Perception of lexical stress and sentence focus by Korean-speaking and Spanish-speaking L2 learners of English

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ABSTRACT

The current study investigates the extent to which the phonological features of a first language (L1) influence the perception of prominence among students of a second language (L2). Considering that Spanish has word-level stress and phrase-level prominence while Korean has only phrase-level accent, we examined how these cross-linguistic differences in the native language influence the processing of an L2 (here, English) lexical stress and sentence focus. In this study, 32 Spanish learners of English and 38 Korean learners of English completed a lexical stress and a sentence focus oddity test. The results revealed that having lexical stress and phrasal accent in the L1 facilitates the acquisition of L2 prominence, but that differences in how this information is instantiated in the L1 may have a negative effect in its acquisition.

Keywords: second language acquisition, English, Korean, Spanish, phrase-level prominence, lexical stress

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Acquiring a second language (L2) phonology involves not only mastery of the pronunciation of segmental information (e.g., articulation of the consonants and vowels and its acoustic consequences) but also suprasegmental information (e.g., fundamental frequency (F0), duration, intensity). One kind of information that needs to be acquired is *prominence*. Prominence can be expressed as the relative salience of two syllables within a word (word-level prominence or lexical stress), but also as the relative salience of words within phrases (phrase-level prominence). Word-level prominence creates lexical contrasts by means of acoustic cues that are both suprasegmental (F0, duration, intensity) and segmental (vowel reduction) differences (e.g., Fry, 1955). Phrase-level prominence creates context-dependent pitch accents that mark phrasal boundaries with F0 or duration (e.g., Beckman, 1986). However, learning to use (and perceive) prominence in an L2 is not easy for L2 learners, because languages differ in the types of cues that signal prominence.

To process an acoustic signal properly, L2 learners must be able to extract both segmental and suprasegmental information from the speech signal and to use this information in decoding the message conveyed. In this study, we examine the acquisition of English word-level and phrase-level prominence by Korean-speaking and Spanish-speaking L2 learners of English, whose native languages differ in the way in which prominence is cued and used. Based on some cross-linguistic differences between Korean and Spanish that will be discussed in the following sub-sections, the current study aims to investigate the extent to which phonological features in the native language (L1) influence the perception of prominence in an L2, which can also have implications for their ability to produce these same features.

Literature Review

Existing research in the acquisition of prominence in an L2 has primarily focused on the acquisition of word-level stress, with very few studies looking at the influence of L1 on the acquisition of L2 phrase-level prominence (e.g., Nava & Zubizarreta, 2008). These previous studies on word-level prominence have shown that L2 learners' acquisition of lexical stress is strongly influenced by whether (and how) this property is instantiated in their L1, thus supporting the claims of the Stress Parameter Model (SPM; Peperkamp, 2004; Peperkamp & Dupoux, 2002). According to the SPM, the ability to encode word-level prominence in a phonological representation is developed early in life, and typological similarity between the L1 and the L2 may determine whether L2 acquisition of word-level prominence is attainable. According to the authors of the Stress Parameter Model, the stress parameter (i.e., marking whether stress is contrastive in a language) is set during L1 acquisition. For example, if a language exhibits an irregular and contrastive stress pattern (e.g., English), then the children will encode the stress parameter and make use of this information, possibly transferring this knowledge to their L2 acquisition process. However, if a language exhibits stress regularity, such that word stress always falls in word-initial or in word-final position in an utterance (e.g., French), then the stress parameter will not be encoded in children's phonological representations. The failure to encode the stress parameter in L1 causes difficulty in acquiring the L2 stress pattern, which is referred to as "stress deafness" (Dupoux, Pallier, Sebastian, & Mehler, 1997). The predictions of this model, although not specifically stated for phrase-level prominence, can also be extended to this feature. Even though this model has found support in the results of different studies showing how adult learners of languages that make use of word-level stress do not seem to have this feature encoded in their L2 (for a review, see Peperkamp & Dupoux, 2002), the role of age of acquisition (AOA) is still under debate, because some simultaneous bilinguals have been found not to behave like monolinguals

in certain tasks (for example, simultaneous French–English bilinguals did not behave like English monolinguals in a sequence-recall task (e.g., Dupoux, Peperkamp, & Sebastián-Gallés, 2010).

Most of the current research on word-level prominence has focused on the acquisition of either Spanish or English as an L2 by learners of an L1 without this feature. This research has been designed to address the question of whether learners whose L1 does not have word-level prominence can encode stress phonologically and use it for word recognition in their L2. Native French speakers have been consistently studied in the literature because French is a language in which prominence consistently falls on the last syllable of the phrase (e.g., Jun & Fougeron, 2002; Welby, 2006). Considering that word-level prominence does not have any role in distinguishing between segmentally identical competing words in French, native French learners are not expected to be able to use this cue in a L2 with free word-level prominence. Current research has found that, indeed, native French listeners experience difficulty when perceiving word-level prominence in foreign languages (e.g., Dupoux, Peperkamp, & Sebastián-Gallés, 2001) and using it as a cue for word recognition in the L2 (e.g., Dupoux, Sebastián-Gallés, Navarrete, & Peperkamp, 2008; Tremblay, 2008, 2009).

French listeners' difficulty in perceiving stress in nonce words (e.g., Dupoux et al., 2001) has brought to attention the question of whether French-speaking L2 learners of languages such as Spanish and English can use this type of information in lexical access. Dupoux et al. (2008) looked at a group of French-speaking L2 learners of Spanish and a group of native speakers of Spanish in order to discern whether stress would constrain French and Spanish listeners' lexical access. In the study, participants completed a speeded lexical decision task, which included word and nonce word minimal pairs where the nonce words were created by incorrectly stressing the wrong syllable in

Spanish (e.g., *ROpa*, "clothing," vs. **roPA*[1]). The results indicated that, while L2 learners were good at identifying the real words, they were less accurate in identifying incorrectly stressed words as nonce words in Spanish. Similarly, while proficiency was a good predictor of overall accuracy for real words, proficiency did not interact with correct identification of the nonce words as non-Spanish words. That is, French speakers had difficulty encoding Spanish stress independently of their proficiency in Spanish (for similar findings with French Canadian L2 learners of English, see Tremblay, 2008). These results suggest that whether L2 learners' native language utilizes prominence in their L1 as well as lexical information (real vs. nonce words) in the L2, influence acquisition of L2 prominence.

On the basis of these (and other) results, Dupoux and colleagues proposed that native French listeners are "deaf" to stress and that they cannot encode phonetically variable word-level prominence in short-term memory; as a result, they do not use stress in lexical access. Native speakers of a language that does not instantiate word-level prominence have not set the stress parameter to encode stress in their phonological representation of lexical words (e.g., Dupoux, Peperkamp, & Sebastián-Gallés, 2001; Dupoux et al., 2008; Peperkamp & Dupoux, 2002). These findings have since been replicated in other investigations (e.g., Francis et al., 2008; Holt & Lotto, 2006; Zhang & Francis, 2010); which also underscored the importance of surface phonetic details present in learners' L1 (even in learners' L1 dialect) for understanding the processing and acquisition of a new L2 phonological system not only at the segmental level but also in the production and perception of L2 suprasegmental features (e.g., Francis et al., 2008; Francis & Nusbaum, 2002; Holt & Lotto, 2006; Qin, Chien, & Tremblay, 2017; Zhang & Francis, 2010).

[1] In all the examples provided, the capitalized syllable (or word) represents the elements that carry the word-level or phrasal level prominence, in comparison with the other syllables/words.

However, these findings do not make clear how similar L1 and L2 need to be, in terms of how they instantiate word-level prominence. For example, we can imagine two scenarios. On the one hand, we might expect that learners whose L1 does not have lexical stress but who are learning a language that does have it (e.g., L1 Korean–L2 English learners) would struggle when using stress in L2 word recognition. On the other hand, learners whose L1 makes use of word-level prominence but uses different acoustic cues than L2 (e.g., L1 Spanish–L2 English learners) might also struggle because they need to learn to use different cues.

How, then, would those two groups of learners compare in how they process word-level prominence? One possibility is that L2 learners' ability to process word-level prominence would depend on whether they can transfer their knowledge of word-level prominence from L1. In this case, Spanish learners of English would outperform Korean learners of English in processing English lexical stress. Other possibility is that, independently of the properties of its L1, each group would show a similar pattern of results because of the differences in how both L1s and the L2 instantiate word prominence. In order to address this open question, the current study aims to study the perception of word-level prominence in English (which has word-level prominence using both suprasegmental and segmental cues) of native speakers of Korean (which has no word-level prominence) and of native speakers of Spanish (which has word-level prominence, but only instantiated with suprasegmental cues).

Moreover, it is still open to debate whether the predictions of the Stress Parameter Model would also apply to phrase-level prominence or whether their predictions are only limited to word-level prominence and L2 word recognition. Ortega-Llebaria and Colantoni (2014) shed some light on this issue. In two experiments, the authors targeted sentential stress as perceived and produced by Mandarin-speaking and Spanish-speaking L2 learners of English and by a control group of

native English speakers. In their study, the experiment was designed to test L2 learners' production and perception of English sentence focus depending on the availability of contextual information. For the context-available condition, participants were provided with a story and then were then asked to produce or perceive sentences that with variably placed contrastive sentence prominence, which could fall on the subject, on the verb, or on the verb complement (either an Object or a Prepositional Phrase). For the decontextualized condition, participants were provided with isolated sentences and then asked to imitate the sentences in the production. In the perception task, they were asked to decide which of three low-pass filtered sentences matched another sentence in the F0 contour. While Spanish uses word order to express sentence prominence, F0 is used to express sentential focus in Mandarin Chinese and English. Due to these cross-linguistic differences, it was predicted that Spanish learners would exhibit greater difficulty in producing and perceiving English sentential focus than Mandarin learners of English.

The results showed that, for the perception tests, Mandarin speakers and native speakers were indistinguishable, while Spanish-speaking learners were statistically less accurate than the other two groups. In production, both groups of learners were different from the control group, but the pattern of the Mandarin-speaking group was more similar to the control group than that of the Spanish-speaking learners. These results were taken to suggest clear evidence of L1 transfer. In particular, a specific pattern emerged in the Spanish-speaking learners' data that suggested transfer: They were more accurate in the perception of sentential stress in object position, which is also the most prominent prosodic element in the native language. These findings led researchers to propose that native speakers of Spanish were more likely to follow syntactic over prosodic means to mark sentence focus in English as they do in Spanish (Nava & Zubizarreta, 2009; Zubizarreta & Nava, 2011).

However, a limitation of Ortega-Llebaria and Colantoni (2014)'s study is that the two groups of learners, albeit highly advanced, differed in their experience with the target language. Even though the results indicated an advantage of the Mandarin-speaking L2 learners of English—which is attributed to the fact that English and Mandarin are more similar to each other with regards to phrase-level prominence—the Spanish-speaking learners had more experience with English than did the Mandarin learners. Thus, this discrepancy between the groups prevents direct comparisons between the two L2 groups in this experiment. These results then, as well as others (Nava and Zubizarreta, 2009; Zubizarreta and Nava, 2011), suggest that, in spite of the typological similarities between English and Spanish, some aspects of sentence prosody are not mastered even by advanced Spanish-speaking English learners.

The study of the acquisition of phrase-level prominence by learners of typologically different languages is also quite limited. One of the most illustrative studies examined the acquisition of English by Mandarin- and Korean-speaking L2 learners (McGory, 1997), by comparing how these learners produced word-level prominence in sentential contexts where the words were produced with sentence focus, before sentence focus, and after sentence focus. The results of this study showed that participants had difficulties with the production of prominence. On the one hand, Mandarin learners tended to assign equal prominence to all words in the sentence, while Korean learners, even at the earliest stages of acquisition, transferred their native accentual phrase pattern (discussed in the following sub-section) to their production of focus in English. These results have then been replicated in other production studies (e.g., Guion, 2005; Ueyama & Jun, 1996). However, these studies focused on the L2 production of phrase-level prominence by Korean-speaking learners of English, leaving open the questions of what happens with perception and how the properties of the native language influence this specific group of learners.

The current study aims to fill in existing gaps in the literature by exploring the roles of L1–L2 typological similarity and of L2 proficiency in the perception of word-level and phrase-level prominence by Korean-speaking and Spanish-speaking learners of English. More specifically, this study aims to explore both the way in which differences in how prominence is expressed in the L1 affects the acquisition of this feature in the L2, and also how this effect may be modulated by L2 proficiency. In order to improve understanding of the aims and predictions that this study makes, the next section will provide an overview of the most relevant features associated with word-level and phrasal prominence in the three languages included in this study.

Word-Level and Phrase-Level Prominence in English, Korean, and Spanish

In terms of word-level prominence, English has free lexical stress (i.e., the prominence within a word can be assigned to any syllable within the word). Moreover, in English stress is cued using both segmental and suprasegmental correlates, such that stressed syllables contain a full vowel and tend to have higher F0 (in pitch-accented words), longer duration, and higher intensity (e.g., Beckman, 1986; Lieberman, 1960), while unstressed syllables tend to contain a reduced vowel quality and have lower F0, shorter duration, and lower intensity than stressed syllables (e.g., Gay, 1978; Lindblom, 1963).

With respect to phrase-level prominence, English exploits F0 and duration cues in a flexible manner (e.g. Jackendoff, 1972; Reinhart, 2006). It exploits its prominence flexibility to align the focused (i.e. non-presupposed or asserted) part of the sentence with the nucleus of the phrasal-prominence (e.g. Jackendoff, 1972; Reinhart, 2006). In English, the location of the prominence seems to be governed by the Nuclear Stress Rule (Chomsky & Halle, 1968), by means of which the focused constituents must contain the rhythmically most prominent word. Thus, in a wide focus example (also referred to as an “unmarked” stress pattern) like (1b), where the entire sentence is focused, the nuclear stress

falls on the rightmost constituent (i.e., the direct object). This stress pattern can only identify the entire sentence as the focused constituent (wide focus), as well as varying degrees of narrow focus (e.g., the verb phrase), if this element is part of the focused constituent. Thus, (1b) is felicitous as an answer to a question such as (1a) (wide focus) as well as an answer to a question like "What did the boy do?" (narrow verb phrase focus) or "What did the boy break?" (narrow direct object). When the focus is narrowed down to a subpart of the sentence that does not contain the unmarked nuclear stress, for example, the subject as in (2b), the rhythmically most prominent stress must shift to this element. Such a sentence is felicitous only as an answer to a question such as (2a) (Zubizarreta, 1998).

Prominence is also used to distinguish in wide focus contexts between categorical statements, which articulate the clause as a topic and the comment predicated of the topic, and thetic statements, which are eventive, topicless clauses, by placing the prominence on the verb in the first case and on the subject in the second case (Sasse, 1987).

(1) a. What happened? b. A boy broke his LEG. (wide focus)

(2) a. Who broke his leg? b. A BOY broke his leg. (narrow focus)

(Zubizarreta and Nava, 2011)

Korean and Spanish show interesting differences in the way in which they instantiate (or not) word-level and phrase-level prominence, making then, thus, interesting cases for comparing how native speakers of these languages perceive these two features in L2 English.

Korean does not have lexical stress (e.g., Lee, 2015), but it has a long and short vowel distinction in the first syllable of certain words (e.g., *sa:.kwa* 'apology' vs. *sa.kwa* 'apple'; Heo, 1965). While this feature is not directly associated with lexical stress, it might help Korean learners of English to be sensitive to lexical stress, because, in English, duration is used as a cue for stress.

However, this feature has undergone a diachronic change and is now mostly lost among younger speakers of Korean (e.g., Kim, 2001; Lee, 2015; Magen & Blumstein, 1993; Kang et al., 2015) except Chonnam (Ko, 2013) and North Kyungsang dialects (Kenstowicz & Park, 2006). Current research exploring the existence of word-level prominence in Seoul Korean further supports the notion that Seoul Korean (the dialect included in this study) has lost any feature that could be associated with word-level prominence (e.g., Ko, 2013; Lee, 2015), and speakers across many generations do not have vowel length contrasts (Kang et al., 2015).

Interestingly, Korean uses phrase-level prominence, also known as Accentual Phrase (AP) cued primarily by F0 in marking a phrasal boundary (e.g., Jun, 1993). Jun (1993; 1998) proposed in her Accentual Phrase (AP) theory that Korean has intonationally defined units (APs) that pattern independently from word-level prosody. In the Korean AP system, each syllable is assigned either a low or a high tone. The initial boundary of the prosodic domain is always delimited with a low tone when the initial segment is a lenis consonant. When the initial segment is either an aspirated or fortis consonant, the initial tone is boosted up to a high tone.[2] The AP boundary tone is always a low tone; thus, an AP with four syllables creates a #LHLH# pitch pattern (or ##HHLH#; # refers to an AP boundary). When there are fewer than four syllables in one AP domain, the initial two tones are undershot, resulting in a #LH# (or #HH#) or #LHH# (or #HHH) pitch pattern (Jun, 1993; 1998). When a prosodic boundary of a larger unit than AP – an Intonational Phrase (IP, that is, a stretch or chunk of spoken material that has its own intonation pattern) –coincides with the edge of the smaller unit, the IP boundary tone overrides the AP boundary tone, resulting in L%, H%, LH%, and HL% pitch patterns (% refers to an IP boundary). At the IP-boundary, final lengthening also occurs

[2] Korean has three-way contrasts in obstruents, which are known as aspirated, lenis, and fortis. Aspirated stops have longer VOT with high F0; lenis stops have longer VOT and lower F0; and fortis stops have short VOT with high F0.

along with the IP-boundary tone; therefore, both a low boundary tone and a lengthened duration of the final syllable can cue an IP final boundary.

The Accentual Phrase in Korean also interacts with phrasal-prominence. Focused elements tend to have longer duration (Cho et al., 2011; Jun & Lee, 1998), greater intensity values (Cho et al., 2011; Lee & Xu, 2010), and a higher F0 peak (Chung & Kenstowicz, 1997; Jun & Kim, 2007; Lee & Xu, 2010) than unfocused elements. Example sentences of neutral and narrow focus in Korean are illustrated in (3) and (4).

(3) Neutral focus

a. hjoli-nɨn ʌntʃena, [IP pʰatʃʌn-hako kʰolla-lɨl mʌk-ni]?
Hyori-Top. always pancake-and coke-Acc. eat-Q
''Does Hyori always eat pajun and coke?'

b. ani, hjoli-nɨn ʌntʃena, [IP pʰatʃʌn-hako **sul**-ɨl mʌkʌ].
No, Hyori-Top. always pancake-and wine-Acc. eat
*''No, Hyori always eats pajun (pancake) and **WINE**.''*

(4) Narrow focus

a. hjoli-nɨn ʌntʃena, [IP tʃʰikhin-hako sul-ɨl mʌk -ni]?
Hyori-Top. always chicken-and wine-Acc. eat-Q ''
Does Hyori always eat chicken and wine?''

b.: ani, hjoli- nɨn ʌntʃena, [IP **pʰatʃʌn**-hako sul-ɨl mʌkʌ].
Hyori-Top. always pancake-and wine-Acc. eat ''
*Hyori always eats **PAJUN (pancake)** and wine.''* (Cho et al., 2011)

As for Spanish, like English, it shows free lexical stress; however, it employs only suprasegmental cues to mark the position of stressed syllables; it does not use vowel reduction. Spanish word-level stress is cued by means of three acoustic parameters: Fundamental frequency (F0) as the primary stress cue, and duration and intensity as secondary cues (e.g., Llisterri, Machuca, de la Mota, Riera, & Ríos, 2002a, 2002b, 2003). In Spanish, stress placement can be predicted by abstract, complex stress assignment rules (Harris, 1969): For nouns, the rule states that stress falls on the last

syllable if it ends with a consonant other than [n] or [s], and otherwise on the penultimate syllable (Harris, 1969).

Similarly to English, Spanish also has phrase-level prominence expressed with F0 and duration. However, while English (or more generally Germanic languages) allows for sentence internal phrase-level prominence, Spanish (or more generally Romance languages) only allows for this feature to be instantiated in sentence final position (e.g. Ladd, 1980, 2008; Zubizarreta, 1998). In Spanish, main phrasal prominence aligns with the last word of the Intonational Phrase (IntP) in wide-focus contexts (e.g., Zubizarreta, 1998; Sosa, 1999).[3] In Spanish, then, if the word order is verb-subject, prominence falls on the subject, and if the word order is subject-verb, prominence falls in the verb, as seen in examples (5) and (6). If a different element in the phrase needs to be emphasized, Spanish requires a word order change, possibly thanks to the relatively free word order (with preverbal and postverbal subjects) that Spanish exhibits (Sosa, 1999; Zubizarreta, 1998).

(5) a. ¿Qué pasó con tu amigo?	b. Mi amigo LLEGÓ.	(wide focus)
'what (It)happen-past with your friend	*my friend arrive-past*	
a. What happened with your friend?	*b. My friend ARRIVED.*	
(6) a. ¿Quién llegó?	b. Llegó mi AMIGO.	(narrow focus)
'who arrive-past	*arrive-past my friend*	
a. Who arrived?	*b. My FRIEND arrived.*	

(Zubizarreta and Nava, 2011)

The unique features marking word-level and phrase-level prominence in English make it, an ideal language for examining whether L2 learners' ability to acquire these features is contingent on the types of cues that signal prominence in learners' native language. Moreover, the cross-linguistic differences between Korean and Spanish provide us with an ideal scenario to explore the role of

[3] This is not true of emphatic or contrastive stress, which can even target a subpart of a word.

typological differences between the L1 and the L2, the role of the existing differences in the way of expressing prominence in the L1, the role of L2 proficiency, as well as the possibility of studying whether the predictions of the Stress Parameter Model can be extended to phrase-level prominence as well as to word-level prominence. Thus, the primary goal of the current study is to examine whether Spanish-speaking L2 learners of English, whose L1 carries word-level and phrase-level prominence, process English lexical stress in a way that is more similar to that of native speakers of English and more accurately than that of Korean L2 learners of English, whose L1 does not employ these cues. We also examine whether having prosodic differences in phrase-level prominence in the L1 vs the L2 will affect the perception of English sentence focus for Spanish vs. Korean L2 learners of English.

Methods

Subjects

Thirty-two Spanish L2 learners of English (25 females, mean age = 25.4 (*SD* = 6.1)) and 38 Korean L2 learners of English (18 females, mean age = 28.2 (*SD* = 6.1) completed a lexical stress oddity test and a sentence focus oddity test implemented in *Praat* (Boersma, 2001). All Korean subjects were native speakers of Seoul Korean. The mean age of acquisition (AOA) was 9.25 (*SD* = 2.68) years old for the Spanish learners and 9.36 (*SD* = 3.00) for the Korean learners. Five of the Korean-speaking learners had experience staying in an English-speaking country for a residency whose length did not exceed more than 6 months. Among the Spanish learners, 22 had experience staying in an English-speaking country, and the mean length of residency was 25.22 months (*SD* = 49.6). All subjects took the Michigan test (Upshur, Spaan, & Thrasher, 1972), which is an L2 proficiency test assessing participants' listening, reading, and grammatical knowledge in their L2 English. The result of a Wilcoxon Ranking test did not reveal a significant difference between these two groups ($p > .05$). The mean score in the Michigan test for the Spanish group was 31.05 out of 45

(*SD* = 9.81), and the mean score for Korean group was 31.5 (*SD* = 5.53). None of the subjects reported any hearing or visual disorders.

Stimuli.

The stimuli for the stress oddity test consisted of 69 pairs of disyllabic stress pairs (e.g., *CONtract-conTRACT*), among which 10 pairs were chosen from Cutler (1984) and 59 pairs were selected from an English dictionary (See Appendix A). Two native speakers of Southern British English (SBE), one male and one female, recorded the stimuli for both oddity tests. The female speaker was 32 years old, and the male speaker was 35 years old at the time of the recording. In order to prompt the intended stress pattern, the speakers were asked to produce the words in terms of the grammatical category (verb or noun) of the given words on the screen (e.g., the noun *compact* ['kɑ:mpækt] vs. the verb *compact* [kəm'pækt]). The speakers produced the recordings with two repetitions in a randomized order. After completing the recording, the most clear and unambiguous stress patterns of the two repetitions were chosen by a trained phonetician for the stress oddity perception test. In doing so, the two other native English speakers with expertise in phonetics auditorily checked whether the recorded stimuli were produced with the correct stress patterns. One phonetician was a native speaker of SBE, and the other was a native speaker of American English (AE) who had lived in UK for more than 15 years. Then, we manually checked F0 differences between the first and second syllables of the stress pairs through *Praat*. Through this procedure, we chose a total of 44 stimuli tokens (13 tokens produced by a male speaker, 31 tokens produced by a female speaker) wherein the stress pattern was expressed the most prominently. These stimuli were then used to construct 36 trials, where three tokens were presented together as the combination of AAB, ABA, BAA, BBA, BAB, and ABB (A=first syllable stressed words, B=second syllable stressed words). The tokens used to construct each trial were randomly chosen, but the three tokens grouped together for each trial were always produced by the same speaker (See Appendix B).

For the sentence focus recognition test, the same L1 native speakers of SBE also produced 61 Bamford-Kowal-Bench (BKB; Bench, Kowal, & Bamford, 1979) sentences (See Appendix C). These sentences were elicited to have the sentence focus either on the first NP (e.g., *THE HOUSE had nine rooms*) or the last NP (e.g., *the house had nine ROOMS*) by answering prompted questions (e.g., *What has nine rooms?* vs. *What did the house have?*). After recording, a trained phonetician manually checked each sentence to pick the clearest examples of focus. Then, two native listeners of English with expertise in phonetics also checked whether the chosen recordings were produced with the proper sentence focus. After this procedure, 45 recordings (22 recordings produced by a female speaker, 23 recordings produced by a male speaker) were chosen for the experiment stimuli. These recordings were then used to construct the 36 trials, wherein three tokens were grouped together for each trial. Two tokens for each trial had the same sentence focus, either on the first NP or on the last NP. The tokens constructed for each trial were randomly chosen, but the three tokens grouped together for each trial were produced by the same speaker (See Appendix D).

Procedure

The subjects participated in three tasks during the experimental session. First, for the stress oddity test, the listeners heard three lexically different words consecutively and then were instructed to click on the button marked "1," "2," or "3" that was presented on a computer monitor. Each number corresponded to the order of the word they were presented with auditorily. For example, the subjects heard "COMpact-inCITE-TRUsty" and then had to choose the word that had the different stress pattern ("inCITE") by clicking "2" on the screen. The inter-stimulus interval was 500 ms. The subjects were allowed to listen to the stimuli up to three times before they made the final decision, and no feedback was given during the task. During this task, a total of 108 stimuli tokens (36 trials x 3 words) were played during this task (See Appendix B for the words used for the stress oddity test).

For the sentence focus oddity test, the same participants heard three different sentences during each trial and then were asked to choose which one had a different intonation pattern from the other two by clicking on the associated number on the screen. For example, the subjects heard "a cat sits on THE BED—THE HOUSE has a nice garden—THE LORRY carried fruit" and then had to choose the sentence that had the different sentence focus ("a cat sits on THE BED") by clicking "1" on the screen. The subjects were allowed to repeat the stimuli up to three times before making the final decision. A total of 108 stimuli tokens (36 trials x 3 sentences) were presented in a randomized order during this test. The order of these two tasks was counterbalanced among the subjects.

After completing both tasks, the subjects also took the University of Michigan Listening Comprehension Test (1972) to measure their English proficiency, as implemented in Paradigm (Perception Research System). The Michigan test is a standardized English proficiency test in which participants hear a sentence auditorily and choose the only grammatically possible answer among three candidates by clicking the computer screen. For example, the subjects first heard a sentence such as "When are you going?" and then had to choose the possible response among three candidates (1. "I am," 2. "Tomorrow," 3. "At home"). The question prompts could be either declarative or interrogative statements. A total of 45 questions were presented and a short practice session was provided before beginning the test. The questions targeted English grammar; however, since the task was an off-line computer task based on an auditory test, the listeners' respective vocabulary size as well as their respective listening comprehension skills were also indirectly assessed.

Analysis

A logistic mixed-effect model was run using the *lme4* package (Bates, Maechler, Bolker, & Walker, 2015) in *R* (R Development Core Team, 2008). The model analysed Accuracy (1 = "correct," 0 = "incorrect") as the dependent variable, with Test (Lexical stress vs. Sentence focus), Group

(Spanish vs. Korean), and Proficiency (1–45) as independent variables. Subject and Trial were included as random effects. The Korean group was used as a baseline against the performance of Spanish learners, since comparing Korean learners' English performance to that of Spanish learners would allow us to see whether having lexical stress in one's native language would be a benefit when learning L2 lexical stress. Thus, the baseline in the model was the Korean learners' performance on the sentence focus oddity test. On the lexical stress and sentence focus oddity tests, the chance level performance was 33%, as the participants chose one answer from three candidates. A series of fitted mixed-effects regression models were tested in a stepwise analysis and the *anova* function was used to compare which model best fit the data.

Results

Results showed a main effect of Test ($\chi^2(1) = 11.88$, $p < .001$), indicating that listeners identified lexical stress more accurately than sentence focus. The mean accuracy for the lexical stress oddity task was 49% (*SD* = 16.3%), and the mean accuracy for the sentence focus oddity test was 38.1% (*SD* = 11.2%). A main effect of Proficiency was also found ($\chi^2(1) = 14.08$, $p < .001$), indicating that listeners performed better in both tests with increasing proficiency. A significant interaction between Test and Group was observed ($\chi^2(1) = 27.68$, $p < .001$), indicating that Spanish listeners were better at recognizing lexical stress than Korean listeners, whereas Korean listeners were better at recognizing sentence focus than Spanish listeners. For Spanish learners, the mean accuracy for the lexical stress oddity task was 61% (*SD* = 21%) and 38% for the sentence focus oddity test. For the Korean learners, the mean accuracy for the lexical stress oddity test was 56% (*SD* = 15%) and 47% (*SD* = 23%) for the sentence focus oddity test. Figure 1 represents the accuracy difference of the two oddity tests for the Spanish-speaking and Korean-speaking learners, respectively. Table 1 presents the results of the logistic regression.

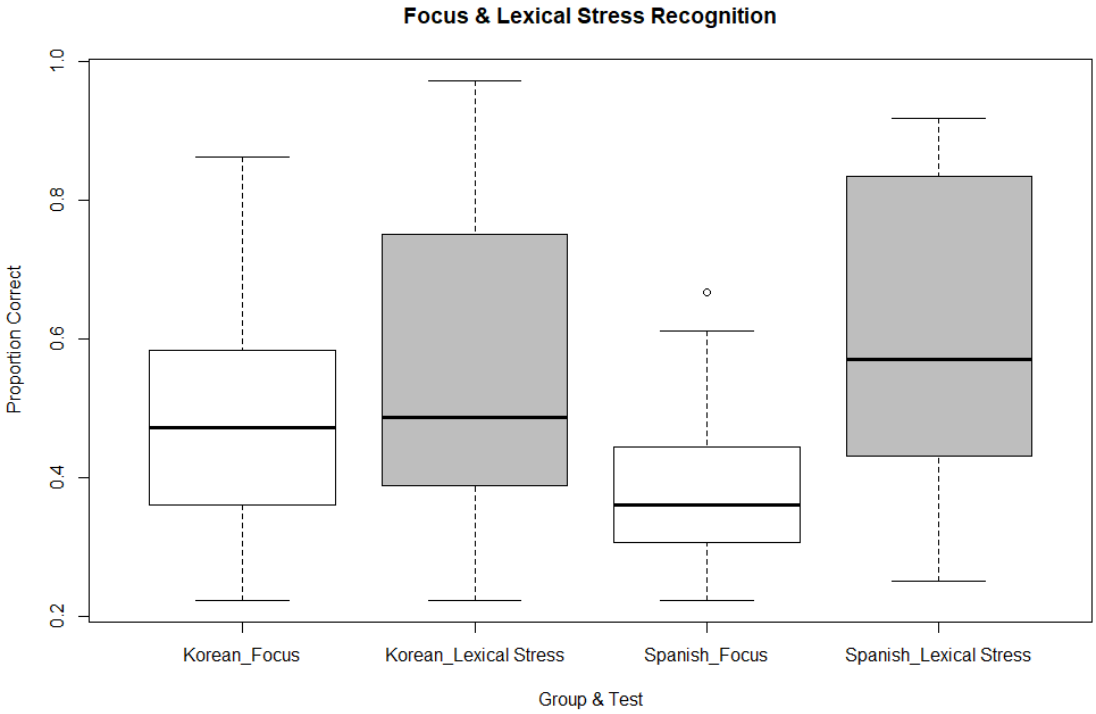

Figure 1. Recognition accuracy of sentence focus (white box) and word-level stress (grey box) of the two speaker groups (Left: Korean learners, Right: Spanish learners).

Table 1. *Summary of results of the optimal model from the logistic regression*

Variable	Estimate (SE)	*z*	*p*
(Intercept)	-1.03 (0.40)	-2.59	= .01
Stress	0.39 (0.16)	2.39	= .02
L1_Spanish	-0.47 (0.19)	-2.48	= .13
Michigan	1.38 (0.52)	2.67	= .007
Stress : L1_Spanish	0.67 (0.13)	5.31	< .01

Discussion

The current study examined how the phonological features found in learners' native language influence the perception of L2 prominence (at the word- and phrase-level). Specifically, this study examined and compared how Spanish-speaking L2 learners of English and Korean-speaking L2 learners of English process English lexical stress and sentence focus. Three major findings were obtained in this study.

First, the results revealed that L1 phonological features facilitate the acquisition of L2 prominence. Spanish learners of English showed a higher accuracy on the stress oddity test than Korean learners. This is in line with the predictions made by the Stress Parameter Model, suggesting that having lexical stress in the L1 (here, Spanish) facilitates the acquisition of L2 word-level prominence even when different acoustic cues are used in L1 and L2. These results, then, indicate that learners whose L1 makes use of word-level prominence but uses different acoustic cues (e.g., L1 Spanish-L2 English learners) can still process this feature. That is, a perfect match between the cue-weighting of the L1 and the L2 is not necessary for successful perception of stress syllables when the L1 also instantiates this acoustic feature.

However, not all results reported in this study were in line with the predictions of the Stress Parameter Model (Peperkamp, 2004; Peperkamp & Dupoux, 2002). One of the most important findings of this study was that Korean-speaking L2 learners of English were able to make use of English stress patterns (with results clearly above chance level at 33%), even when this specific feature of lexical stress is not implemented in their native language. Previous studies also showed evidence that Korean learners of English can acquire English stress in their perception (Han, Hwang, & Choi, 2011; Lee, Guion, & Harada, 2006; Lee, 2015). Thus, the results of this study support a scenario in which the properties of the native language influence yet do not limit the acquisition of

L2 word-level stress. That is, the properties of the native language's phonological features cannot be considered to be the only factors that determine the learnability of L2 lexical stress.

Similar results have been reported in the literature (e.g., Lee et al., 2006; Qin et al., 2017). For example, Lee et al. (2006) examined the production of English lexical stress in a participant sample including native Japanese-speaking and native Korean-speaking L2 learners of English divided by age of acquisition—i.e., by whether an L2 learner was an early bilingual learner or a late bilingual learner. The mean ages for the Japanese-speaking learners were 21 years old (*SD* = 9) for the early bilingual group and 23 (*SD* = 6.5) for the late bilingual group. The mean ages for the Korean-speaking learners were 19 years old (*SD* = 1.3) for the early bilingual group and 21 (*SD* = 9.8) for the late bilingual group. Since none of these two learner groups had lexical stress in their native language, none of the learner groups should be able to acquire word-level stress, as predicted by the SPM. The results showed that not only age of acquisition but also the presence of the phonetic feature in the L1 strongly influences the acquisition of L2 word-level stress. Lee et al. (2006) showed that Japanese learners (independently of age of acquisition) could make use of duration cues in a native-like way, whereas Korean learners (independently of age of acquisition) did not show the same pattern. In addition, the results of F0 showed that all learners were able to use F0 correlates in implementing stress.

In order to understand the results of Lee et al. (2006), two properties of Japanese and Korean need to be considered. On the one hand, Japanese is a mora-timed language in which each mora is assigned a high or a low pitch to signal pitch accent (Sugito, 1980). Japanese also uses duration correlates to express lexical contrasts in consonants (e.g., "tanin" (stranger) – "tannin" (person in charge)), as well as in vowels (e.g., "biru" (beer) – "biiru" (building)). On the other hand, most dialects in contemporary Korean do not have a vowel length contrast but use F0 as a cue to mark

accent on an accentual phrase (Jun, 1996). Thus, it seems that L2 learners can transfer the use of a suprasegmental cue from a different phonological category to word-level stress in the L2.

Focusing specifically on the pattern exhibited by the Korean learners, the results of this previous study seem to suggest that L2 learners whose L1 does not have word-level stress (Korean) can transfer the use of a suprasegmental cue from a different phonological category (AP boundary) to word-level stress in their L2 English. Since Korean dominantly uses F0 cues to mark the phrasal boundary in the AP domain, Korean listeners may be sensitive to the overall use of F0 and can, potentially, transfer this knowledge to the perception of word-level prominence in L2 English. The results of the current study further support this hypothesis, showing that Korean learners were able to acquire word-level stress in L2 English even when their native language does not make use of this phonological feature. Although it is not clear in this experiment which acoustic cues were used by Korean learners in identifying the stress pattern, we can speculate that Korean learners might have been able to use F0 cues when completing the lexical stress oddity test, as demonstrated in Lee et al. (2006).

A similar pattern was also found in the sentence focus identification task, but in the opposite direction. The present study found that both groups performed above chance level (33%). However, Korean-speaking L2 learners of English outperformed the Spanish-speaking group in the sentence focus oddity test (47% vs. 38% accuracy, respectively). These results seem to suggest that having a specific cue in the native language facilitates or hinders the acquisition of L2 prominence at the phrasal level. As described in the introduction section, while Korean marks AP boundaries with F0 (Jun, 1993), Spanish shows a more restricted phrase-level prominence by syntactically (rather than phonologically) marking the focused elements (e.g., Zubizarreta, 1998; Sosa, 1999). This cross-linguistic difference between Spanish and Korean might have contributed to the difference reported between Korean- and Spanish-speaking learners in the sentence focus oddity test.

Since Korean dominantly uses F0 cues to mark the phrasal boundary in the AP domain, Korean listeners may be more sensitive to the use of F0 than Spanish learners in perceiving phrase-level prominence in their L2 English. Previous studies on the perception of English phrase-level prominence have suggested that Spanish-speaking learners show a preference for the use of syntactic over prosodic means to mark sentence focus, even when processing the L2 (Nava & Zubizarreta, 2009; Zubizarreta & Nava, 2011). We also found that, even though Spanish and English both have phrase-level prominence, the two languages differ in how this feature is instantiated (Zubizarreta, 1998), and thus an L1-specific feature in phrasal phonology has a negative impact on the way in which Spanish-speaking learners of English perceive phrase-level prominence in their L2. Once again, Korean-speaking learners, on the other hand, seem to be able to transfer their knowledge of how F0 marks AP boundaries in Korean to the processing of phrase-level prominence in L2 English, thus explaining their better results in this task.

Finally, in the present study, L2 proficiency did not seem to play an important role, considering the lack of an interaction between proficiency and the results of the two main tests conducted and analysed. These findings may suggest that the effects of the L1 acoustic properties on L2 speech perception exist across proficiency levels and survive even at advanced levels. While L2 proficiency could have been proposed as an explanation for our results, considering both the large range of proficiencies included in the study and also the lack of a proficiency effect, this possibility seems unlikely, although it should be further explored in future studies. Alternatively, the proficiency test used in the current study to specify the proficiency of the participants (the Michigan test) may not have been an adequate measure of aural proficiency. Future studies should examine the extent to which native-like perception of L2 prominence is indeed acquirable for Korean- and Spanish-speaking L2 learners whose proficiency is assessed with other proficiency measures.

WORD COUNT (Body, Tables, Figures, References): 8,311

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Appendix A: English words used in the production of word-level stress oddity test

1. ABstract/abSTRACT
2. Abuse/aBUSE
3. Address/aDDRESS
4. Ally/aLLY
5. Attribute/aTTRIbute
6. COMbine/comBINE
7. COMpact/comPACT
8. CONcert/conCERT
9. CONduct/conDUCT
10. CONfines/conFINES
11. CONflict/conFLICT
12. CONscript/conSCRIPT
13. CONsole/conSOLE
14. CONsort/conSORT
15. CONstruct/conSTRUCT
16. CONtest/conTEST
17. CONtract/conTRACT
18. CONvert/conVERT
19. DEsert/deSERT
20. Digest/diGEST
21. Discard/diSCARD
22. DIScount/disCOUNT
23. EXploit/exPLOIT
24. EXtract/exTRACT
25. FORbear/forBEAR
26. FOREarm/foreARM
27. GOAty/goaTEE
28. IMpact/imPACT
29. Implant/imPACT
30. IMport/imPORT
31. IMpress/imPRESS
32. INcense/inCENSE
33. INcline/inCLINE
34. INcrease/inCREASE
35. INsert/inSERT
36. INsult/inSULT
37. INsight/inCITE
38. INtercept/interCEPT
39. Interchange/interCHANGE
40. INtrigue/inTRIGUE
41. Invite/inVITE
42. Object/obJECT
43. OVERlay/overLAY
44. PERmit/perMIT
45. PREsent/preSENT
46. PROceeds/proCEEDS
47. PROgress/proGRESS
48. PROtest/proTEST
49. REbel/reBEL
50. REcap/reCAP
51. REcess/reCESS
52. REcord/reCORD
53. REfund/reFUND
54. REject/reJECT
55. RElay/reLAY
56. REmake/reMAKE
57. REsearch/reSEARCH
58. REtail/reTAIL
59. SUBject/subJECT
60. SUSpect/susPECT
61. TRANsfer/transFER
62. TRANsform/transFORM
63. TRANsplant/tranSPLANT
64. TRANsport/tranSPORT
65. TRANspose/tranSPOSE
66. TRUsty/trusTEE
67. UNDERground/underGROUND
68. UPlift/upLIFT
69. UPset/upSET

Appendix B: Stimuli list for the word-level stress oddity test

	Stimui 1	Stimuli 2	Stimuli 3	Pattern	Speaker
1.	INcrease	REcap	reTAIL	AAB	Female
2.	REject	INcense	transPOSE	AAB	Female
3.	REcess	TRUStee	disCARD	AAB	Female
4.	TRANSfer	EXploit	conTEST	AAB	Female
5.	CONtest	INsight	inCREASE	AAB	Male
6.	EXploit	CONtest	upLIFT	AAB	Male
7.	IMplant	conSOLE	CONfines	ABA	Female
8.	TRANSport	imPRESS	UPlift	ABA	Female
9.	CONfines	proTEST	UPlift	ABA	Female
10.	TRANSfer	inCITE	PROtest	ABA	Female
11.	INcrease	reMAKE	IMplant	ABA	Male
12.	EXploit	upLIFT	ADdress	ABA	Male
13.	CONvert	transPORT	proCEEDS	ABB	Female
14.	TRANSform	transFER	proCEEDS	ABB	Female
15.	CONsole	inCREASE	trusTEE	ABB	Female
16.	TRANSport	reMAKE	inCITE	ABB	Male
17.	ADdress	transPORT	trusTEE	ABB	Male
18.	TRUStee	reMAKE	proTEST	ABB	Male
19.	conSOLE	DIgest	DEsert	BAA	Female
20.	imPLANT	DIgest	DEsert	BAA	Female
21.	conVERT	PERmit	INcense	BAA	Female
22.	upLIFT	PROtest	TRANSfer	BAA	Male
23.	transPORT	IMplant	REmake	BAA	Male
24.	transPORT	UPlift	CONtest	BAA	Male
25.	reJECT	INsight	inVITE	BAB	Female
26.	reCESS	ADdress	imPLANT	BAB	Male
27.	proTEST	IMplant	trusTEE	BAB	Male
28.	transFER	INcrease	reCAP	BAB	Male
29.	proTEST	Recess	inCITE	BAB	Male
30.	transFER	REmake	inVITE	BAB	Male
31.	reMAKE	proTEST	REcord	BBA	Female
32.	overLAY	conTEST	REsearch	BBA	Female
33.	reCAP	reSEARCH	REtail	BBA	Female
34.	reCESS	trusTEE	TRANSfer	BBA	Male
35.	imPLANT	conTEST	INsight	BBA	Male
36.	reCESS	inCREASE	ADdress	BBA	Male

Appendix C: BKB sentences used in the production of the sentence focus oddity test

1. A boy fell from the window.
2. A boy ran down the path.
3. A cat sits on the bed.
4. A girl kicked the table.
5. A letter fell on the mat.
6. Baby broke his mug.
7. Children like strawberries.
8. Father looked at the book.
9. He broke his leg.
10. He found his brother.
11. He frightened his sister.
12. He paid his bill.
13. He's bringing his raincoat.
14. He's washing his face.
15. Lemons grow on trees.
16. Mother made some curtains.
17. She brushed her hair.
18. She drinks from her cup.
19. She found her purse.
20. She made her bed 132.
21. She used her spoon.
22. Somebody took the money.
23. The book tells a story.
24. The car hit a wall.
25. The cat caught a mouse.
26. The child drank some milk.
27. The child grabs the toy.
28. The children dropped the bag.
29. The cleaner used a broom.
30. The cook cut some onions.
31. The cook's making a cake.
32. The cow lies on the grass.
33. The dog drank from a bowl.
34. The floor looked clean.
35. The football hit the goalpost.
36. The girl caught the cold.
37. The girl lost her doll.
38. The house had a nice garden.
39. The house had nine rooms.
40. The lady packed her bag.
41. The lady's making a toy.
42. The lorry carried fruit.
43. The lorry drove up the road 133.
44. The man tied his scarf.
45. The milk was by the front door.
46. The paint dripped on the ground.
47. The police chased the car.
48. The postman brings a letter.
49. The postman shut the gate.
50. The shoes were very dirty.
51. The sun melted the snow.
52. The train had a bad crash.
53. The wife helped her husband.
54. They are looking at the clock.
55. They followed the path.
56. They laughed at his story.
57. They took some food.
58. They wanted some potatoes.
59. They're climbing the tree.
60. They're crossing the street.
61. They're watching the train.

Appendix D: Stimuli list for the sentence focus oddity test

	Stimuli 1	Stimuli 2	Stimuli 3	Pattern	Speaker
1.	THE GIRL caught a cold.	THEY'RE climbing the tree.	She drinks from HER CUP.	AAB	Female
2.	THE POSTMAN brings a letter.	THEY'RE climbing the tree.	They took SOME FOOD.	AAB	Female
3.	SHE brushed her hair.	SHE drinks from her cup.	The lady's making A TOY.	AAB	Female
4.	THE LORRY carried fruit.	THE COOK'S making a cake.	She made HER BED.	AAB	Male
5.	BABY broke his mug.	SHE brushed her hair.	They took SOME FOOD.	AAB	Male
6.	BABY broke his mug.	THE POSTMAN brings a letter.	The cook's making A CAKE.	AAB	Male
7.	SHE brushed her hair.	The lorry carried FRUIT.	THE LADY'S making a toy.	ABA	Female
8.	THEY followed the path.	The lorry carried FRUIT.	THE GIRL caught a cold.	ABA	Female
9.	THE LORRY carried fruit.	The floor looked CLEAN.	SHE brushed her hair.	ABA	Female
10.	THE FLOOR looked clean.	She made HER BED.	THEY took some food.	ABA	Male
11.	THE GIRL caught a cold.	The lorry carried FRUIT.	HE paid his bill.	ABA	Male
12.	THEY took some food.	He paid HIS BILL.	THE GIRL caught a cold.	ABA	Male
13.	THE LORRY carried fruit.	She brushed HER HAIR.	She made HER BED.	ABB	Female
14.	THE LORRY carried fruit.	The girl caught A COLD.	She made HER BED.	ABB	Female
15.	SHE drinks from her cup.	The girl caught A COLD.	The lorry carried FRUIT.	ABB	Female
16.	THE LORRY carried fruit.	Baby broke HIS MUG.	A girl kicked THE TABLE.	ABB	Male
17.	THE LORRY carried fruit.	He paid HIS BILL.	They took SOME FOOD.	ABB	Male
18.	HE paid his bill.	The postman brings A LETTER.	She brushed HER HAIR.	ABB	Male
19.	She made HER BED.	THE POSTMAN brings a letter.	THEY took some food.	BAA	Female
20.	She made HER BED.	SHE brushed her hair.	SHE drinks from her cup.	BAA	Female
21.	She drinks from HER CUP.	THEY followed the path.	THEY'RE climbing the tree.	BAA	Female
22.	She made HER BED.	THE POSTMAN brings a letter.	SHE brushed her hair.	BAA	Male
23.	A girl kicked THE TABLE.	THE CHILD drank some milk.	SHE made her bed.	BAA	Male
24.	The lorry carried FRUIT.	THE CHILD drank some milk.	A GIRL kicked the table.	BAA	Male
25.	She drinks from HER CUP.	THE FLOOR looked clean.	The girl caught A COLD.	BAB	Female
26.	The postman brings A LETTER.	THEY followed the path.	They're climbing THE TREE.	BAB	Female
27.	She made HER BED.	THEY took some food.	They're climbing THE TREE.	BAB	Female

28.	A girl kicked THE TABLE.	THE CHILD drank some milk.	The postman brings A LETTER.	BAB	Male
29.	The girl caught A COLD.	THE COOK'S making a cake.	The child drank SOME MILK.	BAB	Male
30.	he lorry carried FRUIT.	SHE made her bed.	The child drank SOME MILK.	BAB	Male
31.	They followed THE PATH.	The floor looked CLEAN.	THE LADY'S making a toy.	BBA	Female
32.	The lady's making A TOY.	They took SOME FOOD.	THE FLOOR looked clean.	BBA	Female
33.	The postman brings A LETTER.	The girl caught A COLD.	THE CHILD graps some toy.	BBA	Female
34.	A girl kicked THE TABLE.	The cook's making A CAKE.	THE GIRL caught a cold.	BBA	Male
35.	The cook's making A CAKE.	They took SOME FOOD.	THE CHILD drank some milk.	BBA	Male
36.	The girl caught A COLD.	A girl kicked THE TABLE.	BABY broke his mug.	BBA	Male