An Analysis of the English *l* Sound Produced by Korean Students

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ABSTRACT

The purpose of this study was to examine the English *l* sound in an English short story produced by 16 Korean students in order to determine various allophones of the sound using acoustic visual displays and perceptual judgments. The subjects read the story in a quiet office at normal speed. Each word included the lateral sound in onset or coda positions and before a vowel of the following word.

Results showed as follows: Firstly, there was a durational difference between the two major groups. Also the majority of the subjects produced the clear *l* regardless of the contexts. Some students produced the sound as the Korean flap or the English glide [r]. A few missing cases were also seen. The dark *l* was mostly produced by the subjects of English majors in coda position with a few cases before a vowel in a phrase. Visual displays using the computer analysis were very helpful in distinguishing lateral variants but sometimes perceptual process would be necessary to judge them in fast and weak production of the target word. Further studies would be desirable to test the discrepancies between the acoustical and perceptual decisions.

Keywords: Korean numeric sounds, syllable, spectral processing, temporal organization

1. Introduction

Many Korean students had difficulty producing the lateral /l/ sound in English. Worse still, they had difficulty producing and perceiving the velarized or dark /l/ sound in English, which is transcribed as /ɫ/. In English, the clear *l* accounts for 4.08% and the dark *l* for 3.61% from the relative frequency of occurrence of total consonants (Edwards, 2003:211). The light (or clear) *l* appears generally word-initially and word-medially before a vowel as in *look* and *believe*. It is produced by touching the blade of the tongue onto the alveolar region. On the other hand, the dark *l* appears at word-final and pre-consonantal positions, as in *feel* or *always*. Due to the different environment of occurrence, they are considered as allophones of the phoneme /l/ in complementary distribution (Roach, 1999). Roach pointed out that most native speakers do not know about their difference but they will detect the difference when they hear nonnative

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speakers who have not learned the correct pronunciation. The word "dark" has been attributed to the lower pitch found in velar and velarized consonants (Ball & Rahilly, 1999). In some dialects such as Cockney and other South East English, and American varieties, people produce the dark *l* with little or no alveolar contact like a vowel (Davenport & Hannahs, 1998). Acoustically, the sound spectrum for clear *l* approaches /i/ while that of dark *l* does /u/. Collins and Mees (2003) noted that the back of the tongue was raised toward the velum in the production of the velarized /l/. The output gesture resembles the tongue shape of the vowel /u/, which reflects in a lower F2 frequency value with considerable variation (Hayward, 2000). Perceptually we may hear the sound /u/. But the gesture may not approach the final target point for the vowel /u/. Thus, it sometimes ends up with the lax vowel /ʊ/. Or sometimes, if the gesture stays throughout the production, then, it may sound the starting point vowel /o/, well below the tense vowel /u/ in a fast talk. Wells (1982) suggests that the vowel /o/ would simplify the task of the complex production of the clear *l*, by just raising the back part of the tongue upward. On the other hand, there is a study which shows the distinction between light and dark *l* is not that clear as we have described so far. Boersma and Hayes (2001) reported the judgments of ten native consultants on those sounds in various English words. The consultants judged light *l* in initial and pretonic positions while dark *l* in final and preconsonantal position. Interestingly there appeared free variation to the sound in medial, pre-atonic position. Also morphological effects were observed depending on the suffix forms and contexts. This study will not go that much in detail without highly-trained native judges.

Ahn (2005) examined the accuracy ratio of English /l/ and /r/ sounds produced by 20 Korean elementary pupils. He found that they could produce the sound /l/ (74.5%) more accurately than the sound /r/ (46.5%). He observed that the Korean children substituted the Korean liquid ㄹ for English /l/ or /r/ more often than the students attending middle schools or universities in the previous studies (No, 2002; Nam, 2004). As was in No (2002)'s study, eight students out of 16 subjects majored in English at a university so that the higher accuracy ratio might be involved with the selection of the subjects. For example, all of those eight students correctly produced the sound /l/. Moreover, two of the subjects in Ahn's study had an experience of staying in America for more than two years before the age of six. Another male student stayed in the States for two years at the age of eight. Thus, an average accuracy ratio might vary according to proficiency levels of selected subjects in any study. Nevertheless, his study and the other two seem quite important in that they used the CSL (Computerized Speech Lab) software to display the spectrograms of the subjects and to judge the correct production of those sounds. That way, they could reduce cases of any subjective, incoherent judgments even though all the spectrographic displays might not present clear-cut sources for a final decision.

In this paper the author attempts to closely examine the acoustic and perceptual characteristics of the lateral /l/ sounds of words in an English story read by Korean students.

This study may shed light on the understanding of Korean students' pronunciation problems.

2. Method

2.1 Subjects and text

Sixteen students attending a university in Pusan participated in the recording of a short story in English. Those subjects were convenient samples from healthy junior students who majored in English education (4 males: m1 through m4;and 4 females: f1 through f4) and in Korean education (4 males: m5 through m8;and 4 females: f5 through f8). Some English majors and a few Korean majors took the TOEIC test but the others did not have any official score reports. The text was selected from American stories of the VOA homepage (http://www.voanews.com/specialenglish/archive/2005-10/2005-10-24-voa1.cfm). The following lists the target words or phrases in the three categories: light *l* in both onset position and before a vowel in a phrase, and dark *l* in coda position.

light *l*

A few weeks *later*, Carter Druse lay with his face in the dirt by the side of a road.
His *left* hand held his horse's reins.
Giant cliffs, *like* the one Carter lay on, surrounded the valley.
He saw a man on horseback standing on the huge rocky cliff that *looked* down into the valley.

l+vowel in a phrase

Is it so terrible to *kill an* enemy who might kill you and your friends?
Suddenly the horse moved, *pulling* back its head from the edge of the cliff.
But he didn't *tell anyone* what he had seen.
Instead, he let go of his gun and slowly dropped his face *until it* rested again in the dirt.

dark *l*

If he dropped a stone from the edge of this cliff, it would *fall* for six hundred meters before disappearing into the forest.
The officer's legs grew weak, and he *fell*.
This man must die without a moment to prepare his *soul*; without even the chance to say a silent prayer.
He was on his stomach, his arms *still* holding his gun.

2.2 Data collection and analysis

The recording was done in a quiet office using a headset (Sennheiser PC151) on a Samsung Sense X10 notebook computer at a sampling rate of 22 kHz and the resolution of 16 bits in stereo

mode. Each subject read the text once. The total duration of the story was also measured. Then, the recorded speech was played to find the 12 target words inclusive of the preceding and following words. The target portions were saved onto a hard disk. The decision of whether the subject produced light or dark *l* was first made perceptually by carefully listening to the word and then confirmed it by simultaneously seeing the spectrographic display in the speech analysis software, *Praat*.

To facilitate the reader's understanding of the acoustic property of the lateral sound, the author analyzed a few words taken from an English pronunciation CD. <Figure 1> displays a waveform and spectrogram of English word *light* and *right* produced by a native speaker (Lane, 2005:102). The analysis window for the wide band was set to 0.005 seconds. To trace the weak third formant (F3), the number of formants was set to 6 below the range of 5500 Hz. One can see the difference between the two sounds in the F3 transition. The clear *l* has a clear sustained F3 while the glide /r/ starts just on the second formant (F2) to the higher F3 of the following vowel. There is a small notch on the F2 border between the lateral and the vowel. F2 tends to reflect the tongue movement. The energy on the waveform for the lateral sound shows an abrupt attack while the glide shows rather a slow increase because of the blocking of the vocal tract with the narrowed lip aperture for the glide. On the other hand, <Figure 2> is a waveform and spectrogram of the English phrase *on the whole* produced by an American native speaker (Lane, 2005:107). It shows that there is not much transition from the lax vowel of the diphthong [oʊ]. That suggests that the production of the final *l* is almost the same as the lax vowel [ʊ]. Another Canadian native speaker produced the word *milk* as in <Figure 3>. One can easily see the falling F2 transition from the high F2 for the preceding lax vowel [ɪ].

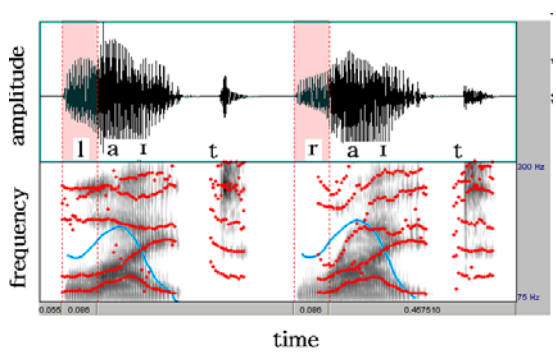

Figure 1. Waveform and spectrogram of English words *light* and *right*.

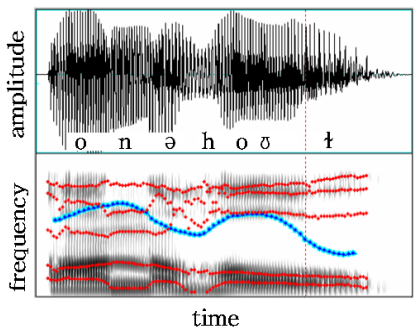

Figure 2. Waveform and spectrogram of an English phrase *on the whole*.

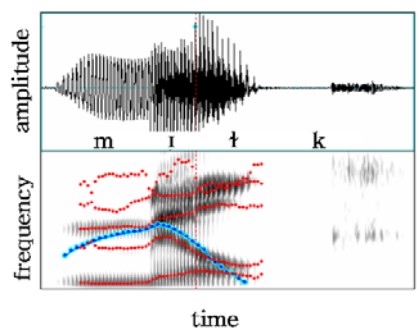

Figure 3. Waveform and spectrogram of an English word *milk*.

3. Results and Discussion

3.1 Total duration of the production

<Table 1> lists the total duration of each subject's production in minutes and seconds. The grand total duration of all the subjects was 10 minutes and 26 seconds. The average duration of the story read by the English majors was 9 minutes and 28 seconds while that of the Korean majors was 11 minutes and 24 seconds. There was also around 2 minute difference in their production between the two groups. The average values suggest that those who major in English read the text faster than those of the Korean majors. There was around 2 minute difference within the male and female groups of the Korean majors. While listening to the whole text, the author found that some subjects with the Korean majors had problem reading such a few unfamiliar words as *regiments, gigantic* and *trigger*. However, the majority of them read it without many pauses. Despite a few unwanted pauses found in between the phrases or sentences, the data still shows some trend that the subjects with the English majors produced the story more fluently than those with the Korean majors.

Table 1. The total duration of each subject's production in minutes (′) and seconds (″).

Major	Male subjects	Duration	Female subjects	Duration
English Education	m1	7′ 40″	f1	8′ 37″
	m2	8′ 40″	f2	9′ 47″
	m3	8′ 51″	f3	10′ 49″
	m4	9′ 03″	f4	11′ 09″
Average		8′ 34″		10′ 05″
Korean Education	m5	9′ 08″	f5	12′ 16″
	m6	9′ 31″	f6	12′ 17″
	m7	11′ 21″	f7	12′ 24″
	m8	11′ 33″	f8	13′ 50″
Average		10′ 23″		12′ 42″
Grand Average		9′ 28″		11′ 24″

3.2 Distribution of the lateral *l* production

<Table 2> lists the total distribution of the lateral *l* production by 16 subjects. From the table, one can note that 72% of the cases were produced as light *l* while 19%, as dark *l*. Negative transfer of the Korean version of flap or the English glide [r] accounts for 7%.

Table 2. Distribution of the lateral *l* production by 16 subjects.

Positions\Sounds	l	ɾ	ɹ/r	Missing
Initial	57		7	
Before a vowel	50	6	7	1
Final	31	31		2
Total	138	37	14	3

<Table 3> shows the distribution of the lateral *l* production by the major groups. The table shows that the English majors produced dark *l*'s in the majority of final positions. To mention a few individual cases, three out of the 14 cases of flaps were produced by m2. He had a total score of 955 in the TOEIC test. English majors or a high test score may not guarantee an appropriate production of the lateral in different contexts. Three cases were reported as missing the lateral production. m6 accounted for the two missing cases and m1 did the remaining one case. m1 was the fastest reader of all the subjects.

Table 3. Distribution of the lateral *l* production by the major groups.

Sounds	l		ɾ		ɹ/r		Missing	
Positions\Majors	English	Korean	English	Korean	English	Korean	English	Korean
Initial	29	28	3	4	3	4		
Before a vowel	22	28	6	4	3	4	1	
Final	8	23	24	7				2
Total	59	79	33	15	6	8	1	2

<Table 4> indicates the distribution of the lateral *l* production by the target words. The light *l* appeared regardless of the positions while the dark *l* did in coda positions. The flap or glide sound can only be seen in onset or before vowels. Those distributions reflect the context in the syllable positions. We may have to consider the context if we want to compare the productions of native and nonnative productions of the lateral sound.

Finally, we will look into some of the individual productions of the subjects and discuss acoustical properties and perceptual impressions of the lateral sound. <Figure 4> shows the word *left* produced by m7. From the waveform one can see the abrupt energy increase just after the onset *l* as was seen in <Figure 1>. On the spectrogram the first formant jumps up and the energy of the lateral was weaker than that of the following vowel portion. m7 had a total score

of 670 in the TOEIC test which is just a little higher than the average score 599 for all the Korean examinees (Korea TOEIC Committee, 2007). Some subjects produced the glide [r] for the initial lateral as can be seen in <Figure 5>. The figure shows [r] produced by f2. The third formant tends to start just over the adjacent F2 and goes upward for the following vowel. The small island on the waveform before the glide seems to indicate the tongue release after touching the tip onto the upper dental region of the speaker. <Figure 6> shows the Korean flap sound for the lateral in onset position produced by m7. Perceptually it sounded like the Korean ㄹ and acoustically one can see the irregular noise at the beginning of the waveform and the spectrogram. The glide in <Figure 5> shows somewhat higher amplitude without any dips on the waveform.

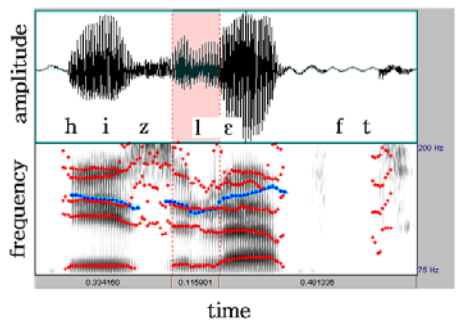

Figure 4. An example of light *l* produced by m7.

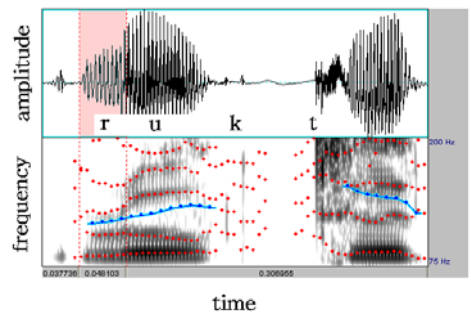

Figure 5. An example of [r] in onset position for the lateral sound produced by f2.

Table 4. Distribution of the lateral variants by the target words.

Words\Sounds	l	ɬ	ɾ/r	Missing
fall	8	8		
fell	7	8		1
soul	6	9		1
still	10	6		
later	15		1	
left	15		1	
like	14		2	
look	13		3	
kill an	12		4	
pulling	14	1		1
tell anyone	14	2		
until it	10	3	3	

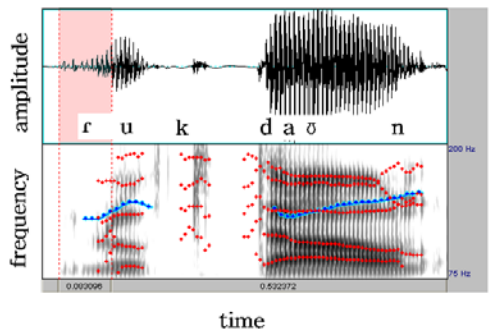

Figure 6. An example of [ɾ] in onset position for the lateral sound produced by m7.

<Figure 7> is an analysis of the word *fell* produced by m1. One can clearly see the sound *l* in the dimmed part of the waveform. The second formant (F2) tract on the spectrographic display clearly shows that the subject produced the sound as a velarized one. If it were produced as a light *l* then F2 would not drop and sustained until the end of the word. For example, m4 produced a light *l* as in <Figure 8>. One can say that the visual display of the part of the sentence may provide a very reliable source for the decision of the lateral sound.

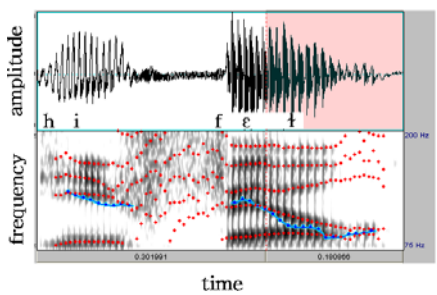

Figure 7. An example of dark *l* in coda position produced by m1.

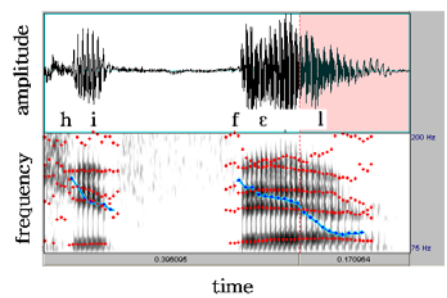

Figure 8. An example of light *l* in coda position produced by m4.

<Figure 9> displays the light *l* in the phrase *kill an* produced by f4. She scored 915 points in the TOEIC test which is quite high for a college student. The duration of the lateral sound was around 108 ms. There is no pause between the two words. Some other subjects showed a short break before the following article. That seems to be related to the longer duration of the whole story production.

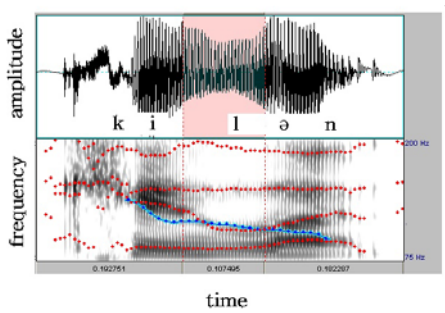

Figure 9. An example of light *l* before a vowel produced by f4.

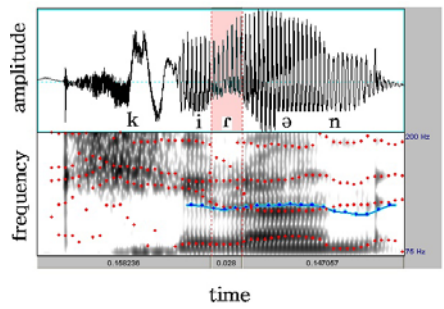

Figure 10. An example of the flap sound before a vowel produced by f3.

<Figure 10> is an example of the flap sound for the lateral *l*. Acoustically there is a durational difference between the light *l* of f4 and the Korean flap. The gesture seems very quick with the duration of 28 ms. f3 scored 840 in the TOEIC test. However, she produced the other three cases as light *l* sounds before the vowel. Some subjects put a long pause before the following word so that they could secure enough time to produce the light *l* sound. Others failed to produce the lateral and all the spectrographic displays showed only a sustained vowel formant tract of the preceding vowel.

So far we have examined some specific cases of the production of the vowels. In just a few cases, the spectrographic display was not clear enough to judge the acoustical quality. Still listening to the sound after manipulating it by extending its duration was quite helpful to catch its sound quality. It may be interesting to ask a group of students to listen and judge the quality of the lateral sound produced by peer students, and to compare native and nonnative production of the lateral or to find out whether the perceptual judgment of the group and their acoustical analyses match, which will be next possible research topics in that regard.

4. Conclusion

This study examined the lateral *l* sound produced by 16 Korean students in order to tap a possibility of using the acoustical and perceptual criteria to distinguish lateral variants and eventually to assess student's English pronunciation skills.

Results showed as follows: Firstly, there was around 2 minute difference between the two major groups. However, not all the members of the English major group produced the light *l* in onset position. Generally the majority of the Korean subjects produced the clear *l* regardless of the contexts. The Korean flap or the English glide [r] were observed for the lateral. A few subjects failed to produce the sound with a sustained vowel formant to the end of the sentence.

The dark *l* was mostly produced by the English majors in coda position. The majority of the subjects produced the light *l* sound before a vowel in a phrase. Visual displays from the computer analysis were very helpful in determining lateral variants but sometimes personal listening to the given sound after temporal manipulation would be necessary in the cases of fast and weak productions of the target words. Further studies would be desirable to compare the productions of native and nonnative production of the lateral sound with more subjects based on a statistical analysis.

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received: January 29, 2008
accepted: March 10, 2008

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