Syntactic and Length Constraints on the Prosodic Phrasing of Second Language Sentences

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Producing an intelligible and fluent utterance is a major goal of second language (L2) learning, but one with which most learners struggle. One of the difficulties is determining the location and the number of breaks in fast-flowing speech [1, 2]. There are usually two ways that non-native phrase boundaries can result in problematic utterances—inappropriate break assignment and too many breaks. Inappropriate break assignment damages the prosodic structure of a sentence so that it sounds awkward. Too many breaks, on the other hand, may induce grammatically correct phrases, but it will reduce the naturalness of articulating a sentence.

The assignment of boundaries is one of the prosodic phrasing issues in sentence production. Prosodic phrasing, or prosodic grouping, is the manner in which phonological units are organized to form larger meaningful units [3]. Traditional approaches to exploring prosodic phrasing in a first language (L1) emphasize the hierarchical representation of prosodic structures in both comprehension and production, including prosodic words, prosodic phrases, and intonational phrases [4, 5]. In L2 processing, however, the features of prosodic unit boundaries are more variable, especially in adult learners' speech, which makes hierarchical classification more difficult [6]. Even highly proficient learners may have difficulty articulating grammatically correct units at refined prosodic structure levels [7]. Moreover, many sub-processes, such as semantic and pragmatic construction, are not automatized, adding more pressure to learners' already burdensome speech production. Thus, learners prefer to produce smaller, more easily managed segments [8], which has a negative impact on L2 oral fluency.

Researchers have investigated the variety and complexity of constraints on prosodic phrasing, particularly the way in which these constraints interact. Syntactic constraints—constituency and dependency relations between words—have been claimed to be the most influential [9, 10], along with the impact of length and focus [11]. The location of a break should first be a syntactic word boundary, otherwise it would be perceived as awkward and inappropriate by native speakers [12]. Yet prosodic structures are much flatter and less branching than syntactic structures because speakers need to balance the length of constituents in their utterances [13]. This becomes more obvious in L2 production, since length is a more explicit and general factor than syntax across languages. Therefore, the interaction of syntactic and length constraints, rather than the establishment of hierarchical prosodic structures, is what learners need to resolve first in their output.

The current study explored the constraints of syntactic constituency, syntactic complexity, and length on the assignment of breaks in the sentence production of Chinese as an L2. Syntactic constituency was operationalized as having adjuncts or not in a sentence. Adjuncts, such as adverbials and prepositional phrases, are not treated as the main elements of an argument structure and are often separated by breaks, but may be bound to the sentence stem as long as they are short [14]. Thus, adding adjuncts to a sentence can influence the syntactic constituency among words, which in turn impacts the prosodic phrasing of the whole sentence. Syntactic complexity was operationalized as simple versus complex sentences, because syntactic complexity in Chinese is realized by sentence pattern [15]. Length was hypothesized to impact learners' phrasing performance by its interaction with syntactic complexity as well as on its own. The reason why the interplay between syntactic constituency and length was not probed was that sentence lengthening inevitably involved adding adjuncts or modifiers, making it difficult to disentangle these two factors.

Two dependent variables were selected to depict learners' phrasing performance. The sequential assembly of sentential components was denoted by phrasing rate—the lower the phrasing rate, the

more fluent sentence production, and the more sophisticated learners' phrasing performance should be [16]. The linearization of a prosodic structure was represented by chunk size—the larger a chunk was, the smoother the structuring of prosodic units, and the more sophisticated learners' phrasing performance should be [17].

Phrasing rate and chunk size from sentence recall tasks showed asymmetric effects of syntax and length across groups of different Chinese language levels. Whereas the performance of lower level learners was largely affected by syntactic constituency that indicated word coherence within a small sentential component, the performance of advanced learners was more impacted by the complexity of syntactic structure. The influence of sentence length could be augmented when superimposed onto syntactic constraints. Neither group of learners attained *compressed chunking*, that is, to divide distinct sentences into a similar number of chunks of various lengths, like native Chinese did, but producing a fixed length of chunks instead. This strategy was particularly important in linearizing prosodic structures during the temporal unfolding of spoken language.

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