

## **A Study on Acoustic Characteristics and Korean EFL Learners' Perception of English Voiceless Fricatives**

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English fricatives are consonants which are produced with a turbulent airstream through a narrow channel [1]. Previous studies on English fricatives mainly focused on the place and manner of articulation of fricative sounds [2,3] and tried to specify distinctive features of English fricative sounds [4]. Recently, research on English fricative sounds focuses on the L2 context and perceiving and producing English fricative sounds became the main research content with regard to learners who learn English as a foreign language (EFL). These studies mainly focused on how differences between English and Korean fricatives interrelate with their perception and production of English and Korean fricatives [5,6,7,8,9,10]. However, few studies examine the role of acoustic characteristics in perception of English fricatives. Therefore, in this study, we will focus on acoustic characteristics of English fricatives and examine the relationship between acoustic characteristics and EFL learners' perception of English fricatives.

Three female American native speakers (N1, N2, N3) participated in this study. Additionally, twenty Korean EFL learners participated in the perception experiment. The stimuli used in this study were monosyllable consonant-vowel-consonant (CVC) words. The onset consonants were three voiceless fricatives, the interdental fricative /θ/, the alveolar fricative /s/ and the palato-alveolar fricative /ʃ/. In according to [11], due to the lack of corresponding phonemes of English /f, v/ in Korean phonetic system, Korean EFL learners tend to produce Korean sounds /ㅍ, ㅅ/ as substitutions of English /f, v/. English labiodental fricatives are often studied by Korean researchers with Korean /ㅍ, ㅅ/ rather than with English interdental, alveolar and palato-alveolar fricatives. Therefore, we excluded the voiceless labiodental fricative sound in the test. Three vowels were used in this study: the high front vowel /i/, the low back vowel /a/ and the high back vowel /u/. The word-final consonant is the voiceless stop sound /p/. The English stimuli were recorded by native speakers in quiet rooms as mono sound files using a Sony recorder at 22.1 kHz and a bit rate of 16. English stimuli were read and recorded three times in the carrier sentence "Say \_\_\_\_\_ again". The recorded sound files were segmented, edited and analysed through Praat. To investigate how Korean EFL learners perceive English voiceless fricatives, the MFC listening test (the identification test) was conducted. In the identification test, the subject heard stimuli one by one and there are three answer candidates on the screen. Three candidates are /θ/, /s/ and /ʃ/. Subjects can select only one of the candidates as their response. Four acoustic characteristics were tested in this study, which include spectral peak location, frication duration, center of gravity (COG) and intensity. All these measurements were completed by hand in Praat (version 6.0.49) [12].

The results of the identification test showed that Korean EFL learners can distinguish between English voiceless interdental fricative, alveolar fricative and palato-alveolar fricative sounds. Furthermore, we used the Spearman correlation test to examine whether there is any relationship between acoustic characteristics and Korean EFL learners' perception of English voiceless fricative sounds and found that normalized duration and intensity show statistically significant correlation between learners' perception of English voiceless fricative sounds.

	Group			Chi-square	P value
	/θ/	/s/	/ʃ/		
Correct Answers	39	35	35	14.886	0.001**

\* p<0.05 \*\* p<0.01

**Table.1 The Kruskal-Wallis Test Results of the identification test**

	1	2	3	4	5
1.Accuracy	--				
2.Spectral peak	0.236	--			
3.COG	-0.100	.452*	--		
4.Frication duration	-0.336	-.563**	0.217	--	
5.Normalized					
Duration	-.550**	-.428*	0.223	.860**	--
6.Intensity	-.422*	-0.033	0.198	0.367	.539**

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

**Table. 2 Spearman Correlation analysis**

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