ABSTRACT

This paper examines the tonal structure of yes-no questions in Chaha, using the autosegmental-metrical model of intonational phonology. Yes-no questions can be formed in two ways: lengthening the final syllable or attach the question suffix to the final word. They exhibit different F₀ patterns at the end of the utterance. We propose that the same underlying tonal structure is realized differently in two types of yes-no questions. In addition to the initial F₀ peak, which is present in both declaratives and questions, the bitonal pitch accent HL is associated with the penultimate syllable of the last word in yes-no questions. The realization of the complex edge tone LH% is different. In the case of lengthening, only L of LH% is associated with the lengthened final syllable, and the floating H% triggers upstep of the preceding tone, leading to a mid-level F₀ plateau on the final syllable. In the case of question suffix attachment, L and H of LH% are realized on the final syllable and the attached question suffix respectively, leading to a final rise.

1. INTRODUCTION

Chaha is a Semitic language spoken in Ethiopia, with approximately half a million speakers. Like other Semitic languages, it has no lexical tone. The word order is relatively flexible, but the basic word order is SOV.

Yes-no questions in Chaha can be constructed in two ways without incurring a semantic difference. The two types of yes-no questions exhibit distinct surface F₀ patterns at the end of utterances. Using the autosegmental-metrical (AM) model of intonational phonology, as proposed in [3,6,7], we will suggest that underlyingly they share the same tonal structure, and the distinct surface F₀ patterns result from different realizations of the same tonal structure.

Chaha intonation structure is interesting since it raises several issues that are of relevance to the AM model of intonation. First, the initial F₀ peak, which is present in both declaratives and interrogatives, is always associated with the second syllable of the utterance regardless of the number of syllables and the location of stress in the first word. If it is not a pitch accent (since it is not associated with an accented syllable), the question is what is its tonal status. Second, in the AM model, a bitonal pitch accent (i.e. LH or HL) usually consists of a starred tone and a leading or trailing tone. The use of star indicates actual alignment with the accented syllable. However, it is not clear as to which tone should be starred if both tones are aligned with the accented syllable. The falling tone in yes-no questions in Chaha is such a case in point. Finally, Chaha also presents an example in which the boundary tone, although aligned with the edge of an intonational phrase, is not necessarily realized on any syllable, i.e. floating in the representation, but it may still influence how the preceding tone is realized.

The data were provided by the second author, a native speaker of Chaha, and analyzed using Xwaves+ to generate waveforms, spectrograms and F₀ tracings.

2. BASIC INTONATION PATTERNS

To better understand the tonal structure of yes-no questions, it is necessary to lay out the basic intonation patterns of both declaratives and interrogatives (i.e. yes-no questions and wh-questions).

The intonation pattern of declarative utterances in Chaha is quite straightforward. It can be characterized by an initial F₀ peak (Hi), associated with the second syllable of the utterance, and a low boundary tone (L%) at the right edge of the intonational phrase. Note that the initial peak is also present in interrogatives with the same association. But it is scaled lower in declaratives, leading to a more gradual downtrend of F₀ curve till the end of the utterance. Depending on the starting F₀, a gradual rising F₀ curve or a high plateau can show up prior to the initial F₀ peak.

Although the initial peak is in general associated with the second syllable, sometimes it is realized on the first syllable if the utterance contains less than three syllables. In single-word utterances having more syllables (from four to ten syllables), the initial peak always seeks out the second syllable. The actual alignment of the initial peak is a little variable: it could be aligned earlier or later within the second syllable. The actual alignment of the initial peak will be determined by the right edge of the intonational phrase and it is realized on the final syllable.

What is interesting about the initial F₀ peak is that it is always associated with the second syllable regardless of the number of syllables and the location of stress in the first word. If the first word is monosyllabic, the peak will occur on the first syllable of the second word. The intuition of word stress in Chaha is not as clear-cut as in English. The second author has a weak intuition that the word stress probably is located on the penultimate syllable of the stem. One piece of evidence comes from the fact that he is able to lengthen the penultimate syllable effortlessly though the vowel is epenthetic. He cannot lengthen the initial syllable though the vowel is a full vowel. In addition, the syntactic category of the first word seems to have no influence at all. No matter it is an NP or adverbial, the same F₀ pattern shows up.

Yes-no questions have much higher initial F₀ peak, leading to a sharper rise at the beginning of the utterance. The major intonational difference between yes-no questions and declaratives resides at the end of the utterance. More complex F₀ patterns show up at the end of yes-no questions.
As a matter of fact, yes-no questions can be formed in two ways without incurring a semantic difference. One way, as in (1), is to lengthen the final syllable so as to make it twice as long as in a declarative utterance. We analyze this as adding a mora to the final syllable rather than attributing it to pre-boundary lengthening. If the final lengthening in yes-no question is due to pre-boundary lengthening, we see no reason why the same amount of lengthening should not take place in declaratives. Apparently, the lengthening is phonologically motivated. Similar lengthening is attested in West Greenlandic Eskimo, where final short vowels in declaratives become long in interrogatives, long vowels become overlong [5]. Chaha is different in that vowel length is not distinctive. The only context in which a vowel becomes a long vowel is in the formation of a yes-no question.

(1) Namaga aram siyam
   Namaga a cow bought
   ‘Did Namaga buy a cow?’

Figure 1: Waveform and F0 contour of the sentence in (1).

Alternatively, the mora attached to the final syllable in (1) can be spelled out as a question suffix -we ‘or’. In this case no lengthening is observed, as in (2).

(2) Namaga aram siyam-we
    Namaga a cow bought-or
    ‘Did Namaga buy a cow?’

Figure 2: Waveform and F0 contour of the sentence in (2). Note the little sagging of F0 in the middle is probably due to focus on the object since the pre-verbal position is the default focus position.

Although the two kinds of yes-no questions do not differ semantically, they exhibit different F0 patterns at the end of the utterance. In the case of final lengthening, as in (1), a falling F0 curve occurs on the penultimate syllable of the last word (normally a verb), followed by a mid-level F0 plateau on the lengthened final syllable. In the case of -we affixation, as in (2), the F0 curve drops to the lower bound of the pitch range on the syllable right before -we and then rises. The similar patterns are also observed in single-word utterances.

Some observations need to be made here. First of all, the initial F0 peak is present in the yes-no questions as well, but it is scaled much higher. Secondly, the mid-level F0 plateau in the case of final lengthening is always higher than the lowest F0 reached right before the rising F0 in the case of -we affixation. Thirdly, the falling F0 curve always occurs on the penultimate syllable (excluding -we), starting from voicing onset and ending at the end of the syllable. This is also shown in (3) where the final word has four syllables: the sharp fall shows up on the penultimate syllable. Thirdly, a high plateau between the initial peak and the beginning of the falling F0 curve is simply transition between these two points if no other prosodic factors such as focus come into play. Finally, if the utterance contains less than three syllables, the initial peak and the beginning of the sharp fall will merge into one peak, which surfaces at the later portion of the first syllable. Examples are given in (4) and (5).

(3) trama am*sanam
    yesterday he-did-it
    ‘Did he did it yesterday?’

Figure 3: Waveform and F0 contour of the sentence in (3).

(4) namam
    ‘Did it grow?’

Figure 4: Waveform and F0 contour of the sentence in (4), where the peak is retracted to the first syllable.

(5) namam-we
    ‘Did it grow?’
Figure 5: Waveform and F0 contour of the sentence in (5). Notice the difference between (4) and (5) lies at the end.

One aspect of wh-question intonation that seems related to yes-no questions is the final rising F0 curve on the last two syllables of the utterance. This is shown below in (6), where the F0 keeps going down until the second to the last syllable.

(6) m\textsuperscript{u}‘an d\textsuperscript{u}nag\textsuperscript{u}‘anim
who hit-him

Who hit him?

Figure 6: Waveform and F0 contour of the sentence in (6).

A possible interpretation would be to assume that the final rising F0 emerges from the complex edge tone LH\%, which is mapped to the last two syllables. We will show that, like wh-questions, yes-no questions are also characterized by LH\%. In addition, the complex edge tones are attested in other languages as well, like Greek, Romanian and Hungarian [4].

3. ANALYSES AND DISCUSSIONS

We have seen that the intonation pattern of declaratives can be adequately described as Hi \ldots L\%, with Hi associated with the second syllable and L\% aligned with the end of the utterance. The initial peak is also present in yes-no questions with the same association, and it is always scaled higher than that in declaratives, leading to a sharper F0 rise at the beginning of the utterance.

We have also seen that the two types of yes-no questions exhibit different F0 patterns at the end of the utterance. What they have in common are the initial peak and the falling F0 curve on the penultimate syllable of the last word (excluding -we). The fall seems to align with the left and right boundary of the syllable, as Figure 3 indicates. Also, recall that the native speaker has the intuition that the word stress falls on the penultimate syllable. Therefore, we suggest that the fall (HL) is a bitonal pitch accent and it is attracted by the accented syllable of the last word in yes-no questions. In declaratives, the since no pitch accent is associated with the last word, the word stress does not show up phonetically.

Up to now, we have partly come up with the tonal structure of yes-no questions, i.e. Hi \ldots HL \ldots, where Hi indicates the initial peak and HL indicates the bitonal pitch accent on the penultimate syllable of the last word. However, the two types of yes-no questions have quite distinct F0 patterns at the end. In the first case, a mid-level plateau occurs on the lengthened final syllable. In the second, a rise surfaces on the final syllable plus the question morpheme -we. The rise on the last two syllables in the second case is reminiscent of the final rise in wh-questions, which is attributable to the complex edge tone LH\%.

It would be a desirable result if it turns out that yes-no questions and wh-questions share the same boundary tone LH\% as opposed to the L\% in declaratives. If so, then the tonal structure of yes-no questions would be Hi \ldots HL LH\%, where Hi is associated with the second syllable, the bitonal pitch accent HL seeks out the penultimate syllable of the last word, and LH\% is realized on the final syllable of the last word and the question suffix -we respectively. The dotted part in the tonal structure could be just transition between Hi and H if no other prosodic factors such as focus are involved.

If the above analysis is correct, then we have to explain why we see a mid-level plateau instead of a rise on the lengthened syllable in the first type of yes-no questions. Recall that we analyzed the final lengthening as adding a mora to the final syllable and this mora is spelled out as an overt phonetic form -we. If we assume mora to be the tone-bearing unit, it would be unexpected that a rise is not realized on the lengthened syllable. This is because in the case of lengthening, the lengthened final syllable has become bimoraic, and consequently it is capable of bearing two tones (i.e. LH\%). In the case of -we suffixation, although the final syllable is not lengthened, i.e. still monomoraic, the question suffix -we contributes one mora. Therefore, we suggest that the rise on the lengthened syllable is associated with the lengthened syllable. The following representations illustrate this.

(7) \sigma \sigma \sigma \ldots \sigma \sigma \sigma \sigma : (\sigma = \text{syllable})
   \begin{array}{c}
   \text{Hi} \\
   \text{LL H\%}
   \end{array}

(8) \sigma \sigma \sigma \sigma \sigma \sigma -\text{we}
   \begin{array}{c}
   \text{Hi} \\
   \text{H L L H\%}
   \end{array}

Suppose we take (7) and (8) as the underlying tonal structure that is being implemented. (8) would generate the F0 contour as we have actually observed. But (7) would generate a low plateau on the lengthened final syllable. The crux, as we see it, lies in the unassociated H\%.

As a matter of fact, the mapping of the complex edge tone LH\% depends upon whether there are sufficient hosting syllables for one-to-one association. If there are two syllables after the bitonal pitch accent, as in (8), both L and H can be mapped. In wh-questions, since there is no pitch accent on the penultimate syllable, L and H are realized on the last two syllables. However, if there is only one, as in (7), L will be mapped, leaving H stray. There are several possibilities for the destiny of the floating H. It can link to the final syllable, creating a rise on the final syllable. This is seen in many African languages where when the number of tones exceeds the number of tone-bearing units, contour tone appears on the final tone-bearing unit. Alternatively, H can be simply erased from the representation, without leaving any trace. Apparently, Chaha opts for a third option: when H is not associated with a tone-bearing unit, it is not simply deleted. Rather it still reveals its effect by affecting the realization of the preceding tone.
We propose that the floating H% upsteps the preceding tone. That is why we get the mid-level F0 plateau on the final lengthened syllable, which is only associated with L. When H% is associated with a syllable, it does trigger upstep on the preceding tone. Recall that the mid-level plateau in the case of final lengthening is higher than the lowest F0 right before the onset of rise in the case of -we affixation. It is evident that the upstep happens in one case, but not in the other.

We have identified the underlying tonal structure of the yes-no questions as Hi … HL LH%. It is realized differently in the two types of yes-no questions, depending on whether there are enough syllables after the bitonal pitch accent HL.

The idea that a floating tone can influence the realization of the adjacent tones receives support in African tone languages. In those languages, H tone can be downstepped by the preceding L tone (no matter whether it is floating or non-floating), i.e. it is realized at a lower value relative to another H tone before it. For example, in Bimoba, a Gur language, the floating low boundary tone reveals its presence by raising the preceding High tone (or sequence of High tones) and by downstepping any following High tones [8]. The Chaha data furnish a case where the L is upstepped by the following floating H.

In the AM model of intonation [3,6,7], a bitonal pitch accent consists of two tones, one of which is marked with a star to indicate its alignment in time with the accented syllable. Therefore, at least in English, L*+H and L+H* are contrasting phonological categories. However, it has been observed that in some languages both the beginning and ending points of a sharp rise have stable alignment with the segment string [1,2]. We also found in Chaha that the HL bitonal pitch accent on the penultimate syllable in yes-no questions is aligned with both edges of the host syllable. It is conceivable that different alignment patterns of L*+H and L+H* in English could result from the existence of phonological contrast. In languages without such a contrast, the alignment of the two points of F0 movement can be stable in an appropriate context. Therefore, we represent the fall as HL, starring neither of them.

An interesting component of yes-no question intonation, also of Chaha intonation in general, is the initial F0 peak that appears at the beginning of the utterance. It is always associated with the second syllable regardless of the number of syllables and the location of stress in the first word. Its tonal status is not easy to determine. One may not want to treat it as a pitch accent, since by definition pitch accent is associated with accented syllable. The initial peak only seeks out the second syllable of the utterance. Another possibility is to analyze it as a boundary tone at the left edge of the utterance. This should not affect the analysis for yes-no questions, whose tonal structure should look like %H … HL LH%. But for declaratives, it means %H … L%. The problem is the lack of pitch accent in declarative intonation if we assume that a well-formed intonation structure should contain at least one pitch accent [6]. We do not have a good explanation for this.

4. CONCLUSION

To summarize, we have presented the different F0 patterns associated with the two types of yes-no questions in Chaha. Using the AM model of intonational phonology, we show that they arise from the same underlying tonal structure, Hi … HL LH%, which is realized differently. For both types of questions, the initial F0 peak is associated with the second syllable and the bitonal pitch accent HL is realized on the penultimate syllable of the last word. The realization of the complex boundary tone LH% is different. In the first type of yes-no questions, where the final syllable is lengthened, only L is realized on the final syllable, and the floating H% triggers the upstep of L, leading to a mid-level F0 plateau. In the second type, where a question suffix -we is attached to last word, both L and H are realized and no upstep is triggered.

5. REFERENCES