Laryngeal reality for Mandarin Tones

Li , Xin and Eric Raimy (University of Wisconsin-Madison)

We develop an analysis of Mandarin Chinese (MC) tones that follows *Laryngeal Realism* (Iverson and Salmons 1995) where tones are derived from laryngeal features and occur as segmental features of vowels. We propose a featural representation of MC tones and discuss how it connects to vocalic phonology in MC. We achieve a unified distinctive feature system for both consonants and vowels. This is in line with the research program of *Laryngeal Realism*.

Laryngeal features are commonly used to contrast consonants in voicing and aspiration. A number of researches (Halle and Stevens 1971, Ladefoged 1983, Kingston and Diehl 1994) have described the interaction between tones and laryngeal features from both phonetic and phonological perspectives. Previous studies (Yip 1989, Duanmu 1990, Bao 1999) have attempted to link tonal features to segmental structure. Duanmu (1990) and Bao (1999) both incorporate [stiff] and [slack] in tone models to capture the relationship between tone and voicing. Bao (1999) proposes a model that separates register and contour, yielding a sequence of tonal features.

We adopt Avery and Idsardi (2001), figure 1, where laryngeal feature geometry consists of three dimensions: GlottalTension (GT), GlottalWidth (GW), and LarynxHeight (LH).We also follow the Modified Contrastive Specification (Dresher, Piggott &Rice 1994), which claims that phonological representations are restricted to contrastive features. Consequently, only dimensions are contrastive, each dimension can be specified with one and only one gesture, andonly contrastive features are specified.

Mandarin has four contrastive tones (contours are sequences of features, Goldsmith 1976, Intrasai 2001)– T1 (high level, high-high), T2 (rising, Ø-high), T3 (contour, low-high), and T4 (falling, high-Ø). Glottal Tension=[stiff] represents 'high' and Larynx Height will produce 'low'. Moisik et al (2014) demonstrates that low tone in Mandarin is produced through variable manipulation of larynx height. Figure 2 presents the four distinct tones in Mandarin by assuming the TBU to be bipositional (Bao 1999). Tone1 is GT associated with both TBU slots producing high level. Tone2 has GT associated only with the second TBU position creating rising. Tone3 has LH associated with the first TBU position and GT with the second. This phonological representation captures the variable phonetics found in Tone3 (Moisik et al 2014, Davison 1991). Finally, Tone4 is represented with GT associated to the first TBU position and an empty second position producing a falling tone.

To support this analysis of tones, we reanalyze T3 Sandhi as the deletion of LH when followed by LH in the proper domain (Shih 1986, Chen 2000, Brooke et al. 2009).This work concurs with Pham (2001) on Vietnamese tones which shows that 'tone' is laryngeal specification on vowels. This growing body of work demonstrates that *Laryngeal Realism* can be applied to vowels and motivates the general reanalysis of tone systems via laryngeal features.

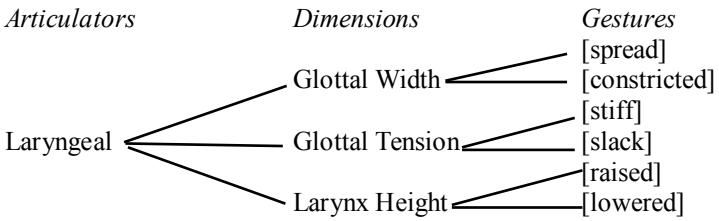

Figure 1: Laryngeal feature geometry(Avery and Idsardi, 2001: 42)

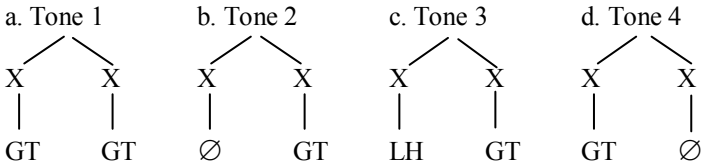

Figure 2: Representations of tones in Mandarin