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Thai tones in Chinese students after using the "Tone Application" and their attitudes

Phanintra Teeranon [a 1]

[a] *University of Phayao, Phayao, Thailand*

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Abstract

This study investigates the acoustic characteristics of Thai tones produced by Chinese students learning Thai through the "Tone Application", and conducts an attitude test towards the use of the Tone Application. A comparison of Thai tones pronounced by the participants with 40 native Thai speakers was also conducted. The acoustic characteristics studied in this research were the fundamental frequencies analyzed with the Praat program version 6.0.9. Statistical analysis such as mean, standard deviation, and t-test were used. The findings revealed that the Tone Application (a mobile phone application for practicing listening and speaking Thai) can partially promoted better tone pronunciation in Chinese students learning Thai as a foreign language. After utilizing the Thai Tone Application with the Chinese students, they could pronounce the mid, the low, the high, and the rising tones. However, the application failed to enhance falling tone which is linguistically classified as the problematic tone for Chinese students. In other words, the application helped expedite contour tones such as the high tone and the rising tone, but not the falling tone. It is questionable whether the application can replace the instructor or not. This study to also show another perspective on the acoustic study of Thai tones issues and another angle of students' attitude towards the use of a language application.

Keywords: acoustic; Chinese; application; Thai; tone

1. Introduction

Southeast Asian linguists have identified five tones in the Thai language: the mid-33, the low-21, the falling-31, the high-45, and the rising-323. In other words, they are significantly differentiating with its word meaning, e.g. [ruu]+high/15 "to know" and [ruu]+rising/323 "elegant". As consonants and vowels are equal in both words, the Thai tones serve to differentiate the meanings (Thepboriruk, 2009; Srisunthornthai, 2013; Yang & Wongpinunwatana, n.d.). The relative fundamental frequency (F0) of a voicing unit in a syllable is a major clue to measure phonemic tones in Thai. Acoustically, Thai tone shapes comprise the following:

[1] Corresponding author.
E-mail address :tphanintra@hotmail.com

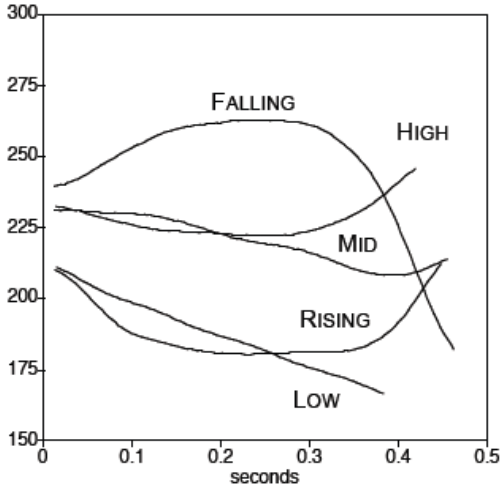

Figure 1. Thai tone shapes (Zsiga & Nitisaroj, 2007)

Five Thai tones (monosyllables) have been shown to be measurable in isolated words (Teeranon, 2007) and a number of studies have investigated the tones' deviant shapes in connected speech (Teeranon, 2002; Panpraneet & Onsuwan, 2013). Regarding the study of isolated words, researchers have categorized level tones and contour tones in Thai (Abramson, 1997; Teeranon, 2007). However, in case of connected speech, linguists have investigated the factors affecting the shapes of Thai tones, which are reported to be steeper in tone shapes compared to isolated words (Tingsabadh & Deeprasert, 1997). The results of previous research on Thai tones have potential benefits for pitch condition on speech recognition, tone language application, and teaching tonal languages, among others. It is likely that the factors affecting Thai tone shapes in various contexts include the stresses, as cited in Potisuk, Gandour & Harper (1994), speaking rates, as cited in Gandour, Tumtavitikul & Satthamnuwong (1999), the speaker's mother tongue and experience in practicing tones (Akkharasena, 2015; Intajamornrak, 2017), and even the hearing ability (e.g. deaf children and other speech disorders) (Suvanich, 2010; Tantibundhit et al., 2014; Teeranon & Detchanarat, 2015).

Thai tones in speech can be identified by two common linguistics analyses: an acoustic analysis and a perception test. An acoustic analysis reflects the physiology of speech production, which is the rate of vocal folds vibration, while a perception test is defined as an auditory system to understand a language. An acoustic study of Thai tones and a Thai tone perception test were investigated by Abramson (1997), who found that differentiating mid and low tones was problematic for native Thai speakers. Later, Nasanee (2003) found that native Thai speakers barely differentiated high and rising tones. These results were in line with findings by Teeranon (2007). This present study focuses on an acoustic study as there are a seeming controversy of the acoustic-phonetics issues of foreigners learning Thai as a foreign language.

It has long been stated that individuals who speak a non-tonal language unable to differentiate lexical tones comparing to those whose mother tongue are tonal language (Wayland & Guion, 2004). Recently, however, both Akkharasena (2015) and Intajamornrak (2017) found that Thai tones are problematic for individuals who speak a tonal language as their mother tongue, as well as for those studying a tonal language but whose mother tongue is toneless. Some Thai tone levels, such as mid and low tones, can be quite confusing for learners who speak other languages, as can certain contour tones, such as high tone, falling tone and rising tone. Kaan, Barkley, Bao and Wayland (2008) and Pancha (2016) has found the falling tone which is a contour tone in Thai sensitive to the speakers with non-tone language (English).

Thus, it is still debatable issue for which types of Thai tone, level tone or contour tone, are the most problematic for foreigners. Similarly, for Americans learners learning to speak Mandarin, the contour tone is the most difficult to pronounce. Guo & Tao (2008) report that of the four tones in Mandarin Chinese, namely Tone 1 (a level), Tone 2 (a rising), Tone 3 (a mid falling-rising), and Tone 4 (a falling), Chinese (Mandarin) Tone 3 (a contour tone) is the most difficult tone for American learners learning Mandarin.

The results of Kaan, Barkley, Bao and Wayland (2008) with the suggestion of the F0 onset of differences between the mid tone and the falling tone in Thai was suppressed by language training.

Thai tone training for those who study Thai as a foreign language has been done with Chinese students (i.e. Putthasatien, 2017) due to a high number of Chinese students in Thailand. The training was conducted through gestures, activities, and textbooks. The findings found that low tone (classified as a level tone) in Thai are still hard for the Chinese students.

Apart from lecturers, training and other learning environments, previous research on Thai tones has suggested applications as alternative tools (Teeranon et al., 2019). Crosbie, Holm and Dodd (2005) has pointed out the importance of approach advocated for speech practice. However, literature of using a mobile phone application in learning tones is limited. Most of the literature found in Thailand are using mobile phone to promote English ability in Thai students (i.e. Suwantarathip & Orawiwatnakul, 2015). Thai tone is a lexically contrastive pitch used to differentiate word meanings. The latest application in Thailand called the Tone Application (TA) has been created based on previous linguistics research and the minimal pairs approach. Its contents are mainly focused on practicing the minimal pairs of problematic tones for language learners, namely the mid-low, low-falling, and high-rising tones (e.g.[khaa]+low tone “galangal”-[khaa]+falling tone “to kill”).

Meanwhile, in using mobile phone to enhance learning a language relate closely to users’ attitude as widely reported in previous research (Cui &Wang, 2008, Kizito, 2012; Wang, 2017). Bazeley (2002) and D rnyei (2007) mentioned that both quantitative and qualitative method should be mixed up for expanding the understanding of a complex issue. Most of the previous study found that there were positive attitudes and benefits of language learners through the use of mobile application. Opposite to these findings, there were negative attitudes on the use of mobile phones applications (Cui & Wang, 2008; Rana, 2014). For example, Cui and Wang (2008) reported that the application did not suitable for the phone sizes. Some studies showed that there were limitations on accessing the internet (Hashemi & Ghasemi, 2011; Wang, 2013). Not many language issues reported in the previous study, only technical problems reported from the learners’ attitudes.

Then, research questions, "Does language application improve Thai tones in Chinese students learning Thai as a foreign language?" and “What are the attitudes of students towards the advantages of using the application to help the development of Thai tones?" have been raised.

Therefore, this study aims to investigate whether the Thai low tone which is a problematic tone after using the exercise handbook in Putthasatien (2017) will be solved and affected by the Tone Application with minimal pairs approach or not. The methods are to analyze the acoustic characteristics (tone shape) and conduct an attitude interview towards the use of Tone Application of Chinese students based on Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989; Venkatesh & Davis, 2000) which is one of the most influential theory in analysing a relationship between attitudes and behavioural change. The use of technology plus minimal pairs approach to enhance learners’ language communication for Thai as a foreign language and its limitations are discussed. Then, all Thai tones produced by Chinese students learning Thai through the “Tone Application” are benchmarked with standard Thai produced by native Thai speakers.

2. Method

2.1. Participants

For this study, 40 Chinese participants in the age range of 19−21 were all selected. There were 10 males and 30 females. All were studying the first year of their major in Thai at Nakhon Ratchasima Rajabhat University, Thailand. As the research questions in this study have been raised upon the previous research of Chinese students at Nakhon Ratchasima Rajabhat University (Putthasatien, 2017), therefore this research area was selected.

2.2. Instruments

A pre-test and a post-test on Chinese students' acoustic analysis together with a test for native Thai speakers, and an attitude test were all conducted with this study.

2.3. Data collection procedures

This study used linguistics methods in the acoustic analysis. Prior to describing the acoustic test method, the language data and participant criteria in the study were the following:

The language data used for the test tokens were derived from standard Thai. Thai has a list of 18 consonants: /p, pʰ, b, t, tʰ, d, k, kʰ, m, n, ŋ, r, f, s, h, tɕ, tɕʰ, j/; and nine monopthongal vowels: /ɪ, ʅ, ʊ, ɛ, ↔, o, E, ɑ, □/, all with vowel length distinctions. Its five tones are mid-33, low-21, low-31, high-45 and rising-323. However, all of the test words included the vowel /ɑɑ/ to prevent the effects of F0 changes in vowels.

The Chinese language has a repertoire of 19 consonants: /p, pʰ, t, tʰ, k, kʰ, m, n, t͡s ʈ͡ʂ (t͡ɕ), ʈ͡ʂʰ(t͡ɕʰ), f, s, ʂ(ɕ), l, z, ø /; five vowels / i u a ia ua o io uae e ie ɛ iɛ ei uei au iau əu iəu iu ãŋ iãŋ uãŋ ẽ iẽ uẽ oŋ ioŋ/; and four tones: Tone 1 (a high level -55), Tone 2 (a rising-35), Tone 3 (a mid falling-rising-214), and Tone 4 (a falling-51) (Guo & Tao, 2008). Though there is one more tone in an unstressed syllable which is the neutral tone (Zhang, 2006), this study counts on the Chinese tones in the stressed syllables.

For the acoustic study, 40 Chinese participants were selected by Thai language grading scores to ensure that all had a broadly equal level of proficiency. Their first language was standard Chinese.

Native Thai speakers were also selected to elicit benchmark data for comparing Thai tone shapes. Forty native Thai speakers aged 19–21 with perfect articulation were recruited.

Three sets of test tokens or words for recording were created using the /ɑɑ/vowel with aspirated, nasal, and fricative initial consonants to control the effect of the initial consonant upon the tone shapes as shown in Table 1.

Table 1. Thai words for recording

Set 1	Set 2	Set 3
[khaa]+mid "to be stuck"	[naa]+mid "rice field"	[faa]+mid "a note"
[khaa]+low "galangal"	[(v□ɪ+high) naa]+low "custard apple"	[faa]+low "palm (of the hand), sole (of the foot)"
[khaa]+falling "value"	[naa]+falling "face"	[faa]+falling "scum"
[khaa]+high "to trade"	[naa]+high "aunt"	[faa]+high "sky"
[khaa]+rising "leg"	[naa]+rising "thick"	[faa]+rising "pot cover"

Both Chinese participants or students and native Thai speakers were then requested to pronounce each word in Table 1 for 5 times. However, the first three test tokens were analyzed. The fourth and the fifth test tokens were eliminated as they tend to be influenced by the intonation.

Pre-Test for Chinese Students

Using the appropriate test tokens that were voiceless and expressed initials to avoid contextual effects to F0 in Table 1, participants were asked to pronounce each test token at a moderate tempo. The overall test token count was 1,800 test tokens /words (40 participants x 3 sets x 3 times x 5 tones). The Praat program version 6.2.09 was used to part each vocalization and study. Frequencies at five time points for each vowel were chosen to be normalized and measured at 0 percent, 25 percent, 50 percent, 75 percent and 100 percent. Line graphs showing the cumulative mean (x) of F0 tones were drawn using Microsoft Excel 2008.

In the class, the participants were asked to learn 50 minimal pairs of test tokens in the Thai Tone Application for five weeks based on a study by Ferguson & DeFelice (2010), which reported that five weeks is a suitable time period for data collection of online class. Before dismissing the class, participants were given a chance to study Thai tones through the application for 20 minutes. The participants were trained to use the application by their teachers.

In the application, there are 50 tone minimal pairs both in the isolated form (word form) and in the sentence form. The Chinese students could listen to the pronunciation in the application and check their tone pronunciation and compare it to a live correction. The scores were shown after using the application.

Three experts tested the application for reliability. An assessment method was developed based on the Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989). The application was tested for reliability by three experts. They were asked to rate the following three aspects: innovations, process, and innovation values. A Likert three-point scale (Kumar, 2014) was used as follows:

0-1.66	means	the application value is low
1.67-2.33	means	the application value is moderate
2.34-3.00	means	the application value is high

The Thai Tone Application had a mean score of 2.75, which was rated as a high value.

Post-Test for Chinese Students

After five weeks of study of the application, the test tokens were pronounced with a moderate tempo. The Praat software was also used to segment isolated words. Frequencies at five time points for each test token's vowel were chosen to be tested at 0 percent, 25 percent, 50 percent, 75 percent and 100 percent. Microsoft Excel 2008 was used to evaluate and plot graphs showing the cumulative mean (x) of the F0 tones.

Test for Native Thai Speakers

Native Thai speakers were asked to speak isolated words. The first three out of five pronunciations have been picked. Each word was pronounced at a moderate tempo. The overall test token count was 1,800 test tokens / words (40 participants x 3 sets x 3 times x 5 tones). The Praat version 6.2.09 software was used to evaluate sounds and graphs with an average mean (x) of F0 tones.

The F0 values were converted to semitone values to lower the effect of the participants' gender. The formula used was as follows:

ST=12*LOG(C21/X)/LOG(2) , where X means the fewest F0 values in each tone

Then, statistical analysis was calculated for the mean, standard deviation (S.D.), and t-test at the onset of the tone shape according to Kaan, Barkley, Bao & Wayland (2008) findings. Therefore, the frequencies at 2 time points for each vowel were selected for t-test analysis at 0% and 25%. Figures and tables were drawn.

The Attitude Test

As the present study integrated the quantitative and qualitative methods for extracting the understanding of a complex language issue (D rnyei, 2007) on Thai tone, an interview method was used with all 40 students. The objective of the interviews was to analyze students' attitude upon the use of Tone Application. The question used in the interview was "How do you feel about using Tone Application in studying Thai tones? Please describe clearly within 2 minutes"

The question was validated by three experts (Kvale, 1996). An evaluation form was created using IOC form. The IOC value for the question is 1. This means that the question is applicable for data collection.

The interview was analyzed and coded based on Technology Acceptance Model (TAM) (Davis et al., 1989; Venkatesh & Davis, 2000) with two primary factors influencing an individual's intention to use new technology: perceived ease of use and perceived usefulness. Therefore, the utterances from the Chinese students' interview comprised of language content, the application function, and interface of the application. The percentage of each category, namely, language contents, its function, and interface of the application was employed for calculation.

The TAM theory used as the basis for the analysis was derived from the Theory of Planned Behavior (TPB) (Ajzen, 1991), which projects the integration of key factors in the initiation of the project; the change will begin with attitudes and will affect behavioral change (Kennedy, 2013). This theory links between attitudes and behavioral changes of an individual. The theory aims to apply in studying human belief, attitude, intention and behavior.

2.4. Data analysis

The Acoustic Analysis

The Chinese students and native Thai speakers were asked to produce Thai tones in isolated words five times. The first three pronunciations were chosen, while the fourth and fifth tone pronunciations were likely to be influenced by their intonation. Chinese students report twice for both pre-test and post-test. The tones of native Thai speakers have been recorded only once.

The Attitude Analysis

This present study applied content analysis methods in analyzing oral reflection. The research steps are: 1) the researchers collected and transcribed the interviewing answer of the Chinese students, 2) grouping the information and conduct coding the data and content based on Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989; Venkatesh & Davis, 2000). Then, identifying their patterns together with interpreting their meanings, and 3) describe obtained data in accordance with the theory.

The interviewing answer was systematically presented in the following format,

"……My learning method has changed from the traditional way to technological-based. I was frustrated at first, but……" (A1)

A1 represents a pseudonym of the interviewee number 1. The percentage of the frequency of the similar content was calculated and describe in descriptive method.

3. Results

3.1 Acoustic Results

In order to analyze the degree to which the application improved the ability of Chinese students to pronounce mid-low tones, low-pitched tones and high-pitched tones, an acoustic study was developed,

as shown in Figure 2. (*pre-test means the tone shape of the Chinese students before using Tone Application, post-test means the tone shape of the Chinese students before using Tone Application, and Thai means tone shape of native Thais).

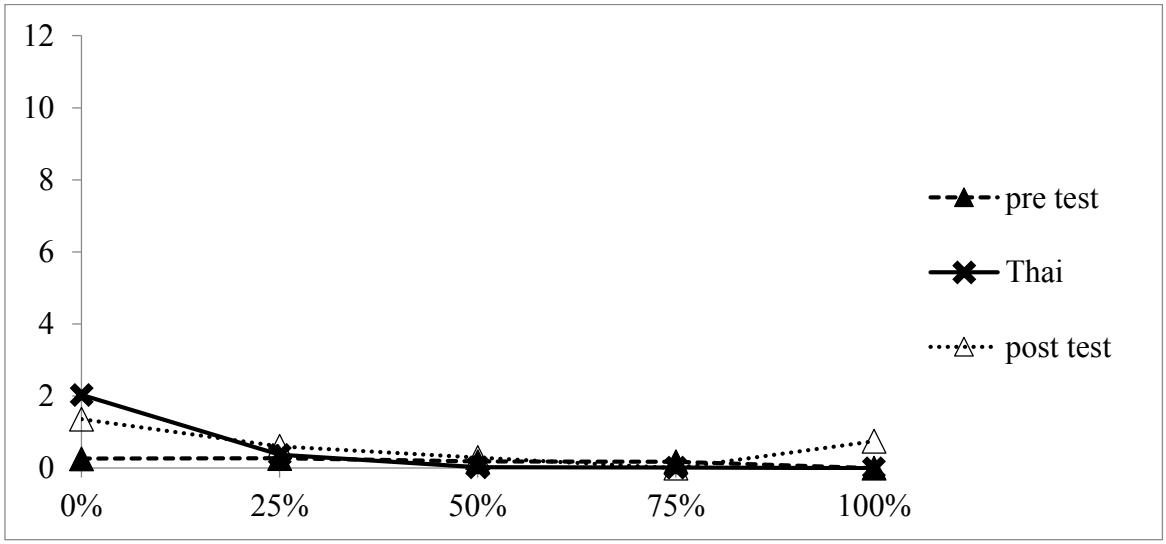

Figure 2． A comparison of mid tone shapes

Table 2. A comparison of the semitone values of the mid tone produced by Chinese students before using the application to native Thai speakers

	Average of the semitone values（ST）at the onset（0%−25%）	**S．D．**	**Sig．(2−tail)**
Pre−test by Chinese students	0．18	5．19	0．415
Native Thai	0．52	6．80	

Table 3. A comparison of the semitone values of the mid tone produced by Chinese students after using the application to native Thai speakers

	Average of the semitone values（ST）at the onset（0%−25%）	**S．D．**	**Sig．(2−tail)**
Post−test by Chinese students	0．60	4．72	0．868
Native Thai	0．52	6．16	

As shown in the comparison of Thai mid tone shapes in Figure 2, it is clear that after using the Tone Application, the Chinese students' pronunciation of mid tones was improved in comparison to before using the application. The first three points of the post-test graph are closer to the tone shape of the Thai pronunciation. It can be seen that the mid tone shapes pronounced by the Chinese speakers were less contoured compared to those of the native Thai speakers. However, there was a small rise found in the end of the tone shape in the post-test.

Tables 2 and 3 show that when comparing the semitone values of the mid tones produced by the Chinese students before using the application to those produced by the native Thai speakers, there was

no statistical significance. Similarly, when comparing the semitone values of the mid tones produced by the Chinese students after using the application to those of the native Thai speakers, there was also no significance. The statistical analysis specified that the mid tone shapes of Chinese students were similar to those of native Thai speakers. However, after using the application, the mid-tone shapes were more identical to those of the native Thai speakers.

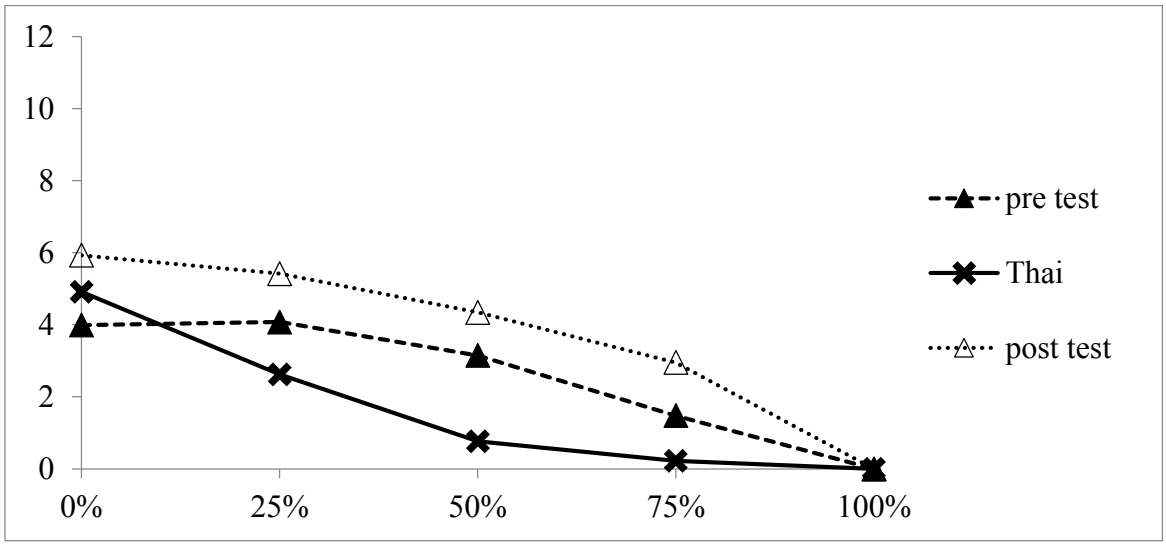

Figure 3. A comparison of low tone shape

Table 4. A comparison of the semitone values of the low tone produced by Chinese students before using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%-25%)	**S.D.**	**Sig. (2-tail)**
Pre-test by Chinese students	2.53	6.38	0.512
Native Thai	1.71	5.22	

Table 5. A comparison of the semitone values of the low tone produced by Chinese students after using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%-25%)	**S.D.**	**Sig. (2-tail)**
Post-test by Chinese students	3.72	7.46	0.189
Native Thai	1.71	4.81	

Figure 3 shows the comparison of Thai low tone shapes. Here, the findings were similar to those of the mid tone shapes. It was found that after using the Thai Tone Application, the Chinese students could produce low tones more effectively than before using the application. The first three points of the graph show the tone shapes were closer to those of the native Thai speakers.

Tables 4 and 5 shows that when comparing the semitone values of the low tone produced by the Chinese students before using the application to those produced by the native Thai speakers, the results were not statistically significant. Similarly, when comparing the semitone values of the low tone

produced by the Chinese students after using the application to those of the native Thai speakers, there was also no significance. The statistical analysis confirmed that the low tone shapes of the Chinese students was similar to those produced by the native Thai speakers. After using the application, the low tone shape of Chinese is a bit different from that of the Thai speakers.

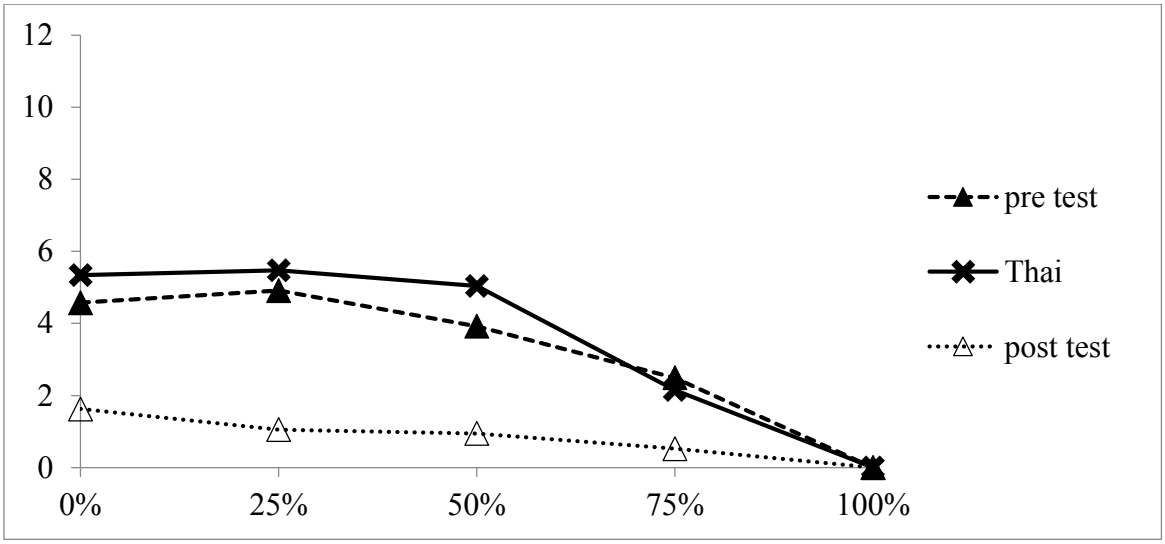

Figure 4. A comparison of falling tone shape

Table 6. A comparison of the semitone values of the falling tone produced by Chinese students before using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%–25%)	**S.D.**	**Sig. (2-tail)**
Pre-test by Chinese students	0.86	8.71	0.049*
Native Thai	3.69	7.23	

* means statistically significance (sig)

Table 7. A comparison of the semitone values of the falling tone produced by Chinese students after using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%–25%)	**S.D.**	**Sig. (2-tail)**
Post-test by Chinese students	0.56	8.85	0.020*
Native Thai	3.69	6.30	

Figure 4 shows a comparison of the falling shape of the tone. The shape was at a higher level for half the length, before steadily falling for native Thai speakers. However, the falling tone shape was less contoured for the Chinese students. Here, the falling tone shape after using the app was similar to the pre-test.

Tables 6 and 7 show that when comparing the semitone values of the falling tone produced by the Chinese students before using the application to those produced by the native Thai speakers, there was a statistical significance. Similarly, when comparing the semitone values of the falling tone produced by the Chinese students after using the application to those of the native Thai speakers, there was a statistical significance. The statistical analysis confirmed that the falling tone shapes of Chinese

students were similar to those produced by the Thai speakers. After using the application, the falling tone shapes of Chinese shows more variety in tone shape than those of the Thai speakers.

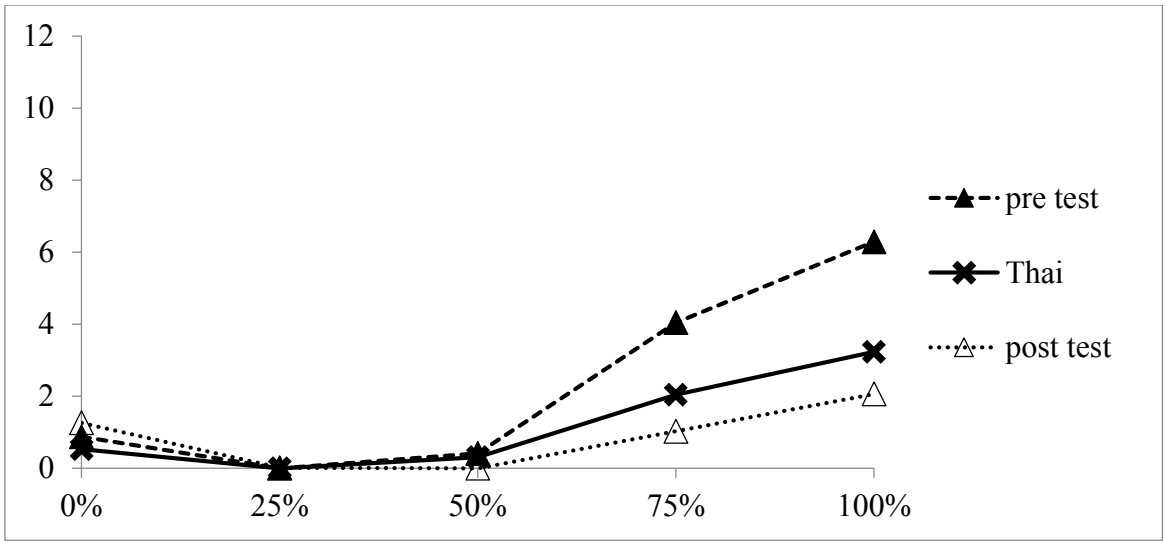

Figure 5. A comparison of high tone shape

Table 8. A comparison of the semitone values of the high tone produced by Chinese students before using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%-25%)	**S.D.**	**Sig.(2-tail)**
Pre-test by Chinese students	2.32	9.48	0.448
Native Thai	1.22	3.77	

Table 9. A comparison of the semitone values of the high tone produced by Chinese students after using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%-25%)	**S.D.**	**Sig.(2-tail)**
Post-test by Chinese students	0.87	7.20	0.642
Native Thai	1.22	5.08	

The high tone shape dropped and was relatively steady before rising in the native Thai speakers. The Thai speakers' pre-test and post-test were both similar in shape compared to that of the Chinese students; however, the pitch level was different in the post-test, where it was slightly lower than the Thai speakers, while the pre-test pitch level was the lowest.

Tables 8 and 9 show that the findings did not show statistical significance when comparing the high-tone semitone values provided by Chinese students prior to the application to those provided by native Thai speakers. Similarly, when comparing the semitone values of the high tone produced by the Chinese students after using the application to those of the native Thai speakers, there was also no significance. The statistical analysis confirmed that the high tone shapes of the Chinese students were

similar to those produced by the Thai speakers. After using the application, the high tone shapes of the Chinese students were closer to those of the Thai speakers.

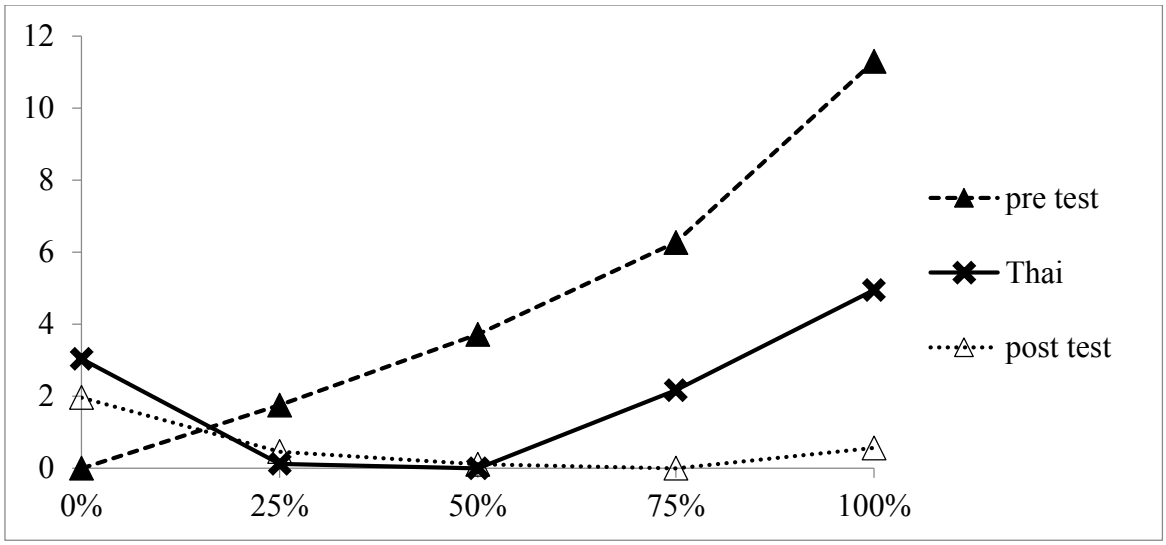

Figure 6. A comparison of rising tone shape

Table 10. A comparison of the semitone values of the rising tone produced by Chinese students before using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%–25%)	**S.D.**	**Sig. (2-tail)**
Pre-test by Chinese students	4.60	5.07	0.275
Native Thai	2.06	4.35	

Table 11. A comparison of the semitone values of the rising tone produced by Chinese students after using the application to native Thai speakers

	Average of the semitone values (ST) at the onset (0%–25%)	**S.D.**	**Sig. (2-tail)**
Post-test by Chinese students	0.62	9.02	0.187
Native Thai	2.06	8.16	

One surprising finding was that the shape of the rising tone produced by the native Thai speakers fell and was relatively steady before rising. However, the tone shape in the pre-test and post-test were similar and were less contoured. Here, the shape was very similar to previous high tone shapes found in Teeranon (2007).

Tables 10 and 11 show that when comparing the semitone values of the rising tone produced by the Chinese students before using the application to those produced by the native Thai speakers, there was no statistical significance. Similarly, when comparing the semitone values of the rising tone produced by the Chinese students after using the application to those of the native Thai speakers, there was no statistical significance. The statistical analysis confirmed that the rising tone shape of Chinese students was similar to those produced by the Thai speakers.

3.2 Students' Attitude Results

While analyzing the interview, the contents of the conversation were divided into content, function, and interface based on TAM theory.

Attitude Towards the Language Content

Most of the answer (47%) from the interview demonstrated that Chinese students were aware of the minimal pairs of the tones in the application content. Various word pairs in the application were their favorite. However, they found falling tone hard to pronounce after using the application.

They have been recalled of their past experiences of academic content or topics, activities with the Tone Application. When recalling occurred, students tend to recall the content, as shown in the following sample:

Positive attitude:

Minimal word pairs and various word pairs were the main cause of positive attitude for the Chinese students using Tone Application.

"*I learned how to pronounce tones of two word pairs which are similar in consonant sounds but different in tones from the Application. I like it because I cannot find this kind of lesson from other materials*" (*A10*)

"*I have a fun time practicing various pairs of words in the application. To practice tones by switching between similar words in the app made me laugh.*" (*A21*)

Negative attitude:

The falling tone have been found to be problematic for the Chinese students learning Thai.

"*I still find falling tone hard to imitate in the application. I cannot differentiate between falling tone and its word pairs.*" (*A15*)

"*I think I have to practice more on falling tone.*" (*A 32*)

Attitude towards the Application Function

Another group of students (38%) demonstrated their attitudes toward the function of the application. They evaluated their experiences in using the application based on the basis of their own level of satisfaction and of dissatisfaction with their understanding of the application. These students made judgments about fun tasks that influenced the change in their learning contexts. There was one interesting answer that the students perceived the application as a tool for speaking treatment. For example, the following statements were provided:

Positive attitude:

"*I have a positive feeling upon the function of the application. I feel like it is a tool for treatment. It helps me to pronounce Thai tones. It makes many difficult words easier.*" (*A2*)

"*The application can give me live feedback. I can check my scores after practicing tones, therefore I want to access to the application throughout the project period.*" (*A7*)

Negative attitude:

"I found the application difficult to find the practice lessons." (A29)

"Sometimes, the microphone doesn't work out well." (A31)

"It is easy to access only if the internet signal is robust. For some phone model, it takes quite a long time to download the application." (A22)

Attitude towards the Application Interface

According to TAM theory, besides, ease of use, the interface of the application such as color, design, or button of the application is the first impression causing positive or negative attitude in making decision of using the application. It was found 15% of the interviewing answers classified under attitudes towards the application interface, for example:

Positive attitude:

"The color of the application is attractive comparing to other education application." (A5)

Negative attitude:

"I think the button style is more like for primary school students." (A19)

From the examples above, it is obvious that falling tone is a problematic area for Chinese students learning Thai after training with Tone Application. This qualitative finding is in line with the acoustic comparison between falling tone shapes of Chinese students before and after using the application.

4. Discussion

This study integrates an acoustic-phonetic analysis of the Thai tone produced by Chinese students learning Thai as a foreign language, as well as qualitative methods for interviewing their attitudes towards the use of this language application. The qualitative research was based on the TAM theory.

In the acoustic study, the Thai Tone Application containing minimal pairs approach (e.g. the word pairs of the low tone vs. the falling tone, [khaa]+low tone "galangal"-[khaa]+falling tone "to kill" etc.) improved the Chinese students' ability to produce both level tones and contour tones. The acoustic characteristics of Thai tones created by Chinese students learning Thai using the Tone Application are close to those of native Thai speakers. However, when comparing the semitone values of the tones created by Chinese students using the application to those of native Thai speakers, there was no significance (see Table 2-11) for the mid tone, low tone, high tone, and rising tone. Falling tone yielded different result. When comparing the semitone values of the falling tones produced by the Chinese students after using the application to those of the native Thai speakers, there was significance.

The results settle the argument of whether Thai tones are problematic for individuals who speak a tonal language as their mother tongue, as well as for those studying a tonal language but whose mother tongue is toneless (Akkharasena, 2015; Intajamornrak, 2017), and whether level tones or contour tones

are problematic for students learning the Thai language (Schaefer & Darey, 2013; Schaefer & Darey, 2014).

It is shown that those whose mother tongue is a tonal language has the problem in producing and differentiating Thai tones. They also reveal that both the level and contour tones in the Thai language are difficult for foreign language speakers learning Thai. These findings are also consistent with the claim of Pancha (2016).

Moreover, the findings of this study are in line with Meesat (2015) and Putthasatien (2017) that the problematic tones of the Chinese students learning Thai tones are the level tones, namely the mid tone [33] and the low tone [21]. This is due to the mid and low tone shapes in the Thai language that display the most similar patterns. The mid tone starts at the mid pitch level and remains steady through the pitch and the low tone starts at a bit lower pitch level comparing to the mid tone and remains stable throughout the end of the syllable.

Considering tone shapes in Figure 2-6 and statistical analysis in Table 2-11, it was found that using the Tone minimal pairs framework in the application did not make it possible for Chinese students to learn Thai tones to distinguish between mid-low tones, low-pitched tones and high-pitched tones. Therefore, it cannot be concluded that the Tone Application with minimal pairs approach is an effective learning tool to improve the pronunciation of Thai tones. The results significantly contrast to the findings by the clinical linguistics studies using minimal pairs approach to therapy (Baker & MacLeod, 2004; Crosbie, Holm & Dodd, 2005). In addition, the present study confirms that the minimal pairs approach can be applied to the segmental levels, but not the suprasegmental levels like tones. The results are not in line with Saran, Seferoglu & Cagiltay (2009) and Haggag (2018), who show that the application is beneficial for training speaking skills.

Moreover, one of the surprising findings in this study was that after using the application, the differentiation of falling tones [31] showed less improvement than other minimal pairs. This is contrast to the findings of Putthasatien (2017) who found that all Thai tones apart from the low tone can be learned by studying an exercise handbook for Chinese students studying Thai at Nakhon Ratchasima Rajabhat University.

Regarding the attitude test of the Chinese students upon using the "Tone Application" to practice Thai tones, the findings particularly supported that falling tone is hard to pronounce for the Chinese students even after using the application. It should be noted that the form of the falling tone after use of the application was close to that of the low tone due to the onset of the low tone and the falling tone was identical for its low pitch. Therefore, the minimal pairs content in the application should be adjusted to falling tone vs. high tone which has maximal in the onset pitch difference.

The findings of the attitude test mainly supported the theory of TAM by Davis, Bagozzi & Warshaw (1989) and Venkatesh & Davis (2000). The understanding of ease of use and effectiveness of implementation are important factors for learners to have strong determination in changing their learning behaviors. The present study reported 38% of Chinese students considering on the application functions and its ease of use as they mentioned upon the ease of internet access or the limitation of the mobile phone in compatible with the application. The finding supports the limitations of the technology in teaching and teaching languages as mentioned in previous studies such as Hashemi & Ghasemi (2011) and Wang (2013).

Recently, Meesat (2015) found that the mid and low tone in Thai are difficult for Chinese students, but this mid and low tone issue in Chinese learning Thai can be solved by using the Somatically Enhanced Method, which involves clapping, humming, and gestures. Meesat (2015) has also reported that the falling tone can be enhanced by the Somatically-Enhanced Approach. Therefore, it is suggested that the mediums of instruction have to be used in align with the teaching methods for better Thai tone

production and perception. The application is an augmentation of teaching method. It helps the process of learning, but it is a doubt whether it can replace the instructor or not.

The present study has some strengths, including the use of integrated methods (i.e.the minimal pairs approach in the application, and linguistic research methods) that enabled this study to show another perspectives on the acoustic study of Thai tones issues and another angle of students' attitude towards the use of a language application.

The findings can be generalized due to the greater number of participants in this sample. However, the time of use of the Tone Application was relatively limited, which may have an effect on the learning process of Chinese students studying Thai tones.

Further investigation is clearly need to determine the long period of using the application to enhance tone production and perception.

5. Conclusions

In conclusion, Thai tones are problematic for individuals who speak a tonal language as their mother tongue as well as those who speak non-tonal language as their mother tongue. A combination of tradition minimal pairs approach with the application can partially promote speech production of the Chinese students learning Thai tones. Falling tone are still problematic for Chinese students after using the application. It is doubt whether the application can replace the instructor or not.

6. Ethics Committee Approval

The author confirms that ethical approval was obtained from Kanlayanee Phucharoen (Approval Date: 21/10/2020).

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Çinli ğrencilerde "Ton Uygulaması" kullandıktan sonra Tayca tonlar ve tutumları

Öz

Bu çalışma, Tayca'yı "Ton Uygulaması" ile ğrenen Çinli ğrencilerin ürettiği Tay tonlarının akustik zelliklerini araştırmakta ve Ton Uygulamasının kullanımına y nelik bir tutum testi yapmaktadır. Katılımcıların ve anadili Tayca olan 40 kişinin telaffuz ettiği Tayca tonlarının karşılaştırması da yapıldı. Bu araştırmada incelenen akustik zellikler, Praat programı 6.0.9 sürümü ile analiz edilen temel frekanslardı. Ortalama, standart sapma ve t-testi gibi istatistiksel analizler kullanıldı. Bulgular, Ton Uygulamasının Tayca'yı yabancı dil olarak ğrenen Çinli ğrencilerde daha iyi bir ton telaffuzunu kısmen desteklediğini ortaya koydu. Çinli ğrenciler Thai Tone Uygulamasını kullandıktan sonra orta, alçak, yüksek ve yükselen tonları telaffuz edebildiler. Ancak uygulama, Çinli ğrenciler için dilbilimsel olarak sorunlu ton olarak sınıflandırılan düşme tonunu geliştiremedi. Uygulamanın ğretim elemanının yerini alıp alamayacağı şüphelidir. Bu çalışma aynı zamanda Tay tonları konularının akustik çalışmasına başka bir bakış açısı ve ğrencilerin bir dil uygulamasının kullanımına y nelik tutumunun başka bir açısını da g stermek içindir.

Anahtar Sözcükler: akustik; Çince; uygulama; Tay dili; ton

AUTHOR BIODATA

Phanintra Teeranon works at School of Liberal Arts University of Phayao.