

The Interlanguage Speech Intelligibility Benefit (ISIB) of English Prosody: The Case of Focal Prominence for Korean Learners of English and Natives

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ABSTRACT

This study investigated the speech intelligibility of Korean-accented and native English focus speech for Korean and native English listeners. Three different types of focus in English, broad, narrow and contrastive, were naturally induced in semantically optimal dialogues. Seven high and seven low proficiency Korean speakers and seven native speakers participated in recording the stimuli with another native speaker. Fifteen listeners from each of Korean high & low proficiency and native groups judged audio signals of focus sentences. Results showed that Korean listeners were more accurate at identifying the focal prominence for Korean speakers' narrow focus speech than that of native speakers, and this suggests that the interlanguage speech intelligibility benefit - talker (ISIB-T) held true for narrow focus regardless of Korean speakers' and listeners' proficiency. However, Korean listeners did not outperform native listeners for Korean speakers' production of narrow focus, which did not support for the ISIB-listener (L). Broad and contrastive focus speech did not provide evidence for either the ISIB-T or ISIB-L. These findings are explained by the interlanguage shared by Korean speakers and listeners where they have established more L1-like common phonetic features and phonological representations. Once semantically and syntactically interpreted in a higher level processing in Korean narrow focus speech, the narrow focus was phonetically realized in a more intelligible way to Korean listeners due to the interlanguage. This may elicit ISIB. However, Korean speakers did not appear to make complete semantic/syntactic access to either broad or contrastive focus, which might lead to detrimental effects on lower level phonetic outputs in top-down processing. This is, therefore, attributed to the fact that Korean listeners did not take advantage over native listeners for Korean talkers and vice versa.

Keywords: ISIB, focus, prosody, Korean talkers, Korean listeners

1. Introduction

Second or foreign language learners often end up with some degree of phonological and/or phonetic deviances from native

pronunciation. There have been various production and perception studies on the L2 learners' speech deviances with a focus on the spectral/acoustic differences between L1 and L2 utterances (Baker & Trofimovich, 2005; Bohn & Flege, 1992; Flege & Hillenbrand, 1984; Flege, McKay & Meador, 1999; Ingram & Park, 1997; Tsukada, Birdsong, Mack, Sung, Bialystok & Flege, 2004) and the degree of foreign accent and comprehensibility of foreign speech and the intelligibility of specific L2 segments (Aoyama, Flege, Guion, Akahane-Yamada & Yamada, 2004; Bradlow & Pisoni, 1999; Fogerty & Kewley-Port, 2009; Markham & Hazan, 2002; Munro, 1998; Munro & Derwing, 1999; Rogers, 1997).⁵⁾ Many more studies

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5) Foreign accent refers to the extent to which an L2 learner's speech is perceived to differ from native speaker norms (Munro

have focused on speakers' foreign accent and comprehensibility than on their intelligibility. However, great attention has been recently paid to the studies of mutual intelligibility about native and non-native listeners' perception of native and non-native talkers' speech (Bent & Bradlow, 2003; Bent, Bradlow & Smith, 2007; Hayes-Harb, Smith, Bent & Bradlow, 2008; Han et al., 2011; Lee & Xue, 2011; Munro, Derwing & Morton, 2006; Smith, Hayes-Harb, Bruss & Harker, 2009; Stibbard & Lee, 2006; van Wijngaarden, 2001; van Wijngaarden & Steeneken & Houtgast, 2002). It may be attributed to the fact that non-native speakers of English now outnumber native speakers; therefore, it is very important to see how mutual intelligibility is maintained among non-native speakers as well as that of native and non-native speakers of English (Crystal, 2003). In general, it has been assumed that native listeners find native speech more intelligible than non-native speech, but interestingly, non-native talkers' speech is sometimes as intelligible as or even more intelligible than native talkers' speech to non-native listeners who share the same L1. This is presumably due to the similar L2 phonological representations directly generated from the same L1, and Bent & Bradlow (2003) called this the 'Interlanguage speech intelligibility benefit (ISIB)'. ISIB has been further developed to two refined types: ISIB-T (talkers) and ISIB-L (listeners) (Hayes-Harb et al., 2008). The ISIB-T refers the cases where non-native speech is more intelligible to non-native talkers than native speech while the ISIB-L refers the cases where non-native speech is more intelligible to non-native talkers than it is to native talkers.

Foreign accent refers to the extent to which an L2 learner's speech is perceived to differ from native speaker norms (Munro & Derwing, 1995; Riney et al., 2005). Comprehensibility stands for the degree of difficulty the listener reports in attempting to understand an utterance while intelligibility is defined as the extent to which a native speaker understands the intended speech (Derwing & Munro, 1997, 2005; Munro & Derwing, 1999).

Speech intelligibility is affected by many factors such as speech rate, certain acoustic properties of speech, degree of speech clearness, word frequency, language background of talkers and listeners, etc. (Bent & Bradlow, 2003; Bradlow &

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Bent, 2002; Bradlow & Pisoni, 1999; Derwing & Munro, 2001; Markhan & Hazan, 2002; Munro, 1998; van Wijngaarden, 2001; Hayes-Harb et al., 2008 among others). In addition to those factors, L2 proficiency of the talkers and listeners has been shown to be crucial in determining the intelligibility of speech. High proficient talkers and listeners showed the ISIB-T effects (Bent & Bradlow, 2003; van Wijngaarden, 2001), and the listeners who were more proficient subjects were likely to have 'near-native' use of contextual constraints (van Wijngaarden et al., 2002). They interpreted these results as stating that less proficient L2 talkers' speech might be more different from the natives' canonical phonological pattern than more proficient talkers, which could render the L2 listeners and natives to find their speech less intelligible. On the other hand, Hayes-Harb et al. (2008) showed that ISIB held only for the low proficiency non-native listeners who listened to the speech produced by low proficiency non-native talkers. That is, low proficiency non-native talkers' speech was shown to be more intelligible to the low proficiency non-native listeners than other types of speech. These results are interpreted in the way that the ISIB might be enhanced between talkers and listeners who share the same interlanguage, presumably with a considerable amount of more L1--like phonological features. The present study examines Korean talkers' intelligibility of English intonation with different proficiencies (high and low), exploring both ISIB-T and ISIB-L. Previous studies have not provided consistent results concerning L2 proficiency or talkers'/ listeners' effects on ISIB. This study which explores prosody as opposed to segments may provide more definite results concerning the still arguable issues in ISIB.

Numerous studies on speech intelligibility have mostly focused on segments (Bent, Bradlow & Smith, 2007; Fogerty & Kewley-Port, 2009; Han et al. 2011; Rogers, 1997; Hayes-Harb et al., 2008; Lee & Xue, 2011; Smith et al. 2009; van Wijngaarden, 2001). Rogers (1997) examined Mandarin-accented English to assess the relationship between segmental accuracy and intelligibility, whereby segmental accuracy was assessed by presenting native listeners with one word spoken by a native Mandarin talker. Intelligibility was determined by presenting listeners with a sentence or phrase from the passage and having them write down what they heard. Rogers (1997) found that when segmental accuracy was divided into accuracy for consonants versus accuracy for vowels, intelligibility was both positively correlated with vowel accuracy but not with consonant accuracy. Bent, Bradlow & Smith demonstrated the

same finding about a correlation between vowel accuracy and intelligibility, but not overall consonant accuracy and intelligibility, and extended their results to word position such that non-native talkers' errors in word-initial position tended to be more detrimental to intelligibility than errors in word-final position.

Fogerty & Kewley-Port (2009) used a fundamental division in speech sound categories, specifically between consonants and vowels, to investigate contributions to sentence intelligibility and confirmed the importance of vowels to sentence intelligibility. Similarly, van Wijngaarden (2001) examined the intelligibility of English-accented Dutch sentences and demonstrated that vowels showed much stronger effect than consonants to non-native speech intelligibility. Particularly, vowels which were not in their L1 brought confusion consistently to L2 learners.

Most studies on L2 consonant intelligibility have used word final stop voicing (Hayes-Harb et al., 2008; Smith et al., 2009). Hayes-Harb et al. investigated the intelligibility of native and Mandarin-accented English speech for native English and native Mandarin listeners. They observed that there were no ISIB-T effects, and that the interlanguage speech intelligibility benefit for listeners (ISIB-L) held only for the low phonological proficiency listeners and low phonological proficiency speech. Smith et al. even further contended that ISIB did not occur at all. That is, German listeners did not take advantage over English listeners in recognizing German talkers' production of English final stops, and moreover, English listeners did not show a better chance to comprehend English talkers' production of the German final stops, either.

Most studies on the prosodic characteristics of L2 speech have focused on the identification of foreign accent (Anderson-Hsieh, Johnson & Koehler, 1992; Boula de Mareuil & Vieru-Dimulescu, 2006; Jilka, 2000; Kang, 2010; Magen, 1998; Munro, 1995; Munro & Derwing, 2001; Trofimovich & Baker, 2006, 2007). They were primarily concerned with how prosody as opposed to segments is correlated with the degree of foreign accentedness and what kind of prosodic factor, more specifically among speech rate, intonation, stress, etc., makes more contribution to the recognition of foreign accent. For example, Anderson-Hsieh et al. (1992) asked a group of three experienced ESL (English as a Second Language) teachers to judge 60 oral reading passages produced by male speakers of 11 different language groups on a 7 point foreign accent rating scale. The speech samples were subjected to a detailed error analysis of each speaker's prosody, segments and syllable

structure. The results suggested that regardless of the language group, prosody outweighs segmental and syllable structure variables in the perception of foreign accent. Munro (1995) examined low-pass filtered L2 English speech in which segmental information was suppressed and rendered segmentally unintelligible. Native listeners rated a higher degree of foreign accent for non-native speech than native speech even though segmental information was not available to them, and this suggests that prosody alone is sufficient for the identification of foreign accent. Trofimovich & Baker (2007) similarly investigated low-pass filtered L2 speech, attempting to compare two different groups' prosody, especially durational and intonational phenomena, in association with foreign accent. They concluded that durational factors which they contended were indicators of speech fluency such as speech rate, pause frequency, and pause duration contributed more to the perception of foreign accent than intonational characteristics like stress timing and peak alignment.

Jilka (2000) investigated the relative contribution of intonation compared to other prosodic cues (including rhythm and speaking rate) and reported that low-pass filtered stimuli with monotonous intonation attracted higher foreign accent ratings than those with preserved intonation. Jilka, therefore, concluded that intonation is the most important prosodic cue in the perception of foreign accent. Magen (1998), on the other hand, manipulated Spanish L2 learners' speech of English and corrected it close to American English in three different ways, segmentally, syllabically, and prosodically. The differently manipulated L2 speech was shown to vary in contribution to perceived foreign accent. Amongst the manipulated factors was prosody found to make a larger contribution to perceptions of foreign accent than segments. These studies showed clearly that prosody played an important and independent role in perception of foreign accentedness, but the degree of prosodic contribution was not conclusive, when compared with that of segmental contribution. Many studies found a larger role for prosody in foreign accent perception (Anderson-Hsieh et al, 1992; Magen, 1998), but others reported an equal role for prosody and segments (Boula de Mareuil et al., 2006; Munro, 1995).

Much less experimental work has been done on the intelligibility of prosodic phenomena in foreign accented speech (Suenobu et al., 1992; Tajima et al., 1997; Tiffen, 1992). Suenobu et al. (1992) reported that intelligibility of Japanese-accented English was, to a larger extent, degraded by consonant deletion, followed by wrong accentuation of words.

Tiffen (1992), on the other hand, found that rhythm/stress errors were the most detrimental to the intelligibility of Nigerian - accented English, followed by segmental, phonotactic, and lexical/syntactic errors. These two studies obviously showed that foreign-accented speech with the prosodic errors of wrong accentuation and incorrect rhythm/stress assignment would lead to reducing its intelligibility.

Tajima, et al. (1997) further developed a synthetic technique to determine a temporal contribution to L2 speech intelligibility. That is, they synthetically corrected Chinese-accented utterances productions by a native speaker. Similarly, the native speaker's productions were distorted to match the durational patterns of the Chinese speakers. Intelligibility of these stimuli was measured, based on native English listeners' performance in a forced-choice identification test with four alternatives: the correct phrase plus three phonetically similar distracter phrases. Their results showed that intelligibility of the unmodified Chinese-accented phrases was poor (39% correct), but that it improved significantly (to 58%) after temporal correction. Performance on the native productions was high (94%), but declined significantly (to 83%) after temporal distortion following the Chinese speakers' timing. They interpreted their results pedagogically, suggesting that intelligibility of foreign-language speakers may be enhanced if explicit training is provided on temporal properties of their speech.

Tajima, et al. (1997) showed that segments' durational effect on intelligibility of foreign accented speech was large, but very few studies have investigated the role of intonation in comprehending foreign speakers' utterances. Intonation has been considered a critical attribute to a semantic interpretation in English such that incorrect intonation patterns may invoke serious communicative problems (Cook, 1968; Holden & Hogan, 1993; O'connor & Arnold, 1973; Pike, 1945). In the studies of second language learning, intonation has been claimed to be more significant than segments (Gilbert, 1980; Nash, 1971; Wilkins, 1974). Moreover, Hewings (1995) claimed that the errors which L2 learners generated at the level of intonation might lead to a different and/or mistaken comprehension which is absolutely not identical to a speaker's intention. Therefore, intonation is expected to play a significant role in intelligibility of foreign accented speech, especially in terms of the semantic interpretation of a speaker's intention.

The current study, therefore, examines the contribution of intonation to the intelligibility of foreign accented speech, concentrating on focus utterances. If misplacing a pitch accent

in a focus sentence, the talker's intelligibility may decrease remarkably because a listener expects the focused word to be prominent with a pitch accent. Both native and Korean talkers' production of English focus sentences are submitted to both native and Korean listeners' perception to see if Korean L2 listeners take advantage of the interlanguage shared with Korean talkers in the identification of correct/incorrect question types based on the intonation patterns of the responses to the questions. In other words, we investigate if interlanguage speech intelligibility benefits (ISIB), which have been claimed to occur in L2 listeners' recognizing L2 talkers' segments, also applies to the perception of L2 prosody, especially in focus sentences. Intonation patterns are intricately associated with a speaker's intention or contextual meanings of the utterance; hence, an utterance may have various intonation patterns in English according to the semantic correlates. However, multiple and/or inconsistent answers cannot be utilized in the identification of a correct intonation in ISIB studies. Consequently, the utterances which are produced with only one tonal pattern should be presented to listeners in the perception test, and focus sentences where the focus is projected to a specific word in a phrase and realized with a high pitch accent depending on its pre-and post-contextual environments. Along with this line, focus types are varied into narrow, contrastive and broad in this study. While narrow and contrastive foci are always anchored to a specific word and their focus scope is crispy aligned with the word boundary, the broad focus has a wide range of scope in a phrase. Thus, its realization to pitch accent is merely predicted by the last content word within the boundary. The emergence of more pitch accents preceding the one of the last content word may be also possible. Therefore, all the feasible tonal patterns are considered on the basis of native speakers' production and counted as correct in the identification task.

2. Method

2.1 Stimuli

All the stimuli used in the perception test were extracted from dialogues between two speakers. The target stimuli were an answer to a question or a response to the immediately preceding statement, whereby the answer and the response were supposedly produced with one of the foci, narrow, contrastive and broad.⁶⁾ The questions were designed to induce

6) Contrastive focus is generally assumed to be a subtype of narrow focus, but they were intentionally split into two different

an appropriate focal pattern in the answer. Each focus type was embedded in 10 sentences; therefore, 30 target focus sentences were embedded in dialogues. Each dialogue was 6 to 8 sentences long. An example of each focus type is presented in (1), and the bold faced sentence was utilized as a target.⁷⁾ As seen in (1a), the target sentence “He bought a present for her.” contains a narrow focus on *present*, because speaker A asks what *John* bought yesterday. Therefore, speaker B is supposed to respond to ‘what’, and assign a high pitch accent on the word *present*. In other words, the word *present* has a narrow focus in the phrase.

In the case of contrastive focus, the target sentence ‘I think they like January better’ is a response to or comment on the immediately preceding sentence ‘American people like December,’ rendering speaker B a contrastive of *January* with *December*. Therefore, the word *January* should be produced with a high pitch accent. The word having a contrastive focus is only pitch accented in an intonational phrase (IP) like a narrow focus. Both contrastive and narrow foci have the focus scope sharply aligned with the boundary of the pitch accented word.

As shown in (1, c), the last sentence uttered by speaker B is an example of a broad focus. It has a focus scope ‘bought a present for her’ because speaker B is supposed to answer about ‘did what’. The subject *he* is not included in the focus scope because speaker A has already mentioned *John* and it is no more new information in B’s response. The whole verb phrase should be, therefore, a scope of the broad focus. Every content word in the focus scope can be potentially pitch accented as in *He [BOUGHT a PRESENT for her]*, but the argument as opposed to the predicate is merely pitch accented as in *He [bought a PRESENT for her]*.

(1)

(a) Narrow focus

A: Valentine’s day is just around the corner. Do you know that I just started dating with Ann?

B: Yeah... you told me that. Seems like you need to go shopping for chocolate.

A: I know.

categories based on the syntactic/semantic norms. Narrow focus is merely embedded in an answer to a *wh*-word construction, and contrastive focus is concerned with two elements which make a contrast semantically with each other not only within a sentence but also across utterances.

7) Capitalized words are pitch accented.

B: I saw John and her girl friend going to a department store together yesterday.

A: What did John buy yesterday?

B: **He bought a [PRESENT]_Fforher.**

A: Present? You mean he bought chocolate for her?

B: I don’t know.

(b) Contrastive focus

A: I think people have been excited recently here.

B: Don’t you know? Christmas is coming in a month.

A: American people like December.

B: **Well... I think they like [JANUARY]_Fbetter.**

A: Why?

B: Because they like to celebrate New Year’s Day and make new resolutions.

(c) Broad focus

A: Ann is leaving Korea next Monday. So, we are going to have a farewell party this Sunday. Would you join us?

B: Sure. Is there anything that I can do for the party?

A: Not really.

B: Who is coming?

A: John, Sally, you and me.

B: What did John do yesterday?

A: **He [bought a PRESENT for her.]_F**
or He [BOUGHT a PRESENT for her.]_F

2.2. Participants

The participant recruiting process was the same as in Han et al. (2011) as this experiment was conducted as parallel as theirs along with the same subjects. 75 Korean learners of English volunteered to participate in the experiment, and they were all college students at the researchers’ institutions with various majors. Each subject took two kinds of diagnostic tests in the phonetics lab: paper-based TOEFL practice test (PBT) and Versant English Test (VET). The full-length paper-based TOEFL practice test was used to measure the subjects’ proficiency of listening, vocabulary, structure and reading. The Versant English Test was conducted to determine the participants’ accentedness and speaking proficiency. VET is a computer-based oral proficiency test which measures non-native English learners’ pronunciation, vocabulary, sentence mastery, and fluency in approximately 15 minutes through an automated scoring system.

VET has been used either in replacement of or in addition to native speakers' accentedness rating for the sake of convenience. The subjects completed the questionnaire on their personal English learning history after two diagnostic tests.

Based on the results of these two tests and the questionnaire, 21 high proficiency (HP) and 21 low proficiency (LP) levels of subjects were selected out of 75 as in Figure 1. Each participant's ranking was determined by the combined scores of TOEFL and VET, and the scores were ordered from high to low with subject numbers assigned from #1 to 75. Anyone with an exceptionally high or low score on either of the tests was excluded in order to maintain the groups as homogeneous as possible. Subject numbers 3 to 24 were grouped as high proficiency (HP) and subject numbers 49 to 70 were grouped as low proficiency (LP). Three students were excluded in the analysis, because they were either found to have speaking impairments or could not complete both tests for personal reasons.

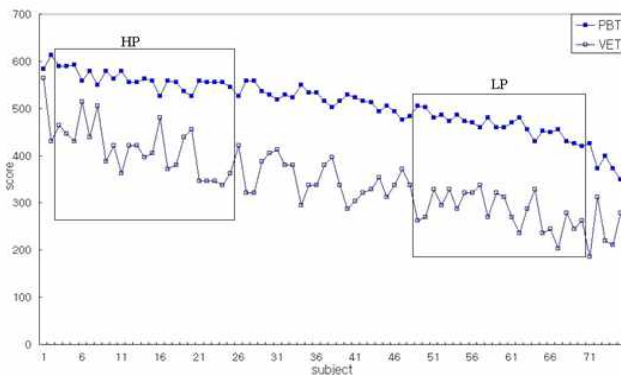


Figure 1. Mean paper-based TOEFL test (PBT) and Versant English Test (VET) scores for individual talkers and listeners (HP=high proficiency; LP=low proficiency).

The HP and LP subjects were confirmed to differ in their sub-parts of the test ratings as well as overall ratings according to ANOVA. The HP and LP groups were significantly different in VET scores, PBT scores, and Sum of VET/PBT ($t(40)=9.024$, $p=.000$ for VET; $t(40)=14.887$, $p=.000$ for PBT; $t(40)=17.138$, $p=.000$ for sum of VET/PBT). For each proficiency group, three male and three female participants were selected randomly to form HP and LP talker groups each. The rest became listener groups (HP listener and LP listener). There was no statistical

difference in the test scores between the talkers and the listeners for both proficiency groups [for HP, $t(19)=0.84$, $p=0.41$ for VET, $t(19)=-0.42$, $p=0.69$ for PBT, $t(19)=0.175$, $p=0.86$ for sum of VET/PBT; for LP, $t(19)=1.073$, $p=0.30$ for VET, $t(19)=-0.319$, $p=0.75$ for PBT, $t(19)=0.19$, $p=0.85$ for sum of VET/PBT]. In addition, 21 English natives who spoke the standard American English accent (GA) were recruited: 6 English native talkers and 15 English native listeners. The native talker group (NE talker) consisted of EFL instructors at the researchers' institutions. As with the Korean EFL groups, three male and three female participants formed the talker group. The native listener group (NE listener) was recruited from the students at the University of Oregon to obtain a uniform variety of English dialects. All other subject variables were as similar as possible to those of the other groups. The biographical and language backgrounds of six groups of participants are shown in Appendix.

2.3 Procedure

In order to build up the stimuli for the intelligibility perception task, six talkers from each of the three groups (English natives, HP Korean and LP Korean) recorded the dialogues with a native speaker of English who did not belong to either talker or listener group. The dialogues were composed with a conversation between speakers A and B, and each subject took the role of speaker A first and then took turn to speaker B. Recordings were conducted in a sound-proof room, using a Tascam HD-P2 solid-state recorder and a MXL M3000 microphone. 30 target sentences (10 narrow focus, 10 contrastive focus, and 10 broad focus) were cut off from the dialogue recordings, and programmed to be input materials for the intelligibility task.

Listeners were supposed to hear a target sentence entailing focus information and then determine if a sentence appearing on the computer screen was a correct question or utterance to the focus sentence which was an answer to or a comment on it. For example, when a participant listened to an auditory stimulus supposedly entailing focus information 'He bought a present for her', the written sentence 'What did John buy yesterday?' was given on the screen. If a talker produced the sentence 'He bought a present for her' with a correct focus structure, that is, with a high pitch accent (H*) on the word 'present', the listener would judge it to be an accurate answer

to the question ‘What did John buy yesterday?’ The listeners were told to press the 0 key if they thought that the given sentence on the screen successfully led to accurate focus information in the speech that they had heard or the 1 key if not. The listeners had a practice session prior to beginning the perception experiment. They were trained to pay special attention to intonation in association with a speaker’s intention in a question and his/her partner’s pitch prominence in the answer when they listened to speech stimuli. They went through 10 speech trials, while the wrong answers got corrected.

540 target stimuli were generated (18 takers * 30 target sentences). Since it would take too long and make the listeners three to four different visits in order to finish all the 540 sentences, the stimuli were randomized and divided by half. 7 out of 15 listeners executed the 270 stimuli and 8 listeners did the other 270 stimuli. They were asked to make two visits on different days and go through 135 stimuli each time to avoid misleading judgments due to fatigue.

A written sentence which was a focus inducing question or statement was programmed to appear right after a listener heard the auditory sentence. The listener was then asked to judge if each sentence they had heard correctly reflected a speaker’s intention in his/her question/utterance in terms of intonation. The probe sentences remained until the listener pressed the key, but not longer than 3 seconds. The listener moved to the next item, upon hitting an answer key. The experiment was controlled using the software SuperLab Pro (version 4.0, CEDRUS), and the auditory stimuli were played over Sennheiser HD 590 headphone. The perception task lasted approximately 70 minutes for 135 stimuli, and each participant completed the whole set of 270 stimuli in two visits.

The 360 target sentences recorded from 12 non-native Korean talkers were analyzed into their focus structure with a reference to native talkers’ intonation patterns. In order to measure the intelligibility of non-native Korean talkers’ intonation, two trained phoneticians checked whether their tonal patterns associated with a focus were correct or not. When their focus sentence was appropriately produced with a correct location of a pitch accent, it was labeled as T(rue). When it was produced with a wrong placement of a pitch accent or with no pitch accents, it was labeled as F(alse). Non-native Korean talkers’ production of focus sentences was categorized into four different cases depending on listeners’ responses. First, if a correctly produced sentence (T) was

judged as correct, it was categorized as *Correct*. That is, the sentence was uttered in a precise intonation, and it is intelligible enough for a listener to recover the intended focus information. Second, if a correctly produced focus sentence (T) was judged as ‘incorrect (F)’, it is categorized as *Incorrect*. This indicates that the sentence was not sufficiently intelligible to a listener even though it was produced in a satisfactory pattern of intonation. Third, if a focus sentence labeled as an incorrectly produced one (F) was consistently perceived as incorrect (F) to a listener, it is classified into *Correct*. The sentence was produced in a wrong intonation, and the listener consequently assessed it as unacceptable because it was intelligible enough for him/her to make a correct judgment. Finally, a target sentence was incorrectly produced (F), but judged as correct (T), and this is classified into *Overcorrect*. The listener comprehended the intended focus information and considered it as an appropriate pattern of pitch prominence corresponding to the focus request. Therefore, it was intelligible to the listener in terms of intonation regardless of the accuracy of focal prominence. This is summarized in Table 1. Non-native Korean talkers’ intonation intelligibility was classified into four different cases when judged by listeners as mentioned above, but native talkers’ production was all assumed to have a correct pitch accent pattern (T).

Table 1. The Classification of Talkers’ intelligibility

| Talkers | Analyzed as | Judged as | Category | Talkers’ Intelligibility |
|-------------------|-------------|-----------|--------------------|--------------------------|
| Non-native Korean | T | T | <i>Correct</i> | yes |
| | | F | <i>Incorrect</i> | no |
| | F | T | <i>Overcorrect</i> | yes |
| | | F | <i>Correct</i> | yes |
| Native | T | T | <i>Correct</i> | yes |
| | | F | <i>Incorrect</i> | no |

Native talkers’ speech was either intelligible or unintelligible depending on native and non-native Korean listeners’ responses, T or F. Non-native Korean talkers’ speech was determined to be intelligible when it was categorized into *Correct* (TT and FF) and *Overcorrect* (FT). The shaded boxes represent that native and non-native speech is intelligible. It was assumed to be unintelligible when categorized into *Incorrect*. The *Correct* category of both native and non-native talkers’ speech was submitted to ANOVA for accuracy measurement..

3. Results

3.1 Overall Accuracy of Focus Identification

Focus identification accuracy for native and non-native Korean talkers' audio stimuli of the focus sentences was measured along with listeners' responses taken as correct if the matching evaluations of the phoneticians' acoustic analyses and the listeners' judgments were categorized as TT, FT, and FF. This accuracy is also directly interpreted as speech intelligibility of intonation as stated in 2.3. An analysis of variance (ANOVA) with listener group (Korean listeners vs. NE listeners) as a between-subjects factor and talker group (Korean talkers vs. NE talkers) as a within-subjects factor was executed as in Figure 2.

There were main effects of talker [$F(1,401)=4.61, p<0.05$], listener [$F(1,401)=11.35, p<0.05$], and their interaction [$F(1,401)=16.18, p<0.05$]. In order to conduct individual group comparisons, simple main effects were examined through a Post-hoc Tukey's Studentized Range (HSD) Test. The accuracy scores for Korean talkers' focus speech were compared between Korean listeners and NE listeners to investigate Interlanguage Speech Intelligibility Benefit - Listeners (ISIB-L), and the accuracy scores for Korea listeners were compared between Korean talkers and NE talkers to evaluate ISIB-talkers (ISIB-T). Korean listeners and NE listeners did not show a statistical difference for Korean talkers at the significance level of 0.05, and this is graphically shown from the comparison of the left two black and white bars in Figure 2. This is interpreted as stating that there was no ISIB-L effect. However, the Korean listeners' accuracy scores were significantly different between Korean talkers and NE talkers at the level of 0.05 as shown from the comparison of the two black bars in Figure 2. This suggests that the tonal patterns of focus produced by Korean talkers was more intelligible to Korean listeners than NE talkers. That is, ISIB-T effects were elicited.

3.2 Focus types

The identification task was carried out with three different focus sentences (broad, narrow and contrastive) to see if there would be any differences among them in listeners' identification of focal prominence as shown in Figure 3. The accuracy scores were submitted to an ANOVA with listener group (Korean listener vs. NE listener) as a between-subject variable and talker group and focus type as a within-subject

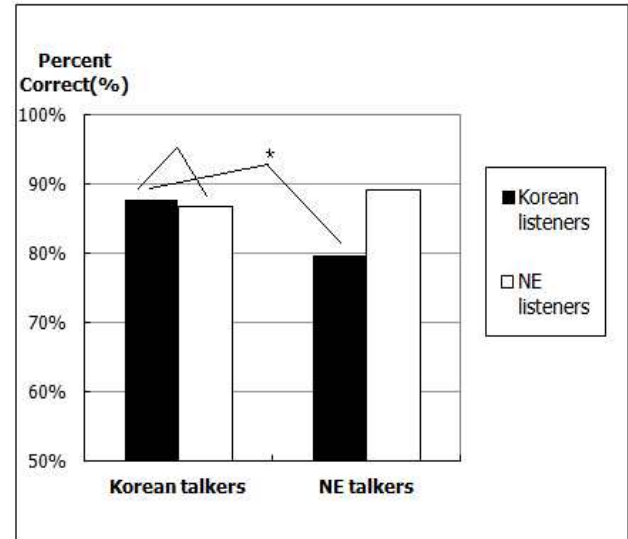


Figure 2. Focus Identification accuracy by native English (NE) and Korean talkers and listeners

variable (Korean talker vs. NE talker; Broad vs. Narrow vs. Contrastive). There were main effects of talker group [$F(1,393)=4.69, p<0.05$] and listener group [$F(1,393)=11.54, p<0.05$], but no main effect of focus type [$F(2,393)=0.35, p=0.70$]. There was a significant interaction between talker and listener group [$F(1,393)=16.46, p<0.05$] and between talker and focus type [$F(2,393)=3.11, p<0.05$]. However, there was no significant interaction between listener and focus type [$F(2,393)=0.15, p=0.86$] and among these three variables, talker * listener * focus type, [$F(2,393)=0.92, p=0.39$].

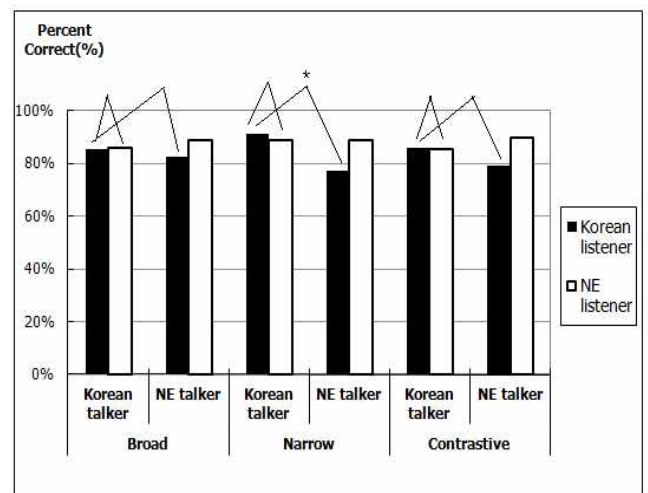


Figure 3. Focus Identification accuracy organized by listener group, talker group and focus type

In order to see if there was any influence of focus types on the ISIB-T and the ISIB-L, simple main effects were carried

out through a Post-hoc Tukey's Studentized Range (HSD) Test. Concerning the effect of the broad focus on the ISIB-T, there was no significant difference of accuracy scores between Korean talkers and NE talkers at the significance level of 0.05 (Compare the results represented by the leftmost black bars too in Figure 3). As for the influence of the broad focus on the ISIB-L, the accuracy scores were not significantly different between Korean listeners and NE listeners at the level of 0.05. You can also compare the leftmost black and white bars in Figure 3. We found that either ISIB-T or ISIB-L did not hold for the broad focus type. To investigate if the narrow focus type influences the ISIB-T, the accuracy scores for Korean talkers were significantly higher than those for NE talkers in the identification of narrow focus at the level of 0.05 (Compare also the two black bars within the Narrow group). This comparison is marked with an asterisk (*). As for the ISIB-L in the narrow focus type, there was no significant difference between Korean listeners and NE listeners at $p=0.05$. We have seen that the ISIB-T held true for narrow focus but that the ISIB-L was not elicited. When we considered the effects of contrastive focus on the ISIB-T, the accuracy scores were not significantly different between Korean talkers and NE talkers for the contrastive focus type as seen from the comparison of the two black bars within the contrastive focus group in Figure 3. As for the ISIB-L for the contrastive focus, Korean listeners were not significantly different from NE listeners in the identification accuracy of contrastive focus sentences. Also compare the left black and white bars within the contrastive group. In other words, contrastive focus did not have any significant influence on either ISIB-T or ISIB-L.

3.3 Listener and talker proficiency

The effects of Korean talkers' and listeners' proficiency on the ISIB have been examined as illustrated in Figure 4. The data were submitted to an ANOVA with listener group as a between-subjects factor (Korean HP talkers vs. Korean LP talkers vs. NE talkers) and with talker group as a within-subject factor (Korean HP listeners vs. Korean LP listeners vs. NE listeners). The results showed that there were main effects of talker [$F(2,396)=8.57, p<0.05$], but there was no main effect of listener [$F(2,396)=2.41, p=0.0913$]. There were, however, main effects of talker and listener interaction [$F(4,396)=4.71, p<0.05$].

In order to see if there were any ISIB effects, individual

group comparisons were executed through a Post-hoc Tukey's Studentized Range (HSD) Test. Concerning effects of non-natives' proficiency on the ISIB-T, Korean HP talkers and NE talkers showed a significant difference to Korean HP listeners (Compare the leftmost black bar with the rightmost black bar in Figure 4), but Korean LP talkers did not show a statistical difference from NE talkers to Korean HP listeners at the significance level of 0.05 as seen from the middle black bar and the rightmost black bar. Furthermore, the accuracy scores for Korean HP talkers were significantly higher than those for NE talkers to Korean LP listeners (Compare the rightmost white bar with the leftmost white bar), but the accuracy scores of Korean LP talkers were not as shown in the comparisons of the middle white bar with the rightmost white bar. These results suggest that the ISIB-T held true only for HP talkers in focus identification and that non-native listeners' proficiency did not play a prominent role in the ISIB-T.

Concerning the effects of non-natives' proficiency on the ISIB-L, the analysis of variance (ANOVA) has already shown that there was no main effect of listener variable. That is, the ISIB-L did not hold true; either Korean HP or LP listeners were not more accurate at identifying focus prominence than NE listeners.

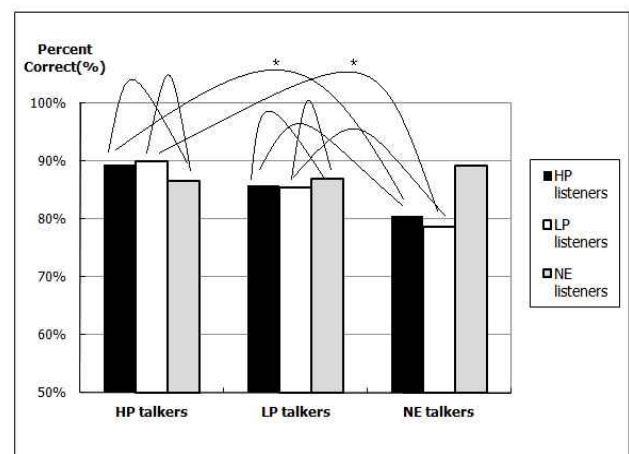


Figure 4. Focus identification accuracy, organized by Korean HP & LP talkers and listeners and NE talkers and listeners

3.4 Focus type and proficiency

Considering the effects of both focus type and talkers' and listener's proficiency together, an analysis of variance (ANOVA) with listener group (three levels: Korean HP, Korean LP and NE) as a between-subjects factor and talker

group and focus type (three levels: Korean HP, Korean LP and NE, three types: Broad, Narrow and Contrastive) as a within-subjects factor revealed a significant main effect of talker group [$F(2,378)=8.64, p<0.05$], but there were no main effects of listener group [$F(2,378)=2.43, p=0.89$] and focus type [$F(2,378)=1.73, p=0.17$]. There were significant interactions between talker and listeners [$F(4, 378)=4.75, p<0.05$] and between talker and focus type [$F(4,378)=2.82, p<0.05$], but not between listener and focus type [$F(4,378)=0.56, p=0.68$] and between all these three variances (talker * listener * focus type) [$F(8,378)=0.52, p<0.83$].

To evaluate the data with respect to the ISIB-T and the ISIB-L, a simple main effects were examined through a Post-hoc Tukey's Studentized Range (HSD) Test. Concerning the ISIB-T for broad focus, either Korean HP and LP talkers did not show a significant difference from NE talkers for either Korean HP or LP listeners at the significance level of 0.05. Compare the NE talker's black bar with the HP talker's and the LP talker's black bars and the NE talker's white bar with the HP talker's and the LP talker's white bars within the Broad focus group in Figure 5. We found that there were no ISIB-T effects when the prominence of broad focus was identified regardless of talkers' and listeners' proficiency.

Concerning the ISIB-T for the narrow focus type, the accuracy scores of both Korean HP and LP talkers are significantly higher to Korean HP listeners than those of NE talkers at the significance level of 0.05. See the black bars comparisons with an asterisk within the Narrow focus type in Figure 5. Moreover, Korean HP and LP talkers showed a significant higher accuracy to Korean LP listeners than NE.

Note that the white bar comparisons are marked with an asterisk in the Narrow focus type. Accordingly, Korean HP and LP talkers' speech of narrow focus was more intelligible to both Korean HP and LP listeners than NE listeners.

As for the ISIB-T for contrastive focus, either Korean HP and LP talkers did not show a significant difference from NE talkers for either Korean HP or LP listeners at the significance level of 0.05. Also compare the NE talker's black bar with the HP talker's and the LP talker's black bars and the NE talker's white bar with the HP talker's and the LP talker's white bars within the Contrastive focus group in Figure 5.

Turning to the ISIB-L, either Korean HP and LP listeners did not show a significant difference from NE listeners for Korean HP talkers' speech or Korean LP talkers' speech in any type of focus. That is, Korean talkers' focus speech was not more intelligible to Korean listeners than NE listeners regardless of talkers' and listeners' proficiency and focus types.

As presented in Figure 5, the accuracy scores were significantly higher for both HP and LP talkers' speech than those of NE talkers to HP listeners in the case of narrow focus. This means that Korean HP and LP talkers were more intelligible than NE talkers to Korean listeners when they produced narrow focus sentences. An ISIB-T held true for both Korean high and low proficiency talkers in narrow focus speech.

4. Discussion

We have investigated separate ISIB-T and ISIB-L effects on

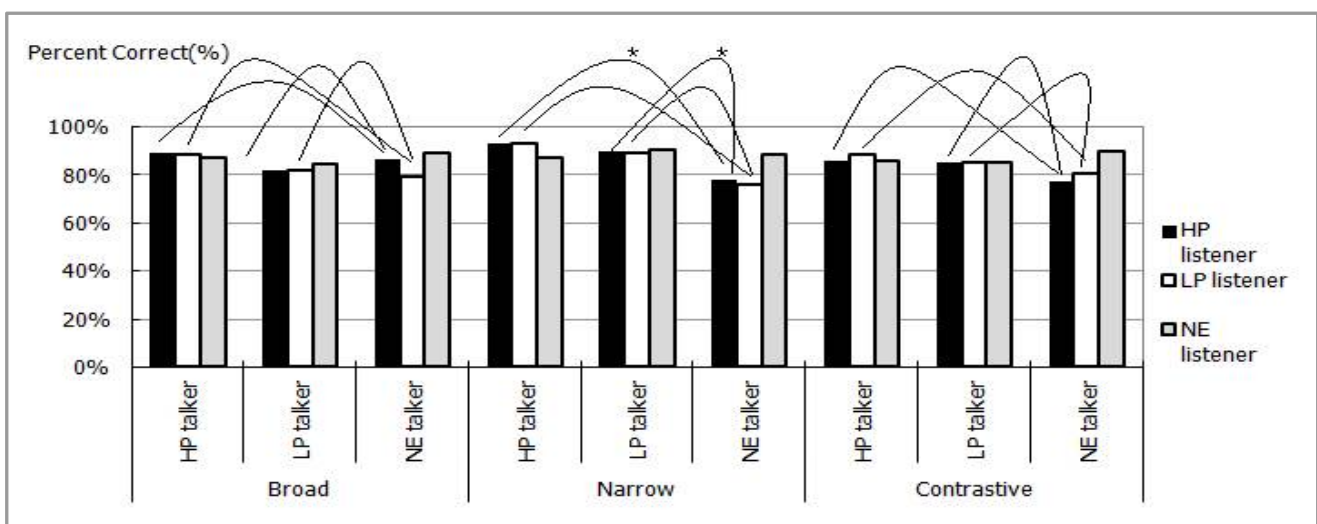
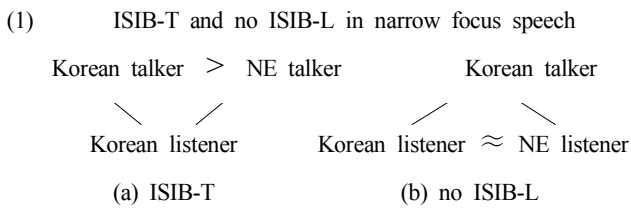
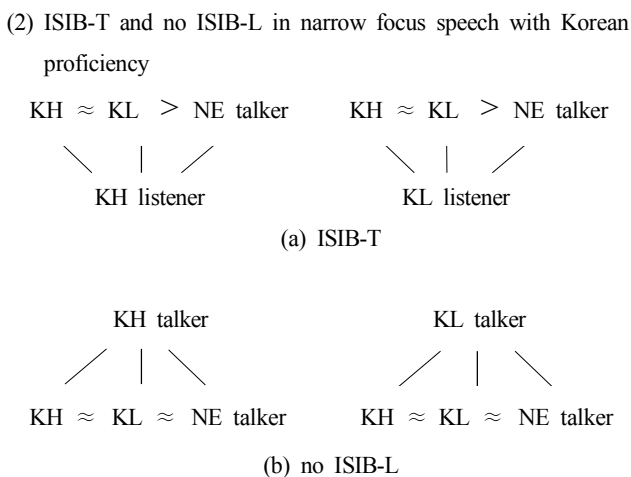


Figure 5. Focus identification accuracy, organized by Korean HP & LP talks and listeners, NE talkers and listeners, and focus types

English focal prominence speech, examining three different focus structures, broad, narrow and contrastive. We found evidence for an ISIB-T merely in narrow focus speech (recall Figure 3), where Korean listeners were more accurate at identifying narrow focus produced by Korean talkers than native talkers as schematically presented in (1). Either ISIB-T or ISIB-L was not found in broad and contrastive focus speech, which indicates that Korean talkers were not more comprehensible than NE talkers (the ISIB-T) to Korean listeners and that listeners did not outperform NE listeners when listening to Korean talkers' speech (the ISIB-L).



When English phonological proficiency of the talkers and listeners was concerned (recall Figure 4), overall the ISIB-T held true only for high proficiency Korean talkers when all the focus types were collapsed together. However, when non-native proficiency was taken into consideration together with the focus types (recall Figure 5), narrow focus speech showed ISIB-T regardless of Korean talkers' and listeners' proficiency as shown in (2). This suggests that Korean high and low proficiency talkers' production of English narrow focus was more intelligible than that of native talkers to both Korean high and low proficiency listeners. The ISIB-T was not yet found in the identification of either broad or contrastive focus.



The ISIB-T pattern has been previously reported by many

studies, for example, Bent & Bradlow (2003), Hayes-Harb et al. (2008), Major et al. (2002), Munro et al. (2006), Smith & Rafiqzad (1979), Smith et al. (2003), van Wijngaarden (2001), and van Wijngaarden et al. (2002), where non-native speech was more intelligible than native speech to non-native listeners.⁸⁾ Their findings were mostly obtained from segmental identifications and attributed to the fact that non-native speech production and perception are both systematically linked to native language sound structure. It was contended that the overall shared phonetic and phonological knowledge between the non-native talkers and listeners from the same language background is likely to be more extensive than non-native/native pair and that it includes higher-level prosodic, morphological, syntactic and semantic structure as well as lower-level segmental category system (Bent & Bradlow, 2003; Hayes-Harb, et al.; 2008). It was not surprising to observe the ISIB-T in the present study as similar finding have been found in many previous studies, but what contributed to Koreans listeners' outperformance of identifying Korean talkers' focal structure over that of native talkers merely in narrow focus speech. It may be attributed to non-native prosodic features in association with focus that non-native talkers and listeners share in their interlanguage. Alternatively or additionally it may be facilitated by higher levels of sentence comprehension where other aspects of linguistic structure come into play because the identification task in the present study was concerned with a whole phrase/sentence as opposed to a local segment. Recent studies on speech intelligibility examined segments elicited from a word or an isolated word where no contextual or higher level cues were available (Hayes-Harb et al., 2008; Smith et al., 2009). Consequently, the subjects were forced to rely merely on phonetic/phonological substances. Even though the identification task in the current study was designed to explore the sole effects of focal prominence on speech intelligibility, the listeners might have possibly used higher-level lexical, syntactic and semantic information other than phonetic/phonological signal. That is, the accumulation of processing at multiple levels may provide many different levels of information such as morphological, syntactic and/or semantic structures as well as phonetic/phonological cues.

Both narrow and contrastive focus types are phonetically

8) Bent & Bradlow (2003), unlike many other studies, applied a less strict definition of the ISIB in such a way that the ISIB occurs when performance by non-native listeners is equal to or exceeds that of native listeners.

associated with pitch prominence in Korean language, while broad focus is not. It is semantically and syntactically explicable in parallel with English broad focus. That is, when a whole phrase or sentence is a scope of focus similarly to the English example presented in (1, c), broad focus applies in Korean too, but it is not substantially realized into pitch prominence unlike English but the pitch pattern of a regular accentual phrase (AP), LHLH or HHLH (the final H is replaced with L when it is phrase final) is realized as in non-focus utterance. Therefore, the interlanguage shared by Korean talkers and listeners may not include a phonetic substance of broad focus. That is, it does not seem to be like an L2 sound which is automatically or spontaneously perceived in a sensory code. It may, therefore, take long to acquire a prosodic and/or phonetic pattern in association with broad focus unless explicitly instructed. Presumably highly proficient or experienced talkers can produce an appropriate or native-like prosodic pattern for broad focus. Lack of support for the ISIB-T or ISIB-L among Korean talkers and learners for broad focus may be attributed to the fact that Korean talkers or listeners have no access to English broad focus in their interlanguage and that failed to produce and perceive focal prominence in broad focus utterances.

Narrow focus, on the other hand, is implemented with a higher pitch on the first syllable of the focused word with its AP pitch frame (LHLH or HHLH - phrase finally LHLL or HHLL) intact. Similarly to English deaccenting, all the words following the focus are dephrased; therefore, the phonetic salience of narrow focus is enhanced by the boosted pitch of the first syllable and dephrasing (Gwak, 2006, Jun, 1990). As presented in (4a), an AP-initial word is narrow-focused. It is realized with its first syllable higher, though not represented here, and the following verb phrase is dephrased, incorporating into the preceding AP.

(4) Korean narrow focus

A: (Eoje)_{AP} (eodi gatsseoyo)_{AP}? 'Wheredidyougoyesterday?
Yesterday where went?

(L HL L)_{AP}
B: (Yonghijip-e gatsseoyo)_{AP}. '(I)wenttoYonghi'shouse.'
Yonghi's house-to went

The narrow focus stimuli used in the present experiment were responses to wh-questions like the Korean example in (4). It should be accessible in Korean talkers and listeners' interlanguage with an aid of lexical information of wh-word, but

it would be presumably differently implemented from that of native talkers due to the common acoustic features that Korean talkers and listeners have as they share the same L1. Therefore, Korean talkers took advantage over NE talkers to Korean listeners, which induced the ISIB-T.

The findings of this study did not provide evidence for an interlanguage speech intelligibility benefit for listeners (the ISIB-L) in narrow focus speech, as it was found that Korean listeners did not outperform native listeners for Korean talkers' speech. This observation is counter to a number of previous reports (e.g., Hayes-harb, 2008; Imai et al., 2005; Munro et al., 2006; Weinreich, 1953). The current study showed that native listeners were as accurate as Korean listeners at identifying the focal prominence irrespective of focus types. In general, NE listeners are likely to have less experience with the cues available in non-native speech, and this might induce the ISIB-L in many studies mentioned above. It has been demonstrated that native listeners improve their perception of non-native speech with experience (Bradlow & Bent, 2008). The NE listeners who participated in our perception task all stayed in Korea longer than a year. They were all instructors in a college, teaching English to Korean college students. Presumably they were very familiar to Korean accented English speech. A comparatively sufficient amount of experience with L2 speech might facilitate NE listeners' access to focus identification in Korean accented speech. Therefore, their accuracy at identifying Korean accented narrow focus speech seemed to be comparable with that of Korean listeners, which did not elicit the ISIB-L.

There was no evidence for the ISIB-T or the ISIB-L in contrastive focus speech. Contrastive focus in Korean is phonetically very similar to narrow focus. The pitch frame of an AP is preserved, and the first syllable of a contrastive focused word is realized in a higher pitch, reducing the phonetic difference between its phonological Low and the following High pitch in LHLH (Gwak, 2006, Jun, 1990). Similar to narrow focus, the lexical items following the contrastive focus are all dephrased, incorporating into the preceding AP as in (5).

(5) Korean contrastive focus

(a) A: sagwa meokeotsseoyo? 'Did you eat an apple?'
apple ate?

(LH L L)_{AP}
B: (Aniyo), (orenji meokeotsseoyo)_{AP}. No, (I)ateanorange'
No, orange ate.

Once contrastive focus is first accessed semantically and syntactically in Korean talkers' and listeners' interlanguage, it may be realized phonetically in the same manner as narrow focus. The ISIB-T would be then expected to occur as in the case of narrow focus. However, our findings did not provide evidence for the ISIB-T in contrastive focus identification. That is, Korean talkers did not take advantage over NE talkers to Korean listeners. There might be a possible explanation for the present lack of support for the ISIB-T. Sentence comprehension requires processing on many different levels. Unlike much previous work on intelligibility of local segments where subjects performed speech perception only by bottom-up processing of the auditory signal (Hayes-Harb et al., 2008; Smith et al., 2009), the current study examines a whole phrase or sentence where top-down processing operates. Due to higher-level lexical, syntactic and semantic structure available to contribute to top-down processing, there might be detrimental effects on lower-level phonological/phonetic outputs if there is any incomplete or inaccurate operational step in the higher level processing. It seemed to be plausible that Korean talkers did not appropriately interpret the semantic structure of contrastive focus utterances. Unlike the narrow focus speech where a lexical access to it was explicitly possible, for example, through a wh-word, the semantic interpretation of contrastive focus seemed to more complicated linguistic process because it is implicitly represented lexically and syntactically. When a higher level semantic access to contrastive focus is not completely executed, it will lead to prosodically unnatural focal structure and finally result in phonetically inauthentic phonetic/acoustic characteristics. It is generally assumed that L2 talkers and listeners use higher level linguistic information and cues and take into consideration of extralinguistic factors better and more frequently as their L2 experience is greater (Hayes-Harb et al. 2008). It was our content that present lack of support of the ISIB-L in contrastive was attributed to Korean talkers' incomplete/incorrect interpretation in higher level semantic processing and that its phonetic implementation was not as intelligible to Korean listeners as in narrow focus. This might degrade Korean listeners' identification. Parallel to lack of the ISIB-T, the ISIB-L was not found either. Korean listeners did not outperform NE listeners when they listened to Korean talkers' contrastive focus sentences.

5. Conclusion

Prosody as opposed to segments has been demonstrated to play a very important role in L2 speech, but there has been relatively little work on L2 speech intelligibility in conjunction with prosody. The current work investigated the interlanguage speech intelligibility benefit (ISIB) of focal prominence for non-native Koreans and English natives in English focus sentences. Korean listeners were more accurate at identifying the focal prominence for Korean talkers' narrow focus speech than that of native talkers, suggesting that the ISIB-T held true for narrow focus regardless of Korean talkers' and listeners' proficiency. However, Korean listeners did not outperform native listeners for Korean talkers' production of narrow focus, which did not support for the ISIB-L. Broad and contrastive focus speech did not provide evidence for either the ISIB-T or ISIB-L. These findings were explained with the interlanguage shared by Korean talkers and listeners where they have established more L1-like common phonetic features and phonological representations. Once semantically and syntactically interpreted in a higher level processing in Korean narrow focus speech, the narrow focus was phonetically realized in a more intelligible way to Korean listeners due to the interlanguage. This may elicit the ISIB. However, Korean talkers did not appear to make a complete semantic/syntactic access to either broad or contrastive focus, which might lead to detrimental effects on lower level phonetic outputs in top-down processing. This is, therefore, attributed to the fact that Korean listeners did not take advantage over native listeners for Korean talkers and vice versa.

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Appendix. Characteristics of the six groups of participants

| | NE listener | NE talker | HP listener | HP talker | LP listener | LP talker |
|-----------------|----------------|--------------|----------------|--------------|----------------|--------------|
| Sex & Number | M9/ F6 | M3/ F3 | M1/ F14 | M3/ F3 | M8/ F7 | M3/ F3 |
| Age | 21.5 | 30.7 | 21.1 | 24.2 | 22.4 | 20.8 |
| LOR | N/A | N/A | 2.2mo | 6.2mo | none | none |
| AOL | N/A | N/A | 10.7 | 11.5 | 10.5 | 10.3 |
| TOEIC | N/A | N/A | 883 | 903 | 562 | 400 |

• LOR (Length of Residence): How long did they stay in an English speaking country?

• AOL (Age of Learning): In what age did they start learning English?