

The Impressionistic Study of English /tʃ/ and /ʃ/ in Initial Position by L2 Thai Learners

Qiandi Huang¹

¹ Department of English, Faculty of Humanities, Naresuan University, Thailand

Correspondence: Qiandi Huang, Department of English, Faculty of Humanities, Naresuan University, No. 99, Moo. 9, Tha Pho Subdistrict, Muang Phitsanulok District, Thailand, 65000.

Received: July 12, 2020

Accepted: August 24, 2020

Online Published: August 26, 2020

doi: 10.5539/elt.v13n9p112

URL: <https://doi.org/10.5539/elt.v13n9p112>

Abstract

Although studies on English sound learning by L2 Thai learners have been widely examined, there have been no studies on the production of the English /tʃ/ and /ʃ/ sounds in the initial position by L2 Thai learners with consideration of vowel contexts, the experience of L2 learners and target sounds. The aim of this study is to examine the production of the English /tʃ/ and /ʃ/ sounds in the initial position while taking the aforementioned factors into account. The data was from 48 L2 Thai learners, and the subjects were divided into two groups of university students: English-majors and non-English-majors. The two target sounds: English /tʃ/ and /ʃ/ together with the Thai /tɕʰ/ sound were tested in 27 words (9 words for each target sound). The subjects produced the target sounds five times, and their production was transcribed by two British transcribers. The results showed that the subjects had high target-like production when producing /ʃ/ but low target-like production when producing /tʃ/. In finding the correlation between the factors and the target-like production, neither the vowel contexts nor the experience could account for the production. The only factor that relates to the production of English /tʃ/ and /ʃ/ was the target sounds, i.e. the number of the productions that was deemed non-target-like was significantly higher when the target sound was /tʃ/ than when it was /ʃ/. This suggests that the target sounds, rather than the L2 experience and the vowel contexts, play a significant role in L2 speech production.

Keywords: fricative, affricate, Thai, English, target sound

1. Introduction

Throughout much of the 20th century, a fair number of theories and models on L2 phonology have come into being, one of them based on behaviorist learning theory and widely applied in the 1960s, known as Contrastive Analysis Hypothesis (Hereinafter referred as CAH). On the basis of CAH by Lado (1957), L2 sounds which do not exist in L1 phonemic inventories are more prone to be a greater challenge for learners to produce. This is especially true in the case of /tʃ/ and /ʃ/ sounds by L2 Thai learners which are absent from the Thai phonological system. Evidence from Jotikasthira (1999) and Ronakiat (2002) demonstrates that the affricate sound /tʃ/ was considered to be problematic for Thai learners, as it does not map onto the same category in the Thai sound system. Richards (1969) and Kitikanan (2016) also suggested that /ʃ/ was difficult for L2 Thai learners to appropriately pronounce because of its nonexistence in their L1. /tʃ/ and /ʃ/ were often substituted with the Thai affricate sound “จ” /tɕʰ/ in both production and perception by L2 Thai learners as they phonetically share the most features with /tɕʰ/ as supported in previous studies (Kitikanan, 2017; Richards, 1969). Briere and Chiachanpong (1980) even directly employed /tʃ/ to symbolize /tɕʰ/ or “จ” sound in the Thai stimuli of their study since they share the most similar place of articulation.

Results from Kitikanan (2016) revealed that /ʃ/ in some cases was realized as [tʃ] because they share close features with one another. In the impressionistic analysis, /ʃ/ was deemed to have been articulated as [tʃ], like the word “shop” /ʃɒp/ realized as [tʃɒp], suggesting that /tʃ/ and /ʃ/ are problematic sounds for L2 Thai learners. Several research studies (Anam, 2018; Briere & Chiachanpono, 1980; Kitikanan, 2016, 2017; Pansottee, 1992; Richards, 1969; Roengpitya, 2011) have been put forward to address the production or perception of /tʃ/ and /ʃ/ sounds of L2 Thai learners. However, none of them have been conducted to explore the production of /tʃ/ and /ʃ/ sounds by L2 Thai learners by comparing them with the production of the Thai “จ” /tɕʰ/, and focusing on other factors such as vowel contexts and L2 learner’s experience.

A comprehensive study of /tʃ/ and /ʃ/ sounds is still needed, and this study was intended to fill the gap by examining the production of the English /tʃ/ and /ʃ/ sounds together with their closest Thai counterpart “จ” /tɕʰ/ in relation to vowel contexts, L2 experience and target sounds. It is possible that none of these investigated factors is important in accounting for the variation of L2 production as shown in studies, such as that of Kitikanan (2019), which showed that motivation, which was the explored factor, had no correlation with pragmatic and grammatical awareness. It is hoped that the findings of the present research would shed new light onto future studies of L2 speech development across L2 Thai learners or learners of other language backgrounds.

2. Literature Review

2.1 Vowel Context

A large volume of studies demonstrated that L2 learners seem to have more problems with target sounds in certain vowel contexts than other vowel contexts, both in production and perception (Harris & Noss, 1972; Kitikanan, 2016; Lambacher, Martens, Nelson, & Berman, 2001). Evidence in the study of Lambacher et al. (2001) underscores the notion that vowel contexts have great influence over listeners' speech perception by carrying out a task of distinguishing English voiceless fricatives under five vowel contexts /i, ε, a, o, u/, and three different consonant environments (initially, medially and finally). The results revealed that the accuracy varied with particular vowel contexts; learners showed confusion with /f/ and /h/ sounds in back vowel context /u/ the most. On the other hand, the /s/ in word final was readily identified with front vowel /ε/ regardless of consonant position. Another piece of evidence is from Kitikanan (2017), which upon investigating the influence of vowel contexts over perceptual assimilation of English fricatives, she elicited 11 target sounds produced by four English native speakers which consisted of seven fricatives /v, f, θ, s, ð, z, ʃ/ (two of them are excluded) and four other sounds /w, tʰ, d, tʃ/ that Thai learners show most confusion with. The stimuli were presented in word-initial position and three different vowel contexts (high, low and back). The results were that the perception of /θ/ was found to vary as a function of vowel contexts. To illustrate, in the high and low vowel contexts /θ/ was assimilated to [f] whereas in the back vowel context, it was more often classified as [s], suggesting that vowel contexts do matter in the process of L2 speech learning.

2.2 L2 Experience

L2 experience has been acknowledged as another crucial factor which correlates to L2 learning or pronunciation. The role of foreign language experience has been widely examined in L2 perception and production by many researchers (Bialystok & Hakuta, 1999; Bohn & Flege, 1990; Cheon, 2005; Flege, Takagi, & Mann, 1996; Kitikanan, 2016; Seidenberg & MacDonald, 2018). They all agreed that experienced L2 learners are more likely to be “skilled” at a variety of L2 tasks comparing to inexperienced learners. In other words, learners' experience in English learning yields progress in L2 perceptual and production performance (Cheon, 2005). To start with, Pansottee (1992) conducted a study examining the influence of L1 on L2 and further investigating the effect of ISI (inter stimulus interval) over speech perception. The participants were six and eight-year-olds divided into two groups. The results indicated that the eight-year-old participants performed better in sound perception than six-year-old group, implying that increasing developmental language experience is responsible for the L2 sound discrimination ability. More recently, Jun and Cowie (1994) investigated English production by participants of Korean adults who lived in the US for 1-5 or 26-31 years. The results also revealed that the experienced Koreans produced more accurately than the less experienced Korean speakers did.

Flege et al. (1996) subscribed to the same notion by investigating the effect of L2 experience on Japanese adults' accuracy in identifying the English consonant sounds /ɪ/ and /I/, by comparing two groups of participants who have lived in US for 2 and 21 years respectively. The results revealed that the subjects who are more experienced identified both /ɪ/ and /I/ sounds more accurately than the inexperienced group did, but still at a lower rate compared to that of the (NE) native English group. Similarly, Yamada (1994) also identified that Japanese learners of English manage to accurately produce English /r/ and /l/ over time, neither of which occurs in their L1. Likewise, their perception of these sounds were enhanced in the wake of language experience of English learning (Best & Strange, 1992; Flege et al., 1996; Yamada & Tohkura, 1991).

However, some linguists have drawn different conclusions about the influence of language experience over target language. Some research studies showed that there was not always a correlation between language experience and the success rate of L2 speech under certain circumstances. For instance, Bohn and Flege (1990) carried out a study amongst German adult learners that were divided into a relatively experienced group, an inexperienced group and a control group of monolingual participants. The findings revealed that influence of language experience on target language is context-dependent, i.e., language experience did not work on the perception of two “similar” vowels, i.e., /i/ and /I/. However, for the “new” vowel sound /æ/, the experienced

group could perceive this nearly perfectly compared to the native group, whereas the inexperienced group did not; suggesting that effect of language experience is context-dependent. Munro (1992) also found that English language experience did not correlate significantly with the performance of English pronunciation. Beyond all that, other studies (Elliott, 1995; Flege & Fletcher, 1992; Purcell & Suter, 1980) have also yielded the contradictory conclusion with the previous standpoint, that there is no correlation between language experience and learners' performance of L2 production. It is still inconclusive whether these generalizations can be applied across the entire L2 inventory of consonant sounds under all possible phonetic contexts. The effect of language experience towards L2 speech is hence an issue of contention which needs to be further investigated or ascertained.

3. Research Questions and Hypotheses

In order to fulfill the given objectives of the study, these research questions below will be answered:

1) How is the production of the English /tʃ/ and /ʃ/ sounds by L2 Thai learners in the impressionistic study?

According to CAH, L2 Thai learners will find it difficult or problematic to produce as these two sounds do not exist in the Thai phonological system.

2) To what extent are the productions of /tʃ/ and /ʃ/ sounds by L2 Thai learners affected by factors of vowel contexts and L2 experience?

In light of the prior literature reviewed above, it is anticipated that the production of /tʃ/ and /ʃ/ by L2 Thai learners will be more problematic in the back vowel context than the other two.

Accordingly, for the current study, it is hypothesized that the production of initial consonant sounds /tʃ/ and /ʃ/ by L2 Thai learners will generally differ with language experience. The prediction is that the experienced group of L2 Thai learners (English majors) would be more accurate in uttering both /tʃ/ and /ʃ/ sounds than the comparatively inexperienced group (non-English majors).

4. Methodology

4.1 Subjects

A total of 48 participants from two groups of Thai English learners were included in the data collection of the present study. These two groups consisted of English majors and non-English majors, equally: 24 participants from each group. All 48 participants in the present study shared a homogeneous linguistic background. They had been born and raised in Thai-speaking households in Thailand and are currently studying in their first year of university. All of them had received approximately twelve years of prior English instruction under EFL contexts at primary and secondary schools in Thailand. None of them had the experience of studying abroad. As many studies had shown that females and males generally have different abilities in L2 speech learning (Asher & García, 1969; Díaz-Campos, 2004; Major, 2004; Piske, MacKay, & Flege, 2001), all participants in this study were female students in their first year of university. None of them reported a history of speech or hearing disorders.

4.2 Stimuli

In order to anticipate the possible effect of vowel contexts towards consonant pronunciation, stimuli in the present study consisted of initial consonant sounds /tʃ/ and /ʃ/ in three different vowel contexts: high, low and back, displayed through a list of 27 target words altogether (including 9 Thai content words and 18 English content words). The list of English and Thai stimuli can be seen in Table 1 and Table 2, respectively.

Table 1. English word list of stimuli

Initial Consonants	Vowel Contexts		
	High	Low	Back
ch /tʃ/	• chip /tʃɪp/	• chart /tʃɑ:t/	• choose /tʃu:z/
	• cheap /tʃi:p/	• champ /tʃæmp/	• chew /tʃu:/
	• cheat /tʃi:t/	• charge /tʃɑ:dʒ/	• chook /tʃʊk/
sh /ʃ/	• she /ʃi:/	• sharp /ʃɑ:p/	• shoot /ʃu:t/
	• sheet /ʃi:t/	• shark /ʃɑ:k/	• should /ʃʊd/
	• sheep /ʃi:p/	• shack /ʃæk/	• shoe /ʃu:/

Table 2. Thai word list of stimuli

Initial Consonant	Vowel Contexts		
	High	Low	Back
ช /tɕʰ/	ชื /tɕʰi:/	ชาติ /tɕʰa:t/	ชู /tɕʰu:/
	ชืพ /tɕʰi:p/	ช้า /tɕʰá:/	ชู้ /tɕʰú:/
	ชื๊ /tɕʰi:/	ชา /tɕʰa:/	ชู้ต /tɕʰú:t/

4.3 Data Collection

Participants were recorded in a sound-isolated room with participants seated approximately 30cm in front of the computer screen where the target words were displayed. For the English stimuli, participants produced the words in the context of ‘Say ___ again’ whereas for Thai stimuli, in the sentence ‘โอเค...อีกครึ่ง (Okay...again)’ /o:kʰe: ____ i:k. kʰráŋ/ was used. Every target word was repeated five times, and the entire recording process for each person took approximately 15 minutes to accomplish.

4.4 Data Analysis

A total of 4 320 recorded tokens (48 participants × 18 words × 5 times) were collected from the participants’ production, and was judged by two English native speakers who were phonetically trained to deem whether it was target-like or not. If not, the phoneticians wrote the substituted sounds for the target sounds. However, during the process, we found that two target words were missed by participants in the first round. That left 4 318 tokens and 4 099 (94.93%) of the word productions were judged by the two phoneticians as exactly the same. The remaining 219 ones were disagreed on, i.e., two phoneticians held different judgements. Hence, we deleted those responses which were not agreed upon by the phoneticians. After deleting the previously mentioned responses, 4 099 responses were left. Generalized Linear Mixed Models (GLMMs) were then conducted for the English production data. The independent variables were the vowel contexts (high, low and back), the L2 experience of the L2 Thai learners (English-majors and non-English-majors), and target sounds (/tʃ/ and /ʃ/). The dependent variable was whether the production was target-like or not. The random intercept was the participants.

5. Results

In summary, the /tʃ/ sound was problematic for the L2 Thai learners in that the subjects had merely 6.24% accuracy of target-like realizations on average. This result confirmed the prediction by CAH. The results of the impressionistic study indicated that L2 /tʃ/ production revealed a low proportion of production that were considered as target-like, which correspond to the findings from the previous studies (Jotikasthira, 1999; Ronakiat, 2002). This suggests that the L2 English sound of /tʃ/ is indeed a problematic sound for L2 Thai learners to obtain. On the other hand, the most frequent substituted sound for /tʃ/ sound turned out to be [ʃ] which subscribes to the notion of previous literature (Kitikanan, 2016; Roengpitya, 2011) and the CAH assumptions which argue that those L2 sounds that are different or absent from L1 phonemic inventories are difficult or problematic for learners to produce. As for /ʃ/ sound, the result was contradictory to the prediction, as the subjects had 96.35% accuracy for the target-like production averagely. This suggests that L2 Thai learners have nearly no difficulty when uttering /ʃ/ in initial position which is contradictory with CAH framework mentioned above.

In terms of the /tʃ/ sound, L2 Thai learners pronounced the onset affricate sound /tʃ/ as [ʃ] in most cases. For the English majors, they were at 93.06% with the low vowel context /a/, 95.16% with the high vowel context /i/, and 95.70% with the back vowel context /u/. For the non-English majors, they were 90.25%, 91.89% and 86.26% respectively. Other substituted sounds were [k, s, h, t].

On the other hand, the results of /ʃ/ sound exhibited that L2 Thai learners could pronounce the /ʃ/ sound correctly by and large. The accuracy rate was at least 94.30% when under the high vowel context /i/ for the non-English-major participants. Other substituted sounds were [tʃ, d, h, s, t, k]. The details of these results are in Table 3.

Table 3. Realizations and percentage of the target sounds

Major learners	of L2	Target sound	Realization	Vowel context					
				High		Low		Back	
				Count	%	Count	%	Count	%
English-major	Eng. /tʃ/	[tʃ]	17	4.84%	22	6.36%	10	2.87%	
		[ʃ]	334	95.16%	322	93.06%	334	95.16%	
		[k]	-	-	1	0.29%	4	1.15%	
	Eng. /ʃ/	[s]	-	-	1	0.29%	1	0.29%	
		[ʃ]	343	97.44%	342	97.44%	343	97.72%	
		[tʃ]	9	2.56%	9	2.56%	6	1.71%	
		[s]	-	-	-	-	1	0.28%	
	Thai /tɕʰ/	[tɕʰ]	-	-	-	-	1	0.28%	
		[tɕʰ]	360	100%	360	100%	360	100%	
	Non-English-major	Eng. /tʃ/	[tʃ]	25	7.51%	27	8.49%	23	7.35%
[ʃ]			306	91.89%	287	90.25%	270	86.26%	
[k]			-	-	4	1.26%	11	3.51%	
[h]			1	0.30%	-	-	8	2.56%	
[t]			1	0.30%	-	-	-	-	
Eng. /ʃ/		[s]	-	-	-	-	1	0.32%	
		[ʃ]	331	94.30%	323	95.28%	331	95.94%	
		[tʃ]	18	5.13%	15	4.42%	13	3.77%	
		[d]	-	-	1	0.29%	-	-	
		[h]	1	0.28%	-	-	-	-	
		[s]	1	0.28%	-	-	-	-	
Thai /tɕʰ/		[k]	-	-	-	-	1	0.29%	
		[tɕʰ]	360	100%	360	100%	360	100%	

It is worth noting that neither of the transcribers wrote the Thai affricate sound “ɕ” [tɕʰ] in their transcription of both the /tʃ/ and /ʃ/ sounds. This suggests that the phonetic background of the transcriber influences the transcription. In other words, when the transcribers are not used to transcribing the L2 sounds, they might not be able to perceive the difference between the L1 and L2 sounds, and they are likely to assimilate the L2 sound to their L1 sound category.

For the inferential statistics using GLMM, it was found that the number of the productions that were deemed non-target-like was significantly higher when the target sound was /tʃ/ than when it is /ʃ/ ($b = 6.35$, $SE = 0.17$, $p < 0.01$). This indicates that the L2 learners were more proficient in producing /ʃ/ than /tʃ/ regardless of their L2 experience or the vowel contexts. Although some studies, such as Kitikanan (2020) showed the importance of the L2 experience, the result of this study suggests that this factor is insignificant. However, it does support previous studies like Bohn and Flege (1990). Thus, the present results are opposite to the prediction that the experienced group of L2 Thai learners would be more accurate in uttering both /tʃ/ and /ʃ/ sounds than the inexperienced group. One explanation to this phenomenon might be because language experience in this study is closer with the range of “more versus less” instead of “some versus none,” since participants from two groups of the present study all learned English to varying degrees. For the vowel contexts, the results showed no significant correlation between the vowel contexts and the production. This is contradictory to the prediction that the back vowel context would be problematic.

6. Conclusion

The findings of this study indicated that L2 Thai learners were significantly more proficient in producing /ʃ/ than /tʃ/ regardless of their L2 experience or the vowel contexts. This signifies that the target sounds, rather than the L2 experience or the vowel contexts, might play a significant role in L2 speech production. Moreover, it is worth noting that the participants mispronounced the onset affricate sound /tʃ/ as [ʃ] by an overwhelming majority. Other substituted sounds were [k, s, h, t]. It can be concluded that L2 English /tʃ/ is indeed a problematic sound for L2 Thai learners and it is readily confused with /ʃ/ sound.

Implications of this study to L2 teaching is that when teaching /tʃ/ and /ʃ/ sounds to L2 Thai learners, teachers should pay more attention to the production of /tʃ/ sound in particular, regardless of students' L2 experience or vowel contexts. Teachers could also provide classroom activities, such as activities comparing /tʃ/ with /ʃ/ to increase the production target-likeness of /tʃ/ sound.

There are limitations to this study though. For example, this study did not find significant correlation between L2 experience and the production of both /tʃ/ and /ʃ/ sounds (as many other studies mentioned above), perhaps due to the L2 experiences of the two groups in this research being fairly similar. Although they were English majors and non-English majors, both groups had studied English for several years under EFL contexts in primary and secondary schools before entering university. Future studies could have participants that have more differentiation in L2 experience to explore in-depth the effect of L2 experience toward L2 speech production.

Acknowledgements

I wish to express my deepest gratitude to Assistant Professor Dr. Patchanok Kitikanan, Department of English, Faculty of Humanities, Naresuan University for her invaluable advice and constant inspiration throughout the study. I also wish to express my sincere appreciation to Adam Paschal for the language proofreading and comments on this paper.

References

- Anam, M. K. (2018). Thai and Indonesian English students' problems in pronouncing English fricative and affricate sounds: A case study in IAIN Kediri. Paper presented at the *Proceedings of the Fourth Prasasti International Seminar on Linguistics* (Prasasti 2018). <https://doi.org/10.2991/prasasti-18.2018.36>
- Asher, J. J., & García, R. (1969). The optimal age to learn a foreign language. *The Modern Language Journal*, 53(5), 334-341. <https://doi.org/10.2307/323026>
- Best, C. T., & Strange, W. (1992). Effects of phonological and phonetic factors on cross-language perception of approximants. *Journal of Phonetics*, 20(3), 305-330. [https://doi.org/10.1016/S0095-4470\(19\)30637-0](https://doi.org/10.1016/S0095-4470(19)30637-0)
- Bialystok, E., & Hakuta, K. (1999). Confounded age: Linguistic and cognitive factors in age differences for second language acquisition. *Second Language Acquisition and the Critical Period Hypothesis*, 161-181.
- Bohn, O.-S., & Flege, J. E. (1990). Interlingual identification and the role of foreign language experience in L2 vowel perception. *Applied Psycholinguistics*, 11(3), 303-328. <https://doi.org/10.1017/S0142716400008912>
- Briere, E. J., & Chiachanpong, C. (1980). An investigation of Thai interference in selected American English phonemes. *Poznań Studies in Contemporary Linguistics*, 11, 101-117.
- Cheon, S. Y. (2005). *Production and perception of phonological contrasts in second language acquisition: Korean and English fricatives*. University of Hawaii at Manoa.
- Díaz-Campos, M. (2004). Context of learning in the acquisition of Spanish second language phonology. *Studies in Second Language Acquisition*, 26(2), 249-273. <https://doi.org/10.1017/S0272263104262052>
- Elliott, A. R. (1995). Foreign language phonology: Field independence, attitude, and the success of formal instruction in Spanish pronunciation. *The Modern Language Journal*, 79(4), 530-542. <https://doi.org/10.1111/j.1540-4781.1995.tb05456.x>
- Flege, J. E., & Fletcher, K. L. (1992). Talker and listener effects on degree of perceived foreign accent. *The Journal of the Acoustical Society of America*, 91(1), 370-389. <https://doi.org/10.1121/1.402780>
- Flege, J. E., Takagi, N., & Mann, V. (1996). Lexical familiarity and English-language experience affect Japanese adults' perception of /ɹ/ and /l/. *The Journal of the Acoustical Society of America*, 99(2), 1161-1173. <https://doi.org/10.1121/1.414884>
- Harris, J. G., & Noss, R. B. (1972). *Tai phonetics and phonology*. Central Institute of English Language, Office of State Universities, Faculty of Science, Mahidol University.

- Jotikasthira, P. (1999). *Elements of spoken English*. Chulalongkorn University, Faculty of Arts.
- Jun, S.-A., & Cowie, I. (1994). Interference for 'new' versus 'similar' vowels in Korean speakers of English. *Ohio State University Working Papers in Linguistics*, 43, 117-130. <https://doi.org/10.1121/1.2029576>
- Kitikanan, P. (2016). *L2 English fricative production by Thai learners*. (Doctoral dissertation, University of Newcastle upon Tyne, United Kingdom). Retrieved from <https://search.proquest.com/docview/1947627980?accountid=49790>
- Kitikanan, P. (2017). The Effects of L2 Experience and Vowel Context on the Perceptual Assimilation of English Fricatives by L2 Thai Learners. *English Language Teaching*, 10(12), 72. <https://doi.org/10.5539/elt.v10n12P72>
- Kitikanan, P. (2019). Do Pragmatic Awareness and Grammatical Awareness Relate to Motivation and Severity Rating, and Do They Relate to One Another? *The New English Teacher*, 13(1), 19.
- Kitikanan, P. (2020). The Effect of L2 Experience on the Perceptual Assimilation of British English Monophthongs to Thai Monophthongs by L2 Thai Learners. *English Language Teaching*, 13(5), 1-10. <https://doi.org/10.5539/elt.v13n5p1>
- Lado, R. (1957). *Linguistics across cultures*. Ann Arbor, Mich.: University of Michigan Press.
- Lambacher, S., Martens, W., Nelson, B., & Berman, J. (2001). Identification of English voiceless fricatives by Japanese listeners: The influence of vowel context on sensitivity and response bias. *Acoustical Science and Technology*, 22(5), 334-343. <https://doi.org/10.1250/ast.22.334>
- Major, R. C. (2004). Gender and stylistic variation in second language phonology. *Language Variation and Change*, 16(3), 169-188. <https://doi.org/10.1017/S0954394504163059>
- Munro, M. J. (1992). Production of the word-final English /t-/d/contrast by native speakers of English, Mandarin, and Spanish. *The Journal of the Acoustical Society of America*, 92(1), 128-143. <https://doi.org/10.1121/1.404278>
- Pansottee, S. (1992). *Fricative perception in six and eight year old Thai children*. (Master's Thesis), Chulalongkorn University, Bangkok.
- Piske, T., MacKay, I. R., & Flege, J. E. (2001). Factors affecting degree of foreign accent in an L2: A review. *Journal of Phonetics*, 29(2), 191-215. <https://doi.org/10.1006/jpho.2001.0134>
- Purcell, E. T., & Suter, R. W. (1980). Predictors of pronunciation accuracy: A reexamination. *Language Learning*, 30(2), 271-287. <https://doi.org/10.1111/j.1467-1770.1980.tb00319.x>
- Richards, J. (1969). Pronunciation Features of Thai Speakers of English. *Te Reo: Proceedings of the Linguistic Society of New Zealand*, 10-11, 67-75.
- Roengpitya, R. (2011). An acoustic study of English and Thai fricatives produced by Thai speakers. In Lee, W. S., & Zee, E. (Eds.), *Proceedings of the 17th International Congress of Phonetic Sciences (ICPhS XVII)*: (pp.1698-1701). University of Hong Kong.
- Ronakiat, N. (2002). *A textbook of sounds, sound system and accents in English*. Bangkok: Thammasat University Press. (In Thai).
- Seidenberg, M. S., & MacDonald, M. C. (2018). The Impact of Language Experience on Language and Reading. *Topics in Language Disorders*, 38(1), 66-83. <https://doi.org/10.1097/tld.0000000000000144>
- Yamada, R. A. (1994). The Intelligibility of Japanese Speakers' Production of American English /r/, /i/, and /w/, as Evaluated by Native Speakers of American English. *Third International Conference on Spoken Language Processing (ICSLP 94)*, 18-22, 2023-2026.
- Yamada, R. A., & Tohkura, Y. I. (1991). Age effect on acquisition of non-native phonemes: perception of English /r/ and /l/ for native speakers of Japanese. *Proceedings of the 12th International Congress of Phonetic Sciences*, 14, 450-453.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).