FUNCTIONS OF AMFO'AN (METO) PROSODY: A PRELIMINARY ACOUSTIC STUDY

ABSTRACT

This paper presents a preliminary study of phrase-level prosody in Amfo'an, an understudied variety of Meto (Austronesian) spoken in Eastern Indonesia. It investigates the role of prosody in demarcating phrases and its possible role highlighting important elements within the phrase. It also examines the possible interaction of prosody with word stress, for which acoustic evidence has previously been demonstrated. This is done by acoustic analysis of F0 movements in the phrase. Results indicate that prosody primarily serves a demarcating function in Amfo'an, and stress was not found have a significant effect on F0 movements. Based on these findings, Amfo'an may be considered an example of a language where 'intonation ignores stress'.

Keywords: Austronesian, Indonesia, prosody, F0, word stress

1. INTRODUCTION

Two primary functions of phrase prosody are typically distinguished: demarcating boundaries between phrases and marking highlighting important elements within phrases [1].

This paper presents a preliminary study of the functions of prosody in Amfo'an, which is a variety of Meto (Austronesian) spoken in Eastern Indonesia. This is done by acoustic analysis of of F0 movements, especially in the final two syllable of the phrase. This focus on final two syllables of the phrase is because in Austronesian languages of Eastern Indonesia, the main prosodic events typically occur at the right phrase boundary [2].

F0 is investigated because it is typically considered to be the important cue for phrase prosody cross-linguistically (e.g. [3]). Following the methodology of [1], the form the shape of F0 movements in different phrase positions is investigated, as well as the role of prosody in demarcating phrases and its possible role highlighting important elements within the phrase.

In this study, I also investigate the possible interplay of F0 movements and word stress. Amfo'an has previously been demonstrated to have acoustic evidence for stress on the penultimate syllable [4]. The primary acoustic correlates of stress in Amfo'an are spectral tilt, vowel quality and the ratio of perceptible pitch rises and falls, with penultimate (stressed) syllables having a higher ratio of rises to falls than ultimate (unstressed) syllables.

In languages with word stress, highlighted words are often marked by F0 movements on or near a syllable which bears word stress, often referred to as *pitch accents* [5]. Models of intonation often assume that this will be the case (e.g. [3]). There are, however, counter-examples such as Kuot [6], where there is no evidence of interaction of F0 and word stress.

2. METHOD

2.1. Data collection

Data for this study comes from spontaneous narrative collected by the author in 2017 in Lelogama, West Timor. Recordings were made using a zoom H1 recorder.

2.2. Participants

All participants are native speakers of Amfo'an, ranging in age from 17-71 at the time of recording. There were four male and three female participants.

2.3. Data selection and preparation

The data was transcribed by a native speaker of Meto, and segmented in into intonation units for transcription with the aid of the transcriber. All words and syllables were then segmented by the author using Praat textgrids.

A subset of the syllables (N = 2834) were selected for analysis. Syllables in utterances that were interrupted (especially by background noise) or cut off were omitted. Words containing sequences of two vowels were omitted because they can be realised as either one or two syllables (either as a long vowel, phonetic diphthong or sequence of two distinct vowels).

The position of each syllable in a phrase was labeled according to a five- way distinction (first, second, medial, pre-final or final). Note that for all statistical tests involving the five-way position distinction (see §2.5), this was performed on syllables taken from phrases that were minimum syllables in length. This was to avoids ambiguous

labels for phrases less than five syllables.

Syllables were also labeled for word class; either content (nouns, verbs, numbers, adverbs) or function words (pronouns, demonstratives, conjunctions). Syllables were also labeled for stress, based in on the findings of [4]. Syllables were also annotated to indicate whether they occurred before a silent pause. Two kinds of pauses were distinguished; within-phrase pauses and between-phrase pauses.

2.4. Measurements

F0 measures were taken using Praat [7] using scripts written by Constantijn Kaland, available at https://osf.io/cr4vn. For each syllable, the F0 minimum and maximum in semitones (henceforth ST) and their timestamps were extracted. Then, for each syllable the size of the F0 movement was calculated by subtracting the F0 minimum from the F0 maximum. F0 movements were also labeled as either rises, falls or rise-falls. Movements where the minimum occurs before maximum were labeled as rises, and movements where the maximum occurs before minimum were labeled as falls. Pitch movements on either side of the max were labeled as rise-falls. Movements were only labeled if they were above the threshold $_{gthr}(ST/s) = .16/T2$ which is a measure of the speed of frequency change in semitones per seconds for a given F0 movement duration, T. This threshold is indicative of whether pitch movements are likely to be perceivable [8, 32].

2.5. Statistical analysis

Statistical analyses were conducted using R [9]. The *lme4* and *afex* packages [10, 11] were used to carry out Linear mixed models fit by maximum likelihood and chi-square tests. The *multcomp* package [12] was used to carry out pairwise comparisons. Predictors are referred to in this paper using SMALL CAPS.

2.5.1. F0 movement shape

The shape analysis examined the sizes and directions of the F0 movements, especially in the pre-final and final positions of the phrase. It also investigated if F0 movements were affected by word stress. To do this, a LMM was carried out with F0 MOVEMENT as the response and PHRASE POSITION (first, second, medial, pre-final, final) and STRESS (stressed, unstressed) as predictors. Participants and words were random intercepts. Pairwise comparisons Tukey honestly significant difference (HSD) test (Bonferroni corrected) were conducted

between PHRASE POSITIONS. Chi-square tests were done on the distribution of rises and falls in the two final syllables in the phrase, testing for the effect of position and stress.

2.5.2. Demarcating function

The demarcating analysis investigated the relationship between F0 movements and pauses in order to determine the extent to which F0 marks prosodic boundaries in Amfo'an,. In particular, it was tested if larger F0 movements signal stronger phrase breaks, as has been previously observed, [13]). This was done by examining the size of F0 movements before within-phrase and between-phrase pauses.

This was done by conducting a LMM on the final two syllables before a pause. F0 MOVEMENT was the response and PAUSE TYPE (within, between) and PHRASE POSITION relative to the pause (pre-final, final) were predictors. Participants and words were random intercepts.

2.5.3. Highlighting function

The possible highlighting function was investigated by examining the possible effect of word class on F0 movements. This is because content words have been predicted to occupy more important positions in prosodic structure than function words [1, 14]. Possible effects of word stress were also examined. Given the acoustic evidence for stress on the penultimate syllable in in Amfo'an, we would expect that the pre-final syllable of the phrase is a prosodically prominent position in Amfo'an.

This was done in three statistical tests. The first was a chi-square test on the distribution of perceptible rises and falls in function and content words. Then, two LMMs were conducted with F0 MOVEMENT as the response with WORD CLASS (function, content), STRESS (unstressed, stressed) and PHRASE POSITION as predictors. In the first LMM, the PHRASE POSITION predictor compared pre-final vs other syllables, and in the second final vs other syllables.

3. RESULTS

3.1. F0 movement shape

Final syllables show larger F0 movements than other positions in the phrase. Significant comparisons were only found for the final position in the phrase (Table 7).

The LMM found no significant affect of stress on

Table 1: Mean F0 movements in ST (SD) in different phrase positions

first	second	medial	pre-final	final
3.74	4.54	3.5	4.78	6.36
(4.78)	(6.52)	(5.44)	(6.93)	(7.02)

Table 2: Pairwise comparisons for different phrase positions

Pairwise comp	β	SE	z	*p*
First-Second	0.86	0.73	1.18	n.s.
First-medial	0.01	0.6	0.01	n.s.
First-pre-final	0.85	0.76	1.11	n.s.
First-final	3.12	0.82	3.80	**=0.001**
Second-medial	-0.85	0.59	-1.43	n.s.
Second-pre-final	-0.01	0.76	-0.01	n.s
Second-final	2.26	0.81	2.81	0.04
Medial-pre-final	0.84	0.61	1.36	n.s.
Medial-final	-3.11	0.66	-4.72	**<0.001**
Pre-final-final	-2.27	0.81	-2.81	**=0.04**

F0 movement in any phrase position (Table 3).

Table 3: LMM results: shape

Predictor	β	SE	t	*p*
Stress	-0.8	0.42	-1.92	n.s.

The distribution of rises, falls and rise falls did not differ significantly between stressed and unstressed syllables (Table 4). Regarding the distribution of rises and falls in the final two syllables in the phrase, the most common pattern is a fall in the pre-final syllable followed by either a rise or fall in the final syllable. A significant affect for position was found (Table 4).

Table 4: Shape analysis, chi-square test results: Perceptible F0 movement

	Rise	Fall	Risefall	χ^2	*p*
Pre-final	130	208	38	204	**<.001**
Final	216	204	74		
Stressed	149	174	63	5.19	n.s.
Unstressed	195	238	48		

3.2. Demarcating

The LMM indicated that PAUSE TYPE significantly affected the size of F0 movements significantly (Table 5) F0 movements were smaller in pre-final (*M*=2.89, *SD*=2.21) and final (*M*=5.28, *SD*=7.51)

syllables before within-phrase pauses than they were in pre-final (*M*=4.7, *SD*=6.67) and final (*M*=7.57, *SD*=8.29) syllables before between-phrase pauses occurring between phrases. The LMM also showed a significant effect of PHRASE POSITION (pre-final, final, Table 5). Pre-final syllables typically have smaller F0 movements (*M*=4.53, *SD*=6.41) than final syllables (*M*=7.29, *SD*=8.23).

Table 5: LMM results: demarcating

Predictor	β	SE	t	*p*
Pause type	-2.58	0.69	-3.71	**<0.001**
Phrase position	-2.83	0.42	-6.8	**<0.001**

3.3. Highlighting

There is no evidence that the distribution of rises and falls differs significantly between content and function words (Table 6).

Table 6: Chi-square test results: Highlighting

	Rise	Fall	Risefall	χ^2	*p*
Content	458	678	176	12.49	n.s.
Function	120	237	33		

Regarding the the size of F0 movements, the LMMs found no significant of WORD CLASS. The effect of PHRASE POSITION was only significant for final syllables, with final syllables having larger F0 movements (*M*=7.48, *SD*=8.23) than syllables in other positions (*M*=4.23, *SD*=6.24). Again, stress did not have a significant affect on the size of F0 movements.

Table 7: LMM results: Highlighting

Predictor	β	SE	t	*p*
Word class	-0.14	0.8	-0.19	n.s.
Phrase position (final vs other)	-3.38	0.94	-3.59	**<0.001**
Stress	-0.57	0.54	-1.05	n.s.
Word class	-0.3	0.83	-0.36	n.s.
Phrase position (pre-final vs other)	0.22	0.8	0.28	n.s.
Stress	0.17	0.52	0.32	n.s.

4. DISCUSSION

The results of the current study indicate that the largest F0 movements in Amfo'an occur in the final syllables of the phrase, indicating that the main

prosodic events in this language occur at the right phrase boundary. In particular, the final syllables differ significantly from other syllables in the size of the F0 movement. This suggests that phrase boundaries in Amfo'an are mainly marked by pitch movements on phrase-final syllables.

F0 movements are larger before between-phrase pauses than before within- phrase pauses. This indicates that stronger phrase breaks are marked by larger F0 movements, as expected [13].

I find no significant effect of word class on F0 movement or on the distribution of rises and falls. I also do not find significant effect of stress on F0 movements, which is not surprising as F0 has not been found to be a correlate of stress in Amfo'an. I find that word stress has a significant affect on the distribution of rises and falls in pre-final and final syllables of the phrase. This is notable because the distribution of rises and falls has been found to be a correlate of stress at the word level [4]. These results provide evidence that stressed syllables do not act as F0 anchoring points in Amfo'an (i.e. pitch accents). Based on these results, Amfo'an may be described as a language where 'intonation ignores stress'.

Based on these findings, it is likely that prosody in Amfo'an does not have a highlighting role, but only a demarcating one. This paper represents the first in-depth study of prosody in an Austronesian language of Timor, and contributes to our understanding prosody in Austronesian languages more broadly. These results are, however preliminary and there are many avenues for further research.

5. REFERENCES

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