**Anterior Release Dynamics of Mangetti Dune !Xung Coronal Click consonants**

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Mangetti Dune !Xung, a Namibian Kx'a language, has the four contrastive coronal click types that are recognized by the IPA. Previous acoustically based descriptions of the four clicks in !Xóõ describe the dental [ǀ] and lateral [ǁ] click release bursts as fricated, and the alveolar [!] and palatal [ǂ] click release bursts as non-fricated (Ladefoged and Traill 1994). Ladefoged and Traill (1994) propose the phonological feature [+/- noisy], referring to the fricated vs. non-fricated properties of the acoustic noisebursts, to classify the two types of clicks. However, Ladefoged and Traill's study collapsed clicks produced in different vowel contexts, and since all clicks co-occur more frequently with back vowels, the results are likely dominated by patterns found in clicks in a back vowel context (see e.g. Miller-Ockhuizen 2001; Miller 2010). Miller and Shah (2009) investigated the acoustic properties of the noisebursts of the four click types in Mangetti Dune !Xung in the [u] context, and found a similar pattern to that described by Ladefoged and Traill (1994). However, Fulop et al. (2003) have shown that the palatal click type in the Bantu language SiYeyi is affricated, and is similar to the dental click type in that language.

This study presents results from an investigation of all four clicks in Mangetti Dune !Xung, comparing the timing of the anterior and dorsal releases in the four click types from High Frame Rate ultrasound data (114 fps) collected using the Corrected High Frame Rate Anchored Ultrasound with Software Alignment (CHAUSA) method (Miller and Finch 2011), and the resulting acoustic noisebursts in the [i] and [u] vowel contexts. Results show that the dental and lateral clicks have fricated anterior release bursts, and the alveolar click has an abrupt non-fricated release across both front and back high vowel contexts, showing that vowel context does not affect the nature of the coronal releases in these three clicks. However, the palatal click releases and resulting noisebursts differ across vowel contexts. In the high front vowel context, the palatal click has a short non-fricated burst, followed by a period of frication noise, consistent with an analysis of the variant of the palatal click in this vowel context as involving secondary palatalization. In the high back vowel context, the release is abrupt and the acoustic noiseburst is short in duration, with no following frication noise.

The results will be compared to the results of the three contrastive click types (dental, lateral and alveolar clicks) found in IsiZulu that have been described in different vowel contexts by Thomas-Vilakati (2008), and the four contrastive coronal click types found in the Bantu language SiYeyi (Fulop et al 2003). The fact that some languages have abrupt palatal clicks (e.g. !Xóõ), other languages have more gradually released palatal clicks (e.g. SiYeyi), and Mangetti Dune !Xung is the first language to be shown to have both fricated and non-fricated variants in differing vowel contexts, suggests that the secondary palatalization of the palatal click in the front vowel context in Mangetti Dune !Xung is due to phonological palatalization.

The results presented here drastically change our understanding of how the lingual airstream mechanism is produced. Ladefoged and Traill's Figure 1 shows the coronal release of clicks occurring before the dorsal release. Their figure is based on the alveolar click, but they generalize the figure to the description of all click types. The High Frame Rate Ultrasound results presented here show that the two releases are more simultaneous in the production of the dental and lateral clicks, in accordance with Stevens' (1998) claim that the two releases are more simultaneous in some clicks. The results show that it is possible to produce the lingual airstream mechanism with a very small degree of opening of the coronal release as in the palatal click in high front vowel contexts. It is shown that the further back posterior constriction seen in the palatal click in the language (Miller 2016) allows the anterior constriction in the palatal click to be far enough back to allow an apico-laminal anterior constriction that encourages frication noise such as that typically found in pulmonic palatal stops. New models illustrating the timing of the coronal and dorsal closures and releases, and the degree of opening of each constriction for each of the four click types will be presented.

## References


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