COMPARING F0 RESET IN TWO PROSODICALLY DIVERSE LANGUAGES
—data from Eskimo and Yoruba—

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ABSTRACT

Analysis of H tone reset from text reading was compared for Eskimo and Yoruba. Our preliminary results indicated that the main difference between the two languages were the regularity vs. irregularity in pitch register. In Yoruba, there was a great regularity in the F0 values of the first H tone in the sentence, with reference to sentence length, and in the F0 values of the upcoming reset Hs. Neither of these regularities were present for the Eskimo speakers.

INTRODUCTION

The present paper is a progress report on an on-going project called MULTILINGUAL PROSODIC RULES, —with specific reference to Eskimo, Japanese, and Yoruba—in which three prosodically diverse languages, all non-European, non-stress languages, are examined for their durational and F0 (fundamental frequency) features. A specific hypothesis for the current topic is that, when F0 or duration is used for signalling lexical properties, there must be a limit in the use of the same acoustic property for other purposes such as phrasing, i.e. we expect that a lexical tone language like Yoruba cannot use F0 with the same degree of freedom as Eskimo can, while Eskimo, in which duration is used extensively for contrastive purposes, cannot use duration with the same degree of freedom as Yoruba.

Research on intonational phrasing has been receiving increasing attention in recent phonetic literature, in particular for discourse analysis. Segmenting texts on the basis of F0 organization, with or without additional cues, appears to be a powerful method in many languages. However, most of the works on prosodic segmentation are based on stress languages like English and Swedish. How F0 and duration are utilized to signal phrasing in languages like Yoruba and Eskimo is still a very open question, and is of typological interest.

Tonal and intonational features in Yoruba and Eskimo have been studied at word, phrase, and sentence levels [1 - 5].Some of this research has indicated a number of features which can be related to intonational phrasing in these languages. In the present study we report the results of a pilot study which compared H tone F0 resets in Eskimo and Yoruba using text reading material. To our knowledge, this is the first study of intonation in these languages which analyses a large corpus of text reading.

MATERIAL AND ANALYSIS

Eskimo

The original material was adopted from a textbook of West Greenlandic Eskimo, which consists of mostly declarative sentences of relatively simple syntactic and semantic structure (recording time approx. 3 minutes for each subject). The text included 148 words, 30 sentences, and was divided into 6 paragraphs in written form. Each sentence consisted of between two and seven words.The number of sentences in each paragraph varied from three to nine. Two female speakers of Central West Greenlandic read the text.

Prosodic transcriptions were made for the entire material, marking word property H and L tones as well as short and long pauses. The recorded utterances were digitized at 20kHz and F0 was analysed using the pitch analysis command of the CSL software package installed on a PC. Figure 1 presents a sample F0 contour, showing how F0 values corresponding to H and L tones are obtained.

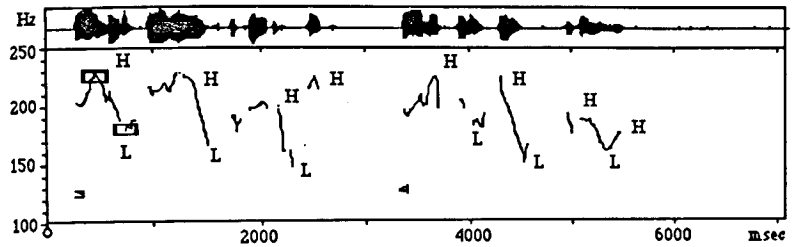

Figure 1. Sample F0 contour and speech waveform for Eskimo sentence "Kaali aqqanilinnik ukioqarpoq, Kaalallu arfineq sisamanik" (Kaali is eleven years old, and Kaala is nine years old-speaker 1), showing how F0 values were obtained for target tones.

Yoruba

The text used for the Eskimo speakers was translated into Yoruba by selecting 18 out of original 30 sentences. The text was read by a male speaker of Yoruba from Lagos in a sound proof studio. The analysis procedure is the same for that of Eskimo. All H, M, and L tones were measured by choosing, in principle, the highest and lowest F0 point for the corresponding syllable, and the F0 value in the middle of the vowel for M tone.

Marking F0 resets

The F0 value of each H tone was examined successively and when it was higher by more than 5Hz relative to the previous H tone, it was marked as a reset H tone.

RESULTS

Number and location of H tone resets

The number of H tone resets in a sentence varied from two to five in both languages, of which two and three resets were most common. In both languages, the number of resets appeared to be related to sentence length - the longer the sentence, the more resets it contains.

As for the location of resets, there was considerable disagreements between the two speakers of Eskimo even though the total number of H resets for the text was extremely similar, i.e. 69 for the first speaker and 68 for the second speaker. The main difference between the two speakers arose from the fact that they had different phrasing strategies in marking syntactic constituents.

While the first speaker tended to mark the beginning of the next constituent by resetting, the second speaker often marked the end of the constituent by resetting. The Yoruba speaker preferred to mark the beginning of the syntactic constituent.

Target F0 values for reset H

F0 values for the reset first H tone as well as the following reset H tones are shown graphically with reference to the number of resets (plus the first H) in a sentence. Figures 2(a)(b)(c) show the results for Yoruba for one, two, and three resets while those for Eskimo are shown in Figures 3 (a)(b)(c).

The main difference between the two speakers of Eskimo and the Yoruba speaker was that of pitch register. For the Yoruba speaker, the F0 value of the first H was fairly steady, clustering around 140-150Hz for majority of sentences, and around 165Hz for longer sentences. Furthermore, subsequent reset H tones had either similar, or lower, but never higher, F0 values. These two characteristics were not observed for the two speakers of Eskimo.

There was a clear indication that sentence length plays a role in determining the F0 target of the first H in Yoruba. The length of sentences in the material varied between 21 morae (sequence of two vowels are counted as two morae) to 51 morae. The first H tone in a longer sentence always had the highest F0 value, i.e. around 165Hz. In Eskimo, on the other hand, no such regularity was observed.

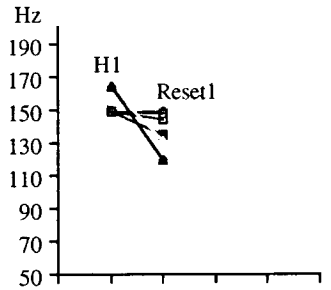

Figure 2 (a). F0 values for the first H and the following reset H in Yoruba.

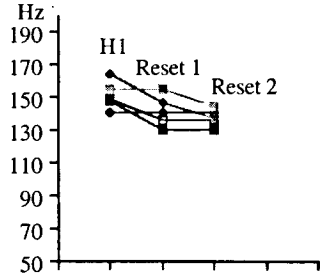

Figure 2 (b). F0 values for the first H and the following two H resets in Yoruba.

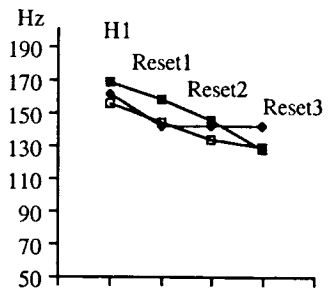

Figure 2 (c). F0 values for the first H and the following three H resets in Yoruba.

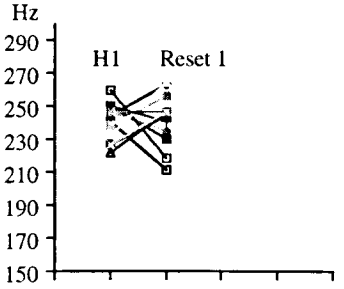

Figure 3 (a). F0 values for the first H and the following H reset in Eskimo (speaker 1).

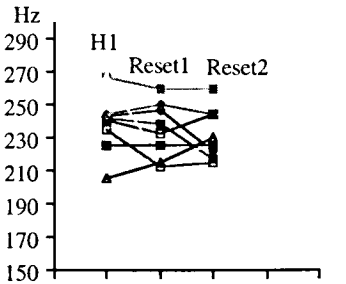

Figure 3 (b). F0 values for the first H and the following two H resets in Eskimo (speaker 1).

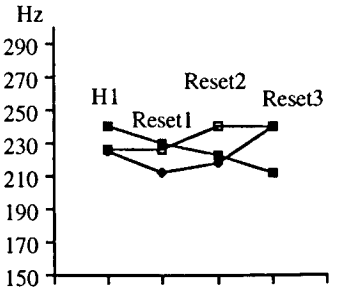

Figure 3 (c). F0 values for the first H and the following three H resets in Eskimo (speaker 1).

SUMMARY AND DISCUSSION

Our pilot analysis of H tone F0 resets in Eskimo and Yoruba revealed both similarities and differences. The fact that the number of F0 resets is related to the length of sentence may imply that speakers in general try to split a stream of speech into segments of reasonable length for comprehension by listeners.

It is interesting to note that the two speakers of Eskimo had different strategies in marking the syntactic boundary by F0 reset, one marking the end of the syntactic constituent, the other marking the beginning of the next constituent. Such a difference has also been reported for Yoruba by Laniran for her two speakers reading identical sentences [4]. Our present speaker of Yoruba preferred to choose the beginning of constituents. Even though this strategy is found to be present in both languages, there seems to be a critical difference. In Eskimo, when the last word of a syntactic constituent is marked by a new reset, the F0 value is often as high, or even higher than that of the previous H. In addition, the total pitch range of the word in question is enlarged by giving an impression of prominence or emphasis. In Laniran's study of Yoruba, the F0 value of such a H reset tone never exceeded the F0 value of sentence initial H.

The most notable difference between Eskimo and Yoruba was that of pitch register. In Yoruba, there was great regularity in the F0 values of the first H tone in the sentence with reference to sentence length, and the F0 values of the upcoming reset Hs. There seems to be a speaker-specific preferred pitch register, i.e. for a long sentence, the first H usually had F0 value of 165Hz and for sentences of moderate length, around 140-50Hz. If the first H had the value of 165Hz or so, the next H reset was likely to be 140-150Hz, and then the value decreases to 130Hz and finally to around 120Hz, being the lowest possible value for H reset for this speaker. The F0 value of the subsequent resets, however, did not decrease step by step to the lowest level. In some sentences, two or three subsequent resets had the same value. There were, however, never more than three sequential resets of the same level. In a few cases, the first H had the highest value (165Hz) and was followed by only one reset of the lowest pitch register (120Hz). How these different levels of pitch register are determined for reset H tones, is not immediately obvious. Possible candidates are (1) tonal structure, (2) syntactic and semantic structure, and (3) the speaker's choice.

Since the results of the present investigation are based on a small number of speakers, we are now continuing to examine some of the points found in this study for more speakers in both Eskimo and Yoruba.

ACKNOWLEDGEMENT

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REFERENCE

[1] Mase, H. (1973), "A study of the role of syllable and mora for the tonal manifestation in West Greenlandic", *Annual Report of the Institute of Phonetics,* 7, pp.1-98, University of Copenhagen.

[2] La Velle, C.R. (1974), "An experimental study of Yoruba tone", *Studies in African Linguistics.* Supplement 5, pp.185-194.

[3] Connell, B. & Ladd, D.R. (1990), "Aspects of pitch realisation in Yoruba", *Phonology* 7, pp.1-29.

[4] Laniran, Y. (1992), *Intonation in tone languages: the phonetic implementation of tones in Yoruba*, PhD thesis, Cornell University.

[5] Nagano-Madsen, Y. (1993), "Phrase-final intonation in West Greenlandic Eskimo", *Working Papers* 40, pp.145-155, Dept. of Linguistics, Lund University.