

Pronunciation of Standard Thai Vowels by Non-native Speakers

การออกเสียงสระภาษาไทยมาตรฐานโดยผู้พูด
ที่ไม่ใช่เจ้าของภาษา

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Abstract

This study aimed to analyze the acoustic characteristics of Standard Thai vowels produced by Khmer, Vietnamese, Burmese, and Malay speakers. The test words comprised eighteen monophthongs /i e ε i ə a u o ɔ ii ee εε ð əə aa uu oo ɔɔ/. The informants were composed of three speakers with high experience in Thai from each language and three speakers with low experience in Thai from each language, comprising a total of twenty-four speakers. The informants' speech was recorded directly by a computer. The total number of test tokens for acoustical analysis was 2,592. Formant frequencies (F1 and F2) and duration of vowels were measured using the Praat program. The results showed that the acoustic characteristics of Thai

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vowels produced by Khmer, Vietnamese, Burmese, and Malay native speakers with high experience in Thai were better than those with low experience in Thai. Greater variation of vowels caused by tongue height position was found for speakers with low experience in Thai because high vowels, mid vowels, and low vowels are highly overlapped. For vowel length, almost all of the speakers with both high and low experience in Thai produced short and long vowels with duration ratios similar to native Thai speakers. However, vowel duration varied for speakers with low experience in the Thai language.

Keywords: acoustic study, second language learning, standard Thai vowels

บทคัดย่อ

บทความนี้มีวัตถุประสงค์เพื่อวิเคราะห์ลักษณะทางกลศาสตร์ของเสียงสระภาษาไทยมาตรฐานโดยผู้พูดภาษาเขมร เวียดนาม พม่า และมาเลเซียเป็นภาษาแม่ รายการคำที่ใช้ในการทดสอบประกอบไปด้วยสระเดี่ยวเสียงสั้นและสระเดี่ยวเสียงยาวจำนวน 18 หน่วยเสียงได้แก่ /i e ε i ə a u o ɔ ii ee εε ñ ð ə a u oo ɔv/ ผู้บอกภาษาประกอบด้วยผู้พูดที่มีประสบการณ์ภาษาไทยมากจำนวนภาษาละ 3 คน และผู้พูดที่มีประสบการณ์ภาษาไทยน้อยจำนวนภาษาละ 3 คน รวมผู้บอกภาษาทั้งสิ้น 24 คน ดำเนินการบันทึกเสียงผู้บอกภาษาผ่านคอมพิวเตอร์โดยตรง รวมจำนวนคำทดสอบเพื่อการวิเคราะห์ทางกลศาสตร์ทั้งสิ้น 2,592 คำ จากนั้นวิเคราะห์ค่าทางกลศาสตร์ได้แก่ ค่าความถี่ฟอร์เมนท (F1 และ F2) และค่าระยะเวลาของเสียงสระด้วยโปรแกรม พราท ผลการวิจัยพบว่าลักษณะทางกลศาสตร์ภาษาไทยที่ออกเสียงโดยผู้พูดภาษาเขมร เวียดนาม พม่า และมาเลเซียเป็นภาษาแม่ที่มี

ประสบการณ์ภาษาไทยมากมีสัทลักษณะที่ดีกว่าในกลุ่มผู้พูดที่มีประสบการณ์ภาษาไทยน้อย นอกจากนี้ ในกลุ่มผู้พูดที่มีประสบการณ์ภาษาไทยน้อยพบว่าเกิดการซ้อนทับกันระหว่างสระสูง สระกลาง และสระต่ำ แสดงให้เห็นว่าเกิดการแปรสูงของสระในด้านระดับสูงต่ำของลิ้น ในด้านของความสั้นยาวของเสียงสระพบว่าผู้บอกภาษาเกือบทั้งหมดทั้งในกลุ่มผู้พูดที่มีประสบการณ์ภาษาไทยมากและผู้พูดที่มีประสบการณ์ภาษาไทยน้อยสามารถออกเสียงสระสั้นและสระยาวในอัตราส่วนที่ใกล้เคียงกับผู้พูดภาษาไทย อย่างไรก็ตาม ค่าระยะเวลาของเสียงสระในกลุ่มผู้พูดที่มีประสบการณ์ภาษาไทยน้อยจะพบการแปรมากกว่า

คำสำคัญ: การศึกษาทางกลศาสตร์ การเรียนรู้ภาษาที่สอง
สระภาษาไทยมาตรฐาน

Introduction

According to Crowley (1997), a typological classification of languages looks for similar features and groups. Seven languages are spoken in ASEAN countries but only four were chosen by typology in this research, namely Khmer, Vietnamese, Burmese, and Malay. Classification by vowel height distinguishes Khmer and Vietnamese, which have more than three degrees of height, from Burmese and Malay that have only three degrees of height. Vowel length also distinguishes Khmer from Vietnamese, Burmese, and Malay.

Copious previous research has focused on the pronunciation of Thai tones produced by second language or foreign language speakers because tone is the most significant feature in the Thai language (Intajamornrak, 2017; Phiasuphan, 2014; Sinthawashewa, 2009; Suebsor, 2019; Teeranon, 2016; Wong-ampai, 2009). However, none of these authors studied the pronunciation of Thai vowels, despite the fact that the vowel systems of the four languages; Khmer, Vietnamese,

Burmese, and Malay are different in number of vowels, vowel quality, and vowel length.

Vowel pronunciation by second language learners has been studied for many languages. Romig (2017) investigated the production and perception of English vowels by native speakers of Brazilian Portuguese living in Victoria, Canada and found that advanced speakers showed a greater ability to both produce and perceive the second language vowels, while Yen-Chen (2017) showed that experience in Mandarin helped English speakers to discriminate vowels. Evans and Alshangiti (2018) studied the perception and production of British English vowels and consonants by Arabic learners of English. They determined that more experienced learners outperformed early learners in perception of vowels and consonants. Yoon (2018) found that English vowel production and perception of Korean learners were influenced by experience levels, while Đào and Nguyễn (2019) showed that Japanese learners transferred their Japanese vowel quality features into the production of Vietnamese vowels. Flege and Wayland (2019) studied the role of input in native Spanish late adult learners' production and perception of English phonetic segments. They found that adequate native speaker input was critical for second language learning.

These previous studies suggested experience level as a crucial factor for second language learners. Experienced learners show a greater ability to produce second language vowels, while the first language (L1) of the learners also influenced production capabilities of the second language (L2).

Therefore, this research aims to analyze the acoustic characteristics of Thai vowels produced by Khmer, Vietnamese,

Burmese, and Malay speakers with high and low experience² in Thai in terms of formant frequencies and duration.

Research Methodology

The informants were twenty-four Khmer, Vietnamese, Burmese, and Malay speakers (20-35 years old) who studied Thai as a second language; six speakers for each language. Three were high experience speakers (Speakers 1, 2, and 3) and three were low experience speakers (Speakers 4, 5, and 6). Two sets of wordlists consisted of minimal and analogous pairs³ of eighteen vowels (nine short vowels /i e ε ì ə a u o ɔ/ and nine long vowels /ii ee εε ìì əə aa uu oo ɔɔ/ occurring in citation form as in Table 1.

Table 1
Wordlists

Set 1			
Wordlist	Gloss	Wordlist	Gloss
kìt	‘works’	kiit	‘to obstruct’
khèt	‘be afraid’	khèet	‘area, zone’
tèʔ	‘to touch’	tèek	‘broken’
fìk	‘to train’	fìit	‘unsmooth’
lòʔ	‘dirty’	lôət	‘excellent’
khàt	‘to polish’	khàat	‘torn’
khùt	‘to dig’	khùut	‘to scratch’

² The questionnaire for deciding high and low experience was developed from Modehiran (2005) and Sinthawashewa (2009). The questions were composed of many aspects including years of studying Thai, frequency of using Thai in daily life, relationships with Thai people, etc.

³ Analogous pair in the wordlists means a pair of words which are different in final consonant. However, the final consonants are voiceless stops including /p t k ʔ/.

Set 1			
Wordlist	Gloss	Wordlist	Gloss
khòt	‘to coil’	khòot	‘hillock’

Set 2			
Wordlist	Gloss	Wordlist	Gloss
cìp	‘to sip’	cìip	‘to flirt’
hèt	‘mushroom’	hèet	‘factor’
chèʔ	‘wet, soaked’	chèek	‘V-shaped’
sìk	‘battle’	sìip	‘to detect’
théʔ	‘hulky’	thêot	‘to praise’
bàt	‘card’	bàat	‘to cut’
sùt	‘end’	sùut	‘to inhale’
sòt	‘fresh’	sòot	‘single’

The informants were asked to pronounce each test word three times randomly⁴. The total number of test tokens was 2,592 for vowels (36 test words x 3 times x 4 languages x 6 speakers). The data were recorded directly by a computer. The formant frequencies (F1 and F2) and duration of vowels were measured using the Praat program. Formant frequencies were measured at every 10% between 30 and 70% of the normalized duration. Then, the variation of each vowel within its space was plotted on a graph for each speaker.

Findings

The acoustic characteristics of nine short vowels /i e ε i ə a u o ɔ/, nine long vowels /ii ee εε ìì əə aa uu oo ɔɔ/ and vowel duration were presented.

⁴ The informants were asked to read the wordlists before recording to ensure that they can pronounce and understand all the words.

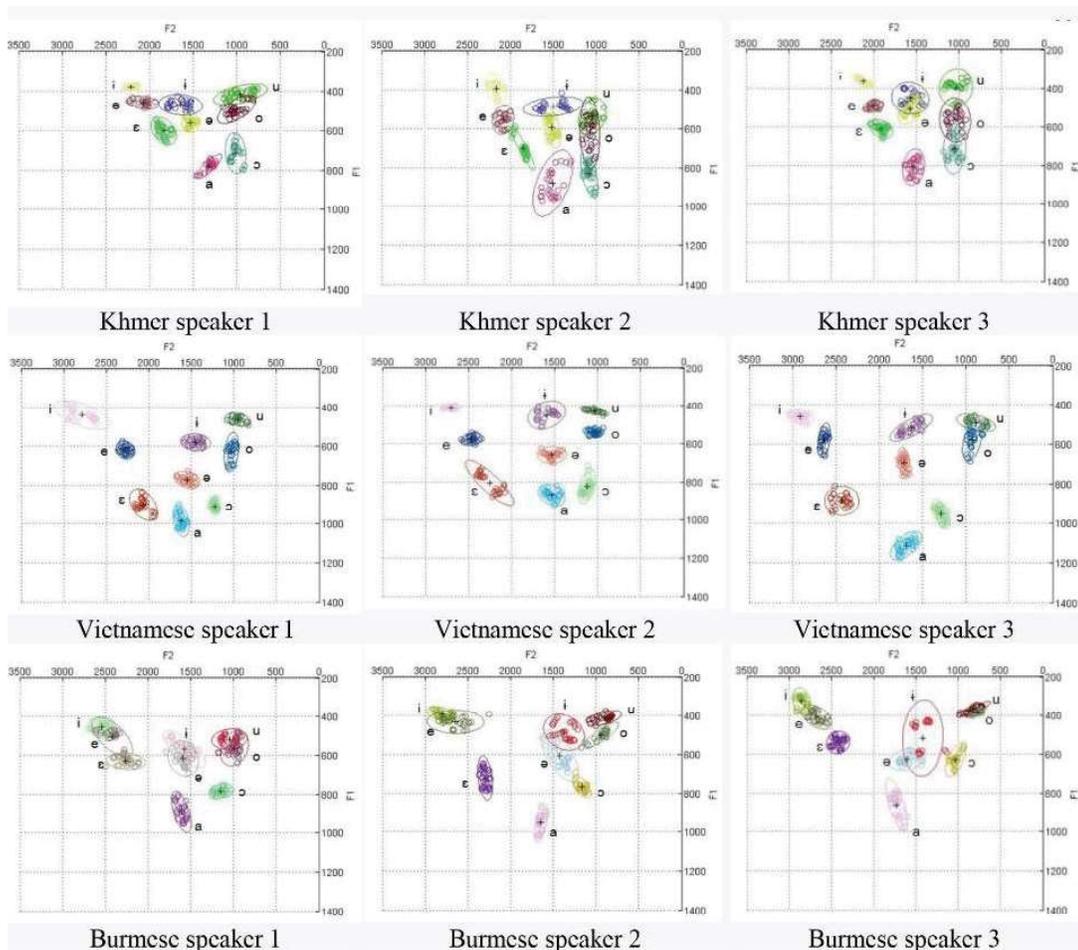
1. Short Vowels

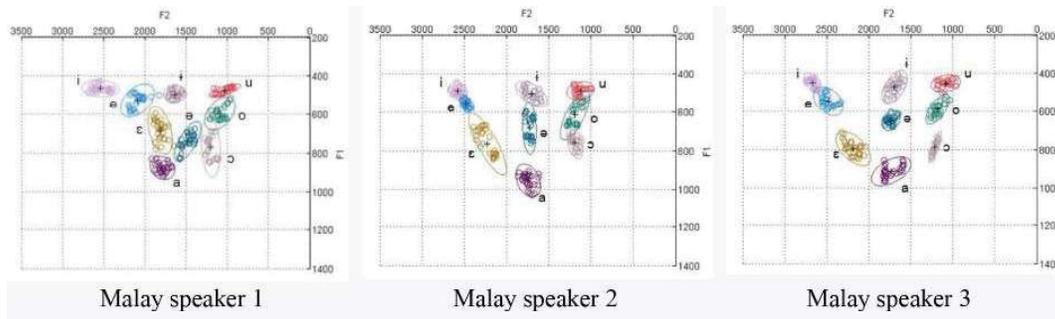
1.1 High Experience Speakers

The vowel spaces of each short vowel produced by the Khmer, Vietnamese, Burmese, and Malay speakers with high experience in Thai are shown in Figure 1.

Figure 1

Vowel Spaces of Each Short Vowel Produced by the Khmer, Vietnamese, Burmese, and Malay Speakers With High Experience in Thai





From Figure 1, in Khmer speakers, the acoustic characteristics of each vowel show that the nine short vowels occur in their own position especially in the front vowels /i e ε/. The central vowel /ɨ/ slightly overlaps with the central vowel /ə/ in speakers 2 and 3, whereas the back vowels strongly overlap between the vowels /u/ and /o/, and the vowels /o/ and /ɔ/. For Vietnamese speakers, the nine vowels occur in their own positions without overlapping with each other in all speakers. The size of each vowel in the vowel space is small. Meanwhile, for Burmese speakers, the high vowels and mid vowels overlap with each other, i.e. between the vowels /i/ - /e/, the vowels /ɨ/ - /ə/, and the vowels /u/ - /o/. In Malay speakers, the high vowel /i/ slightly overlap with the mid vowel /e/ in speakers 1 and 2. Also the back vowels /u o ɔ/ slightly overlap with each other in speaker 2. Each vowel occurs close to each other.

1.2 Low Experience Speakers

The vowel spaces of each short vowel produced by the Khmer, Vietnamese, Burmese, and Malay speakers with low experience in Thai are shown in Figure 2.

Figure 2

Vowel Spaces of Each Short Vowel Produced by the Khmer, Vietnamese, Burmese, and Malay Speakers With low Experience in Thai

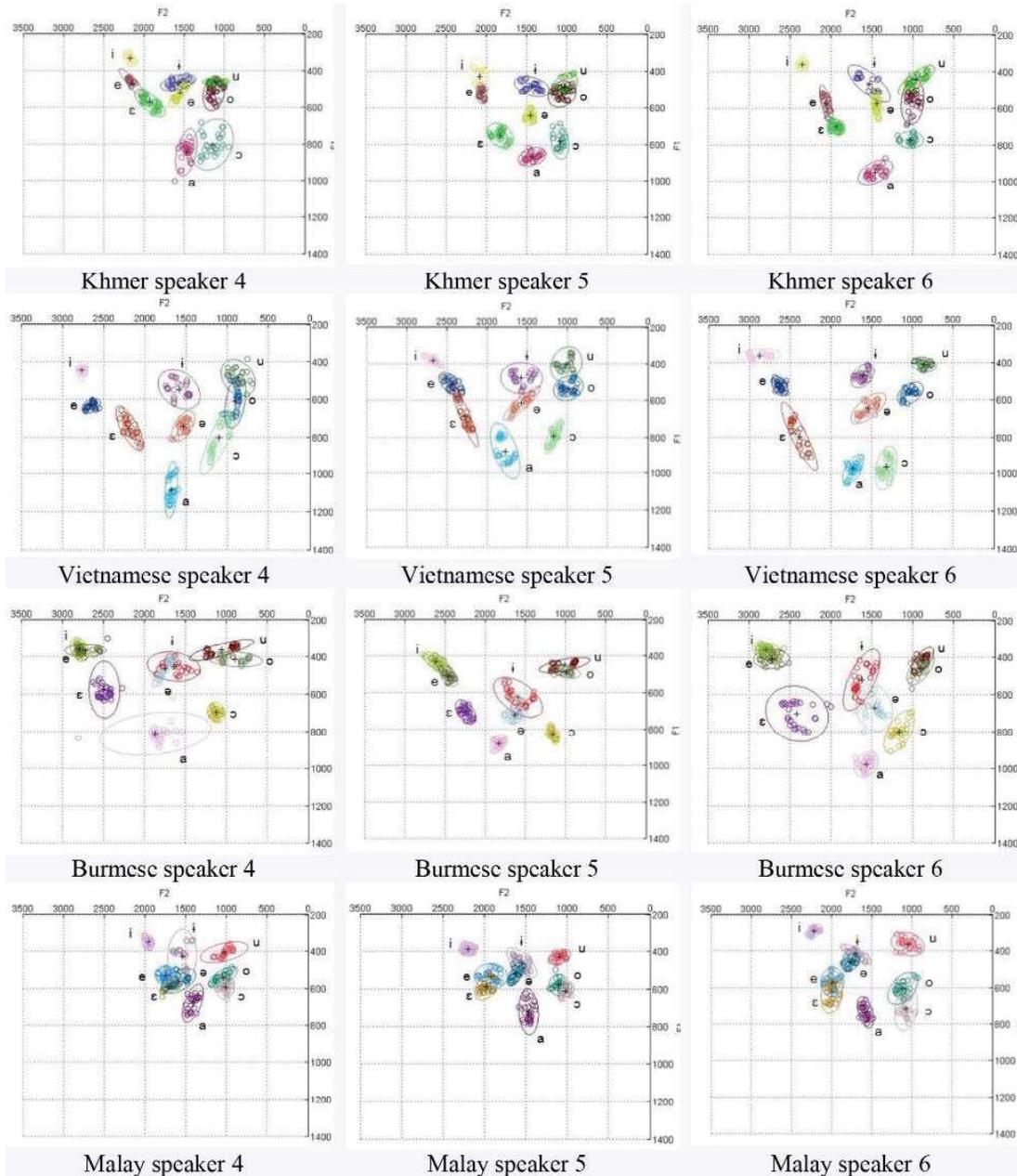


Figure 2 shows some overlaps in Khmer speakers, especially between the high vowels and mid vowels, i.e. the vowels /e/ - /ɛ/, the vowels /i/ - /ə/, the vowels /u/ - /o/, the vowels /a/ - /ɔ/ in Khmer speaker 4, the vowels /i/ - /e/, the vowels /u/ - /o/ in Khmer speaker 5, the vowels /e/ - /ɛ/, the vowels /i/ - /ə/, and the vowels /u/ - /o/ in Khmer speaker 6. Similarly, in Vietnamese speakers there are some overlaps in Vietnamese speakers 4 and 5, i.e. the vowels /u/ - /o/, the vowels /o/ - /ɔ/ in Vietnamese speaker 4, the vowels /e/ - /ɛ/, the vowels /i/ - /ə/, and the vowels /u/ - /o/ in Vietnamese speaker 5. The vowels that overlap with each other have a bigger size. Meanwhile, in Burmese speakers the high vowels strongly overlap with the mid vowels as /i/ - /e/, the vowels /i/ - /ə/, and the vowels /u/ - /o/ in all speakers. Moreover, some vowels have a bigger size than the others, e.g. the vowels /ɛ ə a/ in Vietnamese speaker 4, the vowel /i/ in Vietnamese speaker 5, and the vowels /ɛ i ɔ/ in Vietnamese speaker 6. Lastly, in Malay speakers, there are some overlaps as vowels /e/ - /ɛ/, the vowels /i/ - /ə/, and the vowels /o/ - /ɔ/ in all speakers.

2. Long Vowels

2.1 High Experience Speakers

The vowel spaces of each long vowel produced by the Khmer, Vietnamese, Burmese, and Malay speakers with high experience in Thai are shown in Figure 3.

Figure 3

Vowel Spaces of Each Long Vowel Produced by the Khmer, Vietnamese, Burmese, and Malay Speakers With High Experience in Thai

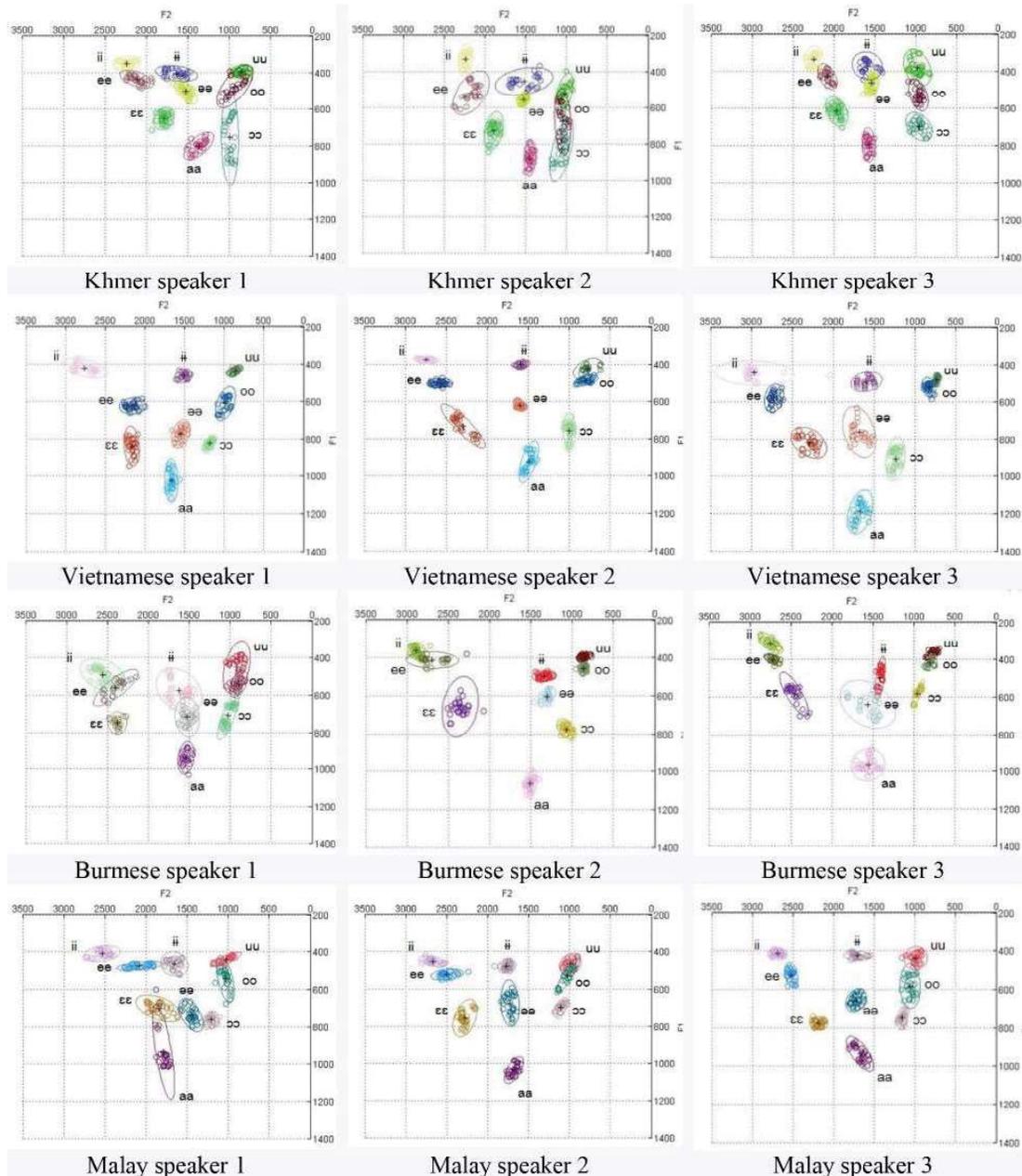


Figure 3 shows overlaps between some vowels in Khmer speakers. In speaker 1, the vowel /ii/ overlaps with /əə/, the vowel /uu/ with /oo/, and the vowel /oo/ with /ɔɔ/. These overlaps also occur in Khmer speaker 2. The vowel spaces of the vowels /oo ɔɔ/ are wider than the other vowels in speakers 1 and 2. Meanwhile, in Khmer speaker 3, there are overlaps between the vowels /ii/ - /əə/ and the vowels /uu/ - /oo/. In Vietnamese speakers, only the vowel /uu/ slightly overlaps with /oo/ in speakers 2 and 3. The vowel spaces of each vowel are dispersed clearly in their position. In Burmese speakers, there are overlaps between the high vowels and mid vowels. In speaker 1, overlaps occur between the vowels /ii/ - /ee/, the vowels /ii/ - /əə/, and the vowels /uu/ - /oo/. Only the vowel /ii/ overlaps with /ee/ in speaker 2. There are overlaps between the vowels /ii/ - /əə/ and the vowels /uu/ - /oo/ in speaker 3. In Malay speakers, there are also overlaps in some vowels. The overlaps occur between the vowels /εε/ - /aa/ and the vowels /uu/ - /oo/ in speaker 1. In speakers 2 and 3, only the vowel /uu/ overlaps with /oo/.

2.2 Low Experience Speakers

The vowel spaces of each long vowel produced by the Khmer, Vietnamese, Burmese, and Malay speakers with low experience speakers are shown in Figure 4.

In Khmer speakers with low experience in Thai, only the vowel /ee/ overlaps with /εε/ in speaker 4, whereas overlap between the vowels /uu/ - /oo/ occurs in all three speakers. The size of each vowel space is small. In Vietnamese speakers, there are overlaps between the back vowels in speaker 4 as the vowels /uu/ - /oo/ and the vowels /oo/ - /ɔɔ/, whereas in speaker 5, there are overlaps between the front vowels /ii/ - /ee/ and the vowels /ee/ - /εε/. Meanwhile, in speaker 6, only the vowel /uu/ overlaps with /oo/. In Burmese speakers, the high vowels /ii ii uu/ overlap with the mid vowels /ee əə oo/ in all three speakers. Lastly, in Malay speakers, there are overlaps between the front vowels /ee/, /εε/ and the vowel /əə/, the central vowels /ii/ - /əə/, and the back vowels /oo/ - /ɔɔ/ in all three speakers.

3. Vowel Duration

The duration of short and long vowels is measured in milliseconds (ms).

3.1 High Experience Speakers

The duration of short and long vowels produced by the Khmer, Vietnamese, Burmese, and Malay speakers with high experience in Thai is shown in Figure 5.

Figure 5

Duration of Short and Long Vowels Produced by the Khmer, Vietnamese, Burmese, and Malay Speakers With High Experience in Thai

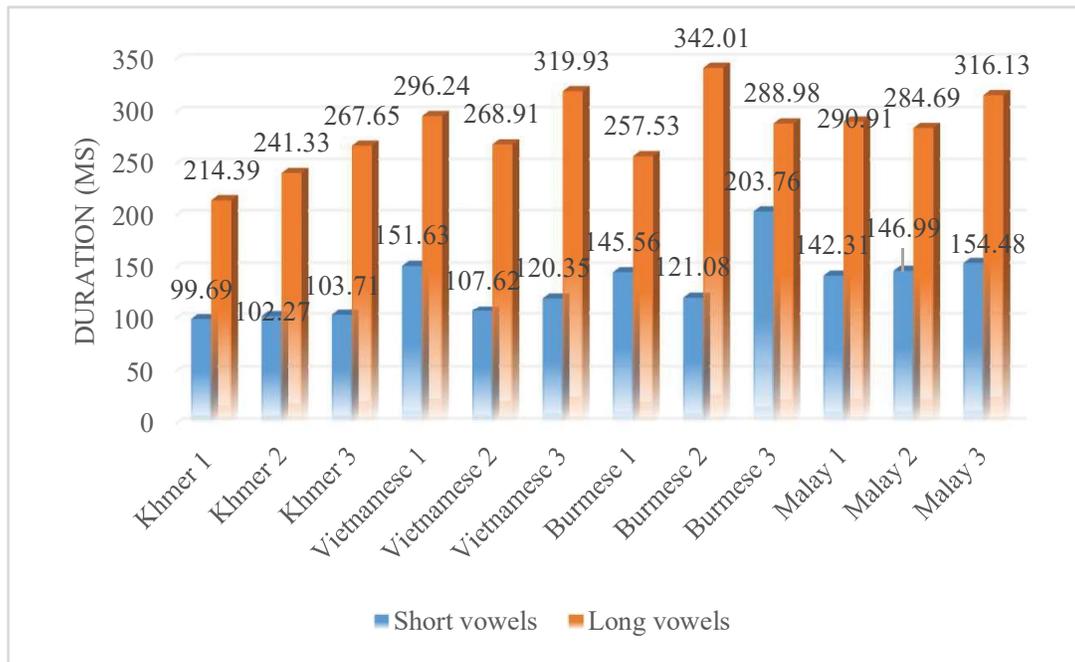


Figure 5 shows that the duration range of short vowels produced by the Khmer speakers with high experience in Thai is between 99.69 – 103.71 ms and the duration range of long vowels is between 214.39 – 267.65 ms. The duration range of short vowels produced by the Vietnamese speakers with high experience in Thai is between 107.62 – 151.63 ms and the duration range of long vowels is between 268.91 – 319.93 ms. The duration range of short vowels produced by the Burmese speakers with high experience in Thai is between 121.08 – 203.76 ms and the duration range of long vowels is between 257.53 – 342.01 ms. The duration range of short vowels produced by the

Malay speakers with high experience in Thai is between 142.31 – 154.48 ms and the duration range of long vowels is between 284.69 – 316.13 ms. The difference between the average duration of short and long vowels in each language is statistically significant ($p < 0.05$).

3.2 Low Experience Speakers

The duration of short and long vowels produced by the Khmer, Vietnamese, Burmese, and Malay speakers with low experience in Thai is shown in Figure 6.

Figure 6

Duration of Short and Long Vowels Produced by the Khmer, Vietnamese, Burmese, and Malay Speakers With Low Experience in Thai

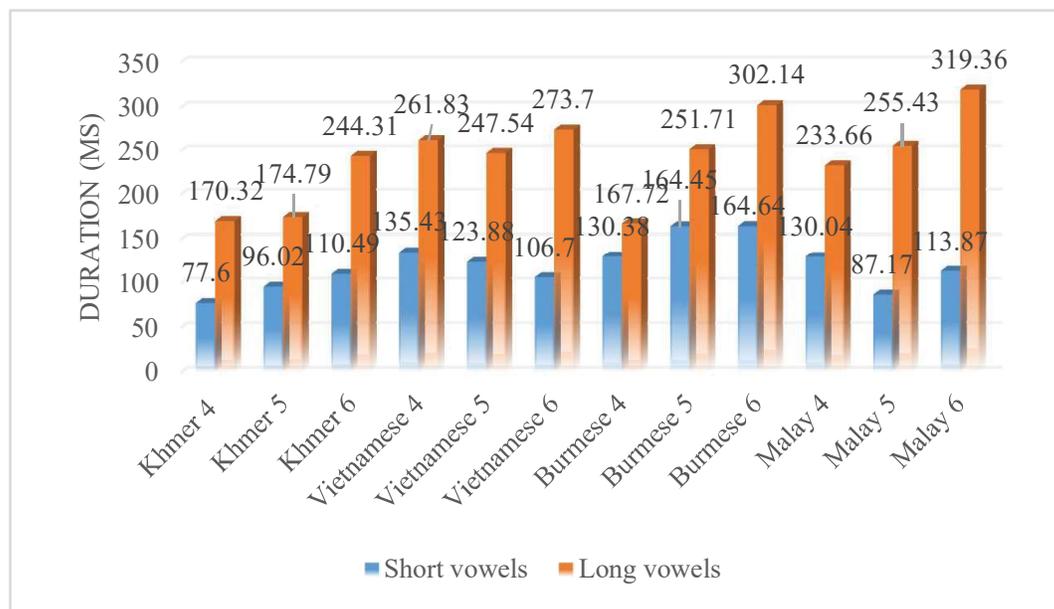


Figure 6 shows that the duration range of short vowels produced by the Khmer speakers with low experience in Thai is

between 77.60 – 110.49 ms and the duration range of long vowels is between 170.32 – 244.31 ms. The duration range of short vowels produced by the Vietnamese speakers with low experience in Thai is between 106.70 – 135.43 ms and the duration range of long vowels is between 247.54 – 273.70 ms. The duration range of short vowels produced by the Burmese speakers with low experience in Thai is between 130.38 – 164.64 ms and the duration range of long vowels is between 167.72 – 302.14 ms. The duration range of short vowels produced by the Malay speakers with low experience in Thai is between 87.17 – 130.04 ms and the duration range of long vowels is between 233.66 – 319.36 ms. The difference between the average duration of short and long vowels in each language is statistically significant ($p < 0.05$).

The duration of short and long vowels is calculated into ratios. The ratio of duration of short vowels to long vowels is shown in Table 2.

Table 2

Ratio of Short Vowels to Long Vowels of High Experience and Low Experience Speakers in Thai

High experience speakers	Ratio	Low experience speakers	Ratio
Khmer 1	1 : 2.15	Khmer 4	1 : 2.19
Khmer 2	1 : 2.36	Khmer 5	1 : 1.82
Khmer 3	1 : 2.58	Khmer 6	1 : 2.21
Vietnamese 1	1 : 1.95	Vietnamese 4	1 : 1.93
Vietnamese 2	1 : 2.50	Vietnamese 5	1 : 2.00
Vietnamese 3	1 : 2.66	Vietnamese 6	1 : 2.57

High experience speakers	Ratio	Low experience speakers	Ratio
Burmese 1	1 : 1.76	Burmese 4	1 : 1.29
Burmese 2	1 : 2.82	Burmese 5	1 : 1.53
Burmese 3	1 : 1.42	Burmese 6	1 : 1.83
Malay 1	1 : 2.04	Malay 4	1 : 1.80
Malay 2	1 : 1.94	Malay 5	1 : 2.93
Malay 3	1 : 2.05	Malay 6	1 : 2.80

Table 2 shows that speakers with high experience in Thai can produce short and long vowels. The ratio of short vowels to long vowels is between 1: 1.76 and 1: 2.88, except for Burmese speaker 3 whose ratio is 1: 1.42. Similarly, speakers with low experience in Thai produce short and long vowels with ratios of short vowels to long vowels between 1: 1.80 and 1: 2.93, except for Burmese speakers 4 and 5 whose ratio is 1: 1.29 and 1: 1.53, respectively.

Conclusion and Discussion

For short vowels, the acoustic characteristics show that speakers with high experience in Thai can produce short vowels. The vowel spaces of each vowel are distributed properly in the vowel area. There are only a few overlaps between some vowels in some speakers. The results show that Vietnamese speakers produce short vowels the best because there is no overlap between vowels. Overlaps between the high and mid vowels mostly occur in Burmese speakers. Speakers with low experience in Thai produce short vowels in terms of tongue advancement better than tongue height. This means that the front, central, and back vowels occur separately in the vowel

area without overlap, whereas the high, mid, and low vowels overlap between each other.

For long vowels, speakers with high experience in Thai produce long vowels better than short vowels because the acoustic characteristics show that the vowel spaces of each vowel are small compared to those in short vowels. For speakers with low experience in Thai, there are overlaps between some vowels and the position of tongue height varies among some speakers.

Regarding the vowel length, most of the speakers can differentiate between short and long vowels even though their first language; Vietnamese, Burmese and Malay do not have short and long vowel distinction.

In comparison to Intajamornrak (2003), the acoustic characteristics of vowels show that Khmer, Vietnamese, Burmese, and Malay speakers can produce Standard Thai vowels, even though the position of each vowel in the vowel space vary among the four languages. However, speakers with high experience in Thai produce Standard Thai vowels better than those with low experience in Thai. This result concurred with Đào and Nguyễn (2019), Evans and Alshangiti (2018), Romig (2017), Yen-Chen (2017), and Yoon (2018). For the size of each vowel space in the vowel area, vowel spaces of each vowel produced by speakers with low experience in Thai are wider.

However, Burmese speakers with high experience in Thai and with low experience in Thai, show overlaps between the high vowels and mid vowels. This may be explained by native language interference. Thein-Tun (1982) studied

Burmese vowels occurring in various contexts and found that the vowels /i/ - /e/ and the vowels /u/ - /o/ occurred very close in the vowels area. Moreover, Burmese does not have the vowels /i/ and /ə/. When Burmese speakers produce these vowels in Standard Thai, the tongue height position of the vowels /i/ and /ə/ is as same as the vowel /i/ - /e/ and the vowel /u/ - /o/.

There are also overlaps between the back vowels, both in short vowels /u o ə/ and long vowels /uu oo ɔɔ/ in almost all of the speakers. This occurs because the oral cavity when producing the back vowels is small and causes overlaps between these vowels, as found by Intajamornrak (2003). However, the position of tongue height is more varied than the position of tongue advancement in speakers with low experience in Thai because a lot of overlaps exist between the high, mid, and low vowels. This suggests that the difference in degree of tongue height may affect the pronunciation of vowels in the second language as well as the position of each vowel in the vowel space as shown in Burmese speakers. Flege, Bohn and Jang (1997) found that production and perception of vowels are related. The correctness of pronunciation and perception relates to the native language vowel system. Moreover, Đào and Nguyễn (2019) also found that Japanese learners transfer their L1 vowel quality features into the production of Vietnamese vowels.

Regarding the duration of vowels, the difference between the average duration of short and long vowels in each language is statistically significant ($p < 0.05$) both in high and low experience in Thai speakers. The long vowels are on average 2-2.5 times longer than short vowels (Abramson, 1962; Gandour, 1984; Intajamornrak, 2003; Roengpitya, 2001). The acoustic characteristics show that speakers of languages with no

vowel length distinction as Vietnamese (only /a – aa/), Burmese, and Malay can produce short and long vowels in Standard Thai. The ratio of short vowels to long vowels of both high experience and low experience speakers agrees with Luangthongkum and Graduate students (2011). This result also concurred with Cebrian (2006) and Phalipat (2009) that whether languages have phonological length or duration contrast or not, the behaviors of duration and ratio are the same.

It is also interesting that Vietnamese speakers who do not have vowel length distinction can produce short vowels and long vowels as well as Khmer speakers with the ratio 1: 1.95 – 2.66, and similar to Thai native speakers. The reason that Vietnamese speakers can differentiate short and long vowels similarly to Thai native speakers may be because Vietnamese has vowel length distinction in the vowel /a/ - /aa/ so they are able to realize the signification of vowel duration.

Similarity in typology or phonological system is one of the factors that supports second language learning; however, this is not always true since many studies (Evans & Alshangiti, 2018; Flege & Wayland, 2019; Romig, 2017; Yen-Chen, 2017), including this one, have shown that speaking a native 3-level vowel language (Burmese and Malay) does not gain benefit when learning another language having 3-level vowels (Thai). This is because the position of each vowel in the vowel area is not the same. Moreover, the speakers of languages with no vowel length distinction can also produce short and long vowel. Experience measured by years of study, objectives of the study, and frequency of usage, all influence the ability of second language speakers to correctly form Thai vowels.

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