Language Documentation & Linguistic Theory 2

Ultrasound imaging and theories of tongue root phenomena in African languages

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During the past decade, ultrasound (US) technology has played an important role in the development of phonetic and phonological theory. Much of the research that has made use of this tool has focused on Indo-European languages. We explore the role of US in the documentation of African languages. We focus on three tongue-root related phenomena: tongue-root harmony, click-vowel retraction, and labial-velar fronting, and demonstrate how US studies contribute to the development of theories of the phonetics / phonology interface.

Stewart (1967) proposed the feature Advanced Tongue-root [ATR] as a cross-height feature to distinguish vowel pairs in many African languages such as i/ɪ, u/ʊ, e/ɛ, o/ɔ. Articulatory studies (Lindau 1979; Tiede 1996, etc.) have supported Stewart's observation that tongue-root position is a major difference between [+ATR] and [-ATR] vowels. Whether low vowels also have [+ATR] variants is a matter of controversy. Goad (1993) claims that low vowels can not bear the feature [+ATR], but Gick et al. (2006) showed that [a] in Kinande does participate in harmony. US results on Dagbani, a Gur language of Ghana, support the results for Kinande. Results further show that the dominant [+ATR] feature of Dagbani corresponds to a consistently anterior position of the tongue root relative to the neutral inter-speech rest position, while the [-ATR] non-dominant feature is more variable. The Dagbani results support a theory of direct mapping between phonetics and phonology for the feature [ATR], with rest position corresponding to the state of the tongue root when there is no value of [ATR].

Clicks and labial-velars are complex segments involving an anterior and a posterior constriction. US studies have shown that contrary to previous descriptions (Traill 1985), the posterior constriction in clicks is uvular (Miller et al. 2007, 2009). We present results of a high-speed US study on Mangetti Dune !Xung clicks. Results show that the central alveolar [!] and lateral alveolar [||] clicks both involve tongue root retraction as part of the rarefaction gesture, while the dental and palatal clicks both involve tongue body lowering and tongue root raising. This mirrors the phonological patterning of clicks with respect to the Back Vowel Constraint (BVC), a co-occurrence constraint between alveolar clicks and front vowels (Traill 1985). The data show that tongue root retraction (TR) is part of the rarefaction gesture and thus part of the mechanics of click production. However, TR implies the presence of an [RTR] feature, which explains the patterning of clicks in the BVC.

Maddieson (1993) shows that labial-velars involve backward movement of the tongue during closure. We show using high-speed US, that the posterior constriction in Dagbani labial-velars involves tongue root retraction. We propose that TR is the phonetic grounding of a constraint that changes labial-velars in front vowel contexts to labial-coronals. We attribute the change to a co-occurrence constraint between [RTR] and front vowels, a constraint similar to the BVC found in click languages. The !Xung and Dagbani US data show that what might be considered inert articulatory movements may be linked to active feature specifications.

These 3 studies demonstrate that US technology contributes to the documentation of African languages. African languages are complex, always providing new insights into linguistic theories. We have shown that African languages contribute to development of a direct mapping theory of the phonetics-phonology interface.

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