

The Grouping Function of F0 and Duration in two Prosodically Diverse Languages — Eskimo and Yoruba

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ABSTRACT

This paper discusses how F0 and duration are utilized as local prosodic cues in two prosodically diverse languages — Eskimo and Yoruba. The analysis of text-reading and radio news-broadcasts has indicated that (1) F0 and duration are used in a mutually exclusive way in the two languages, (2) different relationships exists between F0 and duration for the two languages, but (3) there is a similar principle in the use of local prosodic cue in dividing a paragraph into smaller constituents.

INTRODUCTION

Languages are known to utilize a number of acoustic phonetic cues such as F0, duration, intensity, silence, and voice quality in order to signal prominence, boundary, and coherence in the stream of speech. In many European languages the acoustic variables of F0 and duration are often combined for such purposes, i.e. manifestation of lexical stress in Germanic languages, and boundary tone in French etc.. In this paper, I will discuss how F0 and duration are exploited as local prosodic cues in Eskimo and Yoruba, focusing the relation between the two acoustic dimensions and how they are utilized in dividing a paragraph into smaller constituents.

The present paper is a progress report of an on-going project called "MULTILINGUAL PROSODIC RULES, with specific reference to Eskimo, Japanese, and Yoruba". The immediate goal of the project is to extract rules and parameters which are necessary in order to describe the basic differences in the acoustic patterning of the three languages which are chosen on a typological basis. Eskimo represents a lexical quantity language where duration is the phonetic correlate (Mase and Rischel 1971, Nagano-Madsen 1992) whereas Yoruba represents lexical tone language for which F0 is the phonetic correlate. Eskimo and Yoruba can thus be seen as two extremes in the prosodic dimension, while Japanese comes somewhere in between. An underlying assumption to such an approach is that there is a certain correlation between properties of language and its spoken medium. A specific hypothesis for the current topic is that, when F0 or duration is used for signalling lexical property such as quantity and tone, there must be a limit in using the same acoustic cue for other purposes. Therefore, features other than those used for lexical information will play the major role for such purposes.

DATA AND ANALYSIS

The material used for the analysis consist of a reading of (1) a short text which was used earlier for duration analysis in Nagano-Madsen (1992), and (2) longer texts and news readings which were collected from naturally occurring radio broadcast. In the present paper, the results from three speakers for each (one text-reading and two news-readings for Yoruba and two text-readings and one news-reading for Eskimo), were analysed (total recording time of 25 minutes for each language). Durational analysis was carried out both using mingographs and CSL, while F0 analysis was done on the LUPP program installed on a Macintosh.

ACOUSTIC ANALYSIS

Duration

Durational characteristics of Eskimo and Yoruba were compared earlier by using short texts (Nagano-Madsen, 1992). The most notable difference between the two languages was the presence vs absence of extremely lengthened vowels. While in both languages, the duration of a large majority of vowels is concentrate between 30-120ms, Yoruba had many extremely long vowels.

In the present study, the news-broadcast of two Yoruba radio announcers were examined for this feature. The lengthened vowels were found to be present in both speakers. These vowels are extremely long, some even up to 500-600 ms. Table 1 shows the mean duration of lengthened vs non-lengthened vowels in Yoruba analysed from a female announcer. There was also a notable difference in the magnitude and frequency of the lengthened vowels in Yoruba between the two announcers (Figure 1).

Table 1. *Lengthened vs non-lengthened vowels in Yoruba. Analysis of first 5 minutes news-broadcast by female speaker (S2).*

	mean (ms)	SD	min - max	N
lengthened	300	99	150 - 643	95
not-lengthened	67	23	19 - 146	466

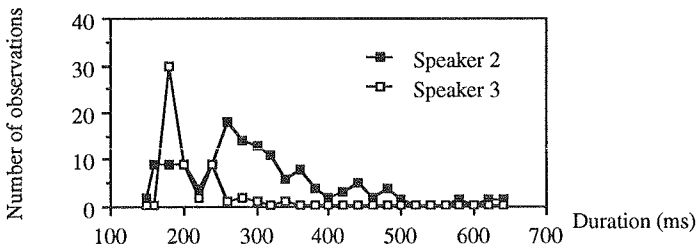


Figure 1. *Discrepancy in the frequency and magnitude of lengthened vowels between the two announcers of Yoruba. Analysis of 10 minutes news-broadcast for each speaker.*

The question arises as to where these lengthened vowels occur. Some words with lengthened vowels have been noted and discussed in Yoruba literature for some time (Ward 1956, Bamgbose 1966, Roland 1969). All these categories were present in the current material but the examples of lengthened vowels extend much further. It is beyond the scope of the present paper to discuss each categories and this is clearly the area which deserves much attention from Yoruba linguists. Though the exact function of these lengthened vowels may differ, i.e. in some cases it may be more appropriate to speak of emphasis and in other cases of boundary and coherence, one possible generalization which covers all the instances is to say that they all occur at initial position of major constituents such as clause VP etc.. Interestingly, Yoruba seems to use shortened vowels as well, though their occurrence is fewer and not as sizable as lengthened ones. The distribution of lengthened and shortened vowels are taken up under DISTRIBUTION.

Fundamental frequency (F0)

The durational prominence which is frequent in Yoruba was totally absent in Eskimo. Eskimo, instead, appears to use the F0 dimension maximally both as local and global intonation. Locally, each phonological word is characterized by a terminal tonal contour H-L which appears on the last two vowel morae. At phrase-final position, an additional H is added finally, shifting the word property H-L to penultimate and antepenultimate morae respectively. The phrasal H is typically lowered at sentence final position in text-

reading material. The present analysis differs significantly from the previous one (cf. Rischel 1974). These features were common for all three speakers examined.

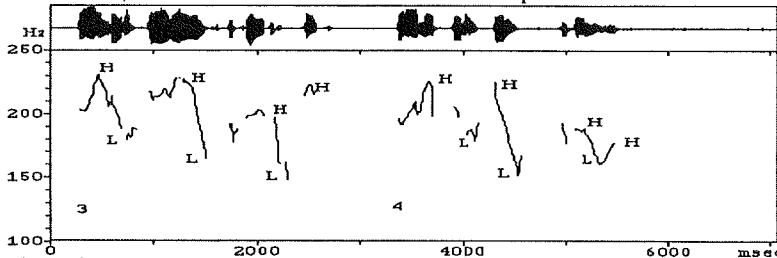


Figure 2. Manifestation of Eskimo phrase-internal and phrase-final contours: (3) *kaali aqqanilinnik ukiqarpoq*, (4) *Kaalallu sisamanik*.

RELATION BETWEEN F0 AND DURATION

Perceptually, the local pitch prominence in Eskimo is signalled without marked durational increase. In order to examine this point, measurement was done for those vowels with or without pitch prominence (Table 2). The acoustic measurements show clearly that local pitch prominence in Eskimo is free from durational increment. The lengthening of vowels in Yoruba, however, seems not to be free from the F0 dimension. Table 3 summarizes the surface tone type of the lengthened vowels. There is a strong indication that lengthening is bound to high or mid tones.

Table 2. Relation between terminal pitch prominence and duration. Analysis of total of 10 minutes speech.

	mean (ms)	SD	min - max	N
H	71	19	39 - 126	123
not H	75	23	38 - 128	126

Table 3. Relation between the lengthened vowels and (surface) tone type in Yoruba. Based on the analysis of two announcers reading 10 minutes each.

tone	N of occurrences
H	165
M	29
L	0

DISTRIBUTION

In the previous sections, it was shown that Eskimo and Yoruba utilize different acoustic property as local prosodic cue. This section examines how these local prosodic prominences, be they F0 or duration, are distributed in relation to their position in a sentence (Tables 4 and 5). The Eskimo analysis shows that H-tone prominence is preferred in sentence-internal position and L-tone ending is preferred dominantly at sentence-final position. Furthermore, there was a strong preference to have L tone at paragraph-final position. Lengthened vowels in Yoruba were found exclusively at sentence-internal position. Shortened vowels occur both sentence internally and finally, but they occur consistently at constituent final position.

Table 4. Distribution of High vs not-High local feature relative to sentence position in Eskimo. Three speakers pooled.

prosodic feature	sentence internal	sentence final
High	103	27
Low	0	65

Table 5. *Distribution of lengthened and shortened vowels in Yoruba in relation to position in sentence. Three speakers pooled.*

prosodic feature	sentence internal	sentence final
lengthened	193	1
shortened	22	13

DISCUSSION

The results of the present study support the initial hypothesis which predicts the coordinative nature among prosodic properties to arrive at an efficient communication system. It has been shown that the acoustic property of F0 and duration are utilized in a mutually exclusive way to mark local prominence in the two languages. In Eskimo, where the durational contrast between single and geminated segments dominates the utterances, the local prominence is signalled exclusively by F0 without durational variation. Yoruba, on the other hand, shows wide range of freedom in the lengthening of vowels. Yoruba data also suggest that the initial hypothesis to be elaborated further since lengthening of vowels were bounded to either high or mid tones, indicating strong correlation between tone and duration.

The lengthening of vowels in Yoruba appears to have a more complicated function than pitch prominence in Eskimo, which regularly correlates with the end of phonological word form. Despite differences in the exact function of these local prominences, and despite differences in the exact acoustic devices the two languages employ, the signalling principles utilized in dividing a paragraph into smaller constituents were found to be similar. In both languages, it is the more prominent form such as high pitch or lengthened vowel which appear in sentence internal position, while in sentence final position the other end (low, or shortened) is preferred. However, it is quite common that sentences end with H tone (in Eskimo) and lengthened vowels (in Yoruba) when read in isolation. Therefore these features are better seen not as acoustic phonetic correlates of specific linguistic entities such as sentence or phrase, but rather they are signals which are dependent on a specific speaking style.

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REFERENCES

- A. Bamgbose (1966), *A grammar of Yoruba*. West African Language Monographs, no.5. (Cambridge University Press).
- Mase, H. and J. Rischel (1971), "A study of consonant quantity in West Greenlandic", *ARIPUC*. University of Copenhagen, Vol. 5, pp.175-247.
- Y. Nagano-Madsen (1992), *Mora and Prosodic Coordination. Phonetic study of Eskimo, Japanese, and Yoruba*. Doctoral dissertation. (Lund University Press, Lund).
- J. Rischel (1974), *Topics in West Greenlandic Phonology* (Akademisk Forlag, Copenhagen).
- E.C. Rowlands (1969), *Teach Yourself Yoruba*. (English Universities Press, London).
- I. C. Ward (1956), *An introduction to the Yoruba language*. Reprinted. (W. Heffer & Sons Ltd., Cambridge).