Production of Bangkok Thai Tones
by Native Speakers of Burmese and Urdu[1]

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Abstract

This study aims to analyze and compare acoustic characteristics of Thai tones produced by native Burmese and native Urdu speakers with those produced by a native Thai speaker. The data were collected from five monosyllabic words in citation form. The Praat Program was employed for analysis in order to examine the fundamental frequency and the F0 range. The analyzed data were then compared with a *t*-test. The results revealed that the mid, low, falling, and rising tones produced by the native Burmese and native Urdu speakers were not significantly different. The only exception was the high tone. Moreover, when comparing the F0 value, all tones produced by the native Burmese and native Urdu speakers were similar to those of the native Thai speaker with the exception of the mid tone. In addition, the findings of F0 ranges indicate that all of the tones produced by the native Urdu speakers had the widest range, followed by those produced by the native Burmese and the native Thai speaker respectively. The results show that regardless of whether one's native language is tonal (Burmese speakers) or non-tonal (Urdu speakers); this is not a factor in determining how well they will be able to produce Thai tones correctly.

Keywords: tone language, non-tone language, Bangkok Thai tones, fundamental frequency, F0 range

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บทคัดย่อ

   งานวิจัยนี้มีวัตถุประสงค์เพื่อวิเคราะห์และเปรียบเทียบลักษณะทางกลสัทศาสตร์ของเสียงวรรณยุกต์ภาษาไทยกรุงเทพฯ ที่ออกเสียงโดยผู้พูดภาษาพม่าและภาษาอูรดูกับผลการออกเสียงวรรณยุกต์ของคนไทย คำทดสอบคือคำพูดเดี่ยวพยางค์เดียวจำนวน 5 คำ ผู้วิจัยวิเคราะห์ค่าความถี่มูลฐานและพิสัยค่าความถี่มูลฐานของเสียงวรรณยุกต์ด้วยโปรแกรมพราท จากนั้น จึงเปรียบเทียบผลการวิเคราะห์ทางกลสัทศาสตร์นี้ด้วยสถิติทดสอบที (*t*-test) ผลการศึกษาพบว่า ค่าความถี่มูลฐานของเสียงวรรณยุกต์สามัญ เอก โท และจัตวาที่ออกเสียงโดยผู้พูดภาษาพม่าและผู้พูดภาษาอูรดูแตกต่างกันอย่างไม่มีนัยสำคัญ ยกเว้นวรรณยุกต์ตรี และเมื่อเปรียบเทียบค่าความถี่มูลฐานของเสียงวรรณยุกต์ที่ออกเสียงโดยกลุ่มตัวอย่างทุกกลุ่ม ผู้วิจัยพบว่า เสียงวรรณยุกต์ส่วนใหญ่ที่ออกเสียงโดยผู้พูดภาษาพม่าและผู้พูดภาษาอูรดูมีสัทลักษณะใกล้เคียงกับเสียงวรรณยุกต์ที่ออกเสียงโดยผู้พูดไทย ยกเว้นเสียงวรรณยุกต์สามัญ ที่แตกต่างอย่างมีนัยสำคัญ นอกจากนี้ ผลการวิเคราะห์พิสัยค่าความถี่มูลฐานแสดงให้เห็นว่า เสียงวรรณยุกต์ทุกเสียงที่ออกเสียงโดยผู้พูดภาษาอูรดูมีพิสัยกว้างที่สุด รองลงมา คือ พิสัยของวรรณยุกต์ที่ออกเสียงโดยผู้พูดภาษาพม่าและผู้พูดไทยตามลำดับ ผลการวิจัยแสดงให้เห็นว่า ระบบเสียงวรรณยุกต์ในภาษาแม่ไม่ส่งผลให้คนที่พูดภาษาพม่าออกเสียงวรรณยุกต์ภาษาไทยดีกว่าคนที่พูดภาษาอูรดูซึ่งไม่มีระบบเสียงวรรณยุกต์

คำสำคัญ: ภาษาที่มีระบบเสียงวรรณยุกต์ ภาษาที่ไม่มีระบบเสียงวรรณยุกต์ วรรณยุกต์ภาษาไทยกรุงเทพฯ ค่าความถี่มูลฐาน พิสัยค่าความถี่มูลฐาน

1. Introduction

Phonologically, all spoken languages can be divided into tone languages and non-tone languages. Yip (2007: 229) explains that a language is a tone language if the pitch of a word can change the meaning of the word. Around 70% of the world's languages are tonal. They are spoken by huge numbers of people, and in geographically diverse locations – Mandarin Chinese (885 million speakers), Yoruba (20 million), and Swedish (9 million) are all tonal. There are certain areas of the world where almost all the languages are tonal, such as sub-Saharan Africa, China, and Central America.

Tone acquisition has been a current trend in second language acquisition research, especially in a cross-linguistic perspective. Many linguists have investigated tones acquired by two groups of non-native speakers, one from a tone language and the other from a non-tone language. However, there is still controversy about which groups of speakers can perceive tones better when learning a tone language.

Francis et al. (2008) states that there are three hypotheses proposed to explain this situation. The first is the so-called 'level of representation'. This hypothesis explains that speakers of non-tone languages are unable to perceive tones of tone languages because they do not use prosodic properties such as F0 to convey meaning in their language (cited in Wayland & Guion, 2004).

The second hypothesis is called 'categories assimilation'. This hypothesis proposes that speakers perceive tones of tone languages by mapping with prosodic category in their own native language. Namely, tone language speakers process foreign lexical tone with reference to their native tone categories. In contrast, non-tone speakers perceive tone by mapping with their native intonational categories. (cited in Halle et al., 2004)

The last hypothesis explains that those that have a tonal native language do not have an advantage when it comes to learning a second tonal language, in comparison with those whose native language is non-tonal. Despite the fact that native tone language speakers were familiar with

lexical tones from their native language, the acoustic features used to define tones in their native language are not similar to those in other tonal languages. (cited in Wang et al., 2004).

Thai is a tone language. The majority of Thailand's population of seventy million people speaks Thai as their native language. Many Thai and non-Thai linguists have investigated Thai tone production; both in citation form (Abramson, 1962; Erickson, 1974) and in connected speech (Tingsabadh & Deeprasert, 1997). Moreover, in recent years, Thai tones acquired by foreign speakers have sparked the interests of linguists (Juwarahawong, 2000; Wayland & Guion, 2004; Nguyen, 2006; Zinck, 2007; Sinthawashewa, 2009; Kittisurakosol, 2012; Piasuwan, 2014).

This paper is an analysis of the Thai tones spoken by two groups of speakers; namely, Burmese[3] and Urdu[4]. There are four reasons why these two groups are significant. First, they learned Thai by their exposure to Thai speakers. They did not attend Thai language courses like informants in previous studies. (for instance Nguyen, 2006; Zinck, 2007; Sinthawashewa, 2009; Kittisurakosol, 2012) nor were they trained by Thai speakers (for instance Wayland & Guion, 2004). Second, despite the fact that there is a large number of native Burmese and native Urdu speakers[5] working in Thailand, especially in Bangkok, there has been no prior research related to their acquisition of the Thai language. Third, the Burmese and Urdu live in the same location of each other which is in the Bangkapi District in Bangkok. And the last reason is that the Burmese and

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[3] Burmese is the official language of Myanmar, a nation situated between the Tibetan plateau and the Malay Peninsula and sharing borders with Bangladesh and India to the north-west, with China to the north-east and with Thailand to the south-east (Wheatley, 1990: 834).

[4] Urdu, a language closely related to Hindi, is spoken by twenty-three million people in India and approximately eight million people in Pakistan as a mother tongue. It is the official language of Pakistan and the state language of the state of Jammu and Kashmir in India (Kachru, 1990: 470).

[5] In 2015, UNHCR-Thailand (2015) declared that the number of refugees, asylum-seekers and stateless people of more than 40 nationalities are living in Thailand, especially in Bangkok. A large number of this population are Burmese (72,900 came in January 2015 and 53,600 in December 2015) and Pakistani (400 in January 2015 and 700 in December 2015) Moreover, Ali (2014) claims that there are 10,000 registered Pakistani asylum seekers, a majority of them Christians and the remaining mostly Ahmaids and Shias.

Urdu have different sound systems in their native languages; namely, Burmese has a tonal system, but this same system does not exist in Urdu.

This study was conducted to analyze and compare acoustic characteristics of these two groups. The analyzed data were then compared with those produced by a native Thai speaker to show who produced better Thai tones.

2. Method

The acoustic analysis of Thai tones produced by these two groups, tone language speakers (Burmese) and non-tone language speakers (Urdu) included fundamental frequency and F0 range.

2.1 Subjects

The subjects consist of three groups: four male Burmese speakers, four male Urdu speakers and one native Thai speaker. The native Burmese and native

Urdu speakers are between twenty to fifty[6] years old. All of them cannot speak English and never attended Thai language courses. The length of residence in Bangkok is a minimum of 2 years. Table 1 illustrates the language backgrounds of these foreign speakers. The native Thai speaker is a forty-year-old educated man. He was born and raised in Bangkok with native Bangkok parents.

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[6] Due to the fact that many Burmese and Urdu immigrants are reclusive because of a questionable legal situation here in Thailand, I could find only eight willing subjects which prevented me from controlling a range of subject ages.

Table 1 *Language Background of the 4 native speakers of Burmese and 4 native speakers of Urdu*

	Speakers							
	B1	B2	B3	B4	U1	U2	U3	U4
Age of first exposure	25	21	20	19	27	17	17	25
Testing age	33	49	22	21	29	20	20	45
Residence in Thailand	15 yrs.	28 yrs.	2yrs.	2yrs.	2yrs.	3yrs.	3yrs.	20 yrs.
Average use of Thai	21hrs./ wk.	7hrs./ wk.	3.5hrs. /wk.	3.5hrs. /wk.	3.5hrs. /wk.	14hrs./ wk.	17.5hr s/wk.	3.5hrs. /wk.

yrs. = years   hrs. = hours   wk. = week

2.2 Language data

The tokens are five monosyllabic words; all begin with a voiceless aspirated velar plosive consonant /kʰ/ and contain the long low front vowel /aː/. Additionally, the words are open-syllable with CV structure. Table 2 shows the words carrying five Thai tones - Mid, Low, Falling, High, and Rising respectively.

Table 2 *Tokens in citation form (adapted from Gandour, 1975)*

Word list	
[kʰaː]	'be stuck'
[kʰàː]	'a kind of spice'
[kʰâː]	'to kill'
[kʰáː]	'to engage in trade'
[kʰǎː]	'leg'

2.3 Recording procedure

Depending on the availability of the subjects, recordings were made in a quiet place in the speaker's place of residence. To obtain the data, pictures were shown to the native Burmese and Urdu speakers one at a time and they were asked to say the corresponding word. Burmese and Urdu meanings below the pictures were important to remind them of Thai words. The native Thai speaker was simply asked to read the word list. All speakers repeated each word three times at a moderate speech rate.

2.4 Data analysis

During the analysis session, the words produced the second time from 3 times, were drawn from the sound files as the best tokens. The number of total test tokens was 135 (nine informants x five tokens x three times). Praat speech analysis software v.5356 was employed for examining acoustic characteristics of tones. In addition, Microsoft Excel 2010 and SPSS for Windows v.21 (*t*-test) were used in this study for statistical analysis.

In the procedure of F0[7] measurement, maximum and minimum pitches were examined to illustrate F0 range. The next step was normalization; time accompanied with F0 value was drawn from the Praat program and pasted on Microsoft Excel for evaluating duration and F0 value into 11 points.

Due to the fact that pitch ranges are varied by factors such as gender, age, and the ethnicity of speakers, tones produced by various groups of speakers resulted in different pitch span when plotted on a Hertz scale. Nolan (2007) proposed a psycho-acoustic scale like 'semitone' as

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[7] Since this paper is focused on tone analysis, fundamental frequency (F0) is the main concern. F0 is a physical property of tone (in the case of the number of glottal pulses in a second); tones achieved through changes of the F0 are the most important.

an available alternative. The method of converting Hertz into semitone, following Jitwiriyanont (2012), was employed for this study because the native Burmese and native Urdu speakers were varied by age, 20 – 50 years.

3. Result

3.1 Fundamental frequency

Figure 1 - 3 are the overall averages of the Thai tones produced by the native speakers of Thai, Burmese and Urdu. To understand F0 shapes of Thai tones produced by the Burmese and Urdu groups, Figure 2 and 3 should be compared with those produced by the native Thai speaker in Figure 1.
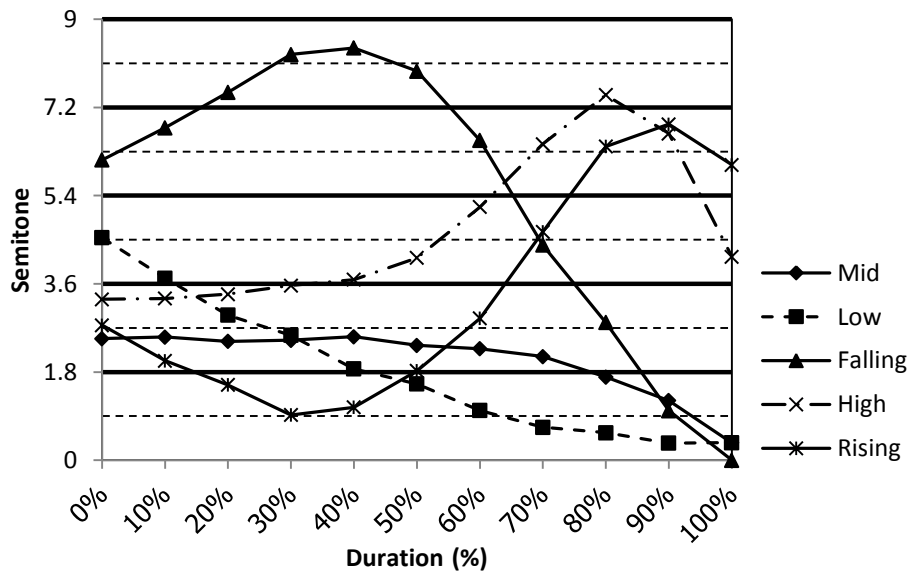
Figure 1 Thai tones (in semitone) produced by the native speakers of Thai
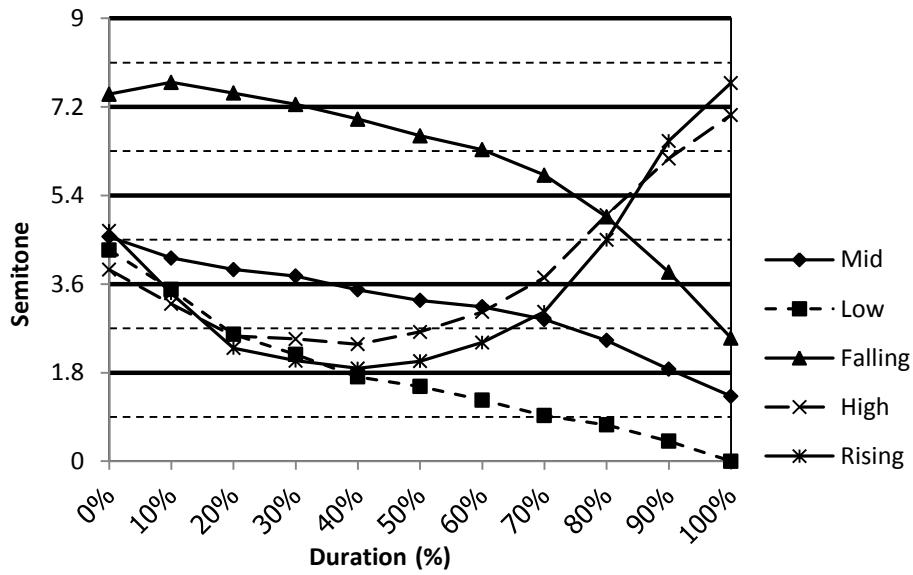
Figure 2 *Thai tones (in semitone) produced by the native speakers of Burmese*
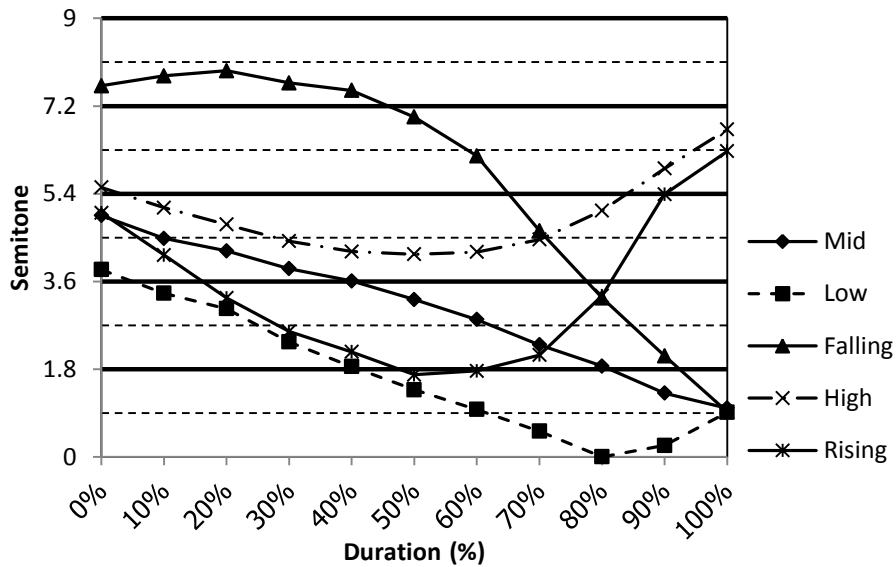

Figure 3 *Thai tones (in semitone) produced by the native speakers of Urdu*

Figure 4 – 8 illustrate acoustic characteristics of Thai tones produced in citation form by native speakers of Thai, Burmese and Urdu. Each F0 curve (in semitone) is an average across all

subjects in the same group. The exception is that of the native Thai speaker that is the original value of the fundamental frequency.

To distinguish the different kinds of tones, in general, I adopted Abramson's idea (1962) which divided Thai tones into two groups, static and dynamic. The mid tone, the low tone and the high tone[8] were classified as static tones; and the falling tone and the rising tone were classified as dynamic tones. Nevertheless, classifying a tone in this study relies on its phonetic characteristic, for example the falling tone can be classified as a static tone if its feature is like the low tone.

In addition, the tone letter of Chao (1930) was applied to describe tone characteristics. The tone letter is a scale raking from 1 – 5: 1 - low, 2 – mid quite low, 3 - mid, 4 – mid quite high and 5 – high. However, the tone productions in this study are quite different from the tone model of the native Thai speaker; I therefore added more ranks in the scale. As can be seen in the Figure 4 - 8, a major rank was divided into two minor ranks, upper and lower. For the upper, I presented it by a marker ^ after a number, for example, 3^, 4^, etc., following Prathankiet (2001).
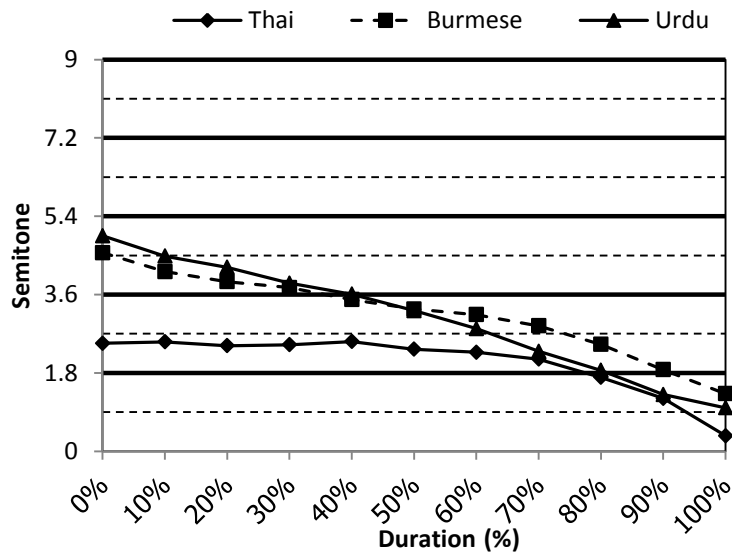

Figure 4 *Mid tone (in semitone) produced by the native speakers of Thai, Burmese and Urdu*

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[8]   In recent years, the static high tone is usually treated as a dynamic one (Teeranon & Rungrojsuwan, 2009)
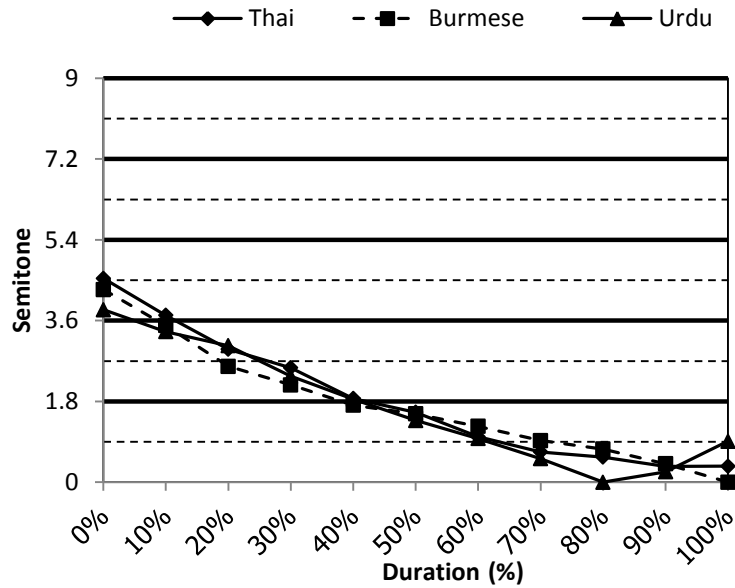
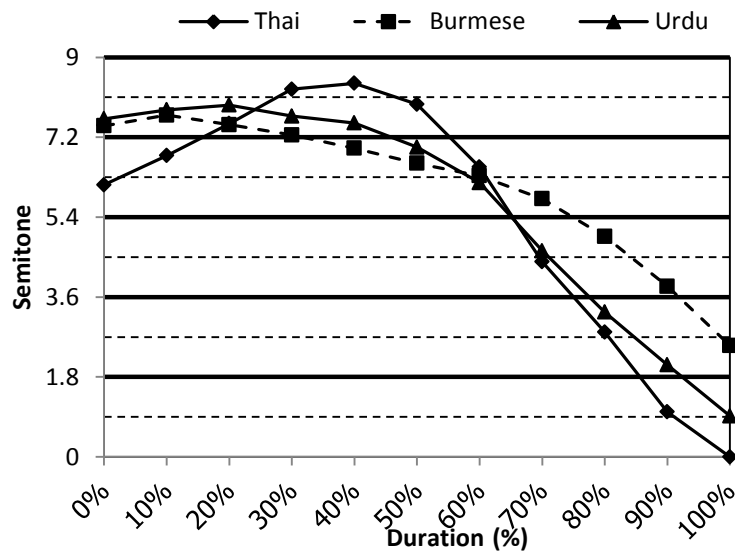*Figure 5* *Low tone (in semitone) produced by the native speakers of Thai, Burmese and Urdu*

Figure 6 *Falling tone (in semitone) produced by the native speakers of Thai, Burmese and Urdu*
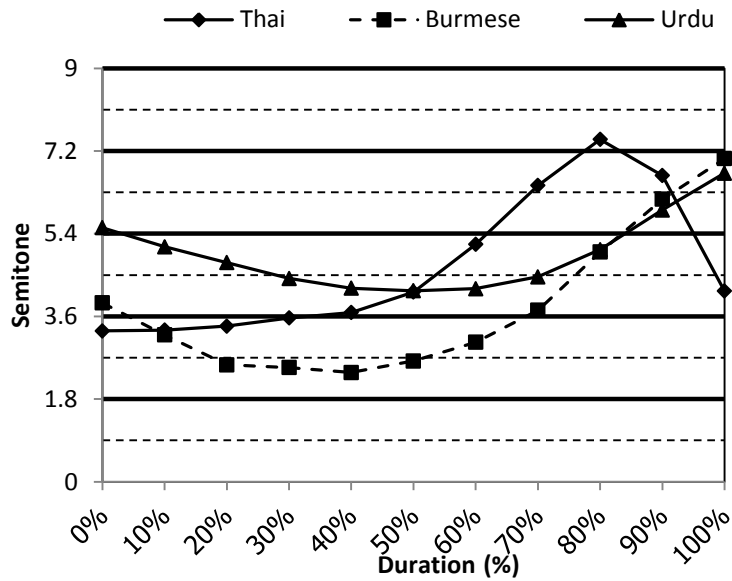
Figure 7 *High tone (in semitone) produced by the native speakers of Thai, Burmese and Urdu*
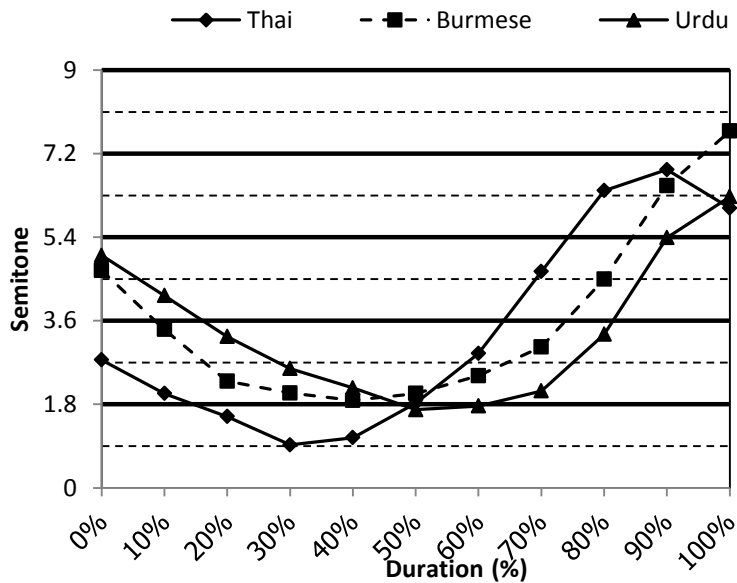

Figure 8 *Rising tone (in semitone) produced by the native speakers of Thai, Burmese and Urdu*

All tones in the above figures can be easily illustrated with tone letters. As can be seen in Table 3, the static tones and the dynamic tones are presented by 2 and 3 numbers respectively. The middle number of the dynamic tones illustrates the bending range of pitch. However, the

amount of number may be more or reduced if it is important to describe actual characteristics. For example I used 3 numbers (221) for describing the mid tone produced by the native Thai speaker because it shows a static level before falling to low at the end.

Table 3 Characteristics of Thai tones produced by the native speakers of Thai, Burmese and Urdu

Speakers	Thai tones				
	Mid	Low	Falling	High	Rising
Thai	221	31	451	2^53	21^4^4
Burmese	31^	31	52	324^	3^25
Urdu	3^1^	31	51^	3^34^	3^24

The marker ^ is for upper rank tones.

The results indicate that most tones are generally similar. However, each tone has specific characteristics. Here are some descriptions.

Tone 1 (Mid): The mid tone produced by the native Burmese speakers is similar to those produced by the native Urdu speakers, (31^) for the native Burmese speakers and (3^1^) for the native Urdu speakers. Both of them begin in the middle of the scale and then fall to low. For the native Thai speaker's, it begins below the mid and falls to low at the end (221).

Tone 2 (Low): The low tones produced by all three groups are similar (31). As illustrated in Table 3, all of them start at the mid and then fall to low.

Tone 3 (Falling): The falling tone produced by the native Thai speaker is different from those produced by the native Burmese and native Urdu speakers because it is a convex contour (451). On the other hand, the falling tones produced by the native Burmese (52) and native Urdu (51^) speakers begin in the highest rank and then fall continuously to low.

Tone 4 (High): The high tone produced by the native Thai speaker begins below the mid and then rises to high with a little drop to low at the end (2^53). By contrast, those produced by the

native Burmese and native Urdu speakers have the feature like the rising tone, namely it begins in the middle of the scale, falls to low, and rises to a little below the highest rank, that is (324^) for the native Burmese speakers and (3^34^) for the native Urdu speakers.

Tone 5 (Rising): As can be seen in Table 3, both the native Burmese and native Urdu speakers can produce the rising tone as a concavely dynamic tone. Those produced by the native Burmese (3^25) and native Urdu (3^24) speakers begin in the mid of the scale, fall to low and rise up to high. The tone produced by the native Thai speaker (2^1^4^4) is a little different, namely it begins below mid, falls to low and then rises to high.

As shown in Figure 7 and 8, bending to low at the end is found only in the high tone and the rising tone produced by the native Thai speaker. It should be noted that this specific characteristic is distinct from the tones produced by the native Burmese and native Urdu speaker.

Regardless of the F0 range, the result shows that most tones produced by the native Burmese and native Urdu speakers are similar to those produced by the native Thai speaker, especially the low tone and the rising tone.

Nevertheless, the tone characteristics indicate that the native Burmese and native Urdu speakers are unable to distinguish between the mid tone and the low tone because they tend to produce the mid tone like the low tone. Additionally, differentiating between the high tone and the rising tone may be a problem of the native Burmese and native Urdu speakers because the two tones produced by these speakers are similar in their concave contour.

As shown in Figure 6 - 8, the falling tones produced by the native Burmese and native Urdu speakers do not rise up and fall down. Conversely, they fall to low continuously just like the low tone. Moreover, the high tones produced by the native Burmese and native Urdu speakers are significant because they fall to low and then rise up to high like the rising tone.

However, statistical analysis in Table 4 shows that the tones produced by the native Burmese speakers are significantly different from those produced by the native Thai speaker only in the mid tone *(p = .005)*. The tones produced by the native Urdu speakers are significantly different from those produced by the native Thai speaker only in the mid tone *(p = .038)* as well. In addition,

the tones produced by the native Burmese speakers are significantly different from those produced by the native Urdu speakers only in the high tone *(p = .048)*. The general result indicates that most tones produced by all groups are similar in term of fundamental frequency.

Table 4 Statistical significance of F0 of the tones produced by the native speakers of Thai, Burmese and Urdu

Speakers	Thai tones				
	Mid	Low	Falling	High	Rising
Thai-Burmese	0.005*	0.872	0.537	0.224	0.725
Thai-Urdu	0.038*	0.799	0.831	0.572	0.944
Burmese-Urdu	0.838	0.922	0.675	0.048*	0.735

* Significant at p < 0.05

Since Thai tones are varied from one person to another, I show the tone shapes of each individual speaker for more clarification.

Table 5 Characteristics of Thai tones produced by individual native speakers of Thai, Burmese and Urdu

Speakers	Tones				
	Mid	Low	Falling	High	Rising
Thai	1^1^1	2^1	3^41	242^	213^
Burmese 1	221	21	4^2^	213^	2^14^
Burmese 2	2^1	2^1	3^1	2^1^3^	2^23^
Burmese 3	21	21	3^2	23^	13^
Burmese 4	31^	31	42	323^	3^24
Urdu 1	3^1	31	4^1	4^34^	425^
Urdu 2	221^	1^1^1	3^1	33^	212
Urdu 3	21^1^	21	3^1^	1^2^	12
Urdu 4	41^	31	51^	2^3^	3^23^

The result in Table 4 indicates that the mid tone is the main problem of tone production among the native speakers of Burmese and Urdu because the fundamental frequencies produced by Thai-Burmese speakers, on the one hand, and those produced by Thai-Urdu speakers, on the other hand, are statistically significant.

As can be seen in Table 5, the Thai speaker produces the mid tone as a static tone before falling to low slightly at the end. There are only three speakers (Burmese 1, Urdu 2 and Urdu 3) who can produce the mid tones which are comparable to that produced by the Thai speaker. The tones produced by these three speakers show that two thirds of the tone duration are static, (Burmese 1 = 221, Urdu 2 = 221^, and Urdu 3 = 21^1^).

3.2 F0 range

F0 range is the highest (peak) and the lowest (valley) value of fundamental frequency. As shown in Figure 9, out of the five tones produced by the native Thai speaker, the rising tone has the widest range, followed by the falling, the high, the low, and the mid tones respectively. Since there is only one native-Thai speaking subject, the F0 ranges of the tones are the original value, not an average.

Unlike the tones of the native Thai speaker, the F0 ranges of the tones produced by the native Burmese and native Urdu speakers are calculated into a mean value of F0 peak and F0 valley. As presented in Figure 10, the F0 range of tones produced by the native Burmese and native Urdu speakers have little difference from those of the native Thai speaker.

For the native Burmese speakers, the rising tone has the widest range followed by the falling, the high, the low, and the mid tones respectively.

In a case of the native Urdu speakers, the widest range belongs to the rising tone, followed by the high, the falling, the mid, and the low tones respectively.
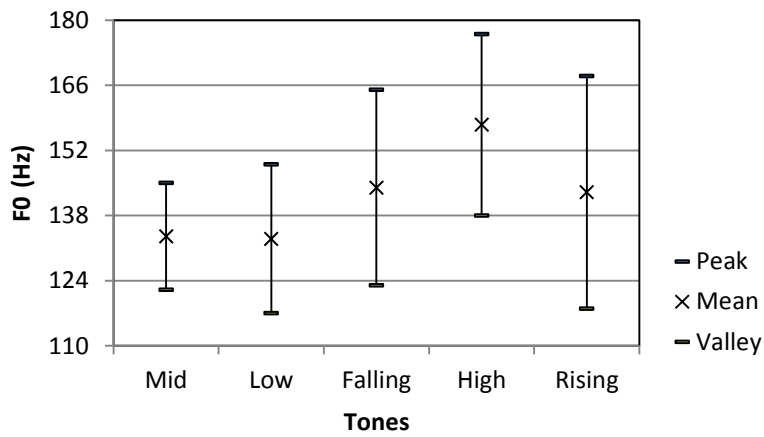
Figure 9 *F0 peak, and F0 valley (in Hertz) of all five tones produced by the native Thai speaker*
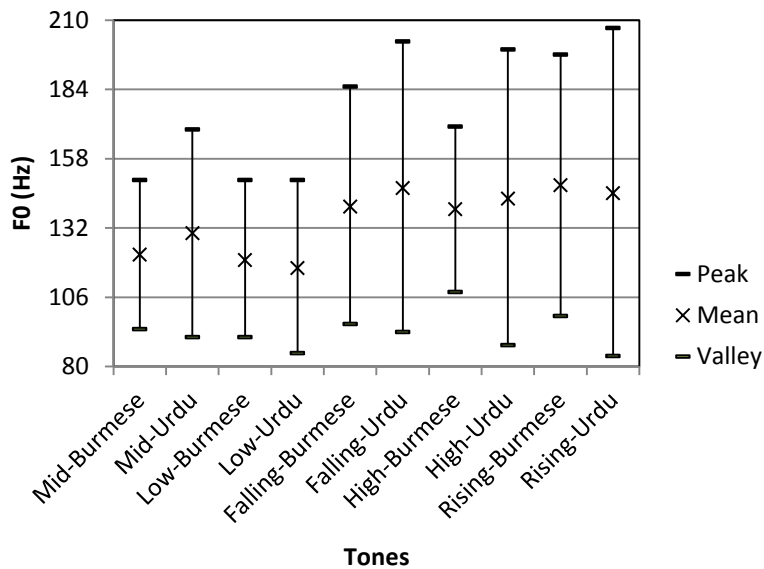

Figure 10 *Mean value of F0 peak, and F0 valley (in Hertz) of all five tones produced by the native Burmese and native Urdu speakers*

Generally, the finding in Figure 11 reveals that all tones produced by the native Urdu speakers have the widest range followed by the native Burmese. Those of the native Thai speakers are the narrowest.

Moreover, the comparative result in Figure 11 indicates that the F0 range analysis corresponds with the previous F0 analysis. That is that the native Burmese and native Urdu speakers have a difficult time in differentiating between the mid tone and the low tone. This difficulty was also found in Abramson's work (1976), which suggested that the low tone and the mid tone are easily confused, even by native speakers of Thai.
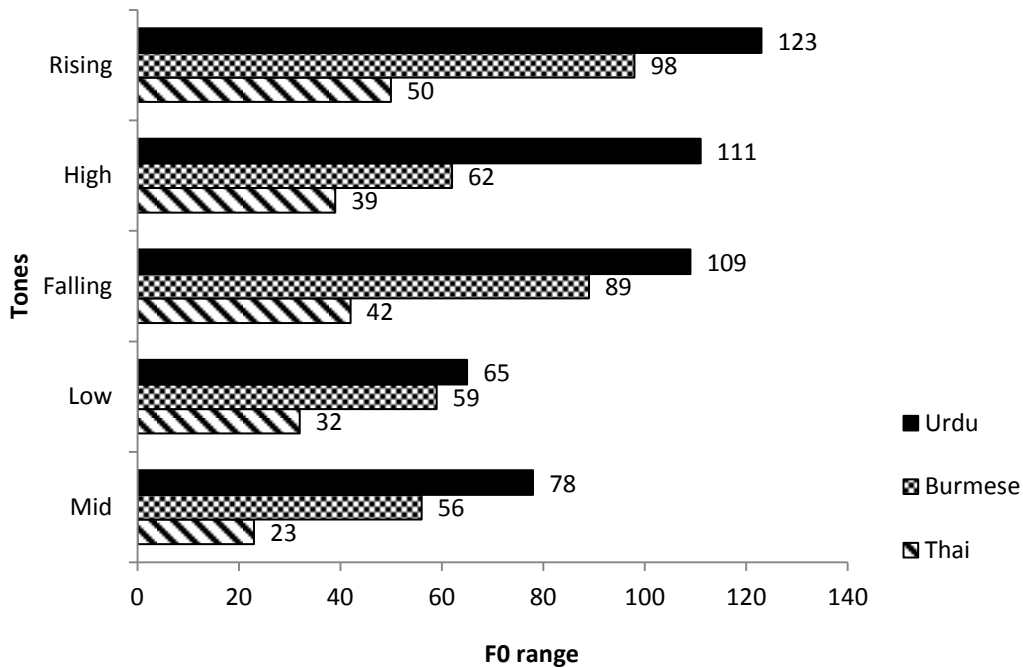

Figure 11 *Mean of F0 range of the tones produced by the native speakers of Thai, Burmese and Urdu*

4. Conclusion and Discussion

The results from this study indicate that the native Burmese and native Urdu speakers have relatively equal capacity for producing Thai tones. Therefore, it is proved that there is no advantage of having a native tonal language (Burmese) instead of a non-tonal native language (Urdu) when it comes to producing Thai tones.

Moreover, the statistical result shows that both the native Burmese and native Urdu speakers had the same difficulties when differentiating tones; namely, they both have trouble distinguishing the mid tone from the low tone. A similar result was previously found in Abramson (1976) and Wayland (1997) who found that level (static) tones are more difficult to master than contour (dynamic) tones for non-native speakers.

The findings support neither the hypothesis of Wayland & Guion (2004) nor that of Halle et al. (2004) which stated that native language has a significant influence on the tones of another language. However, the findings do correspond with the hypothesis proposed by Wang et al. (2004). That is that there is no group that gains advantage over the opponent in tone acquisition. Every language uses specific acoustic properties for changing a word's meaning, but speakers of other languages cannot employ their native language acoustic properties, used as a cue for lexical tone, for acquiring the tones in other tonal languages.

Although Burmese and Thai are tonal languages, the phonetic cues for tonal identification are quite different; namely, creaky voice and glottalization are part of Burmese tones (Kelly, 2012: 2). On the other hand, pitch level, pitch direction and pitch slope are important tonal cues in Thai language (Wayland & Guion, 2004: 690). So the native speaker of Burmese will have difficulty with Thai tones similar to speakers from non-tonal languages.

Another interesting finding obtained in this study is the fact that the characteristics of the tones produced by the native Burmese speakers are comparable to those of the native Urdu speakers. It should be noted that this similarity came from being exposed to the Thai language after years of residence in the same area. They shared not only mutually segmental categories such as

consonants and vowels, but also suprasegmental categories such as tones and intonations of the Thai language.

All findings seem to suggest that the tone system in a native language is not a main factor in enhancing tone production. Another factor such as amount of use of Thai may be a more important indicator of degree of correct pronunciation.

As can be seen in Table 1, the most outstanding factor is average use of Thai. Only three speakers use Thai more than 10 hours per week, the Burmese 1, the Urdu 2 and the Urdu 3. The result in Table 5 shows that the tones produced by these three speakers, especially the mid tone, are comparable to that produced by the Thai speaker.

The influence of language use on degree of L2 foreign accent was found in the work of Dewing, Thomson & Munro (2006), which studied English pronunciation and fluency development in Mandarin and Slavic speakers. The finding showed that the Slavic learners made significant progress in fluency, whereas the Mandarin participants showed no improvement. This was because the Slavic learners had more contact with English speakers than did the Mandarin speakers.

Thus, it should be noted that correct pronunciation is consistent with the amount of Thai language use. Nevertheless, since the number of subjects in this study was limited to four speakers for each language; such a claim is limited.

Acknowledgement

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