The Asymmetric Interaction of Metrical Structure and Tone in Standard Chinese

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Background: Tone has been claimed to play an active role in stress assignment in Standard Chinese: 1) a syllable with tone constitutes the head of a foot, hence is stressed, and a syllable without tone is unstressed (Yip 1980); 2) the intrinsic prominence of tone determines the stressability of a syllable, syllables with the Falling and the High-level tones are stressed, whereas syllables with the Low tone are unstressed (Meredith 1992); 3) tone can modify the metrical structure output according to its intrinsic prominence, the Falling tone attracts stress, and the Low tone repels stress (Chang 1992).

Proposal: This study proposes that Standard Chinese has a generalized trochee system, in which stress is assigned independently of tone, but tone realization is dependent on metrical structure.

Analysis: Standard Chinese has heavy and light syllable distinction (Duanmu 1999). Only heavy syllables are tone bearing units, light syllables cannot bear tones, therefore, the distribution of underlying toneless syllables signals the position of light syllables in the metrical structure. Underlying toneless syllables do not occur word initially, as the [σμσμμ] foot structure is avoided. In similar syllable positions as underlying toneless syllables, syllables with tones undergo tone deletion or reduction. An example of tone alternation by syllable position is observed in verb-particle constructions. When a verb particle immediately follows a monosyllabic verb, the verb particle tends to delete its tone, but when it is separated from the verb by a negative or a potential morpheme, it maintains its tone, kàn jìan ‘see’, kàn bu jiàn ‘cannot see’, kàn de jiàn ‘can see’. Tone reduction is shown by robust strong-weak alternating F0 patterns in words. Tones in odd-numbered syllables are realized more closely to their tonal templates in contrast to tones in even-numbered syllables, which are realized further away (Lai, et al. 2010). A good illustration of such gradient tone reduction is Tone2 sandhi. In Tone2 sandhi the Rising tone is realized with a level or a falling pitch contour instead of an expected rising. T2 sandhi tends to occur in where F0 is relatively weak (Deng 2010).

Segmental reduction is a parallel phenomenon of tone reduction that occurs in identical syllable positions of words. One of its dimensions is reflected in the significantly smaller mean difference between the onset consonant intensity minima and the vowel intensity maxima in even-numbered syllables of words, given that reduced consonants have less restrictions in the vocal tract, hence become more vowel like, and have higher intensity minima, whereas vowels in unstressed syllables are implemented less faithfully to their articulatory targets, hence have lower intensity maxima.

The sensitivity of tone and segments’ realization to syllable position is a manifestation of the metrical structure. And the distribution of tone and segment reduction suggests that Standard Chinese has a generalized trochee system, heavy syllables also occur in unstressed positions. This hypothesis is further supported by the F0 patterns in polysyllabic words of various morphological structures assuming cyclic foot parsing. In this generalized trochee system, tone does not participate in stress assignment, but makes a phonetic distinction as associated to stressed or unstressed syllables. The intrinsic prominence of tone influences prominence perception. Syllables with the Falling and the High-level tones tend to be perceived more prominent, and syllables with the Low tone are judged to be the least prominent. However, the occurrence of the Low tone in stressed syllables and the deletion and reduction of the Falling and the High-level tones in unstressed positions suggest that tones with greater inherent prominence are not structurally more prominent than other tones.

Conclusion: This study provides phonological and phonetic evidence to support the hypothesis that Standard Chinese has a generalized trochee system. It contributes to the typological study of tone and stress interaction by disentangling the relationship between tone, stress and perceived prominence.