

Prosodic Differences Between Declaratives and Polar Questions in Fataluku

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Abstract

The primary goal of the present study is to describe the basic prosodic differences between declaratives and polar questions in Fataluku, an underdocumented Papuan language spoken in the island nation of East Timor. Two robust prosodic differences between statements and questions are observed, namely, the duration of the final vowel and the intonational tune at the right margin of the sentence. Declaratives have a shorter final vowel that carries a low f_0 , while questions have a much longer final vowel that has a rising-falling f_0 pattern. I postulate a $L\%$ boundary tone for declaratives and a $L+HL\%$ boundary tone for questions, proposing that the final syllables of questions are lengthened to accommodate the more complex sequence of final tones.

1 Introduction

Fataluku is an underdocumented language spoken by approximately 37,000 individuals in island Southeast Asia, on the far eastern tip of the nation of East Timor (Lewis et al., 2013). Fataluku is a member of the Timor-Alor-Pantar family of Papuan languages, which includes about twenty-five languages spoken on Timor and nearby islands (Klamer, 2014; Schapper et al., 2014). Relatively little has been published about any aspect of the phonology of Fataluku.

The primary goal of the present paper is to describe the intonational differences between declaratives and polar questions (also known as yes-no questions) in Fataluku. This paper is part of a

larger project to describe Fataluku segmental and suprasegmental phonology. I analyze Fataluku intonation within the framework of the autosegmental-metrical (AM) theory of intonational phonology (Pierrehumbert, 1980; Ladd, 1996), which has become the standard for intonation research. In the AM model, the phonological structure of intonation is represented underlyingly as a sequence of discrete level tones, each of which is associated either with a prominent syllable (a “pitch accent”) or with the edge of some prosodic constituent (a “boundary tone”). The surface intonation contour is a result of continuous interpolation between discrete level tones.

My focus here is on behavior at the right edge of an Intonational Phrase (IP) in Fataluku. The IP—the largest prosodic constituent in the AM framework—is a phrase that can stand alone and is generally accompanied by a final boundary tone and final lengthening (Jun and Fletcher, 2014). Typologically, IP-final boundary tones are rich sources of linguistic information (Lindström and Remijsen, 2005), a generalization that holds for Fataluku as well.

To lay the groundwork for the analysis of intonation, section 2 provides some background on the language, including a review of a previous study on Fataluku question intonation. After a brief discussion of methods, the results of the present study are given, describing the prosodic patterns of statements and polar questions. The discussion section proposes a phonological analysis to explain the observed prosodic differences. The paper concludes with a summary and some suggestions for future research.

2 Background

2.1 Segmental Phonology

By way of introduction, tables 1 and 2 show my present analysis of the phonemes of the Fataluku variety spoken by the participants of this project. Voiced stops are attested only in loan words.

	Bil	Lab	Dnt	Pal	Vel	Gtl
Stop	p b		t d		k g	ʔ
Affr.			ts			
Fric.		f v	s z			h
Nas.	m		n			
Tap			r			
Lat.			l			
Glid.				j		

Table 1: Consonant Phonemes

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	

Table 2: Vowel Phonemes

The basic syllable structure of Fataluku is (C)V(V)(C). Consonant sequences are rare, especially within a morpheme. Fataluku has both long vowels and diphthongs, both of which are represented underlyingly as sequences of vowels—identical in the case of long vowels and non-identical in the case of diphthongs (Heston, 2014). The examples below are given in a phonemic practical orthography.¹

2.2 Morphosyntax

Fataluku morphology is generally isolating. Grammatical relations are indicated primarily by word order, and grammatical information like tense, aspect and negation is coded in independent words. The basic word order is SOV, with generally left-branching

¹Symbols which differ from the IPA are as follows: orthography ʔ = /ʔ/, c = /ts/, j = /z/, w = /v/, y = /j/.

constituent order. Polar questions and declaratives can be identical apart from prosody, or they can be optionally flagged with either the question marking morpheme *aa* ‘Q’ or the tag *ana upe* ‘or not’ at the end of the utterance (see examples 1–3). There is also a particle *ten* which appears in some of the polar questions collected here, but whose exact function is not yet known. No substantial differences in meaning have been found between any of the different strategies for flagging questions.

(1) Declarative/Unflagged question²

kinamoko a maca mahane
child NOM bat fear

‘The child was afraid of the bat.’
or ‘Was the child afraid of the bat?’

(2) Question flagged with *aa* ‘Q’

kinamoko a maca mahane aa
child NOM bat fear Q

‘Was the child afraid of the bat?’

(3) Question flagged with *ana upe* ‘or not’

kinamoko a maca mahane ana upe
child NOM bat fear or not

‘Was the child afraid of the bat or not?’

2.3 Suprasegmental Phonology

Some research on Fataluku suprasegmental phonology was undertaken by Ruben Stoel. He analyzes Fataluku as having lexical “tone” system in which each content word has a lexically specified high tone on either the first or the second syllable (Stoel, 2008). A full discussion of Stoel’s analysis of tone lies outside the scope of this paper, although it is an interesting proposition meriting further investigation.

Stoel has also discussed question intonation in a conference presentation, the slides of which have been made available online (Stoel, 2007). Stoel (2007, p. 3) claims that “Questions have a H [high]

²Glossing abbreviations are as follows: CONJ, conjunction; NOM, nominative; PST, past tense; Q, question particle; SG, singular; and VAL, valency (used to mark the morpheme -m which can be used to add additional arguments to a clause).

tone associated with the last syllable, which is absent in statements.” In the example spectrogram he gives, this tone is realized as a high-falling f_0 contour on the final syllable of the question. He claims that duration is also a correlate of this distinction, with the final syllables of questions lengthened and the final syllables of declaratives shortened.

Since Stoel’s slides do not specify either the dialect on which his analysis is based or the number of speakers, it is not clear how generalizable these findings may be. I analyze new data from three villages in the Fataluku-speaking region, providing a more detailed description of the phonetics of polar question prosody and offering a new phonological analysis to explain the phonetic facts. I hypothesize that both the final f_0 contour and the duration of the final syllable are important components of the declarative/interrogative distinction, although there may be differences between the language varieties analyzed here and the variety Stoel describes.

3 Methods

In order to test this hypothesis, six native speakers of Fataluku (five males, one female) were recorded reading broad-focus declaratives and polar questions. Speakers’ ages ranged from 18 to 30 years. These speakers were from three separate villages (Lospalos, Com and Muapitin), two speakers from each.³

Recordings of short Fataluku sentences were made in a quiet location using a Zoom H4n or H6 solid-state digital recorder at 44.1kHz/16bit. In most cases, a headset condenser microphone (either the Shure WH30 or the Shure SM35) was used for higher-quality recordings. Since the extent of dialect variation was not known at the start of this study, speakers who were fluent in English were prompted with English sentences to translate into Fataluku, to ensure the Fataluku sentences collected were natural in each speaker’s own speech variety. Speakers who were less comfortable in English were given sentences written in Fataluku to read, but they were encouraged to modify any aspects of the sentences that

³I use the abbreviations Com-1, Com-2, Lp-1, etc. to uniquely refer to each speaker. The abbreviations Lp and Mp represent Lospalos and Muapitin, respectively. Com-2 represents the female speaker.

might be unnatural for them. No substantial difference between the elicitation strategies was observed.

To control for the effects of lexical or segmental content, there was a matching set of declaratives and interrogatives. A basic set of 12 declaratives and 12 questions was recorded 2–3 times by each speaker. Sentences with substantial disfluencies were excluded from analysis, yielding a total of 133 declaratives and 162 interrogatives. Pitch contours and durations were observed using the phonetic analysis software Praat (Boersma and Weenink, 2013). Duration was measured based on the presence of periodic vibrations and higher-level formants, as deducible from the waveform. A vowel was judged to end at the point at which regular vocalic vibrations were no longer discernible. A characteristic example of duration measurement is given in figure 1.

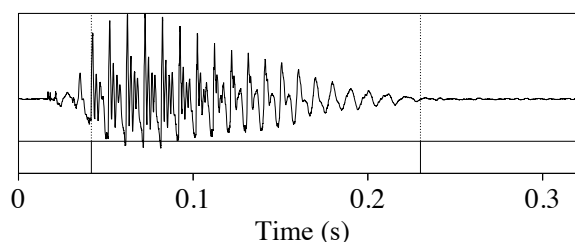


Figure 1: A characteristic duration measurement, from the final syllable of *upe* ‘not’

4 Results

As hypothesized, declaratives and polar questions differ substantially in f_0 and syllable duration at the right periphery of an utterance, although the basic pattern differs to a certain extent from the language variety Stoel describes. The same basic prosodic patterns were used by all six speakers, independent of gender or village. The following subsections describe the basic patterns for declaratives and polar questions.

4.1 Intonational Tune: Declaratives

Analogous to the syntax, questions and statements are very similar prosodically until the right periphery, where the primary differences are shown. Regardless of the sentence type, it is common to find a pitch peak in the first or second syllable of each

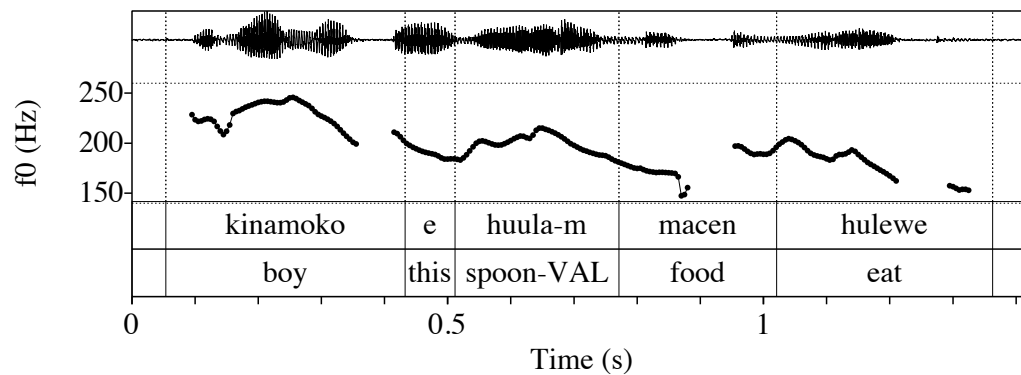


Figure 2: A basic declarative sentence (Com-2)

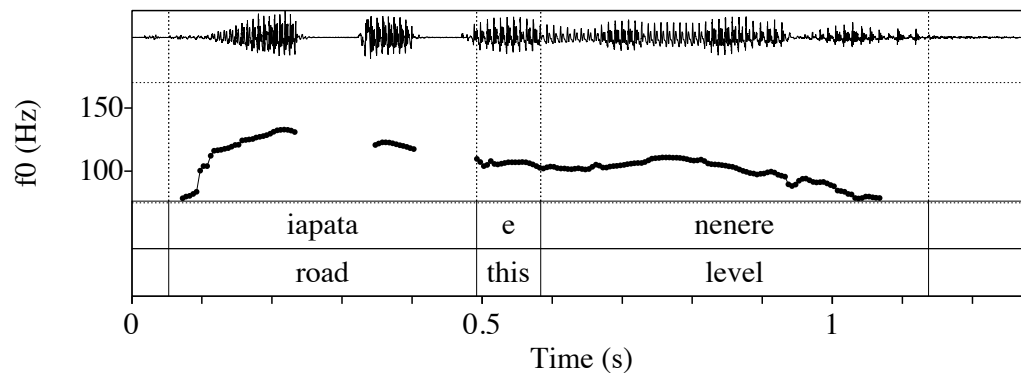


Figure 3: A basic declarative sentence (Mp-1)

word or short phrase, each generally lower than the peak preceding. These pitch peaks occur in approximately the same locations described by Stoel (2008). However, since his analysis of “tone” resembles an intonation system in some ways, I remain ambivalent about the best phonological analysis of these peaks. A more extensive analysis of Fataluku sentence intonation is the subject of ongoing research.

In declaratives, the overwhelming pattern is for the f_0 to fall from earlier pitch peaks through the last several syllables of an utterance, ending on a final low.⁴ The final vowel is generally quite short, and if

⁴There is an alternative prosodic pattern with rising intonation that occurred in a few of the sentences collected here, and that has been observed in narratives in contexts involving continuation. I analyze this as a distinct “continuation” contour, which I do not discuss further here.

it follows a voiceless consonant, it may be devoiced. Figures 2 and 3⁵ show representative examples of declaratives.

4.2 Intonational Tune: Polar Questions

Questions are similar in intonation to declaratives until the right margin of an utterance, where polar questions are distinguished by a rising-falling pitch contour on the final syllable and a significantly lengthened final vowel. The most typical case is for the f_0 to fall throughout the last few syllables, reaching a local minimum within second half of the

⁵All pitch tracks were created with Praat (Boersma and Weenink, 2013), using a modified version of a Praat script developed by Pauline Welby, made available by the Department of Linguistics at the University of Victoria. Pitch ranges are optimized separately for each speaker.

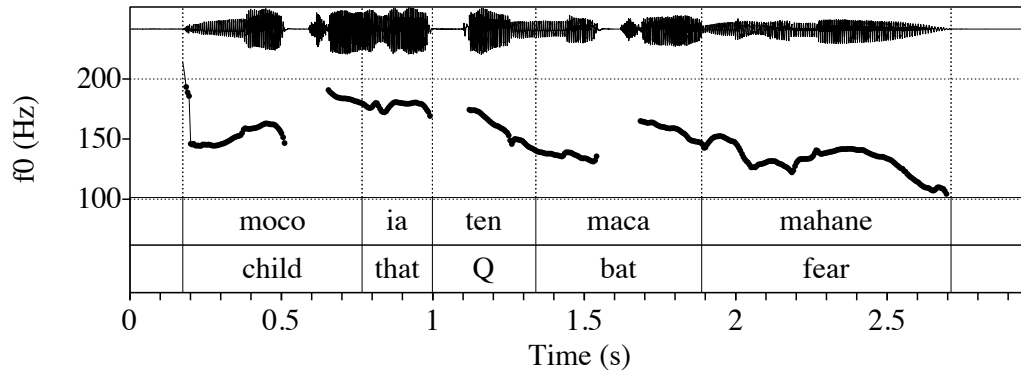


Figure 4: A polar question without *aa* 'Q' or *ana upe* 'or not' (Lp-2)

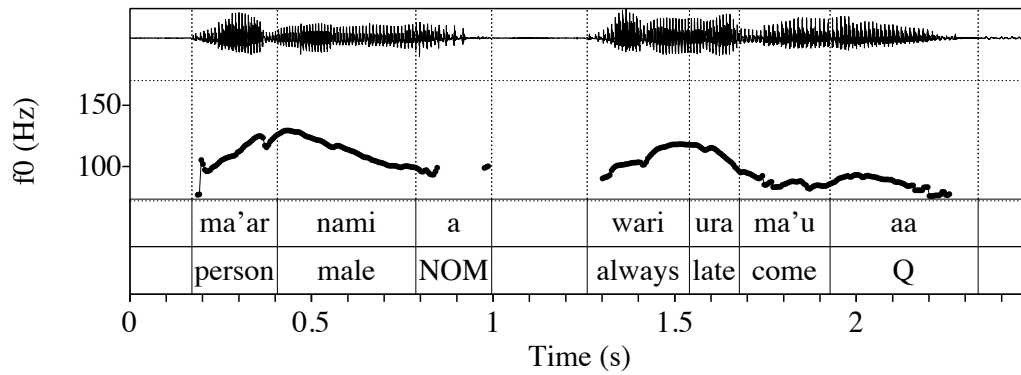


Figure 5: A polar question flagged with *aa* 'Q' (Mp-1)

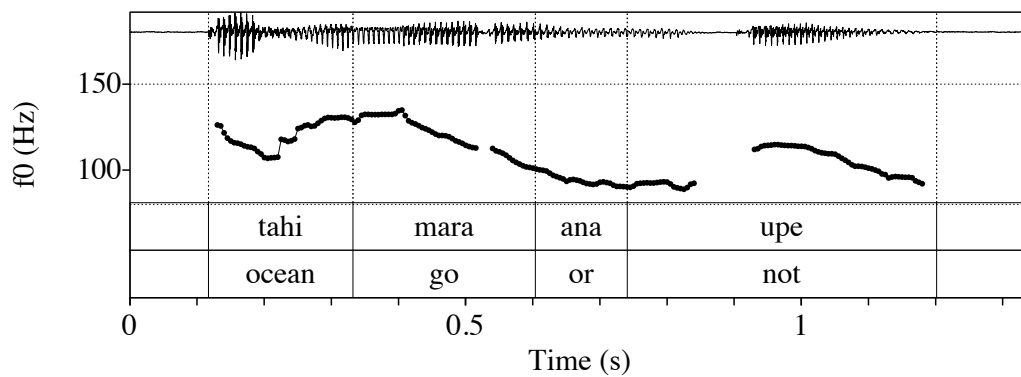


Figure 6: The latter portion of a polar question flagged with *ana upe* 'or not'. Extracted from the sentence, *Aa rahin la'a tahi mara ana upe?* 'Did you go to the beach yesterday or not?' (Lp-1)

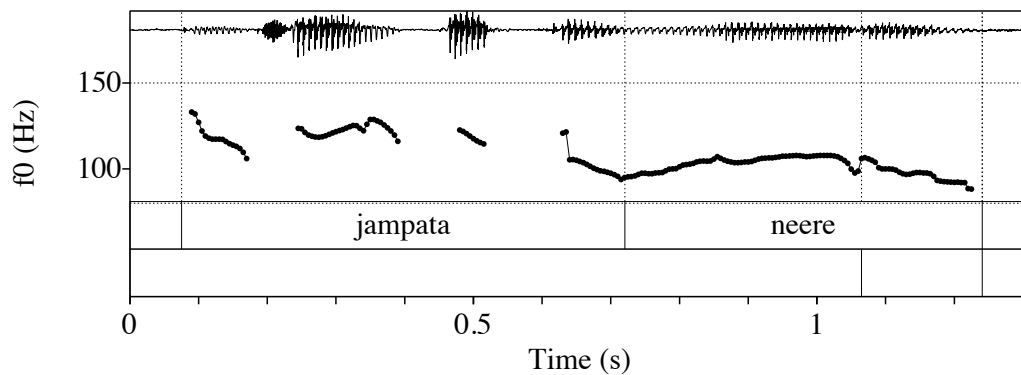


Figure 7: A declarative sentence with a pitch peak on the penultimate syllable (Lp-1)

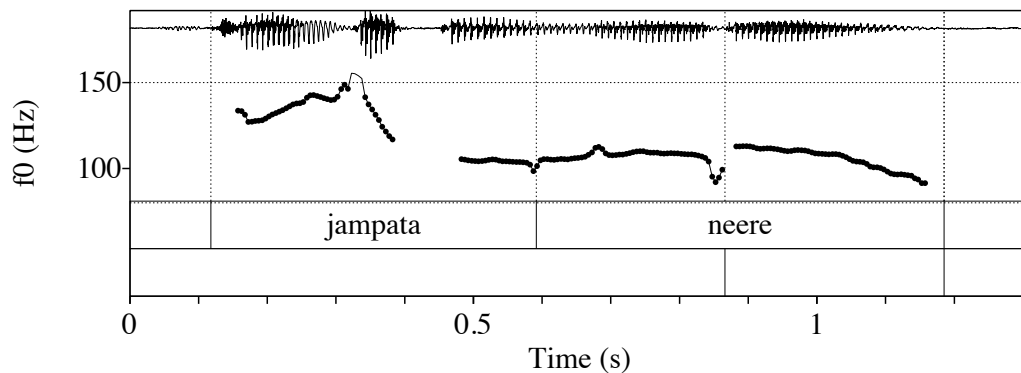


Figure 8: An unflagged interrogative with a pitch peak on the penultimate syllable (Lp-1)

penultimate syllable. The f_0 then rises, peaking in the first half of the final syllable and falling to the end. In the data collected here, most speakers used a mix of syntactic strategies for flagging questions, but the same prosodic pattern occurred regardless of flagging. If the final syllable has a voiceless onset, the initial rise is obscured, since the f_0 track is interrupted, but these examples show the same basic pattern of low-high-low. Figures 4–6 show several examples of this pattern.

There is also a variant of this pattern that occurs when there are other pitch peaks near the end of the utterance. In most of the sentences collected here, there are pitch peaks in the beginning of an utterance, but the last two or three syllables show a gradual decline until the boundary tone. However, there are a few examples with a pitch peak on the penulti-

mate or prepenultimate syllable of an utterance. For instance, in the utterance *jampata neere* ‘The road is level’, there is a pitch peak on the first syllable of both *jampata* ‘road’ and *neere* ‘to be level’. In the declarative condition (fig. 7), the pitch simply falls from the high on the penultimate syllable to the end, though with a steeper slope than normal. However, in the interrogative condition (fig. 8), the typical pattern is changed. There is no low on the penultimate syllable, as would typically be expected. Rather, the pitch sustains a high level throughout the first half of the final syllable before falling to the end. Although both the declarative and the interrogative involve a fall in the final syllable, they are distinguished both by their duration and by the timing of the final fall, which is substantially later in interrogatives (cf. figs. 7 and 8).

	<i>b</i>	<i>SE b</i>	95% <i>CI</i>	<i>p-value</i>
(intercept)	136.50	10.77	115.45, 157.55	$p < .0001$
Question (0=decl., 1=ques.)	146.28	13.72	119.45, 173.10	$p < .0001$
Flagging with <i>aa</i> ‘Q’	21.19	9.51	2.59, 39.78	$p = .0267$
Flagging with <i>ana upe</i> ‘or not’	-19.44	16.55	-51.80, 12.91	$p = .2411$

Table 3: Linear mixed-effects model of the effects of sentence type and flagging on the duration of final vowels (in ms), calculated in R (R Core Team, 2014) using the packages `nlme` (Pinheiro et al., 2014) and `lme4` (Bates et al., 2014)

4.3 Duration

Figure 9 compares the mean duration (in milliseconds) of the final vowel of declaratives with each subcategory of polar question (flagged with *aa* ‘Q’, flagged with *ana upe* ‘or not’ or syntactically unflagged). Environments were controlled as much as possible, such that each vowel came in an utterance-final open syllable. Each vowel was phonemically short (with the possible exception of *aa* ‘Q’, discussed below). Applying these conditions resulted in a total of 133 declaratives, 69 unflagged questions, 52 *aa*-flagged questions and 41 *upe*-flagged questions. On average, the final vowels of polar questions (274.4 ms) were 2.1 times longer than the final vowels of declaratives (132.9 ms).

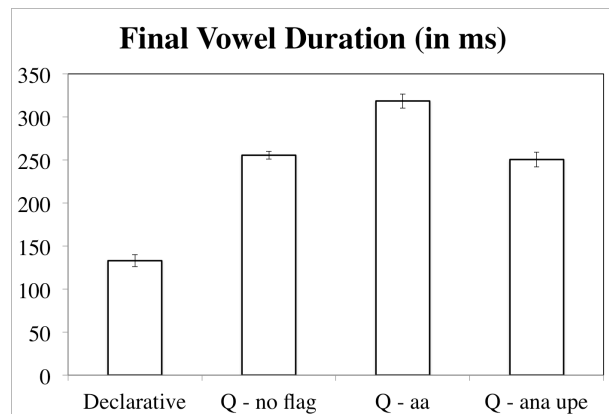


Figure 9: The mean duration (in ms) of final vowels. Error bars show standard error.

Applying a linear mixed-effects model revealed that whether an utterance is a question is a significant predictor of final vowel duration, $b = 146.28$, $t(286) = 10.66$, $p < .0001$. Morphosyntactic flagging with *aa* ‘Q’ was also a significant predictor of duration, $b = 21.19$, $t(286) = 2.23$, $p < .05$, although

flagging with *ana upe* ‘or not’ had no significant effect compared to unflagged questions, $b = -19.44$, $t(286) = -1.17$, $p > .05$.

5 Discussion

The results thus show that the contrast between declaratives and polar questions is characterized by differences in the f0 contour and the duration of the final vowel. These findings are similar to the description given by Stoel, though with some differences. Stoel’s only example of a question has a high-falling contour, which is much rarer in the present dataset than the typical rising-falling pattern. The lack of a preceding pitch valley may be due to undershoot, since there is a pitch peak two syllables before (which Stoel transcribes as a lexical high tone). At this point, it is not clear whether the high-falling pattern shown by Stoel is representative of the rest of his data; more examples are needed to determine whether the variety Stoel describes differs phonetically in crucial respects from the data collected here.

Stoel (2007) claims the primary phonological difference between declaratives and questions is the association of a high (H) tone with the final syllable of questions. However, as stated, this analysis does not explain the final fall present in both declaratives and questions, or the alternation between rising-falling and high-falling question contours observed here. I propose a new analysis, namely, that declaratives have a simple low boundary tone (L%), while polar questions have a low tone on the penultimate syllable and a high-low tone on the final syllable (L+HL%). The initial low of the question contour (L+) is undershot if the penultimate or prepenultimate syllable is associated with a high tone, which explains the observed variation among questions.

Stoel's analysis also provides no apparent explanation for lengthening in questions. On the other hand, I analyze final lengthening as a phonetically motivated phonological process conditioned by the boundary tone for questions. It is phonetically difficult to realize a complex tone—such as L+HL%—in a short phonetic space because of physical limitations on the vocal tract. Prosodic lengthening gives the glottis additional time to hit each pitch target sequentially. The ability of this analysis to provide a motivation for final lengthening is an additional benefit of the complex boundary tone (L+HL%) analysis proposed here.

This lengthening is clearly prosodic, rather than a lexical feature of the morphemes *aa* 'Q' or *ana upe* 'or not', since lengthening can apply to any word in the appropriate prosodic environment. I explain the slightly greater duration of *aa* 'Q' compared to the other strategies by analyzing the morpheme as having a phonemically long vowel, which is then lengthened even further prosodically. Assessing the phonemic vowel length of this morpheme directly is difficult, since I have not found any examples of the morpheme outside of the conditioning environment for prosodic lengthening, but with this addition, the analysis of boundary tones proposed here is able to explain the observed differences in intonational tune and duration between statements and questions.

6 Conclusion

To sum up, this paper describes the differences between declaratives and polar questions in Fataluku. Syntactically, polar questions may be optionally flagged by placing the question marker *aa* 'Q' or *ana upe* 'or not' at the end of the utterance, but the main difference is found in the prosody. Declaratives are characterized by a short final vowel and a low IP-final boundary tone (L%). Polar questions—regardless of their syntactic flagging—have an intonational contour that rises from the penultimate syllable to a high fall on the final syllable (L+HL%). In order to accommodate this more complex series of final tones, the final vowel of a polar question is lengthened prosodically, becoming about twice as long as the final vowel of a declarative.

From a typological perspective, it is interesting to note that Fataluku's rising-falling intonation pat-

tern violates the strong cross-linguistic tendency for questions to end in a high tone (e.g., Jun, 2005). While the final boundary tone does contain a high, it ends with a distinctly falling f₀ contour. Another point of typological interest is the relatively short duration that is characteristic of the final syllable of a declarative, which violates a strong cross-linguistic tendency to lengthen IP-final syllables (Jun and Fletcher, 2014). It is possible that the shorter durations of declaratives are an important perceptual cue for distinguishing them from structurally identical polar questions, although the production data examined here do not make it clear what type of cues are most important for listeners.

An important direction for future research would be to examine the perceptual cues that listeners use to distinguish between declaratives and polar questions in structurally ambiguous sentences, focusing especially on the role of f₀ contour and duration in perception. Another important topic is the phonological representation of the pitch peaks that occur in the first or second syllable of a prosodic phrase, whether these represent phonological tone, intonation or something else. The study of Fataluku intonation is still at its inception, and there is a great need for future research to further illuminate its prosodic structure.

Acknowledgments

I am grateful for the financial support of this project provided by the Bilinski Educational Foundation, the University of Hawai'i Arts and Sciences Advisory Council and the Department of Linguistics Endowment Fund. Much thanks are due to all of my Fataluku language consultants, for their patience and eagerness to teach me about their language. I would also like to thank Victoria Anderson, Katie Drager, Amber Camp and Bradley Rentz for their help, as well as three anonymous reviewers for their helpful suggestions. I take full responsibility for any errors.

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