Articulatory anchors for Tonal events

Caroline Menezes

ABSTRACT

Tonal alignment work has suggested that the temporal location of tonal targets relative to segmental "anchors" might be governed by principles of synchrony and stability (Arvaniti et al 1998, Ladd *et al.* 1999). However, a number of discrepancies have emerged in the cross-linguistic study of alignment. For instance, despite some regularities in the alignment of L(ow) targets with segmental structure (Caspers and van Heuven 1993), the alignment of H(igh) targets appears to be quite controversial. While L tones appear to be anchored to the left edge of the stressed syllable in a variety of stress-accent languages (REFS), the H tones of both monotonal and bitonal pitch accents can be variably aligned with either the middle of the associated stressed syllable, the end (i.e. the right edge) or even with the postaccentual syllable. Specifically, the "peak delay" phenomenon of H tonal targets could partly be accounted for in terms of surface variability of underlying tonal targets (Silverman and Pierrehumbert, 1990). There is yet no production model of how the tonal structure is supposed to align with the segments.

The coordination between laryngeal and supralaryngeal movements also adds constraints to the alignment of tone to syllable (Xu, Y. & Wang, E. 2001, Xu, Y. 2002, Xu, 1999). His study of local and global pitch contours in a tone language (Mandarin) demonstrate that tone targets are always realized with in its designated syllable. Besides Kelso (1984), show that motor coordination of finger wagging can be only phased at 180^0 or 0^0 angles with each other, but when rate is increased the only possible phase angle for motor coordination is 0^0. Based on these findings Xu posits that the speed at which speech is produced, there can only be 0^0 angle phasing between tone and syllable (Xu, 2002, 2001). This association of tone and syllable should be universal given that these constraints are basically phonetic in nature, and therefore, Xu's claim should hold for all languages. Xu's arguments for a rising tone would indicate an alignment of the low tone at the beginning of the syllable while the peak *Fo* should be observed towards the end of the syllable. Assuming that there can only be one kind of phasing for the coordination of laryngeal and supralaryngeal articulators is rather simplistic since we already know that prominent/focused syllables are hyperarticulated when compared to non-prominent/non-focused syllables suggesting within a speech utterance there can exist different phasing relationships.

However, it is often difficult to find definite segmental landmarks to which tonal targets might be aligned. Moreover, most of the alignment proposals so far inherently assume that if some anchors for tonal alignment do exist they must be acoustic in nature. A plausible alternative would be to assume that such anchors are primarily articulatory in nature. Our current research focuses on finding stable alignments of tonal events to articulatory events. Preliminary results show that for French the L(ow) tone appears to be aligned to the peak velocity of the crucial articulator as it approaches constriction for the syllable onset. While studies of H(igh) in Neopolitan Italian appear to be linked to maximum velocity of the crucial articulator as it approaches constriction for the syllable coda (the point at which the vowel gesture is completed). However, in Neopolitan Italian the alignment of the peak *Fo* also serve a prosodic function. The peaks are temporally delayed in questions when compared to statements. The alignment of the peak H(igh) in Neopolitan questions occurs with the 0 velocity of the crucial articulator (time of maximum trajectory of the closing gesture). It must be stated here that for French the target words were not focused while for Italian the target words were focused and were produced in both normal and fast rates. Our results also

indicate that the tonal event occurs temporally closer to the articulatory event than to the acoustic events (syllable edge, vowel onset, or/and vowel offset) that they have been linked to in the current acoustic literature. The