An articulatory study of prenuclear glides in Southwestern Mandarin

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Introduction: The distinction between complex segments and segment sequences remains a central debate in Chinese phonology. While traditional analyses rely on phonotactic evidence and minimal pairs, recent studies propose gestural timing as a key differentiator. Notably, Shaw et al. (2021) suggest that complex segments exhibit in-phase gestural coordination, where onset and glide gestures are co-articulated synchronously, as found in Russian palatalized stops (p^j-). Conversely, segment sequences are locked in "anti-phase" relation, with Consonant and Glide executed sequentially, as in American English /pj-/. This distinction resonates with the ongoing debate around prenuclear glides (*jièyīn*) in Chinese languages. Chao (1968) and Cheng (1973) consider *jièyīn* as part of the rhyme, while Bao (1990) argues for its inclusion in the consonant cluster. More recently, Duanmu (2007) and Lin (2007) propose an analysis wherein prenuclear glides form complex segments, akin to Russian palatalized stops. This study delves deeper into this debate by investigating the articulatory behavior of prenuclear glides in Southwestern Mandarin, employing the high-precision technique of electromagnetic articulography.

Method: Six native speakers in their 20s participated in our experiment. We used an NDI Wave to collect kinematic data on their speech production. The test materials include: /pjen/, /tjen/, /twan/, and /kwan/. Each stimulus was repeated six times, embedded within the carrier phrase "__, pa ___ pa," meaning "speaking of __, give __ to me." The corresponding gestures for each target item are as follows: /pjen/ (C: LA vs. G: TBz), /tjen/ (C: TTz vs. G: TBz), /twan/ (C: TTz vs. G: LA). /kwan/ (C: TDz vs. G: LA), and /pa/ (C: LA) (where LA=Lip Aperture; TT=Tongue Tip; TB=Tongue Boday; TD=Tongue Dorsum; x=front-back; z=high-low).

Results & Discussion: To investigate the relationship between consonants and glides, we measured the duration of C1 (onset plateau) and the C-G lag (Glide - Consonant), normalizing both using the anchor "pa" in the second occurrence. We plotted the data for each consonant-glide (CG) combination in scatterplots. A least-squares regression line was fitted to each panel to reveal the correlation between C1 duration (x-axis) and normalized C-G lag (y-axis). Crucially, we observed flat regression lines for /pjen/, /tjen/, and /twan/, suggesting coordination patterns characteristic of complex segments rather than segment sequences, which would exhibit positive slopes. In contrast, the scatterplot of /kwan/ seems to show a different pattern from its counterparts, showing a slope instead of a level line. However, the blue dots are quite concentrated. Therefore, we conclude the scatterplot of /kwan/ cannot confirm a typical positive correlation between C1 and C-G lag. These findings support the classification of prenuclear glides as a secondary articulation of onsets in Southwestern Mandarin. In conclusion, our result confirmed the glides in Southwestern Mandarin are parts of the onset, forming a complex segment, similar to Duanmu's (2007) proposal for Standard Chinese. Consequently, we transcribe the syllables as following, [p^jen], [t^jen], [t^wan], and [k^wan].