

An Experimental Study on the Lengths of English Diphthongs

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ABSTRACT

This study was done to find out the difference in vowel length between the English language produced by American soldiers and KATUSA soldiers. Though English pronunciation by Koreans shows different features in many ways, I focused on English vowel length of KATUSA soldiers. I wanted to know if KATUSA soldiers, when compared with American soldiers, showed a foreign accent when they produced English diphthongs. The reason I wanted to deal with English diphthongs is that most Koreans have difficulty in pronouncing them since they do not understand the concept of diphthongs. Therefore I selected five English diphthongs, /aɪ/, /ɔɪ/, /aʊ/, /eɪ/, /oʊ/, as the experimental object, and I tried to find out the foreign accent of them.

In this study I also tried to find out the vowel lengths in relation to their utterance positions. I investigated the difference of the English diphthong length between American and KATUSA soldiers using information gathered from experimental results.

Keywords: Vowel Length, English Diphthongs, Utterance Position

1. Introduction

English vowel length is one of the most important factors in English pronunciation. Especially, the difference of the English vowel lengths between Koreans and Americans leads to foreign accent of Koreans' English pronunciation. While there can be various factors leading to the difference of English vowel length, in this study I investigated the effects of sentence stress with English diphthongs. The reason I chose the English diphthongs as the object of my study was that I thought Koreans had difficulty in pronouncing English diphthongs. In addition to this, I think that it is hard for Koreans to pronounce English sentences with sentence stress pattern: When Americans pronounce English sentences, they follow the English sentence stress pattern. But Koreans don't follow this sentence stress pattern. As a result, Koreans easily show a foreign accent, especially in sentence-final positions, when they speak English.

So in this study I devised an experiment and analyzed the diphthong data of

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native-English-speaking American soldiers and KATUSA soldiers who could use English relatively better than the general Korean population. The reason I decided to do this experiment with American and KATUSA soldiers is that I want to investigate two areas of diphthong usage. The first area was whether there was a difference of the lengths of diphthongs at word level between American and KATUSA soldiers or not. The second thing is whether there is sentence final diphthong lengthening or not. I think the second area is important to investigate because the study of the variation of utterance length effected by the difference in sentence position would lead us to a better understanding of the nature of speech rhythm and would shed light on various aspects of the production and perception of speech.

2. Experiment

For this experiment, I chose 5 words that include diphthongs. Then I put each of those words in the sentence-initial and sentence-final position. In total, 5 words and 10 sentences were made and I asked the subjects to read each word and sentence five times at normal speed.

Each of the 12 Subjects read the English test words and sentences. First, they read the list of five words and then the ten sentences. They did this five times. I didn't take measurements from the first reading but took measurements from the last four readings. The test words and sentences were given in order to ascertain that the subjects had a clear understanding of them. The average durations of English diphthongs in the test sentences are presented in Table 1.

2.1 Material

For this experiment, five diphthongs - /aɪ/, /ɔɪ/, /aʊ/, /eɪ/, /oʊ/ - were used and five words - fly/aɪ/, joy/ɔɪ/, out/aʊ/, pay/eɪ/, coat/oʊ/ - containing these diphthongs were selected. The criteria of selecting the words was that the words were easy to pronounce and used frequently in everyday English. After selecting the words, I put each word in sentence-initial and sentence-final position and the sentences were spoken five times by the subjects. The followings are the test words and sentences.

<test words>

fly, joy, out, pay, coat.

<test sentences>

sentence-initial : Fly the kite in the park.

- sentence-final** : I want to learn how to fly.
sentence-initial : Joy is a deeper emotion than happiness.
sentence-final : My newborn son brings me joy.
sentence-initial : Out beyond the fence is a garden.
sentence-final : My wife and I will go out.
sentence-initial : Pay me the money you owe me.
sentence-final : A good worker is worth his pay.
sentence-initial : Coat the walls with paint.
sentence-final : I have a warm winter coat.

2.2 Subjects and Procedures

For this experiment 12 males — 6 KATUSA soldiers and 6 Americans — were recruited from an American military base at Pyungtaek to serve as subjects. The Korean subjects were from Seoul and Kyunggi province whose residents use standard Korean. All the KATUSA subjects served more than one and a half year and used English with Americans for more than one and a half year because they worked at an American military base in Pyungtaek. Six of the KATUSA subjects were university students and all of the American subjects graduated from university in the U.S.A. The followings are personal information.

KATUSA	NAME	ADDRESS	AGE
	Kim, Sewon	Kyunggi	24
	Lim, Dongwook	Seoul	25
	Kim, Seongjung	Seoul	26
	Kwon, Sunjung	Seoul	26
	Kang, Jiwan	Seoul	26
	Uh, Hyungsoo	Seoul	25
OFFICER	Joseph A. Green	Maryland	28
	Paul A. Webb	L.A.	31
	Kenneth C. Kelly	Tennessee	39
	James A. Andrews	Virginia	27
	Thomas J. Danielson	Mississippi	32
	John S. Smith	Ohio	29

2.3 Recording and measurement

I analyzed the vowels in my office and the analysis itself was not difficult. Audiotaped recordings were made in an office room and audiotaped words were recorded into the computer. A cassette tape recorder made by SANYO was used to record the test

sentences and the recorder's model was M1700F. The microphone used was the condenser microphone in the recorder. The test sentences were recorded, and the subjects were asked to read each sentence 5 times at normal speed. A Macintosh computer LCIII was used to analyze the voice signal. The name of the program was Signalize 2.45. Special attention had to be paid, where the target vowel was followed by a lateral sound(/l/), which showed a similar acoustic feature to vowels. Whenever I was not convinced, I used a spectrogram.

3. Results and Discussion

3.1 Effects of position on vowel length

Table1. Comparison of English vowel length between KATUSA and American soldiers.

(unit: ms)

English vowel (diphthong)	position	subjects			
		KATUSA soldiers		American soldiers	
		mean	standard deviation	mean	standard deviation
fly /aɪ/	word	256.98	46.07	196.46	42.83
	s-initial	155.42	20.42	140.59	21.47
	s-final	172.81	15.96	176.32	28.44
joy /ɔɪ/	word	273.85	39.16	226.73	38.72
	s-initial	198.08	28.31	189.74	15.25
	s-final	211.85	24.97	208.82	6.92
out /aʊ/	word	233.95	42.14	175.07	19.89
	s-initial	162.70	36.83	130.67	14.44
	s-final	185.12	28.49	172.22	8.90
pay /eɪ/	word	255.57	42.08	185.37	47.71
	s-initial	130.48	19.63	111.85	17.37
	s-final	170.10	15.63	152.29	40.59
coat /oʊ/	word	189.75	24.22	137.28	25.91
	s-initial	121.89	13.84	100.44	12.46
	s-final	129.86	13.16	131.63	17.38

(s-initial=sentence initial, s-final=sentence final)

3.2 t-test results of English diphthong

A comparison of English vowel duration was made between KATUSA soldiers and Americans. In table 1 we can see that in the English diphthong length there was a

difference between KATUSA soldiers and Americans. In order to see what the difference of vowel length between KATUSA soldiers and Americans meant, I used a t-test. The followings are the results of the t-tests.

3.2.1 English diphthong length in word position

Table 2. The average length of five English diphthongs in word position

subjects	mean	standard deviation	case	t-value
KATUSA soldiers	242.02	24.04	6	-3.55**
Americans	184.18	31.87	6	

(* P<.05, ** P<.01)

Table 2 is the t-test results of the average length of five English diphthongs in word position. According to Table 2, in word position, the average length of the KATUSA soldiers' English diphthongs was greater than that of the Americans'. The t-value tells us that the difference was significant.

3.2.2 English diphthong length in sentence-initial position

Table 3. The average length of five English diphthongs in sentence-initial position

subjects	mean	standard deviation	case	t-value
KATUSA soldiers	153.71	11.35	6	-2.86*
Americans	134.66	11.74	6	

(* P<.05, ** P<.01)

Table 3 is the t-test results of the average length of five English diphthongs in sentence-initial position. According to Table 3, in sentence-initial position, the average length of the KATUSA soldiers' English diphthongs was greater than that of the Americans' and the t-value shows us the difference was significant.

3.2.3 English diphthong length in sentence-final position

Table 4. The average length of five English diphthongs in sentence-final position

subjects	mean	standard deviation	case	t-value
KATUSA soldiers	173.95	13.80	6	n.s
Americans	168.26	14.91	6	

(n.s=non-significance)

Table 4 is the t-test results of the average length of five English diphthongs in sentence-final position. According to Table 4, in sentence-final position, although the

average length of the KATUSA soldiers' English diphthong was greater than that of the Americans', the difference was small. Also the t-value shows us the difference was not significant. We have found that, although the difference of the length of five English diphthongs between KATUSA soldiers and Americans was significant by t-value in word and sentence-initial positions, in sentence-final position the difference was not significant.

3.2.4 The difference of the English diphthong length between sentence-initial and sentence-final position

Table 5. The difference of the average length of five English diphthongs between sentence-initial and sentence-final position

subjects	mean	standard deviation	case	t-value
KATUSA soldiers	20.23	12.56	6	n.s
Americans	33.60	8.55	6	

(n.s=nonsignificance)

Table 5 is the t-test results of the difference of the average length of five English diphthongs between sentence-initial and sentence-final position. According to Table 5, the Americans' differences, between sentence-initial and sentence-final position was greater than that of the KATUSA soldiers. But the difference of the length of the five English diphthongs between the KATUSA soldiers and the Americans was not significant by t-value between sentence-initial and sentence-final position.

3.2.5 The difference of the English diphthong length between word and sentence-final position

Table 6. The difference of the average length of five English diphthongs between word and sentence-final position

subjects	mean	standard deviation	case	t-value
KATUSA soldiers	68.07	19.10	6	-4.69**
Americans	15.93	19.43	6	

(* P<.05, ** P<.01)

Table 6 is the t-test results of the difference of the average length of five English diphthongs between word and sentence-final position. According to table 6, the length of five English diphthongs in the KATUSA soldiers decreased by 68.07 in sentence-final position in comparison with word position. However, the length of five English diphthongs in the Americans decreased by 15.93 in sentence-final position in comparison with word position. Also t-value tells us that the difference of the length between word and sentence-final position was significant.

4. Conclusion

Table 1 shows us that the vowel lengths of English diphthongs between the KATUSA soldiers and the American soldiers were different. Comparing the average length of English diphthongs of KATUSA soldiers with those of Americans, we can see that Americans tend to pronounce the English diphthong shorter than KATUSA soldiers do. Especially in word and sentence-initial position, Americans' English diphthong length appears significantly shorter than KATUSA soldiers'. In sentence-final position, we can see that the Americans' English diphthong length was also shorter than the KATUSA soldiers' though not significant. This study, then, shows that KATUSA soldiers consistently produce English diphthongs with non-native length. KATUSA soldiers do not realize the phenomenon of the diphthong, which is defined as the nucleus plus a glide. As a result, KATUSA soldiers showed a foreign accent in the length of their English diphthongs.

In comparing the duration of the English diphthongs in relation to their utterance position between the KATUSA soldiers and the Americans, we saw that the duration shows different features. When we compared the length of the English diphthong in word position with that of sentence-final position, we found that the KATUSA soldiers' English diphthong duration was decreased more in sentence-final position than it was with the Americans. We need to investigate this result in view of the sentence-final lengthening effect. While the Americans' English diphthong duration was increased in a large degree in sentence-final position in comparison with sentence-initial position, the KATUSA soldiers' duration was increased only relatively slightly. By this experiment result, we could see a sentence-final lengthening effect in the KATUSA soldiers' pronunciation. But, in comparison with the Americans, the KATUSA soldiers' sentence-final lengthening effect was trivial. Native Korean speakers who are studying English would do well to learn more about diphthong pronunciation and sentence-final lengthening effect if they desire a native-English accent.

References

- Jun, SunAh. 1993. *The Phonetics and Phonology of Korean Prosody*. Ph.D. dissertation. Ohio State University.
- Kim, KongOn. 1974. *Temporal Structure of Spoken Korean: An Acoustic Phonetic Study*. Ph. D. dissertation. University of Southern California.
- Klatt, D. H. 1973. "Interaction between Two Factors that Influence Vowel Duration." *Journal of the Acoustical Society of America*, 54, 1102-1104.
- Koo, HeeSan. 1986. *An Experimental Acoustic Study of the Phonetics of Intonation in Standard Korean*. Ph. D. dissertation. University of Texas at Austin.

- Ladefoged P. 1962. *Elements of Acoustic Phonetics*. The University of Chicago Press.
- _____. 1975. *A Course in Phonetics*. New York. Harcourt Brace Jovanovich, Inc.
- Park, HeeSuk. 2000. "A Study on the Foreign Accent of Koreans". *Speech Sciences*, 7-1, 187-201.
- Pierrehumbert, J. 1980. *The Phonology and Phonetics of English Intonation*. Ph.D. dissertation, Cambridge, Massachusetts, MIT.
- Schane, S. 1979. "Rhythm, Accent, and Stress in English Words." *Linguistic Inquiry*, 10.
- Yang, B. 1996. "A Comparative Study of American English and Korean Vowels Produced by Male and Female Speakers." *Journal of Phonetics*, 24, 245-261.

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