

VOWEL SPACE AND ACOUSTIC CHARACTERISTICS OF STRESSED SYLLABLES IN TWO KIBUSHI DIALECTS SPOKEN IN MAYOTTE, FRANCE: A PILOT STUDY

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ABSTRACT

Kibushi is a principally oral language, which is spoken in Mayotte, a multilingual French island located between Madagascar and the Comoros Archipelago in the Mozambique Channel. The aim of this article is to study the two dialects of Kibushi: Kisakalava, used in a dozen villages with some twenty thousand speakers, and Kiantalautsi, spoken mostly in two villages, Ouangani and Poroani, by a few thousand speakers. 19 speakers in Kisakalava and 9 in Kiantalautsi were recorded producing 19 words. Results show a vowel space slightly different between the two dialects, as well as variation between villages.

Keywords: kibushi, variations, dialects, vowel space, stressed syllables.

1. INTRODUCTION

Mayotte is a multilingual French island located between Madagascar and the Comoros Archipelago in the Mozambique Channel. Its geographic location reflects its sociolinguistic landscape because there are two principal local languages: Shimaore, a Sabaki Bantu language used by the majority of the population, and Kibushi, an Austronesian language used only by 15% of Maore (people from Mayotte) [1]. In addition, the island was a French colony in the second half of the 18th century, before becoming a French department in 2011. Because of this, the French language is the only official language of administration and schooling.

Kibushi, mainly used orally, is understudied despite its apparent rich and complex variation. It is linguistically close to the Sakalava Malagasy dialect from the northwest of Madagascar [2]. There are two dialects with limited intercomprehensibility: Kisakalava, used in a dozen villages with some twenty thousand speakers, and Kiantalautsi, spoken mostly in two villages, Ouangani and Poroani, by a few thousand speakers [1]. Intra-dialectal variation does occur, and it has been claimed that there is a “diversity” in the way Kibushi is spoken in Mayotte. [3]. To define these different ways to speak, Laroussi uses prosodic parameters: “intonation”, “rhythm” and “accent” [3]. This prosodic variation depends on

villages. In fact, Gueunier claims that each village is linguistically autonomous with its own accent and lexicon [4]. However, research demonstrating the existence of these prosodic and phonetic variations is lacking. Variation occurs mainly with regards to the lexicon and various phonetic, phonological, and prosodic levels. For example, the two dialects do not have the same word for “water,” which is *ranu* in Kisakalava, but *mehetsaka* in Kiantalautsi.

This intriguing linguistic landscape is the focus of this pilot study which aims to explore variation in Kibushi based on two aspects: vowel space and stressed syllable characteristics. First, studying vowels is an interesting way to describe prosodic and phonetic variation of a language because unlike the consonants, their places of articulation are less stable [5]. It is unclear how vowel spaces vary by dialect and by village in Mayotte. Second, general observations of Kibushi suggest that there may be differences in word stress across villages and dialects. Specifically, there is one village, Chiconi, whose prosody has been described as “singing like” [3]. Research on Malagasy accent gives us some ideas to study stressed syllable characteristics in Kibushi. Indeed, to describe an “accented syllable” in Malagasy (Merina dialect), three acoustic parameters are used: intensity, duration, and pitch [6]. Duration (closely linked with pitch in Malagasy) and pitch have been shown to be by far the most reliable features for identifying a stressed syllable in Malagasy. That is, accent is associated with a syllable which contains higher pitch and longer duration [6].

Stress in both Kibushi dialects is penultimate, just as in the Malagasy language (Merina dialect). But it can also fall on the antepenultimate syllable with words that end in [ka], [fɾa] and [na] [7]. About phones, Kibushi contains eight vowels (/a, ā, e, ē, i, o, ō, u/), two semi-vowels (/w, j/) and 30 consonants [1] [8]. Some of these phones are nonexistent in Malagasy Central dialects’ phonology [9], such as the implosive consonants /b/ and /d/ and the semi-vowel /w/.

These observations led us to two research questions: 1. How do the two dialects and four villages differ in terms of vowel space? 2. How do the two dialects and four villages differ in terms of stressed syllable features, specifically duration, pitch, and intensity?

2. METHODS

Data from four villages were collected: Acoua and Chiconi, of Kisakalava dialect; and Ouangani and Poroani, of Kiantalautsi dialect. For Kisakalava, nine participants from Acoua of which four women, and 10 participants from Chiconi, of which nine women. For Kiantalautsi, nine participants were from Ouangani, of which 1 woman, and four were from Poroani, all men. Ages ranged from 12 to 24 years of age, with the average age of 16. Due to the voluntary nature of the project, age and gender are not representative. Participants were recorded in a quiet space using a Zoom H1N recorder with a sampling rate of 44,100 Hz. Audio files were cleaned for artifacts using Audacity before being processed via Praat [11]. Analyses and graphics were done using R [12]. In order to adjust for individual differences, including male versus female voices, frequency was converted from Hertz to semitones for each participant, using each participant's f_0 averages ($12 * (\log((z)/100)) / \log(2)$). Formant normalization using Spectral Overlap Assessment Metric (SOAM) measurements was obtained using Wassink's VOIS3D [13].

The study elicited words using the 100-word Swadesh list [10]. 19 of them were analyzed in order to obtain the five vowels /a, i, u, e, o/, in stressed position: 'habu (long), 'hifi (tooth), 'holu(ŋu) (person), 'horu(ŋu) (nose), 'lalaŋa (path), la'lahi (man), 'lela(ka) (tongue), 'liu (blood), 'loku (fish), 'luha (head), 'maru (a lot), 'meki (dry), 'nonu (breast), 'rohu (heart), 'vatu (stone), 'vava (mouth), 'viti (foot), 'voru(ŋu) (bird), 'zahu (I)

3. RESULTS

3.1. Vowel space variation

3.1.1. Vowel space by dialect

Figure 1 shows the vowel space by dialect. While vowels [a] and [o] are comparable in Kisakalava and Kiantalautsi, several differences are observed for [i], [e] and [u], specifically in terms of F2. This could be explained by prosodic differences between the two dialects, which can impact vowel pronunciation. As will be explained in Figure 2 of section 3.1.2, the anterior differences may stem from speakers in Chiconi rather than Acoua for Kisakalava. If differences are observed between the dialects, it is possible that contrasts are also notable between the villages where Kibushi is spoken.

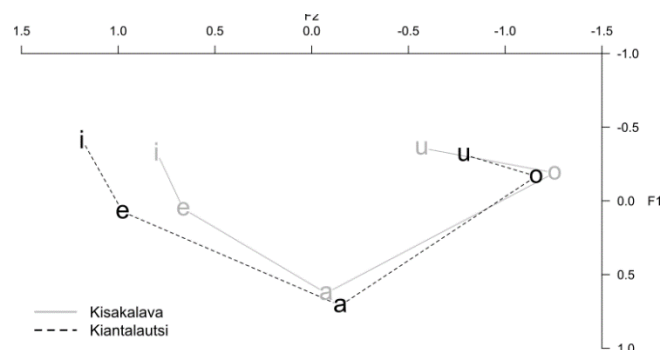


Figure 1: Vowel space by dialect (stressed and unstressed syllables), Lobanov normalization.

3.1.2. Vowel space by village

Variation by village can be seen in Figure 2. Indeed, differences are observed in the formant structure of Kibushi vowels among the four villages, again mainly in terms of F2. As can be seen, the Chiconi (Kisakalava dialect) vowel space is more constrained than the other villages, particularly for anterior vowels. In addition, while from two different dialects, the vowel spaces of Acoua (Kisakalava) and Ouangani (Kiantalautsi) are quite similar save for a slight difference with /u/.

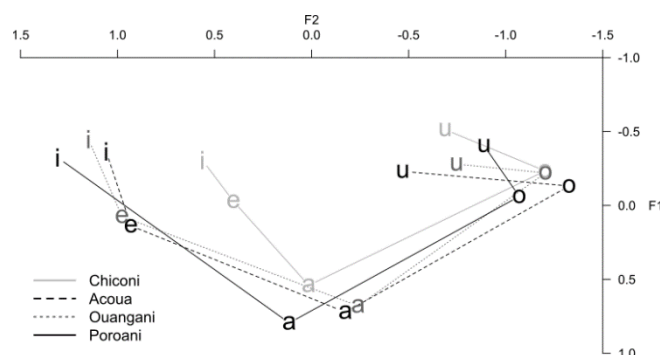


Figure 2: Vowel space by village (stressed and unstressed syllables), Lobanov normalization

3.2. Syllable stress variation

3.2.1. Stressed and unstressed syllable duration

Figure 3 shows the duration of stressed and unstressed syllables in Kibushi. They reveal that stressed syllables are systematically longer than the unstressed syllables. Indeed, the median duration of stressed syllables is 280 ms for Kibushi spoken in Acoua (vs. 182 ms for the unstressed syllables), 320 ms for Chiconi (vs. 185 ms), 287 ms for Ouangani (vs. 190 ms) and 270 ms for Poroani (vs. 179 ms).

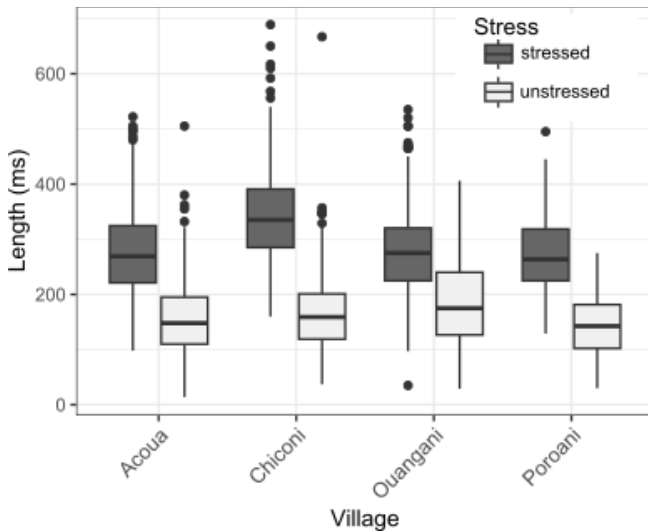


Figure 3: Syllable duration in ms by village.

The fact that the duration of the stressed syllables is longer can reveal prosodic phenomena, which is discussed in the sub-sections below which focus exclusively on stressed syllables.

3.2.2. *f0* curves

Figure 4 shows SSANOVAs of the fundamental frequency throughout the stressed syllable. We observe a rise of the F0 on the second half of the syllable, and this for all villages. Variations between villages are also visible in Figure 5. While pitch for the Kiantalautsi villages (Poroani and Ouangani) are quite similar, those of the Kisakalava villages (Acoua and Chiconi) differ. In fact, pitch for Chiconi stressed syllables stand out from the rest of the villages throughout the syllable (consonant and vowel), in that the pitch rises more gradually. In addition, towards the end of the syllable, Acoua *f0* begins to decrease compared to the other villages.

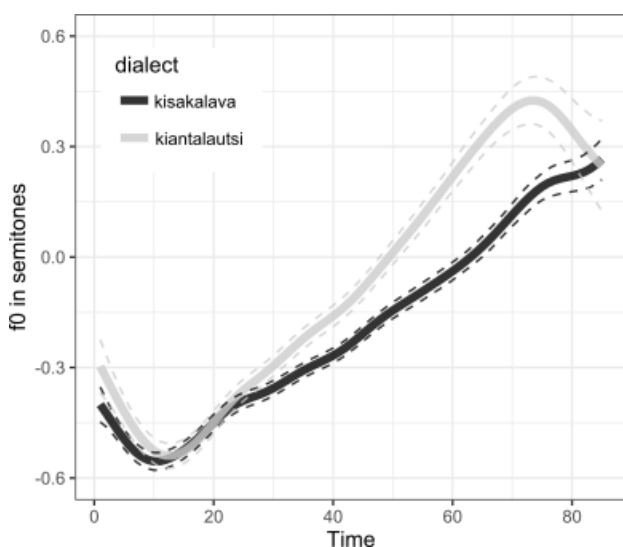


Figure 4: F0 semitones on stressed syllable by dialect

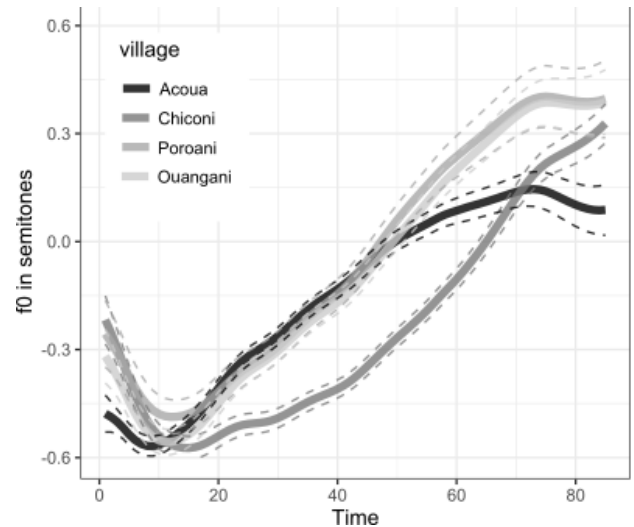


Figure 5: F0 semitones on stressed syllable by village

3.2.2. Intensity

A peak of intensity is noted on the accented syllables. As seen in Figure 6, this peak is located at about 40% of the syllable for Kiantalautsi, and slightly before that for Kisakalava. That is, intensity increases and decreases quicker in this dialect than for Kisakalava. As for village difference, as seen in Figure 7, villages vary quite a bit in terms of dB range and intensity curves, including location of peak intensity. Ouangani has the strongest stressed syllable intensity among the four villages, peaking around halfway through the syllable. Acoua's intensity peaks before that, and this intensity increases and decreases more sharply. Chiconi and Ouangani have similar curves, where intensity builds up steadily over the syllable. However, peak intensity of Ouangani occurs just after halfway, whereas that of Chiconi is near the end of the syllable, about $\frac{3}{4}$ of the way in.

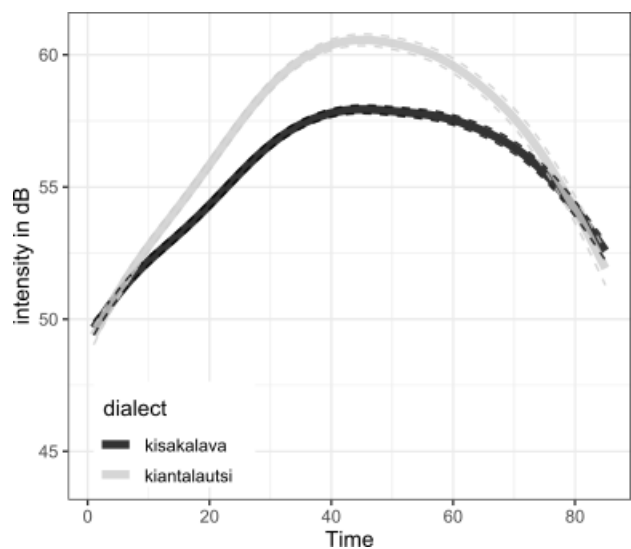


Figure 6: Intensity in dB stressed syllable by dialect

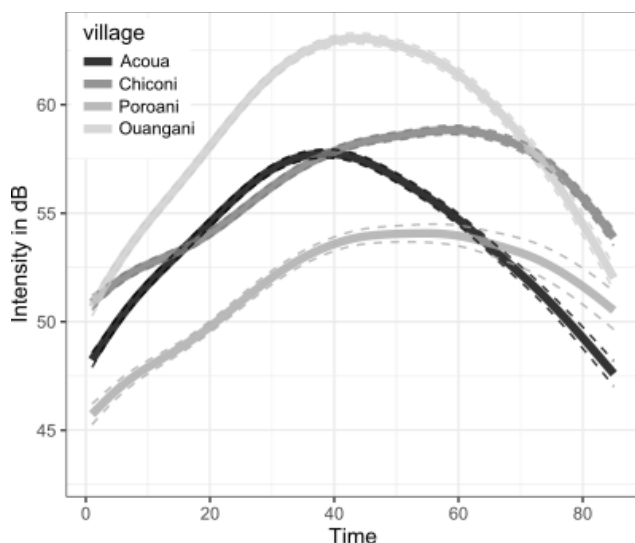


Figure 7: Intensity in dB on stressed syllable by village

4. DISCUSSION

The aim of this pilot study was to explore variation in Kibushi based on two aspects: vowel space and stressed syllable characteristics. Initial results show that Kibushi is subject to diatopic variation. Indeed, the formant structure of vowels is not totally identical from one dialect to another. Moreover, intra-dialectal variations are also noticeable. This indicates that the Kibushi dialects have evolved in slightly different ways. This observation could be explained by different migratory flows in each of the villages tested. Indeed, one can imagine that people who settled more recently on the island do not have the same linguistic origin, which is why vowel pronunciation varies from one village to another. Social networks and isolation between villages may also contribute to variation.

We also observed that the vowel space was larger for stressed syllables than for unstressed syllables. This result can be related to the length of these syllables which are longer than their unstressed counterparts. Indeed, we know that the formant structure of vowels depends on their duration: the longer the vowels are, the more the vowel space will be extended [14].

The other prosodic measures (F0 and intensity) also suggest marked variation. While looking at stressed syllable features by dialect is instructive, it appears to be just as important to look at differences by village. For example, Chiconi and Acoua, though part of the same dialect, differ in terms of f0 and intensity, with Chiconi standing out among the four villages. These findings support Guenier's [4] argument that village is the most important factor when understanding variation in Kibushi. That is, it does not appear to be enough to just address dialectal differences. Rather, when studying Kibushi, villages themselves must be considered. Further studies are needed to refine this observation.

5. REFERENCES

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