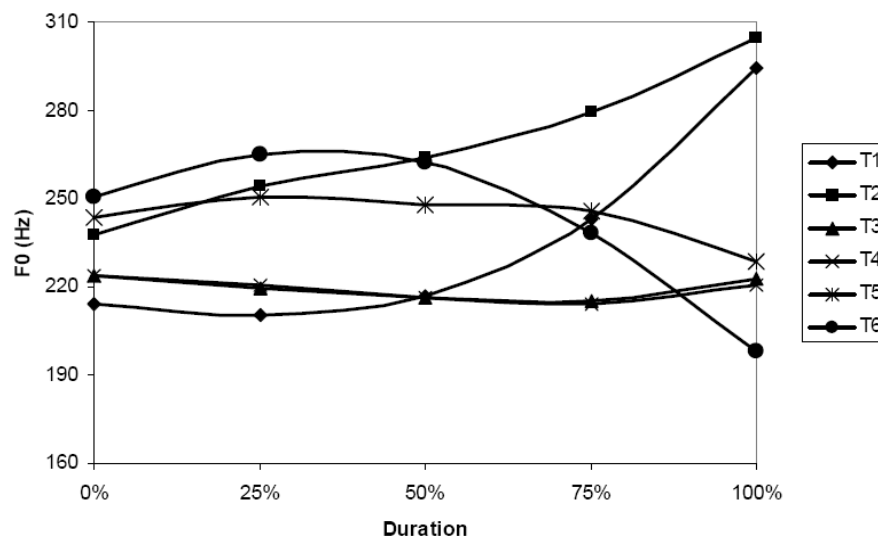


Figure 2 Mean fundamental frequencies (Hz) of Tai Yuan tones in non-checked syllables as spoken by three Ta Luang Mal speakers

Figure 2 shows that the mid-falling tone (T4) has merged with the mid-level tone (T3). As spoken by Ta Luang Mal speakers, the six Tai Yuan tones have become five tones: three contour tones and two level tones. The three contour tones

consist of low-rising (T1), mid-rising (T2), and high-falling (T6). The low-rising tone (T1) begins at a low pitch and then rises sharply to a high point. The mid-rising (T2) has a similar shape, but the contour is less extreme. It starts from a mid-range

pitch and then rises to the highest point on the scale. The high-falling tone (T6) starts at a mid/high pitch⁷ and then rises slightly before sharply falling to a low pitch.

For the level tones, the mid-level (T3), which is a merger of the mid-falling (T4) and mid-level tones (T3), begins at a mid/low pitch,⁸ falls slightly, and then rises slightly again beginning at 75% of the duration. The high-level tone (T5) starts at a mid-range pitch and stays level until it falls slightly during the last 25% of the duration.

It can be noticeable that Mal speakers tend to divide the six tones into 2 groups, especially during 0%-75% of the duration.

Checked syllables

Table 3 shows that the fundamental frequencies of the Tai Yuan tones in checked syllables as spoken by native Tai Yuan speakers lay between 168.77 and 303.34 Hz. The F0 differentials of the contour tones (T2 and T4) were 63.61 and

40.25 Hz respectively, and the F0 differentials of the level tones (T3 and T5) were 15.94 and 12.40 Hz.

In figure 3, the fundamental frequencies of the Tai Yuan tones in checked syllables spoken by native Tai Yuan speakers represent variants of the tones in non-checked syllables, but they differ slightly in their contours. Four tones appear in checked syllables, namely, mid-rising (T2), mid-level (T3), mid-falling (T4), and high-level (T5).

Table 4 shows that the fundamental frequencies of the Tai Yuan tones in checked syllables as spoken by Ta Luang Mal speakers lay between 216.35 and 269.32 Hz. The F0 differentials of contour tones (T2 and T4) were only 26.21 and 21.58 Hz respectively, and the F0 differentials of level tones (T3 and T5) were 7.28 and 5.08 Hz.

Table 3 Mean Fundamental Frequencies (Hz) of Tai Yuan Tones in Checked Syllables as Spoken by Three Native Tai Yuan Speakers

Tone	F0				
	0%	25%	50%	75%	100%
T2	239.73	239.75	254.13	273.49	303.34
S.D.	15.13	16.06	10.83	12.78	11.55
T3	203.62	202.15	197.71	193.25	187.68
S.D.	14.87	17.01	14.53	12.86	14.58
T4	209.02	205.99	200.80	186.86	168.77
S.D.	17.26	13.18	14.58	12.83	12.34
T5	243.17	239.37	238.17	231.41	230.77
S.D.	14.90	11.20	10.23	11.17	11.57

⁷ The mid/high pitch means a mid pitch with gets close to the high pitch.

⁸ The mid/low pitch means a mid pitch with gets close to the low pitch.

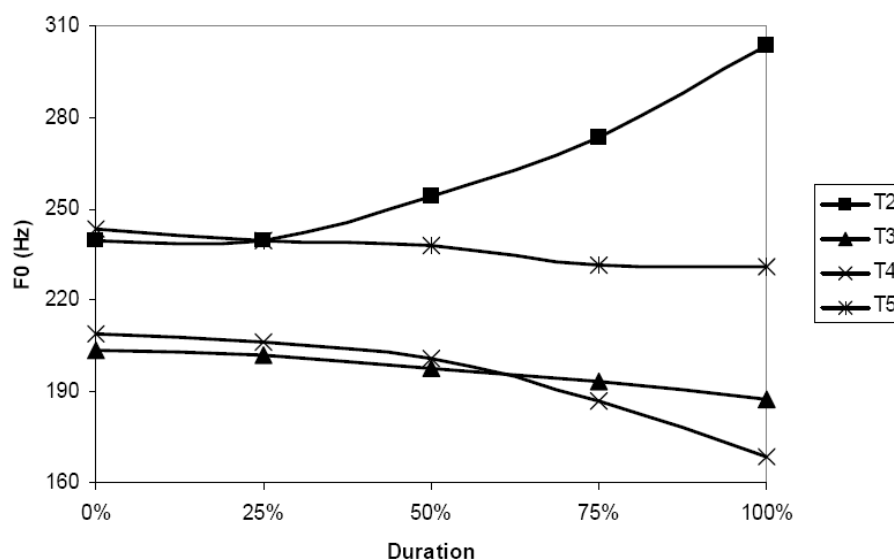


Figure 3 Mean fundamental frequencies (Hz) of Tai Yuan tones in checked syllables as spoken by three native Tai Yuan speakers

Table 4 Mean Fundamental Frequencies (Hz) of Tai Yuan Tones in Checked Syllables as Spoken by Three Ta Luang Mal speakers

Tone	F0				
	0%	25%	50%	75%	100%
T2	240.27	245.50	255.35	263.83	266.39
S.D.	15.12	16.09	19.22	23.62	27.40
T3	223.63	221.88	220.39	220.46	216.35
S.D.	19.48	16.16	13.94	15.58	14.51
T4	244.77	231.76	225.30	223.83	223.19
S.D.	26.88	17.62	15.64	14.98	16.60
T5	268.38	264.24	266.08	269.32	268.97
S.D.	9.38	14.35	19.01	23.33	28.43

In figure 4, the fundamental frequencies of the Tai Yuan tones in checked syllables spoken by Ta Luang Mal speakers show that there are four tones, which are said to be variants of the tones in non-checked syllables. T2 and T4, which are contour tones, evince less extreme contours than T2 and T4 in non-checked syllables. This means that the pitch range is very narrow.

The fundamental frequencies of the Tai Yuan tones spoken by the Ta Luang Mal and the native Tai Yuan speakers have been converted into semitones⁹ and are compared in figures 5, 6, and 7.

⁹ Semitones = $1/\log(2) \times 12 \times \log(\text{Hz to be translated} / \text{Hz reference level})$

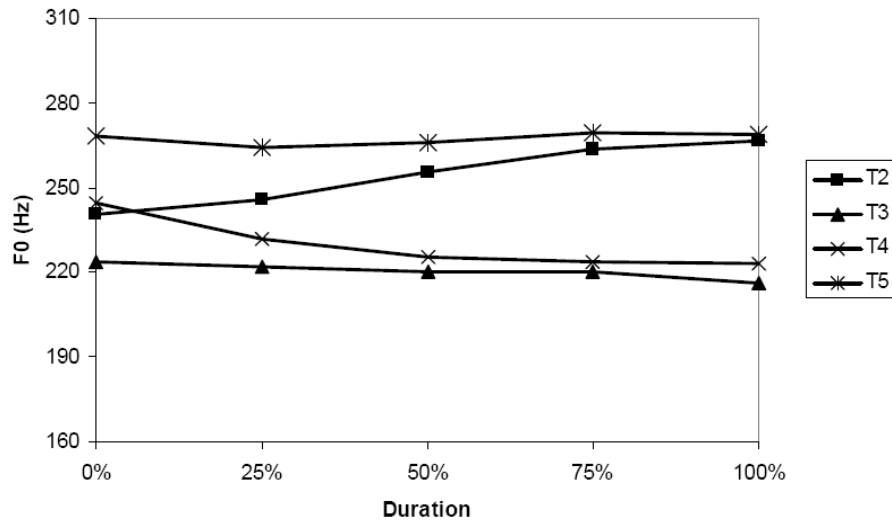


Figure 4 Mean fundamental frequencies (Hz) of Tai Yuan tones in checked syllables as spoken by three Ta Luang Mal speakers

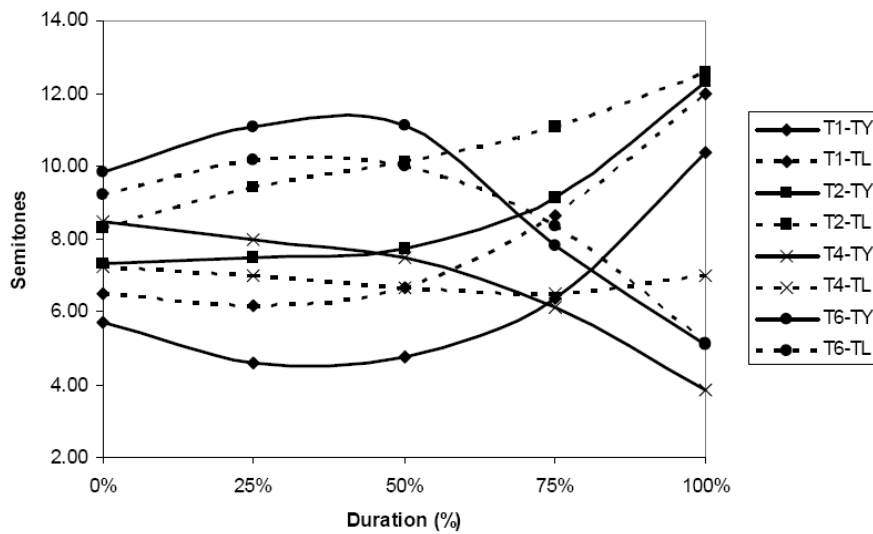


Figure 5 Mean fundamental frequencies of contour tones in non-checked syllables as spoken by native Tai Yuan speakers (TY) and Ta Luang Mal speakers (TL)

Figure 5 shows the differences in pitch height and pitch contour of the contour tones spoken by the two groups of speakers. It clearly shows that the pitch range of the Ta Luang Mal speakers is narrower than that of the native speakers.

The F0 of T1 and T2 as spoken by Ta Luang Mal speakers is higher than that of the native Tai Yuan speakers, while the F0 of T4 and T6 as spoken by the Ta Luang Mal speakers is lower than their native counterparts. It should be emphasized that

the fundamental frequency of the mid-falling tone (T4) as spoken by Ta Luang Mal speakers differs in contour from that of native Tai Yuan speakers because it has become a level tone with the same shape as the mid-level tone (T3). Additionally, the high-falling tone (T6) as spoken by Ta Luang Mal tends to show less contour especially in the first 60% of the duration.

The fundamental frequencies of the level tones spoken by the two groups of speakers are quite similar in terms of both pitch and contour. However, the level tones as spoken by Ta Luang Mal speakers tend to converge during the last 25% of the duration (see figure 6).

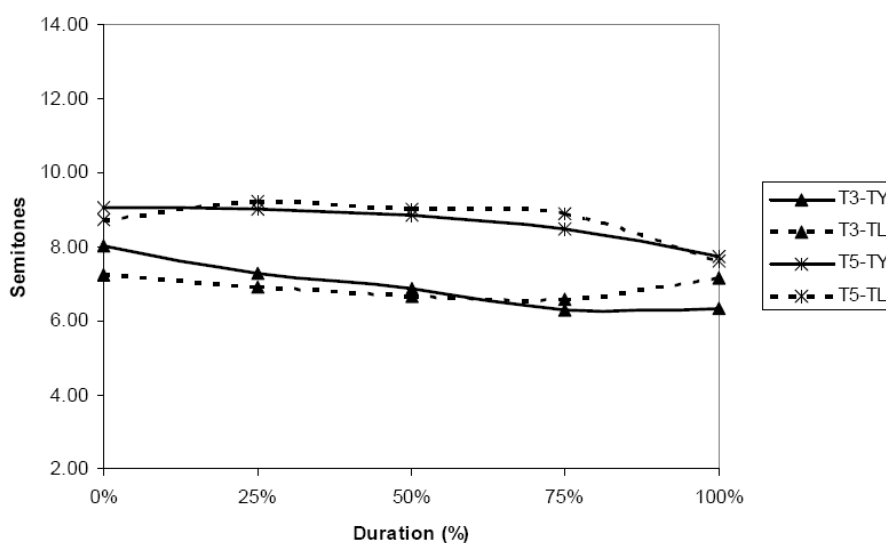


Figure 6 Mean fundamental frequencies of level tones in non-checked syllables as spoken by native Tai Yuan speakers (TY) and Ta Luang Mal speakers (TL)

Figure 7 compares the Tai Yuan tones in checked syllables. Here again, the range of F0 in checked syllables as spoken by native Tai Yuan speakers is wider than its counterpart as produced by the Ta Luang Mal speakers, especially in the contour tones, the mid-rising (T2) and mid-falling (T4), which rise and fall sharply.

Moreover, the acoustic characteristic of the mid-rising tone (T2) suggests that it may be affected by syllable structure. Ta Luang Mal lexical pitch varies according to syllable structure, e.g., high-falling in non-checked syllables and level in checked syllables (Intajamornrak 2008). Therefore, when Mal

speakers produce the mid-rising tone in checked syllables, it shows less contour than it has in non-checked syllables.

Conclusion and discussion

The fundamental frequencies of the Tai Yuan tones spoken by Mal speakers in Ta Luang Village, Pa Klang Sub-District, Pua District, Nan Province, differ from the Tai Yuan tones spoken by native Tai Yuan speakers in terms of the number of tones, pitch, and contour.

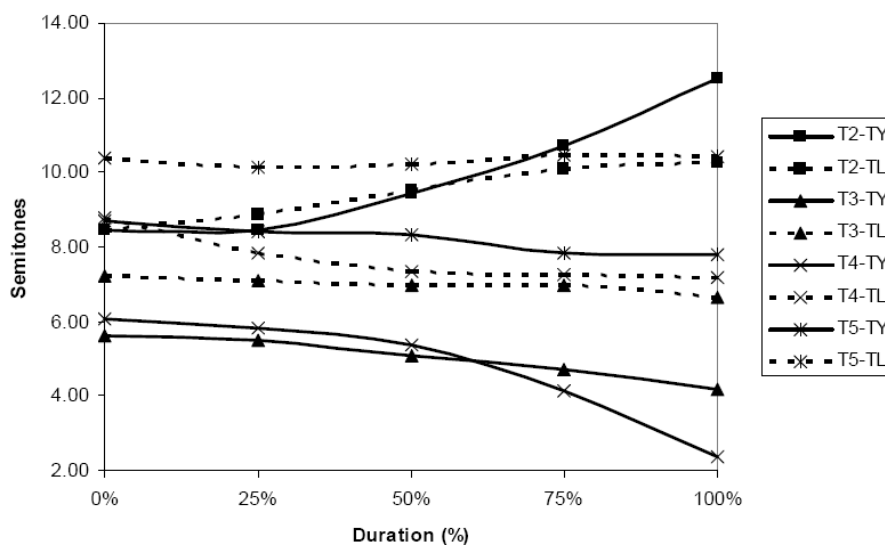


Figure 7 Mean fundamental frequencies of tones in checked syllables as spoken by native Tai Yuan speakers (TY) and Ta Luang Mal speakers (TL)

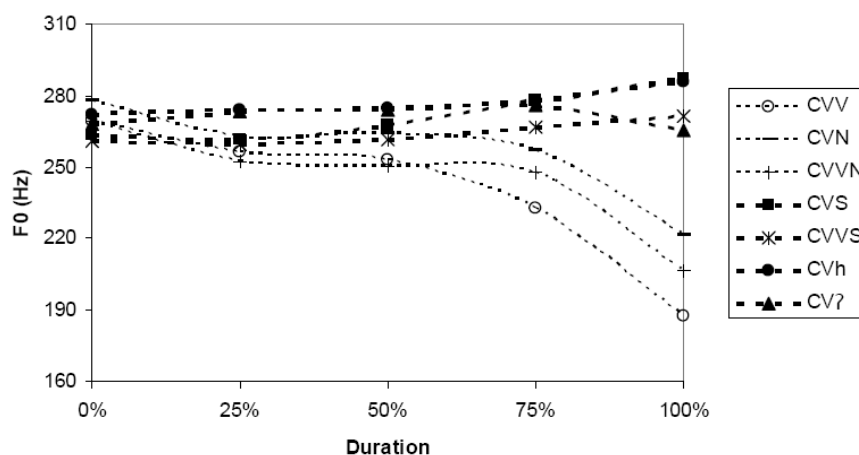


Figure 8 Mean fundamental frequencies of native Mal words with seven types of syllable structures as spoken by three Ta Luang Mal speakers

The six tones of Tai Yuan become five tones when produced by Ta Luang Mal speakers because of the merger of the mid-level (T3) and mid-falling tone (T4). This is clearly evident in non-checked syllables, and it appears in all speakers. The merger can be explained by the contour of these

two tones since the difference between the highest and the lowest frequency of the mid-falling tone (T4) is narrow. The mid-level (T3) starts at a mid pitch and stays level until the end of its duration while the mid-falling (T4) starts from a mid-range pitch and then falls slightly to a low pitch.

The flexion point (that is, the point at which the pitch starts to change its contour) of the mid-falling (T4) comes at 50% of the duration. It may be difficult for the Mal to distinguish these two tones. As a result, they pronounce them at the same pitch and with the same contour. In contrast, the high-falling tone (T5) shows much greater change. It starts at a high pitch and rises before falling sharply to a low pitch. For its part, the high-level tone (T6) starts at a high point and levels off

until the end of duration. The two tones are easily distinguished, so the high-falling (T5) and high-level tones (T6) haven't merged.

The acoustic characteristics of the Tai Yuan tones spoken by native Tai Yuan speakers and Ta Luang Mal speakers who speak Tai Yuan as a second language are shown in table 5.

Table 5 The Acoustic Characteristics of Tai Yuan Tones as Spoken by Native Tai Yuan Speakers and Ta Luang Mal Speakers Who Speak Tai Yuan as a Second Language

Tones	Tai Yuan tones			
	Spoken by native Tai Yuan speakers		Spoken by Ta Luang Mal speakers speaking Tai Yuan as a second language	
T1	Low-rising	24	Low/mid-rising	2 ⁺ 5 ¹⁰
T2	Mid-rising	35	Mid/high-rising	3 ⁺ 5
T3	Mid-level	33	Mid-level	33
T4	Mid-falling	31	Mid-level	33
T5	High-level	44	High-level	443
T6	High-falling	452	High-falling	42

As is shown in table 5, T1 and T2 as spoken by Ta Luang Mal speakers start at a higher pitch (2⁺ and 3⁺), and both tones end at the highest pitch.¹⁰

in pitch and contour show that the range for F0 of Tai Yuan tones as spoken by Mal speakers is narrower than that of native Tai Yuan speakers.

With regard to contour, the tones as spoken by Ta Luang Mal speakers do not evince abrupt falls or rises. Therefore, the shape of their contour tones (e.g., T2 or T6) is flat compared to those spoken by native speakers. The mid-falling tone (T4) becomes mid-level, as can be clearly seen in non-checked syllables. The differences

Ta Luang Mal is becoming a tonal language with two pitches: high and low. The fundamental frequencies of both native Ta Luang Mal words and loan words suggest two groups of pitch patterns, that is, high and low. The high group has two variants according to syllable structure: [high-level] in checked syllable and [high-falling] in non-checked syllable; the low group is phonetically low-rising and has no variants (Intajamornrak 2008).

¹⁰ When using the five-scale tone system, the symbol “+” means a higher pitch. For example, “2⁺” indicates a pitch of the second level that is approaching the third level.

Intajamornrak (2008) also explained that the loan words having T1, T3, and T4 in Tai Yuan appear in Mal with a low pitch, while loan words having T2, T5, and T6 in Tai Yuan have a high pitch in Mal.¹² Therefore, Mal speakers may be perceiving pitch height rather than contour. Gandour (1983) studied the perception of tones by speakers of tone languages namely Mandarin, Cantonese, Taiwanese, Thai, and also a non-tonal language, English. His results showed that English speakers pay more attention to pitch height than speakers of tone languages did. He claimed that English does not have contrastive tones, so English speakers focused their attention on the pitch of the fundamental frequencies. Perhaps, this finding could be confirmed by a perception test.

As a result, when the Mal speakers produce Tai Yuan with its six tones, their production does not exactly match the native speakers', especially with respect to contour tones. The fundamental frequencies indicate that Mal speakers tend to divide the six tones into 2 groups, even though the mid-falling and mid-level have merged (see Figure 2).

It can be concluded that Tai Yuan tones of the Ta Luang Mal speakers are affected by the native language, Mal. The differences in number of tones or pitches as well as the acoustic characteristics of tones or pitches influence how non-tonal speakers produce a tonal language. Moreover, the fundamental frequencies of the Tai Yuan tones spoken by the Mal in Ta Luang Village show that they can be distinguished into two groups: high and low. The high group consists of the mid-

rising (T2), high-level (T5) and high-falling (T6), and the low group includes the low-rising (T1), mid-level (T3), and mid-falling (T4). This classification reflects the way in which Mal speakers classify Tai Yuan tones to suit their own native pitch patterns, which are high and low.

However, it would be interesting to study the fundamental frequencies of Tai Yuan tones spoken by the younger generation of Mal further because they go to school and speak Tai Yuan on a daily basis with friends who are Mien, Hmong, and native Tai Yuan. Moreover, they can speak Standard Thai very well compared to the older generation, which speaks Standard Thai only occasionally.

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¹² See the acoustic characteristics of Tai Yuan loanwords in the appendix.

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Appendix

The pitch range, average pitch, and pitch differential for each speaker

	Pitch range	Average pitch	Δf
TL 1	200.17 – 329.43	257.27	129.26
TL 2	183.12 – 324.04	238.43	140.92
TL 3	183.55 – 302.66	223.89	119.11
3 Speakers		239.86	129.76










	Pitch range	Average pitch	Δf
TY 1	147.25 – 323.35	212.83	176.10
TY 2	154.51 – 323.17	230.87	168.66
TY 3	199.30 – 336.66	259.51	137.36
3 Speakers		234.40	160.71

Real-time duration and average duration for each speaker

	Duration			
	TL 1	TL 2	TL 3	Average
CVV	541.30	388.88	360.94	430.37
CVVS	385.03	322.48	301.17	336.23
CVS	167.96	98.72	120.27	128.97

	Duration			
	TY 1	TY 2	TY 3	Average
CVV	482.15	457.91	423.43	454.50
CVVS	305.24	380.74	345.35	343.78
CVS	149.90	166.87	162.74	159.83

Acoustic characteristics of Tai Yuan loanwords as spoken by Ta Luang Mal speakers when they speak Mal

Loan-word tone	Non-checked syllable	Checked syllable
T1		
T2		
T3		
T4		
T5		
T6	