

## Phonetics of ATR in Keiyo

Keiyo (Southern Nilotic; Kenya) is an under-described Kalenjin language. Most Kalenjin languages have ten contrastive vowel qualities, in five ATR/RTR pairs. To our knowledge, there are no existing phonetic descriptions of Keiyo vowels, though there are two papers about the sound system (Kiprop, Chepkirui & Kibet 2015; Kiprop & Chepkirui 2014).

We report on phonetic measurements from one Keiyo speaker. We collected near-minimal pairs of words differing in ATR. Recordings were done on a Zoom H4n recorder with a Shure SM35-XLR cardioid condenser headset microphone, then words and vowels were annotated in Praat (Boersma & Weenink 2021). A Praat script was used to extract formant and voice quality measurements of all vowels at the midpoint. Preliminary analysis is based on 858 vowels.

As seen in Figure 1, initial results show a great deal of overlap in Keiyo vowels. The overlap is much more than was found by Local & Lodge (2004) on Tugen, another Kalenjin language. To determine which vowels were significantly distinguished by their formant values in Keiyo, we ran mixed effects models on each relevant pair of vowels, with the formant measurement as the dependent variable, tongue root value as the fixed effect, and the word as the random intercept. F1 significantly distinguishes mid and low ATR/RTR pairs, as well as high RTR from mid ATR. However, neither F1 nor F2 can significantly distinguish high ATR/RTR pairs, though the voice quality measure H1-A1 approaches significance ( $p < 0.065$ ) for both pairs.

Across languages with ATR contrasts, including Nilotic languages, F1 has been shown to be the most reliable correlate of ATR (Starwalt 2008; Guion et al. 2004). In Keiyo, however, F1 is not able to distinguish the high vowels. The high vowels are auditorily distinct, but given the extensive overlap, they may be undergoing a merger, which has been suggested for the [ʊ]/[u] pair in other Kalenjin languages (Mietzner 2016). Such a merger would be typologically interesting, since Keiyo remains an ATR-dominant system, where ATR suffixes can trigger harmony onto roots (e.g. [kʊ:t] “blow” vs. [ku:t-e] “blowing”). Such ATR dominance is rare in languages without an ATR contrast in high vowels (Casali 2003).

In our work, we examine three possible explanations for the behaviour of high vowels in Keiyo. First, given that there is a (non-significant) F1 difference in the expected direction, we investigate the possibility that there is a very small F1 distinction that becomes significant with more tokens. Second, we examine other possible correlates of ATR, such as breathiness, to see whether a measure like H1-A1 can reliably distinguish all vowels with more tokens. Finally, we look at whether other factors such as tone or length influence the measurements. Regardless of these results, the extensive overlap in Keiyo high vowels provides an intriguing opportunity to examine what ATR means phonetically and the relationship between ATR phonetics, inventory structure, and phonological patterning in ATR harmony in an under-studied language.

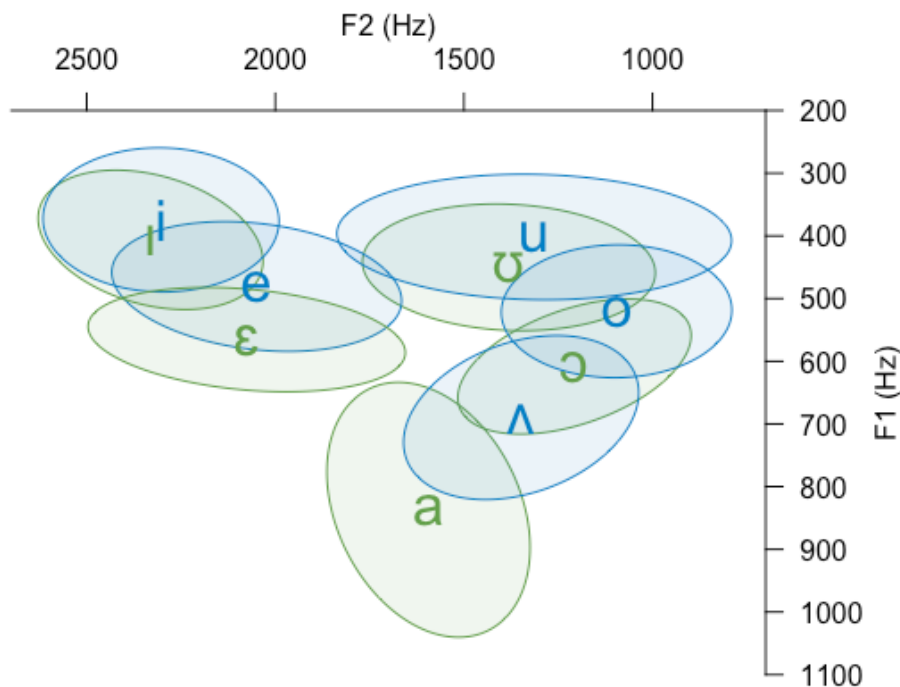


Figure 1: Keiyo vowel plot (green represents RTR vowels and blue is ATR vowels)

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