



# Repeated Mention Reduction in L2 English Spontaneous Speech

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## Abstract

This study examined the effect of language proficiency on repeated mention reduction in L2 English spontaneous speech by Korean native speakers. We found a significant effect of L2 proficiency on word duration in repeated mentions. Specifically, as with native English speakers (EN), Korean learners of English with high English proficiency (KH) reduced the duration of repeated words, while those with intermediate English proficiency (KI) did not. The present study also found that the durations of the subsequently repeated words were statistically shorter than those of the second mentioned words for the KH group (as well as for the EN group), while this was not observed in the KI group, confirming the effect of language proficiency on subsequent mentions in terms of word duration. We suggest that the current findings support a lexical-access-based model [4, 15], where level of L2 proficiency reflects how easily an L2 learner modulates the link between lexical access and articulatory planning.

**Index Terms:** phonetic reduction, repeated mention, language proficiency, second language production, spontaneous speech

## 1. Introduction

It has been reported in previous studies that when talkers repeat words during conversation they may phonetically reduce these repeated mentions in various ways. They may, for example, reduce segmental durations [1, 2, 3, 4, 5, 6], reduce intensity [5, 7], delete segments and syllables [8, 9], or deaccent repeated words [10, 11].

Previous studies have provided accounts of such reduction, and these accounts can be divided into two basic types: listener-oriented and speaker-oriented. Listener-oriented accounts, often discussed in terms of intelligibility, suggest that phonetic reduction of repeated mentions occurs primarily because speakers need to optimize their utterances for listeners [7, 12, 13]. In particular, previously-mentioned words tend to refer to 'old' information, and a speaker may distinguish 'new' from 'old' information by reducing the acoustic-phonetic characteristics of the less informative content [7]. Under this account, speakers attenuate their productions if enough information is given to listeners.

Speaker-oriented accounts, on the other hand, claim that the locus of reduction effects lies in the speaker-internal automatic modulation of articulatory planning [3, 4, 6, 14, 15]. Bell and colleagues, for example, proposed a lexical-access based model, in which articulatory adjustment reflects the speed of lexical access and retrieval [4, 15]. Speakers may reduce their repeated mentions because they experience faster lexical access and retrieval for repeated vs. the first-mentioned words. In a similar

vein, it has been proposed by Bybee [14] that a production-automation model predicts that multiple repetitions will incur cumulative reduction. Previous studies have also found that phonetic reduction is modulated by a word's frequency [12], predictability [4] and neighborhood density [15]. However, as previous studies have mainly focused on native speakers' repeated mention reduction, relatively little is known about such reduction in L2 speech, or the effects of L2 proficiency in particular. It also remains unclear whether multiple repetitions lead to additional shortening, as previous studies have reported conflicting results regarding the difference between second and subsequent mentions [4, 6, 16].

The limitations of previous studies motivated the present study, where we hoped to gain further insight into phonetic reduction in L2 spontaneous speech. Specifically, in this study we asked the following two questions: (1) When non-native speakers repeat words in their L2 conversational speech, do they phonetically reduce their repeated mentions regardless of their L2 proficiency? (2) Do the repetitions (subsequent to the second mention) trigger additional reduction for both native and non-native speakers? The goal of this study was thus to examine effects of proficiency on phonetic reduction of repeated and subsequent mentions in L2 conversational English speech.

## 2. Methods

### 2.1. Participants

Twelve speakers participated in the present study: 4 Korean learners of English with high English proficiency (KH), 4 Korean learners of English with intermediate English proficiency (KI) and 4 English native speakers (EN). The speakers were matched for proficiency, yielding EN-EN, KH-KH and KI-KI pairs. Korean participants were assigned to KH or KI based on their English test scores and length of US residence. KH had TOEFL scores of at least 100 and had resided in the US for at least 1 year (average 3.5 yrs), while KI achieved TOEIC scores of less than 750 (equivalent to TOEFL score of 70~75) and resided in the US for less than a month. All English native speakers were born and raised in an English-speaking environment. The Korean participants' English proficiency was further evaluated independently by 10 English speakers (naive to the experiment) who evaluated the participants' production of an 'accent rating' passage [17]. The means of accent rating scores for the three groups were EN: 9.95, KH: 7.61 and KI: 3.87 (max = 10). The mean accent rating scores were statistically different [ $F(2, 237) = 847.09, p < 0.001$ ].

## 2.2. Speech materials

The speaker pairs participated in the DiapixKR task [18], a spot-the-difference game for eliciting conversational English speech for Korean learners of English. DiapixKR was created based on the concept of the original Diapix task [19], where two talkers are to find the differences between two slightly different versions of the same picture. During the task, each of the interlocutors were given two different versions of a picture and were to produce a set of keywords (e.g., “peach” vs. “beach”) in a conversational speaking style as they worked cooperatively toward finding differences (without seeing each other’s picture). An example of the picture pairs used in the present study is shown in Figure 1.



Figure 1: An example of the DiapixKR picture pairs.

## 2.3. Data processing and analysis

The conversations were recorded in a sound-attenuated booth using two microphones (SHURE Beta 87 and SHURE WH 20) that were directly linked to a Marantz digital audio recorder. The recorded speech was saved as .wav files, digitized at a 4.4 kHz rate. A total of 18,105 words were identified from the recorded conversation data. Among them, 1,052 content words were repeated in the same context and were subject to the current analysis. Among the target words, 764 words were repeated only once in the same context, while 288 words showed third mentions. Segmentation and labeling of each word were carried out manually based on waveform and spectrogram displays in Praat. To examine effects of L2 proficiency on repeated mention reduction, we collected durations of first, second, and third mentions of words automatically using a Praat script [20], and then compared durations of (a) first vs. second mentions and (b) second vs. third mentions. We also measured and compared intensity for first, second and third mentions, although (since only one of the microphones used was head-mounted), we interpret the results for intensity more tentatively.

## 3. Results

### 3.1. Repeated mention reduction

#### 3.1.1. Duration

Figure 2 shows that for EN-EN and KH-KH pairs the mean duration of the second mention was shorter than that of the first mentions, while this was not observed for the KI-KI pairs. A statistical analysis revealed that there was a significant main effect of L2 proficiency on the durations of the repeated mentions (Kruskal-Wallis chi-square = 17.64,  $df = 2$ ,  $p < 0.001$ ). Post-hoc tests revealed that the durational difference between EN-EN and KI-KI group was significant ( $p < 0.05$ ). KH-KH and KI-KI groups were also significantly different from each

other ( $p < 0.05$ ), but the difference between the KH-KH and EN-EN groups was not ( $p > 0.1$ ). This suggests that the Korean learners of English with high proficiency shortened repeated words in their English spontaneous speech much as English native speakers do, while Korean native speakers with lower English proficiency did not.

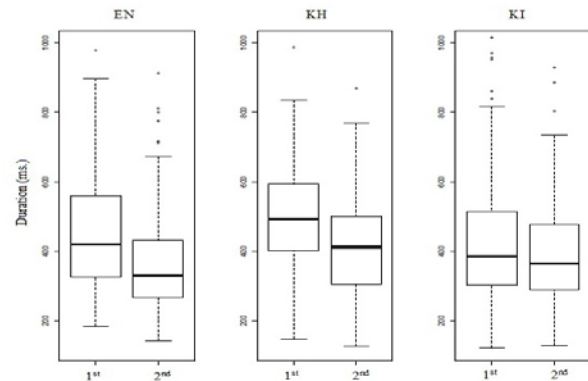


Figure 2: Duration of first and second mentions per group.

#### 3.1.2. Intensity

Some studies have reported that speakers also reduce the intensity of repeated mentions [5, 7]. While the methods used were not ideal for the investigation of intensity, they do allow for a preliminary look. In fact, despite a small trend that indicates reduction of intensity, we observed no significant differences between the groups; data from none of the three groups showed statistically significant intensity reduction (see Figure 3) (Kruskal-Wallis chi-square = 2.96,  $df = 2$ ,  $p = 0.227$ ).

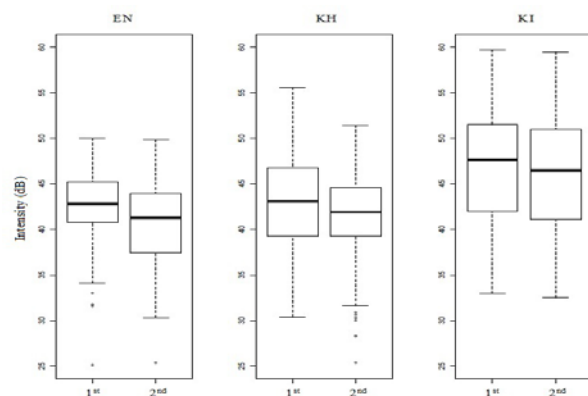


Figure 3: Intensity of first and second mentions per group.

### 3.2. Subsequent mention reduction

Despite the prediction by Bybee in [14], previous studies were unable to find a significant difference between second and subsequent mentions [4, 6]. Bell and his colleagues mentioned that the non-significant results might be due to the limited numbers of the subsequent tokens [4]. The present study, thus, further examined the reduction of mentions subsequent to the second mention.

### 3.2.1. Duration

As shown in Figure 4, for EN-EN and KH-KH pairs, durations for third mentions were shorter than durations for first and second mentions, while this was not the case for the KI-KI pairs (second vs. third mean duration: EN-EN [ $p < 0.001$ ], KH-KH [ $p < 0.05$ ], KI-KI [ $p > 0.1$ ]). These results suggest that language proficiency plays a role in durational reduction of words repeated subsequent to the second mention.

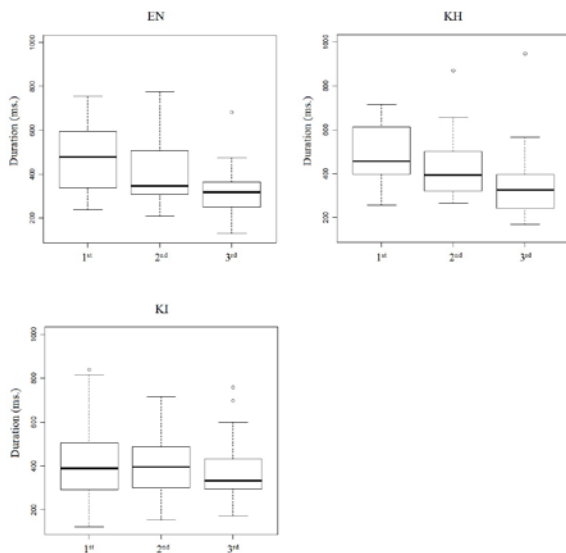


Figure 4: Duration of first, second and third mentions per group.

### 3.2.2. Intensity

As shown in Fig. 5, again none of the groups showed an effect for intensity in subsequent mentions (second vs. third mention: EN-EN [ $p = 0.47$ ], KH-KH [ $p = 0.84$ ], KI-KI [ $p = 0.87$ ]).

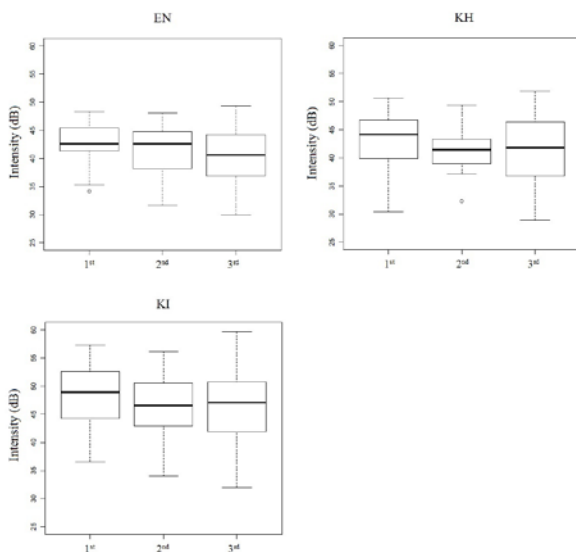


Figure 5: Intensity of first, second and third mentions per group.

## 4. Discussion

The present study examined the effect of language proficiency on phonetic reduction of repeated and subsequent mentions in L2 conversational English speech. The results revealed that L2 proficiency plays a role in determining the degree of phonetic reduction of repetitions in L2 speech. Specifically, the KH-KH group (like the control EN-EN group) shortened the duration of repeated words, while KI-KI pairs did not. We also found that there is a cumulative reduction effect for duration for the KH-KH group (but not for the KI-KI group). None of the three groups, however, showed any significant reduction with respect to intensity.

The results for duration have implications for existing accounts of phonetic reduction in repeated mentions. The observed effect of L2 proficiency is consistent with the lexical-access-based model that emphasizes the role of lexical access and retrieval on articulatory adjustment [4, 15]. The level of one's L2 proficiency may reflect how easily an L2 learner modulates the link between the lexical access and articulatory planning. Under this assumption, L2 learners with high proficiency may have sufficient ability to facilitate lexical access and retrieval and thus can modulate the articulatory forms when the same lexical items are repeated, as native speakers do. On the other hand, the difficulty in the lexical access and retrieval of L2 learners with relatively low target language proficiency may preclude them from achieving the articulatory adjustment of repetition. This can be buttressed by the claim that the processing load of nonnative speech production is inversely proportional to nonnative speakers' proficiency of their target language [21]. The lower processing load required for highly proficient L2 learners may facilitate automatic modulation of articulatory planning in the target language.

The null effect found for intensity, however, is somewhat less clear. That is, why did repeated and subsequent mentions show no significant reduction in terms of intensity? One possibility is that this null finding was an artifact of the recording methods we used. Measuring intensity requires control over head movement during recording (i.e., ensuring constant distance between the speaker and the microphone). In the current study only one of two microphones used was head mounted, the other a table microphone. Thus the recording conditions here may have not been sufficiently sensitive to differences in intensity. Alternatively, the findings may be genuinely attributable to the characteristics of spontaneous speech. Given that spontaneous speech has more intensity variation both within as well as across speakers than read speech [22], it may be difficult to capture the significant reduction in intensity during spontaneous speech. In this regard, [7] points out that speakers may adjust acoustic features such as duration, intensity and pitch differently, taking into consideration the contexts within which the conversations occur. In the case of the DiapixKR task, where interlocutors cooperated to find differences without seeing each other's picture, the intensity of repetitions may not have been consistently reduced. Follow-up studies that obviate the limitations of the current study are required to evaluate these possibilities.

## 5. Conclusions

The results of the present study provide evidence that L2 proficiency in spontaneous speech modulates the phonetic reduction in repeatedly mentioned words at least in terms of the

word duration. Moreover, we found the cumulative reduction effects on multiple repetitions as Bybee predicted [14]. We suggest that the current findings are in support of a lexical-access-based model [4, 15], where the level of one' L2 proficiency is reflective of how an L2 learner easily modulates the link between the lexical access and articulatory planning.

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