Spoken, whistled, drummed, and fluted Kinande: An asymmetry for encoding pitch and rhythm

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In short: This paper presents a preliminary analysis of three undocumented language surrogates of Kinande (Bantu) in and around Butembo, DRC from data gathered in July 2023. Analysis shows that all Kinande surrogates represent the two phonemic tones and phrasal penultimate lengthening (Mutaka 1994), but that only whistling encodes pitch declination and lookahead raising. These differences are argued to stem from mechanical constraints of the respective registers (McPherson & Obiri-Yeboah 2022; Barnes, Batchelder-Schwab & Oppong 2023).

Background: Work on languages with multiple surrogates reveals that different surrogate registers of the same language can vary widely in terms of encoded phonological information.

The best-studied surrogates are of Akan-Twi, which can be spoken by drum (Nketia 1971), trumpet (Kaminski 2008), lute (McPherson & Obiri-Yeboah 2022) and bilabial whistle (Nketia 1962:5; Barnes, Batchelder-Schwab & Oppong 2023).

Comparative phonological analysis reveals that phonetic and phonological processes like tonal downstep and downdrift are encoded only in whistled Akan, but are not represented in drumming or seperewa lute, but that phonemic tone (H, L) is represented in all modalities.

Design: Genzel's 2013 dissertation designed an experiment for Akan-Twi where sentences were stratified by *tonal contour* (all high, all low, alternating high-low, alternating low-high), *length* (by syllable count), and *type* (question/statement) in order to prove that declination, phonological downstep, and falling intonation in questions are distinct features of the language. Barnes et al. 2023 replicated the experiment in whistled Akan-Twi to test the same features.

This study adapts the experiment into Kinande, which is similarly bitonal. Here are some examples, out of the 32 sentences (created with Philip Mutaka):

- Kúmbe kwési ngándisyáha Báh' erítamwánza kwê? (HL; 13 syllables; Ques)
- Wanalangira Mukosa. (L; 8 syllables; Decl)
- Múkánátályá kwê? (H; 6 syllables; Ques)
- Tukándisyátasá twalúha. (LH; 9 syllables; Decl)

Participants: The whistled study was conducted with six university students who are L1-Kinande, L2-French speakers between the ages of 18 and 30 from around Butembo, DRC. The drummed study was conducted with one L1-Kinande ceremonial drummer in Lukanga. The fluted study was conducted with one L1-Kinande shepherd. All participants were male, as women explicitly do not whistle or play instruments in Kinande culture.

Recording equipment included a Zoom Q9 recorder two lab-quality condenser microphones. Nobody is literate in Kinande (despite high literacy in French and Kiswahili), so Dr. Mutaka spoke the sentences for the participants to repeat.

Analysis: 32 drummed and fluted sentences, 192 whistled and spoken sentences were measured in Praat for utterance length (ms), penultimate syllable length, pitch at start of utterance, and pitch at end of utterance. The sentence tokens were additionally coded for participant, modality, syllable count, type (Q/Decl), and tone contour (H, L, HL, LH). Linear regressions were run on R testing penultimate syllable length, pitch difference (initial-final), and initial pitch as dependent variables.

Results:

- Penultimate syllables were significantly longer ($p<.01$) than other syllables in all modalities: 33% for speaking; 30% for whistling; 34% for drumming; 41% for fluting.
- Phonemic pitch is generally maintained in all surrogate registers, though there are some unexplained mismatches in the drummed register.
- No difference was found for pitch (Hz) at the start and end of drummed and fluted sentences, nor was an effect found for sentence length.
- Spoken and whistled sentences are significantly lower at the end of sentences than at the beginning ($p<.01$), with spoken sentences declining at about 0.48 semitones per syllable, and whistled sentences declining at about 0.14 semitones per syllable.
- A significant interaction ($p<.05$) was found between sentence-initial pitch and sentence length, where longer sentences start at higher pitch.

Conclusions: Results show that maintenance of subphonemic phonetic and phonological effects are modality-specific in Kinande.

- Metrical information like predictable penultimate lengthening are maintained in all surrogate registers of Kinande.
- Contrastive tone is encoded in all modalities, but subphonemic pitch effects like lookahead and declination are only preserved in the whistled register.
- The co-occurance of declination and lookahead in both whistled Kinande and whistled Akan (Barnes et al. 2023) suggests a relationship between the two pitch effects.
- Systematic maintenance of non-phonemic phonology in surrogate language suggests a utility in preserving information that does not contribute to maintaining functional load.

Next steps: A return trip is planned in summer of 2024, primarily to collect more data on whistled and drummed Kinande. The priority is to broaden the sample of drummers and flautists, and also collect additional types of data that have been collected for whistled Kinande:

- A segmental experiment examining phoneme distinctions using a frame sentence to test minimal pairs
- An intelligibility experiment stratifying utterance length, familiarity, and visual context.

Acknowledgements: Dr. Jonathan Barnes, dissertation supervisor; Dr. Philip Mutaka, Kinande consultant and research partner; Dr. Laura McPherson, reader and for providing recording equipment and an archive space; Dr. Claude Vindu and Mr. Paluku Mapendano local collaborators at Université de L'Assomption au Congo and ISP Muhangi; Boston University SULa lab for field equipment; Boston University Graduate Research Abroad Fellowship for funding.

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