

The Positive and Negative Effects of Tonal L1 on the Acquisition of Tonal L2: A Case of the Standard Thai Tones and the Chinese Zhuang Learners

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APA Citation:

Phonphanich, S. H. & Burusphat, S. (2021). The positive and negative effects of tonal L1 on the acquisition of Tonal L2: A case of the standard Thai tones and the Chinese Zhuang learners. *LEARN Journal: Language Education and Acquisition Research Network*, 14(2), 28-58.

Received
02/07/2020

Received in
revised form
18/01/2021

Accepted
01/02/2021

Keywords
Chinese Zhuang learners; standard Thai tone; tone language; tone error patterns; L2 tone acquisition

Abstract

This study is a case study of the effects of tonal L1 on the acquisition of tonal L2, comparing two groups of tonal L1 learners, namely, Chinese Zhuang (C+Z) and Chinese non-Zhuang (C-Z) in the same classroom. The two groups of learners read aloud 60 words from a Thai wordlist, then their tone production was analyzed in two dimensions. The phonological analysis focused on tone error patterns while the acoustic analysis focused on the fundamental frequency (F0) compared to the Thai native speakers. The Praat Program was employed for the acoustic part. The analysis of tone errors showed positively that the C+Z group had higher rates of accuracy than the C-Z group, arguably due to their familiarity with Thai tone patterns, with no confusion stemming from Zhuang tone patterns. Contrastingly, the phonetic characteristics findings showed negatively that the C+Z group shared less similar production with Thai native speakers group than the C-Z group's ones, arguably due to

L1 interference. The current study confirmed both positive and negative effects of tonal L1 on the acquisition of L2 tones. Therefore, tonal problems should be investigated closely and identified clearly for the efficiency and effectiveness of tone acquisition training.
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1. Introduction

Tone acquisition is still a popular research area in second and foreign language acquisition for those who are interested in tonal languages. Though it is currently considered understandable and acceptable for non-native learners to exhibit tone errors or differences, which are often regarded as ‘unique accent’ influenced by their first language (L1) according to the interlanguage concept (Selinker, 1972; Corder, 1981), tone errors in Thai are not only about accent. They are also linked to the learner’s language competence in using the Thai system of alphabetic scripts, which also share properties with syllable scripts (Winskel & Iemwanthong, 2010). Learners must connect each script in the syllables or words to its corresponding sound correctly, and then choose or assign five standard Thai tones which are T1-mid tone [33], T2-low tone [21], T3-falling tone [43], T4-high tone [44 or 45], and T5-rising tone [323]¹ (Teeranon & Rungrojsuwan, 2009) to each lexical word. The tonal rule is conditioned by the three class initial consonants, syllable type, length of vowels, and tone marking system. The initial consonants are classified into three tonal classes known as the high, mid, and low consonants. The final consonants, corresponding to the length of vowels, are organized into two syllable types called live or smooth syllables, and dead or checked syllables². Thai tonal rules correspond to the distribution and restriction of consonant-tone interactions (Ruangjaroon, 2006; Lee, 2011; Perkins, 2013).

Teaching and learning Thai tones in the classroom is, therefore, often conducted along with Thai orthography, which makes it different from self-learning through exposure to a Thai language environment. If learners lack the ability to memorize and understand all consonantal, vowel, and tonal scripts and rules, they won’t be able to pronounce the unknown words correctly. In order to tackle the learners’ tonal problems in an effective manner, Thai teachers, therefore, have to place importance on tone errors to figure out which type of Thai tonal problem is, either A. a mispronouncing because the learners do not cope with the tonal scripts

and rules, or B. a mispronouncing because the learners cannot produce the tone they want to assign.

Zhuang are one of the ethnic Chinese who increasingly come to learn Thai as a foreign language because their region, the Guangxi Zhuang autonomous region adjacent to ASEAN countries, has been playing a major role in the Belt and Road Initiative. The region, with a large ethnic minority population, has become the most popular precinct for Thai language learning. Interestingly, very few people are aware that Zhuang and Thai share a profound historical relationship by comparison to other ethnic Chinese and Thai. Even though these three languages are tone languages, Chinese orthography is not alphabetic but logosyllabic³. Moreover, Chinese is a member of the Sino-Tibetan language family whereas Zhuang and Thai are in the same family of Tai (also known as Kra-Dai⁴ or Tai-Kadai). Moreover, both linguistic and anthropological evidence confirms that Zhuang people and Thais share the same ethnic roots (Nartsupha & Lohacharoon, 2017), and considerable genetic characteristics on cognates, phonology, tonology, and grammar (Burusphat & Qin, 2006; Pittayaporn, 2009). This relationship between Zhuang and Thai might be closer than the relationship set by being in the same tonal languages as Chinese and Thai.

Diller (1996 as cited in Pittayaporn, 2009) stated that Tai tonal rules were originally characterized by the non-segmental four tone system called Proto-Tai. There were three tonal distinctions for smooth syllables, identified as A, B, C, and a fourth tonal category for checked syllable as D. While the tone categories of each Tai language are split for the above conditions, different Tai varieties exhibit different tonal behaviors and different patterns of tonal splits. Tone split patterns⁵, thus, have been used as key criteria in the classification of Tai languages, especially Southwestern Tai, and all Tai speakers are assumed to have experienced similar tone split patterns.

Foreign language teaching scholars have always questioned whether L1 tonal experiences necessarily enhance L2 tone acquisition (e.g., Flege, 1995; So, 2006; Wang, 2006; Wang, 2014): do they facilitate the tonal production of L1 learners or cause confusion in production of L2 tones, and could any differences or confusion be predicted based on the degree of correspondence between the tone system of the two languages in question? Among Chinese learners from the above region, the Chinese Zhuang (hereafter CZ) have always mingled with other ethnic Chinese learners. Given that there are still no previous studies that answer the

above questions for them, this current study aims to fill this knowledge gap.

2. Literature Review

Many scholars have studied production and perception of Thai tones by foreign speakers (Juwarahawong, 2000; Wayland & Guion, 2004; Sinthawashewa, 2009), some of them focusing on the Chinese students in the classroom (Khamphut, 2002; Sathiansukon, 2005; Permkesorn, 2008; Wei, 2012; Lapyai, 2016; Lianghiranthaworn & Chapoo, 2019) With regard to Chinese students, they are commonly believed to learn Thai more easily than other groups of students because their language is also tonal and similar to Thai language. Khamphut (2002) studied the Thai language performance of Chinese students majoring in Thai at the Yunnan Institute of Ethnicity, People's Republic of China and found that the students made errors in the use of final consonants the most, followed by errors in the use of initial consonants and vowels. They made only a few mistakes in tones. Permkesorn (2008) also found that in pronunciation, Chinese students mispronounced vowels and consonants the most while tonal pronunciation was not an issue. This might be because both languages are tonal languages, even though their tones are different in quantity and various features (Permkesorn, 2008).

However, these findings contrasted with result from the study by Wei (2012), which consisted of an error analysis of Thai pronunciation produced by two groups of Chinese students at Chiang Mai University, one with Mandarin L1 and the other Cantonese L1. The results of this study revealed that Chinese students in both groups had numerous problems in tone pronunciation. The Mandarin L1 students made errors in every tone, their T2 the most common. Instead of T2, they mispronounced it as T3, followed by T5, T4, and T1 respectively. The Cantonese L1 students made errors in every tone except T1. Their T5 was the most common error. Instead of T5, they pronounced T1 or T2 respectively. However, Wei (2012) concluded that the errors were of substitution resulting from language learning and not related to the students' L1. None of these three studies clearly explained the learners' errors as being down to tone problem type A or B, and this may be because they focused on the other types of tone problem.

This current study investigated both problems A and B with respect to the participating group of Chinese Zhuang students. Being in the same language family and having a very close historical relationship to the Thai language, Chinese Zhuang students are usually expected to have more potential to learn Thai, to learn new words more easily given the familiar cognates in their background, and especially, to produce Thai tones more effectively than other Chinese learners because of the similar tone split patterns between Thai and Zhuang.

Such expectations should be questioned and confirmed by teachers. Flege (1995) stated that an L2 sound that is not too similar to an L1 sound will be easier to acquire than an L2 sound that is relatively similar to the L1 sound because it will be perceived as more obviously "different" by the learner. So and Best (2010) also conducted a case study of Cantonese listeners and found that they tended to perform worse than Japanese listeners in perceiving Mandarin contrastive tones despite the fact that Cantonese is a tonal language like Mandarin whereas Japanese is a pitch-accent language. The study results revealed that Cantonese people's tonal experience became an obstacle preventing them from acquiring the relatively simpler Mandarin tonal system. This was possibly because the learners assimilated the L2 tones into their native tonal categories or patterns, which hindered them from acquiring accurate L2 tones. In other words, familiar native tones do not necessarily enhance L2 lexical tone acquisition or learning.

The Chinese participants in this current study were divided into two groups, taking into account their native language experience and not just ethnicity. The first group was labelled as C+Z for possessing Zhuang language experience on a par with native speakers, while the second group, C-Z, though also ethnic Zhuang, had no experience of the Zhuang language and were considered naïve speakers. Both groups were compared in terms of tonal errors or confusion rates on the one part, and acoustic characteristics on the other. It was hypothesized that explicit L1 effects would occur only with the C+Z group.

3. Materials and Methods

3.1 Research Framework

The theoretical framework used to underpin the relationship between Zhuang and Thai in the current study consisted of a historical and

comparative checklist, or tone box, for determining tones in Tai dialects (Gedney, 1972). The tone box comprised shared phonetic features and conditions found solely in languages of the Tai family and was applied in the design of the research wordlist and prediction of error patterns representing as the negative effect of the learners' L1.

The five vertical columns of the tone box display the four tonal categories reconstructed for the Proto-Tai language labelled as *A, *B, *C in a smooth syllable, and *D in checked syllable. *A is the proto-tone that occurs in a smooth syllable without a tone marker as in Thai ขา /kha:⁵/ [leg] and ปลา /pla:¹/ [fish]. *B is the proto-tone that occurs in a smooth syllable with a tone marker /ʔè:k/ (◌◌) as in ไข่ /khaj²/ [egg] and พ่อ /pho:³/ [father]. *C is the proto-tone that occurs in a smooth syllable with a tone marker /tho:/ (◌◌) as in ห้า /ha:³/ [five] and น้อง /no:⁴/ [sister]. *DL is the proto-tone that occurs in a checked syllable with a long vowel as in ปาก /pa:k²/ [mouth] and เลือด /lu:³/ [blood]. *DS is the proto-tone that occurs in a checked syllable with a short vowel as in หก /hok²/ [six] and นก /nok⁴/ [bird]. In checked syllables where tone splits and mergers are conditioned by vowel length, the tones are identified as being in the same categories as those in smooth syllables.

Horizontally, the four rows represent four different historical consonantal classes, or phonetic features of the initial consonant, of each syllable by which the tone splits and mergers in each category or between different categories are conditioned. They include voiceless friction consonants, voiceless unaspirated, voiceless glottalized, and the voiced consonants.

Each cell represents the tone pattern and actual tone value of the specific combination of tonal category and consonantal class. Therefore, the actual tone of the syllable can be deduced given its consonantal class, tonal category, and tone split pattern. Table 1 shows the tone boxes of standard Thai and standard Zhuang⁶ for examples.

Table 1

Tones and tonal split patterns of Thai and Zhuang in Gedney's (1972) tone box

Languages	Standard Thai Tones					Standard Zhuang Tones				
Type of syllables	Smooth		Checked			Smooth		Checked		
Tonal categories Phonetic features of the initial consonant	*A	*B	*C	*DL	*DS	*A	*B	*C	*DL	*DS
1. Voiceless friction	T5 [323]									
2. Voiceless unaspirated		T2 [21]	T3 [43]	T2 [21]	T2 [21]	Z1 [24]	Z5 [35]	Z3 [55]	Z5 [35]	Z3 [55]
3. Voiceless glottalized	T1 [33]									
4. Voiced		T3 [43]	T4 [44]	T3 [43]	T4 [44]	Z2 [31]	Z6 [33]	Z4 [42]	Z6 [33]	Z6 [33]

As seen in Table 1, standard Thai T1-T5 consisting of [33], [21], [43], [44], and [323] respectively, and the standard Zhuang Z1-Z6 consisting of [24], [31], [55], [42], [35], and [33] respectively, have been entered into the tone boxes. Both tone boxes indicate Zhuang and Thai differences, not only in terms of quantity and features of the tones but also their tone split patterns. The pattern of Thai's tone split is shown as A1-234 and BCD 123-4, while these of Zhuang are shown as ABCD 123-4, and separated by a line of dashes.

3.2 The Error Patterns Predicted

According to Table 1, the yellow area of A1-234 and BCD 123-4; and the green area of ABCD 123-4 illustrate the different tone split pattern contrasts which did not map well with each other, allowing the researcher to anticipate the confusion or error areas for the C+Z learners. If the Zhuang tone split pattern unconsciously affected the C+Z group's tone deductive ability to assign tones for Thai words, their tonal confusion could be predicted to occur in these four different zones, as shown in Table 2.

Table 2

Thai and Zhuang Standard Tone Pattern Mapping in Thai tone split patterns

Types of syllables Classes of the initial consonant	Smooth syllable			Checked syllable	
	without tone marker	Tone marker /rè:k/	Tone marker /tho:/	Long vowel	Short vowel
High consonants	T5 Z1				
Mid consonants	T1 Z1	T2 Z3	T3 Z5	T2 Z3	T2 Z5
Low consonants	T1 Z2	T3 Z4	T4 Z6	T3 Z4	T4 Z4

Table 3 consequently shows four possible patterns of confusion, which are predictable based on the above four zones: A1 of T5, A4 of T1, DS1-3 of T2, and DS4 of T4. The ability of forecast each confused tone can be explained as follows:

1) Confusion pattern A1: smooth syllable with high consonant. It is assumed that the C+Z group would produce T1 instead of T5, the same as their L1 pattern which is A123=Z1

2) Confusion pattern A4: smooth syllable with low consonant. It is assumed that the C+Z group would not produce T1. Another tone different from the T1 in A2 and A3 would be produced, the same as their L1 pattern which is A123≠A4

3) Confusion pattern DS1-3: checked syllable with short vowel and high/mid consonant. It is assumed that the C+Z group would not produce T2, and another tone different from the T2 in DL would be produced, the same as their L1 pattern which is DL1-3≠DS1-3

4) Confusion pattern DS4: checked syllable with short vowel and low consonant. It is assumed that the C+Z group would produce T3 instead of T4, the same as their L1 pattern DL4=DS4

Table 3

The prediction of L2 tonal confusion patterns for the C+Z

Participant group	*A		*DS	
	A1	A4	DS1-3	DS4

C+Z	T1 or T5	not T1	not T2	T3 or T4
C-Z	----- accurate, not confused-----			

3.3 The Research Wordlist

Each monosyllabic word in the research wordlist was constructed with the exact tone value identified in each cell of the tone box, as shown in Table 4 below.

Table 4

The research wordlist

No.	Smooth syllables			Checked syllable	
	A	B	C	DL	DS
1-5	ขา kha: ⁵	ไซ khaj ²	ห้า ha: ³	ขาด kha:t ²	หก hok ²
6-10	ผ่า fa: ⁵	สี่ si: ²	ให้ haj ³	หมาก ma:k ²	หัก hak ²
11-15	ปลา pla: ¹	เก่า kaw ²	เก้า ka:w ³	ปาก pa:k ²	กบ kop ²
16-20	ดาว da:w ¹	ป่า ba: ²	ใต้ da:j ³	ตูด du:t ²	อก ʔok ²
21-25	นา na: ¹	พ้อ pho: ³	น้อง no:w ⁴	เลือด luw:ət ³	นก nok ⁴
26-30	ลม lom ¹	คำ kham ³	น้ำ na:m ⁴	คาบ kha:p ³	มด mot ⁴
31-35	โขน kho:n ⁵	ไฟ phaj ²	เสือ swa: ³	หาด ha:t ²	หด hot ²
36-40	แห hɛ: ⁵	ขาว kha:w ²	ผ้า pha: ³	เสือก swak ²	สุข suk ²
41-45	แก ke: ¹	แก่ ke: ²	แบ่ง pe:w ³	ปีก pi:k ²	เจ็บ ɕep ²
46-50	อาย ʔa:j ¹	อ่าน ʔa:n ²	บ้าน ba:n ³	บาท ba:t ²	บัตร bat ²
51-55	ลา la: ¹	ไฟ phaj ³	น้อม no:m ⁴	เชือด chw:ət ³	นับ nap ⁴
56-60	นาม na:m ¹	ไล่ laj ³	ซ่อน cho:n ⁴	ชาติ cha:t ³	ชัด chat ⁴

The Thai words numbered 1-30 are Zhuang-Thai cognates adapted from Qin (2011) to stimulate the participants' tonal pattern representation, while the randomized words numbered 31-60 are non-cognates with Zhuang⁷. All words which displayed in Thai script with Angsana New 72 point scripts for each PowerPoint slide were arranged to be six words in one line to prevent the participants from recalling any clue of pattern for the five tones.

ชา	ไซ	ห้า	ขาด	หก	ฝา
สี่	ให้	หมาก	หัก	ปลา	เก่า
เก้า	ปาก	กบ	ดาว	ป่า	ได้
ดูด	อก	นา	พ่อ	น้อง	เลือด
นก	ลม	คำ	น้ำ	คาบ	มด
โชน	ไฟ	เสือ	หาด	หด	แห
ข้าว	ผ้า	เสือ	สุข	แก	แก่
แป้ง	ปีก	เจ็บ	อายุ	อ่าน	บ้าน
บาท	บัตร	ลา	ไฟ	นม	เชือด
นับ	นาม	ไล่	ซ่อน	ชาติ	ชัด

3.4 Participants

3.4.1 Participant 1: The Chinese Zhuang students groups (C+Z and C-Z)

The target participants were purposively sampled Chinese Zhuang female students at Guangxi University for Nationalities, GZAR, People's Republic of China (PRC). They were all enrolled in the third semester of Thai courses at the Guangxi University of Nationalities. Before participating in this study, these students had been studying Thai at the university for three semesters, that is, they were all studying the same discipline, in the same class, at the same university, in the same academic year. In fact, they all shared the six following intervening factors:

- 1) Nationality: Zhuang
- 2) Age: 18-23
- 3) Sex: female
- 4) Stage of learning: junior students at an intermediate level
- 5) Exposure: Thai language teachers in classroom, Thai news report, Thai movies, and Thai TV programs.
- 6) Learning attitude: a positive attitude towards Thai L2 language learning.

The questionnaire, designed to ensure these factors and their degree of L1 and L2 experience, was adapted from Pongprairat (2011) and distributed to all participants before the process of purposive sampling. The questionnaire consisted of three parts: Part 1 related to personal data and L1 experience; Part 2 to L2 experience; and Part 3 concerned the participant's attitude towards learning L2. At the end of Part 1, a self-evaluated language proficiency rubric - designed to assess the participants' L1 experience – replaced the language assessment. Participants in the C+Z group needed to obtain three marks or above to meet the high proficiency criterion.

Overall, 18 junior students majoring in Thai participated in the experiment orientation, of which based on the criterion above, five qualified to join the C+Z group. The actual tones they produced for the cognates 1-30 were elicited in a semi-conversation interview to ensure that they knew the pronunciation of the words in Zhuang. The participants in the C+Z group, however, had no idea these Zhuang words would be used in the test in the following week. The five students in the C-Z group were placed there based on their 0-1 mark. See Appendix for details of the CZ participants.

3.4.2 Participation 2: The Thai Native Speakers group (NS)

Five local female university students in the same 18-24-year age group as the CZ participants were recruited to perform the same oral production task under the same procedure in order to establish an updated baseline or norm for comparison. They were all born to native-Thai-speaking parents, were raised or currently resident in Bangkok, and had either never lived outside the Bangkok Metropolitan Region for more than six consecutive months, or not done so in the previous five years. They were all majoring in Thai and used standard Thai as their main language at the same university.

3.5 Data Collection

Before the recording, the participants were given an opportunity to familiarize themselves with the demo-words slides for as they wished. All processes started when the participants were seated in front of the screen and signaled they were ready. The participants were asked to read each word on the PowerPoint slides in isolation from word number 1 to 60

for three rounds. The computer mouse was controlled by the researcher. A three second break was given between each slide, and 1-2 minutes break between each round. After each slide was shown, the next one would appear on screen until the end of the round. Each word was pronounced for three separate rounds to check the consistency of the participants' pronunciation, providing a total of 1,800 monosyllabic tokens (10 participants x 60 words x 3 times).

The process was conducted in full compliance with ethics in human research standard and with the participants' consent. Sound data 4.2.2 and 4.2.3 were recorded in a quiet room using a Sony ICD-UX533 recorder with a Keenion COS 203 microphone, and saved onto a notebook computer.

3.6 Data Analysis

The elicitation data were first analyzed and compared with the four predicted patterns, and the accuracy rates and errors were recorded in the tone confusion matrix table. Prior to the next phase of acoustic analysis, the tone production data were revised so that confused or mispronounced utterances could be eliminated.

During the acoustic analysis session, Praat speech analysis software v.5356 was employed for examining the fundamental frequency (F0) of tones. The onset of each tone was at the vowel onset, and the tone ended at the vowel offset to avoid the effects of pitch perturbation from both initial and final consonants. These were not able to be controlled acoustically because the wordlist had been necessarily created for the cognacy condition first. As part of the F0 measurement procedure, 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 into Microsoft Excel for evaluating duration and F0 value at 11 points. The measured fundamental frequencies in Hertz were converted into semitone values. The method used in this study for converting Hertz into semitone was based on Jitwiriyanont (2012), to gain an overview of the tone shapes and provide a comparison of the lowest pitch height of all the tones, as well as to minimize variation in the pronunciation among the Chinese and Thai participants. The trend lines of the normalized time of duration and

semitone values are presented as a comparison to convey the details of pitch contour shape of the C+Z, C-Z groups and the NS group.

4. RESULTS

4.1 The Phonological Analysis for Problem A: The C+Z Group's Error Patterns and Accuracy Rates

In the verification stage, the two target groups' tonal confusion percentages were compared in terms of the four predicted patterns, as shown in Table 5.

TABLE 5

Verification of L2 tonal confusion patterns for the C+Z group

Participant group	*A		*DS	
	A1	A4	DS1-3	DS4
C+Z	0%	0%	0%	5% T4 ⇒ T2
C-Z	30% T5 ⇒ T1/T2	1.66% T1 ⇒ T4	8.2% T2 ⇒ T4	15% T4 ⇒ T2

In comparison, Table 3 and Table 5 indicate that the C+Z group's confusing tones did not occur as predicted even in the DS4 pattern, and the tone assigned instead was not the one predicted by the tone split paradigm. Moreover, the C-Z group, who had no experience of the Zhuang language, exhibited a high degree of confusion with those tones and patterns, meaning that the difference in tone split patterns between the two languages did not affect the assignment of tones for them.

Each confused pattern and the erroneous tone that was assigned was analyzed in detail. The confusion matrix in Tables 6 shows the correct performance percentage as well as the confusion occurred for each tone among the two groups of students.

TABLE 6

Confusion matrix (in percentages) of the C+Z and C-Z groups tonal performance

Thai Tones	Tone Patterns	Tonal performance percentage (%)									
		T1		T2		T3		T4		T5	
		C+Z	C-Z	C+Z	C-Z	C+Z	C-Z	C+Z	C-Z	C+Z	C-Z
T1	A2	100	95	0	5	0	0	0	0	0	0
	A3	100	100	0	0	0	0	0	0	0	0
	A4	100	98.33	0	0	0	0	0	1.66	0	0
T2	B1	0	0	96.66	93.33	3.33	6.66	0	0	0	0
	B2	0	0	96.66	93.33	3.33	6.66	0	0	0	0
	B3	0	0	100	96.66	0	3.33	0	0	0	0
	DL1	0	0	95	90	5	3.33	0	1.66	0	5
	DL2	0	3.33	100	93.33	0	0	0	3.33	0	0
	DL3	0	0	100	96.66	0	0	0	3.33	0	0
	DS1	0	0	100	98.33	0	0	0	1.66	0	0
	DS2	0	0	100	90	0	0	0	10	0	0
	DS3	0	0	100	100	0	0	0	0	0	0
T3	B4	0	0	10	3.33	90	90	0	6.66	0	0
	C1	0	0	0	3.33	100	90	0	3.33	0	3.33
	C2	0	3.33	0	3.33	100	93.33	0	0	0	0
	C3	3.33	3.33	0	3.33	96.66	93.33	0	0	0	0
	DL4	0	0	1.66	25	98.33	75	0	0	0	0
T4	C4	0	6.66	0	5	1.66	0	98.33	88.33	0	0
	DS4	0	0	5	15	0	0	95	85	0	0
T5	A1	0	6.66	0	23.33	0	0	0	0	100	70

In each rubric, there is a column containing the correct tones highlighted by grey, with the number of tokens as a percentage that correct pronunciation was achieved. Meanwhile, the other four columns represent the tonal errors in the individual rubric and the percentage of incorrect tone assignment. The number of occurrences is presented as a percentage for comparing across the tones because each tone has different possible occurrences. For instance, T5 is in 4 words (only in A1) x 3 rounds x 5 participants, so there are 60 occurrences of T5, while T3 is in 10 words (in B4 = 2 words, C1= 2 words, C2=1 word, C3=1 word, and DL4=2 words) x 3 rounds x 5 participants, making 240 occurrences of T3.

The results shown in Table 6 indicate that the C+Z group's understanding of the rules was better than the C-Z group's one. T1 and T5 were considered as causing no problem or confusion for them even in the

pattern predicted. Moreover, they could produce all the words with T1 and T5 100% correctly. Contrastingly, T1 and T5 were confused by the C-Z group. In T1, only in the syllable pattern A3 was there no sign of confusion. For A2 and A4, instead of T1, the C-Z group produced T2 and T4 respectively. In T5, the C-Z group's confusion was also high, instead of T5, the tone assigned was T1 in 6.66% and T2 in 23.33%. And for the DS4 pattern, T2 was assigned instead of T4 in 15% of cases.

For the C+Z group's T2, there was only 5%, 3.33%, and 3.33% confusion occurring in the patterns DL1, B2, and B1, respectively. The tone which was assigned instead of T2 was T3. This was not supposed to be the case based on the Zhuang's tone split paradigm because the confusion did not occur in B3 which belonged to the same column and shared the same rule. In addition, in Zhuang, the patterns in Column B and DL would be pronounced with the same tone. According to the table above, the C+Z group assigned T3 in B1 and B2, but not in DL1 and DL2. Therefore, the confusion for T2 did not relate to the L1 contrasts as predicted.

As for The C-Z group's T2 recognition, confusion occurred in 1.66%-10% of cases occurred in patterns B1-3, DL1-3, and DS1-2. Only the DS3 encountered no sign of confusion. For the B1-3 patterns, the tone assigned instead of T2 was T3, while for DL1-3, the C-Z group assigned all the four remaining tones instead of T2. Most of the substituted tones in DL and DS were T4, notably in 10% of cases observed for DS2. This confusion was almost certainly down to a lack of familiarity with the rules or conditions of the tone split pattern.

Furthermore, 5% of the confusion related to of "T2 to T5" probably came from the omission of a final consonant. When the C-Z group failed to pronounce the final sounds of the checked syllable, the syllable would become similar to the A1 pattern and so T5 was pronounced. It should be noted that this problem did not occur with the C+Z group because they had no problem with final consonant omission in the checked syllable.

T3 was the most confused tone for both the C+Z group and the C-Z group. As for the C+Z group, 3.33% and 1.66% of confusion occurred in the patterns of C3 and DL4 respectively. It was noted that 10% of confusion was found in the B4 pattern. Instead of T3, the tone assigned in B4 was also T2. The occurrence of this interesting T2-substitution could be attributed to two possible causes: firstly, they might be unfamiliar with the different initial consonants; secondly, they might be unfamiliar with this basic split pattern of both L1 and L2. The second cause would indicate that

the C+Z group's tonal confusion did not relate to their L1 and they did not map their L1 tone patterns to their L2 ones.

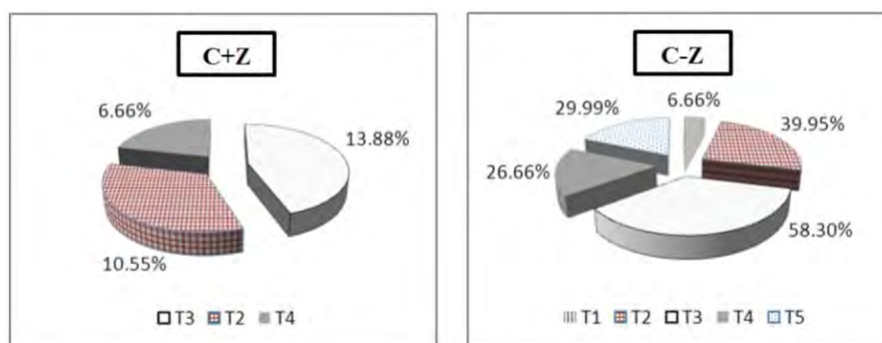
For the C-Z group's T3, 3.33%- 25% of confusion occurred for every pattern, and the tones assigned instead of T3 were also distributed over the four remaining tones. DL4 in that the T3 in all words was mispronounced as T2 at the highest rate (25%). These occurrences of confusion confirmed the learner's unfamiliarity with the different initial consonants by which tonal patterns are conditioned.

For T4, the confusion of the both C+Z and C-Z group occurred for every pattern, but the C+Z group evinced stronger decision-making in their tone assignment. With the C4 pattern, they mispronounced T3 for T4 in 1.66% of cases. For DS4, they mispronounced T2 for T4 on 5% of occasions. This confusion suggests that it is common for the C+Z group to use one tone for DS1-4 without considering splitting or changing to a different tone when reaching the position/pattern of the voiced consonants. This again indicates that they did not map their L1 tone patterns to their L2 ones. For the C-Z group, their confusion manifested itself for every pattern. In the C4 pattern, T1 was assigned instead of T4 on 6.66% of occasions, and T2 on 5%, while for DS4, they assigned T2 instead of T4 on 15% of occasions. The error pattern "T2 in all words" was also considered as a problem of consonant class differentiation related to Thai orthography memorization, as mentioned in the introduction.

According to the frequency of confusion figure presented in Tables 6, the most confused tones for each group are shown in Figure 1 below.

FIGURE 1

The confused tones for the C+Z and the C-Z



According to Figure 1, the tones that confused the C+Z group the most were T3 (13.88%), T2 (10.55%), and T4 (6.66%), while the tones that confused the C-Z group the most were T3 (58.30%), T2 (39.95%), T5 (29.99%), T4 (26.66%), and T1 (6.66%). These results indicate that T3, T2, and T4 are the tones that should be put under close observation by TFL (Thai as a Foreign Language) teachers. Although the confusion rates of the C+Z group were less and more directional than the C-Z group's, the few errors they made nevertheless revealed some confusion in assigning tones for the syllable in A1, DL4, and DS4. The particular patterns included marked patterns and general problems for all groups of Chinese students, especially related to consonant class differentiation in Thai, which was demonstrated in the first column of Table 2 above.

4.2 The Acoustic Analysis for Problem B: The Fundamental Frequency in Semitone Comparison

The content of this section is mainly to identify the standard Thai tones produced by the C+Z and the C-Z groups in terms of fundamental frequency converted to semitones, with reference to the NS control group's production as a norm⁸ for comparison, as shown in Figure 2 below.

FIGURE 2

The standard Thai tones (in semitone) produced by the NS group

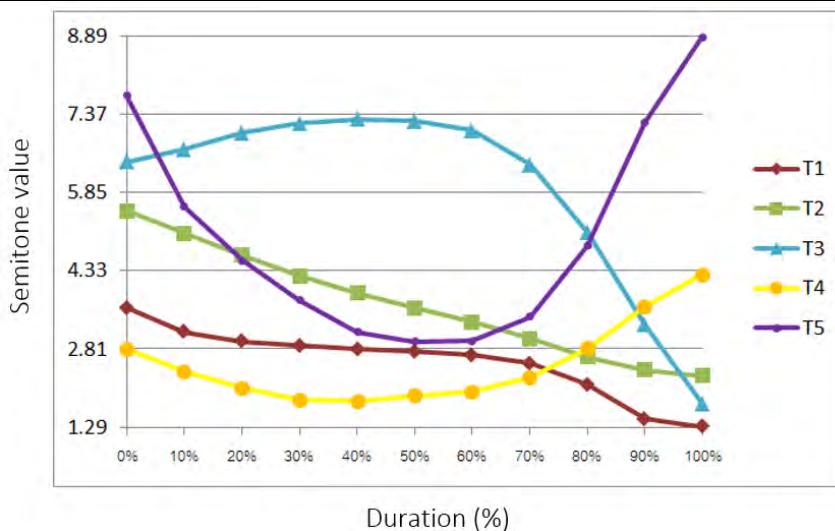
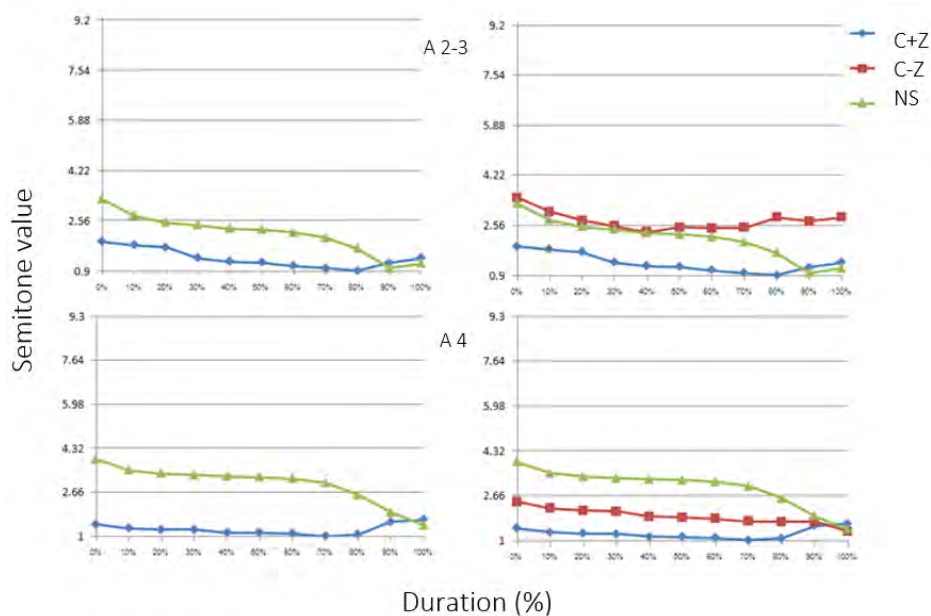


Figure 3 - 7 illustrates the acoustic characteristics of Thai tones produced in citation form by the C+Z, and C-Z groups, and by the NS group. Each F0 curve (in semitone) is an average across all participants in the same group.

FIGURE 3

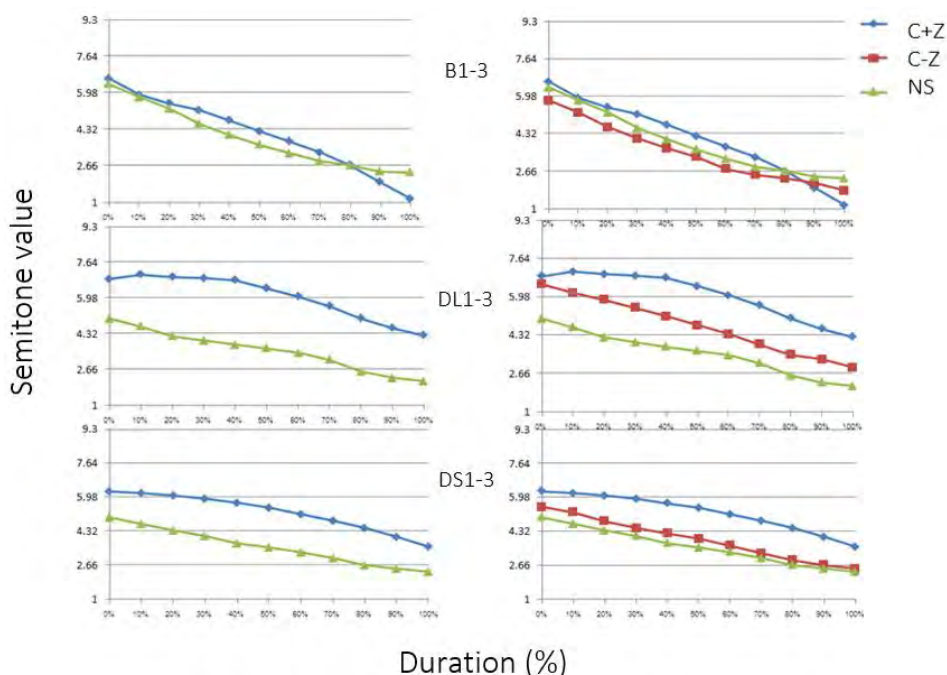
Thai mid tone [T1] produced by the C+Z and C-Z groups, and the NS group



According to Figure 3, referring to T1, it was found that in A2-3, the C+Z group's onset was the lowest one, at 1.87 semitones, while the C-Z group's and the NS group's onsets were quite similar, at 3.3 semitones in the mid-to-low range. However, at 40% of normalized time, the NS group's T1 trended slightly down, while the C-Z group's T1 remained level within the same pitch range. In a comparison of the offsets, the C+Z and NS groups shared a similar semitone offset at 1.1-1.3 semitones in the low range. In A4, all three T1 onsets were more obviously different, almost to one pitch scale, whereas their offsets on the other hand were similar within the low pitch scale. The NS group's T1 direction was downward while those of both CZ groups were horizontal. The differences between their onsets and offsets made both CZ groups' trend lines appear different in direction from those of the NS group.

FIGURE 4

Thai low tone [T2] produced by the C+Z and C-Z groups, and the NS group

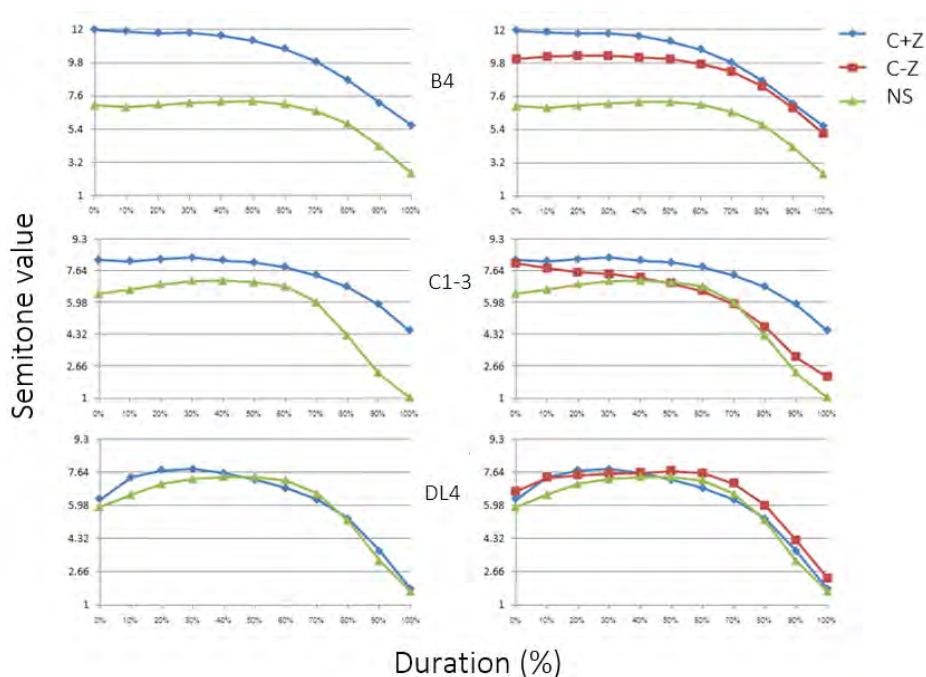


According to Figure 4, referring to T2, both the C+Z and C-Z groups' production looked most like that of the NS group in the B1-3 patterns,

where T2 tended to be a contour tone more than a level one - probably transferred from their Zhuang Z2 [31]. However, in the other two checked syllable patterns, DL1-3 and DS1-3, the C+Z group's T2 was up to 1 pitch higher, resulting in the C-Z group's and the NS group's production being more similar.

FIGURE 5

Thai falling tone [T3] produced by the C+Z and C-Z groups, and the NS group

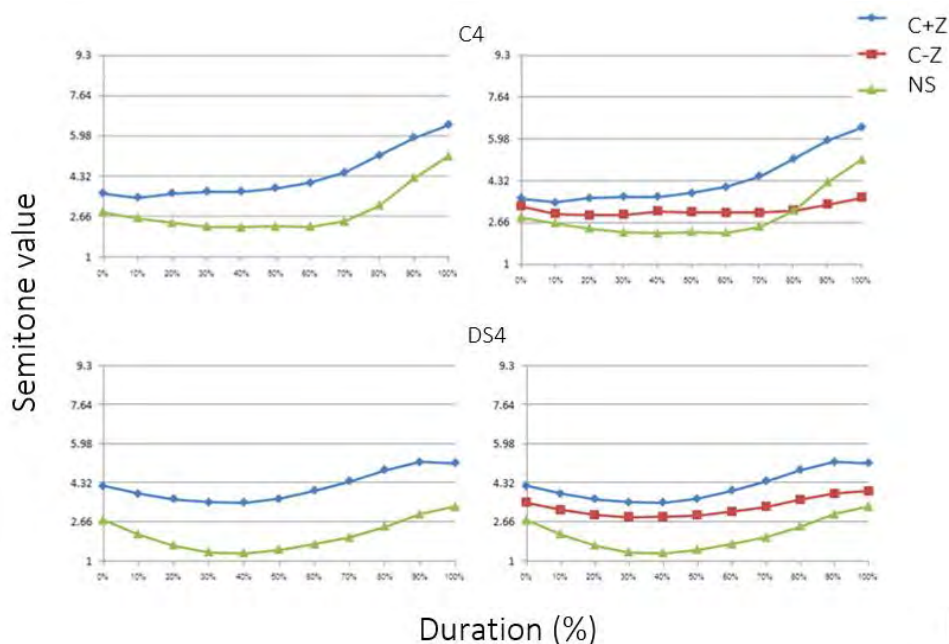


According to Figure 5, referring to T3, both the C+Z and C-Z groups' production was dramatically higher than that of the NS group, especially for B4, which was higher for two pitch ranges. In DL4, production was most similar among the three groups in their onsets, offsets, and contour, but when considering the normalized duration, it was found that the C+Z

group's pitch had rapidly descended by 30%, while that of the C-Z group and that of the NS group had descended at the same points in all patterns.

FIGURE 6

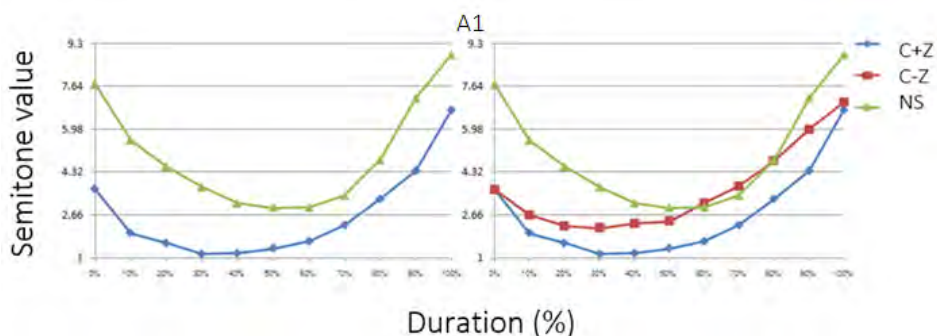
Thai high tone [T4] produced by the C+Z and C-Z groups, and the NS group



According to Figure 6, referring to T4, the C+Z group's production was also dramatically higher than that of the NS group for one pitch range, while that of the C-Z group's production was closer to that of the NS group. However, the C+Z group's T4 shape in both patterns was almost the same as the NS group since the parallel lines in particular were more similar than those of the C-Z group.

FIGURE 7

Thai rising tone [T5] produced by the C+Z and C-Z groups, and the NS group



According to Figure 7, referring to T5, both the C+Z and C-Z group's production was clearly different from that of the NS group. Although both CZ groups shared the 3.66-semitone-onset and 7.03-semitone-offset, which were lower than those of the NS for 1-2 pitch scale, they were different in both height and contour. At 30% of the normalized duration, the C+Z group's trend line was near 1, while that of the C-Z group was near 2.5, 1.5 semitones higher. After the point, the C+Z's trend line went up more concavely than those of the C-Z to end at the same point. However, their features of height and shape were more like to each other than those of the NS.

The findings in these two sections, therefore, indicate that the C+Z group produced Thai tones better than the C-Z group, without any confusion related to corresponding L1 tonal patterns that was predicted. However, it was also found that the C+Z group's production was less similar to that of the NS group than the C-Z group. In other words, the C+Z group was identified as learners with Problem B and not Problem A. Their able performance was arguably due to their familiarity with tone patterns that were similar to the Thai ones, whereas problem B was arguably due to L1 interference. This could be interpreted as supporting So and Best's (2010) case of Cantonese listeners that was discussed in the literature review, wherein the L1 became an obstacle that prevented them from acquiring the simpler Mandarin tonal system. In the current case, although the C+Z group's familiar tonal L1 was found to facilitate the acquisition of the tonal rule that dictate tones patterns for assigning tones, it might also hinder them from fully producing the accurate tone accent. According to So and Best (2010) and Flege (1995), the case study revealed both positive and negative effects of tonal L1 and L2 familiarity, interpreting it as both an advantage and disadvantage of tonal L1 on the acquisition of tonal L2 tones. According to Wei (2012), while the Mandarin L1 and the Cantonese

L1 did not relate to the students' Problem A, the Zhuang L1 related positively to this type of problem.

Phonetically, tonal pronunciation is inextricably linked to consonant and vowel pronunciation, e.g., vowel length, intrinsic vowel duration, syllable structure, and stress, as the tone-bearing units. Determining the tonal differences controlled by these factors paves the way for generalizations about the tones (Roengpitya, 2007). The different tones imply that the two groups of Chinese learners possessed different consonants and vowels as well. The interesting point was that, the C-Z group's combination of consonant, vowel, and tone pronunciation were closer to those of the NS group than the C+Z group's tones with the genetic relationship despite the fact that the C-Z group had some articulation problems, such as the omission of final consonant that constituted a T2 error. Those should be further examined to determine other similarities between the C-Z group's Chinese tonal L1 and Thai tonal L2.

5. Discussion

Since there have been no previous studies identifying specifically the L2 tonal problems of Chinese learners in both A and B dimensions, the current study is a case study of both dimensions, focused on the learner's L1 familiarity of tonal spilt patterns from their shared language family. The results reveal both positive and negative L1 effects on the L2 learner's tone production. Positively, the C+Z group seemed to acquire Thai tonal rules automatically without consciously noticing or making any attempt at L1-L2 tonal pattern mapping. The C+Z group's high accuracy rates of tone production seem to suggest that the familiarity between the L1 and L2 systems helped promote an understanding of L2 tonal rules. However, that familiarity didn't help in producing the L2 tones with the same acoustic characteristics; in fact, the C-Z group's production was acoustically better than the C+Z group's. Every coin has two sides. It all depends on the way the TFL teachers contend with both aspects of L1 effects to focus specifically on developing the learner's L2 tone acquisition in their training. The most important thing for educators is to assess and be aware of the learners' basic prior knowledge (Lapyai, 2016) as well as the unique impacts of their L1 in order to sort them appropriately into each group for the most suitable training. It is also important to be aware of the

differences among Chinese learners and other ethnicities in the same classroom.

Additionally, these findings provided insights that can spur future research that avoids the main limitations of the current study. The first limitation concerns the representativeness of the sample. Because of the specification of a number of control factors, namely: gender, age, prerequisite knowledge, stage of Thai learning, Thai language exposure, and learning attitude, the questionnaire was the primary tool used to screen and categorize the participants into C+Z and C-Z groups. Also, the level of Zhuang language competency of the C+Z group was self-measured by each participant. The second limitation was the language variation. Members of the C+Z group studying in the same university came from different regions, and although they knew Standard Zhuang, they spoke at least 13 different varieties of Zhuang in their hometowns. Therefore, their inherit dialect accent, which could individually intervene in their Thai tonal performance, should be further examined.

Finally, the need for further study and a reanalysis of the production interpretation has also been suggested. In this current study, the NS's tone production as a norm differed from those of previous researches, especially for T1, which, surprisingly, was lower than T2. This might be because each tone had a different number of possible tokens in the pronounceable combinations of the syllable. All of them had to be calculated to determine the average, which meant that they moved away for their individual raw value. Furthermore, the cognate-based wordlist was not sufficiently acoustic restricted, and the citation forms without sentence frame allowed some tokens to become longer as a hyper-correction or overly stressed syllable. These limitations should be noted here, accounting for +error semitone values.

Acknowledgements

Grateful acknowledgement is made to the people who contributed to the production of this article. I would like to express deepest appreciation to Professor Dr. Somsong Burusphat, for her superb guidance and support, Associate Professor Dr. Weera Ostapirat for suggestions which incentivised me to widen my research, Dr. Sujinat Jitwiriyant, for the practical workshop on acoustic phonetic measurement, and the anonymous reviewers, for their helpful and

constructive criticism. I am indebted to all Thai and Zhuang participants for their eager participation in the current study, Dr. Qin Xiuhong and all staff of the School of Southeast Asian Languages, Guangxi University for Nationalities, for their generous support in the process of data collecting; and to Ms Lu Jing, from the Faculty of Southeast Asian Languages, Yunnan Nationalities University, for her support as a verifier for the non-cognate words. My sincere thanks also go to Ajarn Supang Chirarattanawanna and Ms Sarah Aikman for proofreading and commenting on the earlier version of this paper, and Ajarn Richard John Hiam for proofreading and commenting on this version.

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Endnotes

¹ Digits are tone letters devised by Chao (1930); the system provides simplified tone-pitch graphs of the voice. Tones are represented by 2 or 3 letter values to indicate the initial and the final or the initial, the medial, and the final.

² The syllable types, called “live” or “smooth” syllables, end in a long vowel or a sonorant (/m/, /n/, /ŋ/, /j/, /w/), while the “dead” or “checked” syllables end in a plosive (/p/, /t/, /k/) or in a short vowel. The full complement of Thai T1-T5 exists only in the former, and only three tonal distinctions T2, T3, and T4 are possible for the latter.

³ For logosyllabic system of writing, each script generally represents one syllable and may be a word on its own or a part of a polysyllabic word. *Hanzi* in Mandarin, *kanji* in Japanese, *hanja* in Korean

and *Hán tự* in Vietnamese are generally examples, their written scripts are called logograms or logographs.

⁴ Zhuang belongs to the Kam-Tai (Zhuang-Dong) language group. The Kam-Tai (Zhuang-Dong) language group is divided into three subgroups: i.e., Be-Tai, Lakkja, and Kam-Sui. The Be-Tai language group is further divided into Be and Tai subgroups. The Zhuang language, which is divided into Northern Zhuang and Southern Zhuang, and Thai language (Siamese) are within the same Tai group (Burusphat & Qin, 2006).

⁵ See Tai tone split patterns, the varied pattern of tone splitting, in Diller et al. (2008). For the patterns of Thai tone splitting, see Tienmee (1992)

⁶ Standard Zhuang is the official standardized form of the Zhuang varieties. Zhang and Wei (1997) identified 13 Zhuang language varieties, and have divided them into northern and southern dialects. As there are over 60 distinct tonal systems with 5–11 tones depending on the variety (Luo, 2008) and some of these are themselves multiple languages that are not mutually intelligible without previous exposure on the part of speakers, they have to have the standard one as an artificial mix of several Zhuang varieties. The Wuming dialect of Yongbei Zhuang, classified within the "Northern Zhuang dialect," is considered to be the "standard" or prestigious dialect of Zhuang, developed and revitalized by the government for official usage since 1955 (Anttonen, 2017).

⁷ All randomized words 31–60 were verified according to three sources: The Northern Zhuang-Chinese-Thai-English Dictionary (Burusphat & Qin 2006); the Cuengh Gun Yingh Swzdenj Zhuang-Chinese-English Dictionary (Luo et al., 2005), which contains about 4,500 basic Zhuang entries of 7,351 meanings; and a C+Z informant from another university, who was the same age as the participants.

⁸ It should be noted that the tone norm in this study were quite different from the tones recorded by Abramson (1962). In recent years, scholars (Morén & Zsiga, 2006; Teeranon, 2007) have found that high and mid tones now have similar concave tone shapes, that is, beginning with a slight fall in F0 values, followed by a plateau and ending with a slight rise. Teeranon (2007) argued that since high tone is becoming increasingly contoured, it should be categorized as such instead of as a 'level' or static tone. Falling tone remains remarkably similar to previous descriptions in that it has a slight rise followed by a small plateau and a sudden fall. Falling tone is phonetically higher than the high tone. Morén & Zsiga (2006) and

Luksaneeyanawin (1998) showed low tone to be the most phonetically static, characterized by a gradual fall from tonal onset to tonal offset.

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Appendix

The Detail of Participants

No.	Age	Hometown	Zhuang Family members	Learn Zhuang by	Use Zhuang at	Marks of Zhuang competency	Other languages
1	22	Nanning	6	parent	home	4	Mandarin English Thai
2	20	Hechi	4	parent	home	4	Mandarin Guiliu English Thai
3	19	Baise	4	father	home	4	Mandarin English Thai

No.	Age	Hometown	Zhuang Family members	Learn Zhuang by	Use Zhuang at	Marks of Zhuang competency	Other languages
4	20	Chongzuo	2	parent	home	3	Mandarin Baáihuá English Thai
5	20	Nanning	4	parent	home	5	Mandarin English Thai
6	20	Laibin (Wuxuan)	2	parent	-	1	Mandarin English Thai
7	20	Liuzhou	1	mother	-	1	Mandarin Liuzhou English Thai
8	20	Nanning (Binyang)	1	parent	-	1	Mandarin Báihuá English Thai
9	19	Nanning	1	parent	-	1	Mandarin English Thai
10	19	Laibin (Xiangzhou)	2	parent	-	1	Mandarin Guiliu English Thai