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The Effect of L2 Experience on the Identification of British English Monophthongs by L2 Thai Learners

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***Abstract*—This paper investigates the ability of L2 Thai learners to identify eleven British English monophthongs /iː, ɪ, e, æ, ɒ, ɑː, ɔː, ʊ, uː, ʌ, ɜː/. Among these vowels, /æ/, /iː/, /uː/, /e/ and /ɔː/ are vowels that occur in both Thai and English phonological inventories (shared sounds) whereas the other six vowels occur only in English (non-shared sounds). The subjects were split into two groups of L2 Thai learners: high-experienced and low-experienced. The degree to which L2 experience influenced subjects' ability to identify British English monophthongs was measured by their ability to match spoken L2 vowels to their written counterparts. The hypotheses of this study were generated from the results of the perceptual assimilation task in the study of Kitikanan (2020). The results showed that the low-experienced group performed poorly, with low identification scores, across all vowels. However, the high-experienced group obtained high scores identifying British English /e/, /ɔː/, /ɪ/ and /ɜː/. The scores of correct identifications for these four British English vowels of the high-experienced group were significantly higher than that of the low-experienced group, suggesting the positive effect of the L2 experience. For other vowels, the scores of both groups were not significantly different from one another. The predictions of the perceptual assimilation task failed to predict most results. These results might imply the need for other means to compare L1 and L2 sounds to understand the mechanism regarding the identification ability of the L2 sounds. They may also suggest that some vowels are easier to learn than others.**

***Index Terms*—sound identification, British English, monophthongs, Thai, L2 experience**

I. Introduction

In L2 phonology, the investigation into L2 sound identification has been widely studied (e.g., Bohn and Flege, 1990; Ryu, 2018; Lee and Cho, 2018). To generate predictions for this, many methods can be employed, such as using the articulatory aspects, the acoustic characteristics, and the perceived similarity between L1 and L2 sound categories. Among these methods, the exploration of the perceived similarity between the sounds in the L1 and L2 groups seems to be accepted as one of the best methods as shown by Best's Perceptual Assimilation Model-L2 (PAM-L2) (Best and Tyler, 2007). According to PAM-L2, the ability to discriminate L2 sound contrast depends on the degree of perceived similarity of the two sounds. Many research studies have been carried out into the exploration of the sound identification of the L2 sounds based on the perceived similarity experiment (e.g., Horslunda et al., 2015; Wang and Chen, 2019; Lee and Cho, 2020). For example, Horslunda et al. (2015) studied the relationship between the identification of L2 consonants and the perceptual assimilation of L2 consonants compared to L1 sound categories. L2 Danish listeners identified 20 English consonants in the initial position in terms of Danish categories and rated how well these matched. Then the predictions were tested for the identification task in which the same listeners identified the same 20 English consonants using English categories. The results showed that the perceived similarity between L1 and L2 sounds predicted the results of the sound identification task successfully.

Many studies also point out that the perception of the L2 sounds is not only based on the perceived similarity, but many factors, such as length of residence (LOR), age of arrival (AOA), motivation and sex of speakers also play a role in the perception. Among these factors, L2 experience often showed to have an impact on the L2 sound perception (e.g., Bohn and Flege, 1990; Bohn and Ellegaard, 2019). For example, in the study of Bohn and Flege (1990), adult native German speakers participated in an identification task of the English vowels /i, ɪ, ɛ, æ/. The results showed that the experienced Germans were able to identify the new vowel /æ/ more like native English speakers than inexperienced Germans. Another example is from the study of Bohn and Ellegaard (2019), where two groups of Danish listeners differing in L2 English language experience participated in the perceptual assimilation, sound discrimination and sound identification tasks for English fricatives. The effect of language experience was evident in all three tasks as most results showed that experienced listeners exhibited assimilations and graded discriminations with higher sensitivity towards English fricatives than the inexperienced listeners. The higher sensitivity reflected in more accurate identifications.

With regard to the monophthongs in Thai and British English, there are twelve vowels: /iː, ɪ, e, æ, ɒ, ɑː, ɔː, ʊ, uː, ʌ, ɜː, ə/ in British English whereas in Thai, there are eighteen: /i, iː, e, eː, æ, æː, ɔ, ɔː, a, aː, u, uː, ə, əː, o, oː, ɯ, ɯː/. The schwa /ə/ in British English occurs in the unstressed syllable and has no particular spelling (Roach, 2004). For this study, the shared vowels refer to the vowels that occur in both L1 and L2 phonological inventories. The non-shared vowels refer to the vowels that occur only in L2 sound system. The non-shared vowels in this study are /ɑː/, /ɪ/, /ɜː/, /ʌ/, /ʊ/ and /ɒ/. The difficulty and ease of perceiving these vowels will be based on the results of the perceptual assimilation test in the study of Kitikanan (2020). This will be discussed later in the research question and hypothesis section.

Although there are many studies on perceptual assimilation together with sound identification, most studies had subjects in the 'English as a second language' context (ESL) (e.g., Hattori and Iverson, 2009; Lee and Cho, 2020; Flege et al., 1997). Few studies were carried out on the L2 learners in the 'English as a foreign language' (EFL) context (e.g., Horslunda et al., 2015; Farran, 2020; Gong and Zhou, 2015). This study is one of the few studies investigating the L2 sound identification ability of subjects in the EFL category.

It is believed that this is the first time that perception investigation of the L2 Thai learners using the identification task with the hypothesis based on the perceptual assimilation experiment has been used. L2 Thai learners often have difficulty differentiating English vowels even when they are in countries of native speakers of English. The ability to identify English vowels is essential for L2 Thai learners as it enhances the understanding of the words and increases effectiveness in communication. However, teachers in Thailand often have relatively little guidance regarding the extent to which this group of learners can correctly identify English vowels, and to what extent L2 experience can the affect the L2 English sound perception. This study will hopefully show how L2 experience might help to enhance the ability of the L2 learners in perceiving L2 vowels correctly. Thus, the aims of the study are:

1) to investigate the ability of the L2 Thai learners in identifying British monophthongs, and to test the hypotheses generated from the perceived similarity of the L1 and L2 sounds (Kitikanan, 2020) for the sound identification task.

2) to explore the effect of L2 experience in L2 sound identification.

II. Research Questions and Hypotheses

The research hypotheses for this study are formulated from the perceptual assimilation findings from the study of Kitikanan (2020).

This research scores the subjects' ability to correctly identify British monophthongs and how their L2 experience contributes to their success. The research further applies these tests to the hypotheses for shared and non-shared sounds.

1) To what extent can the L2 Thai learners identify the British monophthongs, and to what degree do they perceive the target monophthongs as similar to the identified English ones?

For the percentage of correct identification scores for the shared sounds, the high-experienced group will have high scores of correct identifications for English /æ/, /iː/ and /uː/ whereas the low-experienced group will have low scores for these vowels. This is because these sounds were mostly identified with the sounds of the same IPA symbols by the high-experienced group in that study whereas they were identified with the sounds of other IPA symbols by the low-experienced one.

For English /e/, both groups should receive high scores of correct identifications as both groups had low fit index scores of the most-frequently-identified Thai /e/. This suggests that the L2 learners perceived the difference between /e/ in the two languages. For English /ɔː/, both the high-experienced and low-experienced groups should have low scores of correct identifications as this sound was mostly identified as Thai /oː/.

For the non-shared sounds, the correct identification scores of English /ɑː, ɪ, ɜː, ʌ, ʊ, ɒ/ of both groups should be high as the fit indexes of these vowels to the closest Thai vowels were less than 3.5 out of 7. This indicates that the subjects perceived the difference between Thai and English monophthongs.

2) To what extent does L2 experience affect identification?

Regarding the effect of L2 experience on the identification score, for the shared sounds, it is predicted that there will be no effect for correct identification of English /æ/, /iː/ and /ɔː/ as there were no significant differences in the perceived similarities between the target English vowels and the closest Thai vowels. For English /uː/ and /e/, it is expected that the scores for correct identification within the low-experienced group should be higher than the score for the high-experienced group because the high-experienced group perceived these vowels to be more similar to the closest Thai vowels than the low-experienced group.

For the non-shared sounds, it is hypothesized that L2 experience will have no effect on the scores for the correct identification for both groups for the English /ɑː, ɪ, ɜː, ʌ, ʊ/ as there was no significant difference in the perceived similarities of these vowels and their closest Thai vowels. For the English /ɒ/, the high-experienced group should have greater score of correct identification than the low-experienced one as the low-experienced group perceived this sound to be more similar to the closest Thai vowel /o/ than the high-experienced group.

III. Methodology

A. Subjects

There were 52 subjects in this study. Half of the subjects were studying English as major whereas the other half were studying Computer Science as major. They had studied English as a foreign language (EFL) – English was mainly used in the classroom. The English-major group was classified as the high-experienced group as they had passed the phonetic training from the English Phonetics and Phonology module. The Computer Science major group was considered as the low-experienced group as they had not received any special training in English sounds. The age of the subjects was between 18-19 years old. None of them reported impairment in speech and hearing at the time of the study. They voluntarily participated in this study, and they were the same groups of subjects as for the study of Kitikanan (2020).

B. Stimuli

The stimuli in this study were similar to the ones in the study of (Kitikanan, 2020), i.e. 11 words in English and 13 words in Thai. The English monophthongs were represented by each of the English words: “beet” /iː/, “bit” /ɪ/, “bet” /e/, “bat” /æ/, “bot” /ɒ/, “bart” /ɑː/, “bought” /ɔː/, “butcher” /ʊ/, “boot” /uː/, “but” /ʌ/ and “burt” /ɜː/. They were articulated by three British English native speakers. They were between 34-36 years old. The Thai words were “บิด” /i/, “บีด” /iː/, “เบ็ด” /e/, “เบด” /eː/, “แบ็ด” /æ/, “แบด” /æː/, “บ็อด” /ɔ/, “บอด” /ɔː/, “บัด” /a/ “บาด” /aː/, “บุด” /u/, “บูด” /uː/, “เบิด” /ɜː/. They were produced by three Thai native speakers. Their ages were 36-49 years old. All speakers lived in Thailand while the study was conducted. As we can see, the target vowels were in the context /b/-V-/t/. A listening block was each of the stimuli set. The English words were pronounced in the context, “Say____again.” whereas the Thai words were in the context /pʰûːt.waː____ìːk.kʰráŋ/ “Say ____again”. None of the speakers reported hearing and speech disorders. The recorder for their voices was Zoom: H4n Pro in stereo at a 44.1 kHz (16-bit quantisation). The voice recording process was carried out in a soundproofed room at Naresuan University.

C. Data Collection

The identification task was run with script on Praat MFC (Boersma and Weenink, 2016) on a computer. The subjects wore headphones while listening to the stimuli. The subjects heard a consonant-vowel-consonant sequence. They were told to pay attention to the vowel sound and choose the English vowel that was most similar to the sound they heard. Then they rated the similarity of the English sound to the sound they heard on a scale from 1 (very different) to 7 (very similar). The number of trials was 360. They could break every 50 trials. The instructions were written in Thai to ensure their understanding. The total number of stimuli was 360 (English stimuli: 165, and Thai stimuli: 195). The subjects selected their response by clicking the mouse, choosing from one out of 11 alternatives: “beet” /iː/, “bit” /ɪ/, “bet” /e/, “bat” /æ/, “bot” /ɒ/, “bart” /ɑː/, “bought” /ɔː/, “butcher” /ʊ/, “boot” /uː/, “but” /ʌ/ and “burt” /ɜː/. There was no IPA symbol with the target words. They were allowed to hear the sound as often as they liked by clicking the “replay” button. The stimuli were randomized with <PermuteBalancedNoDoublets> command in the script. The process of the data collection took approximately 45 minutes. This research project gained ethical approval from Naresuan University Institutional Review Board (COA No. 010/2019, IRB No. 0877/61).

D. Data Analysis

The number of responses in this study was 8,580 (165 stimuli x 52 subjects). These are from the English stimuli. The Thai stimuli were excluded as they were not the focus of this study. To encode the data from Praat, they were transferred to Excel. The data consisted of the percentage of correct identification of the English monophthongs to the English words. The matching data and the goodness-of-fit were mixed into a single matrix “the fit index” as suggested by Guion et al. (2000, p. 2716). The calculation of the fit index was similar to the one in the study of Kitikanan (2020); hence, the higher the fit index value represents a higher perceived similarity between the target L2 and matched L2 sounds.

For the exploration on the perceived similarity of the L2 sound which was the most frequently matched with the target L2 vowels, and the relationship with the L2 experience, a linear mixed model (LMM) using the *lme4* package (Bates et al., 2015) was run in *RStudio* statistical software (RStudio Team, 2016). The independent variables were L2 experience (high-experienced and low-experienced) and the target vowel. The interval dependent variable was the score of correct identification. Due to the repetition in observations in the subjects, the random intercept was the subject. The *emmeans* package (Lenth et al., 2018) was run for the effect of the L2 experience on the post-hoc test.

IV. Results and Discussion

A. The Results of the Sound Identification of the British English Monophthongs

For the identification of the British English monophthongs, the high-experienced group outperformed the low-experienced group in all target vowels. The high-experienced group had high scores of correct identifications (over 75% correct) in the matching of the following vowels: /ɔː/, /ɜː/, /e/ and /ɪ/. However, although their scores of the correct identification of /æ/ and /ʊ/ were over 50%, they were lower than expected. The score of the correct identification of /ɑː/ was less than half even though the most-frequently-identified response was correct.

The low-experienced group had low scores for the correct identification of all target vowels. The vowels that seemed to be the easiest ones for them to perceive were /ɜː/ and /ɪ/, as suggested by the correct identification of over 50%. However, these scores were lower than expected. Both high-experienced and low-experienced groups seem to have had difficulty in perceiving /uː/, /iː/ and /ɒ/. They had the same patterns of the identifications, i.e. mostly identified /uː/ as /ʊ/, /iː/ as /ɪ/, and /ɒ/ as /ɔː/. The details of the results of the identification patterns of the English monophthongs and their degree of the perceived identification of both groups are presented in Table 1 (high-experienced group) and Table 2 (low-experienced group).

TABLE 1
PERCENTAGE OF THE SOUND IDENTIFICATION PATTERNS OF ENGLISH TARGET SOUNDS TO ENGLISH RESPONDED SOUNDS, AND MEAN FIT INDEX IN PARENTHESIS FOR THE LEARNERS WITH HIGH EXPERIENCE. BOLD PERCENTAGE FOR THE MOST-FREQUENTLY-IDENTIFIED MATCHING

	/ɑː/	/uː/	/ɔː/	/ɜː/	/iː/	/æ/	/ɒ/	/e/	/ɪ/	/ʌ/	/ʊ/
/ɑː/	**48.21%** (2.57)	0.26% (0.00)	0.26% (0.00)	1.03% (0.04)	-	19.74% (0.94)	0.51% (0.02)	0.51% (0.06)	-	1.79% (0.09)	-
/uː/	0.51% (0.04)	32.82% (1.58)	3.08% (0.15)	-	0.26% (0.00)	-	1.54% (0.09)	0.26% (0.00)	-	0.26% (0.00)	4.36% (0.15)
/ɔː/	36.92% (1.69)	5.13% (0.11)	**78.46%** (3.72)	1.03% (0.04)	-	0.26% (0.00)	**50.77%** (2.48)	0.26% (0.00)	0.51% (0.07)	12.05% (0.45)	3.08% (0.10)
/ɜː/	0.26% (0.00)	0.26% (0.00)	0.26% (0.00)	**92.56%** (4.69)	0.26% (0.00)	0.51% (0.03)	-	7.95% (0.24)	0.26% (0.00)	17.95% (0.65)	2.82% (0.06)
/iː/	-	0.26% (0.00)	0.26% (0.00)	0.77% (0.01)	45.90% (2.21)	-	-	0.26% (0.00)	1.79% (0.08)	0.77% (0.02)	0.26% (0.00)
/æ/	2.31% (0.09)	-	-	0.77% (0.03)	-	**57.44%** (2.76)	0.51% (0.04)	12.56% (0.57)	-	5.38% (0.19)	-
/ɒ/	7.95% (2.49)	0.77% (0.03)	16.15% (0.77)	0.26% (0.00)	0.26% (0.00)	0.51% (0.04)	43.85% (2.08)	-	-	13.85% (0.65)	1.54% (0.07)
/e/	0.26% (0.00)	0.77% (0.03)	-	1.28% (0.04)	1.03% (0.05)	1.79% (0.08)	0.26% (0.00)	**76.15%** (3.81)	11.03% (0.49)	1.28% (0.04)	-
/ɪ/	0.26% (0.00)	1.54% (0.10)	-	0.26% (0.00)	**51.54%** (2.18)	0.51% (0.03)	-	0.77% (0.04)	**86.41%** (4.46)	0.51% (0.02)	0.51% (0.05)
/ʌ/	2.31% (0.08)	12.05% (0.34)	-	1.54% (0.09)	0.51% (0.06)	18.97% (0.87)	2.31% (0.07)	1.03% (0.04)	-	**45.90%** (2.31)	28.97% (0.98)
/ʊ/	1.03% (0.04)	**46.15%** (1.87)	1.54% (0.08)	0.51% (0.03)	0.26% (0.00)	0.26% (0.00)	0.26% (0.00)	0.26% (0.00)	-	0.26% (0.00)	**58.46%** (2.49)

Note: The columns present the target sounds whereas the rows display the identification.

TABLE 2
PERCENTAGE, AND MEAN FIT INDEX IN PARENTHESIS FOR THE LEARNERS WITH LOW EXPERIENCE. BOLD PERCENTAGE FOR THE MOST-FREQUENTLY-IDENTIFIED MATCHING

	/ɑː/	/uː/	/ɔː/	/ɜː/	/iː/	/æ/	/ɒ/	/e/	/ɪ/	/ʌ/	/ʊ/
/ɑː/	**29.74%** (1.45)	1.79% (0.12)	2.56% (0.16)	5.90% (0.30)	0.26% (0.00)	16.41% (0.76)	1.79% (0.11)	2.56% (0.17)	1.28% (0.05)	10.26% (0.51)	1.28% (0.05)
/uː/	7.69% (0.40)	25.13% (1.10)	16.41% (0.78)	3.59% (0.21)	3.85% (0.20)	4.62% (0.24)	10.00% (0.46)	4.87% (0.23)	2.82% (0.14)	4.87% (0.23)	7.95% (0.38)
/ɔː/	24.87% (1.13)	10.26% (0.41)	**47.18%** (2.01)	3.85% (0.16)	0.51% (0.05)	2.05% (0.09)	**37.18%** (1.60)	2.56% (0.11)	0.26% (0.00)	11.28% (0.46)	6.92% (0.24)
/ɜː/	0.51% (0.04)	2.82% (0.15)	2.56% (0.15)	**66.41%** (3.28)	1.79% (0.13)	1.28% (0.06)	1.54% (0.11)	5.38% (0.24)	1.54% (0.12)	10.26% (0.44)	2.56% (0.16)
/iː/	0.51% (0.02)	2.82% (0.11)	0.00% (0.00)	1.79% (0.07)	33.08% (1.71)	0.26% (0.00)	1.54% (0.07)	1.03% (0.04)	1.03% (0.04)	1.28% (0.04)	0.26% (0.00)
/æ/	10.26% (0.48)	2.31% (0.08)	2.56% (0.11)	4.62% (0.25)	2.56% (0.14)	**42.56%** (2.13)	2.05% (0.09)	28.97% (1.36)	5.13% (0.22)	10.77% (0.49)	3.08% (0.14)
/ɒ/	13.85% (0.64)	3.59% (0.15)	15.13% (0.66)	2.31% (0.11)	0.51% (0.07)	1.28% (0.05)	28.97% (1.37)	1.79% (0.10)	1.03% (0.06)	10.00% (0.45)	5.64% (0.23)
/e/	2.82% (0.12)	3.59% (0.16)	1.54% (0.10)	4.36% (0.16)	11.28% (0.50)	5.38% (0.21)	4.36% (0.18)	**41.54%** (2.01)	21.79% (1.04)	4.62% (0.18)	3.33% (0.14)
/ɪ/	2.05% (0.10)	5.13% (0.15)	1.28% (0.04)	2.31% (0.08)	**41.79%** (1.70)	2.31% (0.07)	1.03% (0.04)	3.08% (0.11)	**59.74%** (2.87)	2.56% (0.17)	4.36% (0.14)
/ʌ/	5.38% (0.25)	18.46% (0.74)	4.10% (0.22)	2.56% (0.18)	2.31% (0.11)	22.31% (0.97)	6.92% (0.35)	5.13% (0.26)	2.82% (0.15)	**30.51%** (1.53)	31.03% (1.36)
/ʊ/	2.31% (0.07)	**24.10%** (0.98)	6.67% (0.29)	2.31% (0.08)	2.05% (0.09)	1.54% (0.09)	4.62% (0.18)	3.08% (0.11)	2.56% (0.11)	3.59% (0.19)	**33.59%** (1.39)

Note: The columns present the target sounds whereas the rows display the identification.

For the hypotheses, it was found that half of the hypotheses are incorrect in predicting the correct identification scores of both groups. The details are divided into two groups as follows. First, for shared sounds, the high-experienced group was expected to have a high percentage of correct identification scores for the English /æ/, /iː/ and /uː/ whereas the low-experienced group was expected to have low percentage of the scores for these monophthongs. For these vowels, the prediction was true only in the low-experienced group as they scored less than 50% of correct identifications. The high-experienced group scored less than 70% correct identification for these vowels. For the English /e/, the prediction was that both groups would have a high percentage of correct identification scores. However, this prediction was true only in the high-experienced group as they scored over 75% for correct identification of the English /e/ whereas the low-experienced group scored less than 50% for correct identification. For the English /ɔː/, it was hypothesised that both groups would have a low percentage of correct identification scores. This hypothesis was true only in the low-experienced group as they scored less than 50% for correct identification whereas the high-experienced group scored over 75% for this vowel.

For the hypothesis of the non-shared vowels, it was predicted that both groups would score a high percentage of the correct identification. This is true only in the identification of the English /ɪ/ and /ɜː/ in the high-experienced group as they received over 85% correct identification scores for these vowels. For the English /ɪ/ and /ɜː/ in the low-experienced group; and English /ʌ/, /ɑː/, /ʊ/ and /ɒ/ in both groups, the percentages of the correct identification scores were low (less than 70%); hence, the hypotheses for these vowels are incorrect. In overall, for the hypotheses of the non-shared vowels, they are mostly incorrect.

The results of the low percentages of the correct identifications for all non-shared vowels for the low-experienced group; and the ones for English /æ/, /iː/, /uː/, /ʌ/, /ɑː/, /ʊ/ and /ɒ/ in the high-experienced group suggests that the results of the perceptual assimilation are insufficient in predicting the ability to identify the L2 sounds. Other aspects of the L2 sounds, such as acoustic characteristics and articulatory gestures should be considered when understanding the mechanism of the L2 sound perception. For example, for the phonetic point of view, Flege (1995) and Escudero (2005) suggested that L2 sound should be acoustically compared to L1 sound to predict the ease and difficulty in the L2 sound learning. Flege (1995), in the Speech Learning Model (SLM), mentioned that L2 learners should find an L2 sound with phonemically similar to L1 but phonetically different difficult to learn as the learning might be hindered by the "mechanism of equivalence classification" (Flege, 1995, p. 239). Additionally, the results also suggest the need for training for perceiving British English vowels. One reason of the low percentages might be because the subjects have been exposed to Thai English rather than other accents of English, especially when they studied in school and university (McKenzie et al., 2019). More input from native speakers of British English should help the L2 learners to develop the L2 sounds in their perceptions.

B. The Result of the Effect of L2 Experience on Sound Identification

Regarding the effect of L2 experience on sound identification for the shared sounds, two hypotheses out of five were true. The hypotheses for the shared sounds /æ/ and /iː/ were true in that there would be no effect of the correct identification scores by the two groups ($p > 0.05$). These results are consistent with the finding in the study of Bohn and Flege (1990) that L2 experience did not have an effect in the perception of the two similar vowels /i/ and /ɪ/ in English as perceived by L2 German listeners.

However, for the English /e/ and /ɔː/, the hypotheses were incorrect as it was found that the scores for the correct identification of these two vowels were higher in the high-experienced group than the low-experienced one ($b = 5.19$, $SE = 1.05$, $df = 408.43$, $t = 4.93$, $p < 0.01$ for /e/; and $b = 4.69$, $SE = 1.05$, $df = 408.43$, $t = 4.45$, $p < 0.01$ for /ɔː/). These results are consistent with the finding of the identification of the Mandarin /s/ by L2 English listeners in the study of Wang and Chen (2019). Despite the Mandarin /s/ being a shared sound for L2 English listeners, as this sound also occurs in the English phonological inventory, the intermediate experienced English listeners had a significantly greater score of correct identification than the low-experienced English listeners, suggesting the positive influence of the L2 experience. In the hypothesis of the English /uː/ that the scores of the correct identification would be higher in the low-experienced group than the high-experienced group was also incorrect. It was found no effect of the L2 experience in the scores of the correct identification of this vowel in the two groups ($p > 0.05$).

For the non-shared sounds, the hypotheses for the correct identification scores of English /ɑː/, /ʌ/ and /ʊ/ that there would be no effect of L2 experience are true as it was found that this factor did not play a role in the identification scores of these three English monophthongs ($p > 0.05$ for all contrasts). However, the hypotheses for the correct identification scores of English /ɪ/, /ɜː/ and /ɒ/ are incorrect. It was expected that L2 experience would have no effect on the scores of /ɪ/ and /ɜː/, but it was found that the high-experienced group had significantly greater scores of the correct identification for these two vowels than the low-experienced group ($b = 4.00$, $SE = 1.05$, $df = 408.43$, $t = 3.80$, $p < 0.05$ for /ɪ/; and $b = 3.92$, $SE = 1.05$, $df = 408.43$, $t = 3.72$, $p < 0.05$ for /ɜː/). In addition, it was predicted that the high-experienced group would have higher scores of correct identification for the English /ɒ/, but it was found that there was no effect of L2 experience had no effect on the scores for this vowel ($p > 0.05$). From all the above results, it can be concluded that perceptual assimilation is a poor methodology to use to predict the effect of L2 experience on the identification of British English monophthongs. This was borne out by the result that only five out of the eleven hypotheses using this method correctly predicted the outcome. This finding is contrary to the findings of many studies which suggest that the perceptual assimilation experiment is a good methodology for generating the hypothesis for the sound identification task (e.g., Horslunda et al., 2015). Figure 1 presents the means of the correct identification scores for each British monophthong by both groups, based on LMM result. The red box presents the significantly greater correct identification scores of the high-experienced than the one of the low-experienced group.

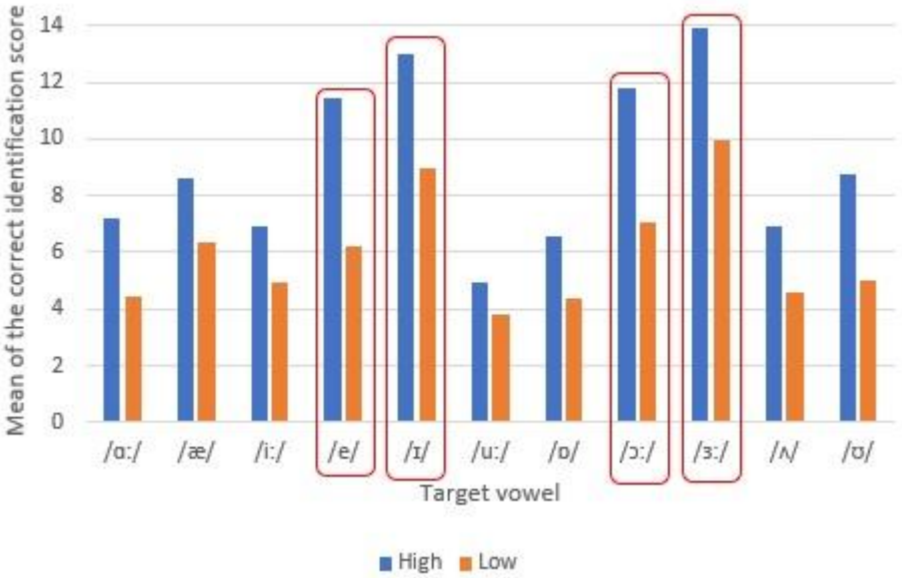

Figure 1. The means of the correct identification scores for each target monophthong by the high-experienced and low-experienced groups, based on LMM result. The red box presents the significantly greater score of the high-experienced than the one of the low-experienced group.

V. Conclusion, and Implication for Teaching and Learning

In this study, the examination of the perceptual ability by L2 Thai learners in identifying the L2 British English monophthongs was undertaken. The overall results showed that the predictions from the perceptual assimilation task are mostly incorrect in predicting the ability of both groups of L2 Thai learners. For the non-shared sounds in the low-experienced group, the hypotheses were completely incorrect as this group received low scores for the correct identification of all vowels. For the shared and non-shared sounds in the high-experienced group, the hypotheses were mostly incorrect – only three hypotheses for /e/, /ɪ/ and /ɜː/ were found to be true. However, the hypotheses for the identification of the shared sounds for the low-experienced group are mostly true – only the hypothesis for British English /e/ is incorrect. The descriptive results showed that the low-experienced group had low scores of correct identifications for all British English vowels, suggesting that they had not created the new sounds in their L2 sound inventory. For the high-experienced group, they had high scores in the identifications of British English /e/, /ɔː/, /ɪ/ and /ɜː/, suggesting that the phonetic training might help develop these L2 sounds in their L2 sound system.

Apart from that, the inferential results also showed that both groups of L2 Thai learners had low scores in the identifications of seven monophthongs: /æ/, /iː/, /uː/, /ʌ/, /ɑː/, /ʊ/ and /ɒ/, and their scores were not significantly different from one another. This suggests that they did not develop their perception towards these seven vowels, even in the high-experienced group who had passed phonetic training. This supports the test results from 2.2 million adults from 100 countries and regions as shown in the 2020 English Proficiency Index by EF Education First (Ashworth, 2020). In these test results, Thailand scored 419 out of 800 according to the English Proficiency Index, indicating very-low level of English proficiency. From 24 countries surveyed in Asia, Thailand ranks 20 out of 24. And from 8 countries surveyed in Southeast Asia, Thailand ranks 7 out of 8. From these results, including the results of this study, there is a call for English teachers in Thailand to develop teaching materials to enhance the ability to identify L2 British English monophthongs. For example, video demonstration of native speakers of British English pronouncing these vowels in the same consonantal contexts might be provided to L2 Thai learners to allow them to see the movements of the mouth. The illustrations from Magnetic Resonance Imaging (MRI) scan might be used to show how the tongue position and movements in the mouth are like when pronouncing these vowels. Many exercises could be used to provide more opportunities for the learners to practice listening to these British English vowels, such as transcription, discrimination and identification.

For the effect of the L2 experience, many hypotheses from the perceptual assimilation task are incorrect. Five out of eleven hypotheses were correct. For the identification of most British English vowels, it was found that L2 experience had no effect. However, in the identification of the British English vowels /e/, /ɔː/, /ɪ/ and /ɜː/, the scores of the correct identification were significantly higher in the high-experienced group than the low-experience one, suggesting the influence of L2 experience in the learning of these vowels. These results are consistent with the findings of the study of Lee and Cho (2020) for the identification ability of Standard Southern British English (SSBE) vowels by L2 Korean listeners as Korean listeners with a long length of residence (LOR) in the United States had much higher mean scores of identification for these four vowels than those with short LOR. These results also suggest that some vowels are easier to learn that the others. As shown in the findings of the study of Munro et al. (1996), over half of the last-arriving age of learning (AOL) group who were L2 Italian learners of English produced [eɪ] and [æ] that were rated as good as the native speakers' productions, and few learners of this group produced other vowels, such as [ʌ] and [ɝ] in a native-like manner. The authors suggested that it is not easy to describe the differences in learnability – no generalizations of L2 sound learning could be easily made. As in this case, the explanation of why the high-experienced group was better at perceiving the British English vowels /e/, /ɔː/, /ɪ/ and /ɜː/ could be made. This might be due to individual differences in success among learners. The other reason might be the unique articulatory aspect when producing these vowels that make them more outstanding and easier to remember than other vowels. One observation here is that these British English vowels /e/, /ɔː/, /ɪ/ and /ɜː/ are not low vowels. British English /ɪ/ is produced with slight jaw opening. Other three vowels /e/, /ɔː/ and /ɜː/ are produced with more jaw opening. However, none of them are produced with wide jaw opening. This might suggest that the British English low vowels /æ/, /ʌ/, /ɑː/ and /ɒ/ are more difficult to perceive than the non-low vowels for L2 Thai learners.

To sum up, the predictions from the perceptual assimilation task did not do well in predicting the ability of the L2 Thai learners in identifying British English monophthongs. This suggests that only the matching of the L1 and L2 sounds and the perceived similarity might not be sufficient in predicting the identification ability of the L2 sounds. Other aspects of the sound investigation, such as phonetic, phonemic, articulatory might be considered when understanding the perception of L2 sound.

VI. Limitations and Directions for Futher Studies

With regard to the limitation of this study, there are two main points. Firstly, this study did not investigate the learning of the L2 British English monophthongs in terms of production. To better understand the mechanism of the L2 sound learning, future study might explore the production of the British English monophthongs by the L2 Thai learners to see the relationship between production and perception. Secondly, in this study, the L2 experience of the subjects was divided according to the major that the subjects were studying. The effect of L2 experience from dividing subjects by their major might not be sufficiently robust. This might explain why there was no effect of the L2 experience in most identifications of the British English monophthongs. For future research, L2 Thai learners with different aspects of L2 experience, such as those with different degrees of LOR (e.g., Lee and Cho, 2020) might be investigated for their identification ability. It is possible that the results might strengthen the influence of foreign language experience in the L2 sound identification.

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