Investigating word prominence in Drehu

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Abstract

This study investigates the realization of informational focus in Drehu, an Oceanic language from New Caledonia. Stress in Drehu has informally been described as being demarcative and always falling on the first syllable of words. Our analysis of post-lexical accentuation shows a tendency for salient cues to be realized on a phrasal level. Results show a preference for marking the right edge with longer acoustic duration of final syllables and more extreme pitch movements. This evidence stands in contrast with the stress pattern reported in the literature and suggests a more detailed investigation of stress realization in Drehu is needed.

Index Terms: prominence marking, stress, Oceanic languages, Melanesia, Drehu, bilingual.

1. Introduction

Drehu is an Oceanic language from Lifou, New Caledonia, and the language with the largest number of speakers [1] in the archipel. According to the 2009 census [2], Lifou counts around 8600 inhabitants from which approximately 5500 are Drehu speakers older than 14 years old. Protestant missionaries developed the first writing system [3], which is in its majority still used for Drehu language class in primary, high school, and religious Sunday school. New Caledonia is a French overseas territory and the education system on the island follows the French metropolitan model. This means that apart from the optional Drehu language class all other subjects are taught in French. Today almost all speakers, especially younger generations, are bilinguals of French and Drehu.

Regarding the phonology of the language, it has been established that Drehu has a 30 consonants system including stops, nasals, fricatives, laterals, and approximants. Further, the inventory for vowels includes short and long vowels, and the language's phonotactics allow a syllabic structure with V, VC, CV, CVC and VV, VVC, CVV, CVVC [4]. Drehu has informally been described as a stress language with a word prosodic system [5, 6]. Stress is classified as demarcative, marking out word edges, and is not weight sensitive. According to [5], stress (accent d'intensité) always falls on the first syllable of a word, pëkö [ˈpɛkʌ] (*none, there is nothing*), fifikë [ˈfifikɛ] (*toy*). In word derivation, when words obtain a prefix, the stress pattern remains and stress shifts to the inserted first syllable e.g.: malan [ˈmalan] (*to fall*) vs. amalan [ˈamalan] (CAUS-*fall*). Compound words behave in the same way meaning that stress always shifts to the first syllable of the word. Finally, [6] proposes secondary stress in polysyllabic words, with it always falling on the third syllable [ˈamaˌlan (CAUS-*fall*)]. Within the Oceanic languages Drehu is classified as a language of the Southern Melanesian linkage and belongs to the Loyalty Islands family [7]. Drehu, Iaai, and Negone are closely related languages (Loyalty Islands) and were described as having similar phonological systems. They share several properties, like a rich vowel system that includes a length distinction, a lack of weight sensitivity regarding stress, which in turn is described as demarcative and fixed. Similarly, in Drehu, Iaai, and Nengone the rhythm type was analysed as trochaic [6, 8, 9, 10]. However, there are no phonetic studies further investigating the acoustics of rhythm or prosody in these three languages.

In this study the prosodic and phonetic realization of *word* prominence under informational focus is investigated in order to see whether the patterns recorded in the literature are born out in this pragmatic context. Our analysis is couched in the Autosegmental Metrical theory and aims at providing a first exploratory analysis of prosody in Drehu. According to intonational phonology [11], tonal events are defined through relative contrast from one tone to another. This contrast is perceived in relative tonal height and differs depending on the speaker's tone range. *High* tones are denoted with an (H) and *low* tones with an (L). Tonal events can be simple monotonal targets (H and L) but they can also be complex and bitonal (HL) falling or (LH) rising tones. In languages that bear stress, like Germanic languages, the stressed syllable acts as nuclear accent when in focus [12, 13]. Duration and fundamental frequency will be investigated to examine how they cue focal prominence and whether or not there is a specific set of acoustic parameters that are localised on particular syllables in the focal word. Regarding F0 it has also been pointed out that a nuclear accent in focus isn't necessarily realized with an increase in F0 but rather that a tonal event will accompany the syllable where it is realized. Hence, we are first of all interested in the tonal patterns as well as tonal movements found in focused constituents, and secondly in the acoustic measurements of F0 that accompany these tonal events.

2. Materials and Method

2.1. Participants

Four female speakers (age 29 - 47) were recorded in Lifou. Participants responded to a linguistic questionnaire similar to the Bilingual Language Profile [14]. All reported they acquired French and Drehu during childhood (starting at no later than 7 years with either language), were schooled in French, and had varying degrees of school instruction in Drehu (0 to 10 years). Participants were not only literate in French but also in Drehu. Additionally, they work in the local community in professions that require them to speak in the two languages (e.g. librarian, secretary).

2.2. Materials

Elicitation materials consist of three carrier phrases, in which 56 target words consisting of 2, 3, 4 and 5 syllables were inserted. Target words only contained short vowels, and had varying syl-

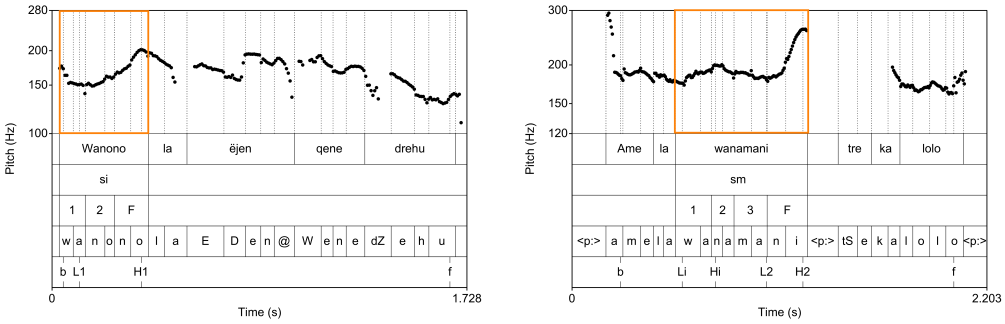

Figure 1: *The plot illustrates F0 contours and annotations of sentences containing the token 'wanono' (grey shrike) in sentence initial (si), and 'wanamani' (water drop) in sentence medial position (sm) with subsequent pause. The labels L1H1 indicate there is only one rise within the token. LiHi indicate there is one initial rise, and L2H2 indicate there is a second rise within the token.*

lable structure at the beginning or end of the word (V- CVC), but only CV syllables were included in the analysis for duration. Target tokens that included stop consonants or fricatives that did not allow reliable labelling of the F0 curve were not included in the analysis of intonation either. The position of the target phrase in the sentence was initial (*si*), medial (*sm*), and final (*sf*). Example (1) shows the carrier phrase used in sentence medial position. Prior to elicitation, the materials were checked for comprehensibility and suitability with a native speaker of Drehu.

(1) Ame la ___ tre ka lolo
ame la tʃe ka lolo
PRS1 ART ___ PRS2 STAT beautiful
'This ___ is beautiful/good'

2.3. Procedure

Recordings were made with a Zoom H6 in a quite room of a community centre. Materials were provided using powerpoint and partcipants had a training phase prior to recording. Sound files were manually transcribed, force aligned in WebMAUS, using a parameter model based on SAMPA [15], and then manually corrected in Praat [16]. Two acoustic parameters were analysed in this study, first duration, and second fundamental frequency. As exemplified in Figure 1, the target tokens, position, syllables and phones were marked. Subsequently, Tones were also manually annotated. A hierarchical database was constructed using the EMU Speech Database Management System [17]. It included tiers for the Tones, phonemic segments, syllables, target token position, and words. The acoustic and durational characteristics of vowel and word tokens produced in the target words were queried and analysed using the emuR package in R [18, 19].

2.4. Analysis

The experiment included three positions for the target tokens: sentence initial (*si*), sentence medial (*sm*), and sentence final (*sf*). Lifou speakers tended to insert pauses between the target tokens and the subsequent stream of speech. Pauses were coded and tokens followed by a pause were not included in statistical analyses. Due to the potential variability in duration of the onset consonants, and to allow for a more consistent comparison, the duration of all vowels in CV syllables was measured and analysed. Additionally, a broad ToBI-style annotation [20, 21] was used to investigate intonation in Drehu. The tonal targets were marked with L for low and H for high tones. Every subsequent tone identified in a token was also marked with an additional number. Figure 1 shows the points marked for tokens in *si*, and *sm* positions.

2.5. Duration hypothesis

As in [22] identified, duration has been recognized as the most frequent correlate of stress in a series of languages. Similarly, duration has been found to correlate with focus marking [23, 24]. Therefore, this parameter is the first one investigated in our study. Recall, stress in Drehu has been described as word initial, regardless of the number of syllables or morphological modifications, like affixation, adding additional syllables. As mentioned earlier, it has been claimed Drehu shows no weight sensitivity, meaning that also light syllables and short vowels can attract stress. Hence, we hypothesise that the first syllable and vowel contained in this syllable will show a greater duration in comparison to all other syllables in the word. Measurements of vowel duration for each CV syllable, in words of different lengths, were taken and then fitted into a linear mixed effects model in order to be compared. The model included 959 observations and included position of syllable and position in carrier sentence as fixed factors, plus speaker, word, and vowel as random factors. We used the step function to arrive at a final model and to obtain significance values, and used post-hoc Bonferroni correction to confirm significance of any interactions. All statistical analyses were carried out in R [19], using lme4 [25].

Table 1: *Identified tonal patterns, only in sentence initial and medial positions, Total = 205.*

Pattern	**LH**	**LHLH**	**LLH**	**HLH**	**LHL**	**HL**
Count	122	38	24	16	2	3
%	59.5	18.5	11.8	7.8	1	1.4

2.6. Intonation hypothesis

Similar to duration, F0 (fundamental frequency) has been recognized as the second most frequent acoustic correlate of stress showing most commonly (but not exclusively) greater F0 values on stressed syllables [22]. In many stress languages that have been previously analysed in an AM framework, the *nu-*

clear accent is a prominence lending pitch movement or target -i.e. a pitch accent, that is associated with the most prominent (stressed) syllable within the segmental string. If stress is word initial in Drehu, we hypothesise that under conditions of informational focus, this will also be the site of a pitch accent or major pitch event. Tonal targets were labelled and F0 values were extracted using Emu-R [18] in order to identify different tonal patterns of the experimental tokens. Additionally, measurements for F0 were taken for tonal targets (L and H Tones) found in tonal movements within tokens. Due to the nature of our data we examined rises and sought to find out if there was a difference in marking focus depending on where the rise was placed. We measured pitch range of rises as the difference in Hz between a H tone and its preceding L tone (See Figure 1). These values were fitted into a maximally specified linear mixed effects model which included 186 observations. The model included position of rise within token (LiHi, L1H1 or L2H2) as a fixed factor, and speaker as random factor. We used the step function to arrive at a final model and to obtain significance values, and used post-hoc Bonferroni correction to confirm significance of any interactions. This analysis was restricted to tokens in *si* and *sm* positions since the right edge of tokens followed by a pause or in *sf* position could be related to the marking of a higher prosodic level.

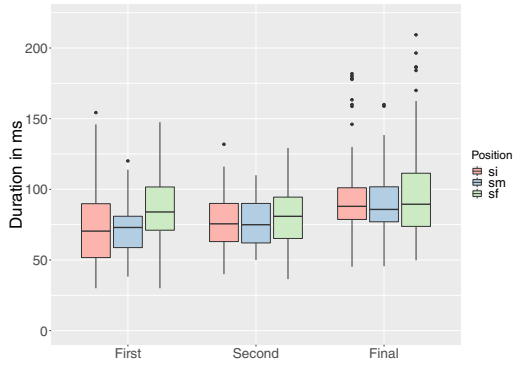

Figure 2: *The plot shows duration in milliseconds of vowels in CV structure of tokens containing two to three syllables, in three different positions: sentence initial (si), sentence medial (sm), and sentence final (sf) positions.*

3. Results

3.1. Duration

Figures 2 and 3 show the duration in milliseconds for vowels in CV syllables, and position of the syllable. Statistical analyses show that in the three different positions included in the experiment the vowel of the final syllable is significantly longer than the first vowel (t = - 8.39, p<0.001) and than all other vowels in preceding syllables. Hence, the first syllable of the word does not contain the longest vowel in the token. Additionally, there is no significant difference between vowels in initial versus medial syllables. These duration results do not provide evidence of word initial stress.

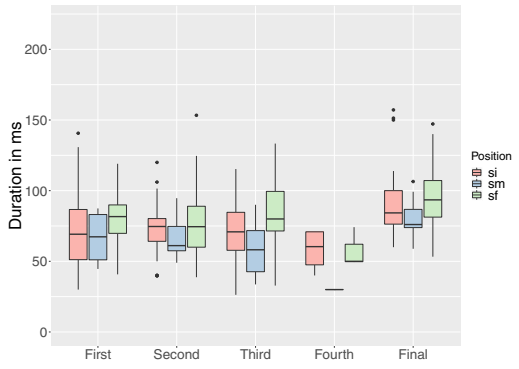

Figure 3: *The plot shows duration in milliseconds of vowels in CV structure of tokens containing four to five syllables, in three different positions: sentence initial (si), sentence medial (sm), and sentence final (sf) positions.*

3.2. Intonation

Table 1 shows the six different intonation patterns identified in our corpus. Four of these patterns represent 97.6% of all occurrences, and are constituted or end on a rising tone (LH). The most frequent pattern found (59,5%) was a rising tone with a H peak towards the right edge of the constituent. Rising tones were found to be either the tonal pattern of a whole constituent or a tonal movement within or at the right boundary of the constituent. Figure 4 shows a comparison of the three types of rises observed in our data: L1H1 tones that spread over the whole constituent; L2H2 tones occurring at the right edge; LiHi tones happening internally, prior to L2H2 (See also Figure 1). In tokens were the initial rise (LiHi) was found, 68% of the words had three or more syllables. There was a statistically significant difference in pitch range depending on the type of rise, with L1H1 (Est. 17 $\pm$ 5 Hz, p<0.002) and L2H2 (Est. 17 $\pm$ 6 Hz, p<0.002) showing greater pitch range expansion when compared to LiHi.

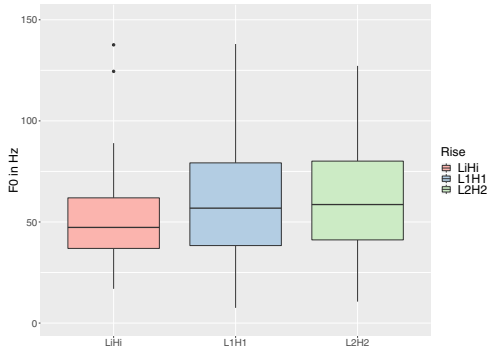

Figure 4: *The plot shows differences of pitch range in Hz of three different rising tones.*

4. Discussion and Conclusion

This study sought to provide a first evaluation of the phonetic marking of informational focus in Drehu. Our hypothesis re-

garding acoustic correlates of focus were confirmed by this data since duration and F0 proved to cue focal prominence consistently at the right edge of the constituent. Previous descriptions of Drehu phonology claimed that the language has initial word stress. In view of these analyses of Drehu as a stress language, we expected the first syllable of target tokens to constitute the location of a nuclear pitch accent in a word insertion task where the tokens were in informational focus. As duration and fundamental frequency have been widely claimed to be major correlates of stress and focus marking, we predicted the first syllable of the word should show longer duration values and a strong prominence-lending tonal movement. Contrary to our predictions, it was found that vowel duration was significantly longer on the *final* syllable of target tokens. Similarly, a rise was often observed, which in 97.6% of the cases ended on a peak at the right edge of the constituent. Measurements of F0 and a comparison of the pitch range of three different types of rises revealed that rises going across the whole constituent (L1H1) or rises placed directly prior to the right boundary (L2H2) showed significantly greater expansion than rises placed within the constituent (LiHi). Presumably, this word internal rise led to earlier interpretations of stress being placed on the first syllable of words. The results reported in our study show consistent tonal and durational marking of the right edge of constituents in focus. As the target tokens measured in our study are in informational focus, we can only interpret our findings in terms of the marking of focused constituents in Drehu. However, the lack of any durational or tonal cues associated with word-initial syllables calls for a further investigation, and a revaluation of previous stress analyses of Drehu, and perhaps also for other languages from the Loyalty Islands family. Finally, a more detailed study of prominence marking, for instance in non-focal words seems desirable in order to provide a more advanced description of Drehu prosodic phonology.

5. Acknowledgements

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