THE COMPARISON OF PROSODIC BOUNDARY FEATURES WITH ENCLITICIZED AND PROCLITICIZED FUNCTION WORDS

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ABSTRACT

In spontaneous speech, unlike read speech, prosodic phrasing doesn’t match with syntactic structure often. Previous research confirms that this phenomenon usually occurs at intermediate phrase boundaries where function words are encliticized or procliticized. The research aims at observing prosodic boundary feature change as intermediate boundary positions were relocated. Ten pairs of the sentences selected from the audio book 『Hoot』 (spontaneous speech) and high school English textbook (read speech) were extracted and the function words were encliticized to proceeding host words or procliticized to succeeding host words. After measuring the length of the pauses, final syllables, and the changes of fundamental frequencies using Pratt, differences among prosodic boundary features were analysed. The results showed that the pause lengths at intermediate phrase boundaries shortened, final syllable length increased and high phrase accents prevailed over low phrase accents. Final syllable lengthening and phrase accents occurred at the early phases of boundary positions. In conclusion, prosodic phrasing exposes the overall sentence structure at the early stages of utterance, and listeners can anticipate the upcoming development of utterances. Considering that prosodic phrasing is essential for language learning, learners of English as a second language should practice prosodic phrasing rather than syntactic phrasing.

KEYWORDS: Analytical Thinking, Computational Methodology, Encliticized and Procliticized Function Words, Language Education, Pratt Analysis, Prosodic Boundary Features
and detail parts.

**Prosodic Boundary Features**

Boundary location and boundary salience are an important component in prosodic phrasing. Prosodic boundary features include pause, breathing, fundamental frequency change, syllable lengthening in front of the boundary, speech speed, intensity change, sound quality, and abbreviation. Relative differences in pause length reveal syntactic hierarchy and discriminating the difference of meaning is possible (Schafer [5], 1997). In ToBI, pause length is scaled from 0 to 4 by an analyzer subjectively. Final syllable lengthening occurs at front of the prosodic unit boundaries such as at the end of the prosodic words, intermediate phrase, and speech unit and the extent of the lengthening differ depending on each hierarchy (Zvonik[6], 2004). Final syllable lengthening is the most reliable clue that represents prosodic boundary features in intermediate boundary (Wightman, Shattuck-Hufnagel, Ostendorf & Price [7], 1992). Intermediate phrase consists of at least one pitch accent and phrase accent. Phrase accent represents the relationship between the current phrase and the succeeding phrase. Low phrase accent (L-) represents that currently spoken speech needs to be separately interpreted with the following phrase while high phrase accent (H-) demands that both the current phrase and the following phrase form upper layer of interpretation unit (Pierrehumbert & Hirshberg [8], 1990). Phrase accent, along with function word, represents the syntactic and informational relationship of the whole sentence structure.

**Syntax Violating Prosodic Boundary and Prosodic Restructuring**

Prosodic boundaries of 20% in a Swedish radio interview material occurred in syntactically unmotivated positions (Strangert [9], 2004 b). Prosodic boundaries of 35% in the subset of the Boston Radio News Corpus were not consistent with syntactic structures (Fach [10], 1999). Syntactic factors, semantic factors, phonological factors, pragmatic factors, processing factors, speech speed and style influence the syntax violation of prosodic phrasing in free speech (Cole et al., 2010; Bachenko & Fitzpatrick, 1990; Fitzpatrick[11-13], 2001).

**Function Words and Prosodic Boundary**

To clarify the relationship between intermediate phrase boundary and function words, identifying the role of function words is required. There are few types of function words but occur frequently and consistently in place. They can restrict words that will come next by appearing at front of the phrase or can inform the type of phrase (Christophe et al.[14], 2008). Prosodic features change noticeably where function words take place. Function words in conjunction with prosody provide cues to prosodic phrasing (Gerken & McIntosh [15], 1993). When function words are encliticized, listeners can predict next content of speech earlier. By encliticizing the function words, they become positioned near the matrix verb, which determines the whole sentence structure, during the speech so that the whole syntactic structure is revealed early.

**Encliticization and Salience of Function Words**

To make modified intermediate phrase around function words salient, it is necessary to adopt prosodic boundary features distinct from general prosodic boundary features based on syntactic structure. The prosodic features of boundaries change from strong to weak ones (Heldner & Megyesi, 2003; Strangert & Carlson [1,16], 2006). In cases except where emphasis is needed for contrast, function words cannot be given accent, so by lengthening final phrase it is possible to make it salient. High phrase accent (H-) will be used more frequently because it indicates there’s more to say, connects the preceding and antecedent phrase, attracts listeners by increasing fundamental frequency, and plays role in making up the
OBJECTIVES

Based on the related works, this research seeks to clarify hypotheses below.

- Position and prosodic features of pauses will be changed when the function words are encliticized at intermediate phrase boundaries in spontaneous speech.
- The length of the pauses following the encliticized function words will be shortened compared with the ones when procliticized.
- Duration of encliticized function words will be lengthened.
- High-phrasal accents will prevail when function words are encliticized.

METHODS

Data Selection

The data were selected from the audio book 「HOOT」 for spontaneous speech and from the Korean English textbook of high school for read-aloud speech. 11 pairs of utterance which contain various classes of function words (in, to, a, have been, and, or, than, if, who, when, that) were analysed at the intermediate phrase boundaries. Monosyllable function words were selected because accent might arise inside poly-syllable function words. For simplicity in the analysis, voiced sound function words were selected as much as possible. ‘To’ and ‘that’ were selected as they occur frequently, but were analysed with caution as they contained voiceless rupture sounds. Sentences where pause position is affected due to pronouns or articles that comes right after the function words were excluded. Complex sentences and long speech were selected so that speaker does not consciously adjust the speech due to pause or final syllable lengthening.

Procedures of Analysis

Speech speeds were normalized by aligning the number of syllables per second in order to eliminate its effect on the analysis (Yeona Jeong[17], 2006). There are intra-speaker variation, inter-speaker variation, and listener variation. Rather than subjective labelling, it was based on contrasting the relative differences in values using Pratt. Pause length, final syllable length, phrase accent pitch were analysed using Praat program, mostly with spectrogram and waveform. Phrase accents and pause length index were labelled by the author based on ToBI system. Subjective decisions were somewhat inevitable during the labelling. However, prosodic research focuses on the relative relationships between the prosodic properties; the methodology in the research has validity to some extent (Byeong-Seop Ahn[18], 2010).

RESULTS

Examples of Analysis

Procliticized ‘in’
According to Pratt analysis, there was 347ms pause in front of the function word ‘in’. The function word length was measured to be 70ms. According to ToBI labeling, H-H% boundary tone appeared in front of the function word ‘in’.

**Encliticized ‘in’**

According to Pratt analysis, there was 79ms pause right after the function word ‘in’ and is 268ms shorter than the procliticized case according to ToBI labeling, the pause length is classified as BI2 rather than BI3. The function word length was 89ms, 19ms shorter than the procliticized case, exemplifying final word lengthening. In front of phrase boundary, H-H% phrase tone appeared.

**Pause length**

![Pause length chart](image)

*Figure 3: Length of Pause when Procliticized and Encliticized*
The pause length in front of the function word for procliticized case is represented in blue bars and the pause length behind the function word for encliticized case is represented in red bars. The average of procliticized case is 229.9ms and 56.3 for encliticized case with p<0.01. Pause length for procliticized case ranged 62~357ms and can be grouped into short 100~200ms group and long 300~400ms group. These groups correspond to intermediate boundary and intonation boundary, respectively (Fant et al[19], 2003). In other words, strong boundary characteristics appear in procliticized case. For encliticized case, the pause length ranged 18~120ms and according to ToBI system, it is classified as B12 rather than B13.

Function Word Length

![Figure 4: Length of Function Words when Procliticized and Encliticized](image)

Blue bars represent the length of the function word for procliticized case and red bars represents for encliticized case. The average of procliticized case is 93.6ms and 138.3ms for encliticized case with p<0.01. Function word ‘have been’ has been excluded when averaging as it can distort the average value. The final syllable lengthening should be significant enough to be perceptible. According to previous research, the final syllable lengthening should be more than 20% (Park Mun-Kyu[20], 2003) or 25% (Yoon Young-Sook[21], 2004). Since the final syllable lengthened by 47.8%, it can be concluded that the final syllable lengthening is perceptible.

Patterns of Phrasal Tones

![Figure 5: Patterns of Phrasal Tones when Procliticized and Encliticized](image)

Blue bars represent the frequency of phrasal tones when procliticized. Red bars represent for the encliticized case. In procliticized case, intonation boundary was prevalent and in encliticized base, phrase boundary was prevalent. H- phrase accents prevailed over L- phrase accents in encliticized case. This indicates that when function words are encliticized, phrase accent changes and acts as a means to represent that the preceding and the following phrases have closely-connected relation.
DISCUSSIONS

The research focused on changes in prosodic boundary features when the function words are encliticized and tried to interpret the phenomena by relating predicting the functions of function words and connection of its constituents in acoustic language. Unlike preceding research (Wellmann et al., 2012; Seidl & Cristia, 2008; Mannel[22-24], 2009), the explanation for pause length shortening when function words are encliticized was not just that pause is not relatively significant in recognizing intermediate boundary, but it is a strategic way to make connections of the constituents prominent.

There was no analysis about the apportionment of functions of prosodic boundary features relating to function word encliticization. Caution was needed in the inference as there wasn’t complete specification of how each prosodic feature interact, how they are fused and realized, whether type of union depends on the condition, or which features play the most important roles. This research only reinforced the inference using previous research and further research needs to be done in order to secure proof.

CONCLUSIONS

According to the research, hypotheses in 2.6 are verified. It is shown that prosodic phrasing in spontaneous speech differs from prosodic phrasing in read speech. Caution is needed when generalizing because the data set was small, however. In recorded high school textbook contents, it was confirmed that prosodic structures coincided with syntactic structure. In audio book 「HOOT」, it was not a completely free-speech sample, but still prosodic phrasing violating syntactic structure was observed. If strictly free-speech sample were used, the hypotheses would be much strongly verified.

One of the important aspects of the future work is to verify that encliticization of function words is the result of evolution and adaptation of language. Perhaps due to the fact that spoken language was introduced much earlier than the written language, there are discrepancies in prosodic boundary features. Another research method is by experimenting with infants. Since there are difficulties in experiments with infants, using ERPs generated from infants’ brain would be helpful. The research asserted the learning strategy related to function word encliticization, but future research is imperative in order to prove the effectiveness of this approach. There should be research that contrast between English native and EFL and between EFLs who used English learning methods in this research and those who didn’t.

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