Discourse-level Prosody Produced by Korean Learners of English

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ABSTRACT

This study investigated (1) whether Korean learners of English use discourse-level prosody in L2 production as native speakers of English do, and (2) whether discourse-level prosody is also found in the Korean language, as is evident in the prosody of native speakers of English. The study compared the production of the same 15 sentences in two types of reading materials, sentence-level and discourse-level. This study analyzed the onset pitch, sentence mean pitch and pause length to examine the *paratone* (intonational paragraph) realization in discourse-level speech. The results showed that in L2 discourse-level prosody, the Korean speakers were limited in displaying paratone and did not made significant difference between sentence-level and discourse-level prosody. On the other hand, in L1 discourse-level text, both English and Korean participants demonstrated paratone using pitch. However, there were differences in using prosodic cues between two groups. In using pauses, the ES group paused longer before both the orthographically marked and not marked topic sentences. The KS group paused longer only before the orthographically marked topic sentence in both L1 and L2 text reading. In the comparison of sentence-level and discourse-level prosody, the topic sentences were marked by different prosodic cues. English participants used higher sentence mean pitch, and the Korean participants used higher onset pitch.

Keywords: discourse prosody, prosody acquisition, paratone, pitch, topic unit

1. Introduction

1.1. Grammatical function of intonation

Couper-Kuhlen (1986) categorized the function of intonation into six: (1) informational, (2) grammatical, (3) illocutionary, (4) attitudinal, (5) textual/discourse, and (6) indexical. Before intonation was studied in the domain of discourse, the traditional view, such as grammatical function examined the function of intonation in a sentence-level. In grammatical function, intonation

plays the important role of dividing utterances into segments by making boundaries.[2] These boundaries are aligned with syntactic structures (Crystal, 1985; Cruttenden, 1997). The example (1) clearly shows that the intonational constituents correspond to the syntactic phrases as in (1b) not as in (1a).

(1a) {(The first) (train to)} {(arrive in the) (one from Paris)}
(1b) {(The first train) (to arrive)} {(is the one) (from Paris)}

(Gussenhoven and Jacobs, 2005, p.220)

In (1b) the segments in the (parenthesis) are phonological phrases and the segments in the {braces} are intonational phrases. In addition, grammatical function of intonation makes

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2) The term intonation is used instead of prosody in this section because many of the earlier works mainly examined the pitch patterns. Intonation indicates the variations in pitch pattern or melody (Crystal, 1985, p.162). Prosody broadens its scope to all suprasegmental features such as rhythm, loudness, pause and tempo (Chun, 2002).

distinction between sentence types. The sentences in the examples (2) could be the statement with falling tone as in the example (2a) or could be the question with rising tone as in the example (2b).

(2a)   ‖ John's going Hòme. ‖
(2b)   ‖ John's going Hóme. ‖

(Couper-Kuhlen, 1986, p.111)

1.2 Discourse-level function of intonation

Research into the intonation of native speakers of the English language has identified intonation as having a discourse-level function and has claimed that discourse-level intonation could be understood only within the context of discourse (Brazil et al., 1980; Brown et al., 1980; Brazil, 1997; Wichmann, 2000; Wennerstrom, 2001; Chun, 2002). The textual/discourse function of intonation examines the use of intonation in the wider scope, more than one utterance (Chun, 2002). The function of discourse intionation is closely related to the scope it is studied. The term *text* is defined as "any passage, spoken or written of whatever length, that does form a unified whole" (Halliday and Hasan, 1976, p.1). According to the definition, coherence is the most critical concept in text or in discourse. Thus, discourse-level intonation has an important function of signaling coherence in discourse, above the sentence level (Chun, 2002). Specifically, speakers connect individual components in the text to make the discourse sound coherent (Wennerstrom, 2001). The other important function of discourse-level intonation is representing *information status,* between *given* and *new* (Pierrehumbert and Hirschberg, 1990). The old or given information refers to the previously discussed or already shared knowledge between speakers and listeners, and new information indicates the information that is newly introduced in the discourse. The discourse-level intionation signals new information from given ones. Lastly, it has turn-taking function in conversation as the completion of a speaking turn coincides with some prosodic features (Oreström, 1983).

There have been many studies done on the discourse-level prosody of native English speakers; Ferrara (1997) studied how the pitch contour of the word *anyway* differs when it is used as a lexical discourse marker from when it is used as an adverb. Regarding illocutionary force and speech act, researchers studied politeness and rudeness in terms of the role intonation plays (Ching, 1982; Brown and Levinson, 1987, Schiffrin 1994). Eaton

(1988) studied how intonation is related to express sarcasm. The turn taking function was studied by Schaffer (1983). Schaffer asked participants to decide whether the played conversations are turn final or turn-medial. Compared to the research on English, less studies have examined the discourse-level prosody of second language (L2) learners. Thus, this study focuses on the L2 learners' discourse-level prosody production.

1.3 Paratone

The notion of paratone was first termed by Fox (1973) and Brown defines it as "a short sequence of units beginning with a stressed peak high in the speaker's voice range" (1980, p.26). What derives the speaker to divide his/her speech into several paratones is the topic in discourse. The characteristics of the paratone are explained in detail by Brown and Yule (1983). They suggest that the paratone is equivalent to the paragraph in written texts and it could be marked phonetically in one's speech. The speaker starts the first sentence of the paratone with a higher pitch. This raised pitch plays the role of introducing the subject to be discussed. On the other hand, a low pitch, less intensity and lengthy pauses occur at the end of the paratone (Brown and Yule, 1983, p. 101). Thus, a paratone boundary is demarcated by three categories: paratone-initial high pitch, paratone-final low pitch, and prolonged pause. Brown (1980) named the lengthy pause between topic units *Topic pause*. In her experiment, when there was a major topic transition which coincided with the orthographic signal, indentation, even though it was placed in the middle of the text, all participants paused longer than one second. Yule's (1980) study also proved that these three boundaries are found in conversational speech as well as in read-aloud speech. He also mentions that the initiating paratone not only makes a pitch peak at the beginning, but also increases the baseline from several tone units or unstressed syllables. Since the height of a pitch peak is determined within the paratone, and even though some paratones do not show pitch peak as high as other paratones, they still show the highest peak than any subsequent pitch heights (Yule, 1980, p. 44).

2. Previous Findings

2.1 Pitch and topic shift

Menn and Boyce (1982) measured the maximum pitch values from 1700 sentences. Sentences were taken from a parent-child conversation which occurred at 16 laboratory-playrooms. The age of the children ranged from two to five years old. They

classified conversations into 11 discourse categories. They compared two successive utterances as a pair, juxtaposing pitch maximum of the first and second sentences. This research found that among all 11 categories, topic change made the biggest pitch difference and it was significant in the statistics. In this study, topic change referred to the conversations which included obvious topic transitions caused by a different speaker or the same speaker. The two sets of conversation pairs they suggested are as below.

(3) Mother: I like peppermint tea
     Child: Could you please stand right over there?
(4) Mother: I don't think that's the right thing.
     Mother: Let's - let's do something else.

2.2 Intonation features used by nonnative speakers

Wennerstrom (1994) compared the native English speakers with the intermediate level English learners whose native language backgrounds are Thai, Japanese and Spanish. All participants were asked to read a passage which contained 6 intonation features such as using L+H* pitch accents to make contrasts, omitting pitch accents on function words and using high pitch at the paratones or topic shifts. In reading the text, the native speakers used intonation features accurately but the nonnative participants showed considerably different results from the native speakers. For example, the text contained "In Spring, Seattle is usually wet. Meanwhile, other cities are having sun" (p.405). The native speakers increased pitch 41Hz at the contrast word, *sun* compared to the previous word, *having* whereas the English learners showed lower average pitch on the contrast word, *sun* than on the previous word *having*.

2.3 Target of the study

This study examines how speakers mark topic units using prosodic cues. Firstly, the study compared the English discourse-level prosody produced by the Korean learners of English with the English native speakers. It would show the aspects of L2 prosody acquisition at discourse-level. Secondly, the study compares the discourse-level prosody in the English language with that in the Korean language produced by native speakers, respectively. It would show language specific differences in discourse-level prosody and the native language effect on the Korean learners of English. The following prosodic features are questioned in the research.

1) Do the mean pitch and onset pitch of the sentence differ when it is produced as a topic sentence in discourse-level text from when it is produced as an isolated sentence in sentence-level material?
2) Does the mean pitch of the paratone-initial sentence differ from that of the paratone-final sentence?
3) Does the pause length differ when it is used between topic units from when it is used between sentences?

3. Experiment

3.1 Participants

The participants were 28 adults. None reported being diagnosed with a language or speech disorder. There were two groups, the group of Korean native speakers (mean age 25.8 years) and the group of English native speakers (mean age 28.6 years). Each group had 14 speakers, 7 males and 7 females. All the participants from the ES group acquired English as their first language and were monolinguals. The thirteen ES participants were from several regions in U.S.; they were mostly from Midwest and South but a few of them were from New England (Massachusetts) and Middle Atlantic (Maryland and New Jersey). The one Canadian participant is from Toronto, Canada. As for the Korean participants, those who use Seoul dialect were recruited. All Korean participants were brought up in Seoul or Gyeonggi-do where the Seoul dialect is used. The speakers in the KS group did not have any immersion experience in an English speaking country for more than 6 months in a row. The English proficiency level of the Korean participants was demonstrated by standardized English test scores. Ten participants reported the TOEIC scores and four reported the IBT TOEFL scores. The mean score of the TOEIC from the ten participants was 881 points out of a possible 990 points, and the mean score of the TOEFL from the four participants was 109 points out of a possible 120 points. For convenience, the Korean group is referred as the two different groups depending on whether they read the English materials (KS_E group) or the Korean materials (KS_K group).

3.2 Materials

(All materials are provided in the appendix.)

The materials in the experiment were designed referencing the previous work done on English native speakers by Levis and Pickering (2004). All the participants were given two types of English reading materials; one was the discourse-level text and

the other was the list of isolated sentences. As for the KS group, the same two types of materials translated in Korean were also provided. Firstly, the English text (EngT) and the Korean text (KorT) materials consisted of two paragraphs with the 15 sentences. Among the 15 sentences, two sentences were interrogative sentences and the rest were declarative sentences. The first interrogative sentence was placed in the middle of the text, the 5th sentence and the other was at the end of the text, the 15th sentence. The 6th sentence was the answer to the 5th question. The rest of the 13 declarative sentences contained 9 to 21 words, with an average of 12 words in length. In terms of topic structure, at the first sentence, the discourse-level text introduced *a global topic* (the cell phone market). At the second sentence, it introduced a set that the global topic was comprised of (a set of competitors in the cell phon market). From the third sentence it explained the three members of the set, one by one. The sentences from 3 to 7 explained the first cell phone company *Cloud*. The sentences 8 to 10 illustrated the second company *QC*. The sentences from 11 to 14 explained the third company, *Tompson*. Each set member becomes a *local topic*, and the sentences explaining a certain set member create one topic unit. Based on the topic structure, the text has four topic units; one regarding the global topic, and three regarding the local topics. Since there were four topic units, topic shifts occurred three times during reading, at the 3rd, the 8th and the 11th sentences.

When orthographic signals mark topic shifts, it helps readers to predict topic shifts. For example, if the local topics start with the orthographical signals such as *First*, *Secondly* or paragraph change, the readers would be able to notice the topic shift before they read and understand the new topic unit. On the other hand, if these signals are not provided, readers have to depend on the contents to notice the topic shift. Among the three topic shifts, only the second topic shift was provided with the orthographical signal, paragraph change. The topic shifts at the 3rd and the 11th sentences were embedded within the first and the second paragraphs, respectively. Since there were not any orthographical signals for these two topic shifts, solely by the contents of the text were the participants able to notice them.

Secondly, the English sentence list (EngL) and the Korean sentence list (KorL) materials had 30 sentences, listed by numbers. For a straightforward comparison, the EngL material was comprised of the same 15 sentences from the text material which were the target sentences of the experiment. The 15 filler sentences were similar to the target sentences in length, the number of words and structures. Each set of sentences, target and filler sentences were randomized within the same resources then listed in rotation for participants not to identify the sentences that belonged together.

3.3 Procedure

The English participants recorded the English sentence list (EngL) first, then English text (EngT). The Korean participants recorded both English materials (EngL, EngT) and Korean materials (KorL, KorT) in the same order. Before recording each of the materials, participants had two to three minutes to look through only the material that they would record. Each material was recorded twice. The data were recorded mostly in Soul, South Korea. Sounds were digitized at a sampling rate of 44,100 Hz and saved as wave files. Only the second recordings were used for analysis.

3.4 Data Analysis

All data were analyzed with Praat. The pitch values were measured in Hertz (Hz) and pause length was measured in milliseconds (ms). Referencing spectrograph and wave form all sentences were demarcated at the first tire on TextGrid, named sentence tire. At the second tire, the first prominent syllable from the paratone-initial sentences were segmented, named syllable tire. Each segment was labeled with the sentence number. <Figure 1> shows the example of analysis. The maximum, the minimum and the average F0 were obtained from the segments in the sentence tire. The pause length, the silent period between sentences was also obtained from the sentence tire. From the syllable tire, the maximum F0 was obtained as onset pitch (Wennerstrom, 2001; Levis and Pickering 2004).

The pitch (F0) values were normalized for inter-group comparisons and statistics. The pitch values were normalized within speaker with reference to the participant's average pitch
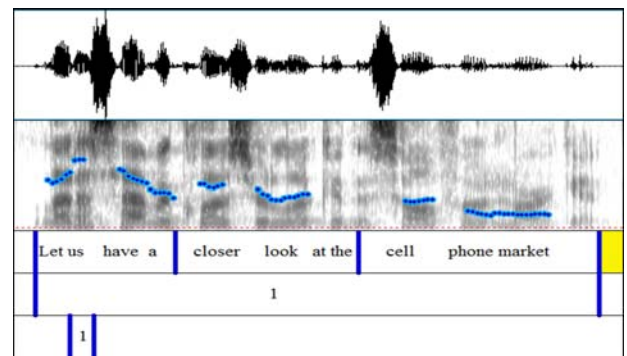

Figure 1. An example of data analysis.

and pitch range, which are presented in Appendix. Since the context of the text materials could influence the pitch values, the sentences from the sentence list materials were only used to decide participant's mean pitch and pitch range. The average pitch of the individual participant was decided by averaging the mean pitch of 15 sentences from the list material. The pitch range indicates the pitch difference between the sentence maximum pitch and the sentence minimum pitch. The pitch range of 15 sentences from the list materials were averaged to get participant's pitch range. The variation was calculated by subtracting the average pitch from result pitch. The result pitch indicates the absolute F0 values (Hz) obtained either from the sentence tire or the syllable tire. The variation divided by the pitch range was measured in a percentage term. This normalization formula is displayed below.

$$\frac{\text{Variation (result pith - average pitch)}}{\text{Pitch range (maximum - minimum)}} \times 100$$

For example, if the maximum F0 obtained from the first prominent syllable is 163Hz, it will become the result pitch in the formula. If this pitch value is from the participant whose average pitch is 112Hz and the pitch range is 95Hz, normalizing would be as follow: (163 - 112)/95 X 100 = 54%. This normalized value, 54% means that this participant raised his pitch 54% higher regarding his average pitch and pitch range. When the normalized value shows minus value, it indicates that the participant's result pitch is lower than one's average pitch. The analysis of the statistics was performed using the IBM SPSS program (ver. 20). An independent T-test was carried out for group comparisons between the ES and the KS group. Within each group, the Paired T-test was used to compare the differences between the same sentences read in the different types of materials, sentence-level and discourse-level. The significance threshold was set at 0.05.

4. Results

4.1. Prosody in sentence-level and discourse-level

4.1.1 Sentence mean pitch of paratone-initial sentences

The ES group made pitch differences between the sentence-level and the discourse-level materials by using higher mean pitch at the topic sentences. They produced the first three paratone-initial sentences higher than the corresponding sentences of the list material (p<0.05). The last paraton-inital sentence, the

11th sentence was placed at the end of the text and this positional effect made its pitch difference not significant. Through the 11th sentence, we can infer that signaling closure of the discourse-level text was prioritized higher than the signaling of a new topic. The result of all sentences from the ES group are shown in <Table 2>.

Table 2. ES group: sentence mean pitch(SD) and statistical comparison between sentence list and text materials.

No.	Normalized pitch (%)		Statistics	
	List	Text	Paired Difference	Sig. (2-tailed)
01	3.35(3.8)	13.63(7.0)	-10.28 (5.6)	**p<.0.01
02	-1.46(1.9)	0.24(4.1)	-1.69(4.1)	p=0.146
03	-4.21(4.0)	0.54(2.3)	-4.75(4.5)	*p=0.002
04	-0.26(4.3)	-1.21(4.1)	0.95(6.3)	p=0.580
06	-0.16(4.3)	0.91(6.5)	-1.07(8.2)	p=0.631
07	-0.41(2.6)	-2.63(4.5)	2.22(4.0)	p=0.057
08	-1.35(2.9)	2.11(2.9)	-3.46(4.3)	*p=0.010
09	-0.33(4.5)	0.09(4.0)	-0.42(6.4)	p=0.809
10	2.29(4.9)	2.89(4.4)	-0.60(7.7)	p=0.776
11	-2.21(2.7)	-2.50(4.0)	0.29(3.5)	p=0.758
12	-1.01(3.4)	-2.59(6.4)	1.58(7.4)	p=0.439
13	1.03(4.3)	-2.48(4.8)	3.51(5.9)	*p=0.044
14	-3.04(2.1)	-5.52 (5.8)	2.48(5.8)	p=0.133

In reading the English materials the KS group (KS_E group) showed the similar result to that of the ES group only at the first paraton-initial sentence, which was higher than the corresponding sentence (p<0.01). The other pairs regarding the paratone-initial sentence did not show statistical significance. Lastly, when the KS group read the Korean text materials (KS_K group), any paratone-inital sentences showed higher mean pitch than the corresponding sentences from the list material. The results of the all sentences from the KS groups are shown in <Table 3> and <Table 4>.

Table 3. KS_E group: sentence mean pitch(SD) and statistical comparison between sentence list and text materials.

No.	Normalized pitch (%)		Statistics	
	List	Text	Paired Difference	Sig. (2-tailed)
01	3.63(4.5)	7.76(4.8)	-4.13(5.2)	*p=0.011
02	0.24(3.6)	0.52(3.5)	-0.28(4.8)	p=0.829

No.	Normalized pitch (%)		Statistics	
	List	Text	Paired Difference	Sig. (2-tailed)
03	-1.20(3.1)	-0.46(3.1)	-0.74(3.9)	p=0.486
04	-1.08(3.6)	-2.01(3.7)	0.92(4.8)	p=0.486
06	-2.01(4.1)	1.15(4.5)	-3.16(6.0)	p=0.069
07	-1.41(4.0)	-3.66(5.8)	2.25(6.5)	p=0.219
08	-0.86(3.1)	-0.94(3.4)	0.08(5.0)	p=0.952
09	0.20(3.1)	1.31(4.7)	-1.10(5.3)	p=0.45
10	4.03(4.3)	3.51(4.9)	0.52(4.6)	p=0.685
11	-2.39(2.9)	-1.39(3.1)	-1.00(4.6)	p=0.434
12	-3.05(3.0)	0.69(3.8)	-3.75(3.0)	**p<0.01
13	0.85(3.2)	0.87(6.3)	-0.02(5.0)	p=0.988
14	-1.92(2.6)	-1.65(3.8)	-0.27(4.6)	p=0.831

Table 4. KS_K group: sentence mean pitch(SD) and statistical comparison between sentence list and text materials.

No.	Normalized pitch (%)		Statistics	
	List	Text	Paired Difference	Sig. (2-tailed)
01	4.47(2.7)	6.66(4.7)	-2.19(1.5)	p=0.155
02	-1.91(1.9)	-2.30(2.8)	0.39(0.8)	p=0.613
03	3.29(4.7)	5.36(4.0)	-2.07(1.3)	p=0.145
04	-0.38(3.4)	0.95(3.4)	-1.33(1.3)	p=0.312
06	2.22(2.5)	2.70(3.9)	-0.48(1.3)	p=0.709
07	-2.90(2.0)	-2.18(3.5)	-0.72(1.1)	p=0.536
08	2.06(2.2)	3.79(4.5)	-1.73(1.5)	p=0.260
09	-3.65(2.0)	-2.58(3.3)	-1.07(0.8)	p=0.211
10	-8.49(3.2)	-5.1(3.4)	-3.38(1.3)	*p=0.026
11	3.48(3.4)	5.78(5.0)	-2.30(1.4)	p=0.114
12	2.40(2.6)	1.02(4.4)	1.38(1.2)	p=0.284
13	0.93(3.1)	0.97(4.5)	-0.04(1.4)	p=0.979
14	2.14(4.3)	3.15(6.3)	-1.02(1.1)	p=0.391

4.1.2 Onset pitch of paratone-initial sentences

The onset pitch of the paratone-initial sentences in the text materials is compared with that of the corresponding sentences in the list materials. The ES group showed a noticeable difference at the first paratone (p<0.01) and it was higher than the KS_E group (p<0.05). However, the other onset pitch did not show significant difference between discourse-level and sentence-level <Table 6>. The KS_E group showed a statistical significance only at the onset pitch of the first paratone. The KS_K group produced the difference at the first and the second paratones (p<0.05). As was the result of the sentence mean pitch, the last paratone showed similar onset pitch between the list and the text

materials from all three groups, the ES, the KS_E and the KS_K groups.

Table 5. Onset pitch of list and text materials

No.	ES		KS_E		KS_K	
	List	Text	List	Text	List	Text
1	37.0	64.2	34.5	42	52.2	58.5
2	27.6	45.0	37.5	43.8	40.9	47.1
3	46.3	59.8	52.0	56.6	53.3	52.3
4	44.8	46.0	43.5	53.2	54.4	52.8

Table 6. Paired T-test result for onset pitch of paratones.

Pairs of comparison	ES	KS_E	KS_K
List 01 & Text 01	**p<0.01	*p<0.05	*p<0.05
List 03 & Text 03	p=0.098	p=0.284	*p<0.05
List 08 & Text 08	p=0.059	p=0.087	p=0.723
List 11 & Text 11	p=0.862	p=0.073	p=0.824

4.2. Prosody in discourse-level

4.2.1 Paratone realization

To examine the participants' pitch change within each paratone, the paratone-initial and the paratone-final sentences were compared <Table 7>. All three groups showed significance at the first two paratones. However, at the third paratone, the KS_E group produced paratone-final sentence much higher than the paratone-initial sentence (p=0.005). The KS_K group showed statistical significance from the first three paratones. At the last paratone, all groups did not show significant pitch difference between the paraton-initial and the paratone-final sentences. How speakers used sentence mean pitch throughout the discourse-level text could be found from <Figures 2 to 4> In Figures the circles around the graph indicate the topic units in the text materials. The order of the sentences in the text material is plotted on the x axis, and the normalized pitch values measured in percentage

Table 7. Paired T-test results for paratone-initial and paratone-final sentences.

Text materials (No.)	ES	KS_E	KS_K
Paratone 1 (01 & 02)	**p<0.01	**p<0.01	**p<0.01
Paratone 2 (03 & 07)	*p<0.05	*p<0.05	**p<0.01
Paratone 3 (08 & 10)	p=0.541	p=0.005	**p<0.01
Paratone 4 (11 & 14)	p=0.149	p=0.777	p=0.090

term are plotted on the y axis. When the circles correspond to the paratone characteristics: high initial pitch, a gradual decline in pitch, and low paratone-final pitch, the participants reflected the topic unit into paratone.
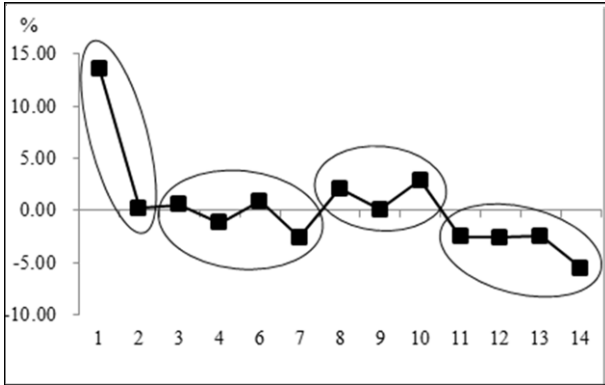

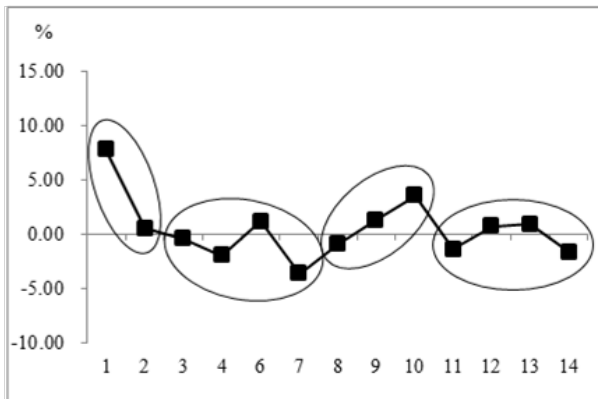Figure 2. Text material pith result of ES group.

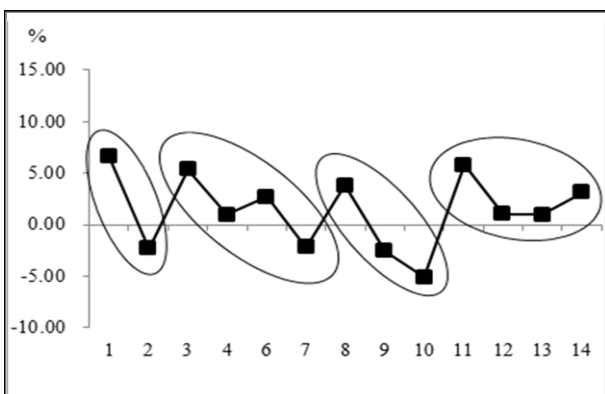Figure 3. Text material pith result of KS_E group.

Figure 4. Text material pith result of KS_K group.

4.2.2. Topic pause

The pauses measured from the discourse-level text materials are shown in <Table 8>. In <Table 8>, the *Topic pause* in the first column indicates the pause length before each topic unit. In

other words, the topic pauses are the pause length preceding each paraton-initial sentence, the 3rd, the 8th and the 11th sentences. In <Table 9>, the *Mean of sentence pauses* is calculated by averaging the pauses which were not the topic pauses; 3 topic pauses were excluded and 11 pauses between the sentences were averaged. The *Total duration* denotes the total length of reading the text material including the all pauses length.

As <Table 9> shows, the ES group paused longer than the mean of sentence pauses before both the topic unit without orthographical signal, Topic pause 1 and the topic unit with the orthographical signal, Topic pause 2 ($p<0.05$). As for the KS group, regardless of the languages, they only paused significantly longer when the paragraph changed, Topic pause 2 in <Table 9> ($p<0.01$). The last paratone was not marked by topic pause by any groups. All groups showed the longest topic pause when the orhographical signal was provided at the Topic pause 2. Especially, the ES group whose total duration was the shortest among the groups showed the longest topic pause when the paragraph changed.

Table 8. Results of pause length and duration.

(ms)	ES	KS_E	KS_K
Topic pause 1	815 (313)	968 (426)	767 (140)
Topic pause 2	1623 (1359)	1394 (783)	1149 (443)
Topic pause 3	834 (364)	1018 (612)	810 (293)
Mean of Sentence pauses	714 (209)	924 (336)	773 (192)
Total duration	64785 (8323)	88490 (13073)	74902 (6304)

Table 9. Paried T-test result for topic pause and mean of sentence pauses.

(ms)	ES	KS_E	KS_K
Topic pause 1	*p<0.05	p=0.561	p=0.900
Topic pause 2	*p<0.05	**p<0.01	**p=0.001
Topic pause 3	p=0.131	p=0.408	p=504

5. Conclusion and General Discussion

Through the experiment, discourse-level prosodic features were demonstrated.

In comparison between the discourse-level and the sentence-level material, the ES group showed the difference in sentence mean pitch. The ES group signalled both the orthographically marked and the embedded topic sentences in the discourse-level text using higher mean pitch. In contrast, the KS_K group did not mark any of the topic sentences by higher mean pitch. It shows that sentence mean pitch differences between the discourse-level and sentence-level are more critically used in the English language than the Korean language. Although the native language (Korean) result did not show sentence mean pitch difference between the discourse-level and sentence-level materials, the KS_E group marked the first topic sentence by higher mean pitch in the text material. It shows that the Korean learners of English acquired the L2 discourse-level prosody to some degree. However, the first topic sentence which was the 1st sentence in the text material may seems easy to prosodify. Moreover, the failure of marking the embedded and the orthographically marked topic sentences demonstrates that their level of realizing discourse-level prosody is not as accurate as the native speakers.

In using the onset pitch at the topic sentences, the KS_K group performed better than the ES and the KS_E groups; the KS_K group marked the first two topic sentences by higher onset pitch than the corresponding sentences in the list material. Although the ES group showed the higher onset pitch in the text material than in the list material, only the onset pitch of the first topic sentence was significantly higher ($p<0.01$). The KS_E group also only showed the significance at the onset pitch of the first topic sentence. This result is inconsistent from the previous work by Levis and Pickering (2004). They reported that the onset pitch of each paragraph was higher than the onset pitch of the same sentences in the list materials. However, they did not provide statistical comparison, a further study is needed for this issue.

Secondly, in discourse-level prosody, paratone realization and using topic pauses were studied. In paratone realization, the KS group showed the clearest paratones showing higher pitch at the paraton-initial sentences, gradual pitch decline, and lower pitch at the paraton-final sentences. The ES group showed the significance at the first two paratones. The ES group did not show significance at the third paratone because of high pitch shown at the 10th sentence. Unexpectedly high pitch at the 10th sentence in the English material may have caused by the original characteristic of the 10th sentence. It's mean pitch from the ES and the KS_E groups was even high in the list material. The

KS_E group also realized the first two paratones, but the characteristic of paratone was not as clear as the other two groups. Considering that the KS group made clear paratones in the Korean materials but not in the English material, L2 learners have some difficulty in verbalizing topic unit into paratone in L2 prosody.

The use of longer pause before a topic unit than before a sentence was observed by the ES group. They paused longer before both the orthographically marked and not marked topic units. The KS group's use of topic pause depended on the orthographical signal. Only when the topic shift coincided with the paragraph change, they paused longer both in the Korean and the English text materials.

The differences of using prosodic cues depending on languages were observed. Firstly, the pitch compression appeared from the ES group. The ES group produced the all sentences of the fourth paratone in minus values. It denotes that the ES group participants produced the last paratone lower than their average pitch. The last paratone may have been used for signaling the closure of the whole discourse-level text material. On the other hand, the KS_K group did not show pitch compression at the last paratone. Unlike the KS_K group, the KS_E group showed the tendency of lowering their pitch at the last paratone; two sentences from the last paratone showed minus values. It indicates that the pitch compression is the prosodic characteristic of the English language, and the Korean learners of English had limited acquisition of it. The other difference was found from the Korean language, the paratone-initial sentences showed all similar mean pitch at the text material. In addition, the pitch pattern of the four paratones were similar. In contrast, the ES group gradually decreased the mean pitch of the paraton-initial sentences and pitch pattern varies among paratones. This difference shows that the Korean language may have the characteristic of resetting the sentence mean pitch to the similar values when new topic unit starts.

This study examined the discourse-level prosody produced by read-aloud task. A further study observing the prosody from spontaneous or natural speech is needed to provide more supportive findings in discourse-level prosody. In addition, along with acoustic measure, if different approaches such as ToBI system are used, it would be more helpful to explain the discourse-level prosody.

Acknowledgement

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Appendix

The material is marked with superscript numbers which indicate the order of each sentence within the text, and the topic shifts sentences are presented in bold type. The target sentences of the EngL are underlined and the superscript numbers are presented before each sentence. Two interrogative sentences were shown in italic type. The original version of the participants' materials did not include any of these marks.

1. English Text material (adapted from Donna, 2000)

[1]Let us have a closer look at the cell phone market. [2]There are three main competitors in the market and their products differ greatly in terms of design, material and software. **[3]Cloud**

is the eldest company and was founded in 1971. [4]This company has grown bigger each year and now owns the largest market share. [5]*Why is Cloud so popular?* [6]Their phones are small and light but not easily damaged. [7]It attracts many adult users who are not very concerned with the design.

[8]**The company QC was founded in 1979 and has grown very rapidly in the past few years.** [9]Their phones are colorful, metal-framed and come in a variety of designs. [10]They are becoming increasingly popular among teenagers. [11]**Tompson was also founded in 1979 and dominated the market during its first few years of establishment.** [12]They developed a new software that operated at twice the speed of other phones. [13]However, it was found to be unstable and their reputation never recovered. [14]Tompson is now favored by the minorities in the market.

[15]*So, what can we say about the trend of cell phones in the market?*

2. English list material (EngL)

15 filler sentences (13 declarative and 2 interrogative sentences) were taken from the *Oral Reading Fluency Grades 1-5* published by Florida department of Education in U.S.A.

1. Mosquitoes have something like a needle on their bodies that is so small and sharp that humans usually do not feel it going in.
2. (4)This company has grown bigger each year and now owns the largest market share.
3. There are actually two kinds of frogs, such as those that live in trees and those that live in water.
4. (10)They are becoming increasingly popular among teenagers.
5. Their coach told the team how proud he was of them and wished them all good luck.
6. (9)Their phones are colorful, metal-framed and come in a variety of designs.
7. Lisa sat down in the field and began to pick some flowers to take home.
8. (14)Tompson is now favored by the minorities in the market.
9. First, we arranged the chairs in a square in the middle of the room.
10. (7)It attracts many adult users who are not very concerned with the design.
11. Inside the office, a teacher was waiting to take him to his new class.
12. (5)Why is Cloud so popular?
13. When I was seven years old, I took my very first gymnastics class.
14. (8)The company QC was founded in 1979 and has grown very rapidly in the past few years.
15. The next activity of the day is walking on the balance beam.
16. (1)Let us have a closer look at the cell phone market.
17. A canoe is the best way to travel along the river.
18. (6)Their phones are small and light but not easily damaged.
19. This company's core business is the repair and service of automated teller machines.
20. (2)There are three main competitors in the market and their products differ greatly in terms of design, material and software.
21. It was Charlie's first day at a new school.
22. (13)However, it was found to be unstable and their reputation never recovered.
23. Kevin was excited when he woke up on Saturday morning.
24. (11)Tompson was also founded in 1979 and dominated the market during its first few years of establishment.
25. She picked each flower and put it in her basket.
26. (12)They developed a new software that operated at twice the speed of other phones.
27. What do we really know about frogs?
28. (15)So, what can we say about the trend of cell phones in the market?
29. You will also see many other kinds of wildlife along the river banks.
30. (3)Cloud is the eldest company and was founded in 1971.

3. Korean Text material (KorT)

[1]휴대폰 시장에 대해 자세히 살펴보겠습니다. [2]시장에는 세 개의 경쟁사들이 있고 각 회사의 제품들은 디자인, 재료 그리고 운영체제에 있어서 매우 다릅니다. [3]클라우드는 가장 오래된 회사로 1971년에 설립되었습니다. [4]이 회사는 매년 더 크게 성장하였고 지금은 가장 큰 시장점유율을 차지하고 있습니다. [5]왜 클라우드는 인기가 많을까요? [6]그들의 휴대폰은 작고 가볍지만 쉽게 파손되지 않습니다. [7]이 제품은 디자인에 많은 관심을 두지 않는 성인 사용자들의 마음을 끌고 있습니다.

[8]QC 회사는 1979년에 설립되었고 지난 몇 년간 급격하게 성장했습니다. [9]그들의 휴대폰은 다양한 색깔과 금속 프레임으로 이루어져있으며 매우 다양한 디자인으로 출시됩니다. [10]

이것은 젊은 층에서 점점 더 인기를 얻고 있습니다. **(11)**탐슨은 1979년에 세워졌고 설립 후 처음 몇 년간은 시장을 점령했습니다. **(12)**이 회사는 다른 휴대폰들보다 두 배의 속도를 내는 새로운 운영체제를 개발했습니다. **(13)**하지만 운영체제의 불안정함이 밝혀지면서 회사의 평판은 회복되지 못하고 있습니다. **(14)**탐슨은 이제 시장에서 소수에게만 인기가 있습니다.

(15)그렇다면, 우리는 휴대폰 시장의 동향이 어떠하다고 말할 수 있을까요?

4. Korean List material (KorL)

1. 모기는 바늘과 같은 침을 몸통에 지니고 있는데 그것은 너무 작고 날카로워 사람들이 주로 침이 들어오는 것을 느끼지 못합니다.
2. **(4)**이 회사는 매년 더 크게 성장하였고 지금은 가장 큰 시장 점유율을 차지하고 있습니다.
3. 사실 개구리는 여러 종류로, 나무에 사는 개구리와 물에 사는 개구리가 있습니다.
4. **(10)**이것은 젊은 층에서 점점 더 인기를 얻고 있습니다.
5. 그들의 감독은 팀에게 그가 얼마나 그들을 자랑스러워하고 그들이 앞으로 잘 될 것을 바라는지 말했습니다.
6. **(9)**그들의 휴대폰은 다양한 색깔과 금속 프레임으로 이루어져있으며 매우 다양한 디자인으로 출시 됩니다.
7. 리사는 들판에 앉아서 집으로 가져갈 꽃을 꺾기 시작했습니다.
8. **(14)**탐슨은 이제 시장에서 소수에게만 인기가 있습니다.
9. 첫번째로, 우리는 의자들을 방 한가운데에 정사각형으로 정렬했습니다.
10. **(7)**이 제품은 디자인에는 많은 관심을 두지 않는 성인 사용자들의 마음을 끌고 있습니다.
11. 사무실 안에서 선생님 한 분이 그를 새 교실로 데려가려고 기다리고 계셨습니다.
12. **(5)**왜 클라우드는 인기가 많을까요?
13. 내가 7살이었을 때, 나는 처음으로 체조수업을 들었습니다.
14. **(8)**QC 회사는 1979년에 설립되었고 지난 몇 년간 급격하게 성장했습니다.
15. 오늘의 다음 활동은 평균대 위를 걷는 것입니다.
16. **(1)**휴대폰 시장에 대해 자세히 살펴보겠습니다.
17. 카누는 강가를 여행하는 최고의 방법입니다.
18. **(6)**그들의 휴대폰은 작고, 가볍지만 쉽게 파손되지 않습니다.
19. 이 회사의 핵심 사업은 현금 자동 입출금기의 수리와 서비스를 제공하는 것이다.
20. **(2)**시장에는 세 개의 주 경쟁사들이 있으며 각 회사의 제품들은 디자인, 재료 그리고 운영체제에 있어서 매우 다릅니다.
21. 오늘은 찰리가 새 학교에서 맞는 첫날입니다.
22. **(13)**그러나, 운영체제는 불안정함이 밝혀졌고 회사의 평판은 그 후로 회복되지 못하였습니다.
23. 토요일 아침에 잠에서 깨어난 캐빈은 기분이 매우 좋았습니다.
24. **(11)**탐슨 역시 1979년에 세워졌으며 설립 후 처음 몇 년간은 시장을 점령했습니다.
25. 그녀는 꺾은 모든 꽃을 바구니에 담았습니다.
26. **(12)**이 회사에서 새롭게 선보인 운영체재는 다른 휴대폰들보다 두 배나 빠른 속도를 내었습니다.
27. 우리는 과연 개구리에 대해서 얼마나 잘 알고 있는 걸까요?
28. **(15)**그렇다면, 우리는 휴대폰 시장의 동향이 어떠하다고 말할 수 있을까요?
29. 당신은 또한 강둑을 따라 여러 종류의 야생동물을 볼 수 있을 것입니다.
30. **(3)**클라우드는 가장 오래된 회사로 1971년에 설립되었습니다.

Participants' average pitch and pitch range

Hz	ES		KS (English Material)		KS (Korean Material)	
ID	Average	Range	Average	Range	Average	Range
1	125	177	147	158	152	126
2	129	198	106	64	117	76
3	113	96	125	210	150	147
4	124	108	160	172	170	171
5	121	129	134	130	164	172
6	108	96	122	154	124	101
7	123	231	111	252	112	138
8	194	193	168	174	186	163
9	235	263	208	215	209	203
10	187	201	215	219	228	187
11	220	271	243	251	249	248
12	205	246	202	229	207	240
13	184	183	206	196	213	200
14	181	185	181	219	214	207