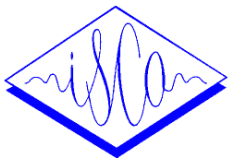

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INTONATION PATTERNS IN UNANGAN (EASTERN ALEUT)

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ABSTRACT

This paper provides phonetic evidence for the following claims about the patterning of intonation in Unangan (Eastern Aleut): 1. each content word in the language is an phonological phrase (PP) of the contour HL; 2. words/PP's are organized into Intonational Phrases (IP's) with boundary tones either H% or L%. (References herein to H and L tone types and phrase types follow the system elaborated by Pierrehumbert [6], and others.) Phonetic evidence is provided by pitch tracks of sentences elicited from eight native speakers of Unangan and by statistical analysis of the pitch tracks.

1. INTRODUCTION

Unangan is the indigenous language of the Eastern Aleutian Islands and the Pribilof Islands in Alaska, USA. A moribund member of the Eskimo-Aleut language family, Unangan has approximately two hundred fluent native speakers, all over the age of fifty.

Unangan is agglutinating with content words taking inflectional suffixes. A single word as in (1) a. can, with appropriate affixes, be an SOV sentence as in (1) b.

(1) a. *Sadan* "outside of"
sada + n
outside pl

b. *Sadaatakun.* "We were out there."
sada + ata + ku + n
outside to have imed past pl

Main word stress is usually on the penultimate but can also be on the ultimate syllable [1], [11]. Stress is primarily marked by duration despite the fact that vowel length is contrastive in Unangan [10]. Final syllables are frequently devoiced, often to the point of complete deletion.

2. METHOD

2.1. Data[1]

Recordings were made of eight native speakers of Unangan, four men and four women. The speakers were recorded indoors on DAT equipment with a flat frequency response throughout the auditory range, using a close-talking, noise-cancelling microphone. Signal-to-noise ratio was always better than 40 dB.

To avoid gaps in pitch tracks and pitch perturbations caused by voiceless segments, sentences were designed to contain words with mostly sonorant and all voiced segments. However, since obtaining natural intonation contours was the primary objective, speakers were not asked to rephrase their responses if they made different word choices than those anticipated by the researcher. Speakers recorded declarative/question pairs and single clause/double clause pairs. A total of 164 sentences are included in this study. Each sentence was transcribed phonetically and in Unangan orthography. Translations, glosses, and speaker intention (e.g. question vs. declarative) were later confirmed by a native speaker.

2.2 Measurements

Utterances were sampled at 10,000 Hz on a Kay Computerized Speech Lab (CSL) 4300B. Pitch tracks with samples taken in a frame length of 25 ms. and frame advance of 20 ms. were generated by the CSL. Numerical results of the entire pitch track for each sentence were entered into a data base for analysis. Measurements were made by hand for cases in which the amplitude of the wave was too low for the pitch tracking function of the CSL. These were calculated from the waveform and entered into the database. Drastic (100 Hz out of range) pitch perturbation spikes caused by changes in phonation (e.g. modal to creaky) were deleted from sentences in the database.

3. RESULTS

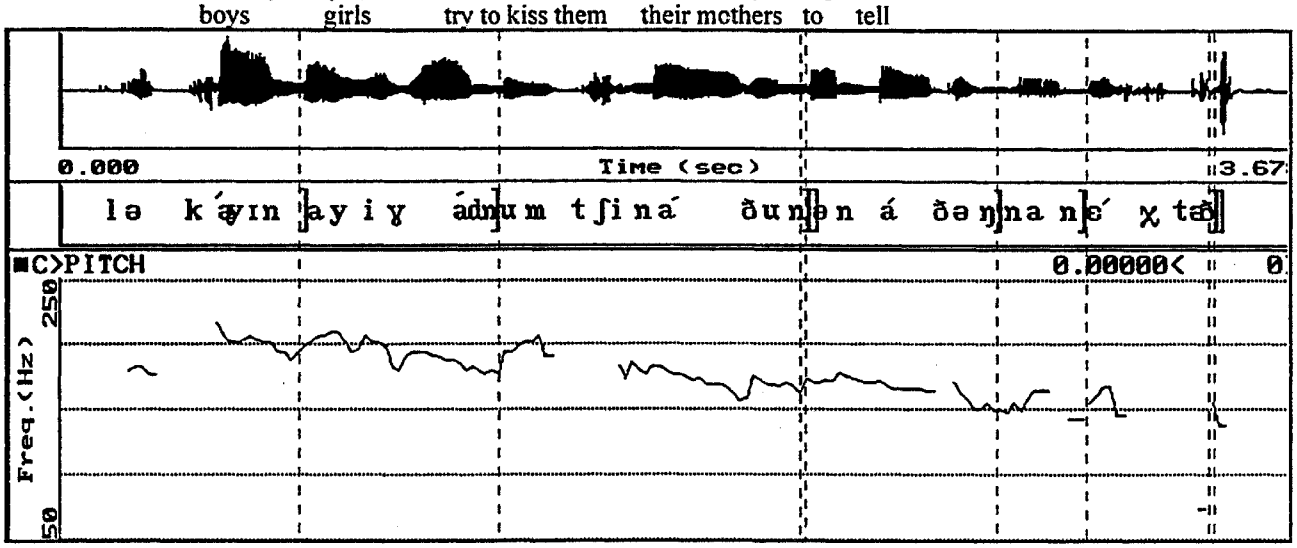
3.1 Pitch tracks

Pitch tracks of declarative sentences suggest that each content word is mapped to its own pitch contour as illustrated in examples (2) a-c. These three sentences, from three different speakers, were elicited by the same two-clause sentence, "If boys try to kiss girls, tell their mothers." Speakers did not give identical lexical responses. In each example the representations are generated by the CSL with pitch tracks analysed and displayed from 50 to 250 Hz.

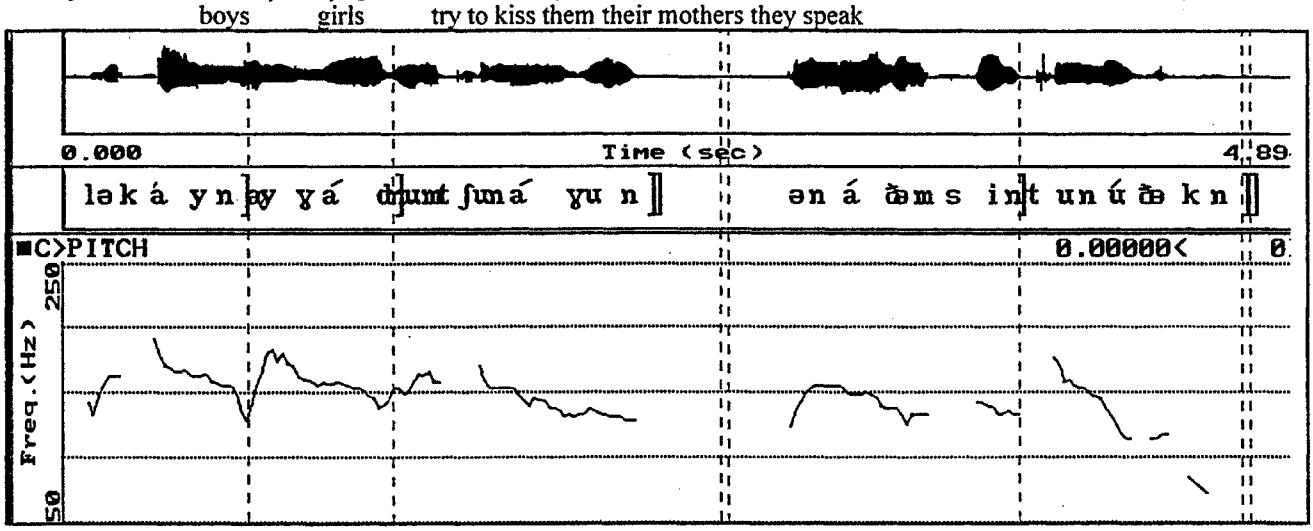
[1] Recordings were made pursuant to National Science Foundation grant #9511113 to Peter Ladefoged and Ian Maddieson, "Phonetic Structures of Endangered Languages", Funding for data corroboration was provided by the Jacobs Research Funds, 1997, "Aleut Intonation".

(2) Examples a. - c. are responses from three different speakers to the English stimulus, "When boys try to kiss girls, tell their mothers." Each example includes an orthographic rendering and gloss, wave form, IPA transcription with main word stress, and pitch track sampled every 20 ms. analysed and displayed from 50 to 250 Hz. Dotted vertical lines and square brackets in the transcriptions indicate word/PP boundaries. Double lines and brackets indicate clause/IP boundaries.

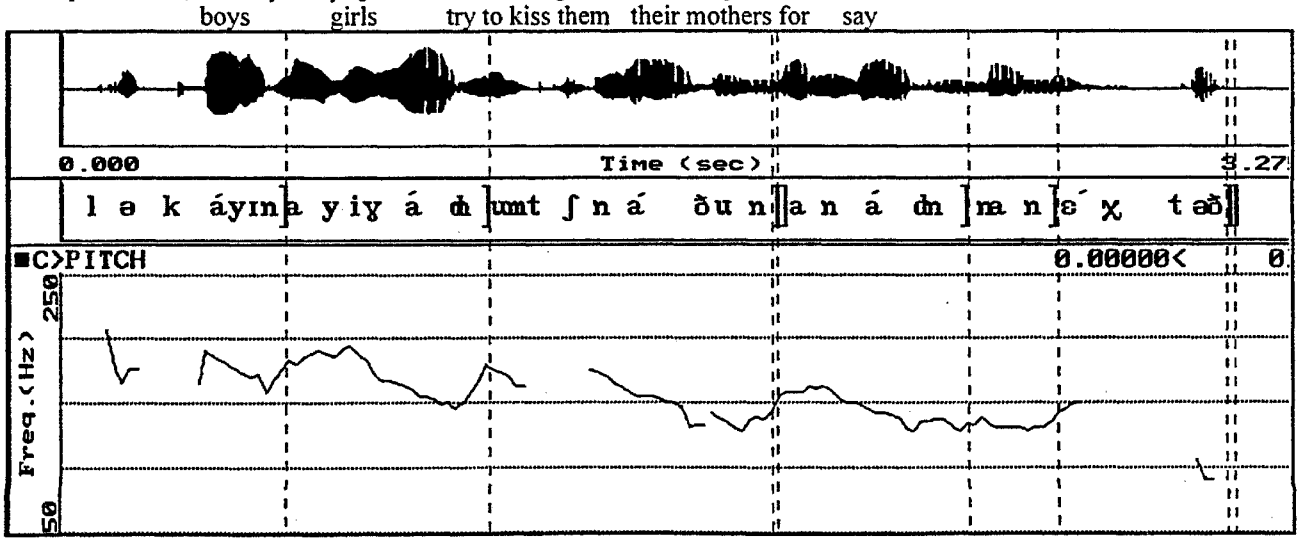
a. Speaker FG, Lakaayan ayagaadan umchunaadunchin, anaadangin ngan ix̌ada.
boys girls try to kiss them their mothers to tell



b. Speaker EK, Lakaayan ayagaadan umchunaaguun, anaadamchin tunudakun.
boys girls try to kiss them their mothers they speak



c. Speaker OR, Lakaayan ayagaadan umchunaaǧidun, anaadangin naan ix̌tada.
boys girls try to kiss them their mothers for say



Except for the first word of each sentence, each content word has a H near its beginning and a L near its end. In (2)a.the word *ngan* is a function word as is *naan* in (2)c. Clause boundaries, marked by double vertical lines in the examples, show level or slightly rising slopes for the first clause endings. The final clause endings all drop steeply.

3.2 Statistical Analysis[2]

Intonation patterns of three-word declarative sentences were analysed for each speaker. In order to compare pitch across words regardless of the time differentials among words, time values were altered such that each word was given a value of one. In each of the graphs in (3), the first words start at 0.0 and end at 1.0. The second words start at 1.0 and end at 2.0. The third words start at 2.0 and end at 3.0. The boldest curve on each plot is the result of applying a smoothing function to the data [3]. Given data x_i and y_i ($i=1,...,n$), a smoother finds a continuous function $y=f(x)$ under the assumption that the y are noisy realizations of $f(x_i)$.

In each example, smoothing shows a robust match between word boundaries and pitch. There are high peaks near word beginnings and low troughs near word ends.

4. DISCUSSION

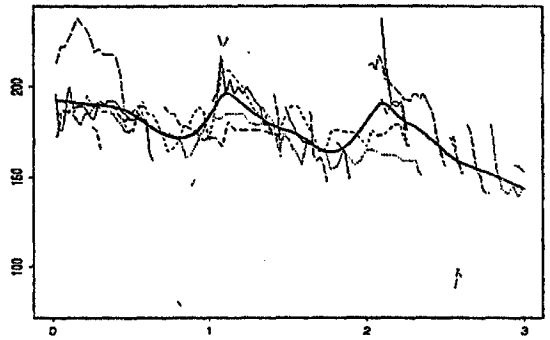
4.1 Word contours

The central finding here is that intonation marks each word-sized domain. Each word has a H near its beginning. Only one of the words in (2) has main word stress on the first syllable. Therefore the H's do not appear to be H* pitch accents associating with main word stress. All content words except for those at first clause endings (the first set of double dotted lines in each pitch track) end in L's. These L's do not seem to be L* pitch accents associating with main word stress because, like the H's, they are in the wrong location for stress. Therefore, these H's and L's are analysed as phrase accent boundary tones associating with PP boundary edges, H's marking the phrase beginnings and L's marking the phrase endings.

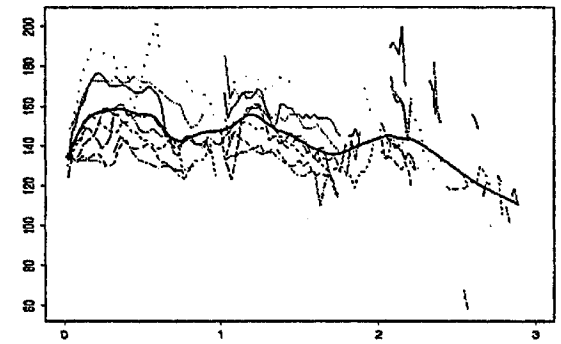
The isomorphy of one HL contour per word observed in the examples in (2) is supported by the statistical analysis illustrated in (3). In each of the graphs in (3) there is a robust correlation between HL contours and word beginnings and ends for each speaker. This kind of one-to-one isomorphy between intonation contours and each (content) word in a sentence has not been described as the case for other languages, e.g. Japanese [7], English [9] (and numerous others), Bengali [5]. However, there is some evidence that for one language related to Unangan, Chup'ik (Central Alaskan Yupik), content words have characteristic intonation contours although they appear to begin with L's and end with H's [12].

(3) Each three-word sentence is depicted by one style of line. The boldest line in each window is the smoothed statistical analysis. Vertical axes give pitch in Hz. Horizontal axes give word boundaries.

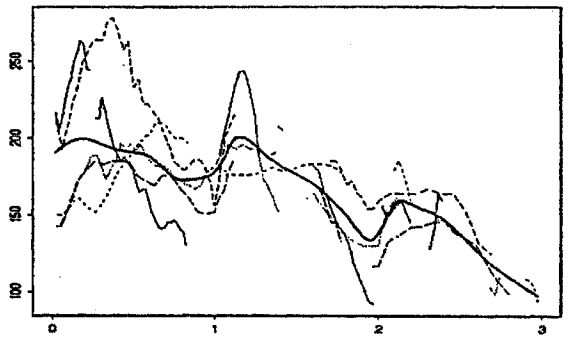
a. Speaker FG, five three-word declarative sentences.



b. Speaker EK, eight three-word declarative sentences.



c. Speaker RM, five three-word declarative sentences.



The fact that a word-sized domain functions as an intoantional domain may be related to the morphological structure mentioned in Section 1. Perhaps each word is treated intonationally as an individual phrase within the sentence since it must have inflectional suffixes and may have numerous

[2] Many thanks to Jake Wegelin for implementing the statistical analysis presented here.

derivational suffixes giving it the potential for standing alone as a sentence.

4.2 IP boundaries

The intonation pattern at the ends of first IP boundaries, the first set of double dotted lines in the pitch tracks shown here in (2), is relatively flat or rises. This contrasts with the intonation pattern at the ends of final IP boundaries, a relatively steep drop. These are analysed as H% for the first clause boundaries, and L% for the final clause boundaries. This conforms to analyses of other languages, e.g. English where H% is taken to mean a continuing proposition and L% to mean that the proposition is complete [8].

5. CONCLUSION

This investigaton of Unangan intonation patterns reveals some language specific characteristics as well as some characteristics that appear to conform to proposed intonational universals. The language specific claim made here is that each content word in Unangan is defined intonationally by its own contour, H near the beginning and L near the end. These are analysed as H and L phrase accents, the boundary tones of phonological phrases. Intonational universals to which Unangan appears to conform are the use of H% final intonational phrase boundary tones to mark an unfinished proposition and L% final intonational phrase boundary tones to mark a completed proposition [4] [2].

The pitch tracks here also indicate that characteristics of Unangan intonation include declination, range resetting, and final lowering, all features for future investigation that are part of the author's ongoing research program.

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