

# The Peak Alignment of Prenuclear and Nuclear Accents among Advanced L2 English Learners

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## Abstract

Previous studies have shown that even advanced L2 speakers align pitch accents differently from native speakers, and the only possibility for full attainment of L2 is through immersion. This study investigated two groups of five advanced L2 English speakers who first exposed to English through early immersion. Their alignment of prenuclear and nuclear accents was compared with that of the native English speakers. Results showed that these advanced L2 learners aligned nuclear accents in a similar way to the native speakers; however, difference was found on the alignment of prenuclear accents between their production and the native speakers'.

## 1. Introduction

In addition to conveying linguistic information, intonation also plays an essential role in regulating discourse. As we all have the experience that we derive our impression about another's disposition from the way they intonate [10], inappropriate intonation patterns may bring up misunderstandings. Unfortunately, this is usually the case with L2 speech.

The mainstream of current L2 studies focuses on the investigation of segments, and several well-known models have been developed. For example, both the speech learning model (SLM) [4, 5] and the perceptual assimilation model (PAM) [1, 2, 3] predict the degree of success listeners have in perceiving nonnative sounds is based on the perceived phonetic distance between L1 and L2 sounds. On the contrary, research with regards to suprasegments, such as intonation, is scarce and mainly on intonational errors [9].

Pitch alignment is an important issue in suprasegmental studies [11, 12]; however, there is a lack of research on the cross-linguistic aspect. How we align pitch is actually language-specific. For instance, Italian, when compared with English or German, has earlier peaks, and the fall concluding an accent starts before the occurrence of the next syllable. Influenced by their L1 percept of pitch alignment, L2 speakers whose native language is English or German tend to pronounce Italian with relatively later peaks [7].

Thus, like segments, suprasegments of L2 production were also reported to be influenced by L1

transfer. Even advanced L2 speakers were found hard to resist this influence. However, there was still an exception reported in a series of studies: an experienced Dutch speaker of Greek was reported to have her Greek peak alignment comparable to those of the native Greek speakers. The authors speculated that this "full attainment" might have resulted from the fact that this participant was first exposed to Greek through immersion in Greece, while other experienced L2 Greek speakers of those studies initiated their Greek learning in the Dutch-speaking environment [6, 8, 9].

## 2. Aim of the study

The aim of this study was to investigate whether advanced L2 English speakers whose first exposure to English was through immersion align high tones in the same way as native English speakers do. Two factors were included: Different initial ages of the same immersion environment provide us with a better opportunity to observe the effect of early immersion. In addition, different behavioral patterns might be shown in the alignment of the accents of various prominence levels.

## 3. Method

### 3.1. Participants

Ten advanced L2 adult English speakers majored in English were recruited for the study. All of them had their first exposure to English in the United States and stayed there for 3 or 4 years before coming back to Taiwan. They were further divided into two groups: The Kindergarten group included 5 participants whose first exposure to English was at the preschool age (3-4); the Elementary group included the other 5 whose first English exposure was around the age of 9 or 10. After returning to Taiwan, these participants resumed their education in the local school system, in which they had English courses since the 7<sup>th</sup> grade, the same as all the other local students. Another group of four native English speakers were also recruited. Their production data would serve as the baseline for comparison.

### 3.2. Material

42 declarative sentences with the basic S-V-O structure were used. Sentences only varied in the last word, which consistently received the nuclear accent. (eg. *I know the word dry.*) Each sentence was printed on an individual index card for recording.

### 3.3. Equipment

A SONY DAT PCM-M1 digital recorder along with a Maxell DM120 tape and a SHURE SM10A-CN head-mounted microphone were used for recording. Cool Edit Pro 2.0 was used for sound processing and Praat 4.4.20 for sound labeling and measurement.

### 3.4. Procedure

The recording took place in a quiet room. Participants were asked to read sentences as naturally as possible while being recorded. They were asked to repeat if there was any pause or slip of tongue occurred in the middle of their production. The sampling rate for recording was 48kHz and it was downsampled to 22.05 kHz after digitization for further analyses.

### 3.5. Measurement

Pitch contours of each sentence was generated and checked manually using Praat. As shown in Figure 1, word boundaries were labeled in the first tier. Prenuclear and nuclear accents were marked in a separate point tier (H\*). The two black boxes in the figure framed the sonorant portion of the accented syllables, to which later analyses were conducted.

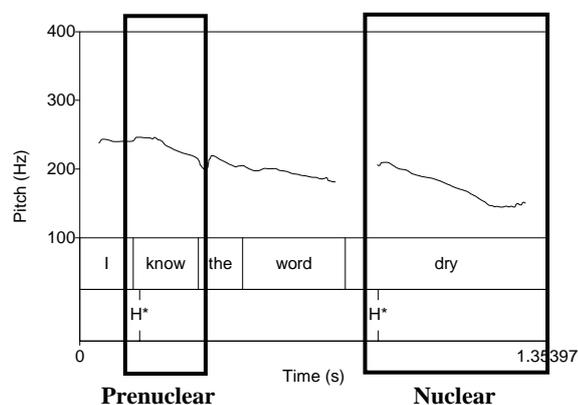


Figure 1: Measurement of peak alignments.

## 4. Results

A Group (3) × Accent Type (2) two-way ANOVA was performed on half of the data that has been analyzed so far. Through this analysis, we examined how pitch alignment between native English speakers and the two L2 groups may differ with regards to accents of different prominence levels. Results showed that both

main effects were significant [Group:  $F(2, 497) = 21.83, p < .0001$ ; Accent Type:  $F(1, 497) = 123.85, p < .0001$ ]. In addition, the two-way interaction between Group and Accent Type was also significant [ $F(2, 497) = 31.98, p < .0001$ ].

### 4.1. The prenuclear accent

In Figure 2, the bars stand for the amount of time participants took to reach the maximal pitch the accented syllable. Black bars represent nuclear accents, whereas grey ones represent nuclear accents. Clearly, we can see that for nuclear accents, the two L2 groups shared a similar pattern with native English speakers. Post-hoc analysis also showed that the difference across the three groups for nuclear accents only reached near significance [ $p = .07$ ].

As for prenuclear accents, post-hoc analysis showed that the difference among the three groups was significant [ $F(2, 252) = 93.89, p < .0001$ ], and pairwise comparison exhibited that the difference actually resided between the Native group and the two L2 groups. The difference between Kindergarten and Elementary groups, however, was not significant.

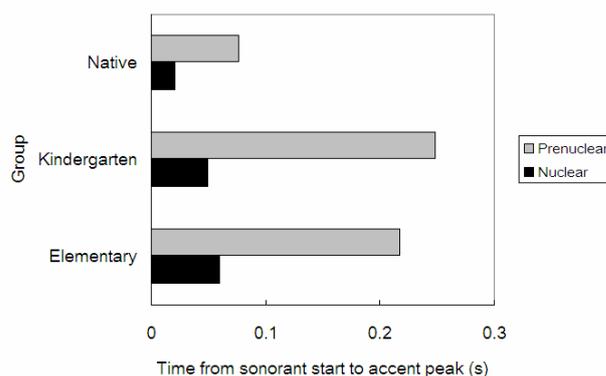


Figure 2: Time to reach the peak of the two accent types across three groups.

Through Figure 3, we may have an even clearer idea from another perspective: In this figure, the time point on which the maximal pitch occurred in the syllable receiving prenuclear accent was plotted in the x-axis; the total duration of this syllable was plotted in the y-axis (eg. *know* in *I know the word dry.*). As shown in the figure, the peaks of prenuclear accents occurred much earlier in native English speakers' productions, as compared to those of the L2 speakers'. The close clustering of the alignment of the Kindergarten group and the Elementary group has already been verified by the statistical insignificance mentioned earlier. The linear trend fit between these two L2 groups showed that no matter how long the accented syllable was pronounced, the alignment of their prenuclear accent consistently located at the very end of it, which was

different from the native speakers' production. For native speakers, most tokens were pronounced with comparable duration, and they all had early peaks.

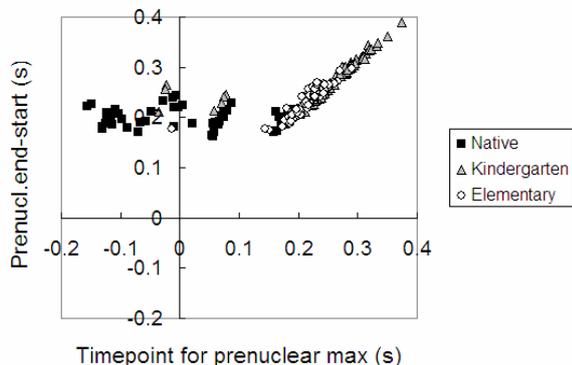


Figure 3: Alignment of the prenuclear accent.

#### 4.2. The nuclear accent

In a similar sense, the relative alignment of nuclear syllables was plotted as in Figure 4: X-axis stands for the time point on which the maximal pitch occurred in the sonorant portion of the syllable receiving the nuclear accent; y-axis stands for the duration of the entire sonorant portion of this accented syllable (eg. *ry* [ɹaɪ] in *dry*). As shown in the figure, the vertical distribution along the y-axis indicates that no matter how long the sonorant portion of an accented syllable was pronounced, the alignment of the nuclear peak consistently resided in the very beginning of it. No significance was found on the alignment pattern among groups. The only difference observed was that the two L2 groups tended to have a wider distribution area, indicating a relatively higher variability, which is commonly seen in the nonnative production.

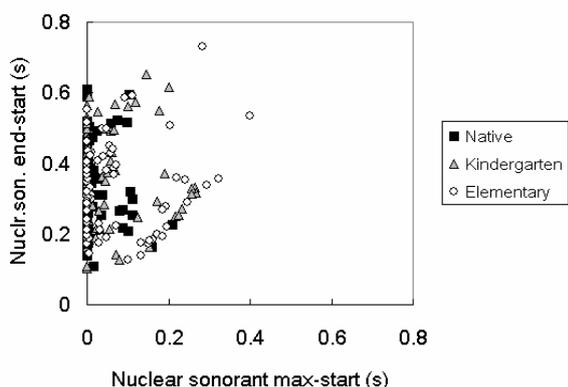


Figure 4: Alignment of the nuclear accent.

### 5. Discussion and conclusion

Results obtained in the present study showed that initial age of immersion, seemed not crucial. Taking only the

two nonnative groups into consideration, the peak alignment of prenuclear and nuclear accents of those with an earlier English immersion since preschool was not significantly different from those with a relatively later immersion at elementary school.

As for the two pitch accent types, our results partially supported Mennen's speculation in that initial exposure occurs during early immersion into an English-speaking environment did help these advanced learners' to behave in the way similar to native speakers do with nuclear accents. On the other hand, their peak alignment of prenuclear accents did not reach the native level, as statistical significance was found between the Native group and the two nonnative groups but not between the Kindergarten group and the Elementary group.

As cross-linguistic research on suprasegmental cues is scarce, this study verified the advantage of immersion learning for L2—at least to some extent: immersing into the English-speaking environment does help with a more general temporal planning in aligning peaks on nuclear accents, or accents of the highest prominence; however, this advantage was not observed for the peak alignment on prenuclear accents, or accents of a fine-grained prominence level. This may either result from these learners' loss of it due to the long-term wearing-out from all these years' nonnative input from an English-as-foreign-language environment, or due to the possibility that to master the accent alignment of a fine-grained level took longer time than the years of their immersion, so they had never learned it in the first place. However, this empirical speculation needs further evidence to back it up.

For the next step, we are now under the process of data collection from advanced L2 learners with their first English exposure in Taiwan. We believe that with the addition of this counterpart group, we will have a more complete understanding of the role initial environment plays on L2 pitch alignment.

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