

A preliminary model of Ikpana intonational phonology

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ABSTRACT

This study reports a preliminary model of the intonational phonology of Ikpana, an endangered Ghana-Togo Mountain language spoken in Ghana. Based on analysis of like-tone sentences collected from three speakers through fieldwork in Ghana, I propose that Ikpana has three prosodic units: the prosodic word (PW), the intermediate phrase (ip), and the Intonational Phrase (IP). The PW is marked by an F0 rise at the right edge of a word, referred to as upsweep (H), while the ip is marked by final lowering on its right edge (L-) and pitch reset. The IP is marked by a pause, boundary tones (L% and H%), and final lengthening. It is also the domain of vowel hiatus resolution, where the vowel on the left is either deleted or reduced unless there is an intervening IP boundary. The model neatly predicts the interactions of the cues marking each prosodic unit.

Keywords: intonation, tone, final lowering, autosegmental-metrical, fieldwork, Ikpana

1. INTRODUCTION

Ikpana is an under-documented Kwa language spoken by roughly 7,500 speakers in the Logba area in Ghana's Volta Region. It is an SVO language with a noun class system, and adjectives and demonstratives follow the head noun. Although a grammar and dictionary are provided by [7], little is known about its suprasegmental properties. This study thus provides the first analysis of intonation in Ikpana.

Ikpana has lexical tones as its word-level prosody. This study follows [7], who recognizes two level tones: High (H) and Low (L), and the existence of tonally-unmarked syllables. The tonally-unmarked syllables typically (but not always) appear as a noun class marker, and they are not as frequent as H- and L-tone syllables in roots.

The goal of the current study is to provide a preliminary model of Ikpana intonation within the Autosegmental-Metrical (AM) framework of intonation [3, 9, 12]. Specifically, I propose that Ikpana has three prosodic units: the prosodic word (PW), the intermediate phrase (ip), and the Intonational Phrase (IP), and discuss how each unit is marked by an edge tone, and how this is related to the domain of vowel hiatus resolution.

2. METHODS

2.1. Materials/data

The analysis is based on data elicited from three native speakers (two males and one female): M1 (70s), M2 (70s), and F1 (50s) during a six-week fieldwork trip to Ghana, conducted in the summer of 2018.

To observe the effect of F0 at the postlexical level, I constructed 48 like-tone simple (mono-clausal) declaratives, which consist of either only lexical H tones (28 sentences) or only lexical L tones (20 sentences). This excludes the subject agreement marker, which is assumed to be tonally-unmarked in the present tense, and the adverb *kpane* "now", whose first and second syllables are H and tonally-unmarked, respectively. The adverb is used in a small subset of both H-tone and L-tone sentences because no adverbs could be identified that consist of either only H or L tones. In addition, M1's pronunciation of 30 complex (bi-clausal) declaratives, which are also tonally-controlled, is used to identify the IP cues. All the sentences are in the present tense, and their grammaticality was confirmed by the speakers. The sentences vary in length and syntactic structure in order to determine whether these factors affect prosodic phrasing.

The sentences were randomized and presented in both Ikpana and English on a computer screen, one after another. The English versions of the sentences were provided to avoid misreading, since there are a number of tonal minimal pairs in Ikpana. The speakers were asked to produce each sentence in two speech styles (careful and natural speech) with a neutral focus. Each sentence was repeated three times.

2.2. Analysis procedure

The recordings have been analyzed in Praat [4] on four tiers: lexical tones, Ikpana words, English gloss of each Ikpana word, and the English translation of the sentence. The vowels deleted in hiatus resolution are enclosed in parentheses, while reduced vowels are enclosed in square brackets in the Ikpana words tier.

3. IKPANA INTONATION MODEL

I propose that Ikpana has three prosodic units marked by intonation: PW, ip, and IP. The PW is marked by

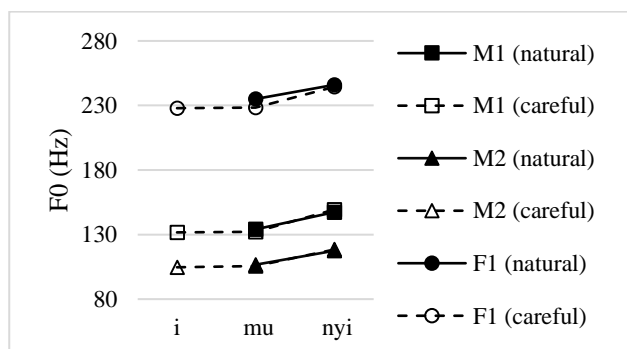
an F0 rise on its right edge (H). The ip is marked by the final lowering of F0 on its right edge (L-) and pitch reset. The IP is marked by a pause, boundary tones (L% and H%), and final lengthening. It is also the domain of vowel hiatus resolution.

3.1. Prosodic word (PW): upsweep

A PW is marked by an F0 rise on its right edge, which occurs in both H-tone and L-tone sequences. [10] observes a similar phenomenon in Baule, where sequences of H tones are marked by a gradual F0 rise over the PW. The authors call this “upsweep” and refer to the F0 peak at the right edge as Super-High. Furthermore, they mention that there is an alternative variant of upsweep, where only the final H tone in the PW is raised, while the preceding tones remain flat. The upsweep pattern in Ikpana is similar to this variant in Baule, raising only the right-edge tone.

Figure 1 shows the average F0 values of a H-tone noun *imunyi* “hair”, which appears as an object of H-tone verb *ri* “hold” in the data. The values are based on the three repetitions of 12 different all-H sentences, in which the target noun is always followed by an adjective *bibi* “a little”, forming an NP. Solid lines represent F0 values in natural speech, while dotted lines represent those in careful speech. The first syllable of the noun in natural speech is missing because, in natural speech, the vowel of the verb *ri* is deleted before the noun-initial vowel [i] due to vowel hiatus, and the initial vowel [i] of the noun *imunyi* is re-syllabified as the nucleus of the verb, i.e., *r[i]*.

Figure 1: Average F0 values of a H-tone word *imunyi* “hair”. (solid line: natural speech, dotted line: careful speech)

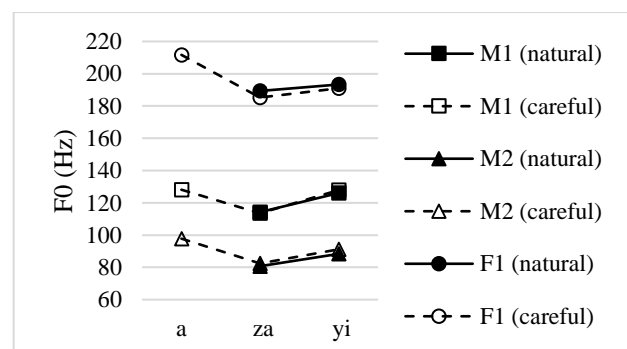


A linear regression per individual speaker indicates that the F0 values of the final syllable are higher than those of the second syllable, in both natural and careful speech ($p < .01$ for F1’s natural speech and $p < .001$ for F1’s careful speech and the other speakers’ natural and careful speech).

Figure 2 shows the average F0 values of a L-tone word *azayi* “beans”, which appears as an object of L-

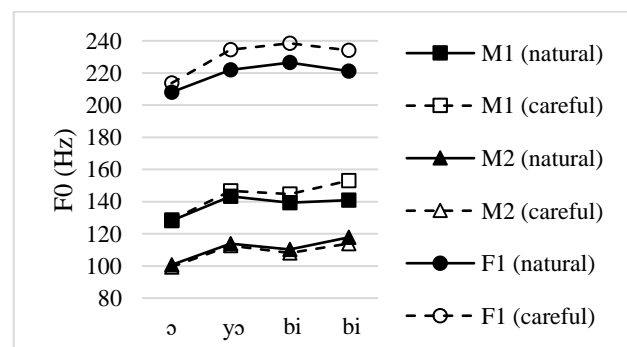
tone verb *ne* “hold”. The values are based on the three repetitions of eight different all-L sentences, in which the target noun is always followed by an adjective *vuvɔ* “new”, forming an NP. Again, the first syllable is missing in natural speech due to vowel hiatus. The F0 values of the final syllable are significantly higher than those of the second syllable for the male speakers ($p < .001$ for both natural and careful speech), while there is no significant difference for the female speaker F1 ($p = .165$ for natural speech and $p = .101$ for careful speech). It should be noted, however, that the first syllable is also higher than the second syllable. This illustrates that H-tone sequences tend to maintain flat F0 values, while L-tone sequences tend to fall gradually, which is also observed in other languages such as Mambila [6] and Ibibio [13]. Considering this, the female speaker’s results are not unexpected, and should not be interpreted as a lack of upsweep.

Figure 2: Average F0 values of a L-tone word *azayi* “beans”.



Upsweep is also observed in adjectives, as long as the adjective is not in a phrase-final position. Figure 3 shows the average F0 values of a H-tone phrase consisting of *ɔɔ* “a tree” and *bibi* “small”. The values are based on the three repetitions of six all-H sentences, in which the phrase is followed by one of two H-tone postpositions (*etsi* “under” or *otsu* “on top of”), forming a postpositional phrase (PP).

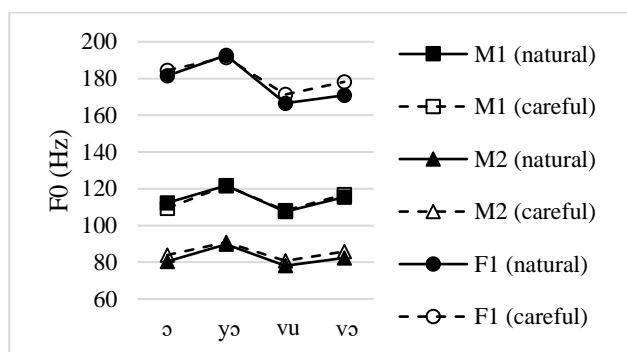
Figure 3: Average F0 values of a H-tone phrase, “a small tree”, consisting of *ɔɔ* “a tree” and *bibi* “small”.



There appears to be a difference between the male speakers and the female speaker: M1 and M2 exhibit an F0 rise at the end of each word, while F1 exhibits an F0 rise over the first three syllables of the phrase. It is possible that the F0 peak in F1's speech is delayed to the third syllable due to her speech rate being faster than those of the other speakers, and that the lower F0 on her final syllable is due to coarticulation to the following tone, which is lower as it is a word-initial H tone. This coarticulation effect is also observed in M1's natural speech.

The upswEEP pattern is clearer in a L-tone phrase consisting of $\gamma\gamma$ "a grave" and $\nu\nu\gamma$ "new", as shown in Figure 4. The values are based on the three repetitions of four all-L sentences, in which the phrase is followed by a L-tone postposition nu "in", forming a PP. As is clear from the figure, the second syllable of each word is raised.

Figure 4: Average F0 values of a L tone phrase, "a new grave", consisting of $\gamma\gamma$ "a grave" and $\nu\nu\gamma$ "new".



Overall, it is found that the Ikpana PW is marked by an F0 rise on its right edge, which is observed in nouns and adjectives. Regarding verbs, H-tone verbs exhibit a similar upswEEP pattern, while L-tone verbs exhibit a more complex pattern: the F0 tends to rise in monosyllabic verbs, whereas it falls in disyllabic verbs. More work need be conducted to understand the phrasal tone pattern of Ikpana verbs.

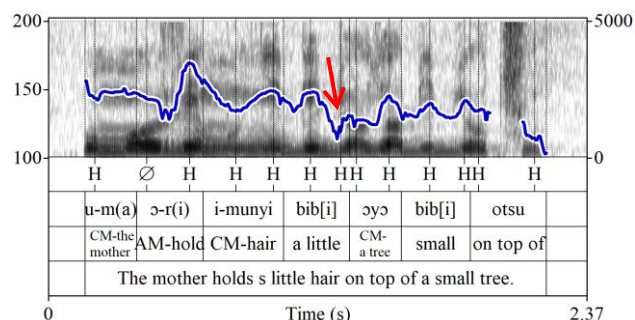
3.2. Intermediate phrase (ip)

3.2.1. Final lowering and pitch reset

An ip is marked by phrase-final lowering (L-). In Figure 5, ip-final lowering is observed on the last syllable of the first instance of *bibi* "a little", which appears at the right edge of the object NP. It should also be noted that the pitch range is reset at the ip boundary. Final lowering is also observed on the last syllable of *otsu* "on top of", but it is analyzed as a L% boundary tone, which usually exhibits a greater degree of lowering than an ip-final L- boundary tone, as it marks the sentence-final IP boundary. It is unclear whether the

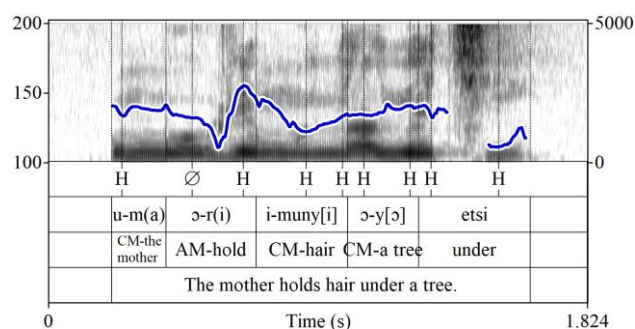
subject NP *uma* "the mother" is also subject to final lowering here, since the second vowel is deleted at vowel hiatus.

Figure 5: Sample pitch track showing ip-final lowering (L-), marked by a downward arrow.



The ip generally corresponds to a lexical maximal projection (XP), so final lowering is often observed at the right edge of both subject and object NPs. However, the syntactic constituency does not suffice to capture the environment in which final lowering occurs. For example, an object NP does not exhibit final lowering when it consists only of a noun, and is followed by a shorter postpositional phrase, as in Figure 6. This suggests that phonological factors also play a role in determining the ip domain.

Figure 6: Sample pitch track showing a lack of final lowering when the object NP consists only of a noun.

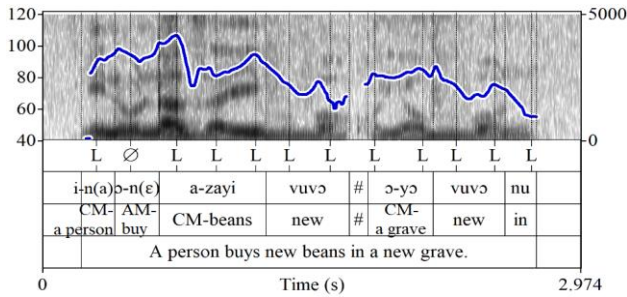


3.3. Intonational Phrase (IP)

3.3.1. Pause, boundary tones, and final lengthening

An IP is marked by a pause, which frequently occurs at a syntactic boundary. For example, it is possible to insert a pause (i.e., an IP boundary) into a location which otherwise has an ip boundary. When there is a pause, a boundary tone (L% or H%) appears, which overrides an ip-final L- tone, and the pitch range is reset, as in Figure 7. Furthermore, a sentence-medial IP boundary is often marked by final lengthening: it can be considered as a continuation marker, as it only occurs sentence-medially rather than sentence-finally.

Figure 7: Sample pitch track showing a sentence-medial IP boundary ('#') in an all-L sentence.



The visibility of final lowering (L- and L%) is influenced by the tonal context of the phrase-final word. The sentence in Figure 8 has the adjective *bibi* “a little” in the sentence-final IP position. Here, the effect of the final lowering is clear because the initial tone remains high due to the preceding upsweep on the noun. On the other hand, the sentence in Figure 9 ends with the noun *imunyi* “hair”, and the final tone does not appear to be falling. This is probably a result of the penultimate tone of the three-syllable noun not being raised due to its non-finality in the PW. In this case, the effect of final lowering is indicated by the lack of upsweep on the noun.

Figure 8: Sample pitch track showing final lowering when the sentence ends with an adjective.

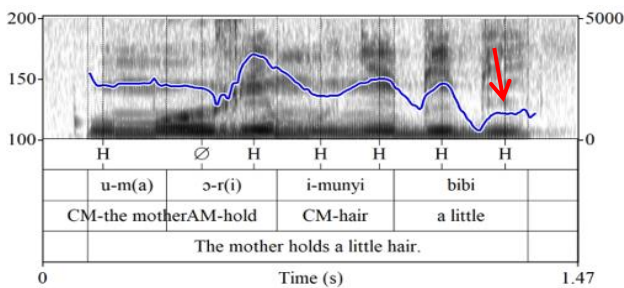
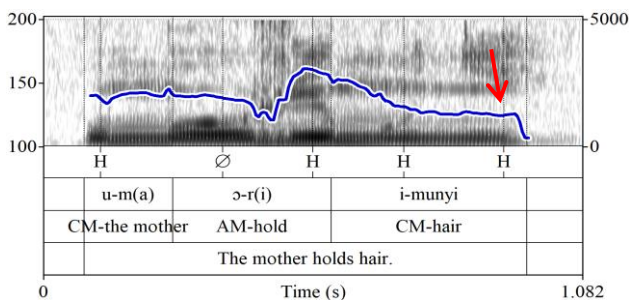


Figure 9: Sample pitch track showing final lowering when the sentence ends with a noun.



Some complex sentences require an obligatory pause. For example, sentences that involve an “if”-clause involve the main and subordinate clauses being separated by an obligatory pause, if the subordinate clause precedes the main clause. Furthermore, only

when the clauses appear in that order, the right edge of the subordinate clause is marked by a H% boundary tone. This is considered as a continuation rise, as it is a common marker of sentence-medial IP edges in African tone languages [8].

3.3.2. Vowel hiatus

Since nouns are often preceded by a vowel class marker and verbs are often prefixed by a vowel subject agreement marker, vowel hiatus abounds in Ikpana sentences. As a strategy to resolve the hiatus, one of the adjacent vowels (usually the left one in the data) is either deleted or reduced. I analyze this reduction as an incomplete realization of deletion, because the phonetic realization of the reduced vowel is not a glide, which is a common resolution strategy cross-linguistically [5].

Crucially, hiatus resolution is limited by the presence or absence of a pause, i.e., an intervening IP boundary. Specifically, hiatus resolution does not occur when there is an IP boundary between the two vowels, but almost always occurs when there is no intervening IP boundary, as in (1).

$$(1) V \rightarrow \emptyset / [\dots _ V \dots]_{IP}$$

4. DISCUSSION AND CONCLUSION

This study investigated the types of prosodic units that exist in Ikpana, how each prosodic unit is marked by intonation, and how they interact with the domain of segmental phonological rules. It was found that Ikpana has a PW, an ip, and an IP, and only the IP is the domain of vowel hiatus resolution. A PW is marked by upsweep (H), an ip is marked by final lowering (L-) and pitch reset, and an IP is marked by a pause, boundary tones (L% or H%), and final lengthening.

This model neatly predicts how these prosodic cues interact with each other. Specifically, the effect of upsweep (H) is overridden by that of ip-final lowering (L-) in the ip-final position, and the effect of ip-final lowering is overridden by that of IP-final boundary tone (L% or H%) in the IP-final position. In addition, if an ip boundary occurs at a point of vowel hiatus, the lowered syllable is reduced to avoid hiatus. This is because vowel hiatus resolution happens across an ip boundary, which is different from the case in some other languages, such as Greek [1, 2] and Uyghur [11], whose domain of vowel hiatus resolution is the ip boundary.

Finally, other sentence types (e.g., interrogatives) and focus prosody should be examined to establish a more comprehensive model of Ikpana intonational phonology.

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