The Effects of Syntactic Constraints on Prosodic Chunking of L2 Speech in Sentence Recall

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Human immediate memory capacities are severely limited in general. In contrast to non-native speakers, native speakers are more capable of overcoming some of such limits and demonstrating a stronger ability to talk fluently and continuously (Pawley & Syder, 1983). Second language (L2) learners usually find it difficult to achieve such native-like fluency. Prosodic chunking has the potential to unravel this puzzle. According to Jun (2003), prosodic chunking allows speakers of any given language to organize an utterance into meaningful chunks by combining small constituents (e.g., morphemes, words) into larger units (e.g., phrase, clauses). Failure to master prosodic chunking would lead to speech dysfluency, which is more noticeable in L2 speech production as a result of L2 speakers' limited chunking capability. During the chunking process, the syntactic structure construction is of great importance. However, previous studies mostly focused on the effect of syntax on speech production while paid little attention to the role of the number of syntactic constituents and syntactic structure complexity in L2 learning (Wang, Yang, & Lyu, 2004). The present study investigated the effects of the number of syntactic constituents and syntactic structure complexity on the chunking of words in the speech production of Chinese as a second language. The research questions were as follow:

1) How does the number of syntactic constituents in one sentence affect the prosodic chunking of Chinese as L2?

2) How does the syntactic structure complexity of sentences affect the prosodic chunking of Chinese as L2?

Two experiments were conducted to investigate the proposed questions. Fifteen English speakers with a low-level Chinese, 15 English speakers with a high-level Chinese and 15 native Chinese speakers were recruited as participants.

In Experiment 1, two groups of 10 subject-predicate sentences were generated for each of the short sentences (six or seven constituents in length) and the long sentences (10 or 11 constituents in length). In Experiment 2, another 10 subject-predicate sentences and 10 pivotal sentences were manipulated as simple and complex syntactic structure. A sentence recall task was used to elicit online oral production. Each sentence was visually presented on the screen for 5 seconds, and then participants were asked to orally repeat the sentence as accurately and fluently as possible within another 5 seconds.

We used chunk length as a measure of the prosodic chunking. Chunk length was defined as the number of words between each of two consecutive chunk boundaries. Chunk boundaries were obtained by two different ways: native speakers' perception and phonetic analysis method. Two native Chinese listeners were invited to mark the chunk boundaries by estimating the temporal speech information such as pause, final word vowel lengthening and pitch reset (Wang, Yang & Lyu, 2004). For phonetic analysis, any inter-syllable interval (ISI) more than 50ms was identified as chunk boundaries by using Praat. The analysis revealed that the phonetic analysis method had a strict criterion to measure the chunk length.

Our results suggested that the number of constituents and syntactic structure complexity affected L2 prosodic chunking, and that these effects were regulated by their L2 proficiency. Both groups of L2 learners have not acquired the chunking capability as the native Chinese speakers do. In specific, low-level Chinese speakers produced utterances in a word-by-word mode, while high-level speakers

uttered in a phrase-by-phrase mode. Even the latter still failed to develop into a native-like sentence-by-sentence mode.

For low-level Chinese speakers, the prosodic chunking was constrained by both the number of constituents and syntactic structure complexity. Based on the *Perception* measurement, high-level Chinese speakers can be able to free from the constraint of increasing the number of constituents, but it is not this case for syntactic structure complexity. Based on *Phonetic Analysis* methods, both more constituents and complex syntactic structure decreased the chunking capability for high-level Chinese speakers. For native Chinese speakers, the prosodic chunking was not affected by both the number of constituents and syntactic structure complexity.

To conclude, for L2 speakers, most words were not chunked together; that is, a limited amount of chunks was stored in their long-term memory and these chunks were weak as well. Therefore, processing these small and weak chunks during speech production would consume more working memory resources, resulting in a less fluent speech than native speakers. As a result of the less well-established chunking capabilities, L2 speakers had difficulties in finding the right words, pronouncing them correctly, and manipulating syntax to construct word sequences in speech production. In contrast, for native Chinese speakers, those little pieces of information were chunked into higher-level meaningful units (Breen, Watson, & Gibson, 2011), and syntactic combination between words had achieved procedural automaticity. Therefore, native speakers were successfully freed from the activities of integrating words into chunks, and thus working memory resources could be reserved for high-level activities such as focusing on rhythm of the discourse, or the content and coherence of the speech.

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