

The Prediction of Lado's CAH in Taiwanese EFL Learners' Perceptual Acquisition of /s/ and /θ/



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ABSTRACT: This study mainly investigated the predictions of the Contrastive Analysis Hypothesis (CAH) on Taiwanese vocational high school EFL learners' acquisition of two English fricative consonants (/s/ and /θ/) by examining the learners' relative perceptual difficulty of the consonants. To achieve this purpose, two research questions were devised, and a self-designed listening identification test was carried out. A total of 43 students from a private vocational high school in northern Taiwan participated in this experiment. Their accuracy in perceiving the tested consonants was measured through the identification test. After all the participants' test scores were gathered, an independent-samples *t*-test was used to analyze the data. The results of the study showed that the relative perceptual difficulty of the two fricatives for the students was /s/ = /θ/. The finding suggested that Lado's (1957) CAH could not accurately predict the participants' acquisition of the consonants in perception.

KEYWORDS: Contrastive Analysis Hypothesis (CAH), perception, fricatives, consonants

INTRODUCTION

From theoretical points of view, there were theories indicating the difficulties that L2 learners may encounter during the process of second language acquisition (SLA). Lado's (1957) Contrastive Analysis Hypothesis (CAH) described that L2 learners tend to transfer their L1 systems to the L2 learning process. In Lado's CAH, L2 sounds which are different from L1 sounds are more difficult for L2 learners while L2 sounds which are similar to L1 ones are easier for them. In other words, new L2 sounds are the most difficult elements for L2 learners to acquire, and similar L2 sounds are the easiest. However, Best's (1995) Perceptual Assimilation Model (PAM) asserted that the more similar the sounds are between L1 and L2, the more L2 learners are not able to differentiate the sounds. Moreover, Flege's (1995) Speech Learning Model (SLM) stated that the more distinct the sounds are between L1 and L2, the easier L2 learners can differentiate the sounds. That is to say, the similarity between L1 and L2 sounds makes it difficult for L2 learners to distinguish the differences between L1 and L2 sounds. The above theory models of SLA suggest that the similar or dissimilar sounds between L1 and L2 may influence the process of SLA.

In addition, some past research studies even showed that the similar or dissimilar sounds between L1 and L2/FL can further create some substitutions for the target sounds (Aoyama, Flege, Guion, Akahane-Yamada, & Yamada, 2004; Michaels, 1974; Rau, Chang, & Tarone, 2009). For instance, Wester, Gilbers, and Lowie (2007) stated that for Dutch L2 learners of English, the substitution of the English dental fricatives /θ/ and /ð/ was on a large scale. The alveolar fricatives /s/ and /z/ were used as substitutions for /θ/ and /ð/ in word-final position, and /t/ and /d/ were in word-initial position. Peust (1996) found that for Asian learners of English, Hong Kong Chinese were inclined to substitute /θ/ with /f/, Malaysia or Singapore Chinese replace /θ/ with /t/, and Taiwanese substitute /θ/ with /s/.

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The English fricative was considered to be one of the most difficult classes among the English consonants for Chinese EFL learners (Xiao & Zhang, 2011). According to the English and Mandarin Chinese phonemic inventories, the English fricative consonant is the largest group in the English phonemic inventory, and there are nine sounds including /f/, /v/, /θ/, /ð/, /s/, /z/, /ʃ/, /ʒ/, and /h/ (American Speech-language-hearing Association). In contrast, the Mandarin Chinese fricative consonant is the second largest group in the Mandarin phonemic inventory, and there are five fricative consonants including /f/, /s/, /ʃ/, /x/, and /h/ (American Speech-language-hearing Association). The fact of comparison in the English and Mandarin phonemic inventories is that English and Mandarin share two same fricatives /s/ and /f/. Fricative /θ/ only occurs in the English phonemic inventory, but it does not occur in the Mandarin phonemic inventory. Hence, /θ/ can be viewed as a new sound for Mandarin Chinese speakers.

In the past years, some studies have been conducted to examine the claims/predictions of Lado's (1957) CAH in the acquisition of L2/FL sounds. A study by Curtin, Goad and Pater (1998) compared native English-speaking and French-speaking participants' abilities to identify two Thai aspirated and unaspirated /p/s. The results showed that the English-speaking group could hear the phonemic difference in the two sounds but the French-speaking group could not. The study concluded that some English speakers could distinguish the two Thai /p/s because the sounds were present as allophones of the same phoneme in English; however, there was only one /p/ (unaspirated) in French. The conclusion appeared to have sustained the claims of the CAH. Suter (1976) analyzed the relationship between 61 non-English speakers' pronunciation accuracy and 20 factors that were considered to be possibly related to pronunciation accuracy. The researcher discovered that the one *native language* was the most relevant variable and asserted that "native language was clearly a very important and very significant predictor of pronunciation accuracy" (p. 245). The CAH was also favored based on the results of the study. In contrast, Hung (2012a) investigated the relative perceptual difficulty of four English vowels for 104 Taiwanese EFL university freshmen. A self-designed listening identification test was used to collect data. The results of a one-way ANOVA showed that /ey/ and /ε/¹ posed a similar level of difficulty for the students. The finding was therefore taken as disproving the predictions of the CAH. Hung (2014) administered a pronunciation test to 50 English majors from a university in Taiwan to explore whether or not the English /s/ was easier for the EFL learners to produce than the English /θ/. An independent-samples *t*-test was performed to analyze the collected data. The statistical outcome indicated that the participants did not pronounce /s/ more accurately than /θ/ and vice versa. The CAH was declined again. In addition, Hung (2018) investigated 39 Taiwanese vocational high EFL learners' relative perceptual and productive difficulty of two English vowels. The participants' scores on a listening identification test and a pronunciation test were analyzed via two independent-samples *t*-tests. The statistical data indicated that the relative perceptual difficulty of the two vowels for the participants was /i/ = /ɪ/ but the relative productive difficulty was /i/ > /ɪ/². In this research project, the predictions of Lado's (1957) CAH played a role but only in the students' acquisition of the vowels in production.

From the review of the past studies above, there are agreements and disagreements with the claims/predictions of the CAH. It appears that the significance of the hypothesis in L2/FL acquisition of pronunciation is still controversial, and this urged the researchers of the present project to examine the role of the CAH in the prediction of FL learners' acquisition of FL sounds by measuring Taiwanese vocational high EFL students' perception of two English fricative consonants (/s/ and /θ/). To understand the importance of the theory, the following research questions were formed: ***What is the relative perceptual difficulty of the two English fricatives (/s/ and /θ/) for Taiwanese vocational high school EFL learners? Is the relative perceptual difficulty accurately predicted by the Contrastive Analysis Hypothesis (CAH)?*** By responding to the questions, it was hoped that the results of this study could shed light on the relationship between the CAH and FL pronunciation teaching and learning. Furthermore, the authors would like to make it clear whether or not language instructors could actually predict their students' ease and difficulty in acquiring FL

¹ The English /ey/ has a counterpart in Chinese, but /ε/ is completely different from any Chinese vowels (Ma, 1995).

² > means *more difficult than*

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segments by comparing the learners' mother tongue with the target language.

METHOD

Participants

A total of 43 3rd-grade students from a private vocational high school in northern Taiwan participated in the current study. They were 10 males and 33 females, and their average age was 17 years old. According to the data of the questionnaires administered to the participants, the students had learned English as a foreign language (FL) in Taiwan for more than five years by the time of the study. They all reported no impediments in their hearing and speaking abilities. In addition, the participants had never lived abroad or learned English in a foreign country. Neither had they communicated in English in their daily life.

The 43 learners studied in the same class, and their class had received the first place of English exams twice a year among the 25 classes in the 3rd grade. Therefore, their English proficiency level was more excellent than the level of the other students in the same grade of the private vocational high school.

A native speaker of American English was also recruited in the study. He was born in the United States and had taught English as a FL in Taiwan for approximately five years. His task in this research was to produce the recording of stimuli for a listening identification test. The test consisted of 16 words of two English fricative consonants (i.e., /s/ and /θ/), eight in word-initial and eight in word-final position.

Instruments

The goal of this study was to investigate the relative perceptual difficulty of two English fricatives (/s/ and /θ/) for Taiwanese vocational high school EFL learners. The instruments used in the experiment to collect data included a language learning background questionnaire and a listening identification test.

Language learning background questionnaire. The researchers of the study administered a questionnaire (see Appendix A) to understand the participants' English learning background. The questionnaire was adopted and adjusted from Hung's (2012b) questionnaire, and it primarily elicited the students' gender, age, major, hearing and speaking conditions, English learning environment, age of first exposure to English, and etc. The one administered to the vocational high EFL learners was written in Chinese (see Appendix B) in order for the students to thoroughly understand the content and the meanings of the questions. Before the participants were required to fill in the blanks and choose the most appropriate answers to complete the questionnaire, they were informed of the purposes of the study. The time given to the students to finish the questionnaire was 10 minutes.

Listening identification test. The main goal of this project was to evaluate participants' perceptual accuracy of two English fricative consonants (i.e., /s/ and /θ/). Hence, a listening identification test was designed. The stimuli in the test were selected from 16 minimal pairs, and these minimal pairs were categorized into eight pairs of word-initial contrasts and eight pairs of word-final contrasts based on the position of the two consonants (/s/ and /θ/) in the tested words (see Appendix C). In addition, the words in the 16 minimal pairs were all monosyllabic words, and they were chosen from the participants' English textbooks from first grade to third grade. These 32 words were all included in the Taiwanese vocational high school 4000 English word list³ announced by the Ministry of Education (MOE) in Taiwan.

As Appendix D shows, the content of the listening identification test was actually made up of 16 question words, and they were adopted from the 16 minimal pairs of consonants /s/ and /θ/ and arranged randomly in order. These stimuli were pronounced by a native speaker of American English. He had taught English as an FL in a private language school in northern Taiwan for five years. In this study, the English teacher was invited to record the stimuli using a quality recording machine in a noise-free classroom. When the recording task was conducted, each stimulus was repeated twice with one second interval and two second interval between

³ The 4000 words were defined as frequently used words in daily life.

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each question. Afterwards, a computer was used to convert the recording files to CD format for the participants' listening identification test.

In terms of the answer sheet for participants, there were 16 pairs of test cues on it. The two tested fricatives /s/ and /θ/ in word-initial and word-final position were evenly dispersed not only in the listening test stimuli but in the test cues as well (see Appendix D & E). The test cues were split into two columns on the answer sheet (see Appendix E). In the left column of the answer sheet were the cues with /s/ and in the right column were the cues with /θ/.

Scoring measures. Among the 16 questions in the listening identification test, scores were measured with one question worth one point. The maximum score of the test was 16/16, and the minimum score was 0/16. The higher the score the EFL participants received from the test, the more accurately they could perceive the two English fricatives (/s/ and /θ/).

PROCEDURE

The current research was conducted in the following steps. First, the researchers recruited Taiwanese vocational high school EFL students and informed them of the purposes of the study. Then the students were required to fill in a language learning background questionnaire. After completing the questionnaire, they were given a listening identification test for examining their perception of two English fricative consonants (/s/ and /θ/). The questionnaire and the listening test were both conducted on a class basis. When all the relevant data were collected, the participants' personal information and their test scores were calculated and organized on Excel for further statistical analysis.

RESULTS

One purpose of this study was to investigate the relative perceptual difficulty of two English fricatives (/s/ and /θ/) for Taiwanese vocational high school EFL learners. To respond to the research question, an independent-samples *t*-test was used to determine the level of significance for the difference between the Taiwanese EFL learners' mean scores in perceiving the two English consonants (/s/ and /θ/). Tables 1 and 2 summarize the data obtained.

As Table 1 shows, the mean scores that the 43 Taiwanese vocational high EFL learners received for the two consonants (/s/ and /θ/) on the listening identification test were 7.25 and 7.23 respectively.

Table 1. Means and Standard Deviations for the Two English Consonants (/s/ and /θ/) on Perception (N=43)

	Mean	Std. Deviation
/s/	7.25	1.02
/θ/	7.23	1

Table 2 presents the comparison of the perceptual difficulty between the two English consonants (/s/ and /θ/) for the Taiwanese vocational high EFL learners. The result of the independent-samples *t* test showed that there was not a significant difference between the participants' perceptual mean score for the English consonant /s/ and their perceptual mean score for the English consonant /θ/ [$t(43)=.11, p>.05$]. The statistical result implied that the mean score for the English consonant /s/ was not significantly higher than the score for the other consonant /θ/. This finding suggested that the English /s/ and /θ/ posed a similar level of difficulty for the EFL learners. Therefore, the relative perceptual difficulty sequence for the Taiwanese vocational high EFL participants was /s/ = /θ/.

Table 2. Independent-Samples *t* Test Results for the Mean Difference between the Scores for the Two English Consonants (/s/ and /θ/) on Perception (N=43)

	Mean Difference	t	df	Sig. (2-tailed)
Equal Variances assumed	.02	.11	84	.92
Equal Variances not assumed	.02	.11	83.93	.92

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DISCUSSION

This research attempted to determine the relative perceptual difficulty of two English fricative consonants (/s/ and /θ/) for 43 Taiwanese vocational high EFL learners, followed by utilizing the difficulty to examine the predictions of Lado's (1957) CAH in the acquisition of FL sounds. The statistics of the experiment showed that the participants' perception of the consonant /s/ was not significantly better than their perception of the other consonant /θ/, and vice versa. Hence, Lado's CAH was found invalid in accurately predicting the EFL learners' ease or difficulty in perceptually acquiring segments.

On the basis of Lado's CAH, L2/FL learners should have more difficulties in the perception of the phonemes which do not exist in their mother language. Moreover, Taiwanese EFL learners tend to replace /s/ for /θ/ in English perception for the lack of /θ/ in the Mandarin phonemic inventory (Chomsky & Halle, 1968; Rau, Chang, & Tarone, 2009; Zhang & Xiao, 2014). Accordingly, the Taiwanese vocational high school students in the current study were supposed to have more difficulties in perceiving /θ/ sound than perceiving /s/ sound for the lack of equivalent sounds in Mandarin Chinese. However, the participants in this study did not show different difficulty level in perceiving the two English fricatives, /s/ and /θ/. In other words, the Taiwanese vocational high school EFL students did not perceive /s/ and /θ/ easier or more difficult than one another.

A closer look at the descriptive statistics of this study reveals that the mean score the Taiwanese EFL learners received for the consonant /s/ was 7.25 and the mean score they received for the consonant /θ/ was 7.23. There was only .02 difference, and both mean scores were very close to the maximum score (8). The students' listening performance suggested that they had reached a near-native proficiency in perceiving the two English fricatives. If CAH had played a role in predicting the ease or difficulty in the participants' acquisition of the two sounds, the mean score for /θ/ sound would not have been so high, and the mean difference between the two consonants would have been significant. Therefore, the claim was not supported that new FL sounds are the most difficult elements for FL learners to acquire.

With respect to the limitations and delimitations of this research, the number of participants was only 43, and they were all recruited from a single vocational high school. Hence, the results of the study might not be generalized to students in other vocational high schools. Furthermore, the current study primarily examined English consonants. To better understand the role of CAH in L2/FL acquisition, other aspects such as vowels and suprasegmental and morphosyntactic features should also be explored. As a consequence, it is suggested that future researchers of the same interest use a larger sample size, select a great variety of participants, and investigate a wider range of linguistic properties to gain more reliability.

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Appendix A

Language Background Questionnaire

Dear participant,

We would like to understand your English learning experiences. Please help us by answering the following questions. The information you provide can help us research and analyze the relationship between Taiwanese English learners' proficiency and the ways they learn English. The results from this research may help you and later generations of classmates learn English more effectively. The questionnaire will take 1~2 minutes for you to finish. Please try to give as many details as possible. Thanks for your time!

- =====
1. Name: _____
 2. Gender: male female
 3. Age: _____ years old
 4. Major/grade: _____/_____
 5. Do you have any hearing/speaking impediments? Yes No
 6. Have you ever lived in an English-speaking country or learned English in another country? Yes, which country: _____ No
 7. Were you raised in the environment where English is consistently spoken?
Yes No
 8. At what age did you start learning English? Age: _____

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9. Have you learned English before elementary school graduation? (Please tick one answer) Yes No (If you select "No", please skip to Question 15)
10. Was your elementary school a public or a private school? public private
11. How many weekly hours on English lessons were there in your elementary school?
2 (included below) 3 4 5 6 7 (included above)
12. In elementary school, have you taught by foreign teachers (at school)?
Yes, _____ year(s) and _____ month(s) in total No
13. In elementary school, have you attended English cram schools or English tutoring?
Yes, _____ year(s) and _____ month(s) in total; about _____ hours per week No
14. Did you reinforce your English speaking ability after class? (such as: go to the church, language learning centers etc., or practice English conversation with foreigners)?
Yes, _____ hours in a week No
15. Was your junior high school a public or a private school? public private
16. How many weekly hours on English lessons were there in your junior high school??
2 (included below) 3 4 5 6 7 (included above)
17. In junior high school, have you taught by foreign teachers (at school)?
Yes, _____ year(s) and _____ month(s) in total No
18. In junior high school, have you attended English cram schools or English tutoring?
Yes, _____ year(s) and _____ month(s) in total; about _____ hours per week No
19. Did you reinforce your English speaking ability after class? (such as: go to the church, language learning centers etc., or practice English conversation with foreigners)?
Yes, _____ hours in a week No
20. Was your senior/vocational high school a public or a private school?
public Private
21. How many weekly hours on English lessons were there in your senior/vocational high school??
2 (included below) 3 4 5 6 7 (included above)
22. In senior/vocational high school, have you taught by foreign teachers (at school)?
Yes, _____ year(s) and _____ month(s) in total No
23. In senior/vocational high school, have you attended English cram schools or English tutoring? Yes, _____ year(s) and _____ month(s) in total; about _____ hours per week No
24. Did you reinforce your English speaking ability after class? (such as: go to the church, language learning centers etc., or practice English conversation with foreigners)?
Yes, _____ hours in a week No
25. Your contact information: Cell phone no.: _____ Email address: _____

This is the end of the questionnaire. Thanks again for your cooperation!

Appendix B

英語學習歷程問卷

各位同學好:

我們想要了解您學習英文的經驗,麻煩您幫忙回答以下的問題。您提供的資料可以幫助我們研究、分析大家學習英文的方法與成就的關係,也可以進一步幫助您自己和我們的下一代更有效地學習英文。問卷大約 5 到 10 分鐘可以填完。請盡量不要漏填。謝謝您的合作!

- =====
1. 姓名: _____
 2. 性別: 男 女
 3. 年紀: _____ 歲
 4. 科系/年級: _____系/_____年級
 5. 有無任何聽力/口語、學習或其他語言障礙? 有 無
 6. 是否住過英語系國家或是在其他國家學過英文?
是, 哪一個國家: _____ 否
 7. 你是否在持續說英文的環境中長大? 是 否
 8. 你是從幾歲開始接受正式的英文教學? _____ 歲
 9. 請問你於國小畢業以前是否學過英語?(請勾選一答案)
是 否(若選擇『否』,請跳至第 15 題)
 10. 請問你所就讀的國小為公立或私立小學? 公立 私立
 11. 請問你在國小時平均每週上幾節英文課?
2 節(包含以下) 3 節 4 節 5 節 6 節 7 節(包含以上)
 12. 在國小時(在學校)是否有被外籍老師教導過?
是, 共上了_____年_____個月 否
 13. 在國小時, 你是否參加校外英文補習或請人個別家教你英文?
是, 共上了_____年_____月; 每星期約_____小時 否
 14. 課後是否有自己加強英文口語能力(如:到教會、語言學習中心等找外籍人士交談來練習英文)? 有, 平均每週_____小時 無
 15. 請問你所就讀的國中為公立或私立中學? 公立 私立
 16. 請問你在國中時平均每週上幾節英文課?
2 節(包含以下) 3 節 4 節 5 節 6 節 7 節(包含以上)
 17. 在國中時(在學校)是否有被外籍老師教導過?
是, 共上了_____年_____個月 否
 18. 在國中時, 你是否參加校外英文補習或請人個別家教你英文?
是, 共上了_____年_____月; 每星期約_____小時 否
 19. 課後是否有自己加強英文口語能力(如:到教會、語言學習中心等找外籍人士交談來練習英文)? 有, 平均每週_____小時 無
 20. 請問你所就讀的高中/職為公立或私立高中/職? 公立 私立
 21. 請問你在高中/職時平均每週上幾節英文課?
2 節(包含以下) 3 節 4 節 5 節 6 節 7 節(包含以上)

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22. 在高中/職時(在學校)是否有被外籍老師教導過?

是，共上了_____年_____個月 否

23. 在高中/職時，你是否參加校外英文補習或請人個別家教你英文?

是，共上了_____年_____月；每星期約_____小時 否

24. 課後是否有自己加強英文口語能力(如:到教會、語言學習中心等找外籍人士交談來練習英文)? 有，平均每週_____小時 無

25. 你的聯絡方式:

手機: _____

E-mail: _____

問卷結束。再次謝謝您的合作, 祝您學業有成!

Appendix C

Minimal Pairs

/s/

/θ/

Word-initially:

sing	thing
seem	theme
sink	think
sigh	thigh
sick	thick
sum	thumb
sin	thin
sank	thank

Word-finally:

face	faith
mass	math
force	fourth
mouse	mouth
worse	worth
pass	path
tense	tenth
use	youth

Appendix D

Listening Identification Test

(Stimuli—for the native reader)

1. thigh
2. worse
3. sick

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4. pass
5. tenth
6. youth
7. sum
8. sin
9. faith
10. thing
11. theme
12. mass
13. sink
14. fourth
15. mouse
16. thank

Appendix E

Listening Identification Test

(Answer Sheet—for participants)

Class: _____ Name: _____ Number: _____

Listen and circle/mark the word according to what you hear:

1. sigh thigh
2. worse worth
3. sick thick
4. pass path
5. tense tenth
6. use youth
7. sum thumb
8. sin thin
9. face faith
10. sing thing
11. seem theme
12. mass math
13. sink think
14. force fourth
15. mouse mouth
16. sank thank