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PHONETICS AND PHONOLOGY OF  
UNANGAN (EASTERN ALEUT)  
INTONATION

by

Alice Taff

A dissertation submitted in partial fulfillment of the  
requirements for the degree of

Doctor of Philosophy

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1999

Approved by Sharon H.  
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University of Washington

Abstract

PHONETICS AND PHONOLOGY OF  
UNANGAN (EASTERN ALEUT)  
INTONATION

by Alice Taff

Chairperson of the Supervisory Committee: Professor Sharon L. Hargus  
Department of Linguistics

This dissertation gives the first detailed description of the phonetics and phonology of the intonation system of Unangan (Eastern Aleut), an indigenous Alaskan language. Twelve fluent speakers were recorded giving translations of elicited sentences. The recordings were analyzed instrumentally and the resulting data were 'smoothed' statistically to investigate patterns in the intonation contours. Five types of utterances were investigated: simple declaratives, yes/no questions, two-clause sentences, noun phrases, and focus contrast sentences. Findings include pitch range and distribution for eight of the speakers. Proposed intonation universals supported by Unangan facts are: declination, major syntactic constituency marking by intonation, falling tone associating with closed topics and rising tone associating with open topics, and (possibly) focus marking by pitch prominence. Language specific findings are: the isomorphy of words with intermediate phrases, a characteristic peak-trough contour for words, a characteristic 'cascade' contour for sentences, an apparent syntactic connection between noun phrase structure and intonation, and a sparse use, if any, of pitch accents since there is little evidence of pitch prominence associating with stressed syllables. Declarative and yes/no question contours contrast primarily in sentence-final voicing. A phonological account of the findings is provided using a two-level tone system. The tone inventory includes a H\* pitch accent, H, L, LH, and  $\uparrow$ H phrase accents, and L% and H% boundary tones. This research expands the prosodic analysis of the Eskimo/Aleut language family, allowing for comparisons within and outside the family. The findings here for Unangan intonation

parallel some aspects of the related language, Central Alaskan Yup'ik: e.g., there is a characteristic contour associated with content words; declaratives and yes/no questions appear to have similar contours.

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## GLOSSARY

- ACCENT TONE** - Tone that associates with a stressed syllable. See **PITCH ACCENT**.
- BOUNDARY TONE** – A tone that marks the edge of an Intonational Phrase, **T%**.
- BASE POINT** - The lowest pitch in a speaker's range.
- CONTOUR** - The melodic shape given to an utterance by intonational changes in pitch.
- DECLINATION** - The gradual lowering of  $f_0$  over the course of an utterance.
- DOWNSTEP** - A lowering and compression of the range triggered, in English, by any bitonal pitch accent. - The domain of downstep in English is the intermediate phrase so the register is reset again at the beginning of the next intermediate phrase
- F<sub>0</sub>** - Fundamental frequency. The number of glottal openings per second.
- FINAL LOWERING** - An abrupt local pitch drop at the end of an utterance, steeper than in declination.
- FREQUENCY** - A physical count of cycles in time. The units of measurement for pitch frequency are cycles per second (cps), also called Hertz (Hz).
- HERTZ** - (Hz) the unit for cycles per second.
- INTERMEDIATE PHRASE** - An intonation domain smaller than the **INTONATIONAL PHRASE**.
- INTERPOLATION** – Pitch assignment between tone targets.
- INTONATION** - The linguistically meaningful change in  $f_0$  across an utterance.
- INTONATIONAL PHRASE**- A large phrase in the intonational hierarchy, intonationally marked at the edges.
- LOOKAHEAD** - Advance planning by speakers used here with reference to access to the declination domain before beginning an utterance.
- NUCLEUS** – The main part of an intonation contour which contains the final pitch accent.
- PHRASE ACCENT TONE** – a boundary tone that marks the edge of an intermediate phrase, **T**.
- PITCH** - The sensation of  $f_0$ , how high or low a sound is perceived to be.
- PITCH ACCENT** - A tone associated at the word level with the stressed syllable of the word, **T\***. Pitch accent makes a word perceptually more prominent, therefore more salient, than others in the utterance. Also called **ACCENT TONE**
- PITCH TRACK** or **PITCH TRACE** - An instrumentally generated visual representation of intonation. Measurements of the rate of glottal openings per second are taken at

designated time intervals throughout an utterance, plotted with Hz on the Y axis against time on the X axis.

**PRE NUCLEAR** – That portion of the intonation contour preceding the nucleus.

**RANGE** - The difference between a speaker's highest and lowest pitch points.

**REGISTER** – The pitch range that a speaker uses for a particular utterance or part of an utterance.

**RESET** - A change of pitch range at the beginning of a new intonation domain.

**TOP POINT** - The highest pitch in a speaker's range.

**UPSTEP** - A phonologically triggered marked rise in pitch target.

**UTTERANCE** - The highest node in the intonational hierarchy. An utterance may be as short as a word or as long as a sentence.

**WAVE FORM** - An instrumentally generated graph of a sound wave.

## LIST OF ABBREVIATIONS

(Morpheme examples appear in parentheses.)

↑ - upstep

1 - first person

2 - second person

3 - third person

3R - reflexive third person

3refrlp - third person referential relative plural

3REF (3ref)- referential third person, 3refs - singular(-V = sg), 3refp – plural, (-ngin = p)

ab - absolutive

abl - ablative

abs - absolutive singular (-x)

abp - absolutive plural (-n)

CAY – Central Alaskan Yup'ik

cnd - conditional

cnj - conjunctive (-lix)

dems - demonstrative singular

demp - demonstrative plural

dub - dubitative

ft - future (V in future -duka-)

H- high phrase accent tone

H\* - high pitch accent tone

H% - high boundary tone

hab - habitual (-sa-, -da- )

imp - imperative (-da)

ip – intermediate phrase

IP – Intonational phrase

L – low phrase accent tone

LH – bitonal low/high phrase accent tone

L% - low boundary tone

like – diminutive, small N, V a little (-ada-)

loc - locative ( -ng for demonstratives)

N - noun

neg, ng - negative (-laqaŋin, -laka-, -laklaka-)

nom - nominalizer

p - plural

prs - present tense

prt - participle (-n-)

ps - passive ( -lga, sxa, ŋa)

Q-question particle (ii)

R - reflexive (3R Vn)  
rcnt pst - recent past (-laaḡana-)  
refl – reflexive  
ref3srel – referential third person singular relative (-gan)  
REL - relative  
RELs- relative singular ( -m -im)  
RELp - relative plural ( -n)  
rmt pst - remote past tense ( -qa)  
s - singular  
st – something  
T – phrase accent tone  
T\* - pitch accent tone  
T% - boundary tone  
temp – temporal  
U - utterance  
V – verb or vowel depending on context  
ω – prosodic word  
was - to have ever Ved ( -aḡtu-)

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## DEDICATION

The author wishes to dedicate this dissertation  
to Unangam Tunuu speakers and learners  
and to Joe and Tim.



## INTRODUCTION

This dissertation is an instrumental investigation of intonation in Unangan (Eastern Aleut) with the goal of describing its general features, then comparing and contrasting these patterns with those found in other languages. Similarity found between the intonation of Unangan and that of other languages has implications for the theory of language universal traits. Differences found between Unangan intonation and that of other languages expand the known inventory of possible structures in human language.

In order to arrive at a description of Unangan intonation patterns this study employs phonetic measurement and statistical analyses of recorded sentences. Intonation patterns thus revealed are accounted for by an underlying phonological representation. The phonological framework used here is based on an approach elaborated by Pierrehumbert (1980) and others.

The impetus for this study came from observations of the language shift process in which two generations of Unangan, in some families three generations, have now shifted from their ancestral language to English. Along with a few segmental variations and some lexical items from the ancestral language, a “nonstandard” American English intonation is a feature of the local English. The aim of this work then is to document, describe, and analyze the patterns of intonation in the ancestral language with an eye towards determining whether these intonation patterns have survived the shift to Unangan English.

This thesis observes intonation of whole sentences, notes patterns, and correlates these patterns with phonology and syntax in the grammar. Since this is the first detailed investigation of the phonetics and phonology of intonation in Unangan, fine detail about the semantics of particular intonation contours is not a focus of this investigation. The relationship drawn between intonation and meaning is limited to meaning at the level of

declarative vs. question or continuing utterance vs. finished utterance. One of the reasons for this limitation is that intonation is only one of the prosodic cues that speakers apparently use to cue meaning beyond the word level. Other prosodic cues include pause, duration, voice quality, and amplitude. Investigating all these cues and bundling them in subsets to correlate with meaning is an area for research beyond the scope of this thesis.

The analysis of intonation in Unangan provided here is intended as a piece in the descriptive puzzle of the Aleut language, the Eskimo-Aleut language family, and the world's languages. The major questions asked are:

Are there pitch contour patterns in Unangan?

If so, what are they?

What is the relation between Unangan pitch patterns map and syntax?

How can Unangan pitch patterns be accounted for in the phonology?

Do Unangan intonation facts provide evidence for or against any proposed intonation universals?

## CHAPTER 1: BACKGROUND

### 1.1: INTONATION

Intonation is linguistically compelled pitch change that takes place over the course of an utterance. 'Linguistically compelled' is used here to mean the pitch changes speakers make intentionally, though not necessarily consciously, to serve linguistic purposes. These purposes may be structural, e.g., breaking up the speech stream into units, or meaningful, e.g., contrasting sentence types, or pragmatic.

Background on intonation that is pertinent to this investigation is provided in this section. As in following sections, phonetic considerations are addressed first, then phonological considerations. Herein we establish the assumptions on which this study is based.

#### 1.1.1: INTONATIONAL PHONETICS

Instrumental analysis has greatly enhanced the study of intonation by providing researchers with easily obtained absolute measurements. Descriptive linguistic studies such as the one presented here have benefited from the instrumentation developed for more commercial purposes -- speech synthesis and recognition -- as well as medically related speech and hearing research.

Phonetic studies of intonation use instrumentation to measure properties of the sound wave, the WAVE FORM, which is the speech signal. The particular measurement taken in the study of intonation is the number of glottal openings per second. A physical count of the opening/closing cycle per second is given in number of HERTZ (Hz) as the FUNDAMENTAL FREQUENCY ( $f_0$ ). It is this fundamental frequency that we hear as the 'melody' or intonation of language. While healthy humans can hear from around 20 to 20,000 Hz, the normal speech range is more limited, from around 100 to 5000 Hz

(Borden and Harris 1984: 35). Within this speech range, the  $f_0$  range for normal adults is, very roughly, around 100 to 300 Hz.

PITCH is a sensation of  $f_0$ , how high or low in pitch a sound is perceived to be. Pitch, a perception, and  $f_0$ , a measurement of glottal pulses, are not exactly equivalent but the two terms are often used interchangeably. We can perceive a difference in pitch of 2 to 3 Hz within the  $f_0$  range for speech (Ladefoged 1996). This dissertation makes use of acoustic phonetic data observed in speech waveforms. The waveforms were used to generate narrowband spectrograms and pitch tracks. The instrumentally generated representation of  $f_0$  measured at small intervals across an utterance is called a PITCH TRACK or PITCH TRACE. A pitch track is a single line visual representation of the rise and fall of pitch in an utterance. Intonation changes can be observed in the narrowband spectrogram because this representation makes visible the harmonics, the whole number multiples of  $f_0$ . Conclusions in this investigation are reached on the basis of narrowband spectrogram, pitch track and waveform observations. Narrowband spectrograms and pitch tracks are illustrated and details about the methodology are provided in Chapter 2. Good introductory sources about the acoustic phonetics of intonation are Ladefoged 1993, 1996, and Johnson 1997.

Since pitch track analysis is the foundation of this investigation and not every reading in a pitch track is related to intonation, a discussion of pitch track perturbations will be given here. Pitch is affected in at least three systematic ways by consonants and vowels (House and Fairbanks 1953, Hombert, et al. 1979, Whalen, et al. 1993, Whalen and Levitt 1995, Whalen et al. 1998). Three types of pitch effect will be discussed here: 1. intrinsic  $f_0$ s of vowels; 2. predictable pitch effects of consonants on vowels; 3. predictable pitch contours of voiced obstruents.

In a study of the intrinsic  $f_0$  of vowels using American English data from six speakers, Lehiste and Peterson (1961) found that the more open vowels, e.g. /a/, have lower fundamental frequency averages than the more closed vowels, e.g. /i/. Their results

averaged around 165 Hz for /a/ and around 185 for /i/ and /u/. Peterson and Barney (1952) found the same general result for vowels but their average per vowel was lower than that of Lehiste and Peterson. In more recent work Whalen and Levitt (1995) computed intrinsic f0 of vowels for languages in eleven different language families. Their results showed that high vowels were on average 15 Hz higher than low vowels across all languages studied, not as much difference in the intrinsic f0 as the Lehiste and Peterson results indicate. Although some languages showed as little as two Hz difference in intrinsic f0 of high vs. low vowels and others as much as 49 Hz, this was likely an effect of too few speakers in the studies. Studies with more than twenty speakers showed results around the 15 Hz intrinsic f0 difference. In addition, the intrinsic f0 effect was found to disappear as speakers approached their BASE POINT, the lowest pitch in a speaker's range. The pervasiveness of intrinsic f0 across languages is evidence that this effect is automatic, not deliberate on the part of speakers.

Three kinds of consonant effects on the pitch of vowels are reported by Lehiste and Peterson (1961). First, onset consonants have stronger pitch effects on vowels than coda consonants. Second, consonant voicing affects vowel pitch; voiceless onsets cause a higher f0 in vowels than voiced onsets. Pitch results for the onset effect range from 164 Hz (for /v/) to 196 Hz (for /f/). The third effect relates to pitch contour. After a voiceless onset, pitch drops steeply into a vowel; after a voiced onset pitch rises gradually into a vowel. The report does not include information about where in the vowel the measurements were made but 164 to 196 Hz is such a wide difference in pitch that these measurements must have been taken at the very beginnings of the vowels, not in the midpoints. This implies that preceding consonants affect the shape of the vowel pitch contour, more than the speaker's target pitch for the vowel.

Voiced obstruents affect vowel onsets by lowering their pitch. The pitch across a voiced obstruent itself is readable. Voiced obstruents cause a dip in pitch across the consonant with a rise into the vowel. There is no readable pitch across voiceless consonants, of course, since f0 is a measure of the number of glottal openings per second and the glottis

stays open during voiceless sounds. Maddieson (1984) presents data showing that the same pitch effects on vowel onsets hold for voiced and voiceless sonorants as for voiced and voiceless obstruents.

The intrinsic pitch effects noted above are not considered to be linguistically meaningful to intonation. That is, these intrinsic effects are beyond the control of speakers. To avoid including these intrinsic pitch effects of in intonation measurements, researchers working with intonation typically refer to displays of whole pitch tracks but for statistical comparison, take individual f0 measurements 'by hand' in whatever syllables are deemed to be salient to their particular study. The measurements are taken in the vowel after that portion affected by the consonant. This method is used in this study to compare peak differences between words in genitives and non-genitives. To control for intrinsic vowel f0 researchers may either normalize across vowels or design a study with a single vowel.

A different approach is taken in this study. A mass of measurements in which all segmental environments are represented will, in effect, normalize itself. The predominant method of analysis used in this study takes all the measurements generated for many pitch tracks and compares them together to determine intonation patterns. This method is described in detail in §2.3.2: Smoothing program.

Because of the above mentioned intrinsic pitch characteristics of consonants and vowels, IPA transcriptions provided herein with the waveforms and pitch tracks are given narrowly enough to show allophones; e.g., if the underlying voiceless fricative  $\chi$  is voiced by a speaker, the voiced allophone  $\mathfrak{z}$  is written. This is to ensure that perturbations in the pitch tracks caused by voicing or lack thereof are reflected in the transcriptions.

### 1.1.2: INTONATIONAL PHONOLOGY

Moving from the concrete world of actual f0 measurements to the abstraction of underlying representations that generate such pitch data takes us from phonetics to

phonology. Intonation as an area of phonological study has lagged behind the study of segmental and other suprasegmental phenomena because of the scalar character of pitch, the lack of one-to-one mapping between sound and meaning, and the relationship of intonation to emotive states, sometimes considered to be outside the realm of linguistics. But intonation as an object for linguistic study is supported by minimal pair sentences, sentences which differ in meaning when the only phonological difference is intonation (e.g., Wales and Toner 1979).

#### 1.1.2.1: Models of intonational phonology

Phonological models to account for intonation have been developed on several fronts with primary application in speech synthesis and recognition technology. A promising model has been developed for Swedish in which accents are placed in a sentence grid (see Bruce 1997 for an overview). A 'stylization' of tones system has been developed for Dutch (e.g., 't Hart et al. 1990). In this system  $f_0$  traces are radically smoothed until only straight lines connect the major prominences. But English is the language for which the largest body of intonation research has been done to date and much of the work on other languages has used models derived from those developed for English. Detailed descriptions and comparisons of the models can be found in Crystal 1969, Lehiste 1970, Ladd 1980, 1996, Cruttenden 1997, and Rossi 1997. What follows is a brief summary of the two currently predominant theories, the 'American' or 'levels' model, and the 'British' or 'configurations' model.

An early 'whole tune' approach considered the entire sentence contour to be a prime unit. Then researchers, recognizing the existence of primes below the level of the whole contour, argued about whether these are pitch 'levels' or whether they are 'configurations'. The theory of 'levels', that is, individual target frequencies, became the 'American' model (e.g. Pike 1945, Wells 1945, Trager and Smith 1951, Liberman 1978, Leben 1976, Goldsmith 1979, Pierrehumbert 1980 [1987]). The theory of 'configurations', that is, pitch movements or gestures such as 'rise', 'fall', etc., became the 'British' model (e.g. Palmer 1922, O'Connor and Arnold 1961, Armstrong and Ward

1961). Ladd (1980, 1996) documents the 'levels vs. configurations' debate in English intonation research.

In the American 'levels' model, pitch prominence cues listeners to certain target points in the contour, in effect saying, "Pay attention to this; I'm up here (or down here)." Researchers proposed various numbers of level tones, four being the most popular. The system also includes boundary tones described in terms of rises and falls.

In the British 'configurations' model, pitch change cues listeners to movement in the contour, in effect saying, "Pay attention to this; I'm moving up (or down)." Another important notion from the British school is the division of the intonation group into two parts; the NUCLEUS, the primary, usually the final PITCH ACCENT, which usually has pitch movement (Couper-Kuhlen 1986), and the PRENUCLEAR material which is everything preceding the nucleus.

The discussion over the merits of level tones versus configurations persists to this day. For instance, Arvaniti et al. (1998) report results favoring pitch targets, not pitch movements as intonational primitives from an investigation of prenuclear accent in Modern Greek.

As Cruttenden (1997: 144) notes, the two models are not so very distant theoretically since groups of tones form configurations in the contour and configurations have beginning and end or turning points. Another similarity between the two schools is that neither has yet been able to account for all the variation in intonation in such a way that a machine can be programmed to reliably recognize complex natural contours nor produce contours that sound naturally meaningful.

The lack of theoretical ability to map intonation to meaning is partly due to the fact that we have as yet no list of what the complex meanings are. This is a job for which intonation phonologists need to enlist the aid of semanticists, psychologists, anthropologists, sociologists, and philosophers. Since the task of organizing 'meaning' in

all its levels has yet to be completed for even one single culture, we find ourselves at present able to account only for intonation mapping to broad levels of meaning such as 'new in the discourse, add to mutual beliefs', 'not predicated, not new, mutually believed', 'uncertainty', 'new and not open to question', 'elaborates on previous utterance' (Pierrehumbert and Hirschberg 1990).

The phonological model of intonation against which the contours of Unangan will be tested is a branch of the American level tone school. In this framework, the number of tones was distilled to two, low (L), and high (H), by Pierrehumbert (1980/87) and refined by her with Mary Beckman (e.g. Pierrehumbert and Beckman 1988), Julia Hirschberg (e.g. Pierrehumbert and Hirschberg 1990) and others. Originally designed for English, this elegant approach, simple yet able to account for complex contours, is largely responsible for the upsurge of intonation research in many languages in the ensuing years becoming the 'dominant' model (Cruttenden 1997: 59). A description of this framework follows.

#### 1.1.2.2: Compositional, two-level tones model

In Pierrehumbert's theory (1980/87: 3) an intonational phonology has three components: 1) a grammar of allowable phrasal tunes, 2) a metrical representation of the text (following Liberman 1975, Liberman and Prince 1977), 3) rules for associating the tune with the text.

This model defines intonation as the surface pitch contours generated from underlying H and L tones. A tone is not judged to be H or L with reference to particular absolute pitches. Rather a tone is H or L relative to its neighboring, or local, contour. Consider a 900' high piece of ground called a 'peak' because the land surrounding it is lower. Some miles away from this peak there is a valley whose lowest point is 1000'. It qualifies as a valley because the surrounding land is higher. The 1000' valley is higher than the 900' peak but this does not change their classification since the perception of their contour is based on the local context. The valley is a valley in its locality and the peak is a peak in

its locality. In the same way, intonational peaks and troughs are so perceived within the context of immediately neighboring pitches.

The manifestation of tone between two phonological pitch targets is a phonetic INTERPOLATION. Since every syllable does have a pitch representation on the surface, syllables with underlyingly unspecified tones are assigned tone by interpolation of pitches from target to target, connecting the dots if you will. The phonetic interpolation of pitch between phonological pitch targets is linear (for English) except between H\*'s where the pitch 'sags'. A lower sag correlates with a longer distance between H\* loci (Grice 1995: 222).

H and L tones are of two basic types. The first type is PITCH ACCENT tone (Bolinger 1965, Pierrehumbert 1980) represented by T\* in the Pierrehumbert system. Accent tones associate with stressed syllables (Goldsmith 1974/80, Pierrehumbert 1980/87). Syllable stress is established language specifically. The actual timing of an accent tone, whether earlier or later in its associated syllable, is a language specific parameter. Tones may be either single, H\* or L\*, or bi-tonal, e.g. H\*+L or L+H\*. In bi-tonal accents, it is the starred tone that associates with the stressed syllable. Pitch accent tones serve to focus attention on a word for narrow focus, or a phrase for broad focus.

The second type of tone is boundary tone. Two types of boundary tones align with phrase edges. The PHRASE ACCENT TONE (T) associates with the edge of an INTERMEDIATE PHRASE (ip), a small phrase. Phrase accents, proposed to account for intonation effects near ip edges, control the f0 of the region from the last pitch accent to the phrase boundary (Beckman and Pierrehumbert 1986, Pierrehumbert and Hirschberg 1990). An intermediate phrase contains one or more pitch accents and a phrase accent. When these fall on the same syllable the timing of the T\* moves further from the boundary.

A second type of boundary tone is called just that in the Pierrehumbert framework. A BOUNDARY TONE (T%) associates with the edge of an INTONATIONAL PHRASE (IP). An

intonational phrase is composed of one or more intermediate phrases so that it ends with a combined phrase accent/boundary tone. Each intonational phrase is paired with a choice of tune (Pierrehumbert and Hirschberg 1990: 272). There may be one or more intonational phrases per sentence. Boundaries may also be marked by other prosodic devices such as pause, duration, and voice quality.

In their distribution of H and L tones, languages may obey or violate the Obligatory Contour Principle (OCP), either allowing or disallowing sequences of like tones (Hayes and Lahiri 1991).

To illustrate the level tone framework, the sentence, "Marianna made the marmalade," is given in Figure 1 first as a yes/no question, then as a declarative. This sentence, adapted from Beckman and Ayres (1994), was produced by the author and digitized at a sampling rate of 20,000 Hz on the Kay CSL 3400B. The pitch track was generated with a frame advance and frame length of 20 ms. The question has L\* pitch accents on the stressed syllables, a H phrase accent and a H% boundary tone. The declarative has H\* pitch accents on the stressed syllables, a L phrase accent and a L% boundary tone. Remembering the earlier discussion of 'peak' and 'valley' in local contexts, note that the L\* on the first 'marmalade' is approximately the same pitch as the H\* on the second 'marmalade'.

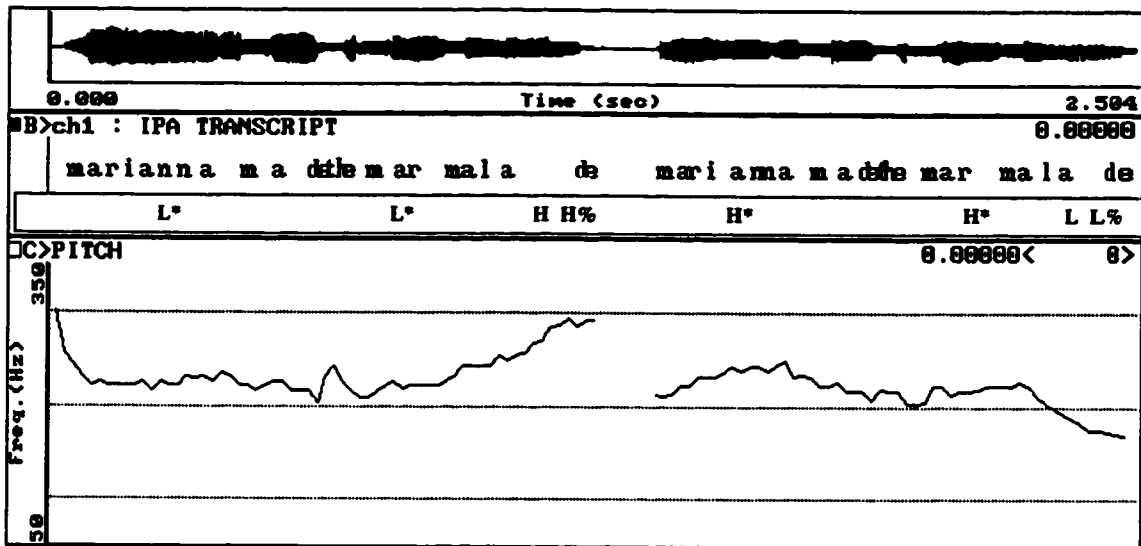


Figure 1: An illustration of tone labeling in the Pierrehumbert model. The sentence, “Marianna made the marmalade,” is given first as a yes/no question, then as a declarative.

Tone sequences are organized into language-specific intonation phrase hierarchies. The generalized hierarchy from top to bottom is roughly:

Intonational phrase hierarchy:

Utterance

Intonational phrase (intonational clause, intonational contour, or major phrase depending on analysis).

Intermediate phrase (or phonological phrase, or accentual phrase depending on analysis).

Tones

The intonational phrase hierarchy is related to the prosodic hierarchy proposed by, among others, Selkirk (1978) and Nespor and Vogel (1982, 1986).

## Prosodic hierarchy

Utterance,  $\cup$   
 Intonational phrase, IP  
 Phonological phrase, ip  
 Phonological word,  $\omega$   
 Foot  
 Syllable,  $\sigma$

The following terms are used somewhat variously by researchers working in a variety of frameworks so the definitions used in this study are given here. RANGE is a measurement of the distance between a speaker's highest and lowest pitches (Pierrehumbert & Hirschberg 1990: 278). This may be in reference to a single utterance or a larger corpus. The lowest pitch a speaker uses is referred to as the BASE POINT. The highest pitch a speaker uses is referred to as the TOP POINT. As with range, the base point reference may be for a single utterance, part of an utterance or a larger corpus. Speech REGISTER refers to a more limited span within his or her range that a speaker uses for a particular utterance or part of an utterance (Laniran 1992: 93, 181).

Triggered by language particular tones or tone sequences, register may be affected by DOWNSTEP (also referred to as CATATHESIS (Beckman and Pierrehumbert 1986)), a lowering and compression of the range. In English, any bi-tonal pitch accent triggers downstep. The domain of downstep in English is the intermediate phrase so the register is reset again at the beginning of the next intermediate phrase. Beckman and Pierrehumbert (1986: 279) treat downstep as an effect on the phrasal pitch range as a whole, not an effect on individual tones. UPSTEP, a local raising of pitch range, is triggered by H phrase accent (Beckman and Ayers 1994: 21). As a speaker's range expands, due to e.g., introduction of a new topic, or compresses due to e.g., downstep, other aspects of intonation change proportionally (Pierrehumbert & Hirschberg 1990). The register reverts to default pitch range at RESET points during an utterance or from one utterance to another (Laniran 1992/93: 182).

Global effects on the  $f_0$  contour include both downstep and DECLINATION. Declination is the lowering of pitch range from the beginning to the end of an utterance regardless of sentence type or sequence of tones (Beckman and Pierrehumbert 1986, Pierrehumbert and Beckman 1988). Cruttenden (1997: 162) defines declination as  $f_0$  which is on average lower at the end of an intonation-group than at the beginning. Declination causes the gradual lowering of all tones regardless of their identity but less lowering than is caused by downstep. Tone range is reset with the start of each declination domain.

In contrast to the global downtrend effects of downstep and declination, a more local effect on only adjacent tones is caused by FINAL LOWERING, a decrease of  $f_0$  more abrupt than the gradual lowering caused by declination. Final lowering is linked to the final boundary of a major prosodic constituent such as an utterance or intonational phrase resulting in the acceleration of lowering right at the end of the sentence (Beckman and Pierrehumbert 1986). Final lowering appears to be scalar with the degree of final lowering related to the degree of finality intended in the utterance (Pierrehumbert & Hirschberg 1990: 279). Beckman and Pierrehumbert suggest that the domain of final lowering is 'some unit larger than the intonational phrase' (1986: 302), that it may apply only at the ends of sentences which conclude a topic or subtopic, and that the effects of final lowering are strengthened by the degree of dominance a sentence has in the meaning of the discourse.

The framework described above, derived from Pierrehumbert 1980/87, will be used here in accounting for intonation phenomena found in Unangan. The Tones and Break Indices (ToBI) transcription system was developed from the same framework as a way of standardizing prosodic transcription. This system, used mostly for American, British, and Australian English, has its detractors (e.g., Nolan and Grabe 1997) and is still under development. At this point, the type of visual coding of pitch tracks that ToBI is intended to standardize is still more of an art than a science. Strict ToBI transcription conventions are not used in this dissertation although H and L tones of the three types,

pitch accent, phrase accent, and boundary tone, are referred to and used to code utterances.

### 1.1.3: INTONATION UNIVERSALS

Intonation itself appears to be a universal of spoken language. This may seem obvious but it is not a given that pitch should be used over the course of an utterance as part of the linguistic signal. However, in all the languages that have been studied, no monotone languages have been reported. Even tone languages that use pitch phonemically also put it to more global use over the course of an utterance.

There are smaller features within intonation that are considered universals. Exploring this issue, Bolinger suggested universals associated with both meaning and structure: low or falling pitch at a clause juncture cues finality, high or rising pitch in the same place cues non-finality, pitch accent cues ‘focus and climax’ (1978: 471). He relates these manifestations of intonation to ‘...a primitive drive mechanism that raises pitch as tension rises and lowers it as tension falls...’ (1986: 194) and expresses the need for supportive evidence from language acquisition studies. Ladd (1986: 115) questions these claims, without denying them, on the basis that the descriptions are too broad to be falsified. Cruttenden (1997) suggests the following intonation universals culled from his longer list of intonation universals as the ones to be addressed in this dissertation:

- Declination.
- Intonation marks major syntactic constituents.
- Pitch prominence marks focus.
- Falling tone associates with closed topics while rising tone associates with open topics.

Testing universals requires data from many languages and language families and, using current technology and phonetic and phonological models, intonation is being investigated in a growing number of languages. A by no means exhaustive list of these languages includes: Aleut, Arabic, Basque, Baule, Bengali, Bulgarian, Central Alaskan Yup’ik, Chichewa, Chinese, Czech, Danish, Dutch, English, Finnish, French, German,

Greek, Hausa, Hindi, Hungarian, Igbo, Italian, Japanese, Korean, Maltese, Mandarin, Norwegian, Portuguese, Romanian, Russian, Seneca, Serbo-Croatian, Spanish, Swedish, Teochew, Thai, Toishon, Vietnamese, Wolof, Yorùbá. For many of these languages, several varieties have been researched. Intonation facts from other languages that are pertinent to this study of Unangan will be given in discussions and summaries in Chapter 3: Analyses and results.

## 1.2: UNANGAN

### 1.2.1: HISTORY

#### 1.2.1.1: Language family relationships - divergence

The Eskimo/Aleut language family consists of the members shown in Figure 2 (following Krauss 1995). Here the language names are given in the respective languages with the English referents in parentheses. Unangam Tunuu (Aleut, lit. “of the Unangan, their language”, “the Aleut language”) is depicted in this figure as a daughter of Proto Eskimo/Aleut in the topmost branch of the Eskimo/Aleut family tree. The community of speakers of Unangam Tunuu are the people of the Western Alaskan Peninsula, Pribilof Islands, and Aleutian Islands, the dwellers of the southern Bering Sea. See Figure 3 for a map of the indigenous language territory. The name ‘Aleut’ comes from the Russian *Aleuty*, Aleuts, a term of uncertain origin, possibly derived from the Russian name of the Koryak village *Olyútorskoye* by the first Russian explorers (Bergsland 1959:11, 1997:1).

Research bringing to light cognates and structural similarities among the languages of the family (Bergsland 1986, 1989, Fortescue et al. 1994) suggests that Proto Eskimo/Aleut was spoken three to four thousand years ago and that Unangam Tunuu began to diverge thereafter but without abrupt dislocation from the family since contact is thought to have continued among the branches of Eskimo/Aleut (Bergsland 1989: 67, Fortescue et al., 1994: xi). The similarities and differences in structure between Unangam Tunuu and the

other branches are described in Bergsland 1986, 1989, 1994, 1997a and b, and Fortescue et al. 1994.

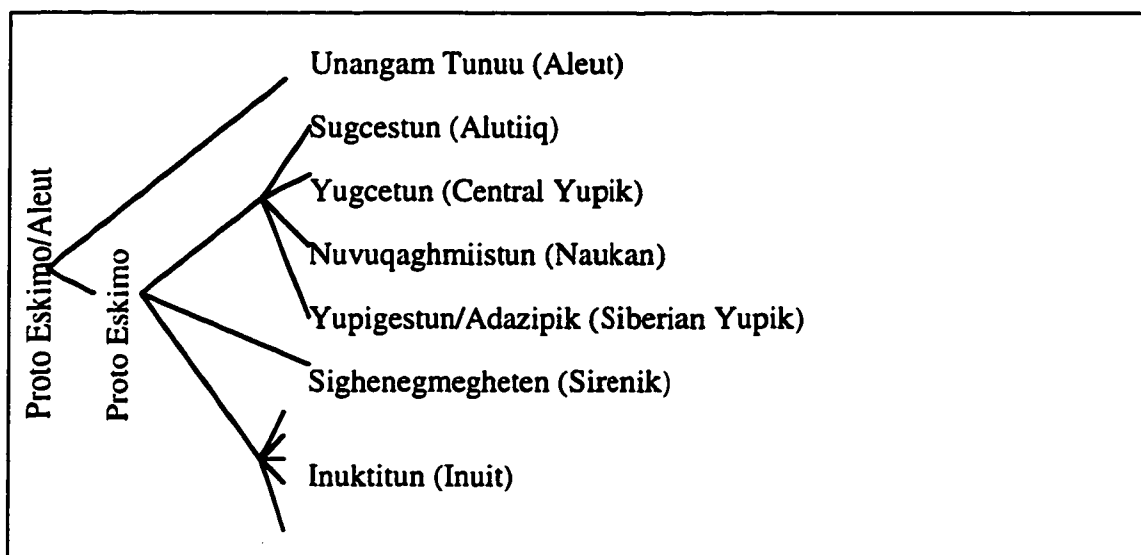


Figure 2: Eskimo/Aleut language family (Krauss 1995).

There are two extant dialects of Unangam Tunuu, Eastern and Western. The name for the Aleut people or language is **Unangan** (plural of **Unangax̂**) in the Eastern dialect, **Unangas** in the Western dialect. Out of respect for those who are working to revitalize the use of their ancestral language, the term **Unangan** will be used hereafter to refer to the Eastern dialect of the Aleut language and **Unangas** to the Western dialect. **Unangan/s** will be used to refer to both groups, either the people or their language. Alternately, **Unangam Tunuu** will be used to refer to the language.

The historical geographic region of Unangam Tunuu is illustrated Figure 3 (reprinted from Bergsland and Dirks 1990: xviii, with permission from the publisher). Subdialect names are given in italics along the bottom of the figure and their boundaries are shown as dotted lines. The east/west dialect boundary appears as a dashed line.

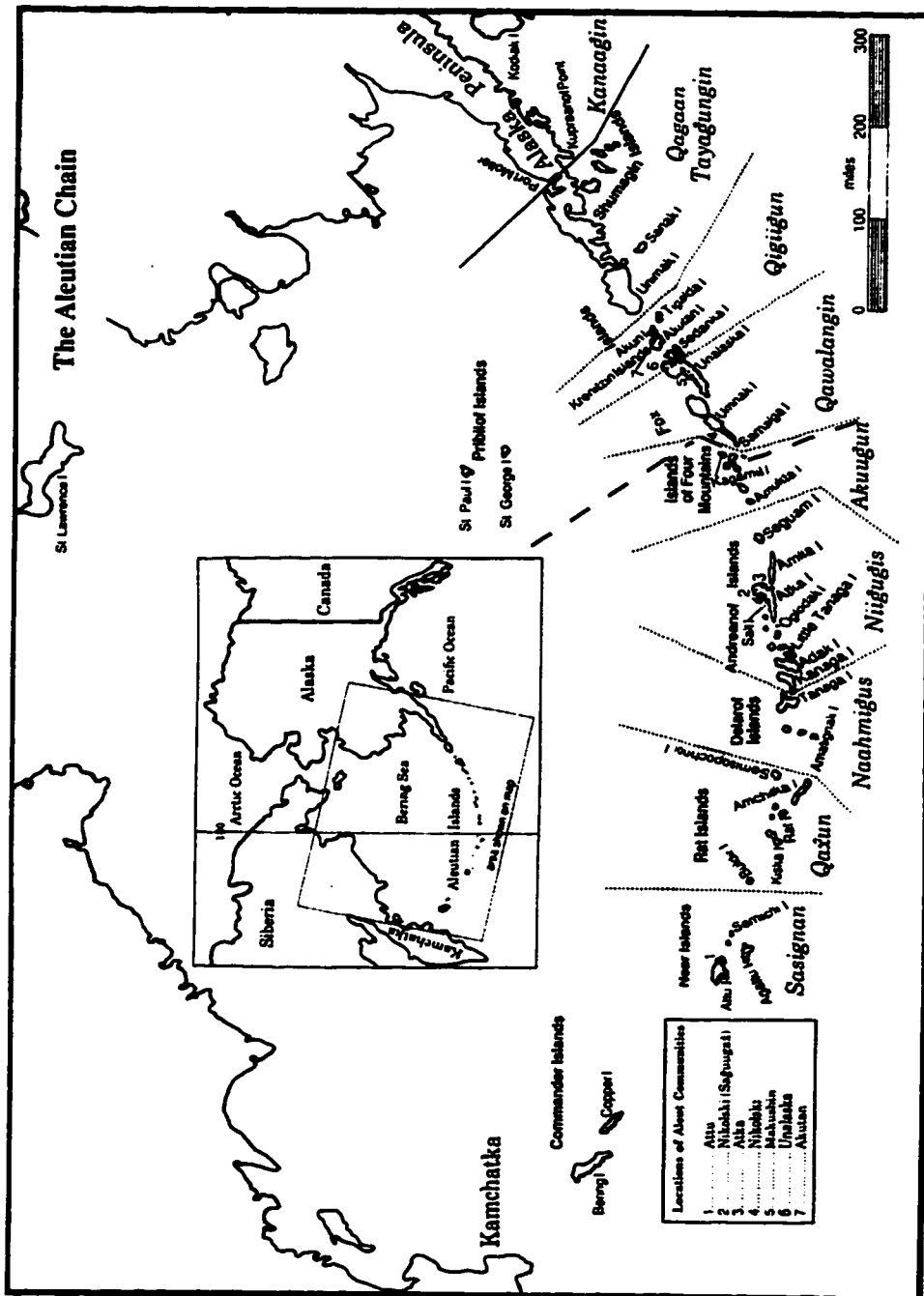


Figure 3: Map of the Aleutian Chain showing Unangan/Unangas dialect boundary as a dashed line. Subdialect boundaries are dotted lines.

The relationship among the dialects of Unangam Tunuu is illustrated in Figure 4 (following Bergsland and Dirks 1990, Bergsland 1994, 1997a). Here the extinct branches

are given in smaller type. The dialect, subdialect and subsubdialect that is the object of this study are given in bold type. Data for this study was collected in St. Paul and St. George Islands, the Pribilof Islands, Alaska, where the indigenous language is Unangam Tunuu, dialect Unangan, subdialect Qawalangin. A description of the data collection is given in § 2.1: Data collection.

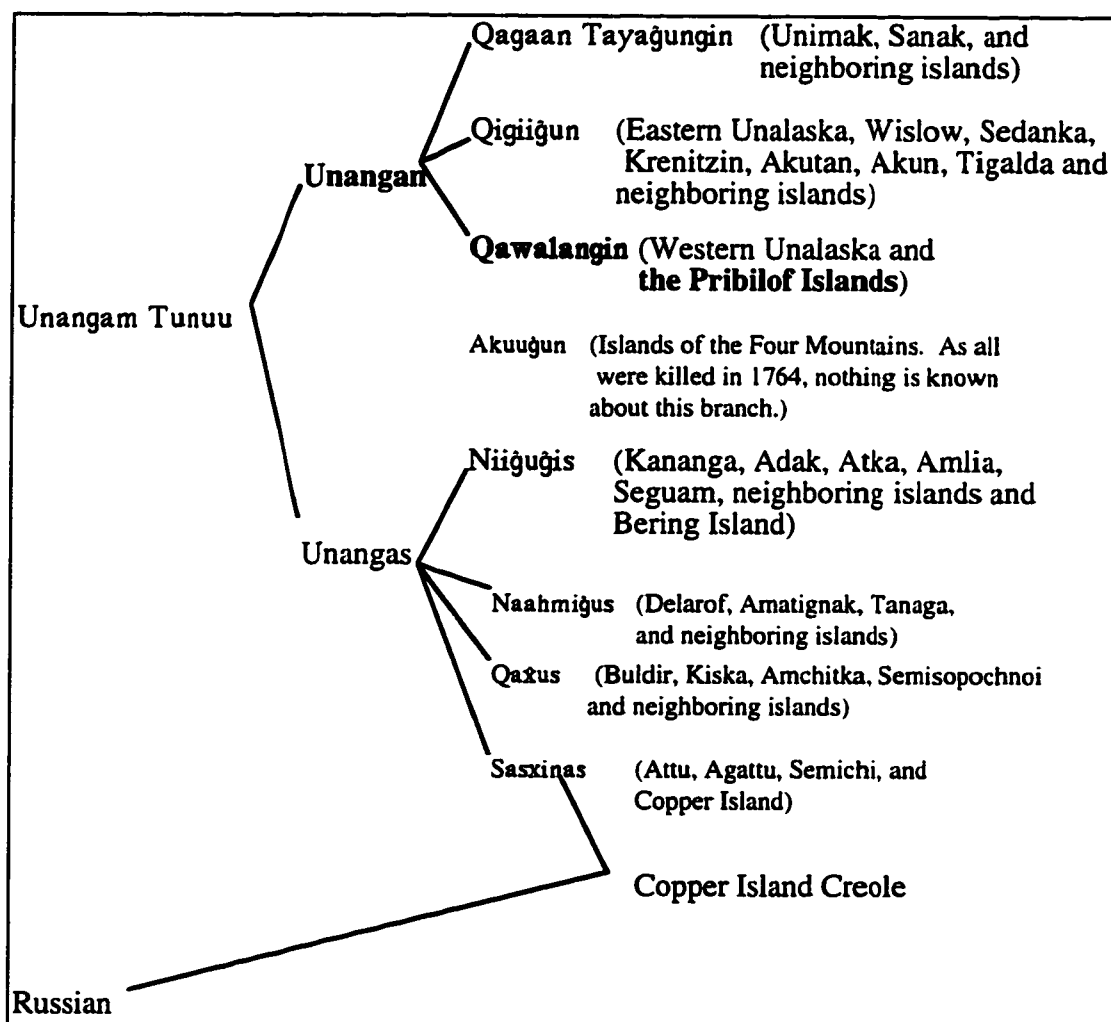


Figure 4: Unangam Tunuu dialect relationships.

The dialect, subdialect and subsubdialect investigated here appear in bold type. Extinct branches appear in small type.

This section focused on the relationships within Unangam Tunuu and its language family. The next section describes language contacts and their effects from outside the family.

### 1.2.1.2: Contact outside the family - convergence and shift

The tragic history of contact between the people of the Aleutian Chain and European-derived colonists is similar to that enacted across the Americas. An influx of colonists with commercial interest, supported by religious and education conversion zealots, undermines the established culture for economic gain. These new influences cause dramatic shifts in lifestyle, frequently including language shift.

At the time of the first European contact with Unangan/s in 1745 there are estimated to have been between 12,000 and 15,000 speakers of the language as a whole (Lantis 1984). Today there are approximately 305 fluent speakers of Unangam Tunuu out of a total population of approximately 2,200 (Krauss 1997:32). Unangan is now spoken in the Alaskan villages of St. Paul, St. George, Unalaska, Akutan, King Cove, Nikolski, False Pass, and Sand Point with a total of about 200 fluent speakers, nearly all over the age of fifty. Unangas is spoken mainly in the village of Atka, with about 40 speakers, most over the age of thirty (Taff 1994, Krauss 1997). Additional speakers scattered throughout Alaska and elsewhere account for the total figure of 305 speakers.

The Russian period began in 1745 with the discovery of the Aleutian Islands by Russian sea otter hunters. The hunters, prospecting new territory, encountered and subjugated the islanders to assist them in the fur trade, murdering those unwilling to serve. In 1786 the Russians discovered the Pribilof Islands, then as now the main breeding grounds of the Northern fur seal, known to but uninhabited by the Unangan/s. To expedite the fur seal harvest there, Unangan slaves from the Unalaska area were transported to the Pribilofs to settle St. Paul and St. George Islands.

New diseases transmitted by the Russian colonists caused further decimation of the people, reducing the population by at least two thirds within fifty years (Bergsland 1997a:2, Lantis 1984:163). The Russians divided the area into Eastern and Western divisions for commercial reasons with Eastern headquarters in Unalaska and Western in Atka, along the dialect lines. Many Unangan/s became bilingual, learning Russian after

their ancestral language, and with the arrival of priests who followed the hunters to the new territory, most converted to Russian Orthodoxy.

Notable among the Russian clergy for his positive influence during this time is Ioann Veniaminov, canonized St. Innocent in 1977, the first priest in Unalaska, living there from 1824-1834. Veniaminov studied Unangam Tunuu, devising for it an alphabet using Cyrillic symbols. With local assistance, he translated religious works into Unangan, thereby preserving the language in the ritual of the church, and wrote a grammar and dictionary (Geoghegan 1944). Although many Aleuts learned Russian, there is no evidence that this language was forced on them to the exclusion of their own. On the contrary, church schools established by the Russian priests offered not only religious instruction and literacy in Slavonic, but also literacy in Unangan/s using Veniaminov's orthography. By the 1860s most Unangan/s adults were literate in Unangam Tunuu (Bergsland 1997a: 4). They corresponded and kept diaries (Geoghegan 1940).

In 1867 the United States purchased Alaska from Russia, primarily for the acquisition of the sealing grounds on the Pribilof Islands. Revenues from sales of Pribilof fur seal pelts repaid the seven million dollar purchase price within a few years. The Pribilof Unangan remained in bondage, now as wards of the U.S. government. Those who left the islands without permission were not allowed to return. The Americans, in their eagerness to introduce English, began to suppress the residents' ancestral language and second language, Russian. In particular, all things Russian were forbidden. This extended to the writing of Unangan with Cyrillic symbols. The American suppression of Unangam Tunuu is well documented in the daily logs kept by government managers in the Pribilofs (Bureau of Commercial Fisheries 1870-1861). Although perhaps not as earnestly, and in a later time frame, the same process was taking place in American schools throughout the Aleutian Chain. Adults reportedly learned English during the summers when they worked on the Pribilof seal hunts (Ransom 1978).

During World War II the Japanese attacked the Aleutians, taking prisoner the residents of Attu, the westernmost Aleutian village. Shortly thereafter the Aleutian and Pribilof Unangan/s were evacuated to Southeast Alaska for the duration of the war. There they lived in squalor in abandoned canneries while their villages were commandeered and ravaged by their American protectors (Kohlhoff 1995). Although conditions were miserable in the internment camps, horizons were broadened as many people, against government orders, found work in Juneau and other Southeast communities. Some attended high school. Men served in the armed forces during the war though they were returned to the Pribilofs during the summers to carry on sealing operations (Ransom 1978: 22). The postwar era found most of the population bilingual in Unangan/s and English except the youngest who spoke only English. The American government representatives, in the person of the island managers and schoolteachers, had convinced the parents that learning their ancestral language would handicap their children as US citizens (Taff 1978).

Aleut language programs were established in the schools in 1972 using a Romanized orthography developed by Knut Bergsland. By that time three clear distinctions of Unangan Tunuu knowledge had developed among the population, an elder generation of speakers (active users), a middle generation of understanders (latent or passive users), and the youngest generation who spoke only English. This situation persists today as the numbers of speakers dwindle and the number who have shifted to English swells. Because the Eastern Aleutians are relatively more accessible, the shift to English happened earlier for Unangan than for Unangas. The youngest speakers of Unangan are now in their fifties with two generations of non-speakers while the youngest speakers of Unangas are in their thirties. School programs teaching Unangan/s, K-12, continue, as of this writing, under the guidance in Unalaska of Moses Dirks, in St. Paul Island of Edna Philemonoff Floyd, and in Atka of Dennis Golodoff, but at this point the language is moribund. No children are learning it as their native language nor are any reported to have achieved second language fluency. However, most Unangan/s descendants speak a

distinctive variety of English marked by features of their ancestral language that have thus far survived language shift (Taff 1978).

With the exception of the creolized Attuan of Copper Island in Russia, integrations from outside the language family are considered to be minor in Unangam Tunuu, relative to the mixings found between other languages of the world. Around 800 loan words were borrowed from Russian and incorporated into the phonology (Bergsland 1994: 657-662). Russian phonemes added to the inventory in borrowed words are noted in §1.2.2: Phonology. Structural influences are not really known since Russians were in contact with the Unangan/s for around 100 years before major documentation of the language took place; however these appear to be very limited (Bergsland 1995, 1997a: 15) since the structure of Unangam Tunuu differs so widely from Russian.

The impact of English on the internal structure of Unangam Tunuu is difficult to pin down because all Unangan/s speakers are bilingual and tend to switch back and forth between the languages within sentences. This is an area for further study. Bergsland (1994: 662) gives illustrations of English words adapted to Unangan/s phonology. The manifest influence of English has been erosion of Unangam Tunuu with whole generations shifting to English. Simplification of the morphology and syntax by the youngest speakers, attested by Dorian and others as characteristic of dying languages (e.g., Dorian 1989, Fishman 1991), has not been rigorously investigated for Unangam Tunuu.

### 1.2.1.3: Previous linguistic studies of Unangam Tunuu

Early wordlists made by explorers are documented in Bergsland 1994 (p viii). Other works include Veniaminov's grammar mentioned above and Gordon Marsh's dissertation on Eastern Aleut morphology (1956). The most remarkable output of work on Unangam Tunuu has been by Knut Bergsland whose publications between his first fieldwork in Atka 1949 and his death in 1998 form the bulk of the language's linguistic studies. These include phonological (1956, 1973, 1986), morphological and syntactic analyses (1951,

1964, 1969, 1970, 1973, 1976, 1989), translations of important texts (1959, 1990, Bergsland and Dirks 1978b, Bergsland et al. 1980), comparative Eskimo/Aleut studies (1951, 1959, 1964, 1986, 1989, 1991, 1994b, 1997b), language status reporting (1979, 1995), school dictionaries and grammars (1980, Bergsland and Dirks 1978a, 1981, Bergsland et al. 1978), and, in his last years, a compendious multi-dialectal lexicon (1994a) followed by the major grammar published a few months before his death (1997a). The scope of this lifelong scholarship becomes more stunning with the knowledge that Finno-Ugric, not Unangan Tunuu, was the major focus of Bergsland's work.

The last sections of this chapter will give details of Unangan grammar pertinent to this investigation of intonation.

## 1.2.2: PHONOLOGY

### 1.2.2.1: Segment inventory

Unangan has three vowels, **i**, **u**, and **a**, each with contrastive length. Minimal and near minimal pairs contrasting vowel length are: **chidaḡa** *border, space beside* vs. **chi:daḡ** *baby animal*; **kukay** *grandmother* vs. **ku:kay** *cat*, **alay** *whale* vs. **a:lax** *two*. Measuring vowel duration for Unangan, Rozelle (1997) found long vowels to be twice as long as short vowels. Vowel quality is illustrated in the formant plots given in Figure 5 through Figure 7 which are reproduced from Cho et al. 1997 with permission of the authors. These plots were drawn using the UCLA Plot Formants software. The scales are Bark scale. The ellipses are drawn with radii of two standard deviations along the axes of the first two principal components of the distribution. Vowel quality for the **i** is much the same as for **i:**. Vowel quality for **u** is much the same as for **u:**. Vowel quality for **a** is more central than and does not overlap with the lower, further back **a:**.

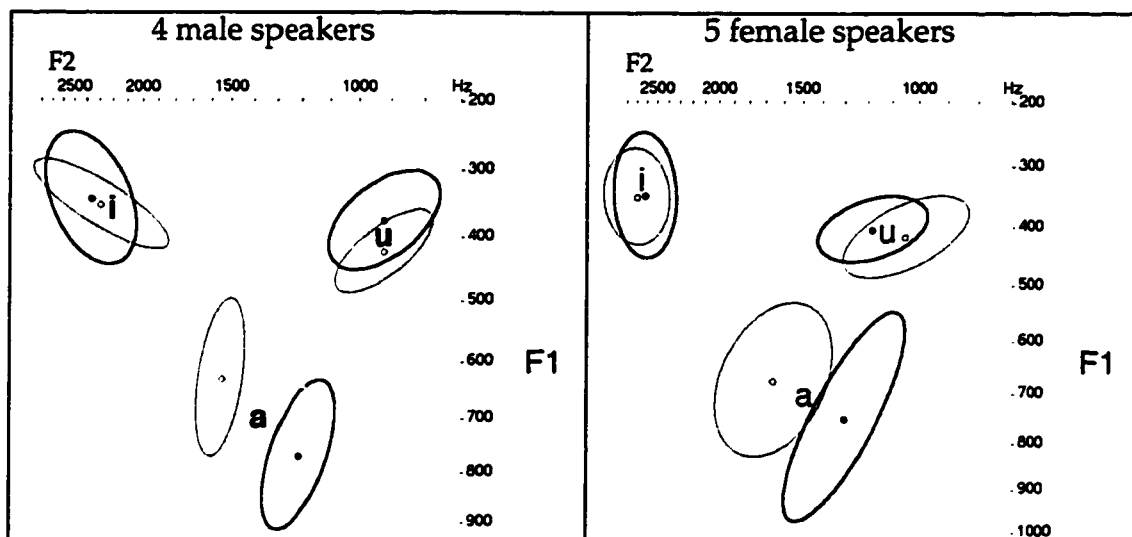


Figure 5: Formant plots of the long and short stressed vowels in the environments **kiy, kiik, kaɔ̃, kaaj, kuk, kuus.**

The short vowels are enclosed by light ellipses with centers marked by open dots. The long vowels are enclosed by bold ellipses with centers marked by filled dots.

Since only three vowels share the whole vowel space, the quality for each one can vary considerably and is affected by both preceding and following consonants, e.g. the uvulars have a centralizing effect on all the vowels (Taff 1992a, 1993, Bergsland 1994: xix, Cho et al. 1997). The centralizing effect is less strong for preceding uvulars as plotted in Figure 6 than for following uvulars as plotted in Figure 7.

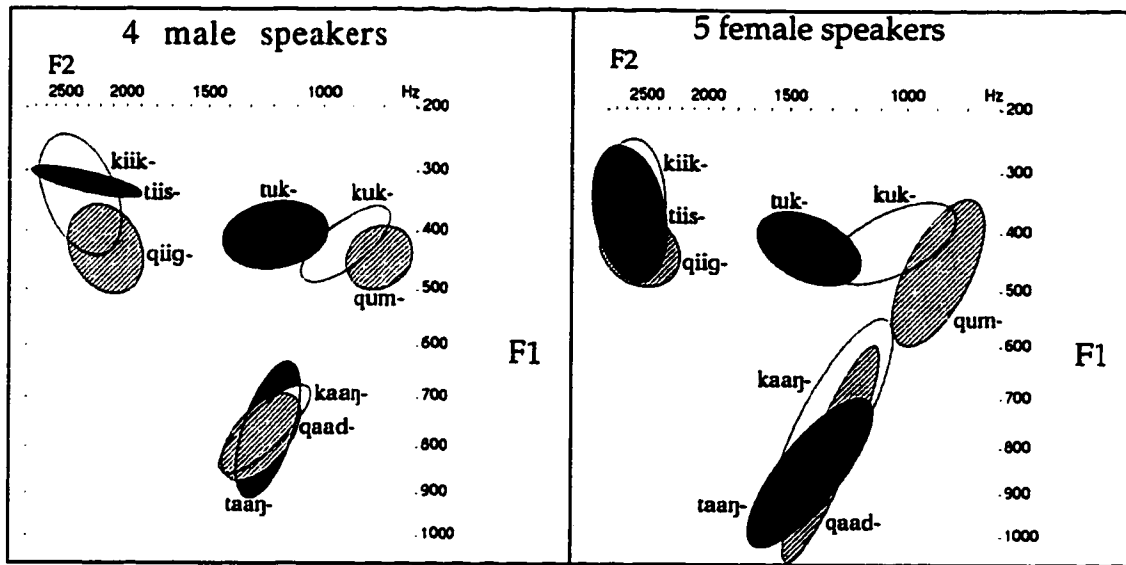


Figure 6: Formant plots showing effects of the preceding and following consonant on vowel quality.

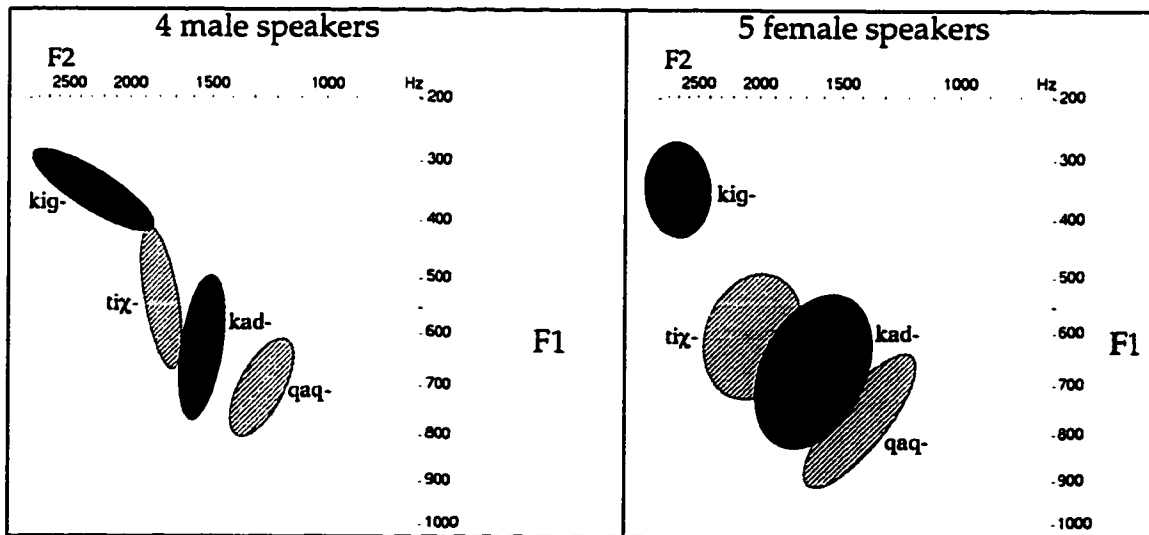


Figure 7: Formant plots showing the effects on i and a of a following uvular. Not enough data was available to plot u.

In the common orthography the short vowels are written as in IPA; the long vowels are written double, i.e., IPA a: is orthographic aa.

The Unangan consonant inventory is shown in Table 1. (Unangas includes also **z** and the voiceless sonorants **ɱ, ɳ, ɲ, ɺ, ɸ, ɹ**.) Phonemes introduced by and limited to loanwords are **p, b, f, v, r, and d**.

IPA	BILABIAL	DENTAL	PALATO-ALVEOLAR	VELAR	LABIO-VELAR	UVULAR
STOP		t	tʃ	k		q
NASAL	m	n		ŋ		
SIBILANT		s				
VOICELESS FRICATIVE				x		χ
VOICED FRICATIVE		ð		ɣ		ʁ
LATERAL APPROXIMANT		l				
CENTRAL APPROXIMANT			j*		w	

Table 1: Unangan consonant inventory in IPA. \*j is represented as y in the IPA transcriptions throughout.

In the common orthography these sounds appear as shown in Table 2.

IPA	BILABIAL	DENTAL	PALATO-ALVEOLAR	VELAR	LABIO-VELAR	UVULAR
STOP		t	ch	k		q
NASAL	m	n		ng		
SIBILANT		s				
VOICELESS FRICATIVE				x		χ
VOICED FRICATIVE		d		g		ʁ
LATERAL APPROXIMANT		l				
CENTRAL APPROXIMANT			y		w	

Table 2: Unangan consonants in the common orthography.

Final syllable reduction in Unangan is a process by which the final syllable of a word may be weakened on a continuum from reduction in amplitude, devoicing of the final rhyme, to deletion of the final rhyme, or deletion of the whole final syllable and reduction of the penultimate syllable. A discussion of final syllable reduction is pertinent here because of its interaction with intonation. Intonation at the ends of prosodic units is an important communication cue and therefore an important research point. If final syllables are reduced such that intonation is impacted, then reduction needs to be addressed.

The final syllable reduction continuum is illustrated in Figure 8. Final syllable reduction most frequently occurs sentence-finally or clause-finally but also occurs elsewhere in sentences. The degree of final syllable reduction in the present corpus appears to be a function of two kinds of formality. First is the immediate formality of the recording situation, spoken language being examined by an expert. It is assumed that the data collected for this study reflect this very formal situation and therefore show less syllable weakening that would be the case in casual speech. However, even in this setting, some of the speakers weakened final syllables throughout their data. This leads to the second, broader manifestation of formality. The speakers with the least final-syllable reduction are those who have taught Unangan in their school. They have the most formal information about their ancestral language.

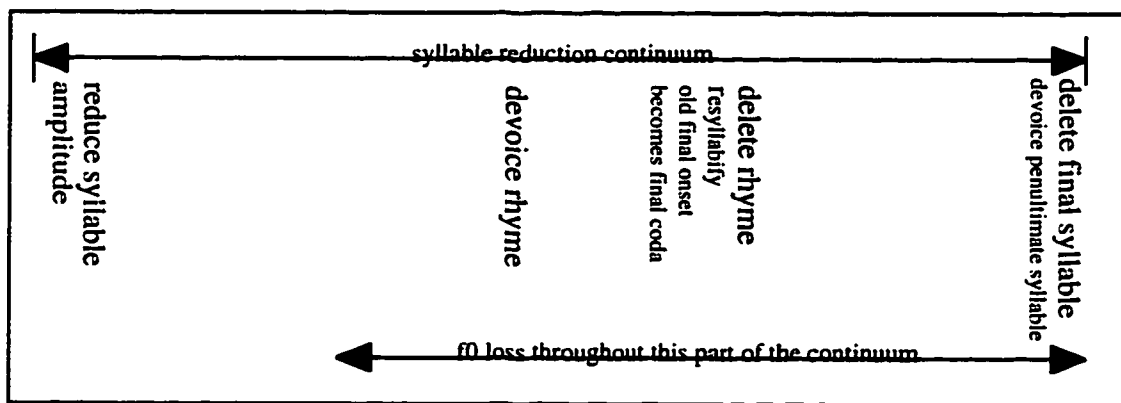


Figure 8: Continuum of final syllable reduction.

The impact of final syllable weakening on intonation is that  $f_0$  is lost in syllables that have been weakened at a point on the continuum approaching devoicing. Various points along this continuum are illustrated in Figure 9 through Figure 12, all examples of the sentence **igaxtaday waagakux** "The airplane came," with slight morphological variations. Narrowband spectrograms are included in these figures as an additional means for comparing signal strengths. Figure 9 is an example of slight reduction of the final syllable [kox] where the pitch track is still readable. The first and second formants of this syllable are readable in the spectrogram but the higher formants are not.

Figure 9 illustrates the kinds of graphs used in this dissertation. This figure shows pitch track and narrowband spectrogram in a single window (c). This is accomplished by generating the narrowband spectrogram, then, without clearing the window, generating a pitch track in the same window. When the pitch track appears, the vertical Hz scale for the narrowband spectrogram is displaced by the scale for the pitch track, also in Hz. For this reason, The scale for the pitch track display range in Hz appears in window c and the narrowband spectrogram display range for Hz is given in the caption for each such illustration. The result of displaying two different vertical scales in the same window is that the pitch track appears much higher than it is relative to the formants and harmonics of the narrowband spectrogram.

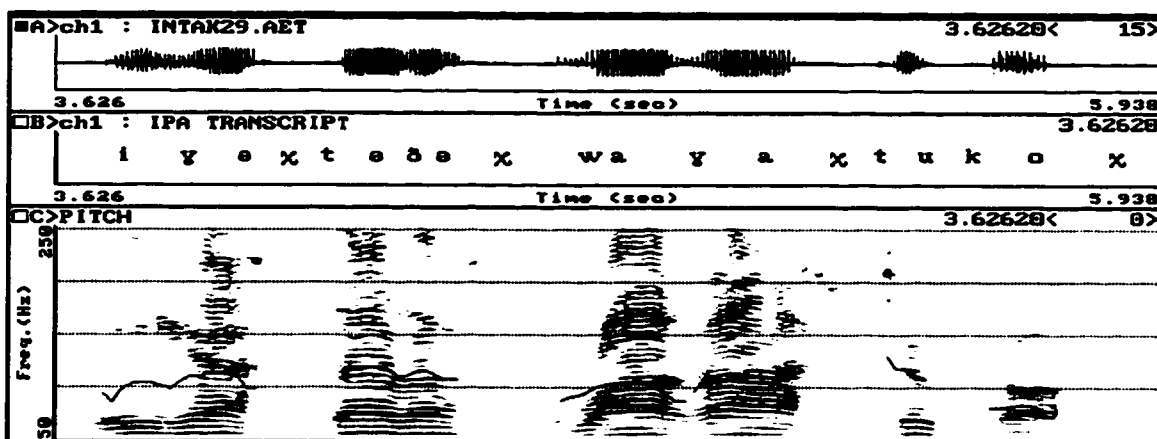


Figure 9: Final syllable is reduced in duration and amplitude but has audible intonation and generates a pitch track. Man's voice.  
The display range for the narrowband spectrogram is 0-4000 Hz.

Figure 10 is an example of devoicing of the same final syllable yielding [kχ] making the signal unreadable by the pitch tracker. No formant structure is visible but there is friction from the voiceless uvular fricative.

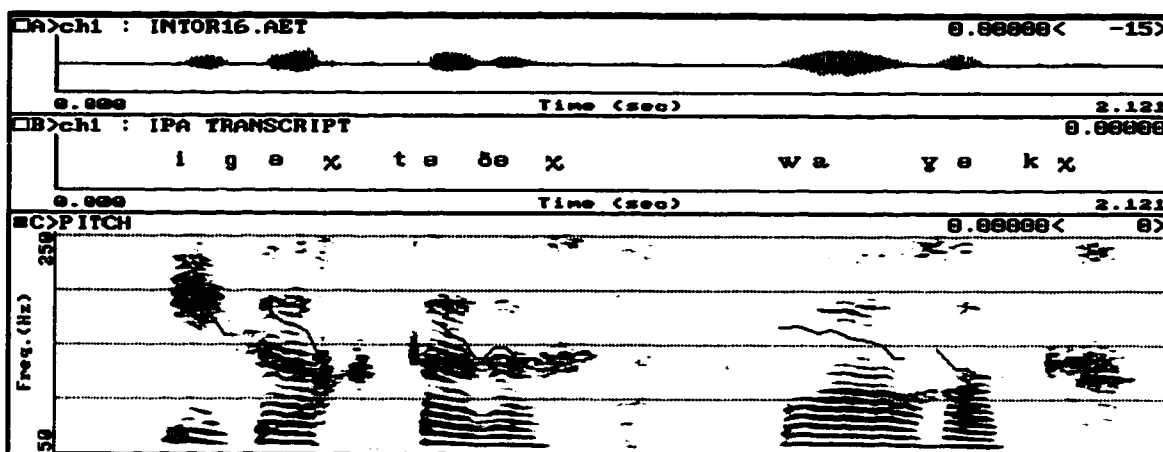


Figure 10: Final syllable is devoiced, has no audible intonation and does not generate a pitch track. Woman's voice.

The display range for the narrowband spectrogram is 0-4000 Hz.

Figure 11 is an example of complete deletion of the final rhyme with final onset resyllabified as final coda. Here the word *waagakut* has lost its final rhyme and become [wa:yək]. The new final rhyme [ək] is reduced as evidenced from the low amplitude in the wave form and spectrogram but the pitch is readable.

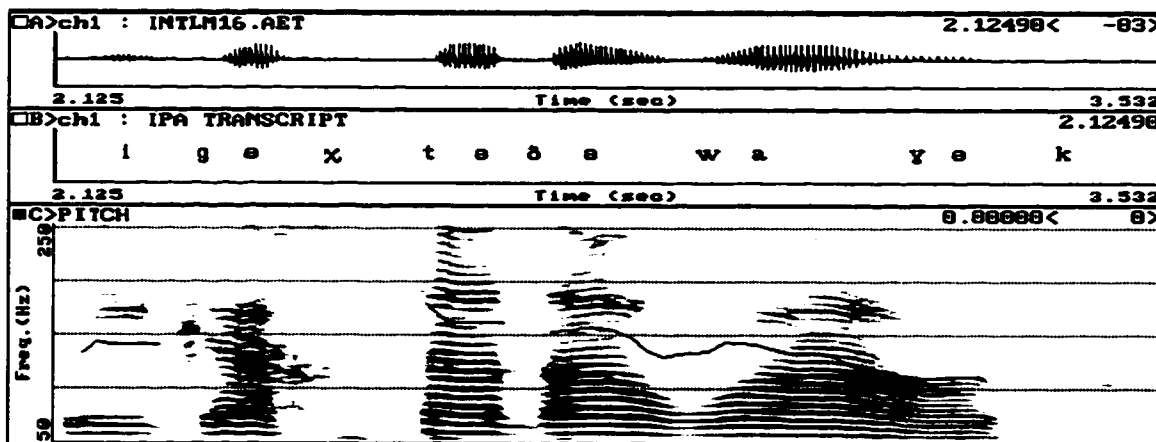


Figure 11: Final rhyme is deleted and its onset is resyllabified as the coda of the previous syllable. Woman's voice.

The display range for the narrowband spectrogram is 0-4000 Hz.

Figure 12 is an example of devoicing of the final two syllables of *waagaxt(u)k(u)ɿ*. There is evidence of the consonants of these two syllables in the wave form and

spectrogram but no voicing to generate a pitch track. The last vowel which appears in -*gaɪ*-, is reduced.

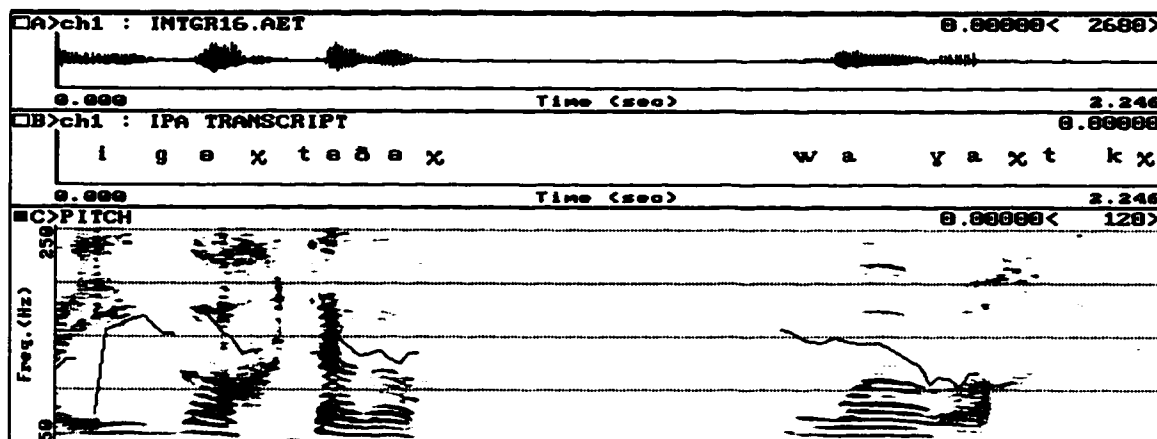


Figure 12: Final two syllables are devoiced. Woman's voice.  
The display range for the narrowband spectrogram is 0-4000 Hz.

The process of syllable reduction is addressed again in §1.2.3: Morphology, in a discussion of morpheme shape related to final syllable weakening, and in §3.3.1.4: Final lowering, where the interaction with  $f_0$  will be examined.

### 1.2.2.3: Stress

Impressionistic (i.e., non-instrumental) studies describe primary word stress in Unangan as typically occurring on the penultimate syllable unless another syllable, particularly the ultima, has a long vowel and the penult has a short vowel (Geohegan 1944: 10, Bergsland and Dirks 1990: 36, Taff 1992b). Marsh (1956: 47) describes primary stress as coinciding with 'the next to the last vowel of the word.' Table 3 gives examples of the 'typical' word stress.

Table 3: Typical Unangan stress patterns. Stressed syllables are underlined.

VOWEL LENGTH	STRESSED SYLLABLE	EXAMPLE	TRANSLATION
a. short penult and ultima	penult	sis <u>mi</u> kun	'they are helping'
b. Short penult, long ultima	final	sismi <u>ku:</u>	'he/she is helping him'
c. Long penult and ultima	penult	<u>bra:</u> ta:n	'his own brother'

Unangan is quantity sensitive (Taff 1992b: 138), i.e., syllables have a 'weight', measured in moras, that is related to stress patterns. In Unangan only vowels have weight; consonants do not count. This is illustrated in Table 3, a where mi weighs the same as kun, even though kun ends with a consonant. In b. the long vowel in ku: weighs more than the short vowel in mi. Using a metrical phonological framework (following Hayes 1991) Taff 1992b proposes an algorithm for word stress: assign moraic trochees from right to left iteratively, delete the heavy final foot when it clashes with a heavy penult, and assign main stress to the rightmost remaining foot (p 143). Table 4 illustrates stress assignment using this algorithm. In this system primary stress is assigned to the syllable with the most Xs in a column on the grid.

Table 4: Stress assignment in a metrical phonological framework.  
 $\mu$ =mora. (X ·)=trochaic foot. X=stressed foot member. ·=stressless foot member.

sis	<u>mi</u>	kun	sis	mi	<u>ku:</u>	<u>bra:</u>	ta:n	
$\mu$	$\mu$	$\mu$	$\mu$	$\mu$	$\mu\mu$	$\mu\mu$	$\mu\mu$	moraic wieght
	(X ·)	·	(X ·)	·	(X)	(X)	(X)	assign trochaic foot
						(X)	<del>(X)</del>	delete clashing final foot
	(X)				(X)	(X)		stress rightmost strong member

However Bergsland paints a more complex picture of word stress, citing examples to show that while the primary stress norm is as shown in Table 3, primary stress can occur on other syllables, 'attracted' there by syllable weight, rhythm, or discourse factors (1994: xx).

“Stress is not distinctive ... In so far as the first syllable of a wordform very often has more than weak, if not primary, stress, stress may be a configurational feature. However, the distribution of stress within a stretch seems to depend to a large extent also on rhythmic factors, on the length of the syllabic nucleus and on the sonority of the consonants... (1956: 39).”

He elsewhere describes stress as dependent on “the length of the syllables and never [having] independent value as in English” (1991: 779). Emphatic stress is realized as lengthening on the first syllable of a word (Bergsland 1997: 45). I assume that Bergsland’s ‘emphatic’ stress is equivalent to ‘focus’, discussed further in §3.4.2: Focus.

Duration as a phonetic correlate of stress is also mentioned by Geohegan who notes that, “There is a slight prolongation of sound of such stressed vowels (1944: 10).” But Marsh (1956:49) claims that the acoustic correlate of primary stress is “indicated with additional force and raising of the voice pitch but no additional lengthening.” Oshima claims primary stress “...accompanied by the peak of pitch falls on the penultimate mora marking the ending of the word with the sudden fall of the pitch in the last mora (1994:151).” For the data examined here, the pitch peak of a word is not usually on the penultimate mora or syllable. On a long word the pitch peak occurs nearly word initially and the word ends in a trough. Marsh’s and Oshima’s descriptions are more accurate for sentence-final words as described here in §3.3.1.4: Final lowering, which examines a small penult peak that may sometimes occur in a sentence-final word but which is not usually the highest peak of the word. Both Marsh and Oshima may have been listening

to stress in citation words which would have given them sentence edge effects along with word intonation.

Secondary stress is said to occur on the first syllable of the word (Marsh 1956: 48, Bergsland 1994:xx, Oshima 1994:151). Marsh describes the secondary stress acoustic correlate as lengthening of the first vowel if it is long or, if the first vowel is short, lengthening of the following consonant. Oshima does not note acoustic correlates for secondary stress.

An instrumental phonetic study of the interaction between stress and vowel duration in Unangan (Rozelle 1997) measured data from the sentences recorded for this dissertation from subjects BS, GF, and LM and an additional subject, ML. Rozelle assumed stress placement according to the algorithm illustrated in Table 4; stress is penultimate unless the penultimate syllable has a short vowel and the last syllable has a long vowel (Taff 1992b). Rozelle found that while long vowels are about twice as long as short vowels, stressed vowels, long or short, are about 20% longer than their unstressed counterparts. These findings robustly support the stress assignment algorithm and they support Bergsland's observation that duration is a phonetic correlate of stress.

Rozelle 1997 also finds that stress is assigned before final syllable reduction since, in words with deleted final rhymes, the new final syllables (the old penults) have longer vowels than the new penults. As Rozelle points out, the variable nature of final syllable reduction is characteristic of a postlexical rule (following Kiparsky 1985).

The interaction between word stress and intonation is addressed in this investigation in §3.2.4: Summary of word shape analyses.

#### 1.2.2.4: Intonation

Bergsland (1997: 44-45) gives the most detailed description heretofore of the intonation of Unangam Tunuu. Here he defines a CONTOUR as, "a stretch without an intonational break". Based on recorded texts (Bergsland 1959, Bergsland and Dirks 1990) Bergsland

gives the length of a contour from as short as one syllable, a single word, to as long as thirty syllables, a dozen words. Contours are described as “rising-falling” (Bergsland 1997a: 44) with three different endings; a steep descent with devoicing of several final syllables in long contours (less in Unangan than Unangas) to mark utterance-final boundaries, a moderate fall to mark an utterance-internal boundary, and a slight fall for a “syntactic function is less distinctive” (p 45). The yes/no question particle *ii* “appears to have an inherent rising pitch... at the end ...[or]... within a sentence” (p 45). Data collected for this thesis indicate that a marked rise for the question particle may be clear for Unangas but not for Unangan. Bergsland’s remarks on intonation refer only to its structural function in marking boundaries in the discourse and to some undefined syntactic function. Aside from ‘finality’, he does not mention any semantic ‘meaning’ that is linked to contrasting contours.

### 1.2.3: MORPHOLOGY AND SYNTAX

Unangam Tunuu is an agglutinating, stem initial language. Word order is Subject-Object-Verb. The word classes are: (open) nouns and verbs; (closed) personal pronouns, contrastive terms, quantifiers, numerals, positional nouns, demonstratives, interrogatives, and particles (Bergsland 1997). Open class words are formed by derivational and inflectional suffixation on a stem. Bergsland catalogs around 2,000 stems and 570 suffixes (1997a: 15). Of the suffixes, many are composite and fewer than a third, around 160, are productive (Bergsland 1997b). In Table 5 derivational suffixes are added between the stem **adalu-** and the inflectional suffixes **-ku-** and **-χ**,

Table 5: Suffixation on a stem. (Example from Bergsland and Dirks 1978: 49.)

	<b>adalu-</b> tell lies	<b>ku-</b> prs	<b>χ</b> s	<i>He is lying.</i>				
<b>tig</b> ls	<b>adalu-</b> tell lies	<b>usa-</b> with	<b>ku-</b> prs	<b>χ</b> s	<i>He is fooling me.</i>			
<b>tig</b> ls	<b>adalu-</b> tell lies	<b>usa-</b> with	<b>naasi-</b> try	<b>ku-</b> prs	<b>χ</b> s	<i>He tries to fool me.</i>		
<b>tig</b> ls	<b>adalu-</b> tell lies	<b>usa-</b> with	<b>naasi-</b> try	<b>iqalta-</b> again	<b>ku-</b> prs	<b>χ</b> s	<i>He tries to fool me again.</i>	
<b>tig</b> ls	<b>adalu-</b> tell lies	<b>usa-</b> with	<b>naasi-</b> try	<b>iqalta-</b> again	<b>musu-</b> maybe	<b>χta-</b> temporarily	<b>ku-</b> prs	<b>χ</b> s
<i>Maybe he tries to fool me again.</i>								

Although words in Unangan can be very long, they tend to have fewer syllables than words in Unangas or in the Eskimo languages.

Two morphological points pertinent in this investigation will be described in this section: declarative vs. question morphology and relational morphology.

A comparison of declarative vs. question morphology is given in Table 6. Underlining shows the morphemes that contrast in these two sentence types. The sentences are identical except at the very ends where the declarative sentence has tense and person morphemes and the question has conjunctive and question morphemes.

Table 6: Declarative vs. yes/no question morphology.

<b>a:gyu:ɬim uyunin aɖuqlaɖakun.</b>									<i>Cormorants' necks are long.</i>
<b>a:gyu:ɬi-</b> cormorant	<b>m</b> RELS	<b>uyu-</b> neck	<b>ɲin-</b> REFp	<b>aɖu-</b> long	<b>qla-</b> clumsy	<b>ɖa-</b> hab	<b>ku-</b> prs	<b>n</b> abp	
<b>a:gyu:ɬim uyunin aɖuqlaɖalix i:</b>									<i>Are cormorants' necks long?</i>
<b>a:gyu:ɬi-</b> cormorant	<b>m</b> RELS	<b>uyu-</b> neck	<b>ɲin-</b> REFp	<b>aɖu-</b> long	<b>qla-</b> clumsy	<b>ɖa-</b> hab	<b>lix</b> cni	<b>i:</b> Q	

Since there is a morphological contrast between declaratives and questions, it may seem that Unangan would not 'need' a contrast in intonation to distinguish these two sentence types. However, other languages, for example English, use morphology and syntax, as well as intonation for this contrast: *The boys ate.* with falling intonation vs. *Did the boys eat?* with rising intonation. Declarative vs. question intonation contrasts for Unangan are addressed in §3.3.2: Yes/no questions.

Relativizing morphology is described in some detail here since it plays a part in genitive constructions and genitives were found to have distinctive intonation contours. Unangan genitives examined here translate into English as either noun + adjective or possessor + possessed. A possessor + possessed example appears in Table 6, **a:gyu:ɬim uyunin**, *the necks of the cormorants*. An example of a noun + adjective translation is **ayaya:dam aɲunagin** *the big girls (the big of the girls, cf. the poor of the nation)*.

Two-word genitive constructions are morphologically related by means of a relative suffix (REL) and a referential suffix (REF) (following Bergsland 1997a) as in Table 6. These suffixes vary by number and definiteness. The REL suffix is either **-m**, singular relative, or **-n**, plural relative. This is the 'regular' relative construction as described by Bergsland. However, sometimes in place of the REL suffix, the singular absolutive **-x** indicating definiteness is given instead. The singular REF suffix is **-V**, doubling of the stem-final vowel. The plural REF suffix is **-ɲin** or **-in**. In the present corpus, speakers gave various combinations of these suffixes. Table 7 summarizes the genitive morphology combinations given by speakers in the elicited sentences. Verb inflection (**-ɬ**

singular, -n plural) is also given as an indication of speakers' intention for subject number.

Table 7: Morphological variations for genitive constructions as given in the elicited data.

REL suffix for genitive possessor or 'adjective'	REF suffix for (possessed) noun	Verb inflection	Description	Number of instances in the data (speakers)
<b>'Regular' genitive morphology.</b>				
a. -m	-V	-ʔ	Regular singular genitive morphology. Indefinite - 'A cormorant's neck is long.'	7 (MM, RM, GR)
b. -n	-ngin	-n	Regular plural genitive morphology. 'Cormorants' necks are long.'	6 (AK, RM)
<b>Other variations on the genitive.</b>				
c. -m	-ngin (sometimes -in)	-n	Singular relative on the genitive but plural referential on the noun and plural verb inflection. Bergsland (1989:10) reports that in Unangan the REL plural -n as in b. has been almost completely replaced with the singular -m, which is certainly supported by this data. The number is indicated in the noun only. 'Cormorants' necks are long.'	42 (all but MM and RM)
d. -ʔ	-V	-ʔ	Singular absolutive on the genitive, singular referential on the noun, singular verb inflection. According to Leer (1987:155) this construction indicates topicalization of a preposed NP, thus 'The cormorant, its neck...'	3 (EK, RM)
e. -m	-V	-n	Singular relative on the genitive, singular referential on the noun, but plural verb inflection. No reference was found to this combination given by two speakers to the stimuli, 'The big girls laughed,'(MM) and 'Cormorants' necks are long.' (LM)	7 (MM, LM)

The intonation of genitives is addressed in §3.4.1: Noun Phrase, and is compared to the intonation of demonstrative-noun constructions.

The demonstrative system in Unangam Tunuu is complex, with forms derivable from some thirty stems (Bergsland 1951, 1997: 72). The demonstratives locate the referent in

space or time. Most of the word classes include derivatives with demonstrative stems (Bergsland 1997: 72). The demonstrative-nouns examined here are two-word combinations such as **amakun ayaya:dan** “*those girls*”: **ama-** (that one invisible) -**kun** (demonstrative absolutive plural) **ayaya:da-** (girl) -**n** (absolutive plural).

This chapter has given background on the phonetics and phonology of intonation and on the language family relationships of Unangam Tunuu and the influences on the language from outside the family. Grammatical points bearing on this investigation were explained. The next chapter details the methodology for the study.

## CHAPTER 2: METHODOLOGY

### 2.1: DATA COLLECTION

Preliminary data from two speakers were recorded from 1990 through 1994 in Seattle and St. George Island, AK, partly under a Phillips Foundation Grant. Recordings were made in quiet home settings with a Sony TC-56 analog field recorder and Realistic 33-1052 lapel microphone. Speakers' ages were between 75 and 80. Data are short texts around a minute in length, their topics chosen by the speakers. Observations of intonation patterns found in these initial recordings (Taff 1996) provided direction for the research questions and data collection that followed.

The bulk of the data recorded for this study was collected on St. Paul Island and St. George Island, Alaska, (the Pribilof Islands) in the spring of 1996 as part of NSF grant SBR9511118 to Peter Ladefoged and Ian Maddieson, *Phonetic Structures of Endangered Languages*. The recording project had the approval of local village governing bodies, the St. George Tana Corporation and Traditional Council/IRA and the St. Paul Tanadgusix Corporation. The Central Bering Sea Fishermen's Association supported research in St. Paul.

These recordings were made in quiet home settings with DAT equipment with a flat frequency response throughout the auditory range, using a close-talking (head mounted), noise-canceling microphone. Signal-to-noise ratio was always better than 40 dB.

Twelve speakers were recorded in these sessions, eight women and four men. Their ages ranged from mid 50s to mid 70s. All but one learned Unangan as their first language and are also fluent speakers of English. They learned English as they entered school. Speaker EF learned Unangan as her second language. They are each the last generation of speakers in their families. Speakers were each sent a certificate commending their valuable participation in the NSF project.

First each speaker was recorded giving Unangan translations of around eighteen English stimuli sentences spoken by the researcher. This list, designed to show intonation contrasts, included declarative vs. yes/no question pairs and simple vs. complex sentences. After the sentence elicitation, each speaker was asked to speak on a topic of their choice for around one minute. Recording sessions lasted from ten to twenty minutes per speaker. See the appendix for the transcription and translation of each recording session.

We cannot conclude that results drawn from the elicited sentences are the same as results we would draw from speech used in actual conversations. In the elicited data, speakers were not really giving new information, which is the function of a declarative sentence in a real conversational setting. Nor were they asking questions expecting to get an answer, which is the function of an interrogative in a real conversational setting. Speakers were asked, “How would you say...?” to elicit declaratives or, “How would you ask the question...?” to elicit interrogatives. The benefit, of course, of using elicited speech is that the data could be controlled for both the pitch patterns under investigation and for the best segmental data to carry the pitch information.

To this end, sentences were designed to contain words with mostly sonorant and all voiced segments in order to avoid gaps in pitch tracks and pitch perturbations caused by voiceless segments; however, this was not entirely possible and, in any case, speakers did not always give the target responses. Since obtaining natural intonation contours was the primary objective, speakers were not asked to rephrase their response if, as frequently happened, they used slightly different morphology and sometimes entirely different words than anticipated.

For instance, the stimulus “Old men hunted sea mammals,” was designed to elicit the response **alisin alarum alga: alganarynan**. Actual responses are given in Table 8.

Table 8: Different responses to the same stimulus.

<u>Anticipated response</u>				<u>Stimulus</u>
<b>Aligin</b> old men	<b>alagum</b> sea	<b>alanganin</b> its animals	<b>alganaaginan.</b> they tried for animals	<i>Old men hunted sea mammals.</i>
<u>Actual responses</u>				<u>Translations</u>
<b>Aligaadan</b> old men	<b>alagum</b> sea	<b>alanganin</b> animals	<b>alganaaginan</b> they tried for animals	ii. you know <i>Old men hunted sea mammals, you know.</i>
<b>Aligaadax</b> old man		<b>qawanaagikuŋ.</b> he tried for sealions		<i>The old men hunted sealions.</i>
<b>Aligaa</b> old man	<b>qawan</b> sealions	<b>agikuŋ.</b> he tried for		<i>The old man hunted sealions.</i>
<b>Aligaadaŋ</b> old man		<b>qawanaagilaaganaŋ.</b> he tried for sealions		<i>The old man hunted sealions.</i>
<b>Alit</b> old men		<b>tumdanaagikun.</b> they were trying shooting		<i>Old men went hunting.</i>
<b>Aligaadaŋ</b> old man		<b>mayaagikuŋ.</b> he hunted		<i>The old man hunted.</i>
<b>Taayum</b> old man	<b>alagaadan</b> animals	<b>aligin</b> old men	<b>mayaattan.</b> they hunted	<i>Old men hunted sea mammals.</i>
<b>Tayuut</b> man	<b>tulastaakan</b> fur seals	<b>ayuluk.</b> they went out for		<i>Old men hunted fur seals.</i>
<b>Tayuum</b> man	<b>slutuu</b> aged	<b>alugum</b> sea	<b>alanganin</b> it's animals	<b>mayaattakuŋ.</b> he tried to hunt <i>Old man hunted sea mammals.</i>
<b>Tayuut</b> man	<b>slutuu</b> aged	<b>angqaxtal,</b> go away for a while	<b>qawaŋ</b> sealion	<b>ilgakuŋ.</b> he searched for <i>The old man went out to look for sealions.</i>

However, some of the stimulus sentences elicited exactly the same response from all speakers, e.g.: **Igattadaŋ** **waagakuŋ.** *The airplane came.*

airplane            it came here

To compare the responses each speaker gave to the all stimuli see the Appendix.

Another aspect of elicited speech is that it reflects a neutral, 'non-emotive' state. That is, we assume that in elicited data speakers give an output that is unmarked by the emotions of anger, love, dismay..., that are presumed to influence intonation. Of course, emotions like impatience related to the recording task or relief that it is nearly over may be in play but, in any case, the influence of emotion on output is not considered in this investigation.

Although sentences were designed under the constraints of certain types of segments and sentence types, effort was made to come up with plausible sentences, that is, strings that would not be unlikely for people to say. This was also part of the attempt to have speakers respond with natural intonation.

Transcriptions, translations, glosses, and speaker intention (e.g. question vs. declarative) were later reviewed with native speaker and linguist, Moses Dirks, with support from The Jacobs Research Fund granted to Taff, "Aleut Intonation", 1997.

The recordings have been archived in the Jacobs Research Fund Collection of the University of Washington Libraries' Manuscripts and University Archives and in the UCLA Phonetics Archives. The UCLA collection includes a segment contrast word list recorded by each Unangan speaker and, in addition, recordings of the word list, elicited sentences, and short texts from 12 speakers of Unangas.

Data from fourteen speakers is referred to in this study; the preliminary data from two speakers living in Seattle, and the data from twelve speakers in St. Paul and St. George.

## 2.2: INSTRUMENTAL ANALYSIS

### 2.2.1: MEASUREMENT

Analog recordings were digitized at 10,000 samples per second on a Kay Computerized Speech Lab 4300B (CSL). DAT recordings were sampled at 10,000 samples per second on the CSL.

Pitch tracks were generated of all the elicited sentences and short texts from twelve speakers, eight women and four men, using a frame length of 25 ms. and a frame advance of 20 ms.

Numerical results of the entire pitch track for each elicited sentence for eight of the speakers were entered into a database which will be referred to hereafter as the "numerical database". Results from only four women were selected for inclusion in the numerical database so that men and women would be equally represented since the sentence set was elicited from only four men,. This is the reason that the numerical database is limited to eight speakers. The women included in the numerical database were selected at random.

The numerical database includes around 24,000 data samples. A small portion of the database is given in Table 9. Additional columns in the complete database encode other variables.

Table 9: A portion of the numerical database.

sec = number of seconds elapsed since the beginning of the sentence measurement. Pitch = pitch measurement generated by the CSL pitch tracker. Sent = the file name of the sentence. Cls = the clause in the sentence. Wd = the position of the word in the sentence. Declar = the sentence is a declarative (as opposed to a question). spkr = initials of the speaker. Sentwdfraction = the percent of the word reached at each pitch measurement point. Wdpercent = number of words in the sentence. Sex = male or female. Clspersent = number of clauses in the sentence.

Row Names	frame	sec	pitch	sent	cls	wd	declar	spkr	Sentwdfraction	wd.per .sent	sex	cls.per .sent
1	4.00	0.06		ak 1	1.00	1.00	decl	ak	0.02	2.00	M	1.00
2	4.00	0.06		ak 1	1.00	1.00	decl	ak	0.02	2.00	M	1.00
3	4.00	0.06	114.00	ak 1	1.00	1.00	decl	ak	0.02	2.00	M	1.00
4	5.00	0.08	81.00	ak 1	1.00	1.00	decl	ak	0.04	2.00	M	1.00
5	6.00	0.10	88.00	ak 1	1.00	1.00	decl	ak	0.06	2.00	M	1.00
6	7.00	0.12		ak 1	1.00	1.00	decl	ak	0.08	2.00	M	1.00
7	8.00	0.14		ak 1	1.00	1.00	decl	ak	0.10	2.00	M	1.00
8	9.00	0.16	110.00	ak 1	1.00	1.00	decl	ak	0.12	2.00	M	1.00
9	10.00	0.18	110.00	ak 1	1.00	1.00	decl	ak	0.14	2.00	M	1.00
10	11.00	0.20	108.00	ak 1	1.00	1.00	decl	ak	0.16	2.00	M	1.00
11	12.00	0.22	106.00	ak 1	1.00	1.00	decl	ak	0.18	2.00	M	1.00
12	13.00	0.24		ak 1	1.00	1.00	decl	ak	0.20	2.00	M	1.00
13	14.00	0.26	113.00	ak 1	1.00	1.00	decl	ak	0.22	2.00	M	1.00
14	15.00	0.28	112.00	ak 1	1.00	1.00	decl	ak	0.24	2.00	M	1.00
15	16.00	0.30	111.00	ak 1	1.00	1.00	decl	ak	0.26	2.00	M	1.00
16	17.00	0.32	110.00	ak 1	1.00	1.00	decl	ak	0.28	2.00	M	1.00
17	18.00	0.34	110.00	ak 1	1.00	1.00	decl	ak	0.30	2.00	M	1.00
18	19.00	0.36	106.00	ak 1	1.00	1.00	decl	ak	0.32	2.00	M	1.00
19	20.00	0.38	102.00	ak 1	1.00	1.00	decl	ak	0.34	2.00	M	1.00
20	21.00	0.40	97.00	ak 1	1.00	1.00	decl	ak	0.36	2.00	M	1.00
21	22.00	0.42	92.00	ak 1	1.00	1.00	decl	ak	0.38	2.00	M	1.00
22	23.00	0.44	90.00	ak 1	1.00	1.00	decl	ak	0.40	2.00	M	1.00
23	24.00	0.46		ak 1	1.00	1.00	decl	ak	0.42	2.00	M	1.00
24	25.00	0.48	89.00	ak 1	1.00	1.00	decl	ak	0.44	2.00	M	1.00
25	26.00	0.50	101.00	ak 1	1.00	1.00	decl	ak	0.46	2.00	M	1.00

For cases in which the amplitude of the wave was too low for the pitch tracking function of the CSL to generate a measurement, measurements were made by hand. These low amplitude cases typically happened, more frequently for some speakers than others, at the ends of sentences. See §1.2.2: Phonology and §3.3.1.4: Final lowering for discussion of apocope and final lowering. F0s for these cases were calculated from the waveform by highlighting four or five pitch pulses in the wave of the area to be measured. This part of

the wave was expanded on screen to make it easier to view. The duration of two or three glottal pulses was measured and the result was divided by the number of these measured pitch pulses. The resulting number is the  $f_0$ .

Reference will be made to data from both the numerical database of eight speakers as well as to the pitch track data which includes all twelve speakers, the NSF consultants, who gave responses to the elicitations. Data from the four women who are not represented in the numerical data base are used as some of the pitch track illustrations. Their data is also represented in the measurements taken for word peaks in §3.4: Patterns above the word and below the sentence. These measurements were made using the Kay CSL4300 by running the cursor along the pitch track and recording the highest pitch per word.

#### 2.2.1.1: Pitch perturbations selected for deletion from the numerical database

Segmental causes of pitch perturbations are discussed in §1.1.1 . These small changes in pitch help listeners identify segments and must be taken into account in describing intonation. Voiced obstruents cause a dip in pitch with a rise into the vowel somewhat lowering the pitch of the vowel. Voiceless obstruents cause a sharp drop into the vowel somewhat raising the pitch of the vowel. These consonant perturbations can be seen in Figure 13 in the narrow band spectrogram and pitch track. Voiced obstruents  $\gamma$  and  $\delta$  appear as dips in pitch with a rise into the vowel. Voiceless obstruents  $\chi$ ,  $k$ ,  $s$ ,  $t$ , cause steep pitch drops into the vowel. The first  $\chi$  does not cause this effect being very much reduced in amplitude as compared to the second  $\chi$ .

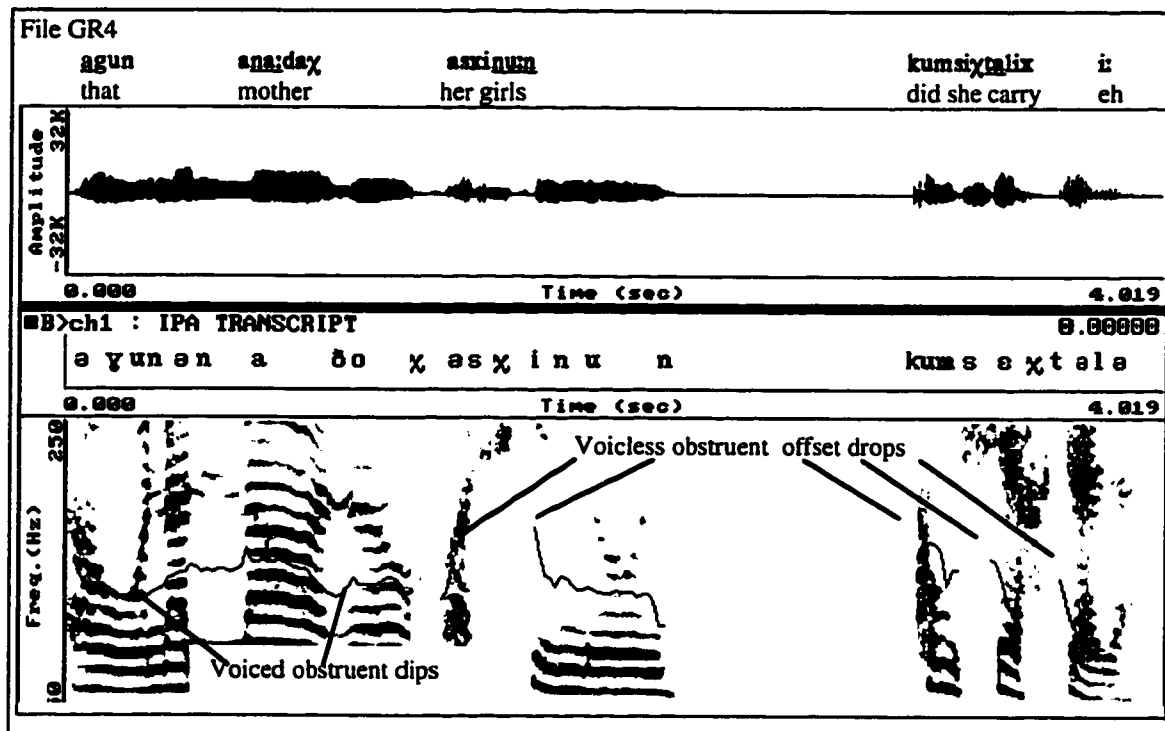


Figure 13: Consonant pitch effects.

The display range of the narrow band spectrogram in the bottom window is 0-2000 Hz.

While perturbations of the type illustrated in Figure 13 remain in the numerical database, pitch perturbations caused by failure of the CSL algorithm were deleted from the database. These appeared in the pitch tracks as sharp spikes, a single data point far out of line with the rest of the pitch track by as much as 100 Hz. An example of deleted perturbations is given in Figure 14. In the data set for this file, the data points representing pitch at 223 Hz, 238 Hz, and 233 Hz were deleted. Compare these readings to the 84 Hz and 89 Hz readings for this sequence in the speech stream. Pitches around the 85 Hz range are audible in this recording while pitches at the 230 Hz range are not.

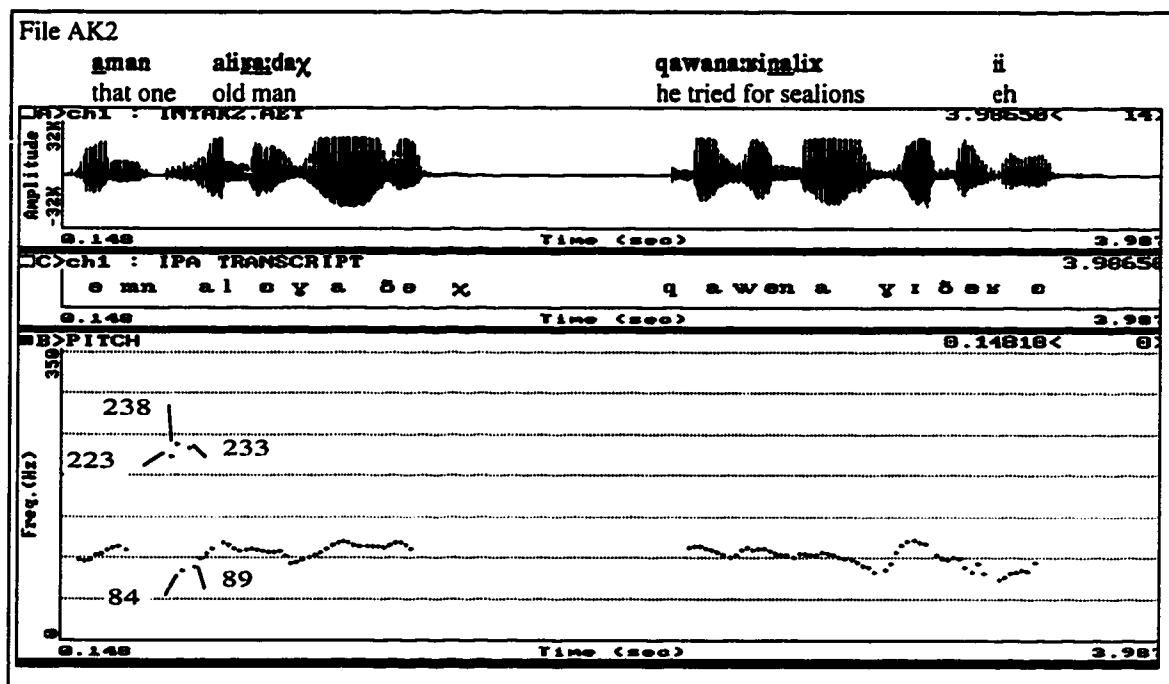


Figure 14: Pitch track illustrating pitch perturbations at 223 Hz, 238 Hz, and 233 Hz, deleted from the numerical database.

See **APPENDIX: Pitch tracks**, to observe other such non-intonational pitch excursions.

### 2.2.2: PITCH TRACK TRANSCRIPTIONS

The transcription accompanying each pitch track is nearly phonemic with two kinds of exceptions. First, there are cases of vowel quality variations e.g., /a/ ⇒ [o] / \_\_ uvular; the [o] is given in the pitch track transcript as in Figure 9. Providing notation of the vowel quality as close as possible to the actual output will allow readers to judge whether pitch is being affected by vowel height. As noted above, the parameter of intrinsic pitch of vowels is not otherwise addressed in this investigation. Second, a discrepancy between a phonemic and phonetic transcription here occurs with voicing of consonants. Intervocalic voiceless consonants are frequently voiced e.g., /χ/ ⇒ [ɣ] / V\_\_V; the [ɣ] is given in the transcription. Transcribing a phonemically voiceless consonant as voiceless when it is actually voiced by a speaker would not account for the continuous pitch contour that accompanies it in the pitch track. Stress is indicated in the transcriptions with underlining.

## 2.3: STATISTICAL ANALYSIS

### 2.3.1: TIME NORMALIZATION

In order to compare pitch tracks among sentences, time normalization was employed (Taff and Wegelin 1997). A combination of factors required that time be normalized. The entire pitch track, not just a few points along the contour were included in the analysis. Word contour was an issue but words were of different durations. Time normalization allowed word boundaries to be juxtaposed. The data for each word was rescaled, either stretched or squashed evenly relative to other words, so that the boundaries matched for each word in, say, a four-word sentence.

To accomplish this, a new variable, *sentwdf* (sentence word fraction), was created as a piecewise linear function of the time variable, seconds. Whereas speech tokens are of varying length when measured in seconds, all tokens are of length one when measured by *sentwdf*. Thus, all utterances of, say, a four-word sentence are of length four.

Figure 15 illustrates the piecewise linear function for a particular token. The dotted lines represent rows of numerals which are the measurements generated by the pitch tracker. Gaps in the dotted line illustrate gaps in the pitch track caused by voiceless segments. Vertical lines separate the pieces. Each piece corresponds to one word. The slope of a piece is equal to the inverse of the length of the word in seconds. The creation of the *sentwdf* variable does nothing to change the number of frames (records, or rows in the data matrix) per word. *Sentwdf* is directly proportional to the length of the word in seconds. Length varies from word to word on the horizontal axis in seconds. However, length is the same for each word on the vertical axis in *sentwdf*. Consequently, when a set of sentences is plotted together and a smoothing is computed, word boundaries are aligned.

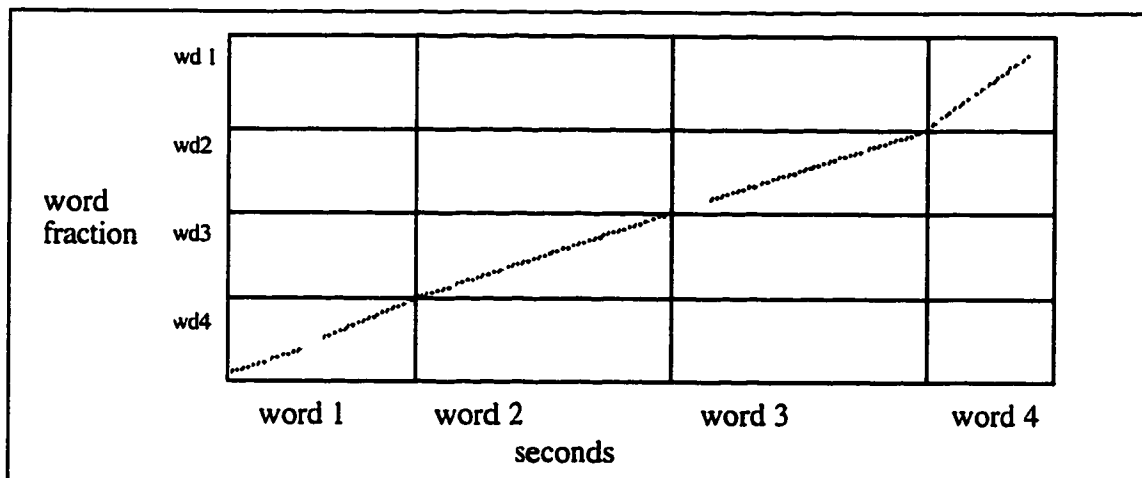


Figure 15: Time normalization of words. The X axis shows unequal word lengths which are converted into equal lengths on the Y axis.

### 2.3.2: SMOOTHING PROGRAM

After words were normalized for time, a 'smoother' was used to make it easier for the eye to find patterns in the noisy data. Smoothers estimate an 'average' value for  $y$  a few  $x$  values at a time (the **window** width), such as the first four points, then estimate again for the second through fifth points, then the third through sixth points... The wider the window width, the smoother or 'stiffer' the curve; the narrower the window width, the bumpier the curve, since it is more strongly influenced by nearby data points.

Two different smoothers were used, the "supsmu" (supersmoother) function (Friedan 1984) and the "lowess" function (Cleveland 1981) of the software S-PLUS, version 3.4, release 1 for Silicon Graphics Iris, IRIX 5.3.1996. Supersmoother calculates its own variable window width by examining local slopes and variances at different regions along the  $x$  axis. Lowess (**L**Ocally **W**Eighted **S**catterplot **S**moother) uses the proportion of the dataset specified. Tension parameters from 1-100% control how tightly the curve follows the data. The parameter used here is 20%. Lowess smoothing is robust to outliers. The switch from supsmu to lowess was made in order to be able to control the window width. However, both smoothers gave similar results (Taff 1997, Taff and Wegelin 1997, Taff and Wegelin 1998). Smooths were produced in the following ways: sentences with the

same number of words were smoothed speaker by speaker (e.g., Figure 19), the same sentence spoken by several speakers was smoothed ( e.g., Figure 21), words types were smoothed with all speakers together (e.g., Figure 29), and words types were smoothed by individual speakers (e.g., Figure 30).

This chapter has described the research methods employed for this dissertation. Next, analyses and results will be presented.

## CHAPTER 3: ANALYSES AND RESULTS

This chapter reports the results of analyses carried out to define intonation contours and processes in Unangan. Each major section includes descriptions of phonetic analysis procedures, analysis results, and discussion of the results as they relate to phonology, syntax, meaning, and as they compare to other languages. The chapter begins with an investigation of f<sub>0</sub> RANGE §3.1. Then intonation is described, first at the word level in §3.2, followed by sentence level intonation of declaratives and yes/no questions in §3.3. Finally, an analysis of contours larger than the word but smaller than the sentence is provided in §3.4. Data collection, instrumental analysis and statistical analysis are as given in Chapter 2: Methodology.

### 3.1 RANGE

Establishing the pitch RANGE an individual uses in speaking is important to the study of intonation since range plays a part in discussions of other intonation phenomena such as DECLINATION, RESET, DOWNSTEP, UPSTEP, and FINAL LOWERING. A speaker's widest pitch range can be compared to actual ranges used for particular parts of sentences or in order to contrast sentence types. This section establishes BASE POINT, TOP POINT and RANGE for each of the eight speakers in the numerical data base, then looks at the distribution of pitches used by each speaker.

Another reason to collect pitch range information is for future comparison with other languages. It is probably the case that some languages exploit possible pitch range more than others.

#### 3.1.1: BASE POINT, TOP POINT, AND RANGE

BASE POINT is the lowest point reached in a speaker's range. TOP POINT refers to the highest point reached by a speaker. RANGE is the number of Hz between the base point

and top point. In this section the terms BASE POINT, TOP POINT, and RANGE are used in reference to each speaker's whole corpus of elicited sentences. Elsewhere in the dissertation these terms may refer to a more limited data set, a single utterance, for example.

**Methodology:** To establish base point, top point, and range all the data in the numerical database was examined for each speaker.

**Results:** Results are given in Table 10. Men's base points, 50-85 Hz, are lower in pitch than women's, 60-100 Hz, but not much lower. The base point for three of the women is within the base point range of the men and the base point for three of the men is within the base point range for the women. There is almost complete overlap between the men and women in base point range.

Women's top points are higher in pitch, 200-325 Hz, than men's, 175-275 Hz. There is almost as much overlap between men and women in the top points as there is in the base points; two women's top points are within the men's top point range and two men's top points are within the women's top point range.

Speaker	Base point in Hz.	Top point in Hz.	Span of speaking range in Hz.
women MM	100	200	100
RM	75	325	250
EK	60	300	240
FG	75	240	175
men AK	70	200	130
GR	85	275	190
GF	50	190	140
BS	75	175	100

Table 10: Summary of pitch range for each speaker in the numerical database.

The span of the men's ranges is from 100 to 190 Hz. The span of the women's ranges, from 100-250 Hz, is greater than that for men with two women using speaking ranges wider than the widest of the men's ranges.

### 3.1.2: PITCH DISTRIBUTION

Another way of looking at how speakers use the pitch in their range is to calculate the frequency of occurrence of pitch.

**Methodology:** Histograms were plotted by speaker of all measurements in the numerical database.

**Results:** The distribution of pitches for each speaker is summarized in Figure 16 and Figure 17, which show histograms of the numerical database. Here the horizontal axes are all on the same scale, from 50 to 350 Hz in 25 Hz increments. The vertical axes give the number of occurrence of a particular pitch. The height of a column at 175 Hz, for example, represents the number of times a speaker's pitch was measured at between 151 Hz and 175 Hz. Remember that the numerical database contains measurements taken every 20 ms. throughout the utterance. These graphs report all these measurements, except the 0 values for voiceless sections, either consonantal or in pauses. The vertical axes are not on the same scale across speakers since some speakers had much more data than others. Cf. AK with a scale from 0 to 2500 and MM with a scale from 0 to 400.

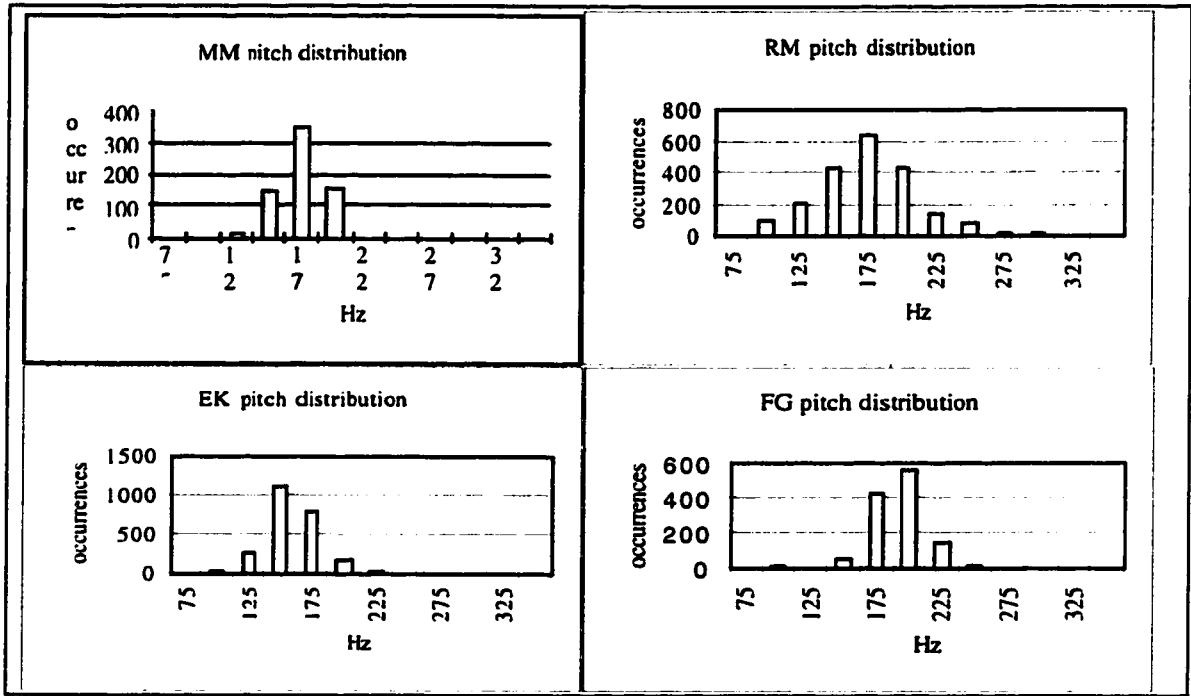


Figure 16: Pitch distribution by speakers: women.

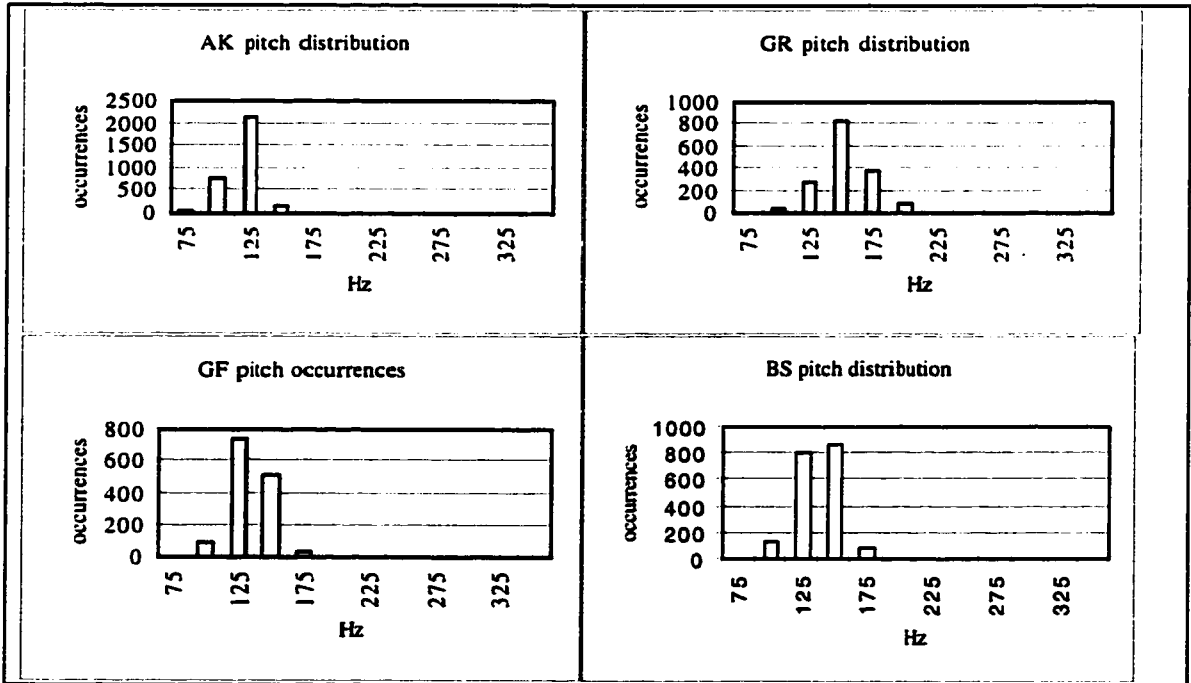


Figure 17: Pitch distribution by speakers: men.

These plots show the pitch distribution for each speaker relative to the others. Women's ranges tend to be wider and higher than men's as reported in Table 10.

This section has reported speakers' pitch ranges so that the measurements can be compared at a later date to those of speakers with similar profiles in other languages. The next section begins the description and analysis of intonation contour in Unangan.

### 3.2: WORD SHAPE

In the discussion of word shape 'word' will mean a content word, stem + suffixes as described in §1.2.3: Morphology and syntax. Function words, such as conjunctions, are few in Unangan; most sentences in the data presented here contain no function words. The intonation of function words may be different from that of content words; however, function words are not analyzed here.

As phonetic transcription was being added to the wave files of the digitized elicited sentences, it became apparent that pitch contour information could often predict word boundaries. Near the beginning of a word, pitch rose to a peak then fell to a low near the word's end. Discounting the small pitch perturbations caused by consonant effects, a pattern of high-beginning, low-ending word contours became apparent. This contour is illustrated in Figure 18 in file FG12 in words 2, 3, 4, 5, and 6; in File OR11 in words 1, 2, 3, 4, and 6; and in File EK15 in words 1, 2, 3, 4, and 5.

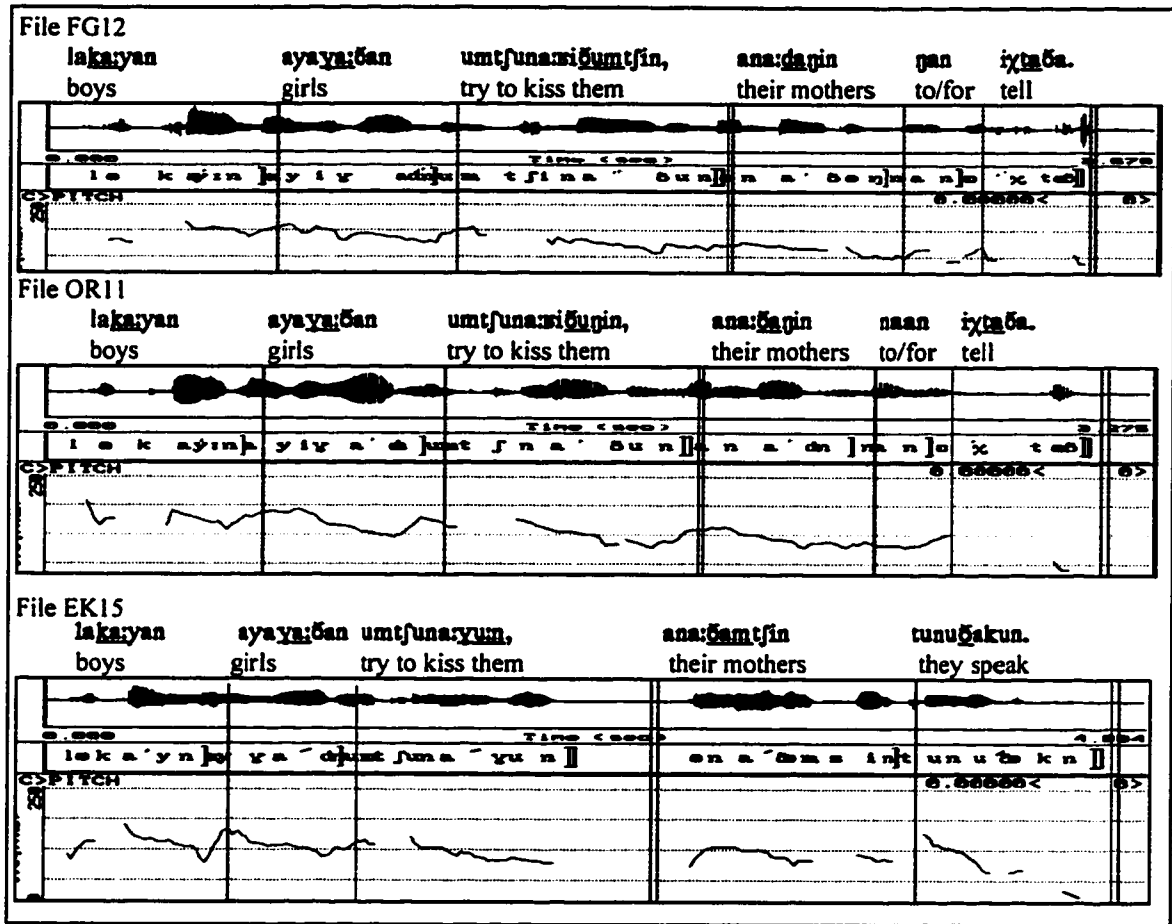


Figure 18: Pitch tracks from three different speakers illustrating the mapping between word boundaries and pitch contours.

Each includes an orthographic rendering and gloss, wave form, IPA transcription with main word stress, and pitch track sampled every 20 ms. Single dotted vertical lines through the displays and square brackets indicate word boundaries. Double dotted lines and square brackets indicate clause boundaries.

Additional examples of the mapping between pitch contour and word boundaries can be observed in **APPENDIX: Pitch tracks**.

This section reports on analyses designed to confirm whether or not there is a one-to-one mapping between word and pitch contour. Word contour hypotheses are tested by both inter- and intra- speaker analyses. The final subsection discusses these results and their relationship to phonology, citing languages which both do and do not appear to have pitch contours mapped to words.

### 3.2.1: INTRA-SPEAKER SMOOTHING ANALYSIS

An analysis was designed to test the notion that the beginnings and endings of words might be visible in the intonation contours of the elicited sentences.

**Hypothesis:** Words in Unangan are likely to have a characteristic intonational shape associated with them. If, on the other hand, the null hypothesis is true, there should be no visual pattern to the shape of words in the statistical smoothing.

**Methodology:** Word shape was investigated in the context of the sentence since words spoken in isolation would be expected to be produced with sentence intonation. Since the goal of the experiment was to create a visual display comparing the pitch contours of words of various lengths, this required time normalization across words.

The sentences in this experiment are drawn from the numerical database of elicited sentences from eight speakers, four women and four men, and include all of the three word declaratives, a total of 36 sentences, and their yes/no question counterparts, a total of 32 sentences. The yes/no questions have four words due to the addition of the question word *ii*. Sentences were smoothed by speaker in order to observe major pitch prominences.

**Results:** The results for women appear in Figure 19 and for men in Figure 20. Initials for each speaker are given above their data. Actual pitch track data is given as dotted lines in each graph while the bold, solid curve represents the smoothing result. In each figure the column on the left shows results for three-word declaratives while the column on the right shows results for the corresponding yes/no questions, i.e., sentences like **ayaya:dan aɲunagin aɲuxta:dakun**, “*Big girls laughed,*” in the left column vs. sentences like **ayaga:dan aɲunagin aɲuxta:dalix i**: “*Did the big girls laugh?*” in the right column. The overall contours of these two sentence types are discussed in §3.3: Sentence Shape.

Smoothed results for speakers RM, MM, FG, EK, and GR show a clear mapping between word boundary and pitch. Pitch peaks appear near word beginnings and troughs near

word ends. Results from speakers AK, BS, and GF are not as easy to analyze. AK has two peaks in his second words. Both AK and BS's words are better characterized as having troughs near their beginnings and peaks near their ends. GF's smoothed contours are relatively flatter than those of the other speakers; however, the dotted pitch track data shows troughs near word boundaries.

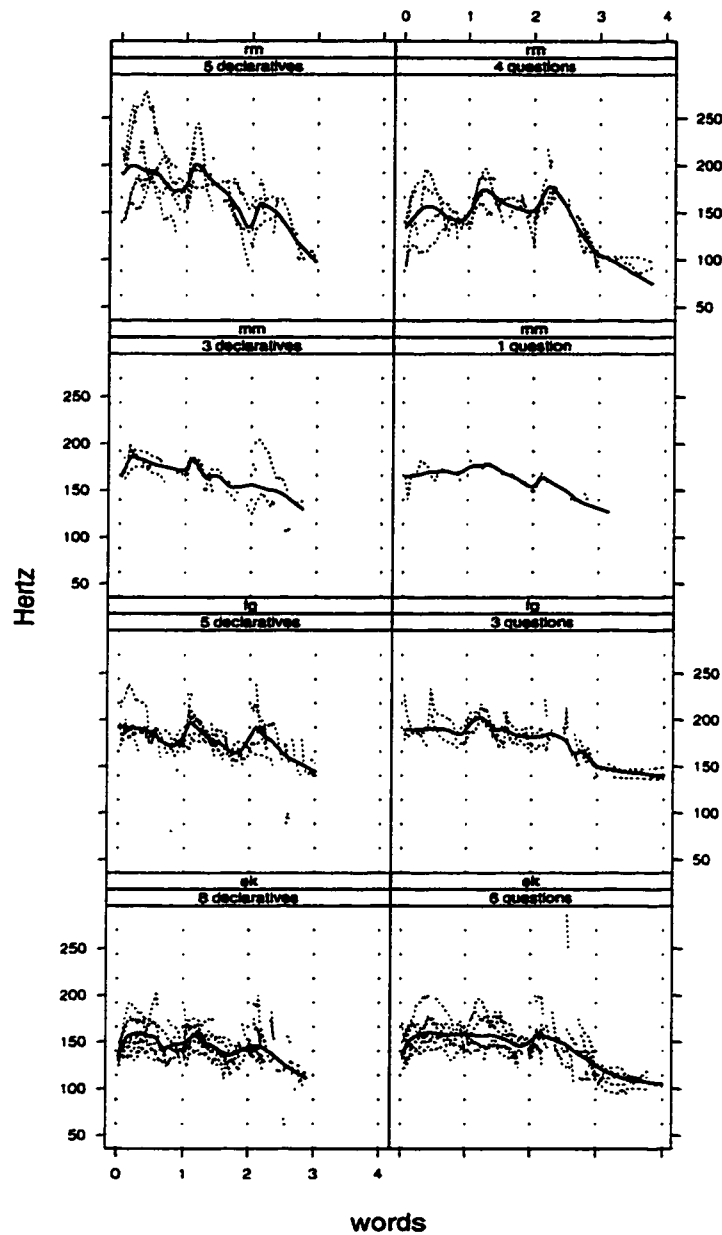
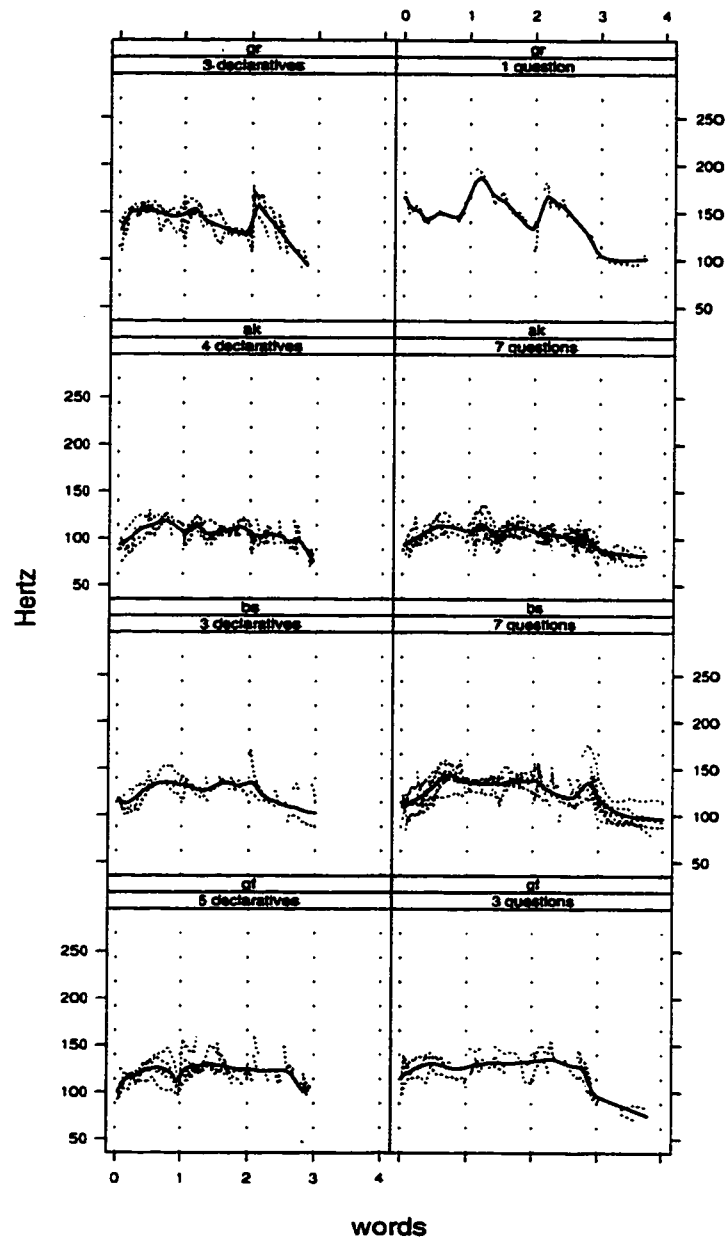


Figure 19: Smoothed sentences for four women.

Vertical dotted lines indicate word boundaries. The bold curve is the smoothed intonation contour. Dotted curves are the pitch tracks of individual sentences. The number of sentences smoothed and the initials of the speaker are given above each plot. Declaratives appear on the left and questions on the right.



**Figure 20: Smoothed sentences for four men.**

Vertical dotted lines indicate word boundaries. The bold curve is the smoothed intonation contour. Dotted curves are the pitch tracks of individual sentences. The number of sentences smoothed and the initials of the speaker are given above each plot. Declaratives appear on the left and questions on the right.

Despite some ambiguous results from the last three speakers, the smoothing by speaker analysis supports the hypothesis that word length information chunks are identifiable intonationally by a particular pitch contour: a peak near a word beginning and a trough near a word end for most speakers but a word-beginning trough, word-end peak for AK and BS. Discounting the final fourth word of the question sentences in the right hand columns, there are 48 word contours smoothed in Figure 19 and Figure 20. Of these, 44 of the word smoothings conform to the description of word-beginning peak and word-end trough or the opposite for speakers BS and AK. The four word smoothings that do not conform, given by speaker, question (Q) or declarative (D), and the number of the word in the sentence, are: MM Q 1, FG Q 1 (final trough but no initial peak), EK Q 1 (initial peak but no final trough in smoothing; however, actual data in dotted lines indicate some word-final troughs) and GF Q 2 (flat). So of the four nonconformists, only one word smoothing shows no word shape.

Discussion: If words have no contour it would be extremely unlikely that we would see 47/48 (98%) of the smoothed words conforming to a particular word shape. This result is corroborated by calculating the number of words that yielded a word shape smooth versus the total number of words tested. The number of sentences smoothed was 68 x three words/sentence for a total of 204. Of this total, 201/204 or 98%, of the words yielded smoothings with a particular word contour. Thus, the initial hypothesis is not supported by this analysis.

### 3.2.2: INTER-SPEAKER SMOOTHING ANALYSIS

The results above suggest that Unangan words have a particular contour, initial peak and final trough. To test this possibility, the next analysis examined the smoothing of a single sentence across speakers.

Hypothesis: Unangan words have a pitch contour of peak near the beginning and trough near the end.

**Methodology:** A sentence was selected for smoothing across speakers on the basis of comparability. The stimulus sentence was, *'When we were out there, the airplane came'*. This sentence was selected for two reasons; it has one more word than sentences in the previous test, and many of the speakers responded to the stimulus with the same number of words. Even if they did not include the same words, as long as only four words were included in the sentence, responses were smoothed together. Compare files GR17 and BS18 and GF17 in Table 11. The speaker not included in this smooth was GF who responded with five words instead of four.

Table 11: Contrasting responses to the same stimulus.

GR17	<b>səbɑ:ðan</b> outside	<b>akuni:n</b> we were for	<b>iyaxtaðax</b> airplane	<b>waacakax</b> it came	
BS18	<b>amaliyin</b> there	<b>akucɑ:n</b> at that time	<b>iyaxtaðax</b> airplane	<b>waacakax</b> it came	
GF17	<b>tanaxxan</b> there	<b>akuni:n</b> we were	<b>aman</b> that one	<b>iyaxtanɑn</b> airplane	<b>wa:çanan</b> it came

**Results:** Figure 21 shows the result of smoothing across seven speakers' pitch tracks of the same sentence. For each word in this four-word sentence there is a word-beginning peak and word-end trough. (See §3.3.1.3: Initial lowering for discussion of the late peak on the first word.)

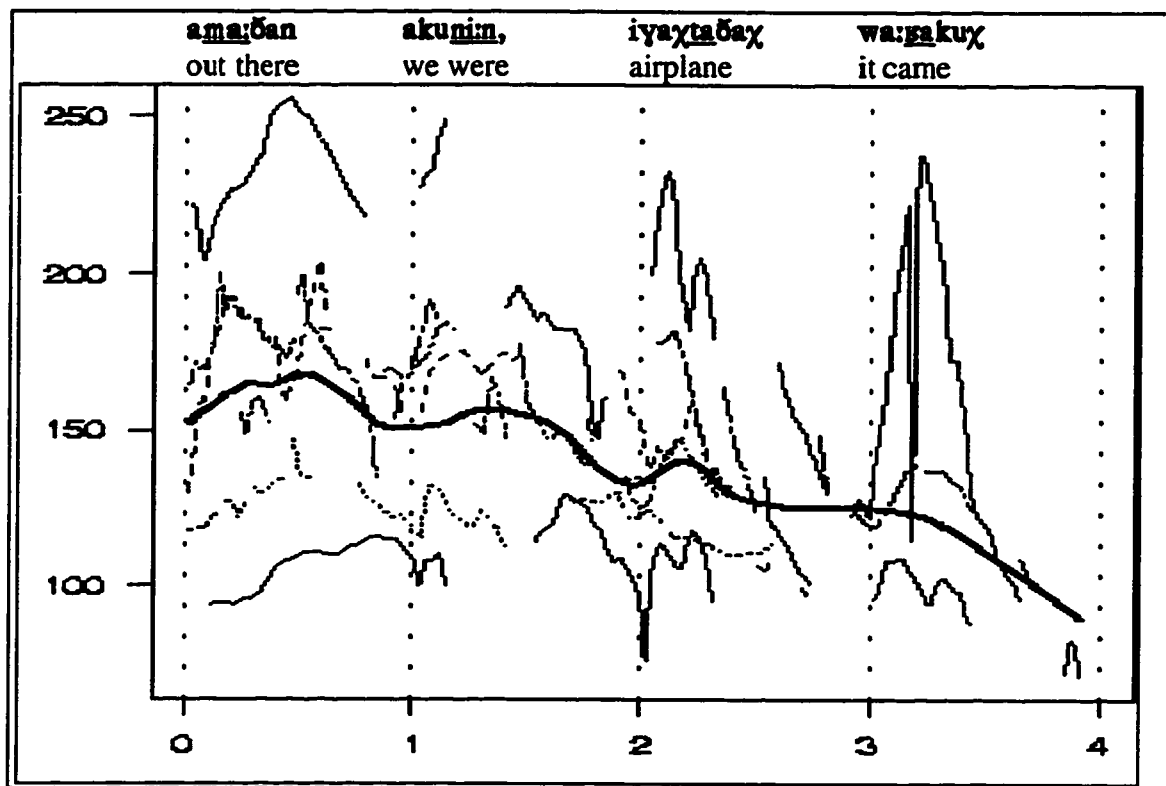


Figure 21: Smoothed pitch tracks of seven speakers' responses to the stimulus, *'When we were out there, the airplane came,'* displayed as in Figure 19.

Other results of smoothing individual sentences across speakers are given in Figure 40, Figure 41, Figure 42, Figure 57, and Figure 58. These smoothings all show the same result for word contour; each word has a word-beginning peak and word-end trough.

Discussion: The smoothing of one sentence across seven speakers corroborates the word contour finding from the smoothings by speaker across several sentences: words do have an identifiable contour. The plot in Figure 21 shows this contour to be word-beginning high and word-ending trough.

In addition, the four-word sentence in Figure 21 shows the same word contour result as the three-word sentences in Figure 19 and Figure 20, suggesting that the number of words per sentence does not influence word shape.

Slight variations in word shape due to sentence position are examined in the context of the sentence in §3.3.1.3: Initial lowering, §3.3.1.4: Final lowering §3.3.1.5: Clause boundaries, and §3.3.2.3: Yes/no question contour analysis.

### 3.2.4: SUMMARY OF WORD SHAPE ANALYSES

Smoothings of two types, intra-speaker and inter-speaker, support the peak-trough word contour hypothesis for Unangan. To account for this within the Pierrehumbert framework, tones must be classified as either pitch accents or phrase accents. Recall that pitch accents are defined as tones that associate with word stress. As discussed in §1.2.2.3: Stress, primary lexical stress in Unangan is penultimate unless the final syllable is heavy, with a secondary stress on the first syllable of words with four or more syllables. The peaks and troughs of word contours in Unangan do not associate one-to-one with stressed syllables since stress is penultimate and the word contour L usually occurs on the final syllable. Therefore I classify the peak-trough word contour as a set of H and L phrase-accent boundary tones that associate with word edges, not T\* pitch accents that associate with word stress.

The Unangan intonation tone inventory as thus far discussed consists of the following tones and speaker intentions:

Table 12: Unangan tone inventory for word contour with phonetic implementation, and speaker intent.

<b>Tone</b>	<b>Phonetic implementation</b>	<b>Speaker intention</b>
H	Reach a peak near the word beginning after which no other pitch in the word will be as high.	A word is starting.
L	Reach a low near the word end that is the lowest in the word.	A word is ending.

Classifying word association tones as phrase accents means that in the Pierrehumbert system, each content word is both a prosodic word ( $\omega$ ) and an intermediate phrase (ip) since ip is the domain with which the phrase accents associate. Unangan tones associate

with words as illustrated in Figure 22 where each  $\omega$  is associated with a single ip and vice versa. Hs and Ls are linked with ip edges and associate on the surface with syllables. As the pitch track in Figure 22 shows, in the first word (underlining marks stress), **saba:ban**, the H associates with the stressed syllable, **ba**, and the L associates with the unstressed final syllable, **ban**. The second word **akuni:n** has an attached question particle, **i:**. Together these two form a  $\omega$ . In the  $\omega$  **akuni:n i:**, the H associates with the unstressed first syllable, **a**, the L associates with the unstressed cliticized question particle, **i:**. In the third word, **iyatab(ax)**, the H associates with the unstressed first syllable, **i**, and the L associates with the stressed final syllable which has become **tab** with the deletion of the final rhyme, **ax**. In the fourth word, **wa:gakux**, the H is associated with the first syllable, **wa:**, and the L is associated with the unstressed ultima **kux**. (See §3.3.1.4: Final lowering, for details about L assignment to a syllable without intonation.)

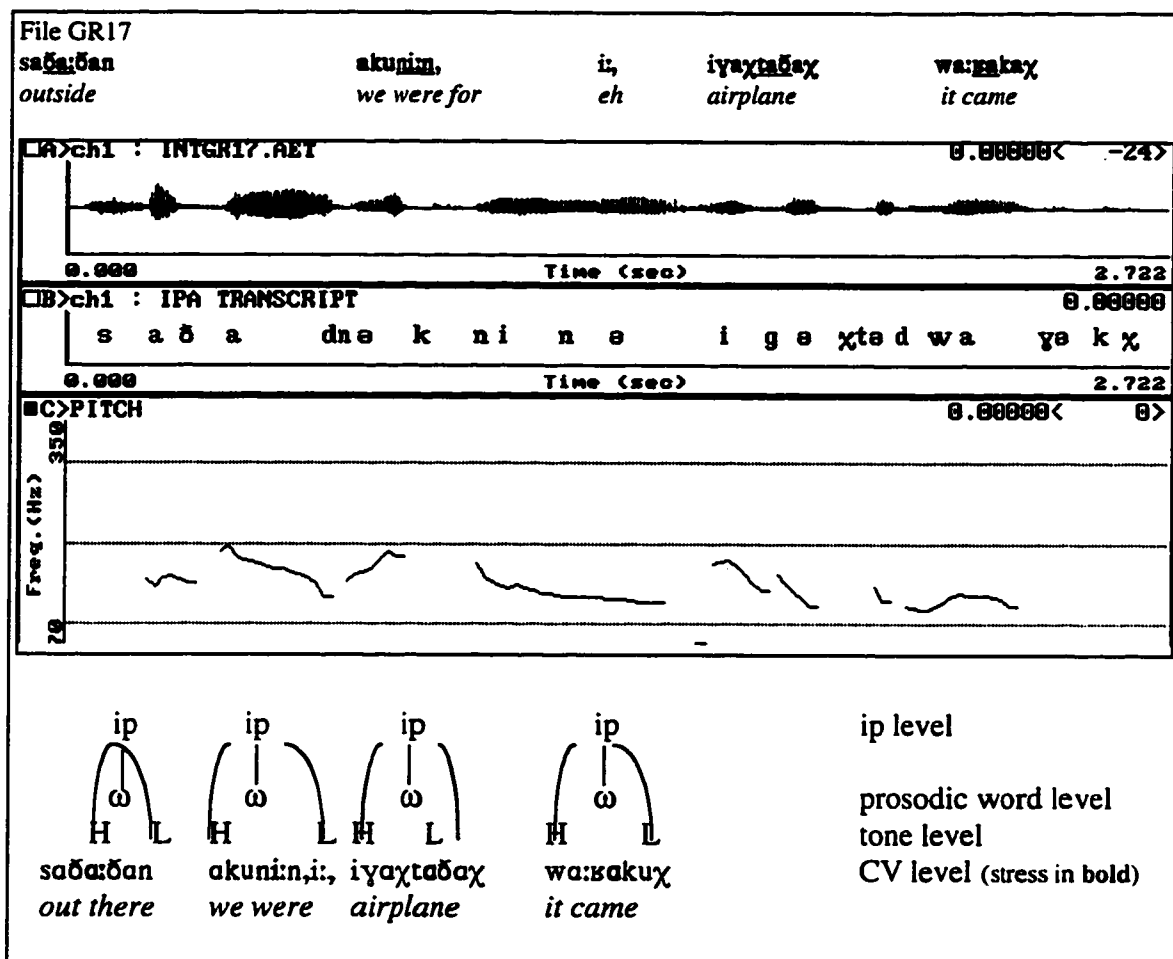


Figure 22: Phrase accent association with  $\omega$  and ip in the prosodic hierarchy.

We can see from the summary in Table 13 that the only alignment between stressed syllables and tones is the H on the penult syllable in the first word and the L on the final syllable of the third word. In the first case, the alignment of tones has been shifted inward from the edge of the word at the sentence boundary. This sentence boundary effect on word shape is accounted for in §3.3.1.3: Initial lowering. The example sentence summarized in Table 13 does not show a robust association between peaks or troughs and stressed syllables which would be required in order to classify the tones as pitch accents. Instead, I have proposed that they are phrase accent tones.

Table 13: Summary of tone alignment with stressed vs. unstressed syllables in the sentence **saða:ðan akuni:n i:iyaχtaðax wa:ɪakux** as in Figure 22.

	H aligned with _ syllable	L aligned with _ syllable
1st ω	stressed penult	unstressed final
2nd ω	unstressed first	unstressed clitic
3rd ω	unstressed first	stressed final
4th ω	unstressed first	unstressed penult

Although word shape will be defined here as H L, as mentioned in §3.2.1, two speakers, AK and BS, seem to characteristically use L H word shape. L H word shape is typical of non-sentence-final words in the elicited sentences of these two speakers. Another speaker, LM, whose data is not included in the numerical database, also predominantly uses L H word contour. There do not appear to be gender or regional dialectal causes for their difference in word shape since AK is male, from St. George Island; BS is male from St. Paul Island; and LM is female from St. Paul Island. The fact that three of the twelve NFS consultants characteristically use a word contour opposite from that of the rest of the sample implies that either contour is acceptable. It also reinforces the observation that words are each marked by a simple contour. There appears to be no correlation between word shape preference and sex, geographical dialect or age.

Descriptions of two languages in the Eskimo/Aleut family offer contrasts with Unangan. Woodbury (Woodbury 1994: C-3) describes a trough-peak word contour for CAY: “Pitch reaches a low at (or slightly past) the end of the first stressed syllable of each word, then rises to a peak at or near the word’s end”. The opposite is the case for most of the Unangan speakers; in Unangan the contour falls in pitch over the word. Woodbury (Woodbury 1987: 699) analyses this contour as that of an Intonational Phrase (IP). “The

IP may be a single content word, a genitive, a noun-demonstrative, or a verb-complement”.

With a long term research project in CAY prosody Woodbury has fine tuned his analysis over the years. In 1988 he analysed the content word as an Accent Phrase (AP). One or more APs may constitute an IP. In later work (Woodbury 1990), he described the word contour in CAY as L H aligning with the first and last stressed syllables of a content word. Here he proposed a system of ‘right linking’ or ‘left linking’ to account for the fact that the L and H do not associate exactly with the stressed syllables. Later (Woodbury 1994: C-7) he proposed that in the L H word pattern “...the final H optionally lags rightward to the word edge”. The variation in these analyses shows that there is not a close linking between peaks and troughs and stressed syllables in CAY; however, there is a strong correlation between a L and a H near the edge of each word, as in Unangan.

Leer (1985) gives a brief impressionistic description of pitch in Koniag Alutiiq, a language geographically proximate and related to Unangan, as relatively flat and ‘unremarkable’. Beginnings and ends of words are lower in pitch than the ‘medium’ word internal pitch but ‘some speakers tend to elevate the pitch of the non-final unaccented foot above that of contiguous syllables.’ (p 91). Apparently words are marked in Koniag Alutiiq by word boundary lows. The elevated final unaccented foot may be similar to Woodbury’s L H analysis of CAY words.

As to languages unrelated to Unangan that have identifiable word contours, Harnsberger describes Hindi as having content words with L H contours, the final H often steeply rising. The tone type, whether pitch accent or phrase accent, is not firmly established in this investigation (Harnsberger 1994).

Palková and Pátč&ek give an analysis of Czech in which “...each word makes a stress unit” (1997: 64). Czech stress units conform to intonation units that are similar to Unangan word shape (Zdena Palková 1997, p.c.).

This section has established that Unangan words are mapped to characteristic H L pitch contours. This word contour may be the opposite, L H, for some speakers but words are still defined by intonation contour. I classify H and L as phrase accents, boundary tones that associate with the edges of small phrases. The domain of this small phrase word contour is analyzed as the prosodic word, which appears to be isomorphic with the intermediate phrase. Other languages, both inside and outside the language family, show similar patterns of content word contours.

### 3.3: SENTENCE SHAPE

Having established word shape as H L in the previous section, this section goes on to describe Unangan sentence shape for declaratives of one and two clauses and for yes/no questions. Effects on word shape that are relative to sentence contour are also described.

#### 3.3.1: DECLARATIVES

##### 3.3.1.1: Declarative declination

DECLINATION, a gradual decline in f<sub>0</sub> over the course of an utterance, is evident in the pitch tracks in Figure 18, page 57. In these pitch tracks, the peaks and troughs of each successive word decrease in f<sub>0</sub>. A visual impression from the pitch tracks is that the peak-trough word contours combine with downtrends to form a cascading pitch contour for each sentence, each word a step in the falls. This section examines the evidence for the existence of DECLINATION in Unangan.

Hypothesis: Declarative sentences are likely to have a negative slope.

Methodology: Medians were computed for each word in the numerical database. This approach was used to prevent possible researcher bias that could result from obtaining f<sub>0</sub> measurements at selected points in the word. A word median calculation, on the other hand, reflects a central tendency for each word, the middle pitch value when all the pitch values of the word are listed in order of size.

For each sentence a simple linear (least squares) model (Strang 1988: 154, Seber 1977: 44) was fit to the word medians with word number on the abscissa (the independent or predictor variable) and word median pitch on the ordinate (the dependent or outcome variable) using the “lm” function in the software S-PLUS (Mathsoft 1996). The resulting sentence slopes were recorded.

A sign test was performed on the sentence slopes using the “binom.test” function in S-PLUS.

**Results:** The slope for each declarative is given in Table 14. Here any minus value in the ‘Slope’ column indicates a downward slope of the medians of the words in the sentence. Sentences are organized in the table from least to most number of words per sentence. The ‘Slope’ number is the average reduction in Hz per word median over the sentence, i.e., in a sentence with slope -8.0 the median word pitch drops an average of 8 Hz from word to word over the sentence.

This sentence slope analysis gave the result that 108 of 127 sentences had a negative slope, giving a p-value well below .01. If sentences were equally likely to have a positive or a negative slope, it would be extremely unlikely that we would see 108 of the 127 sentences, 85%, with negative slope. This result supports downtrending in the cascade contour characterization of f0 in Unangan sentences.

Table 14: Sentence slope for each elicited declarative sentence.

File	w/snt*	Slope	File	wd/sn	Slope	File	wd/sn	Slope	File	wd/sn	Slope
ak 1	2	-6.5	mm 3	2	-7.5	fg20	3	-14.25	ek15	5	-5
ak 1a	2	-4	mm15	2	-22	gf 3	3	0.5	ek18	5	-5.1
ak28	2	3	rm 1	2	-22	gf 7	3	1	ek19	5	-4.9
ak28a	2	1.5	rm 3	2	-6	gf 9	3	-5.5	fg13	5	-7.8
ak29	2	-14.5	rm 3a	2	-36	gf13	3	-3	fg15	5	-6.45
ak29a	2	-8	rm 6	2	12.5	gf18a	3	15	fg16	5	-2.95
bs 1	2	-12	rm 6a	2	-11.5	gr 7	3	-3	gf14	5	-3.75
bs6	2	-11	rm 7	2	-13	gr 9	3	-8.5	gr11	5	-16.1
bs6a	2	-2	rm22	2	-5.5	gr13	3	-1.5	mm10	5	-12
bs16	2	8.5	rm22a	2	-27.5	mm 1	3	-1.25	mm13	5	-7.65
bs17	2	8	rm25a	2	-28	mm16	3	-20.75	ak19	6	-2.61
ek7	2	-17	rm25b	2	-54	mm17	3	-7	ak21	6	-3.48
ek7a	2	-9	rm26	2	-43.5	rm12	3	-17.25	ak22	6	-2.7
ek20	2	-37	ak 3	3	-8	rm13	3	-16.25	ak32	6	-5.68
ek20a	2	-31.5	ak 7	3	1	rm18	3	-11.5	bs12	6	-7.65
ek21	2	-1	ak8	3	2.5	rm21	3	-27.75	ek14	6	-4.3
ek23	2	-17.5	ak24	3	-4	rm21a	3	-18	fg12	6	-10.65
ek23a	2	-37	bs4	3	-2.5	ak 4	4	-4.4	gf11	6	-5.17
ek24	2	-15	bs8a	3	-14.25	ak12	4	-0.2	gr12	6	-6.88
ek24a	2	-22	bs18	3	-6.5	ak31	4	-3.05	gr14	6	-5.12
fg 6	2	-5	ek3	3	0	bs19	4	-11	mm11	6	-7.44
fg18	2	-26	ek4	3	-4	bs19a	4	-7.85	rm19	6	0.28
gf 5	2	-8	ek9	3	-7	fg19	4	-6.7	rm20	6	-6.62
gf16	2	-10.5	ek9a	3	-3.5	gf 1	4	-5.7	ak18	7	-2.07
gr 5	2	-16	ek11	3	-4	gf17	4	-8.3	ak25	7	-2.35
gr15	2	-14.5	ek17	3	7	gr 1	4	-13.15	ak33	7	-3.58
gr15a	2	1	ek17a	3	3.5	gr17	4	-9.25	bs11	7	-6.92
gr15b	2	-1	ek22	3	-19	mm 8	4	-17.4	rm15	7	-15.41
gr16	2	-9	fg4	3	2	rm23	4	-25	rm16	7	-8.1
gr18	2	11	fg8	3	-10	rm24	4	-0.65	rm17	7	-12.32
gr18a	2	0	fg10	3	-6.25	bs15	5	-6.2	bs13	8	-2.19
			fg14	3	1.5	ek13	5	-10.2	gf12	8	-2.4

\*Words per sentence.

Table 14 shows that the 19 sentences with positive slope are distributed across all speakers except MM: AK has 4, BS has 2, GR has 2, GF has 2, RM has 2, EK has 3, FG has 2. These nineteen sentences fall into three categories: two-word sentences (AK7, AK8, BS17), sentences with *to be* morphology (AK 28, AK28a, BS16, GR15a), and sentences with an object (or with the verb **kumsitta-** carry) (EK3, EK17, EK17a, FG4, FG14, GF3, RM19). All other sentences in the database in these same categories have negative slopes. In fact GR15, GR15a, and GR15b are essentially the same sentence but only GR15a has negative slope. (See APPENDIX: Pitch tracks, for these files.)

In Figure 23 the results from Table 14 are displayed by slope compared to number of words per sentence for women and for men. Data points below the zero line on the Y-axis represent sentences that slope downwards. 108/127 (85%) sentences are below the zero line.

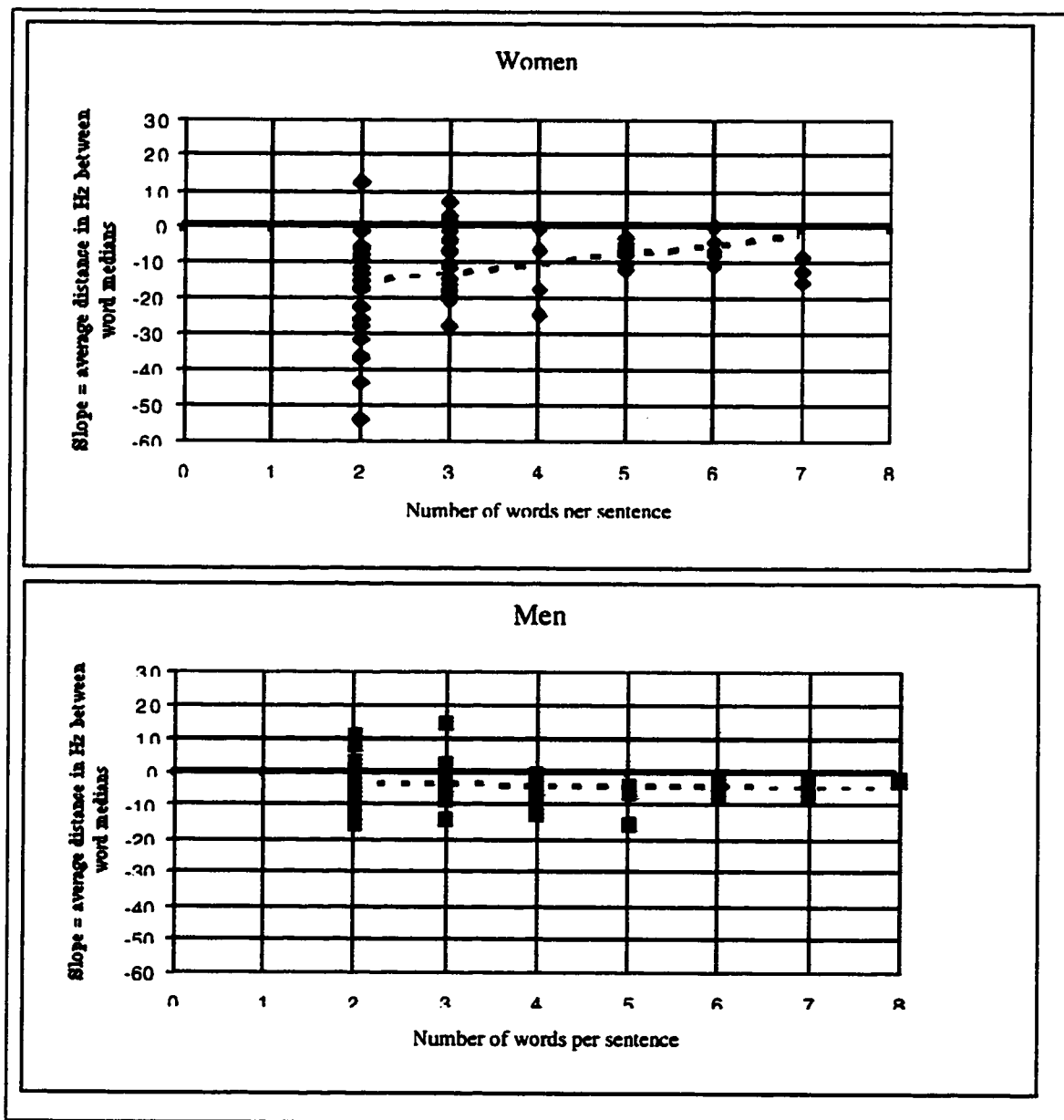


Figure 23: Slope of declaratives compared to number of words per sentence for women (top) and men (bottom) with linear regression trendlines (Excel 98).

Only sentences of four words and less slope more steeply than -20 Hz. Women's shorter sentences tend to slope more steeply than longer ones as indicated by the trendline in the top plot. This is not the case for men. The trendline in the lower plot indicates that men's slopes are about the same for short as for long sentences.

The charts in Figure 24 and Figure 25 separate the slope results by speaker. These charts show variation across speakers with some speakers, RM, and EK, having more steeply sloped sentences than others. In general, women have more steeply sloped sentences than men. Remember that the range for women is, in general, greater than that for men.

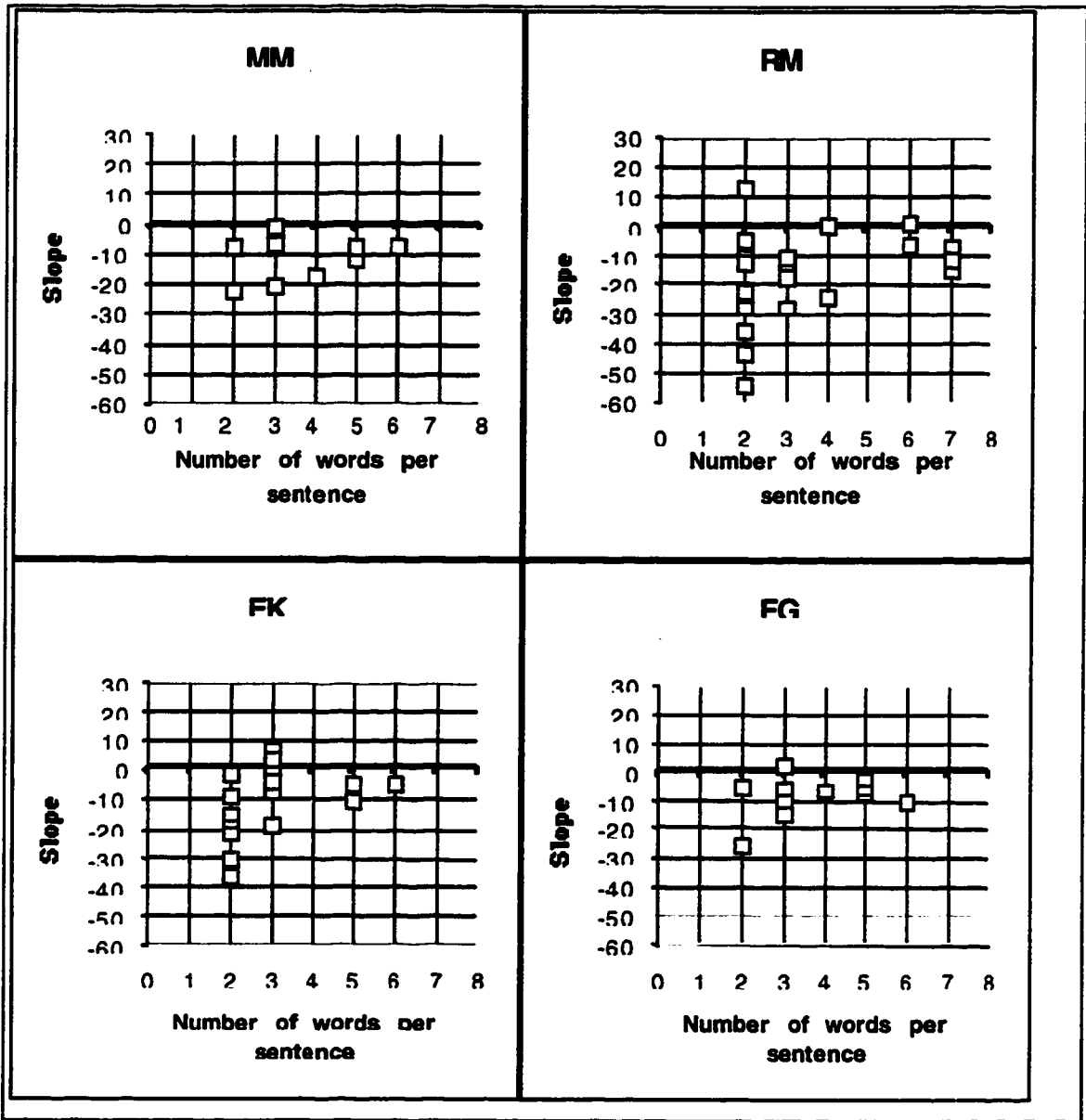


Figure 24: Declarative slopes for individual women.

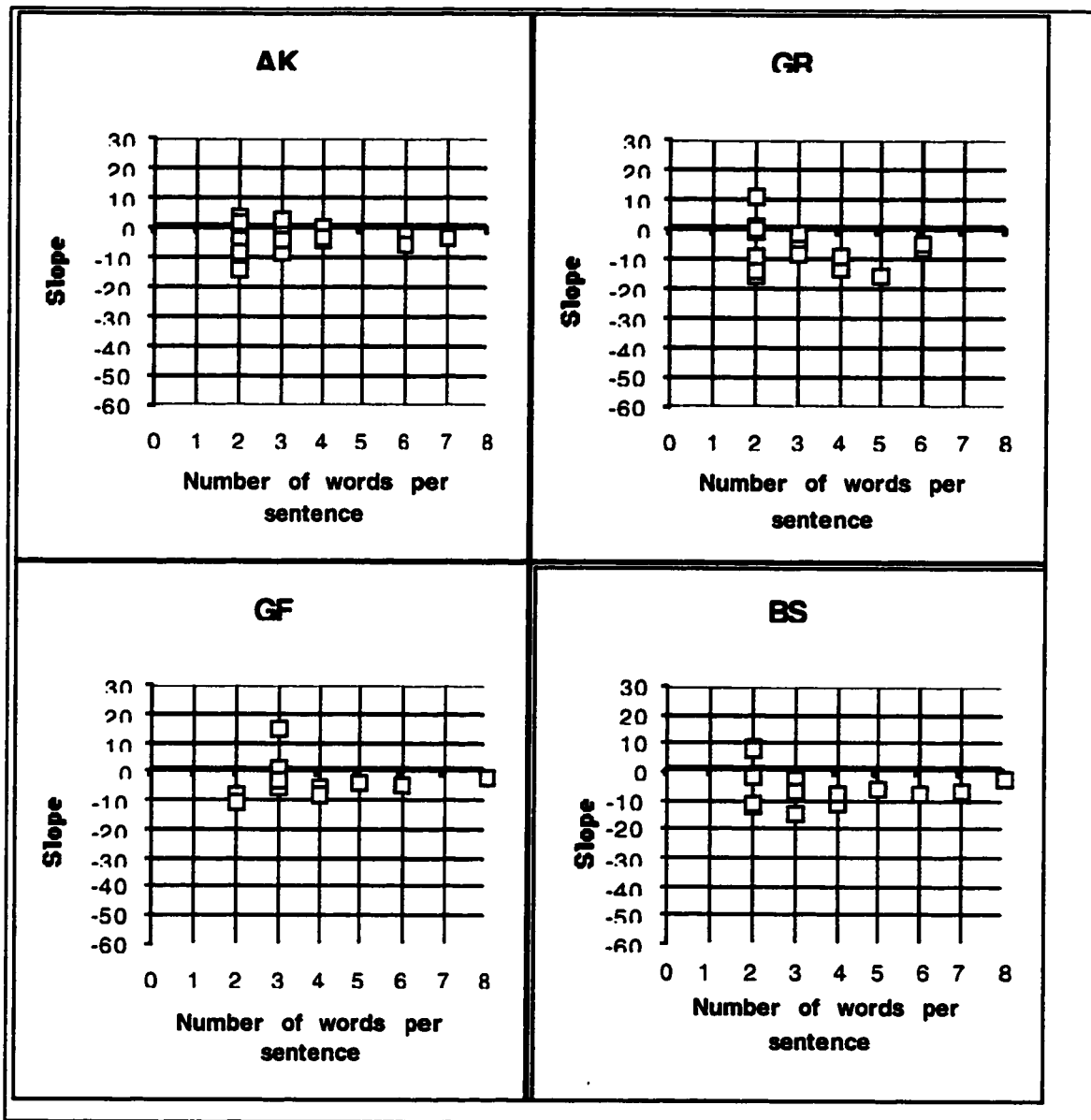


Figure 25: Declarative slopes for individual men.

All speakers, including AK and BS (both men) whose word shapes are characterized as trough-peak, have predominantly downward sloping sentences. It may also be the case for AK and BS that their choice of L H word shape may make their sentences flatter, that is less sloped, resulting in a closer clustering around zero on the Y-axis for their sentences. AK and BS also have the narrowest range of any of the speakers.

**Discussion:** The results of sentence slope calculations support the claim that declination is part of the Unangan intonation system. Pitch across sentences tends to slope downward.

In addition, the results suggest that shorter sentences tend to have steeper slopes than longer sentences for women. This is evidence for the notion of LOOKAHEAD (Ladd 1996: 29), according to which, speakers have access to the length of an utterance before they begin speaking. The idea is that for sentences with similar pitch ranges, the shorter sentence has less time to reach its base point. This is depicted in Figure 26 where sentence a. is shorter than sentence b.

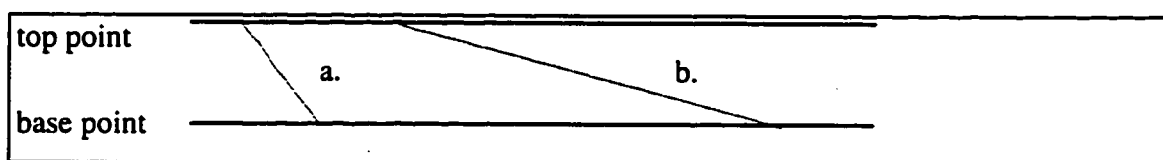


Figure 26: Representation of the slope of two sentences with the same top point and base point. a. is a short sentence. b. is a long sentence.

Ladd considers the possibility of such planning to be “psycholinguistically implausible” (1996: 30) even though he notes on the previous page that declination slope has been found in numerous studies to be steeper in short sentences than long ones. But how else can the correlation between slope and sentence length be accounted for? The Unangan data seem ideal for testing the notion of lookahead since in this language words are treated as intonation units. If there is incremental declination of these units over the course of utterances, as the smoothings indicate, and if there is correlation between the declination slopes and sentence length (measured here by number of words per sentence), then it is difficult to understand how the slope/sentence length correlation could occur except by lookahead. Additionally there is the question of why there is a slope correlation implying lookahead for women but not for men.

Another variable that might indicate that speakers do use lookahead in executing intonation is the range of sentences. The representation in Figure 26 assumes that the two

sentences begin at the same pitch, say 200 Hz, and end at the same pitch, say 100 Hz. We might also assume that speakers planning a longer sentence would start higher, at say 220 Hz for sentence b in Figure 26, in order to give themselves a greater range over which to spread a long sentence. The plots in Figure 27 indicate that there is a correlation between the median pitch of the first word of a sentence and the number of words in the sentence for women. The linear regression trendline in the top plot indicates that women do start longer sentences higher than shorter sentences. To determine if the smaller number of sentences at the 6 and 7 word length had an effect on the result, only women's 2, 3, 4, and 5 word sentences were plotted but the result was the same. The trendline in the bottom plot indicates only a slight tendency for men to raise the pitch of first words in planning longer sentences.

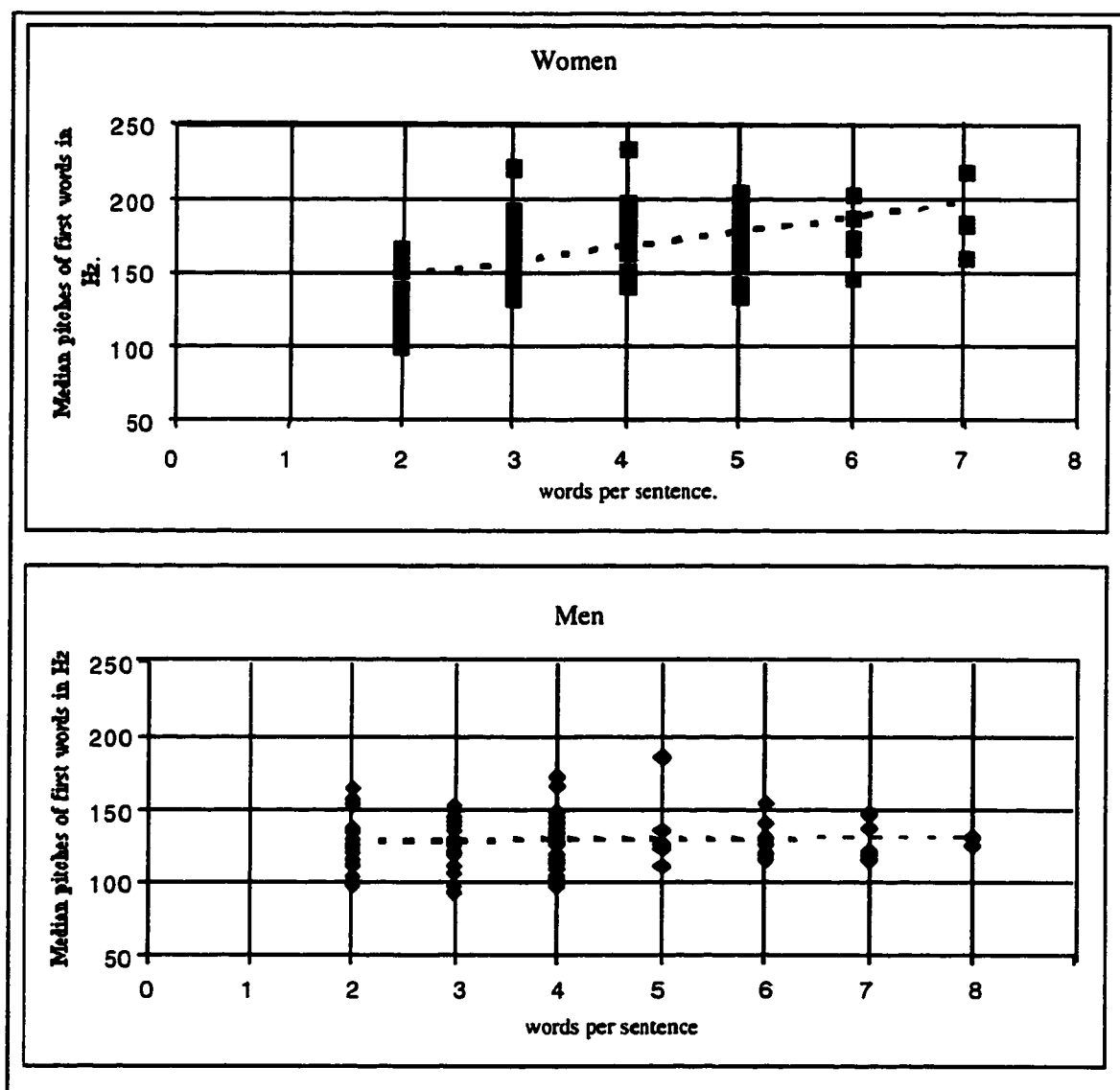


Figure 27: Median pitches of first words vs. number of words per sentence for women (top) and men (bottom) with linear regression trendline (Excel 98).

In summary, slope results support the claim that declination exists in Unangan. Women's results support the concept of lookahead with steeper slopes for shorter sentences and higher first word median pitches. However, the results for men indicate that slopes and first word median pitches are about the same regardless of sentence length.

Taking into account the declination results reported in this section, the next section will investigate the shape of declarative sentences.

### 3.3.1.2: Cascade contour analysis

Pitch tracks, cf. Figure 18, suggest that sentence contours are concatenations of simple peak-trough word contours affected by declination. The H L word shape is clearly defined. Each successive peak is slightly lower than its predecessor. Each successive trough is slightly lower than the preceding trough as well. These effects combine to form the “cascade contour”. To test this claim, the following analyses were performed.

Hypothesis: Sentence contours are downtrending concatenations of peak-trough word contours.

This analysis combines the word contour findings with those for declination to investigate sentence contour.

Methodology: Sentences were smoothed inter- and intra-speaker.

Results: The smoothing of a single sentence across speakers in Figure 21, page 64 shows the cascade contour. Each of the four words in the smoothed contour has a clearly defined peak-trough contour slightly lower than the previous word.

Evidence for the sentence cascade contour of declaratives for women can be seen in the left column of Figure 19, page 60, however a caution in interpreting these smoothings is required. For Figure 19 and Figure 20, **all** three word sentences in the numerical database and their corresponding yes/no questions were collected by speaker and smoothed. This means that many of these smoothed sentences contained genitive structures which have the effect of raising the peak of the second word. See §3.4.1, for a discussion of this counter-cascade contour. Genitives notwithstanding, the smoothings in the left column of Figure 19 support the cascade contour for declaratives. Words are clearly defined by contour and peaks are successively lower as are troughs.

Smoothing results of three-word declaratives for four men are given in the left column of Figure 20. These do not conform as clearly to the cascade contour hypothesis as do the results for women. For GR word shape is clear; each trough steps down but the peaks do

not. For AK, a L H word-contour speaker, words are defined by intonation contour though they are bumpier than for other speakers; both peaks and troughs step down. For BS, another L H word-contour speaker, words are defined; troughs step down but peaks do not. For GF, though the first word is clearly defined, the last two words are not well defined in the smoothed curve. However, the dotted pitch tracks indicate that there does seem to be a trough at the end of the second word. There is no indication in GF's smoothing of downtrending.

Discussion: Sentence slope and smoothing results indicate that sentences are concatenations of word contours affected by declination. Concatenated tone to word association is illustrated in Figure 28. Declination causes the H and L of each word to be lower than that of the previous word.

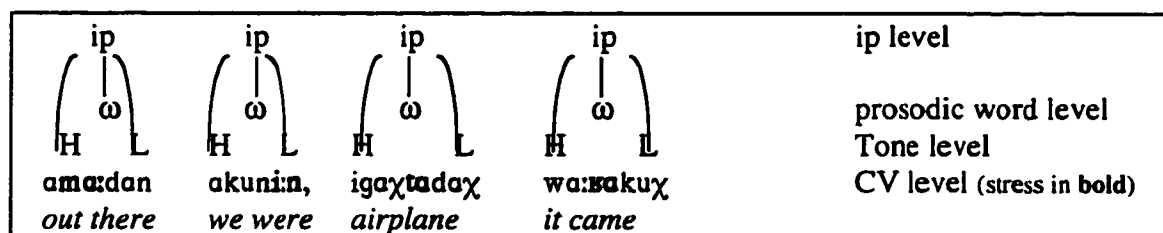


Figure 28: Tone to word association in a sentence.

The concatenation of prosodic words does not require any addition of tones to the tone inventory but declination effects mean that an additional note needs to be added to the phonetic implementation as in the italics in Table 15.

Table 15: Unangan tone inventory for *cascade* contour, with phonetic implementation, and speaker intent.

Tone	Phonetic implementation	Speaker intention
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. <i>This peak is lower than the peak of the previous word in the sentence.</i>	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. <i>This trough is lower than the trough of the previous word in the sentence.</i>	A word is ending.

Concatenations of downtrending word contours are also evident in pitch tracks of other languages for which word length contours have been proposed, Czech (Palková and Pátč&ek 1997), Hindi (Harnsberger 1994), and CAY (Woodbury 1994: C-3). When words are marked by pitch accent we also find sentences with similar appearances: in the English ‘list’ contour, Spanish downstepped contours (Prieto et al. 1996, Prieto 1998), and for Japanese, “F0 contours of words and sentences are generally characterized by a gradual declination from the onset towards the end of an utterance, superposed by local humps corresponding to word accent” (Fujisaki 1981 quoted in Liberman and Pierrehumbert 1984: 225).

The effects of large phrase boundaries on Unangan sentence shape are explored in the next sections.

### 3.3.1.3: Initial lowering

The shape of sentence-initial words is counter to the peak-trough word shape proposed above for Unangan. Observations of pitch tracks suggest that sentences begin by rising from a trough which delays the peak of the first word. This section will report on analyses of INITIAL LOWERING.

**Hypothesis:** Word peaks occur later in sentence-initial words than in sentence-medial words.

**Methodology:** The contour of sentence-initial words was compared to the contour of sentence medial words. Smoothings were made for all declarative sentences in the numerical database, Words were selected automatically from the numerical database as follows. Sentence-initial words were selected from sentences meeting the following criteria: for all eight speakers “sentence” is larger than one word, “sentence” = declarative, “word” = first word. Sentence-medial words were also selected from sentences meeting the following criteria: for all eight speakers “sentence” is greater than one word, “sentence” = declarative, “word is not sentence-initial, “word” is not sentence-final, “word” is not clause-final. Plots were drawn of all speakers together and of individual speakers.

**Results:** Smoothed pitch contours of sentence-initial versus sentence-medial words for all eight speakers together in Figure 29 show a clear difference in peak placement. Sentence-initial word pitch contours rise sharply then gradually rise, attaining a peak after the second half of the word. Sentence-medial word pitch contours attain their peak before the first half of the word. This result supports the hypothesis that word peaks occur later in sentence-initial words than in sentence medial words.

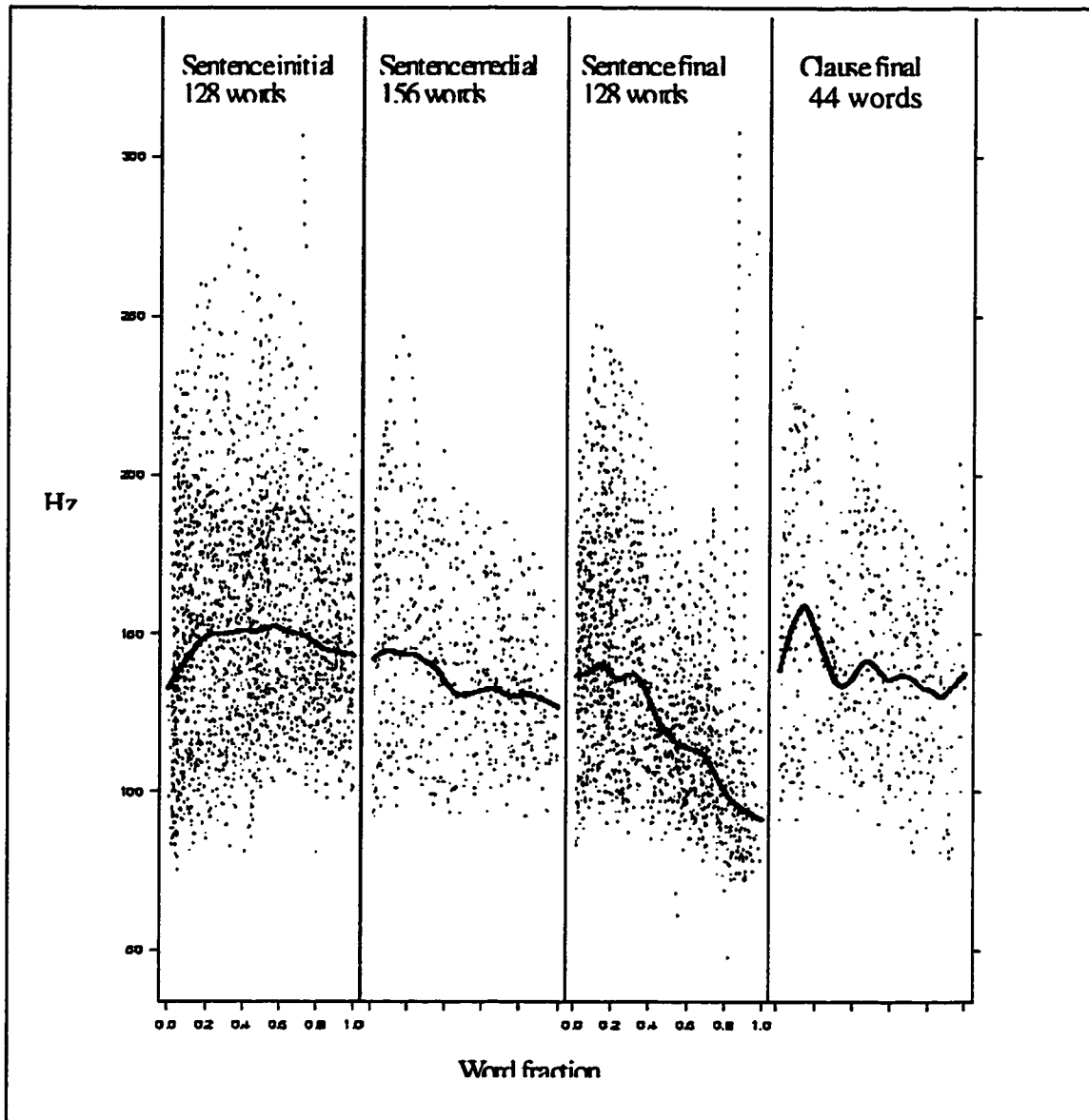


Figure 29: Eight speakers' sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. The dotted lines represent individual pitch tracks.

Variation in the results appears when the same word selection parameters are used to produce plots of individual speakers. These plots are given in Figure 30 through Figure 37. Those speakers whose results most clearly confirm the sentence-initial-word late-peak hypothesis are RM (Figure 30), EK (Figure 31), GR (Figure 32), and GF (Figure

33). For these speakers, the word peak of sentence-initial words occurs later in the word than does the word peak in sentence-medial words.

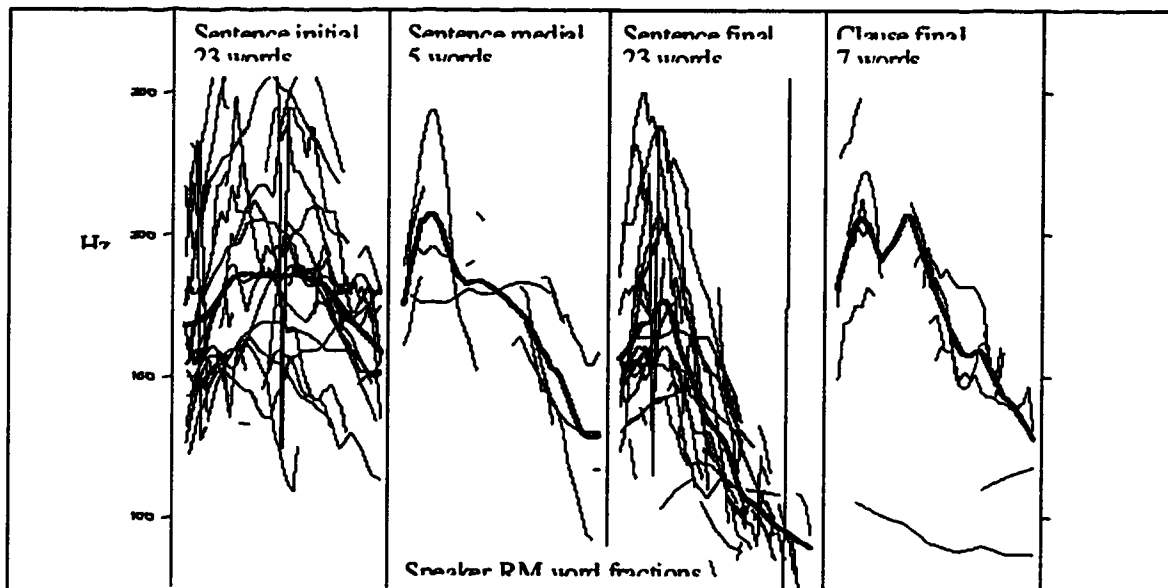


Figure 30: Speaker RM's (woman) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch track data.

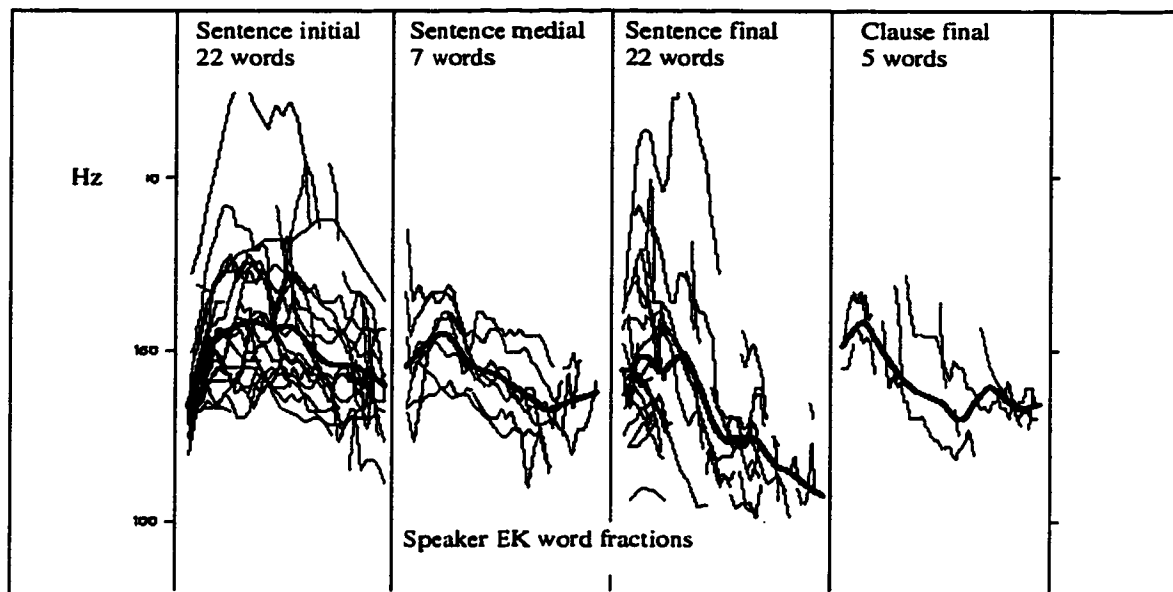


Figure 31: Speaker EK's (woman) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch track data.

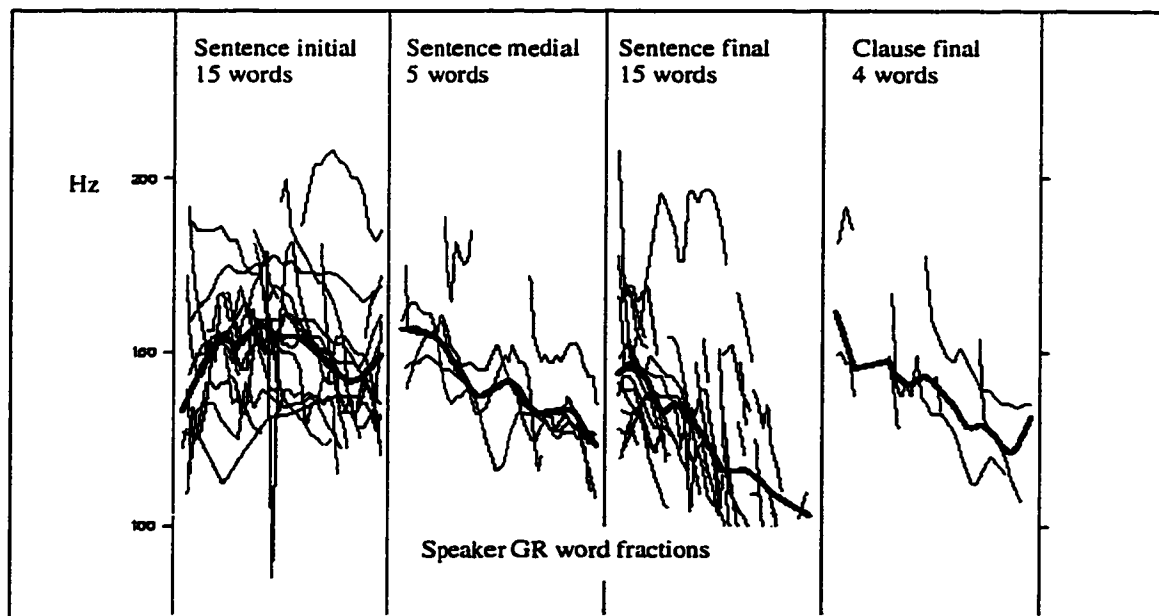


Figure 32: Speaker GR's (man) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch track data.

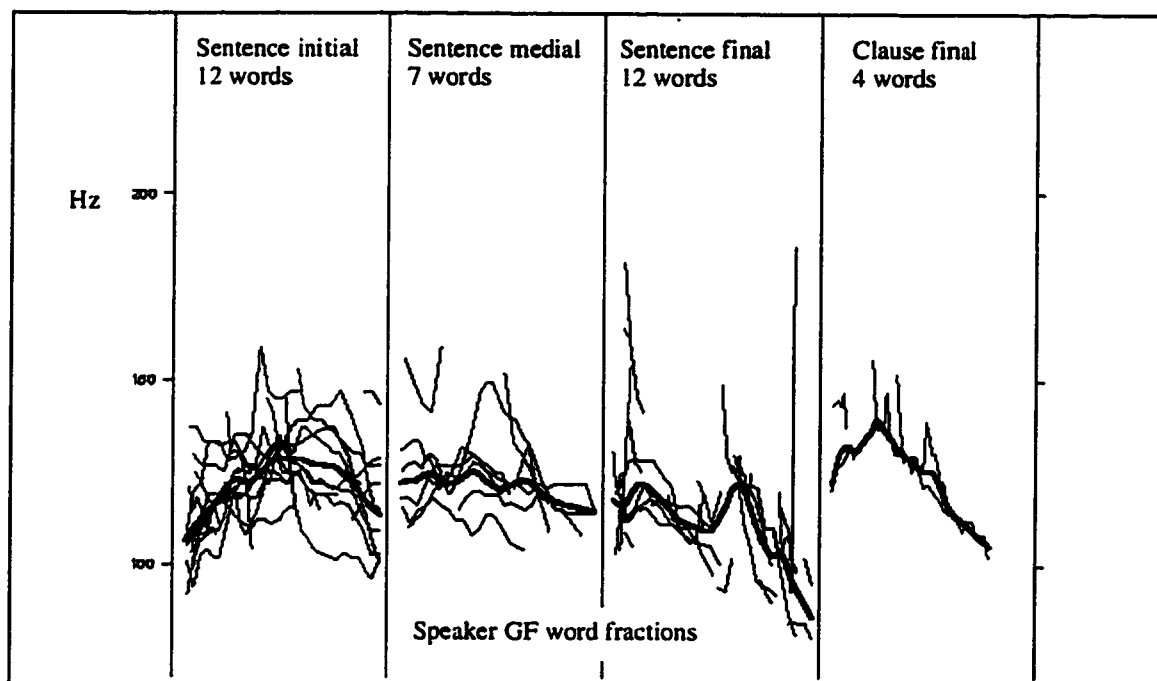


Figure 33: Speaker GF's (man) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch track data.

Other speakers do not show the same pattern but their results also support the claim that sentences begin with an initial low. For AK (Figure 34) and BS (Figure 35), both classified as L H word shape speakers, the low point of initial words is lower than that of medial words. Both speakers have an average sentence beginning that is lower than the average low point of their sentence-medial words. Since declination is a factor, we would expect that the lows of medial words would be lower than the beginning of the sentence if there were no sentence-initial low. Results from EK, GR, GF, and MM (Figure 36) also show a similar effect; for these speakers the beginning of the sentence is lower than the beginning of sentence-medial words.

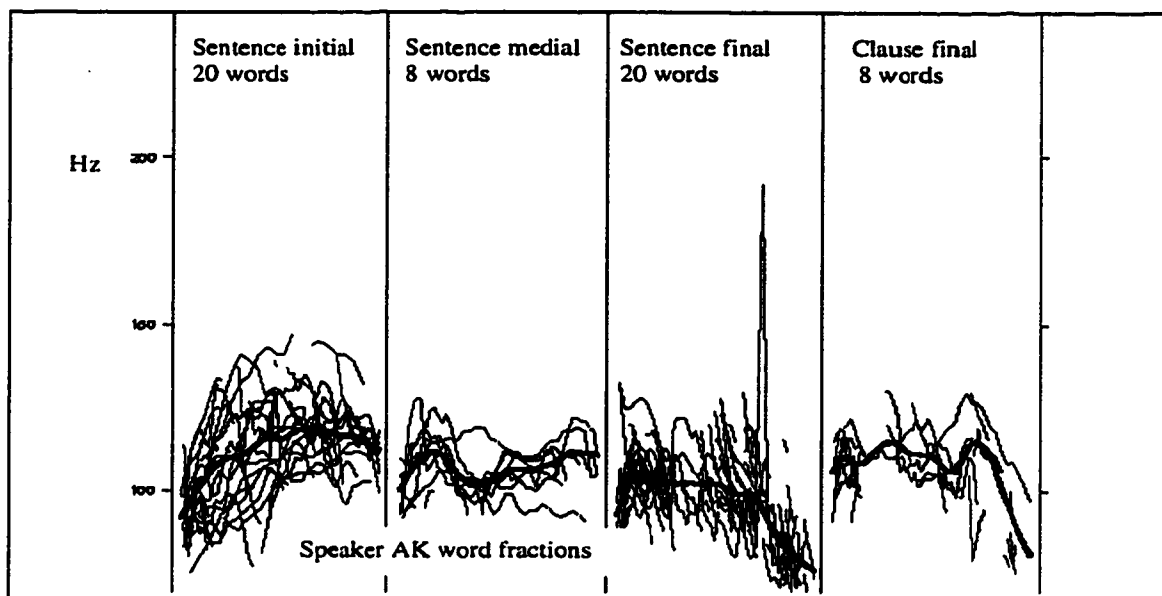


Figure 34: Speaker AK's (man) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch tracks.

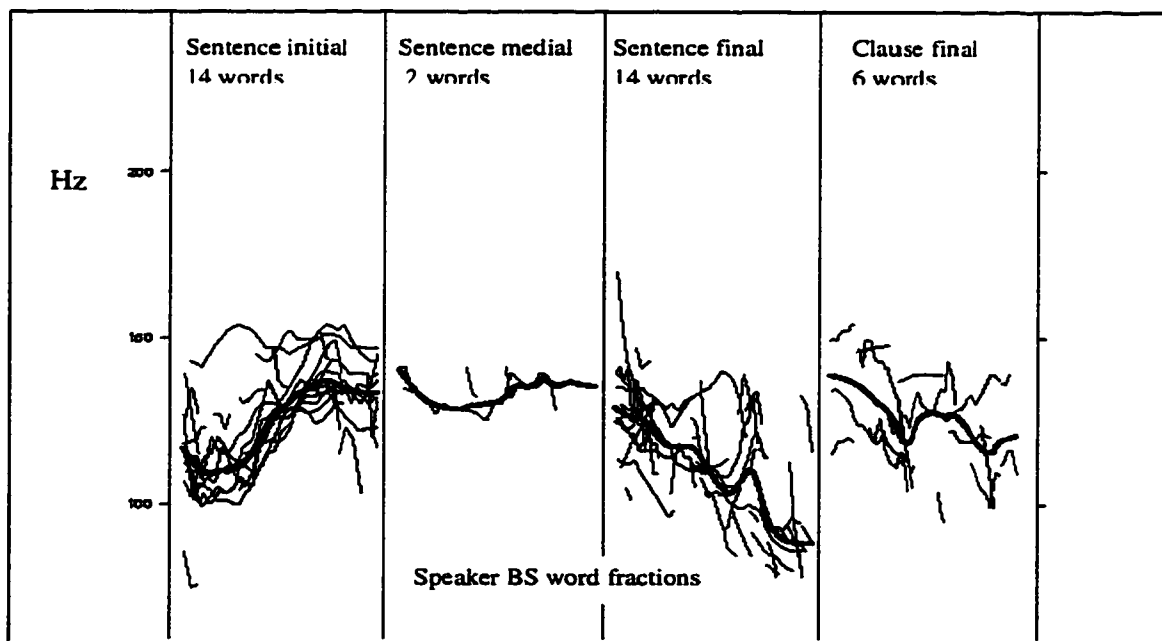


Figure 35: Speaker BS's (man) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch tracks.

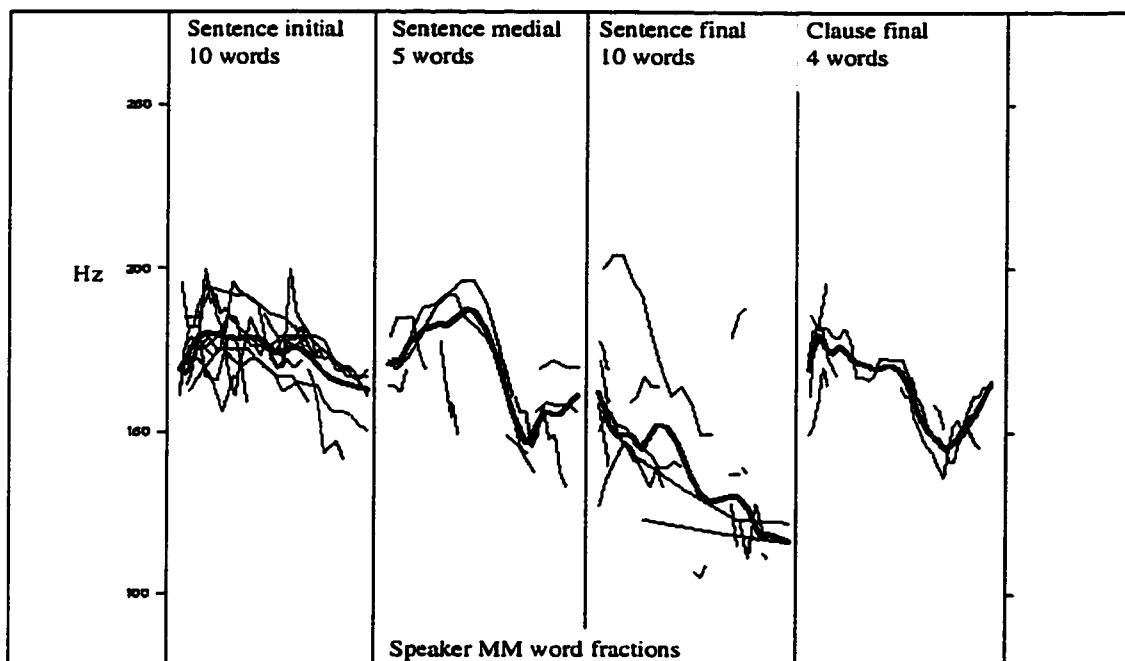


Figure 36: Speaker MM's (woman) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch tracks.

Results from speaker FG (Figure 37) do not support the claim that sentences begin with an initial low as her initial peak is attained at the beginning of her sentence-initial word.

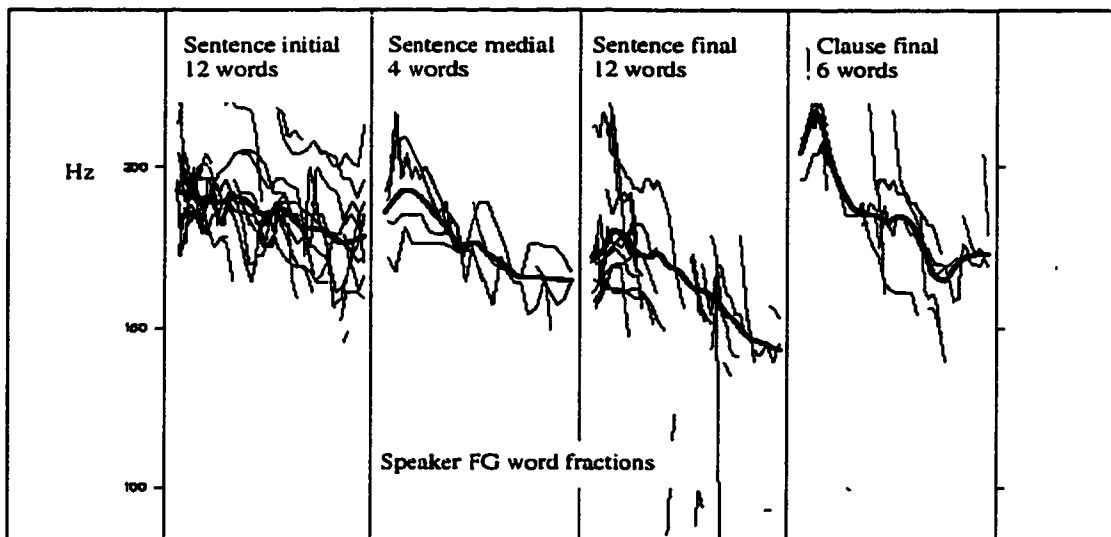


Figure 37: Speaker FG's (woman) sentence-initial, sentence-medial, sentence-final, and clause-final word contours smoothed as bold curves. Finer lines represent pitch tracks.

Results of the smoothing of all speakers combined and for half of the individual speakers support the hypothesis that word peaks occur later in sentence-initial words than in sentence-medial words. 75% of the speakers provide evidence supporting an initial lowering effect in a slightly different way; their smooths show that their initial words start lower than their medial words.

Discussion: As a phonological account of the sentence initial word late peak, I propose that sentences begin with a L% Intonational Phrase boundary tone. This L% causes the H word peak to occur later in the first word than it does in other words. This proposal is in line with analyses of other languages. Initial phrase boundary tones have been proposed for English (Pierrehumbert 1980/87: 9) and for Japanese (Pierrehumbert and Beckman 1988: 9). Woodbury observes that in Central Alaskan Yup'ik initial lowering causes a first words' L to be lowest in the sentence (1994: C-3).



and compare lexical pitch contour at sentence ends vs. at other points in the sentence for Unangan.

**Hypothesis:** The pitch drop of sentence-final words is steeper than that of other words.

**Methodology:** The contour of sentence-final words was compared to the contour of sentence-medial words. For all declarative sentences in the numerical database, smoothings were made as for sentence-initial and sentence-medial words. Sentence-final words were selected according to the following criteria: for all eight speakers “sentence” is greater than one word, “sentence” = declarative, “word” = last word. Sentence-medial words were selected as described in 3.3.1.3: Initial lowering.

**Results:** Smoothings of sentence-medial versus sentence-final words in Figure 29 show a clear contrast. The drop of sentence-final words is steeper than that for sentence-medial words. In individual speaker results this is the case for 100% of the speakers in the numerical database. This result strongly supports the claim that FINAL LOWERING is a feature of Unangan.

But what is the interaction of sentence-final syllable weakening with final lowering? As discussed in §1.2.2.2, the interaction of syllable weakening with intonation is important since the pitch of weakened syllables is often not measurable. Recall that sentence-final syllable weakening ranges from reduction of amplitude, devoicing of the final rhyme, deletion of the final rhyme, to, rarely, deletion of the penult rhyme and entire final syllable. If the intonation of sentence final syllables is not measurable or, indeed, audible, how best can sentence-final intonation be characterized? Can intonation be considered a cue for sentence finality if it is not audible? The phenomenon of sentence-final syllable weakening is examined in the following analysis.

**Hypothesis:** Sentence-final syllables in declaratives are likely to be devoiced/deleted.

**Methodology:** Sentence-final syllable weakening was tabulated from the printouts of pitch tracks for all sentences in the elicited data of all 12 speakers. Devoicing was judged

to occur if the waveform showed that duration was allocated to the syllable and/or there was some amplitude evidence as in Figure 10 and Figure 12. Devoiced final syllables are audible as 'whispered' syllables. Deletion was judged to occur if the citation form of the word had an additional syllable or syllables for which there was no duration or amplitude evidence in the waveform as in Figure 11. Syllables that were still voiced even though reduced in amplitude, as in Figure 9, were not considered part of the devoicing/deletion count because their pitch is audible. Results were tabulated by hand.

Results: Tabulation results given by speaker in

Table 16 show that 145/205, 71%, of the declaratives in the elicited data end with devoiced/deleted syllables. Of the 60 remaining sentences ending in voiced syllables with no deletion, 42 were from two speakers. If data from these two speakers, AK and EF, are not included in the tabulation, the result from the remaining ten speakers is that 145/163, 89%, of the declaratives end with devoiced/deleted syllables. Sentences that did not actually have devoicing did show reduced amplitude on the final syllable relative to the rest of the sentence.

Table 16: Declarative sentence-final syllable devoicing tabulated by speaker.

Speaker (m=male)	Number of verb-final rhymes devoiced or deleted compared to total declaratives	Percent of declaratives with rhyme deletion/devoicing.	Notes
GRm	13/13	100%	GR always devoices rhyme dec S finally, sometimes penult rhyme and ultima.
OR	13/13	100%	OR always devoices last rhyme, sometimes penult rhyme and whole ultima of declarative Ss, so she is weakening last two syllables quite a bit. Deletes entirely the last rhyme of questions.
MM	14/14	100%	Devoices all declaratives. Some medial-word final-syl devoicing also.
EK	18/19	95%	With one exception, devoices final rhyme, sometimes penult rhyme and ultima of declaratives.
ES	17/18	94%	Devoices and deletes, mostly rhymes, mostly declarative ends but also some other words, not only at clause ends.
LM	22/25	88%	Almost always devoices rhyme and sometimes whole ultima syl.
FG	14/16	88%	Devoices most S-final rhymes; deletes some medial-word final-rhymes.
RM	16/19	84%	RM devoices rhymes unless followed by 'ii' e.g. RM15.
GFm	10/13	77%	GF sometimes devoices final rhyme of declaratives.
BSm	8/13	62%	Dec ends have some devoicing. Seems more related to careful speech than syllable type e.g. BS19.
AKm	0/25	0%	AK never devoices ends of declaratives, at least in recording situation.
EF	0/17	0%	EF never devoices declarative ends. Being careful for the recording?
<b>total</b>	<b>145/205</b>	<b>71%</b>	
<b>Total without AK and EF</b>	<b>145/163</b>	<b>89%</b>	

Supporting the hypothesis that declaratives are likely to end with devoiced/deleted syllables, the 89% devoicing/deletion result from ten of the speakers indicates that declaratives can be expected to end with syllable weakening.

Discussion of final lowering: In light of the robust finding for devoicing/deletion of sentence-final syllables we might expect that final lowering might not be apparent in such sentences. However, we have already seen that smoothing of pitch tracks, by speaker and across speakers, indicates a steep pitch drop sentence-finally in declaratives. This steep pitch drop is the definition of final lowering and indicates that final lowering is a feature of Unangan. Since final lowering occurs despite devoicing/deletion we might conclude that devoicing/deletion takes place in sentence planning before final lowering. Then final lowering is applied to the syllables that remain in the word. If, on the other hand, final lowering were assigned to the final word as a whole, then the final syllables were devoiced/deleted, final lowering would be deleted also so that sentences would not end in a steep pitch drop.

However, there is another way of looking at this interaction between pitch drop and devoicing/deletion. There is a possibility that speakers 'overdo' the final lowering effect causing them to reach their base point before they get to the end of the word. Reaching the middle of the word and running out of pitch range, speakers choose to devoice, 'whisper', the final syllable. This would be a phonetic effect in that speakers are physically unable to reach a pitch target. Woodbury suggests that this is the case for CAY, "...these whispers count as very low tones and arise when the tone heads below a certain threshold" (Woodbury 1992b: 250). In this case, it seems as if final-syllable devoicing/deletion happens through lack of planning, that is, speakers don't accurately time the pitch drop of final lowering to coincide with the number of syllables available in the final word.

But the robust cooccurrence of final lowering with sentence-final syllable deletion/devoicing suggests a third possibility: speakers use both cues to signal the ends of sentences. Final lowering is deliberately timed to reach the speaker's base point before the last syllable and both cues, final lowering and syllable devoicing/deletion together indicate the end of a declarative sentence.

I suggest that syllable devoicing, which may have begun as a phonetic effect due to 'running out of pitch range too early', has become phonologized. Devoicing combines with final lowering as double markers of sentence finality. Another phonological result of this interaction would be the complete reduction of the devoiced segmental material to final-syllable deletion as in Figure 11.

There appears to be a correlation between devoicing and speech style such that there is more devoicing associated with casual speech. It may be the case that in casual speech devoicing plus final lowering is used to make the domain boundaries more salient in this fast-paced style. On the other hand, in the slower pace of formal speech devoicing may be replaced by other cues such as pause.

The phonological marker for final lowering is the same L% that indicates initial lowering. For final lowering, the L% is aligned loosely with the end of the sentence. Further work that investigates pitch on individual syllables would be needed to determine if the following is the case, but we might suspect that when L% is aligned with the final syllable, the final syllable is voiced; when the L% is aligned with the penultimate syllable, the final syllable is devoiced or deleted, and when L% is aligned with the antepenult, the last two syllables are devoiced or deleted.

With the addition of a L% for both initial lowering and final lowering, the tone inventory then consists of:

Table 17: Revised Unangan tone inventory for *cascade* contour with phonetic implementation, and speaker intent.

Tone	Phonetic implementation	Speaker intention
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is lower than the peak of the previous word in the sentence.	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. This trough is lower than the trough of the previous word in the sentence.	A word is ending.
L%	<i>sentence initially – start the sentence below the first word peak.</i> <i>sentence finally – end the sentence at a pitch lower than the anticipated trough of the final word.</i>	<i>A major prosodic boundary is occurring:</i> <i>sentence initially - 'here comes a series of small, related intonation units.'</i> <i>sentence finally - 'this ends a series of small, related intonation units.'</i>

Following Pierrehumbert, I propose that L% marks the edges of Intonational Phrases which are domains larger than the  $\omega/ip$  intonation units proposed here for Unangan words. This is similar to Woodbury's (1988) analysis for CAY in which IPs are sequences of APs with a final L% (1988) and initial lowering. In Unangan the initial L% makes the H of the first word occur later than it does on medial words. In CAY initial lowering causes the trough of the first word (words are L H) to be the lowest of the sentence. In Unangan the final L% causes a steep drop in pitch, usually accompanied by final syllable devoicing and deletion. In CAY the H on the final word is "retracted to the final stress followed by a steady fall to the end" (Woodbury 1994: C-3); that is, the word-final H of the last word happens earlier in this word than in others in the sentence to make room for a final L%. And similar to the finding here for Unangan, Woodbury notes that devoicing occurs with final lowering.

This section has investigated the effect on word shape of sentence-final intonation, finding that sentence-final word shape contrasts with both sentence-initial words and

sentence-medial words. Sentence-final words can be characterized in the phonology as H L L%; sentence-medial words are H L; sentence-initial words are L% H L. Sentence intonation is therefore characterizable as L% H L ... H L L%.

Investigators propose that utterance-final L% means 'finality', that is, L% marks the end of a prosodic unit. H% has been used to mark sentence-internal clause ends as well as ends of yes/no questions. The next section will look at sentence internal clause boundaries in Unangan. Questions will be examined in §3.3.2: Yes/no questions.

### 3.3.1.5: Clause boundaries

Many languages have been found to have intonation cues at sentence-internal clause boundaries. The main finding is that sentence-internal clause-final boundaries have a rising or level pitch while sentence-final boundaries have a fall in pitch. This is the case for English, and is thought to cue non-finality of the clause (Pierrehumbert & Hirschberg 1990: 308). Unangan sentence-internal clause boundaries were examined to determine whether they are marked intonationally.

**Hypothesis:** The clause-final word contour (of sentence-internal clauses) contrasts with the clause-medial word contour and with sentence-final word contour.

If there is no intonation cue for sentence-internal clause boundaries, then clause-final word contour should match clause-medial word contours. If there is an intonation cue at clause boundaries, clause-final contours will contrast with clause-medial word contours and may or may not contrast with sentence-final word contours. They may or may not exhibit FINAL LOWERING.

**Methodology:** The contour of clause-final words was compared to the contour of clause-medial and sentence-final words. For all declarative sentences in the numerical database, smoothings were made as for sentence-initial, sentence-medial words and sentence-final words. Clause-final words were selected according to the following criteria: for all eight speakers "sentence" is greater than one clause, "sentence" = declarative, "word" is not

sentence-initial, “word” is not sentence-final, “word” = number of words per clause. Sentence-medial and sentence-final words were selected as described above.

The sentence from Figure 40 will illustrate how words were classified: **lak:yan** (boys) **ayaya:ɔ̃an** (girls) **umtʃuna:ɪɔ̃u:n** (they try to kiss them) **ana:ɔ̃ayana:n** (to their mothers) **suya:saba** (tattle), “*If boys try to kiss girls, tattle to their mothers.*” In this sentence, **umtʃuna:ɪɔ̃u:n** is the sentence-internal clause final word. **ayaya:ɔ̃an** is a clause-medial word. **suya:saba** is a sentence-final word.

Results: Smoothings of clause-final contours are given in the last column of Figure 29, page 84, alongside words in the other positions examined. Clause-final and sentence-final word contours are not marked the same way intonationally; clause-final words rise at the end while sentence-final words drop off steeply due to FINAL LOWERING. Clause-final and clause-medial words also contrast though not as markedly. Both these word types end with a rise but the rise is more prominent for clause-final than for medial words.

Observation of clause-final words, smoothed by individual speaker as displayed in Figure 30 through Figure 37, finds the clause-final rise result less robust. Speakers whose clause-final words rise at the end in contrast to both medial and sentence-final words are EK, FG, and GR, only 3 out of 8 of the speakers in the numerical database. Most speakers’ contours do not conform to the clause-final rise. MM’s clause-final smoothing ends in a downslope while the medial smoothing rises. However, her clause-final pitch traces show that one token does go up. RM has a similar pattern; the clause-final smoothing slopes down but individual pitch traces show that some tokens end on a rise. The characterization of AK as a L H speaker is supported by the smoothing of his medial words, which start low and end high. His clause-final words might be expected to end even higher than medial words but they do not; they slope down. GF’s clause-final smoothings and pitch traces show no final rise. BS is a L H speaker; his medial word smoothing has a low near the beginning and ends high. His clause-final smoothing, on

the other hand, has a high to low trend. Some pitch traces show a final rise but this is the case for his medial words also. BS's medial words pattern like AK's but clause-final words pattern differently for the two speakers.

In order to determine whether declination is reset after a clause boundary, a smoothing was generated of clause-final words and their following clause-initial words.

**Hypothesis:** At a sentence-internal clause boundary the pitch peak of the word before the boundary is lower than the pitch peak of the word after the boundary.

**Methodology:** For all declarative sentences in the numerical database, smoothings were made as above for clause-final words. Clause-initial words were selected according to the following criteria: for all eight speakers "sentence" is greater than one clause, "sentence" = declarative, "word" is not sentence-initial, "word" is not sentence-final, "word" = first word in clause.

In addition, intra-speaker smoothings were made of sentences with relative clauses. The sentences were responses to the stimuli: "*When boys try to kiss girls, tell their mothers.*" "*When boys try to kiss, girls tell their mothers.*" Subsets of responses to these stimuli are grouped based on the number of words per sentence since speaker responses varied.

**Results:** The smoothings in Figure 39 indicate that the first word following a clause boundary does not have a pitch peak higher than the pitch peak of the previous word.

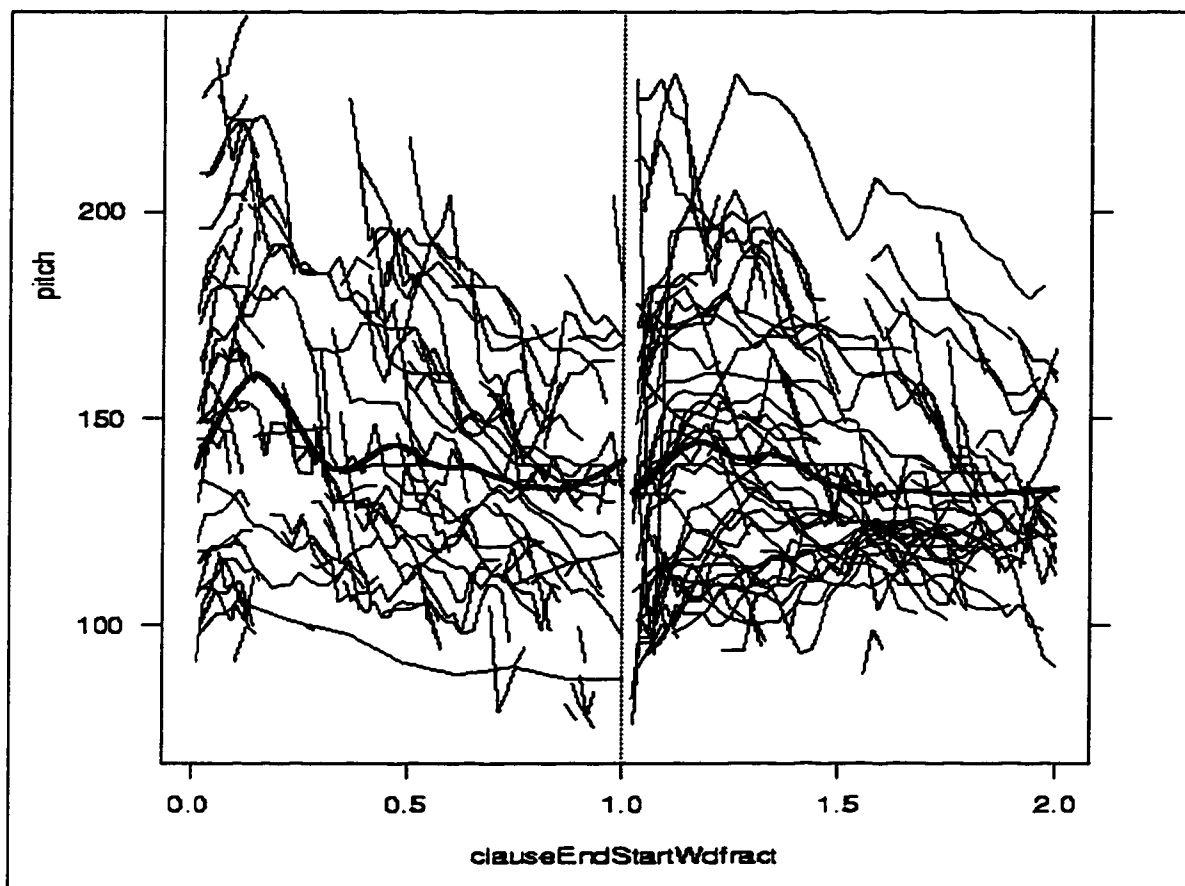


Figure 39: Smoothing of 44 clause-final words on the left and their 44 following clause-initial words on the right.

The bold curves are the smoothings. The finer lines are the pitch track data.

In the intra-speaker smoothings, clause boundary between the third and fourth words is visible in Figure 40 as a large dip. The peak of the final word of the first clause is higher than the peak of the following clause-initial word.

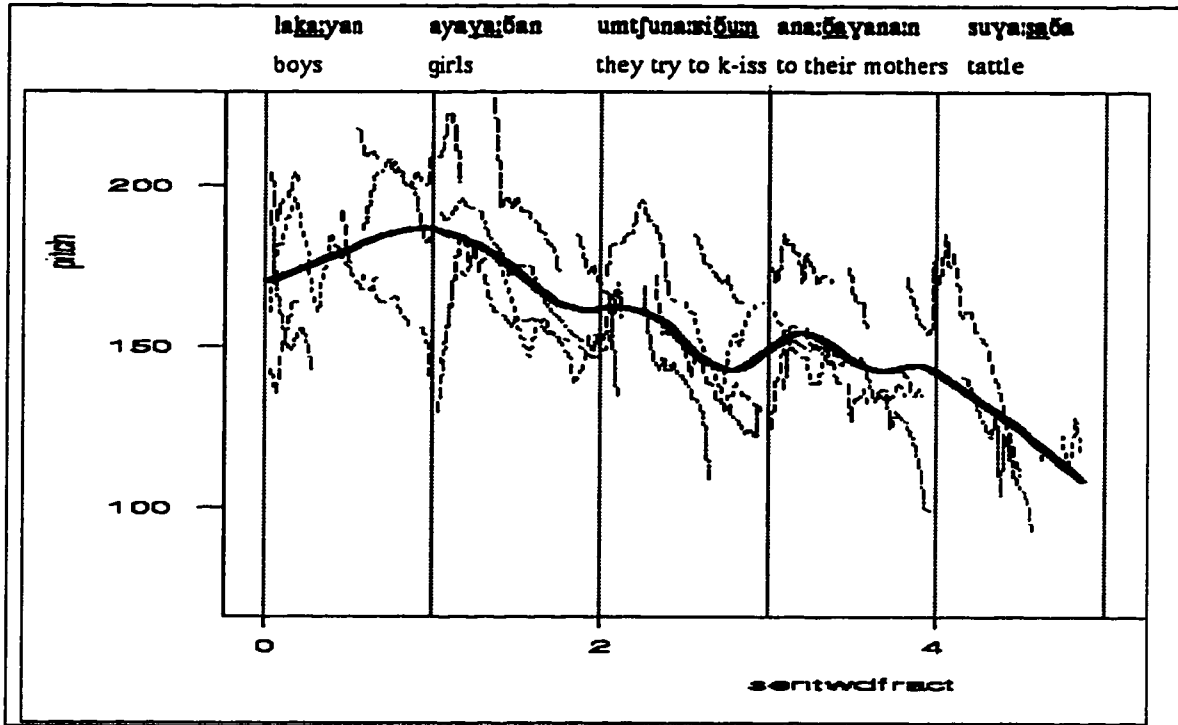


Figure 40: Smoothing of seven speakers' response to the stimulus: "If boys try to kiss girls, tell their mothers." The clause boundary is between the third and fourth words.

In Figure 41 the clause boundary is again between the third and fourth words and is visible as a low trough, but in this smoothing the clause-boundary trough appears earlier in the clause-final word than it does in Figure 40. The peak of the clause-final word is higher than the peak of the following clause-initial word. In Figure 41 the first three words of the transcription are too long to line up well with the first three words in the graph.

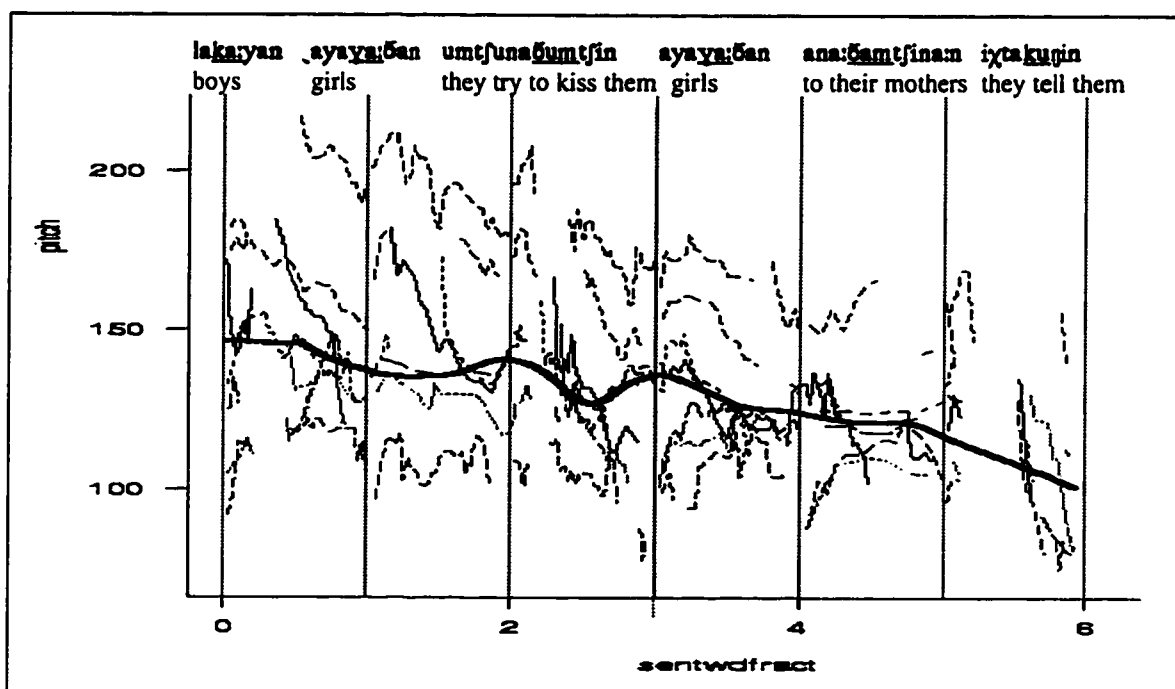


Figure 41: Smoothing of seven speakers' responses to the stimulus: "If boys try to kiss, girls tell their mothers." The clause boundary is between the third and fourth words.

Figure 42 is a smoothing of two responses by one speaker to the same stimulus. Here the major trough is at the clause boundary which occurs between the second and third words. But here the peak of the second word is lower, not higher, than the peak of the third word. For this speaker, in this sentence, declination appears to be reset at the beginning of the second clause.

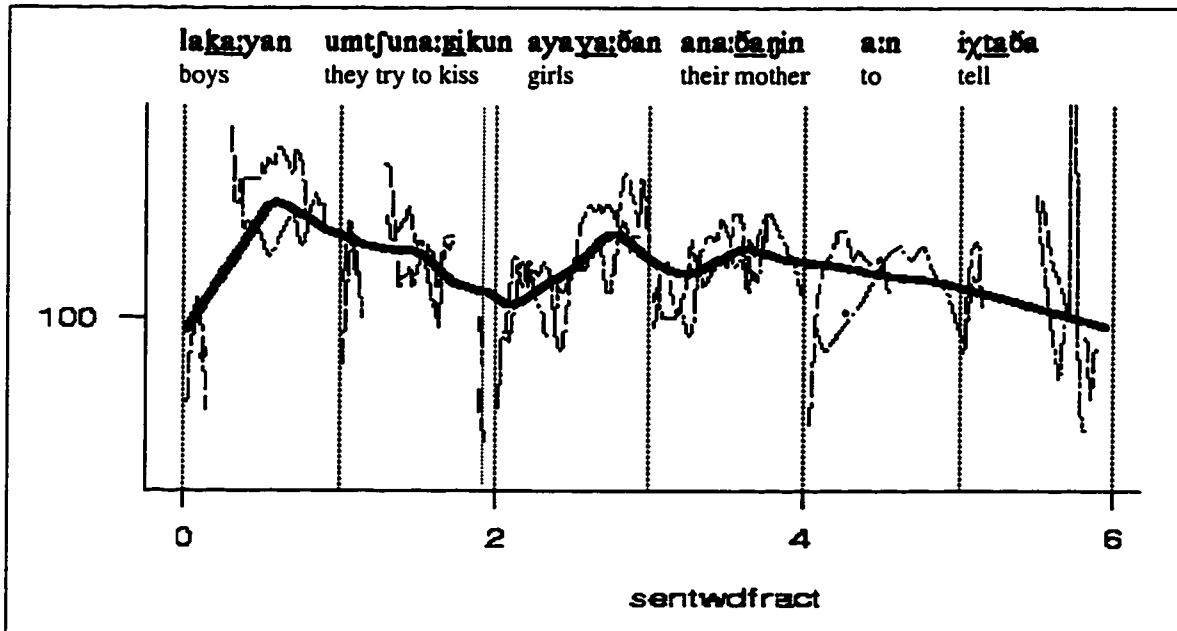


Figure 42: Smoothing of AK's two responses to the stimulus: "If boys try to kiss, girls tell their mothers." The clause boundary is between the second and third words.

Discussion of clause boundary analyses: The smoothing of individual words by word type in the last column in Figure 29 shows a contrast between clause-final and sentence-final words as well as between clause-final and medial words. These contour contrasts are the expected result if there is a clause-final high tone marking. If all words are marked with phonological phrase boundary tones H L and clause-final words have an additional H% we would expect to see the rise at the end of the clause-final words that we do see in Figure 29.

However, when these results are broken down by individual speaker the support for a H% phonological phrase boundary tone is not as robust. Smoothings from three of the eight speakers, EK, FG, and GR, show a clear rise at the end of clause-final words; pitch traces from an additional two speakers, MM and RM, show that some of their clause-final words end in a rise but not enough to impact their smoothings. Clause-final smoothings and pitch traces end in downslopes for AK and GF. Clause-final smoothings and pitch traces end in rises for BS but so do his medial words.

Intra-speaker smoothings of individual sentences show that the most salient troughs occur at clause boundaries. In the three examples given here, the clause-final rise varies in placement, occurring earliest in the word in Figure 41, slightly later in Figure 40 and there is no rise at all in the clause-final word of Figure 42.

It appears that sometimes speakers end clauses with a final high tone, enough to influence the smoothing of all speakers. But this strategy is not employed by all speakers all the time. Impressions from pitch tracks suggest that pause and duration are also frequent cues for clause boundary and although pause and duration will not be analyzed here, I will assume that they interact with high boundary tone such that speakers have a choice of either cue or of some bundling among them.

Based on the smoothings of all speakers combined, the smoothings of individual speakers, the pitch tracks, and the intra-speaker smoothings of individual sentences, an f0 rise at the end of a sentence-internal clause does seem to be a cue that some speakers use some of the time. To account for this cue in the phonology a high boundary tone, H%, will be added to the tone inventory. The revised inventory then is:

Table 18: Unangan tone inventory for *multi-clause* cascade contour with phonetic implementation, and speaker intent.

Tone	Phonetic implementation	Speaker intention
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is lower than the peak of the previous word in the sentence.	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. This trough is lower than the trough of the previous word in the sentence.	A word is ending.
L%	sentence initially – start the sentence below the first word peak. sentence finally – end the sentence at a pitch lower than the anticipated trough of the final word. Devoice final rhyme (or two.)	A major prosodic boundary is occurring: sentence initially - 'here comes a series of small, related intonation units: sentence finally - 'this ends a series of small, related intonation units.
H%	<i>End the clause-final word in a rise.</i>	<i>A major prosodic boundary is occurring but it's closely related to the following prosodic unit.</i>

The association of accent tones and boundary tones to words in a two clause sentence is illustrated in Figure 43. The pitch track in this figure illustrates the effect of the boundary tones on word shape. Sentence-initial words have a delayed peak. In the first word, **lakayan** the phrase accent H is pushed later into the word to make room for the sentence-initial boundary tone L% which associates with the unstressed first syllable, **la**. The same effect of H delay caused by initial L% is seen in the first word in Figure 22 where phrase accent alignment is illustrated. In the second word in Figure 43, **ayaya:ban**, the H associates with the unstressed first syllable and the L associates with the final unstressed syllable. This is the neutral H L word contour. Mid-sentence clause-final words have a rise at the end. In the clause-final third word, **umtjunayidun**, the citation form penult merges with the antepenult so the surface penult is **na:**. The H in this word associates with the unstressed first syllable, **um**, and the L associates with the stressed penult, **na:**.

The H% clause boundary marker associates with the unstressed final syllable, **ʔu:n**. The fourth word, **ana:ʔayana:n**, has a neutral H L word contour (ignoring the word-initial high spike caused by the pitch tracker reaction to glottalization). Sentence-final words end in a steep drop and usually syllable reduction. In the last word, **suya:səʔa**, the final rhyme is deleted. The H associates with the unstressed first syllable, the L associates with the stressed penult, and the L% associates with the unstressed final syllable. The same effect of L% on word shape is seen in the final word in Figure 22. In the IPA transcript, ] marks the right edge of  $\omega$ /ip and ]] marks the right edge of IP.

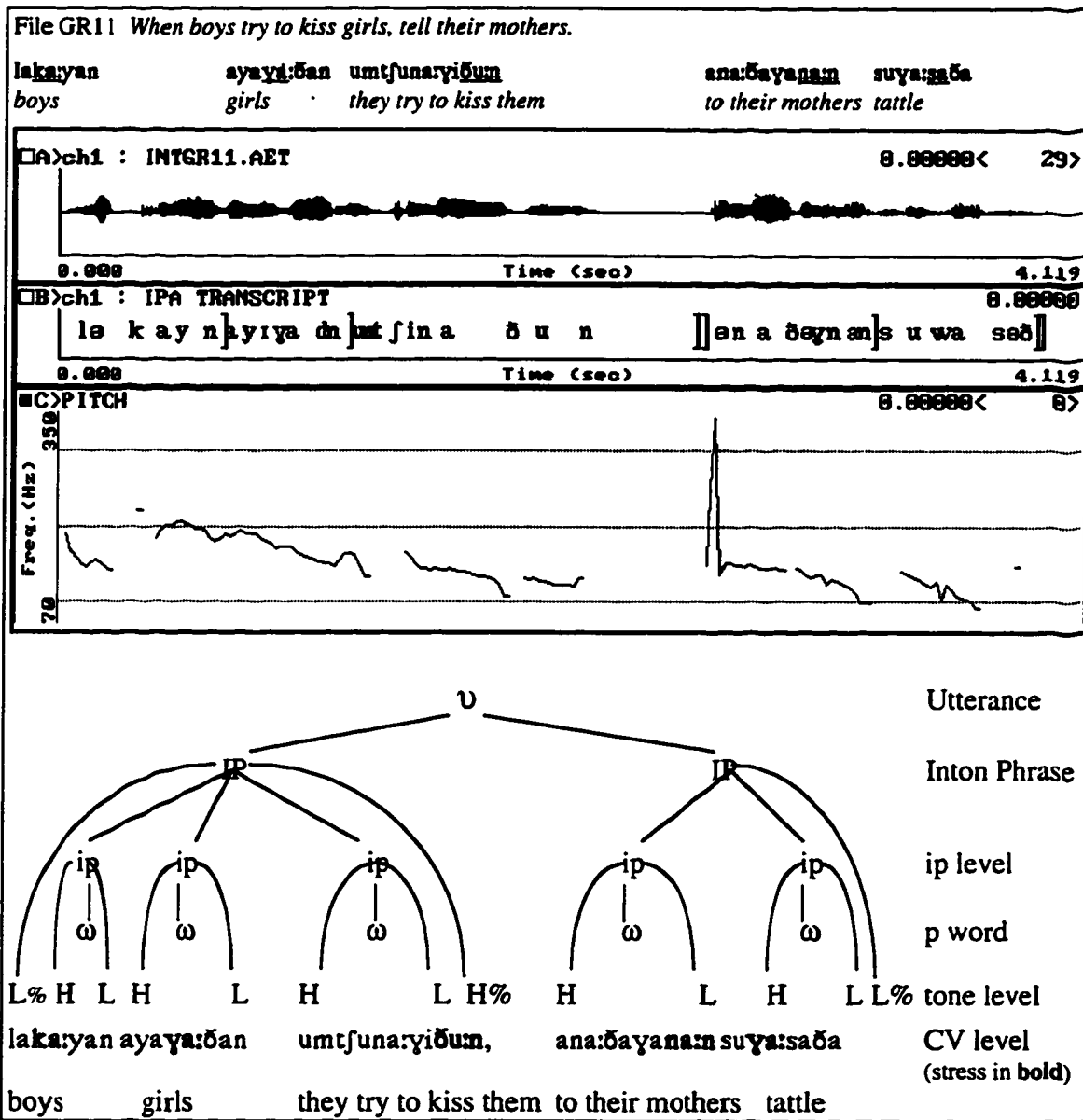


Figure 43: Boundary tone and accent tone association with ip and IP in the prosodic hierarchy.

This section has proposed the addition to the tone inventory of a H% to mark the end of a sentence-internal clause. The next section will summarize the investigation of declarative sentence shape and its effect on word shape.

### 3.3.1.6: Summary of declarative sentence shape analyses

The cascade contour description for Unangan sentences which was inspired by observations of pitch tracks is supported by smoothings of sentences. Batches of sentences were smoothed both by individual speakers and by individual sentences across speakers. These smoothings of sentences show sentence shape to be concatenations of H L (or for two speakers, L H) word contours. Downtrend in sentences is quantified by sentence slope calculations, which establish the presence of declination in the utterance. The combination of concatenated H L word contours and declination results in a sentence shape described herein as a 'cascade contour'. The domain of phrase accent tones, H and L, is the intermediate phrase, which is isomorphic with the prosodic word in Unangan. This phonological construct corresponds to a single content word, sometimes with a clitic attached at the end.

Initial lowering and final lowering are sentence edge effects that add the boundary tone L% to the tone inventory. Both of these edge effects are established by the results of smoothing batches of sentence-initial words and batches of sentence-final words. L% appears at the beginning of the sentence causing the H phrase accent to occur later in the first word than the H in sentence medial words. L% appears again at the end of the sentence where the combination of the final word L and L% results in final lowering, an abrupt drop of pitch at the end of the utterance. Final lowering causes syllable reduction and deletion sentence-finally. The leveling out of word-final contour at the end of a clause mid-sentence adds H% to the tone inventory. Evidence for H% is not as robust as the evidence for L%. The existence of H% is supported by the clause-final word smoothing across all speakers but by only some of the individual speaker smoothings. The domain of the boundary tones L% and H% is the Intonational Phrase.

This section has dealt with the contour of declarative sentences finding them to be concatenations of H L word contours which are affected by declination. The resulting cascade contour is marked at the beginning and end by L% boundary tones and internal-

clause finally by a continuation H%. The next section will compare the declarative contour with yes/no questions to see if there is a contrasting contour for questions.

### 3.3.2: YES/NO QUESTIONS

In many languages yes/no questions typically end with a rise. Investigating this claim, Bolinger (1978: 501) cites evidence from 266 languages in which for yes/no questions there is at least "...a tendency to higher pitch somewhere in the utterance..." the most common manifestation being pitch rise at the end of the question. More current research confirms that some languages do mark yes/no questions with rising final pitch as in English, Hindi (Harnsberger 1994), and Bengali (Hayes and Lahiri 1991). Or languages may mark questions intonationally by higher overall pitch range as in Mandarin Chinese (Shen 1990).

In this section declination, range, and contour contrasts between Unangan declaratives and questions are considered. Yes/no questions are referred to herein simply as questions. Example questions are given in of Table 19 along with their declarative counterparts, samples from speaker OR. Details of translation and morphology are available in the appendix.

Table 19: Yes/no questions with their declarative counterparts, illustrated with responses from speaker OR.

Response from speaker OR	Translation
<b>alisa:ɔax maya:ɔikux</b>	<i>The old man went hunting.</i>
<b>alisa:ɔax maya:ɔixtul i:</b>	<i>Did the old man go hunting?</i>
<b>ana:ɔan ayaya:ɔan kumsiɔtaxtukun</b>	<i>The mothers carried the girls.</i>
<b>ana:ɔan ayaya:ɔan kumsiɔtal i:</b>	<i>Did the mothers carry the girls?</i>
<b>ayaya:ɔan a:ɔxta:ɔakun</b>	<i>The girls laughed.</i>
<b>ayaya:ɔan a:luxa:ɔal i:</b>	<i>Did the girls laugh?</i>
<b>ayaya:ɔan aɟunaqluɟin a:luxta:ɔakun</b>	<i>The big girls laughed.</i>
<b>ayaya:ɔan aɟunaqluɟin a:luxta:ɔaxtul i:</b>	<i>Did the big girls laugh?</i>
<b>a:ɟyuuɔ uyunin a:ɔuqlakun</b>	<i>Cormorants' necks are long.</i>
<b>a:ɟyuuun uyunin a:ɔuqlal i:</b>	<i>Are cormorants' necks long?</i>

### 3.3.2.1: Question declination

Recall that 85% of the elicited declaratives were found to have a negative slope. This section reports slope analyses for questions.

Hypothesis: Yes/no questions are likely to have a positive slope.

It is expected that questions will slope positively or at least less negatively than declaratives since in most languages investigated, questions have a pitch contour with some rise at the end. A sentence-final rise would have the effect of leveling out the negative sentence slope of questions relative to the declarative slope.

Methodology: Slopes for questions were determined using the same word median computation and linear model fit as described for declaratives in §3.3.1.1: Declarative declination. That is, for each sentence a simple linear (least squares) model (Strang 1988: 154, Seber 1977: 44) was fit to the word medians with word number on the abscissa (the independent or predictor variable) and word median pitch on the ordinate (the dependent or outcome variable) using the “lm” function in the software S-PLUS (Mathsoft 1996). A

sign test was performed on the resulting sentence slopes using the “binom.test” function in S-PLUS.

**Results:** The slope for each question is given in Table 20. Here any minus value in the ‘Slope’ column indicates a downward slope for the sentence. The ‘Slope’ number is the average reduction in Hz per word median over the sentence, i.e., in a sentence with slope -8.0 the median word pitch drops an average of 8 Hz from word to word over the sentence. Sentences are organized in the table from least to most number of words per sentence.

This test gave the result that all 53 questions had a negative slope. If sentences were likely to have a positive slope, it would be extremely unlikely that we would see 100% of the 53 questions with negative slope. This result is more robust than the same analysis run on the declaratives where only 85% of the sentences had negative slope. Questions are even more likely than declaratives to have a negative slope, contrary to the hypothesis that questions are likely to exhibit a positive slope.

Table 20: Sentence slope for each elicited question.

File	w/snt*	Slope	File	wd/sn	Slope	File	wd/sn	Slope	File	wd/sn	Slope
ak9a	3	-1	ak2a	4	-8.55	ek5a	4	-15.8	mm 9	4	-16.55
bs2a	3	-8	ak9	4	-4	ek10	4	-17.9	rm5	4	-29.25
bs3	3	-5.75	ak13	4	-11.05	ek10a	4	-7.4	rml4	4	-21.75
bs7	3	-12.5	ak13a	4	-5.2	ek12	4	-17.05	rml4a	4	-13.85
bs7a	3	-8	ak17	4	-9.6	ek12a	4	-16.25	ak6	5	-4.8
ek8	3	-29	bs2	4	-2.5	fg5	4	-17.9	ek1	5	-16.6
e 8a	3	-26.5	bs5	4	-11.65	fg9	4	-14.3	ek2	5	-13.2
fg3	3	-9.5	bs5a	4	-6.7	fg11	4	-13.75	gf2	5	-8.45
gf6	3	-16	bs9	4	-13.45	gf4	4	-18.6	gr4	5	-8.3
gr6	3	-23	bs9a	4	-9.1	gf8	4	-10.5	rml0	5	-15
gr8	3	-11	bs10	4	-14.4	gf10	4	-11.8	rml1	5	-9.8
mm 5	3	-8.25	bs10a	4	-12.55	gr10	4	-15.75	ak5	6	-7.2
rm8	3	-36.5	ek5	4	-20.25	mm 7	4	-21.75	gr2	7	-7
ak2	4	-6.9									

\*Words per sentence.

A comparison of average and median slopes for declaratives vs. questions is given in Table 21. The slope results for questions are steeper than those for declaratives. The comparison of just the three-word declaratives with the corresponding three-word +

particle questions was made to confirm that the difference in the results was not related to number of words per sentence

Table 21: Comparison of median and average slopes in Hz for declaratives and questions.

	Declaratives	Questions
average slope of 3-word declaratives, 3-word+particle questions	-5.8 Hz	-13.4 Hz
median slope of 3-word declaratives, 3-word+particle questions	-4 Hz	-13.8 Hz
average slope of all sentences	-8.7 Hz	-13.2 Hz
median slope of all sentences	-6.6 Hz	-12.5 Hz

Data from Table 20 are plotted by number of words per sentence compared to slope in Figure 44. Data points below the zero line on the Y-axis represent sentences that slope downwards. All of the question sentences (53/53, 100%) are below the zero line.

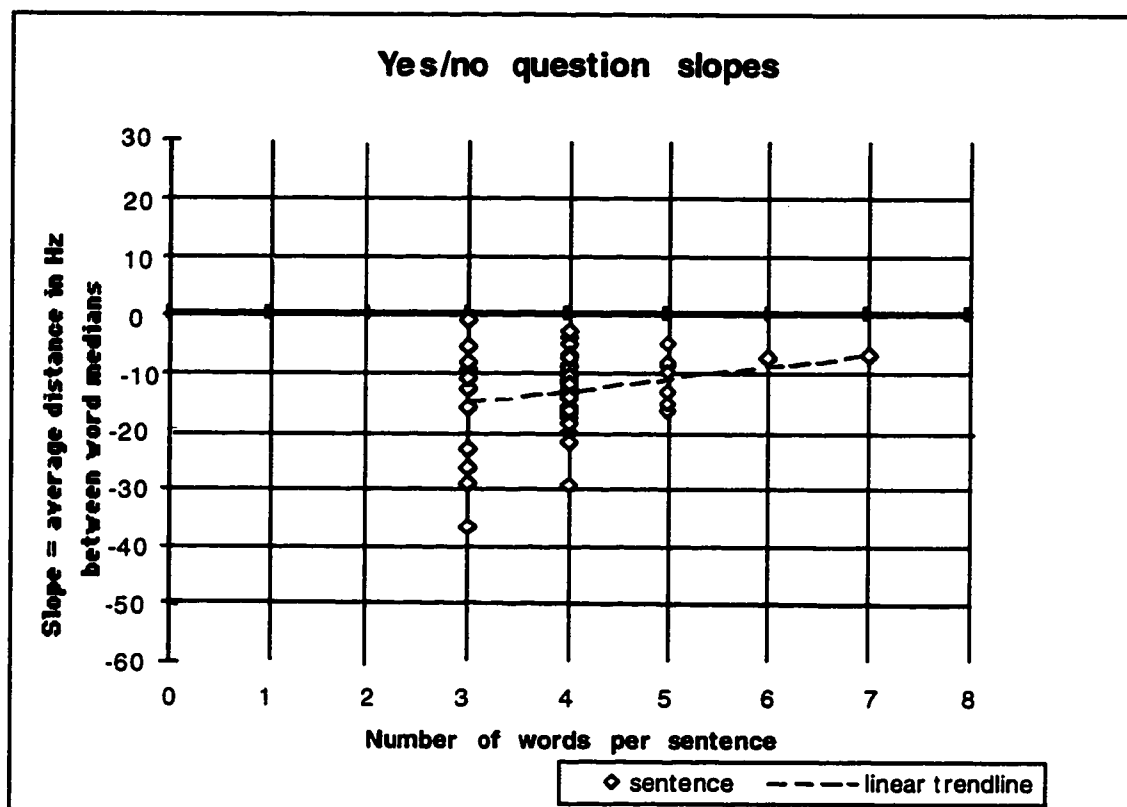


Figure 44: Slope of questions compared to number of words per sentence.

As with declaratives, shorter sentences tend to slope more steeply than longer ones as the trendline indicates. Remember that two-word declaratives become three-word questions with the addition of the question clitic, thus there are no two-word questions plotted. Comparing the plot for question slopes above with the ones for declaratives on page 73, the most notable contrast is the lack of positive sloped sentences in the question plot. There is slightly less range plotted for the slopes of questions than declaratives but there are fewer tokens also.

The plots in Figure 45 and Figure 46 separate the slope results by speaker. As with the declaratives, these plots show variation across speakers with some speakers having less steeply declining sentences than others. E.g., RM and EK have sentences that slope more steeply than MM and FG. As with declaratives, women have more steeply sloped

sentences than men. However, as the plots show, there is very little data for each speaker.

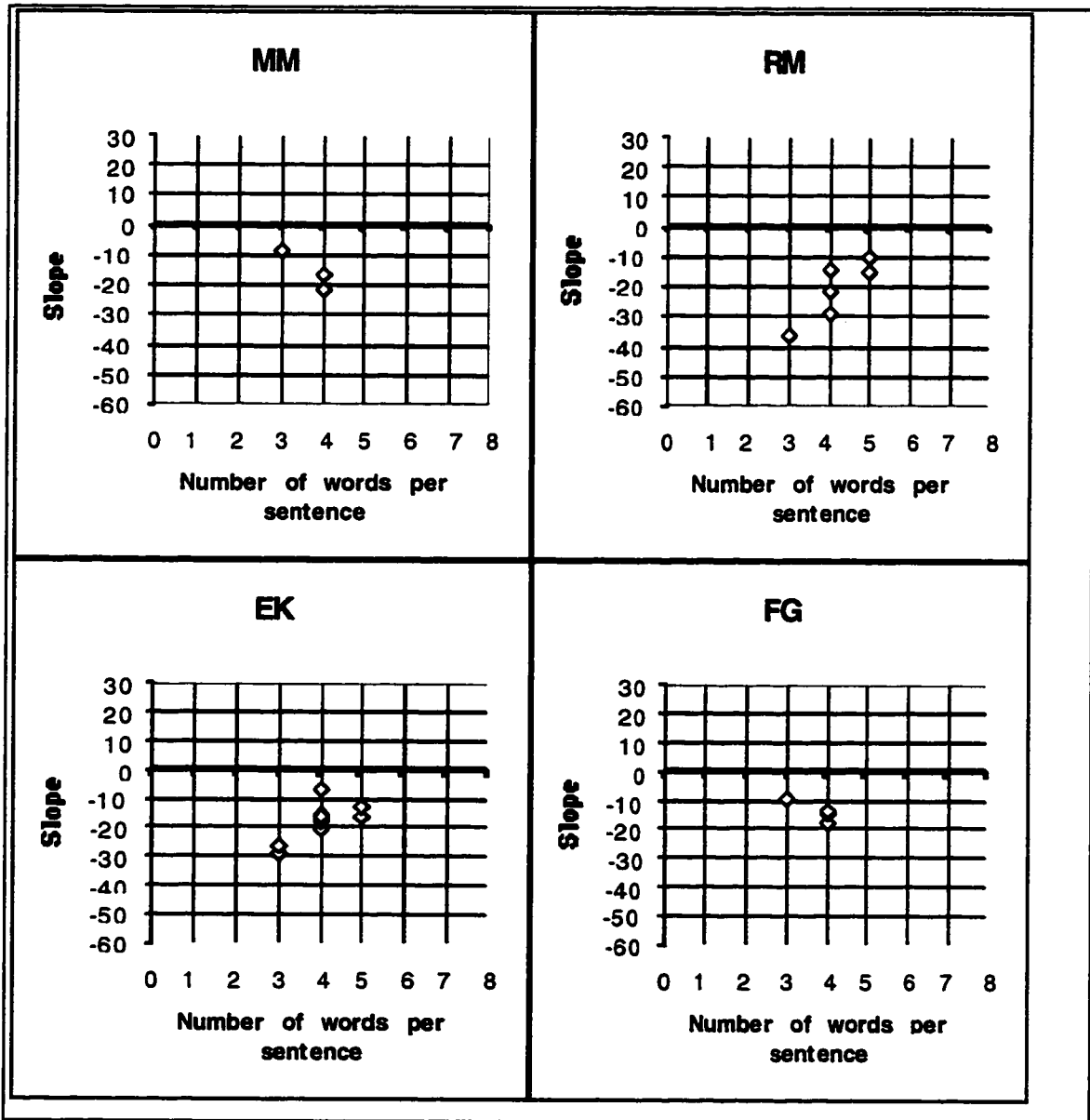


Figure 45: Question slopes for women.

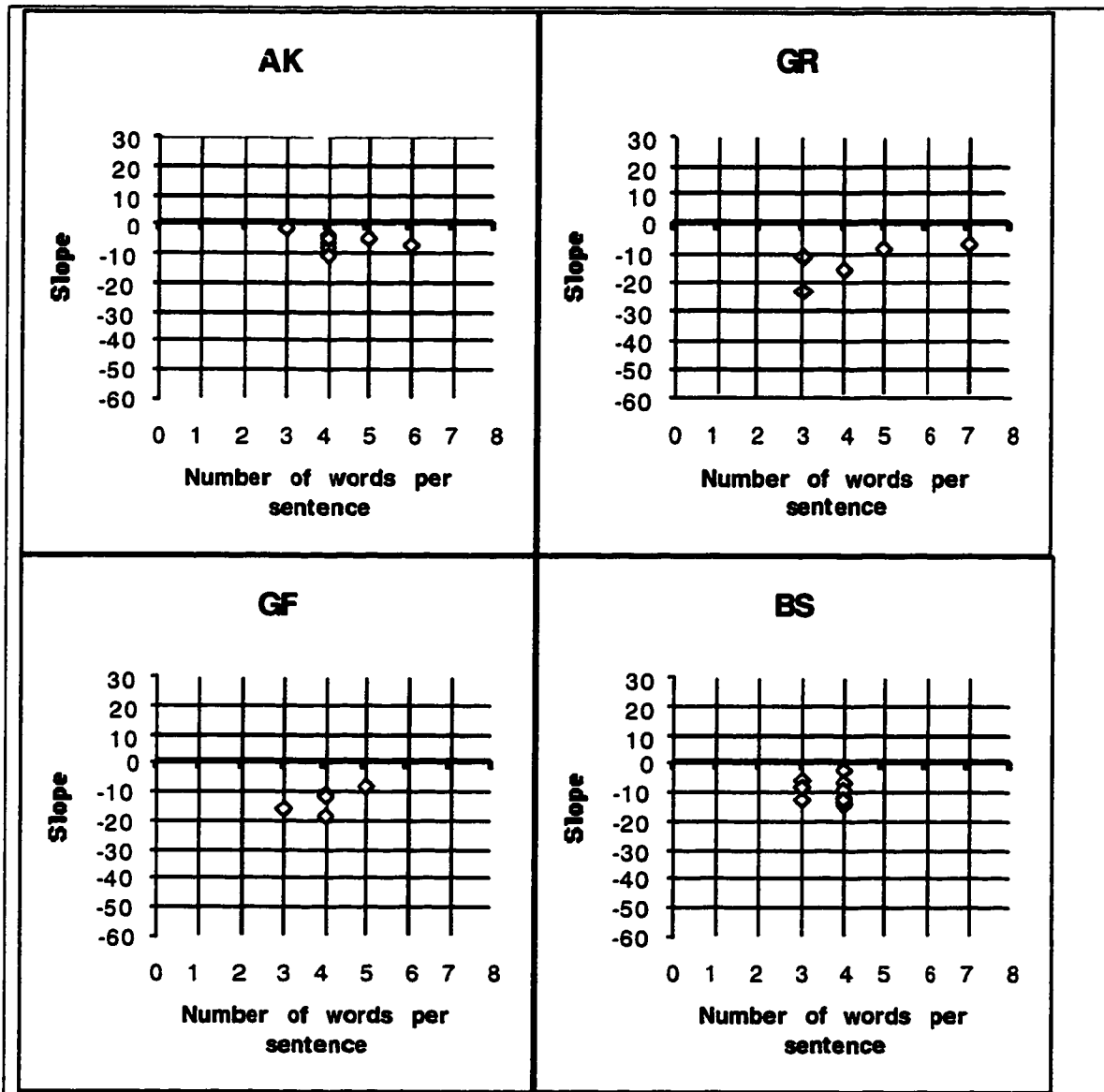


Figure 46: Question slopes for men.

Slope results show a contrast between questions and declaratives but in an unexpected way; whereas it was predicted that questions would slope less steeply than declaratives since they might have a rise at the end, in fact, question slopes decline more steeply than declarative slopes. Since intonation universals predict 'something higher' about questions, but slope calculations for Unangan do not show such a trend, the possibility of a range difference between questions and declaratives was investigated. Perhaps a higher

pitch effect for questions would be evident as a higher range overall for questions than for declaratives.

### 3.3.2.2: Pitch range contrast between questions and declaratives.

To determine whether Unangan contrasts questions and declaratives with a pitch range difference, sentence medians were computed and compared.

Hypothesis: The range of question medians is higher than the range of declarative medians.

If questions are overall higher in pitch than declaratives, the medians should be visibly higher when plotted.

Methodology: In order to determine whether there is a contrast in overall pitch range between declaratives and questions, the median pitch was computed for each sentence in the numerical database and plotted by speaker and sentence type.

Results: In Figure 47, sentence median pitches are plotted as open circles and compared by speaker and sentence type. Sentence median pitches are plotted on the horizontal axis. Pitch data points are 'jittered' on the vertical axis so that the reader can see each of them. Results from female speakers appear in the top half of the figure, those from male speakers in the bottom half.

Median pitches for 172 sentences plotted in Figure 47 show that the range of the medians of questions is within that of declaratives; the center points are in about the same area for each speaker. For each speaker, pitch medians for declaratives are dispersed over a wider range than that of questions but this may be an artifact of the data; there are more declaratives than questions. The speakers with the most questions show the least difference between the range of declaratives and questions.

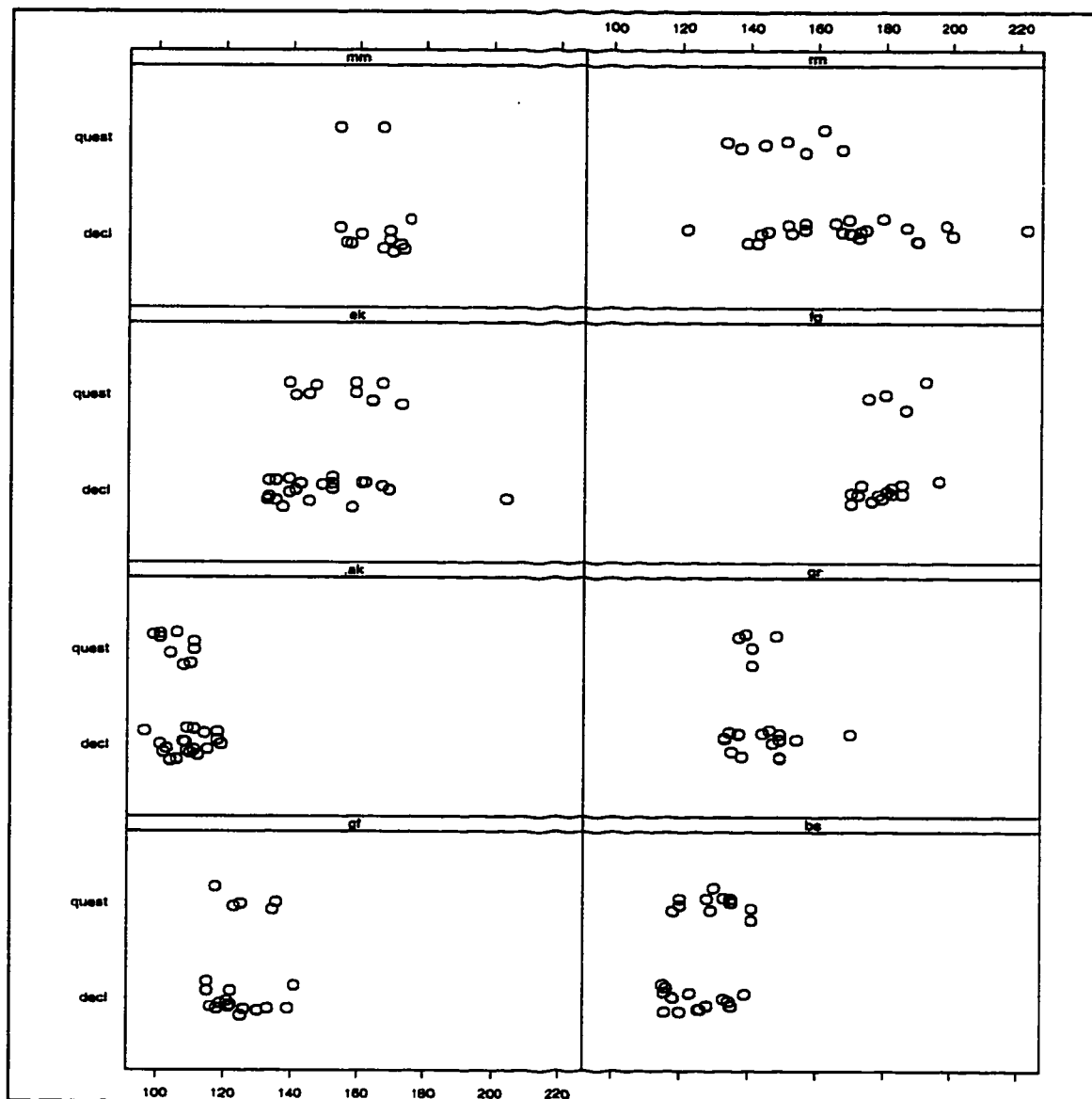


Figure 47: Declarative vs. question median sentence pitch by speaker. Pitch is plotted on the horizontal axis in Hz and 'jittered' vertically to separate data points. Results for women appear in the top half, results for men in the bottom.

Since sentence slope results suggest that questions slope downwards more steeply than declaratives, and sentence median results suggest that there is no difference in overall range between declaratives and questions, the possibility of a difference in sentence-final pitch range was investigated for these two sentence types.

**Hypothesis:** Questions end higher than declaratives.

Based on cross-linguistic evidence we would expect to find that the questions end higher than the declaratives.

**Methodology:** The last three frames (20 ms. increments) of pitch measurements for each sentence were taken from the numerical database. The median and average of the sentence final pitch measurements for each speaker's declaratives and questions were calculated (Excel 98). A two-tailed heteroscedastic t-test (Excel 98) was performed on the raw declarative and question final numbers to determine the probability of significant differences between end-of-sentence pitches of declaratives vs. questions for each speaker.

**Results:** The average and median results of end-of-sentence pitch measurements reported in Table 22 show no significant difference in end-of-sentence pitch between questions and declaratives except for one speaker. For GR, questions end significantly lower than declaratives. For the other seven speakers, there is no significant difference.

Table 22: End-of-sentence pitch calculations for questions and declaratives.

speakers	Declarative final pitch in Hz.		Question final pitch in Hz.		Declaratives vs. Questions
	average	median	average	median	2-tailed heteroscedastic t-test
women MM	132	135	130	136	.6798
RM	95	97	94	93	.6119
EK	113	112	108	111	.0597
FG	135	145	146	145	.1828
men AK	79	79	81	81	.3286
GR	108	109	95	95	.0013
GF	89	92	82	83	.0275
BS	100.8	89.5	100.6	96	.9566

Comparing questions to declaratives, results so far presented suggest: 1. question and declarative sentence slopes contrast, questions having steeper declination; 2. questions are not higher in overall pitch than declaratives; 3. end of sentence pitch does not differ significantly between questions and declaratives for 7 out of 8 speakers. Continuing to look for some intonation feature of questions that is higher than for declaratives, sentence contours were examined.

### 3.3.2.3: Yes/no question contour analysis

Since questions end with a final rise in a number of languages, this feature was examined for Unangan.

**Hypothesis:** Unangan yes/no questions end with a sentence-final rise.

**Methodology:** Compare the smoothed declaratives and questions in Figure 19 and Figure 20.

**Results:** Smoothing results of questions in the right columns of Figure 19 on page 60 and Figure 20 on page 61 do not show that questions end in a rise. All of the smoothed questions end in pitch drops followed by a long, nearly level final word. The appearance of the nearly level final word is misleading, and points out a consideration in this word-duration normalization methodology. The fourth and final word in each of the questions is the clitic, *ii*. This word is very short in duration and often its pitch drops steeply in the real time of actual speech similar to the final lowering described above for declaratives. In the smoothed examples in Figure 19 and Figure 20 the fourth word question clitic appears as a flat, near horizontal line because its duration is stretched due to time normalization to make it as long as each of the other words on the horizontal axis. Cf. Figure 48 in which the top pitch track is a declarative and the bottom its corresponding yes/no question. The question clitic at the end of the bottom pitch track is not normalized and is not a long level tone. The contour of the last word of the declarative, **aḏuqlakun**, and the contour of the last word of the question plus the question clitic, **aḏuqlalix i:**, is similar.

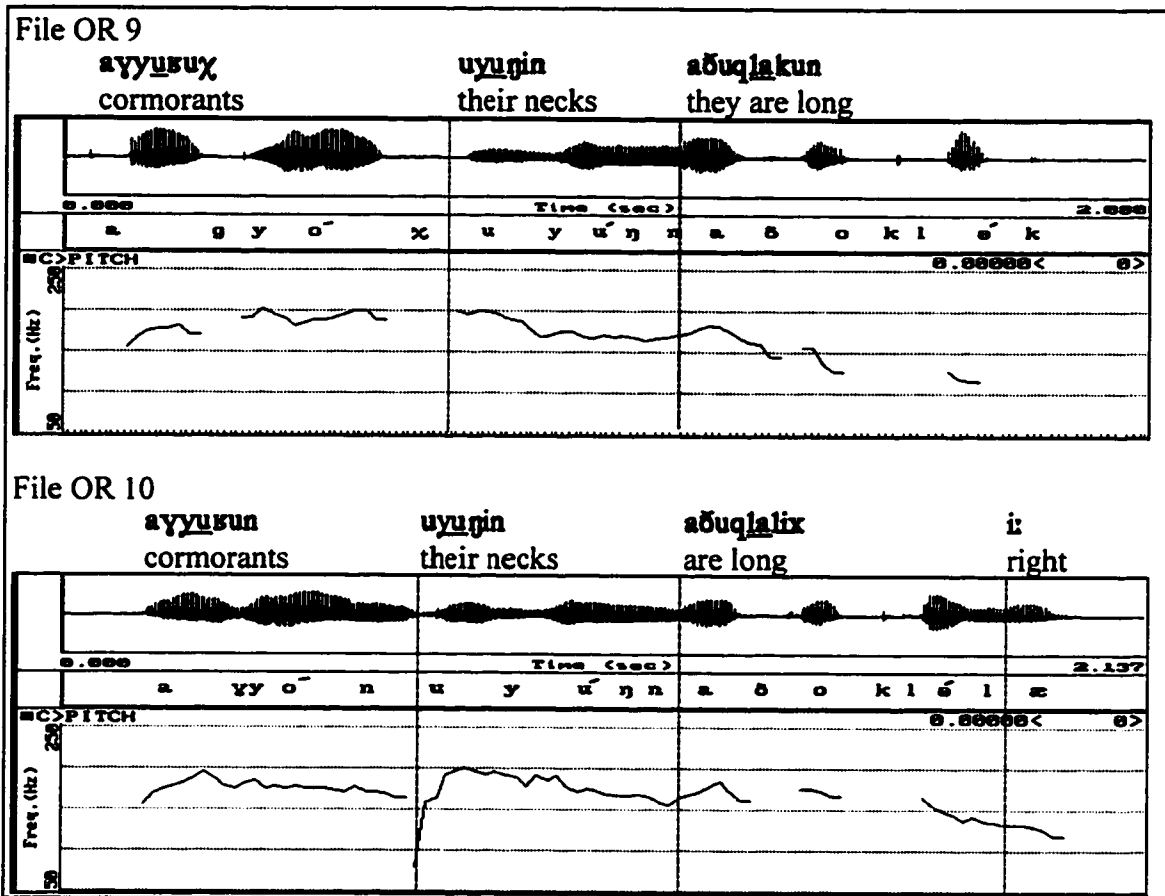


Figure 48: Pitch tracks of a declarative and yes/no question pair. Dotted lines indicate word boundaries.

Not all questions in the elicited responses end with the question particle, *ii*. For the few that do not, the particle appears earlier in the question as in Figure 49 where the question particle occurs after the second word, *ayunaqlajin*. The verb, *aluyta:ɕal*, shows a very slight rise in the final syllable.

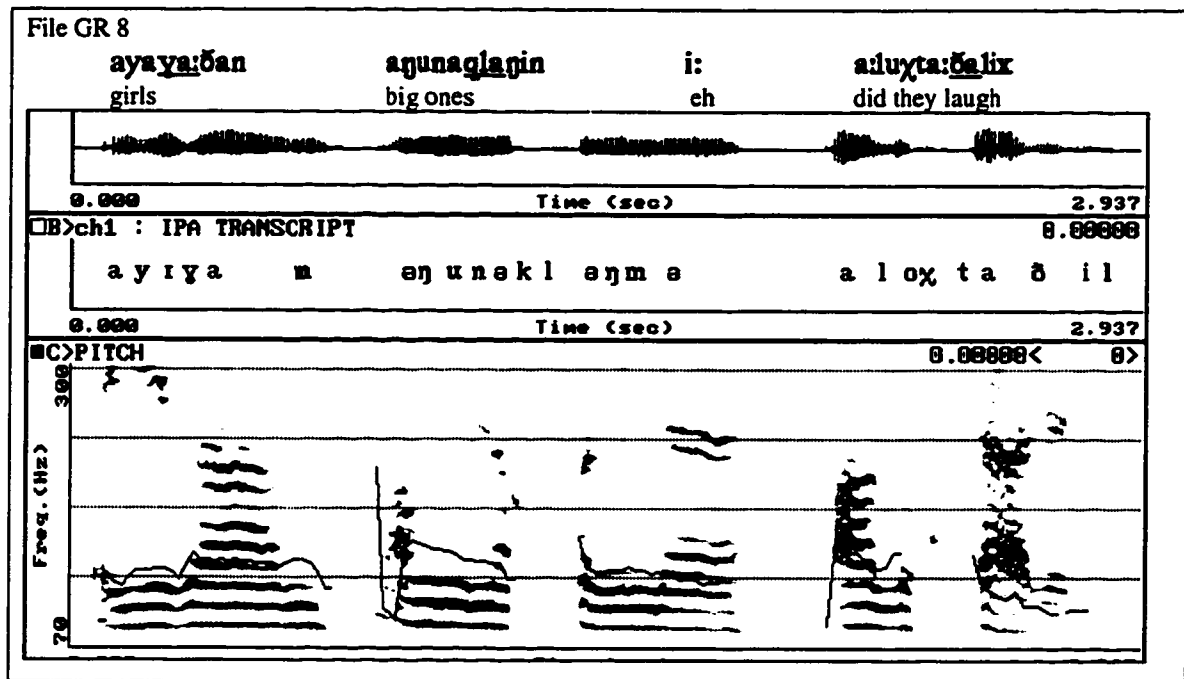


Figure 49: A question in which the question particle appears before the end of the sentence in response to the stimulus, “*Did the big girls laugh?*” In this sentence the question particle follows the second word.

None of the smoothed questions in Figure 19 and Figure 20 end with sentence-final rise. Since neither final-rise shape, nor over all range, nor final pitch range showed intonation contrasts between questions and declaratives and slope results gave an unexpected ‘lower’ effect for questions, further analysis investigated the possibility of some other contour contrast between these types.

**Hypothesis:** The contours of declaratives and yes/no questions are different.

**Methodology:** Compare the smoothed declaratives and questions in Figure 19 and Figure 20, pages 60 and 61.

**Results:** The smoothings by speaker shown in Figure 19, page 60, and Figure 20, page 61, do not show that yes/no interrogatives have intonation contours that clearly pattern differently from declaratives.

Results from the first speaker, RM, suggest that downtrending of troughs is not a feature of yes/no questions: however, other speakers do show downtrending.

The first five speakers show peaks near word beginnings and troughs near word ends for the yes/no questions, much like their declaratives. The sixth speaker, AK, has less dip at the second word boundary for interrogatives than for declaratives, otherwise there is not much contrast between his declaratives and yes/no question contours. Speaker BS has less dip at the beginning of the second word for interrogatives than for declaratives and a noticeable peak at the end of the third word. AK and BS have been classified here as L H word-shape speakers and word shape in their questions seems to bear this out. Speaker GF has a less noticeable trough at the end of the first word of interrogatives; otherwise, both his declaratives and questions can be said to smooth fairly flat.

Figure 19 and Figure 20 suggest an intonational contour difference between declaratives and yes/no questions in the small peak on the final syllable of the final content word of the questions, just before the fourth word question clitic. This is most pronounced for speakers FG, AK, BS, and GF, showing up near the end of the third word, the verb. This small peak appears as a shoulder at the end of GR's verb (note that there is only one question smoothed for GR.) The verb-final peak does not show up in the smoothed question contours for RM, MM or EK but the actual pitch tracks (which appear as dotted lines on the plots in Figure 19 and Figure 20) suggest that such peaks are produced. However, this final syllable peak also appears sometimes in the declaratives. This is most pronounced in the smoothed declarative contour for AK but also appears in the dotted data of the other speakers. This phenomenon is investigated in the following analysis.

**Hypothesis:** In questions, the final syllable of the last content word, the verb, is raised relative to the penultimate syllable.

The expectation is that a contrast will be visible between questions and declaratives.

**Methodology:** Using the time normalization and statistical smoothing techniques described on page 49, smoothings were generated for women, men, and all speakers together, of question verb + particle. For these plots the question particle is time normalized but is displayed in a smaller horizontal scale than the verbs. This was done to mimic the relative duration of the question particle in natural speech.

**Results:** The plots in Figure 50 show a peak at the end of the verb, the first word in each bold curve. They also indicate a rise at the end of each of the question particles. This rise was not visible in the plots by individual speaker shown in Figure 19, page 60, and Figure 20, page 61.

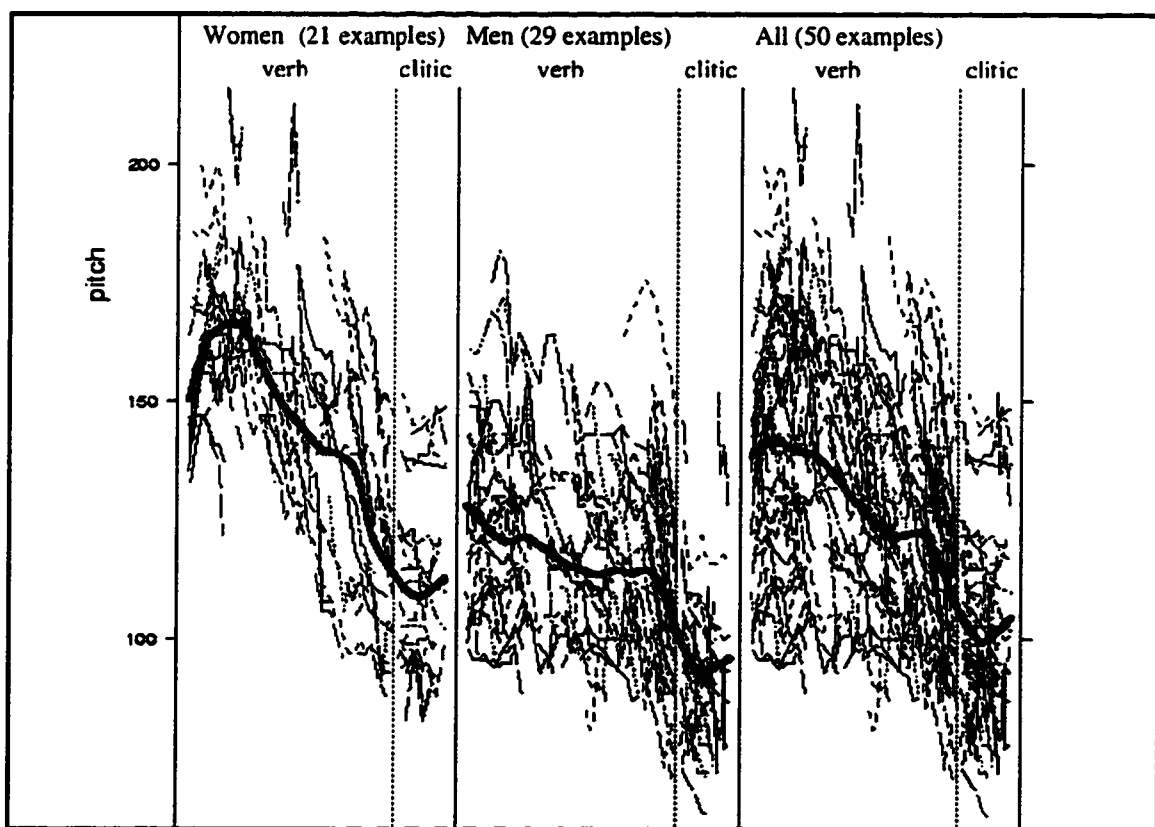


Figure 50: Smoothed results of all question-final verbs + particles for women, men, and the two groups together, 'all'.

All 8 speakers are represented. Solid vertical lines indicate word boundaries. Dashed vertical lines indicate the boundary between the verb and the clitic. Bold curves are the result of smoothing. Dotted and dashed curves are the pitch track data.

A summary of speaker choice in question-final intonation patterns is given in Figure 51. This plot indicates that, whereas speakers may opt for neither peak in the verb nor rise in the particle (labeled 'downslope') and they may also opt to have both peak and rise in the same question, they are more likely to use only one or the other. The results indicate that men are more likely to use peaks than rises while women are about equally likely to use either. However this apparent contrast between men and women may be because twice as many women as men are represented in the data.

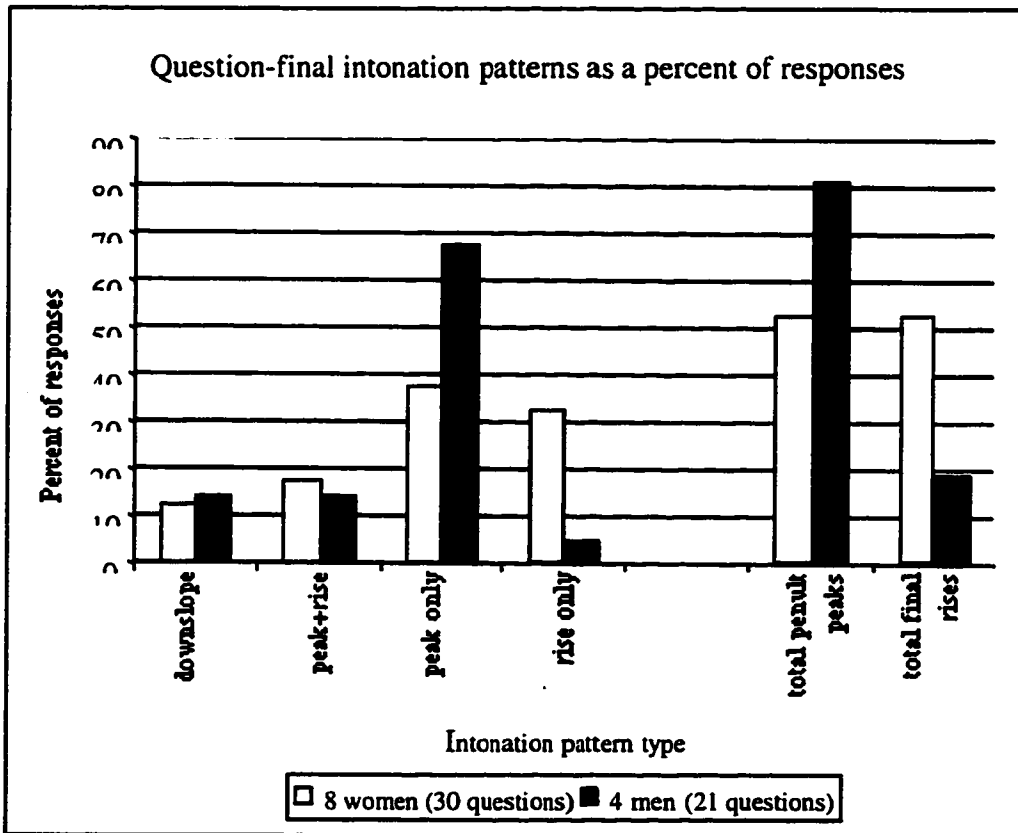


Figure 51: Question-final contour patterns of women vs. men.

Since it was determined that there is an interaction between devoicing and intonation sentence-finally (verb-finally) for declaratives, this interaction was investigated for questions also. Pitch tracks suggest that there is no voiceless syllable at the ends of questions because the question clitic, *ii*, is voiced. Cf. the pitch tracks in Figure 48 and other question sentences in APPENDIX: Pitch tracks and translations of elicited

sentences and texts for each speaker. To determine whether there is an interaction between sentence-final syllable devoicing and the small verb-final peak reported above, the following analysis was performed.

**Hypothesis:** There is no devoicing/deletion of syllables sentence-finally in questions.

**Methodology:** Devoicing/deletion was tabulated from the printouts of pitch tracks for all questions in the elicited data of all 12 speakers. Devoicing was judged to occur if there was no voicing but duration was allocated to the syllable and/or there was some amplitude evidence in the wave form. Deletion was judged to occur if there was no duration or amplitude evidence in the waveform. Results were tabulated by hand.

**Results:** 0/59, 0%, of questions were devoiced sentence-finally, a result that robustly supports the hypothesis. Compare this with the result that 85% of declaratives were devoiced sentence-finally; however, there is complete deletion of the final rhyme of the verb in 68% of the questions. Remember though, that in questions the verb is not the final element, the question clitic is. Compare the orthography with the IPA transcription in Figure 48. In the declarative the final rhyme of the last word, ( . separates syllables) **a.du.qla.kun**, is deleted and the remaining final syllable is reanalyzed to generate **a.du.qlak**. In the question the final rhyme of the verb **a.du.qla.lix** is deleted and the word is reanalyzed to generate **a.du.qlal** to which the **i:** is cliticized. The verb-final rhyme deletion in questions includes deletion of a word-final voiceless consonant. Deletion of this voiceless segment allows the remaining final syllable of the verb to connect to the following question clitic, **i:**, with continuous voicing in the pitch contour. There is no devoicing of syllables in questions like we find in declaratives.

In cases where the final rhyme is not deleted the word-final voiceless consonant is voiced. That is, /-lix / becomes [-lɔy] as in the verb **aɔuqlalix** in Figure 52. This voicing from /x/ to [ɣ] in questions is noted by Oshima (1994:152).

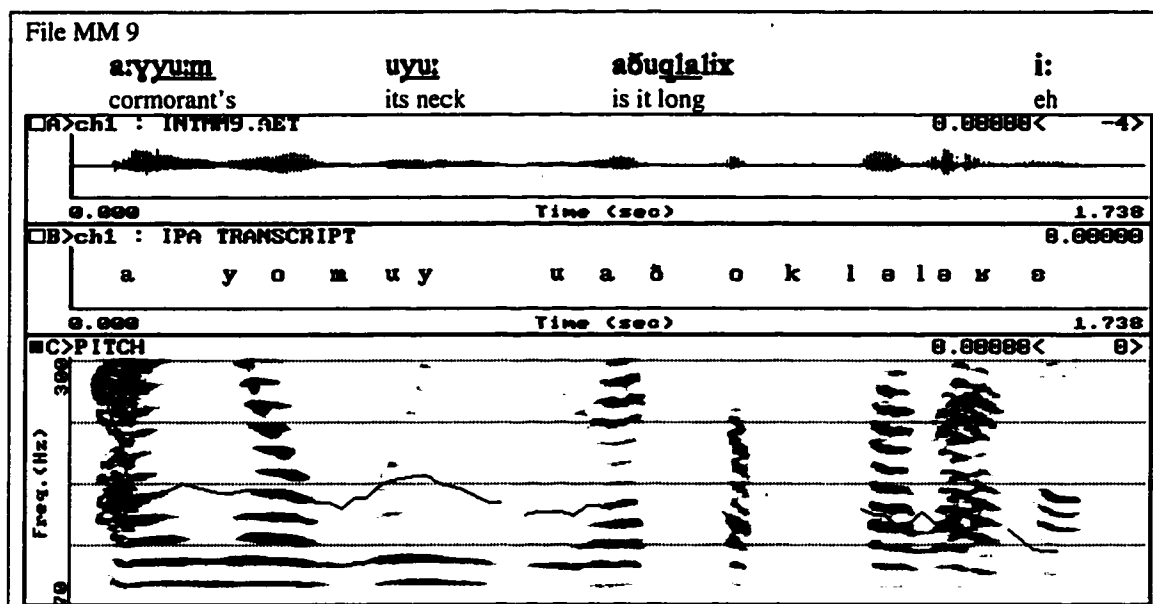


Figure 52: A question in which the final rhyme of the verb is not deleted, in response to the stimulus “*Are cormorants’ necks long?*”

The single example in the data of a question verb that ends in a voiceless consonant occurs in file EF8, her second production of this sentence. Speaker EF is literate in Unangan so knows that this morpheme is spelled with a voiceless final consonant and in this production may have been influenced by the spelling.

The amount of rhyme deletion as well as the choice of question morphology varies by speaker. The yes/no question verb-final syllable is either *-naχ* (*-na-* past *-χ* singular) or *-lix* (conjunctive). Both are followed by the question clitic, *i:*. Morphological variation and rhyme deletion is summarized in Table 23.

Table 23: Speaker variation in deleting question-final syllable structure.

Speaker (m=male)	Number of rhymes deleted/total questions/percent of questions with rhyme deletion.	Verb-final morphology with deleted portion in parentheses.
GRm	5/5 100%	-l(ix) <i>These speakers always delete.</i>
OR	5/5 100%	-l(ix)
EK	6/6 100%	-l(ix)
LM	3/3 100%	-l(ix)
BSm	10/10 100%	-l(ix)
GFm	3/5 60%	-n(aɣ), -l(ix) <i>These speakers sometimes delete.</i>
FG	3/5 60%	-naɣ -l(ix)
ES	4/5 80%	-naɣ/l, -n(aɣ), -l(ix)
RM	2/5 40%	-naɣ, -niin, -l(ix)
AKm	1/7 14%	-naɣ...-l(ix)
MM	1/4 25%	-n(aɣ), naɣ, -lix
EF	0/3 0%	no deletion at all <i>This speaker never deletes.</i>
total	43/63 68%	

We have seen that both questions and declaratives have verb-final rhyme loss. With declaratives, rhyme loss is most often implemented as rhyme devoicing, questions most often as rhyme deletion followed by the voiced clitic. The result is a voicing contrast sentence finally; declarative sentence-final processes weaken voicing while question sentence-final processes strengthen voicing. Since voicing produces intonation this means that, relative to each other, declaratives have weakened sentence-final intonation and questions have strengthened sentence-final intonation.

#### 3.3.2.4: Summary of question intonation analyses

In the analysis of declination we found that questions are more likely to have a negative slope than declaratives. This is an unexpected result. We might expect question slopes to be less negative or even to be positive, sloping upwards, since the literature reports that questions usually have some feature of higher pitch than declaratives. But results of slope calculations show that questions, with an average drop of -12 Hz from word to

word, slope downwards more steeply than declaratives, with an average pitch drop of -8 Hz from word to word.

Range results comparing questions to declaratives by sentence median pitch show no difference between questions and declaratives. This analysis did not support a claim that questions are overall higher than declaratives.

Neither did sentence-final pitch range results show a difference between the final pitch of questions and declaratives. T-test results comparing the final pitches of questions vs. declaratives for all speakers showed no significant difference between the two sentence types.

In comparing question to declarative contours, the hypothesis that Unangan question intonation rises at the end was not supported by results of individual speaker smoothings (32 sentences total). These showed pitch drops or level intonation for questions. This finding is reinforced by preliminary work on the intonation contour of interrogatives in a related language, CAY (Woodbury 1994: C-13), which found no contrast between the contours of questions and declaratives. However, a further examination of the whole contours of Unangan 3-word declaratives vs. their 4-word question counterparts suggested a difference between the two types might be found in a peak on the final syllable of the verb in questions. The result of smoothing the last two words of all questions (52 sentences total) did show a peak on the last syllable of the verb. In addition, this analysis showed a final rise in the question clitic, perhaps because more sentences were represented in this analysis than in the individual speaker smoothings of 4-word questions.

A comparison of sentence-final devoicing/deletion between questions vs. declaratives showed that declaratives are more likely to be devoiced sentence finally, 85% of the time, vs. questions 0% of the time. But questions are more likely to have verb-final rhyme deletion. However, since the verb is not the final word of questions, this deletion, which includes a voiceless fricative, /x/, has the effect of strengthening the voicing and hence

intonation signal, relative to declaratives. In all but one case where the verb-final rhyme is not deleted, the fricative /x/ is voiced. Voicing an otherwise voiceless consonant between two vowels is a common phonological phenomenon in the world's languages. Near the ends of Unangan questions such voicing serves to enhance the voiced component.

The question analyses together suggested an interaction among sentence final pitch range, devoicing/deletion, and the sentence penultimate syllable peak (the final voiced syllable of the verb that is evident on the questions in Figure 20 and discussed in the question contour analyses). This peak is most evident for the men. It is also visible in FG's question smoothing in Figure 19. However, this pitch adjustment effect is not restricted to questions. We see the same penult pitch bump in the declaratives of AK. BS also produces these declarative penult peaks though they are not visible in the smoothing in Figure 20. Cf. files BS1, BS4, BS6, BS8 which do show such peaks. Marsh (1956) and Oshima (1994) both noted this penult peak (as discussed in §1.2.2.3: Stress) but they likely analyzed the peak as word stress on all words. I analyze it as part of the sentence contour.

I propose that the pitch peak found near the end of sentences is a means of adjusting pitch range as the speaker reaches the pitch range base point. I will call this process 'sentence-penult syllable peak' since it occurs on the ultima of the verb in the question, which is then followed by the single-syllable question clitic. In declaratives when this peak occurs it is on the penult of the verb. This peak formation to adjust pitch range is the voiced alternative to the sentence-final syllable devoicing/deletion process discussed in §3.3.1.4: Final lowering. The peak insertion process allows speakers to voice the sentence-final syllable. The devoicing/deletion process emphasizes sentence-final voicelessness.

The most robust intonation contrast found here between declaratives and questions is that intonation ends before the sentence does for declaratives but for questions intonation continues to the end of the sentence. At the end of a declarative sentence listeners

frequently hear a voiceless fricative; speakers get to their base point on the penultimate syllable and finish the last syllable in a whisper or delete its rhyme entirely. Declaratives are marked by final syllable reduction on a scale from: 1. lowering the amplitude relative to previous syllables, as AK typically does, to 2. voicelessness, the whispered final syllable, to 3. deletion of the final rhyme and reanalysis of the new final syllable to end with a voiceless coda. Even when the final syllable of a declarative verb ends with a voiced segment as in **-kun (-ku- pres, -n p)** devoicing the final rhyme creates a voiceless fricative.

Verb-final processes in declaratives achieve sentence-final voicelessness. These processes are: most commonly, 1. devoice verb-final rhyme (which is also sentence-final) since the pitch trajectory of the word takes the speaker below pitch range before the end of the word. The resulting contour is a steep drop which ends in a voiceless syllable. Alternately, 2. raise the penult syllable to adjust the pitch range so that the last syllable can be voiced. The resulting contour is a steep drop with a small peak on the penult before a drop on the final syllable.

In contrast, at the end of yes/no questions, listeners always hear a voiced syllable; speakers still have enough pitch range to end yes/no questions with intonation. If they are about to run out of range due to the pitch trajectory of the verb, they make an adjustment by raising the last syllable of the verb relative to its previous syllable.

Verb-final processes in yes/no questions achieve sentence-final voicing. These processes are: most commonly, 1. delete the verb-final voiceless consonant with its preceding vowel or voice the verb-final voiceless consonant. Raise the final syllable of the verb to adjust the pitch range so that the clitic can be voiced. The resulting contour is a steep drop with a small peak near the end before a level or rising final question clitic. Alternately, 2. when there is no pitch adjustment necessary, do not form a pitch peak on the final syllable of the verb. The resulting contour is a steep drop which ends in a short level pitch or slight rise.

We see a clear contrast between the most common contour types which are numbered 1 above for the declarative and question sentence-final processes. We also see that the alternate contour 2 for declaratives looks much like contour 1 for questions. And the alternate contour 2 for questions looks much like 1 for declaratives in the pitch tracks, but in speech we hear the voiceless final syllable of the declaratives which does not show up in the pitch track.

Figure 53 is a diagram of the contrast between declarative and yes/no question contours. Here the solid curves represent voicing. The broken line at the end of the declarative verb represents voicelessness. The ‘penult bump’ is not represented here. Though more likely to appear on questions, it occurs on declaratives as well but is not mandatory for either.

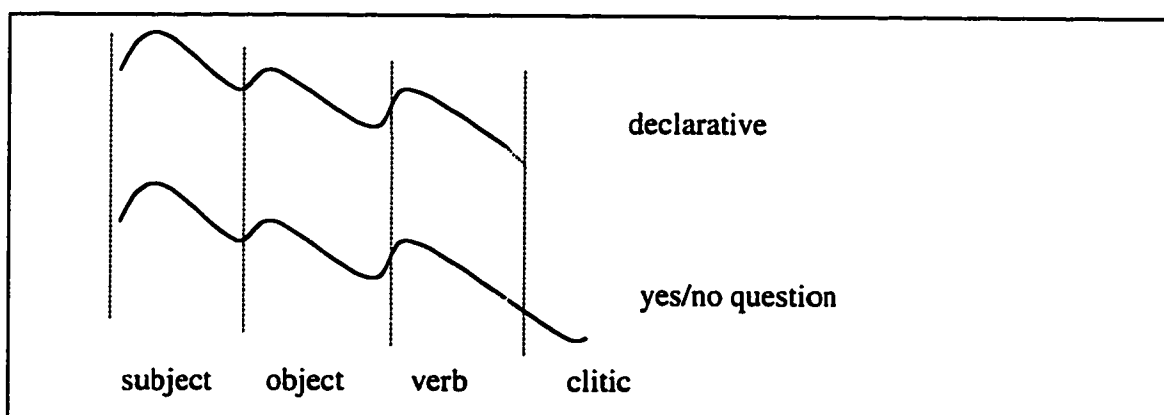


Figure 53: Representation of the difference between declarative and question intonation contours.

The solid curves represent voicing. The broken line at the end of the declarative verb represents voicelessness. Vertical lines represent word boundaries.

Surveying yes/no question intonation in 41 languages, Bolinger notes only Itonama, Papago, Quechua, and Zuni for which neither terminal rise nor a nebulously defined, “...tendency to higher pitch somewhere in the utterance...” are reported (Bolinger 1978: 500-1). I would not include Unangan among the Itonama type languages, even though most Unangan yes/no questions end in the kind of final fall exemplified in Figure 48. The

'higher pitch' in Unangan questions is found in the robust final voicing and a tendency towards a small sentence-penultimate syllable peak and/or a small final rise.

To account for the voicing at the end of yes/no questions, I propose the standard use of H% question-finally. The rise at the end of the smoothing result in Figure 50 of all question-final verbs + clitics suggests that H% may be used at the end of questions. However, the question-final rise result is not robust. The plots of individual speakers in Figure 19 and Figure 20 do not show a rise at the ends of questions. However, robust devoicing/deletion results show voicing is a final feature of questions. I characterize (question-final) voiced syllables as higher than (declarative-final) voiceless syllables (the result of pitch targets lower than the speaker's pitch range), Sentence-final H% is manifested in Unangan as voicing, an unusual realization of H%. Sometimes H% is also manifested in a small peak near the sentence end and sometimes a small rise at the end. The addition of the phonetic implementation of H% for questions is given in Table 24.

Table 24: Unangan tone inventory for multi-clause cascade contour declaratives and *questions* with phonetic implementation and speaker intent.

Tone	Phonetic implementation	Speaker intention
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is lower than the peak of the previous word in the sentence.	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. This trough is lower than the trough of the previous word in the sentence.	A word is ending.
L%	Sentence initially – start the sentence below the first word peak. Sentence finally – end the sentence at a pitch lower than the anticipated trough of the final word. Devoice final rhyme (or two.)	A major prosodic boundary is occurring: Sentence initially - 'here comes a series of small, related intonation units.' Sentence finally - 'this ends a series of small, related intonation units.'
H%	End the clause-final word in a rise. And/or <i>Continue voicing to the end of the clause.</i> <i>Make the penult syllable higher than the antepenult.</i>	A major prosodic boundary is occurring but it's closely related to the following prosodic unit.

The association of H% question-finally is illustrated in Figure 54. In this sentence the J% is manifested as both a peak on the last realized syllable in the verb **kumsix<sup>ta</sup>1(ix)** and a rise on the question particle, **i:**.

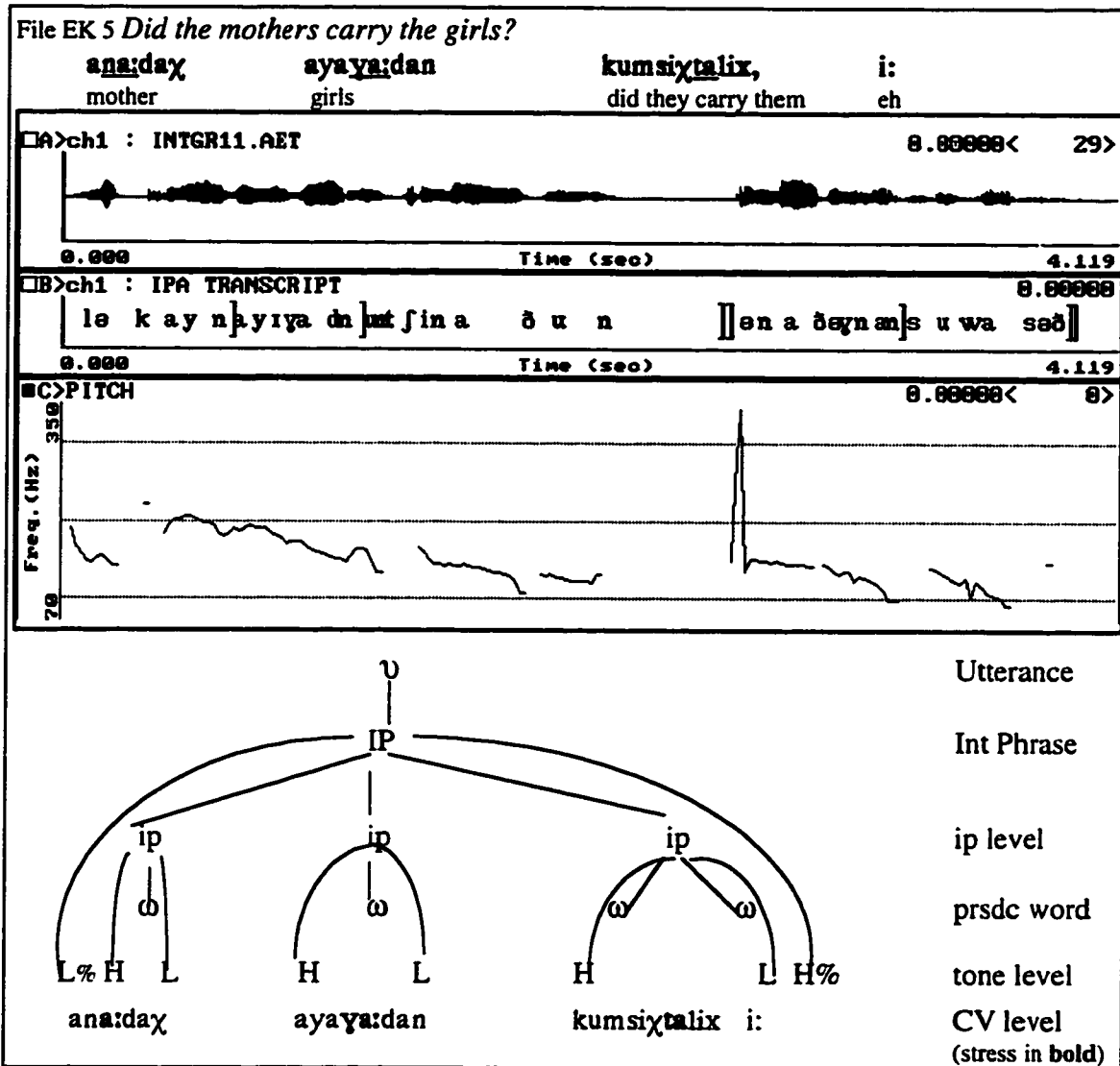


Figure 54: Association of H% at the end of yes/no questions in the prosodic hierarchy.

So far the contours of words and sentences have been examined. The next section examines contours larger than the prosodic word/ip but smaller than the clause/IP.

### 3.4: PATTERNS ABOVE THE WORD AND BELOW THE SENTENCE

Not all sentences in the data base conform to the cascade contour. In many sentences, although the H L contour holds for each word, there are some words in which the peak is

higher in pitch than the peak of the preceding word, contrary to the cascade description in which each succeeding word is slightly lower than the one before it. These sentence contour anomalies will be examined in this section.

#### 3.4.1: NOUN PHRASE

Preliminary observation of the pitch tracks suggested that many of these cascade anomalies involve words with the relativizing morphology in noun phrase constructions described in §1.2.3: Morphology and syntax. An example of such a noun phrase occurs in Figure 55 in the genitive construction **tayusux slutu:** (**tayusu-**(man) **-χ**(generic REL) **slutu-**(aged) **-u**(REF)). In the pitch track the second word, **slutu:**, has a higher peak than the first, **tayusux**. The high point of **tayusux** is 175 Hz while the high point of **slutu:** is 189 Hz. Arrows in Figure 55 mark the measured Hz. In **slutu:** there is a fall from a high point after the **t**, a frequent pitch trace following the burst of a voiceless stop. This characteristic sharp drop following a voiceless stop can also be observed after the initial **q** of the fourth word **qawana:yił**. The brief high point is not audible so is not measured as the high point of the word.

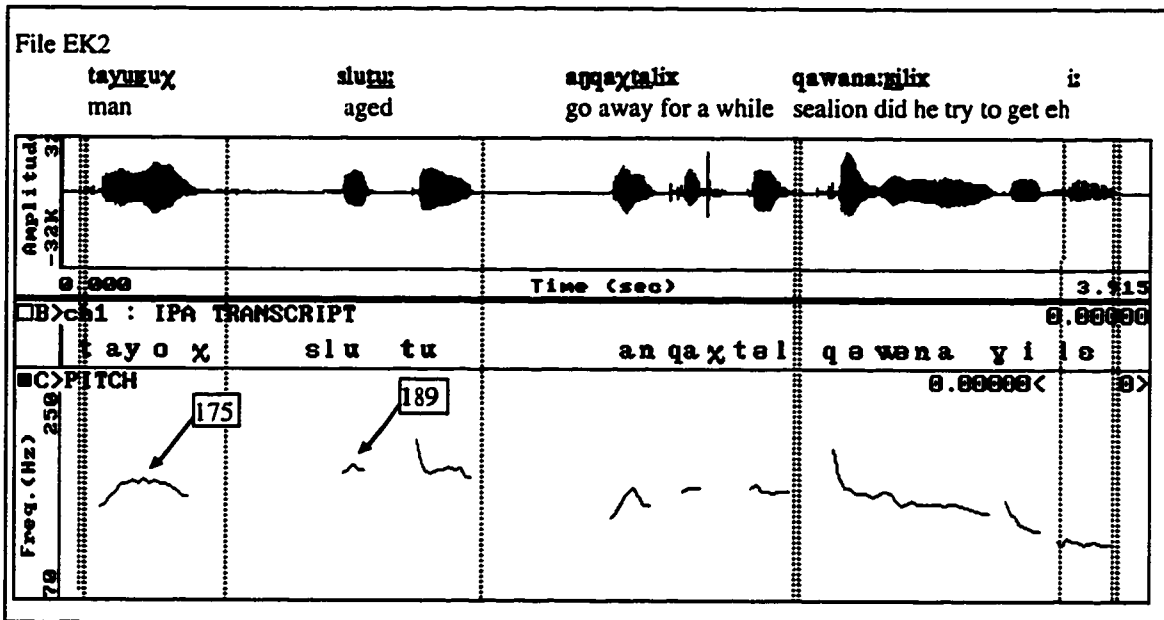


Figure 55: Pitch track of the response to the English stimulus, “*Did old men hunt sea mammals?*” illustrating an exception to the cascade contour.

Association between intonation and NP constituency has been reported in several unrelated languages. Harnsberger (1994) reports results for Hindi indicating that in a NP a possessor gets an expected LH contour while the possessed noun may have this typical LH ‘weakly realized’, that is, with less prominent pitch excursions or smaller range. The degree of weakening is related to the degree of syntactic embeddedness. Harnsberger suggests that constituents following possessive particles also show weak realization.

Leben and Ahoua (1997) compare upsweep, a mapping of L H contour to certain syntactic constituents, in Baule, a tone language of the Bia language family spoken in the Ivory Coast, West Africa. Environments for a single upsweep of L H tones are simple noun, compound noun, proper noun, noun + adjective, and noun + numeral constructions. Environments for interrupted upsweep, that is, two L H contours (producing two upsweeps) are possessor + possessed and subject + predicate. An example of a single upsweep is the two-word proper name ‘Momlo Amlan’, over which pitch rises continuously from beginning to end. When the same two words, Momlo Amlan, constitute a genitive construction, ‘Momlo’s Amlan’, upsweep happens separately over

each word with a L at the beginning of each word. Pitch contour contrast appears to be the only feature that disambiguates the proper name from the genitive.

For Central Alaskan Yup'ik (CAY) Woodbury 1987 claimed, based on impressionistic observations, that IPs form "...syntactic constituents like possessor and possessum, noun and demonstrative, verb and complement..." and that the IP is the domain for upstepping..." (p 699). Woodbury 1988 concluded that word level phrases (his accentual phrase, or AP) and intonational phrases (IP) each relate to syntax in different ways, possibly independently, AP more directly than IP. Woodbury 1998 investigated the rescaling of pitch in two-word noun-demonstrative or demonstrative-noun phrases finding, contrary to Woodbury 1987 and 1988, that there are no multiword intonational units in CAY. The 1998 report does not include information about how the recorded data was analyzed. Woodbury includes in this report the genitive sequence **anaani Alaam** '*Alaaq's aunt*' (lit. 'his/her aunt Alaaq-possessed'), a construction similar to the Unangan genitives discussed below. He concluded that what may look like a single LH across two words is just weakening of the LH+LH sequence.

However, this weakening across a two-word phrase does seem like justification for multiword units. Each of the two words may maintain some semblance of LH but across the phrase the troughs and peaks are less pronounced. In the 1998 study Woodbury does not report on the two-word constructions in the context of the sentence. For this reason the 1998 analysis is not convincing counterevidence for the 1987 impressions. In fact, CAY pitch tracks (Woodbury 1990: 7, 1993: 2) indicate just the kind of upstep on the second word of the genitive construction as will be described below for Unangan.

The following distinction between content words vs. function words is pertinent to the syntactic analysis below. Woodbury 1998 makes no categorical distinction between the CAY words **kan'a**, '*down there*', and **anaani**, '*his/her aunt*'. He treats both as demonstratives, i.e., function words. I analyze such words in Unangan as genitives. Genitives are generally analyzed as nouns, i.e., content words. In earlier work Woodbury

distinguished between the two types as “possessor and possessum, noun and demonstrative” (1987:699). Regarding the relative weakening of content vs. function words, Woodbury 1998 reports that the function words undergo slightly more weakening of intonation excursion than the noun, regardless of the ordering of the two words.

The Unangan constructions discussed in the following section are two-word genitives and two word noun-demonstratives. Pertinent details of the grammar are given in §1.2.3: Morphology and syntax. Genitives will be dealt with first.

### 3.4.1.1: Genitive contour analysis.

**Hypothesis:** The genitive construction in Unangan has a pitch contour that contrasts with the unmarked sentence contour.

**Methodology:** For this analysis batches of the two sentences given in Figure 56 were smoothed. In the present corpus, the genitive (possessive, adjective) is usually marked by **-m**, and the (possessed) noun, by **-ngin**. However, variation occurred — see §1.2.3. In these sentences the second element of the genitive structure, **angunangin** or **uyuungin**, is the subject of the sentences (Bergsland 1989:57). These two sentences are plotted in Figure 57 and Figure 58.

ayaga + aḏa + <b>m</b>	aguna + <b>ḡin</b>	a:luxta + -	aḏa + n
wife like <b>REL</b>	big <b>3REFp</b>	laugh	like p
<i>'The big girls laughed.'</i> [lit. 'The big of the girls laughed.]			
aryyugi + <b>m</b>	yuy + <b>ḡin</b>	aḏu + q̄la +	aḏa + ku + n
cormorant <b>REL</b>	neck <b>3REFp</b>	long clumsy	like pres p
<i>'Cormorants' necks are long.'</i> [lit. 'The necks of the cormorants are long.']			

Figure 56: Genitive construction sentences for smoothing.  
Relativizing morphemes and their glosses appear in bold.

Since genitives most often appear sentence initially in these data, a smoothing of the first two words of sentences with genitives in this position was plotted in Figure 59. For

comparison a smoothing of the first two words of non-genitive sentences was plotted in Figure 60.

The number of speakers represented in Figure 57 through Figure 60 varies due to the comparability of speaker response. That is, for Figure 57 only four speakers responded to the stimulus with the same word choice. For Figure 58 five speakers responded to the stimulus with the same word choice. Since results from a variety of stimuli are smoothed in Figure 59 and Figure 60 data from all eight speakers in the numerical data based could be included.

**Results:** Smoothed results given in Figure 57 and Figure 58 support the hypothesis that the pitch contours of genitives are exceptions to the 'cascade contour'. In these figures the peak of the second word is higher than the peak of the first word, not lower as established in section 3.3: Sentence Shape. However, it can also be seen that the trough of the second word is lower than the trough of the first word in both Figure 57 and Figure 58, conforming to the cascade expectation.

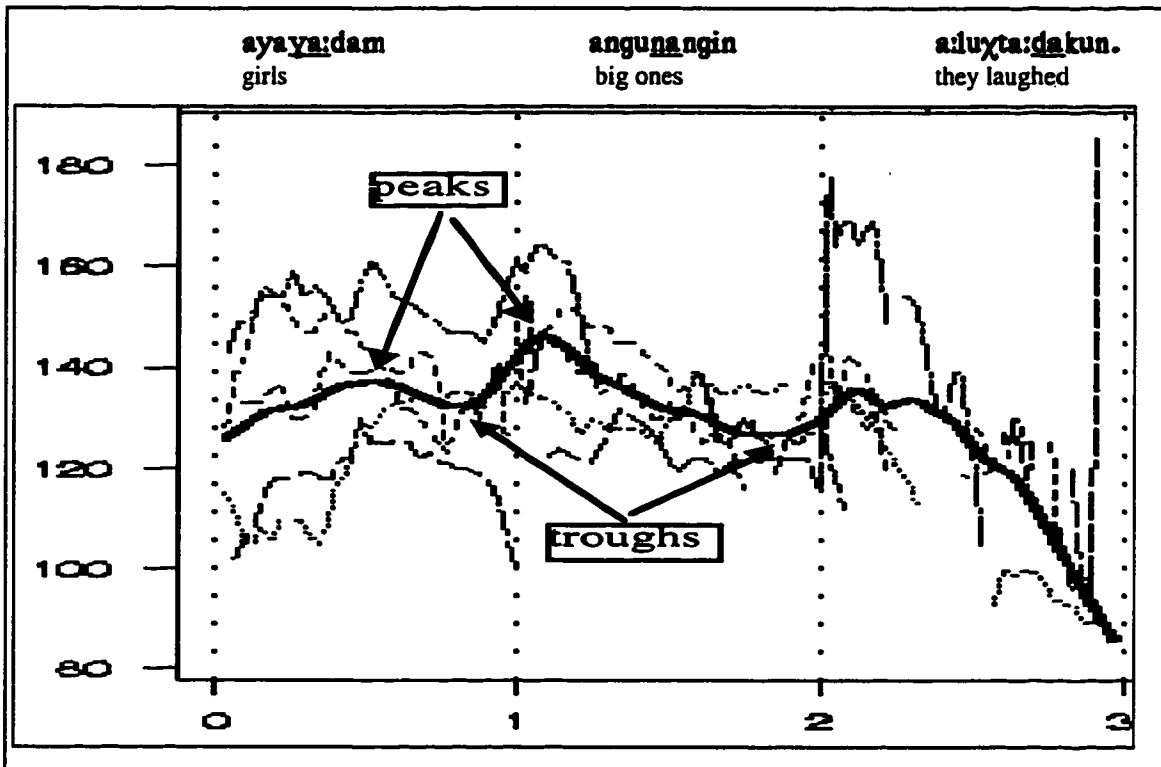


Figure 57: Smoothed responses from four speakers to the English stimulus, "*The big girls laughed.*"

The signal is displayed from 50-250 Hz on the vertical axis and in word units on the horizontal axis. The bold curve is the smoothed result. Other curves are the pitch track data. Word peaks and troughs are labeled for the genitive structure.

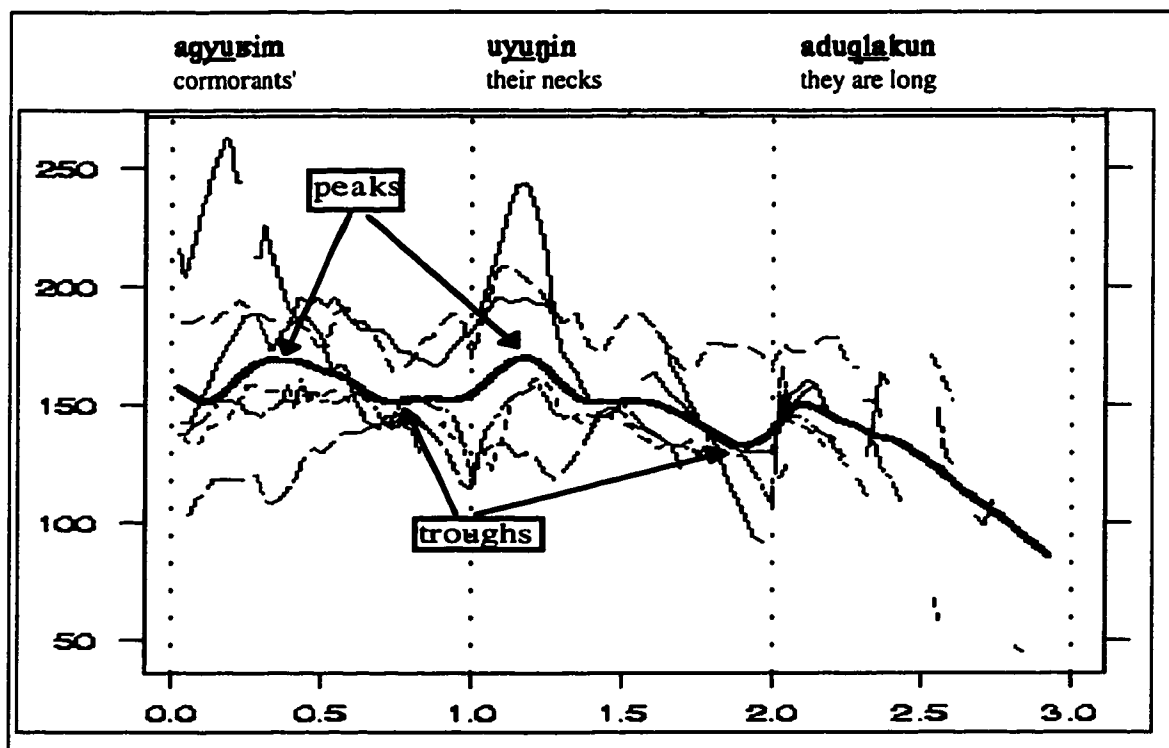


Figure 58: Smoothed responses from five speakers to the English stimulus, "Cormorants' necks are long," displayed as in Figure 57.

Results in Figure 57 and Figure 58 are based on single sentences. Results in Figure 59 are based on all the genitives in the numerical database. In this figure only the two-word genitive structures are smoothed, not the whole sentences, because the sentences are of varying numbers of words making entire sentences incomparable. The smoothed result is that the peak of the second word is higher than the peak of the first word. This is the same result found in Figure 57 and Figure 58. This result holds for the smoothings and for most of the individual responses observable in the pitch tracks. Counter-examples are dealt with in section 3.4.1.2: Genitive peak differences .

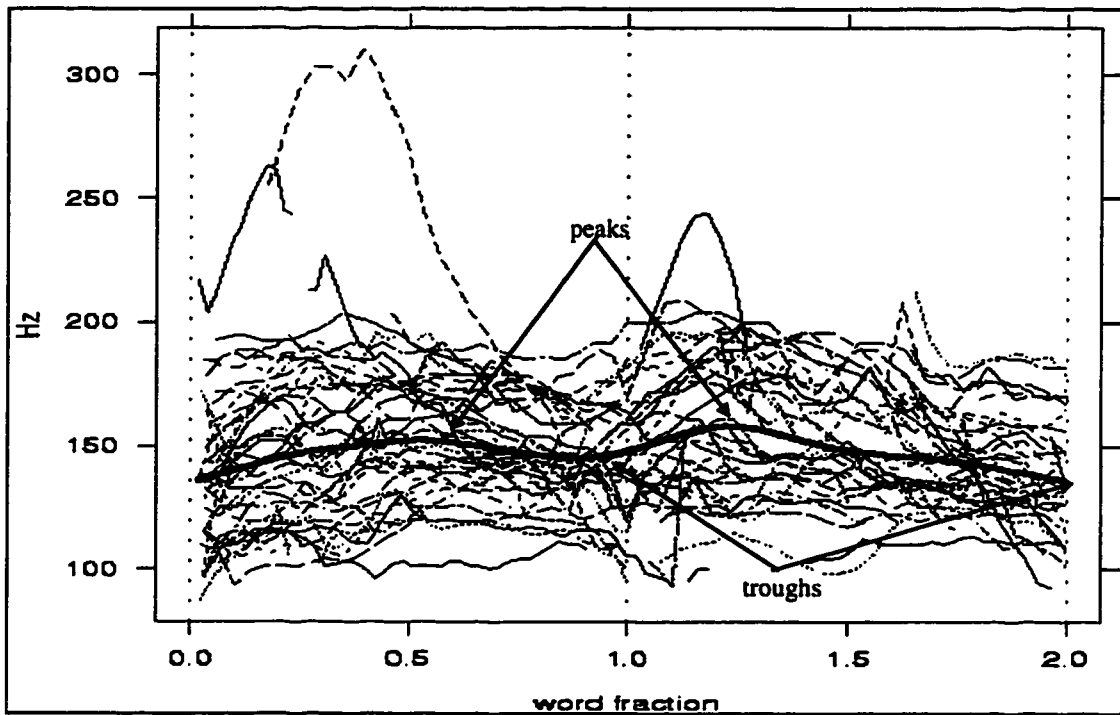


Figure 59: Smoothed result of thirty-nine two-word genitive constructions spoken by eight speakers.

Vertical dotted lines indicate word boundaries. The continuous solid curve is the smoothing. The bold horizontal line marks the highest peak in the word pair.

Because these genitive constructions were all sentence initial, a smoothing was made of the first two words of non-genitive sentences for comparison. This is given below as Figure 60. The smoothed result here is that the peak of the second word of non-genitive sentences is not (quite) as high as the peak of the first word, i.e. these two-word sequences conform to the cascade contour.

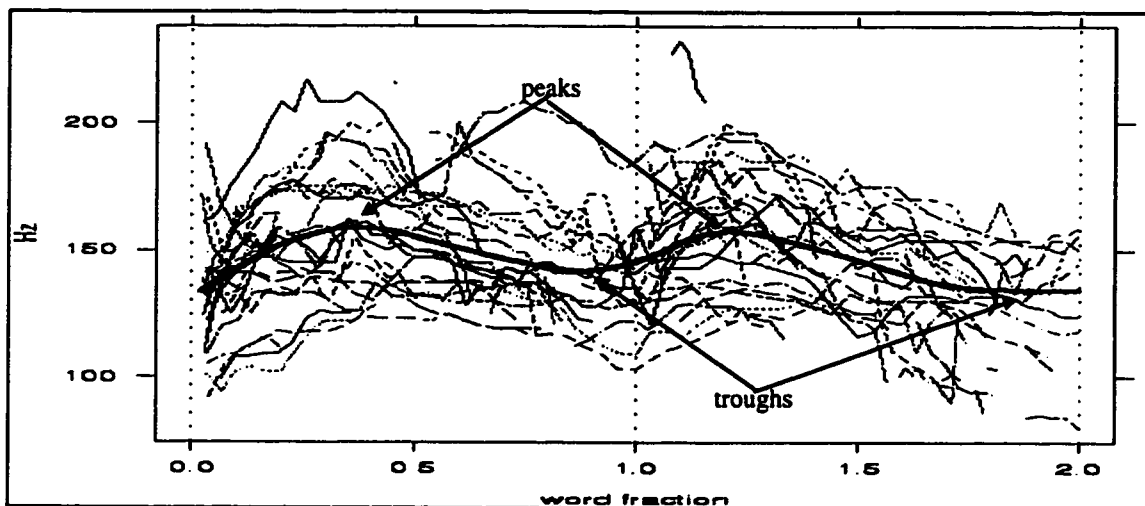


Figure 60: Smoothed result of the first two words of twenty-one sentences without genitives spoken by eight speakers, displayed as in Figure 59.

Individual sentence smoothings and multi-genitive smoothings both support the hypothesis that the genitive construction contour does not conform to the cascade hypothesis. The following section examines the genitive contour using a different type of analysis.

#### 3.4.1.2: Genitive peak differences analysis.

The previous section tested the hypothesis that the genitive contour differs from the cascade contour, found support for this claim and further specified the genitive contour as having a higher pitch peak on the second word than the first word. This section continues the analysis of the difference between peak heights for genitives compared with non-genitive word pairs by comparing single pitch measurements taken from the peak of each construction.

The observation that most pitch peaks of the second element of the genitive are higher than the peak of the first holds across all speakers in both elicited sentences and in the short texts. However, this observation does not hold for every genitive example. Of the 66 examples of genitives in the elicited sentences (including sentences from the four women speakers not included in the numerical database), only 48, or 73%, have a second

word peak higher or equal in pitch than that of the first word. A counter-example to the genitive contour is illustrated in Figure 61. Compare Figure 55, which clearly shows the genitive contour and is a repetition of Figure 61 which does not show the genitive contour.

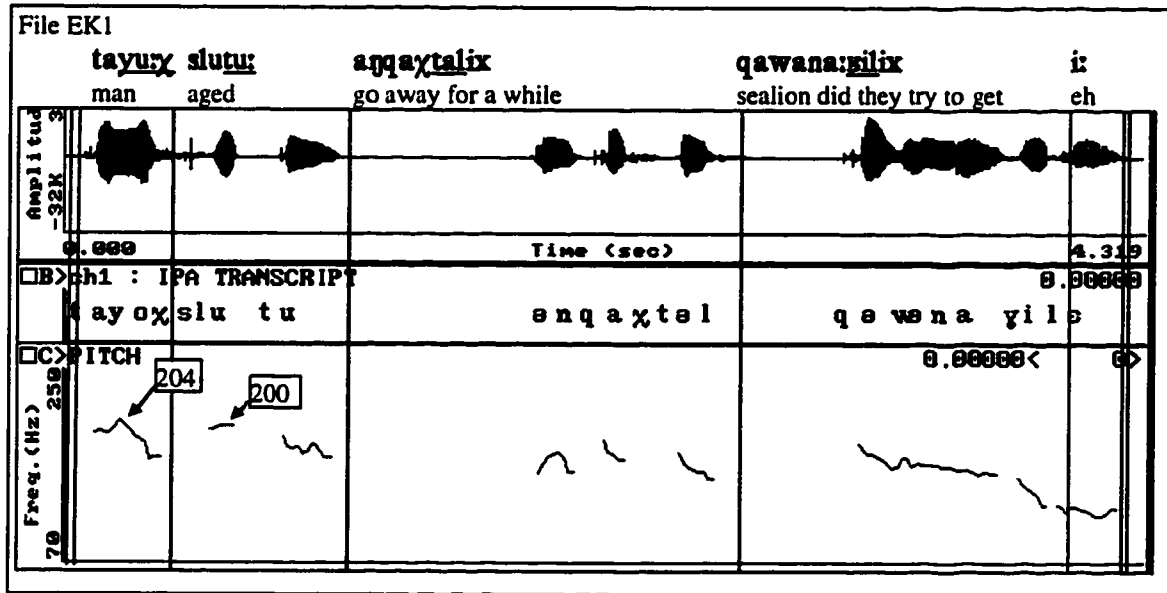


Figure 61: Pitch track of a response to the English stimulus, "Did old men hunt sea mammals?" illustrating an exception to the genitive contour.

**Hypothesis:** The peak of the second word of genitive constructions is higher in pitch than the peak of the second word of non-genitive sentences.

**Methodology:** Because not all the pitch tracks of elicited sentences with genitive structures conformed to the genitive contour hypothesis, word peak averages were taken to help determine a pattern. Peak measurements, one measurement for the peak of each first word and one for the peak of each second word, were made by hand as in Figure 61. Measurements were taken for 4 men and 8 women, all the speakers from whom sentences were elicited, and the results were tabulated. Averages were computed for the peaks of all 66 measurable genitives in the elicited sentences and for the first two words of 81 sentences without genitives and without demonstrative-noun constructions. These 81 sentences will be referred to as 'non-genitive' sentences.

**Results:** Table 25 gives the results of genitive and non-genitive peak measurements. The second column shows the ratio between genitives with 'genitive contour', first word peak lower than second word peak, and total number of genitives for each speaker. These ratios show that all speakers use the genitive contour for genitives more often than not. 91% of the genitives from men have a first word peak lower than the second word peak. This is true for 70% of the genitives from women. For all speakers together 80% of the genitives have the first word peak lower than the second word peak. For each two-word sequence the difference between the first word peak and second word peak was computed. These differences were averaged for each speaker. The third column gives the average of the difference between word peaks of the non-genitives for each speaker. Eight of the twelve speakers have positive number averages. A positive number here means that the first peak is higher than the second peak, e.g., first word peak at 178 Hz minus second word peak at 168 Hz = 10 Hz difference. So for 66% of speakers the first word peak is higher than the second word peak in non-genitives. For men there is an average drop of 6 Hz from the peak of the first word to the peak of the second word. For women there is a smaller drop in pitch, 1.1 Hz. For all speakers together the average drop is 2.1 from the first word peak to the second word peak in non-genitives.

The fourth column gives the average of the difference between word peaks of the genitives for each speaker. Nine of the twelve speakers have negative number averages. A negative number here means that the first peak is lower than the second peak in a genitive, e.g. first word peak at 178 Hz minus second word peak at 186 Hz = -8 Hz. So for 75% of the speakers the first word peak is lower than the second word peak in genitives. For men there is an average rise of 2 Hz from first word peak to second word peak. For women the rise is larger, 3.9 Hz. For all speakers together the average rise is 3.3 Hz from the first word peak to the second word peak in genitives.

The fifth column gives the non-genitive average minus the genitive average for each speaker. Ten of twelve speakers have positive number results. A positive number here means that the drop in pitch from the first word peak to the second word peak of non-

genitives is greater than the drop in pitch from the first word peak to the second word peak for genitives. For instance, speaker EF averages a drop in pitch of 11 Hz from word peak to word peak in non-genitives but a rise in pitch of 5 Hz from word peak to word peak in genitives. Listeners expecting to hear the 11 Hz drop for the more frequently occurring non-genitives hear instead a rise of 5 Hz, a 16 Hz difference between the expectation and the actuality. For 10/12, 83%, of the speakers the genitives have higher successive word peaks than non-genitives. This is true even for speaker AK, who has positive numbers for both non-genitive and genitive peak difference averages in columns three and four. His first word peaks average higher than his second word peaks for both genitives and non-genitives but the drop between peaks is greater for non-genitives. The same effect is true for speaker FG who has negative numbers in both column three and column four.

Table 25: Averages for peaks of first and second words of genitive structures compared with non-genitives.

1 Speakers	2 Number of genitive contour/ total genitive examples.	3 Average of the difference between word peaks of non-genitives in Hz.	4 Average of the difference between word peaks of genitives in Hz.	5 Non-genitive average minus genitive average in Hz.
EF (F)	2/2	11	-5	16
RM (F)	4/7	4	-11	15
GR (M)	8/8	10.4	-2.3	12.8
MM (F)	4/4	0.4	-9.8	10.2
AK (M)	3/5	9.8	2	7.8
FG (F)	3/4	-0.2	-6	5.8
BS (M)	6/6	4	0	4
EK (F)	6/9	0.5	-2.6	3.1
GF (M)	4/4	1.1	-1	2.1
OR (F)	4/4	-0.2	-0.3	0.1
ES (F)	5/6	-3.2	-1.5	-1.7
LM (F)	4/7	-0.9	1	-1.8

**Discussion:** In Table 25 the ratios (column two) of genitive contour per genitive construction show that each speaker uses the genitive contour for genitives more often than not. Now compare the results in column three with those in column four. Column three gives the average difference in Hz between the word peaks in non-genitives. Most of these are positive numbers; the peak of the first word is higher than the peak of the second word. Column four gives the average difference in Hz between the word peaks in genitives. Most of these results are negative numbers; the peak of the first word is lower than the peak of the second word. These results support the hypothesis that, relative to the first word, the peak of second words of genitive constructions is higher than the peak of second words of non-genitive sentences. Genitive structures have a different contour from the cascade contour.

#### 3.4.1.3: Demonstrative-noun peak differences analysis.

Because the syntactic structure of genitives is similar to that of demonstrative-nouns and because Woodbury analyzes both types together, contours of the latter phrase type were analyzed for comparison.

**Hypothesis:** Demonstrative-nouns have pitch contours similar to genitive constructions in that the pitch peak of a noun is higher than the pitch peak of its preceding demonstrative.

**Methodology:** This analysis is based on very little data because demonstrative-noun structures were not intentionally elicited. However, some speakers chose to use these forms. All of the speakers who did generate demonstrative-noun constructions are men. Although word class choice is not a subject of this investigation, these results do suggest that there may be some gender difference in such selection since 75% of the men used demonstratives in the elicited sentences compared to 0% of the women.

Measurements were taken and averages given in Table 25 were computed as for Table 26.

**Results:** Table 26 gives the results of noun-demonstrative compared to non-genitive peak measurements. The second column shows the ratio between demonstrative-nouns with a lower first than second word peak compared to total number of demonstrative-noun constructions. These ratios indicate that demonstrative peaks are sometimes lower than the following noun but may also be higher. The positive numbers in column three, repeated from Table 25, show that all three speakers use the cascade contour for the first two words of non-genitive sentences (these are also non-demonstrative-noun sentences); the first word peak is higher than the second word peak. The negative numbers in column four show that these three speakers, on average, do not use the cascade contour for demonstrative-noun constructions. In the demonstrative-noun construction, the first word peak is lower than the second word peak. The positive numbers for all speakers in the fifth column confirm this result.

Table 26: Average difference between peaks for demonstrative-noun structures compared with non-genitives.

1 Speakers	2 Number of examples with counter-cascade contour.	3 Average of the difference between word peaks of non-genitives given in Hz.	4 Average of demonstrative peak minus noun peak in Hz.	5 Non-genitive average minus demonstrative- noun average in Hz.
GR	2/2	10.4	-21	31.4
AK	10/19	9.8	-3	12.8
GF	2/4	1.1	-6	7.35

**Discussion:** Although little data is available, the demonstrative-noun constructions measured indicate that these structures, like genitives, do not conform to the cascade contour. Speaker averages support the hypothesis that demonstratives have lower pitch peaks than their following noun. This is true for 100% of the speakers that generated demonstratives. Results suggest inter-speaker differences in magnitude of prominence between demonstrative and noun peaks but there is very little data for two of the speakers.

**Summary of noun phrase analysis results:** Both smoothing results and averaging results support the hypothesis that a pitch contour across two-word genitives is exceptional to the cascade contour of normal declaratives. Frequently, though not always, in this morpho-syntactic construction the peak of the second word is equal to or higher than the peak of the first word. A similar effect is seen in demonstrative-noun structures.

#### 3.4.1.4: Summary of NP intonation

Researchers have adopted a variety of approaches in order to account for the phonetic patterns of intonation contours within the sentence. One type of approach is the mapping-to-syntax given for Hindi (Harnsberger 1994) and Baule (Leben and Ahoua 1997). Another type of approach is phonological tone mapping with prosodic domain such as that given for CAY (Woodbury 1987, 1988, 1998). In this section I will give syntactic and phonological accounts for the Unangan genitive contour and suggest a relationship between them.

##### 3.4.1.4.1: Mapping-to-syntax

I propose a syntactic account of genitive structure intonation for Unangan in which the first word, with the relative **-m** suffix, is outside the noun phrase (NP) but still within the same determiner phrase (DP) as the final noun in the genitive construction. The exceptional intonation contour is associated with elements in the DP. The syntactic tree diagram in Figure 62 illustrates this structure. In her analysis of connected speech Kaisse (1985) found c-command to be an important domain for phonological processes at word boundaries. By Kaisse's definition (1985: 159) "In the structure  $[_X^{\max} \dots \alpha \dots]$ ,  $X^{\max}$  is defined as the domain of  $\alpha$ . Then  $\alpha$  c-commands any  $\beta$  in its domain." Kaisse applied the c-command domain to segmental alternations between words but this domain may be relevant to the genitive contour discussion here as well. In the syntactic structure proposed in Figure 62 the DP Specifier (Spec) and Determiner (D) both c-command the noun (N). The NP Spec and N c-command each other. The genitive contour indicates this close syntactic relationship. Whereas the cascade contour only indicates word-sized

chunking, therefore nothing about syntactic structure, the genitive contour with its counter-cascade raised second word peak indicates that something else is going on. I propose that the raising of the N's peak in the genitive indicates 'the previous word is raised from the Spec of this word'. In simpler terms the contour means 'the first word is related to but less important the second word,' similar to the intent for H% (§3.3.1.5).

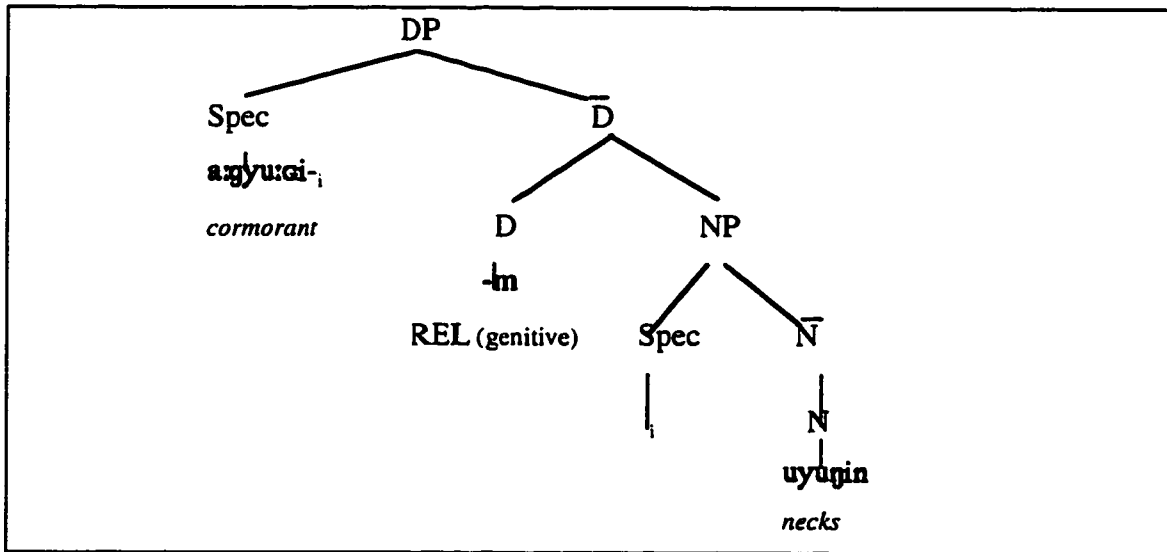


Figure 62: A syntactic tree for the genitive phrase showing the structure of the determiner phrase (DP) and its relationship to the noun phrase (NP).

If intonation contours for genitives are the result of c-command effects we would expect to see similar contours elsewhere in sentences where there is c-command and we do. The demonstrative-noun structures discussed above have the same structure as genitives, the same c-command relationship, and the same contour. Demonstrative-noun syntax is illustrated in Figure 63.

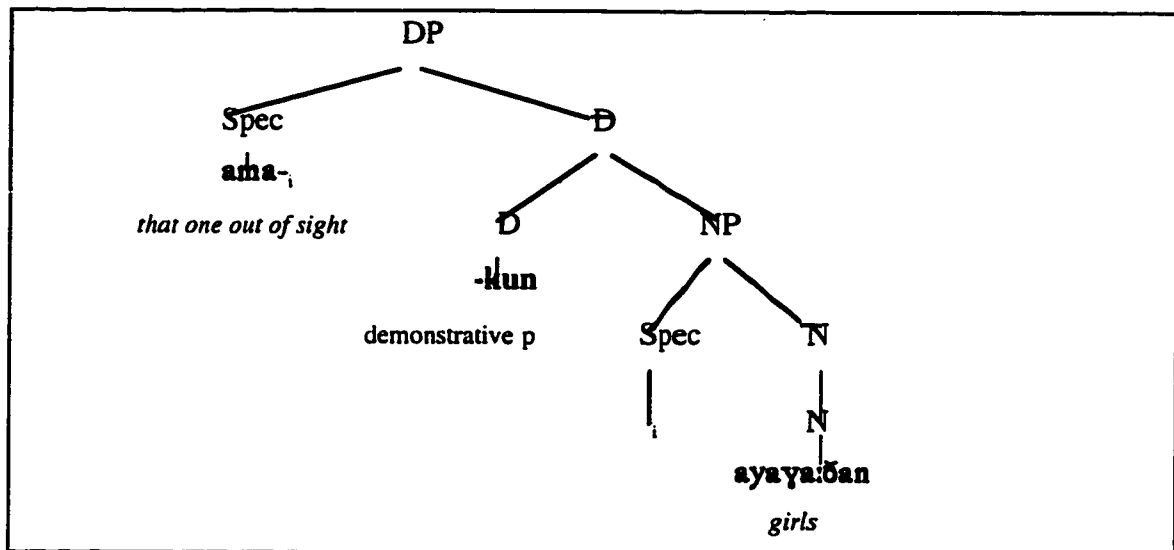


Figure 63: A syntactic tree for the demonstrative-noun phrase showing its similarity to genitive structure syntax.

The counter-cascade contour correlation with genitives suggested a relationship between contour and relativizing morphology. However, since the syntax and contour of genitive structures is similar to that of demonstrative-nouns but their morphology differs, c-command domain effect is a more likely candidate for mapping to contour than morphological mapping-to-contour..

In a different syntactic account it might be said that the subject of the sentence is receiving prominence in the genitive contour. Most simple Unangan sentences begin with their subjects because the language is SOV. The subjects have the highest peak in the sentences as the first word in the cascade contour. Most of the genitive structures in this data set are in subject position. The second word in the genitive structure, the subject word, has the highest peak in the sentence. This suggests that the prominence on the N in a genitive occurs due to mapping between the highest sentence peak and the subject of a sentence even if the subject is not the first word of a sentence. However, based on a small amount of data, it appears that it is the N of the genitive phrase, not the subject of the sentence, that receives prominence in the genitive contour.

There are two examples in the data of genitives in object position. These are a declarative-Y/N question pair by the same speaker. Both object genitives have genitive contour. The Y/N question is given below as Figure 64. Note that this is a response to the same stimulus given for Figure 61. This sentence begins with the demonstrative *ayun*, *that one*, with a lower pitch peak than the following subject genitive *tayum slutu*, *old man*. The N of the subject genitive, *slutu*, has a higher peak than does the preceding, *tayum*. This is followed by the object genitive *alugum alayagin*, *sea animals*, where the peak in the N, *alayagin*, as in the subject genitive, is higher than peak in the preceding word. The small peak in *alugum* is not audible.

This limited data suggests that object genitives can have the same genitive contour that subject genitives do. This in turn suggests that it is not the subject of the sentence that receives intonation prominence, but the N of a genitive phrase, whether subject or object, further reinforcing the proposal that this contour indicates a relationship in the syntax.

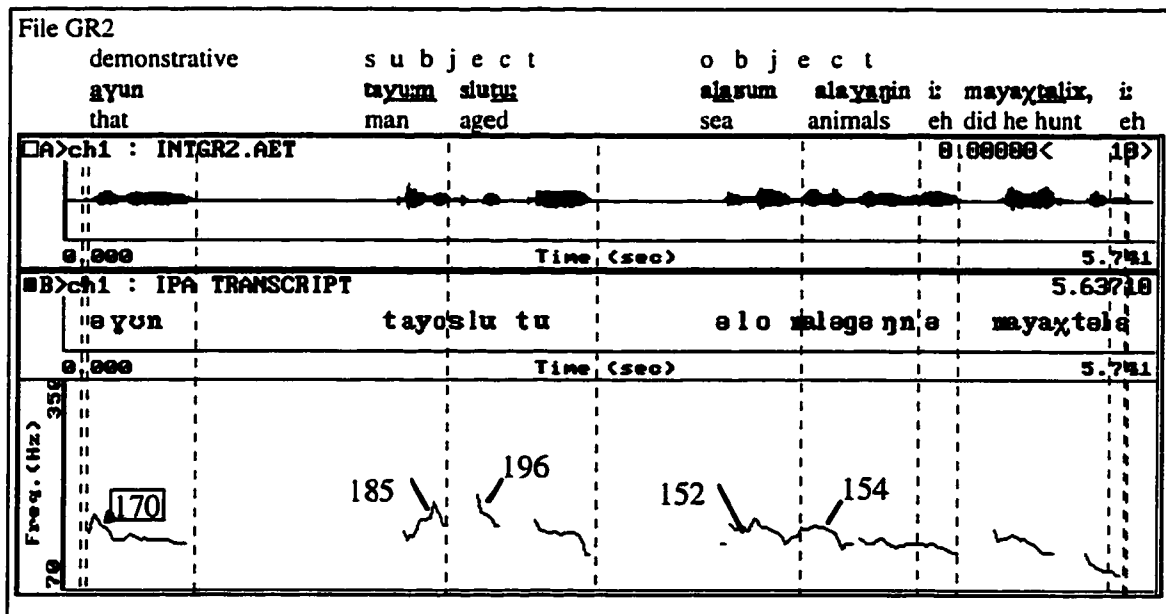


Figure 64: Pitch track of a response to the English stimulus, “*Did old men hunt sea mammals?*” illustrating a sentence with initial demonstrative then genitive constructions in both subject and object position.

The fact that both demonstratives and genitives are treated the same (lower pitch peaks than their following arguments) suggests a blurring of the distinction Woodbury makes between content and function words.

#### 3.4.1.4.2: Phonological account

So far the proposed tone inventory for Unangan includes H and L boundary tones which mark the word edges. Most speakers use H near word beginnings and L near word ends but some, BS, LM, and AK, characteristically do the opposite, using L near word beginnings and H near word ends. In addition the tone inventory includes L% and H% tones to mark major phrase boundaries. L% marks the sentence beginning and end. H% marks the end of a sentence-internal clause and the end of a question. The genitive contour requires additional explanation since the inventory of tones so far proposed cannot account for the higher peak of the second word.

A H\* pitch accent added to the inventory can have the effect of making the accented word higher than those preceding or following. But inherent in the definition of pitch accent is the assumption that this accent associates with the lexically stressed syllable of the word (e.g., Ladd 1996: 162, 213). In Unangan genitive structures, the pitch peak is usually near the beginning of the second word while lexical stress in Unangan is penultimate. In only 19 of the 66 genitive structures (29%) does the pitch peak occur late in the word and therefore associate with lexical stress. 15 of these 19 are from the same three speakers, AK, BS, and LM, all of whom characteristically use L H word shape. The other four instances of pitch peak near the end of the word are from three different speakers, GF, EK, and RM, who all typically use H L word shape. Thus, 94% (62/66) of the peaks associate with word edge while only 29% associate with lexical stress. Therefore the H on the N of genitives and demonstrative-nouns does not seem to be a pitch accent since it more robustly associates with word edge than word stress.

A different way of accounting for the genitive contour is to propose UPSTEP on the second word of genitives and demonstrative-nouns. Upstep has been treated in the literature as

resulting from a triggering H phrase accent tone (Pierrehumbert and Hirschberg 1990:280). Evidence for a word-final H is suggested by comparing the smoothings in Figure 59 for genitives and Figure 60 for non-genitives. The difference between the first word peak and trough of genitives is considerably smaller than that of non-genitives. Since the first word trough does appear, I propose for genitives a LH phrase accent tone. The tone to word mapping would then be as in Figure 65 ( $\uparrow$  indicates upstep).

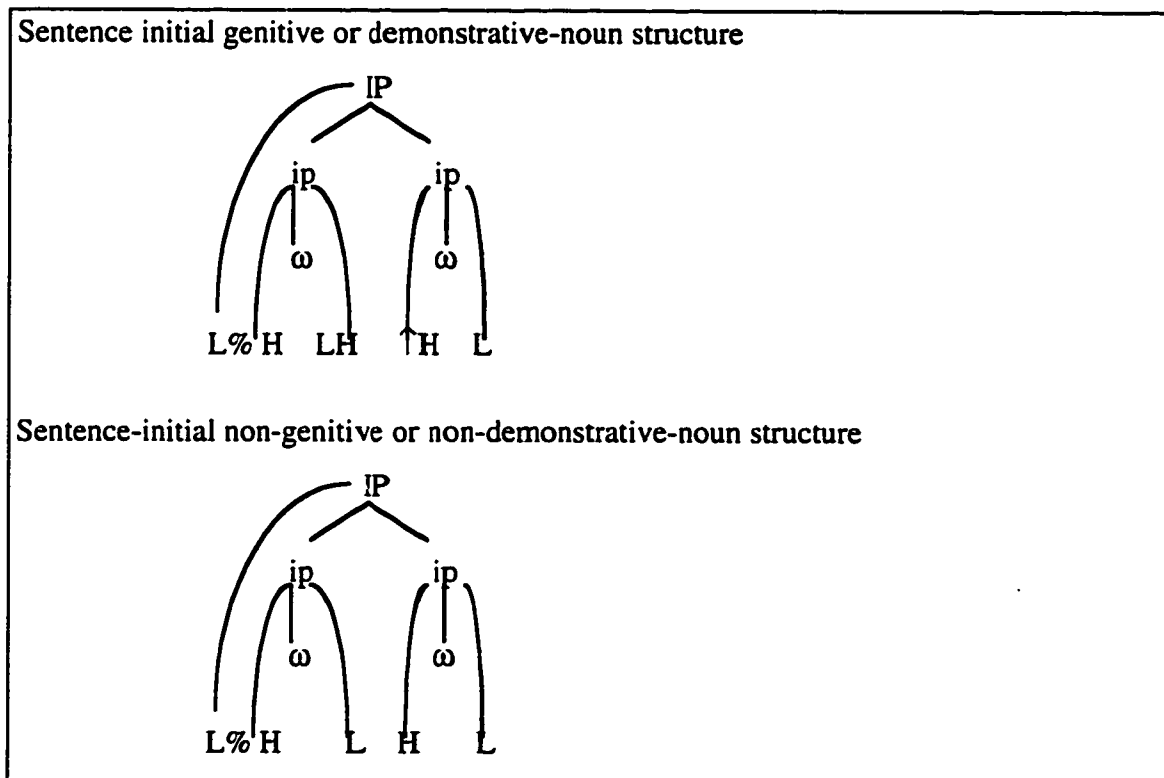


Figure 65: Tone association in the first two words of genitive sentences compared to non-genitive sentences.

Thus the final LH on the first word of a genitive or noun-demonstrative structure would have the phonetic effect of raising the word end L as well as triggering  $\uparrow$ H of the following word. Bitonal Intonational Phrase boundary tones are proposed for English (Pierrehumbert and Hirschberg 1990) and Bengali (Hayes and Lahiri 1991) but I do not know of other languages where sequences of phrase accent tones have been proposed for

the weaker boundaries, ip, pp, or AP. This LH is motivated by four factors: 1. surface representation, 2. effect on following H tones, 3. prosodic domain, 4. meaning.

The surface representation of LH, as mentioned above, is a shallow L. The difference between the H and L of a genitive (first word of genitive structures) or a demonstrative is smaller than the difference between the H and L of other words. Figure 57 through Figure 60 provide evidence in the form of smoothed pitch tracks which support this claim.

The effect of this bitonal phrase accent on following H tones is consistent; the immediately following H tone at the beginning of the following word is upstepped.

The prosodic domain of the genitive contour is the intermediate phrase. The upstep trigger is proposed as a LH phrase accent, that is an intermediate phrase boundary tone, not a H% after the word H L contour. A H% marks a major phrase edge and there is no such edge here: indeed, the LH signals the minimizing of a boundary, noting a close relationship between two words. Woodbury (1987) remarks that IP is the domain for upstepping. I assume this means that upstep occurs within the IP, not across IP boundaries.

The meaning of LH is different from phrase accent L or phrase accent H. Genitive structures and noun-demonstratives have a phrase boundary that refers to their cohesive internal structure. LH phrase accent provides this reference.

Under this proposal the LH phrase accent is mapped in the syntax to the c-command domain or possibly an intonational reflection of the raising of Spec from NP to DP. A linear representation is : ip-final L-> LH/ ip<sub>i</sub> \_\_\_ ip<sub>j</sub> where <sub>i</sub> c-commands <sub>j</sub>.

With the addition of the LH and  $\hat{H}$  phrase accents, the tone inventory consists of the following tones and their meanings:

Table 27: Unangan tone inventory for multi-clause cascade contour declaratives, questions, and *NPs* with phonetic implementation, and speaker intent.

Tone	Phonetic implementation	Speaker intention
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is lower than the peak of the previous word in the sentence.	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. This trough is lower than the trough of the previous word in the sentence.	A word is ending.
LH	<i>Reach a trough near the word end that is the lowest in the word. This trough is shallower than the average trough.</i>	<i>A word is ending but it's closely related to the next word</i>
↑H	<i>Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is not lower than the peak of the previous word in the sentence.</i>	<i>A word is starting; it's related to and it's more important than the one just said.</i>
L%	Sentence initially – start the sentence below the first word peak. Sentence finally – end the sentence at a pitch lower than the anticipated trough of the final word. Devoice final rhyme (or two.)	A major prosodic boundary is occurring: Sentence initially - 'here comes a series of small, related intonation units.' Sentence finally - 'this ends a series of small, related intonation units.'
H%	End the clause-final word in a rise. And/or Continue voicing to the end of the clause. Make the penult syllable higher than the antepenult.	A major prosodic boundary is occurring but it's closely related to the following prosodic unit.

To recap this section, Unangan genitives have a characteristic pitch contour exceptional to that of the unmarked cascade contour sentence. Non-genitive sentences conform to a cascade contour in which the peak of each word is lower than that of the preceding word. The pitch contour of genitive constructions, on the other hand, is generally characterized by a pitch pitch peak on the second word of the phrase which is equal to or higher than the pitch peak of the preceding word. Among the recorded genitive structures, all

speakers used the genitive contour in genitive structures more often than not. The first element of a genitive structure is treated the same intonationally as demonstratives; their pitch peaks are generally lower than that of their following noun.

Unangan genitive contours, like those in Hindi, Baule, and Central Alaskan Yup'ik, are marked intentionally within the sentence. But Unangan genitive contours are realized differently from these languages. Hindi shows compressed pitch range on the possessed (second) noun whereas in Unangan any compressed pitch range would be on the possessor (first) noun. Baule shows upsweep on both possessor and possessed nouns, marking these as two separate constituents, whereas in Unangan there is arguably a contour across the two words. CAY shows weakening of a LH+LH two-word sequence and compressed pitch range on the demonstrative or genitive word, basically the same as Unangan in that a two-word sequence looks more like one word, but different in surface representation since CAY word contours are characteristically L H while Unangan words are H L.

In a syntactic account I rejected the possibility that prominence is associated with the sentence subject or with genitive morphology, instead finding a more plausible explanation in the c-command relationship of words in the two-word genitive or demonstrative-noun phrases.

A phonological account adds a LH phrase accent to the tone inventory as a trigger for an upstepped  $\uparrow$ H and links this LH to c-command domain, specifically to the raising of Spec in DP. The intonational phonology maps to the syntax.

This section has provided evidence that NPs and DPs exhibit surface representations exceptional to the cascade contour. The following section deals with another possible exception to the cascade contour, focus prominence.

### 3.4.2: FOCUS

So far we have seen no evidence of pitch accent tones in the intonation system of Unangan. If there is a place for this tone type we should find it in an analysis of focus. As discussed in Chapter 1, pitch accent tones associate at the word level and, by definition, are aligned with the stressed syllable of a word. These tones serve to direct attention to a single word (narrow focus) or a whole phrase (broad focus). The use of pitch to mark focus is suggested as an intonation universal. According to Bolinger, (1978: 471) "Accents are generally set off by contrasting pitch levels, and their position in the sentence indicates both focus and climax." In the British framework, Cruttenden (1997: 161) describes this as "...nucleus placement as a form of focussing attention..."

But some languages appear to mark focus by intonation without pitch accent. In Hindi focus is implemented intonationally by expanded range on the focused constituent and failure of the H assignment in the expected LH of the following content word, deaccenting this word (Harnsberger 1994). Harnsberger cites other languages as having similar focus strategies; English, Korean, Hausa, and Bengali mark focus with larger than expected pitch excursions and deaccentuation of other typically accented elements. In Bengali, all words before a focused element are deaccented; in English only the focused element gets this expanded pitch range; in Korean and Hausa everything after the focused element is deaccented; and in Hindi everything after the focused element gets pitch range compression. Following others (Ladd 1988, 1990, 1994, Inkelas and Leben 1990, van den Berg, Gussenhoven and Rietveld 1992), Harnsberger 1996 suggests a register tier as part of the system. In the register tier the speaker would access information to expand or compress pitch register in parts of an utterance. Woodbury suggests that CAY may not have pitch prominence related to grammatical focus (1988: 7, 1994: C-13).

### 3.4.2.1: Focus analysis

Since pitch accent or nuclear placement associated with focus have been proposed as intonation universals, the relationship between these factors will be examined for Unangan in this section.

Hypothesis: Focus is associated with pitch prominence in Unangan.

Methodology: The recording of the set of stimulus sentences included a contradiction/contrast example. For this example speakers were given the stimulus, "Somebody says, *'Their car is red.'* But it isn't. So you say, *'Their car isn't red, it's black.'*" The expectation was that focus would be used to contrast the colors. In English this contrast can be realized either by emphasizing the color word as in: It isn't red, it's black. Or by emphasizing the polarity: It isn't red, it's black. In the polarity example we see that in English we emphasize the negative by making isn't prominent but we do not emphasize the positive by making is prominent; we emphasize the word of the true color because this is the new information.

Over the course of the recording sessions the noun **karax** 'car' was changed to **trakax** 'truck' when a speaker could not readily come up with a word for 'car'. Then the noun was changed to **ulax** 'house' to maximize sonority. Sometimes the colors were reversed.

In the responses three morpho-syntactic choices are used to designate color: 1. a verbalized form with the color designation as the stem e. g., **qaxtfiklu-ku-χ** black-prs-3abs; 2. the genitive possessor/possessed construction, e. g., **ula-m uluda-a**, house-REL red-3REFs, '*the red house*' [lit. 'the house's redness']; 3. the 'possessed' color term with referential suffix and an anaphoric possessor, **qaxtfiklu-u** black-3REFs '*its blackness*'.

When speakers gave the color designation as a noun (2. or 3.), the verbs used were either the copula, e. g., **a-axt-laka-χ**, be-toVagain-neg-3abs, '*it is*', or the stem **axaliχta-** 'light', which, when verbalized, means 'to be the color' e. g., **axaliχta-ku-χ** be hue-prs-3abs '*it is the color.*'

The variety in word choice, coupled with morpho-syntactic variety resulted in the speakers each giving a unique response. This made a statistical comparison of the contrast sentences unworkable. Instead, in this analysis pitch tracks of all the focus sentences were examined. Illustrative examples are given in this section.

Note that there are references to sentence stress counter to the stress algorithm for some examples in this section and that this stress is determined purely impressionistically. This approach was used for sentences in which one syllable gives the impression of being more prominent than the others, either by duration, loudness, or pitch.

**Results:** Examination of the focus sentence pitch tracks revealed four intonation patterns. These are summarized in Table 28. The first pattern is the neutral cascade contour with no indication of focus prominence. The second pattern is also a cascade but one in which focus is indicated by a word, **ayats** 'only', or **i:**, the question particle. The third pattern is the penultimate peak described above in §3.3.1.4: Final lowering. The fourth pattern is counter-cascade prominence on the verb stem.

Table 28: Summary of focus results, organized by prominence type.

N=noun. N-N=genitive construction. not=negative. is=positive. be=copula. s=singular. S=subject.  
V=verb. File names refer to CSL files available in the appendix.

file	Syntax	contour	intonation prominence
FG20	N color-is. Color-not.	Cascade	none
MM17	N-ref color-is. Color-not.	Cascade	none
RM25a	N-N hue-is.	Cascade	none
RM25b	No. Color-ref hue-not. Color-s hue-is.	Cascade	none
OR18	N color-not. Color-is only.	Cascade	(syntax)
EK23	N color-not. Color-is only.	Cascade	(syntax)
EK24	N color-not. Color-is only.	Cascade	(syntax)
BS19a	N-ref color-not, eh. N-ref color-is.	First sentence is cascade. Second sentence S peak lower than V peak.	(syntax) Verb-stem
BS19b	N-ref color-not. N-ref color-is.	Cascade penult peaks. Pitch contour contrast with BS19a.	Penult syllable
AK32	N-N be-not. N-N be.	Cascades w/ penult peaks.	Penult syllable
AK33	N-N be-not. N-N only be.	Cascade w/ penult peaks.	Penult syllable
EF21a	Color-not. Color-is.	Cascade w/penult peaks.	Penult syllable
EF21b	Color-not. Color-is.	Cascade w/penult peaks.	Penult syllable
LM21	N color-is. N color-not. Color-is.	Cascade w/penult peaks.	Penult syllable
GR18	N-ref color-not. N-ref color-is.	S peaks lower than V peaks.	Verb-stems
ES21a	N-ref color-not. Color-is.	S peak lower than V peak.	Verb-stem
ES21b	N-ref color-not. Color-is.	S peak lower than V peak.	Verb-stem
GF18	No. That N-ref color-is.	S peak lower than V peak.	Verb-stem

The first pattern, neither intonation prominence nor special syntax, is illustrated in Figure 66 with a two-sentence response. The first sentence has a cascade contour. The second sentence, composed of one word, starts slightly lower than the first. There is no evidence of intonation prominence marking focus. There is emphasis correlated with lengthening on the stressed syllable of **ulu:da-lakaχ**. Note the difference in length between the first l in **ulu:da-lakaχ** and the other ls in this sentence. The long vowel **u:** is more than twice as long as any other vowel in the sentence. Impressionistically, stress occurs on the second syllable of **ulu:da-laka-χ**, contrary to the stress algorithm which predicts penultimate stress. There is no pitch prominence on **-lu:-**. Remember from §1.2.2.3 that duration is a correlate of stress.

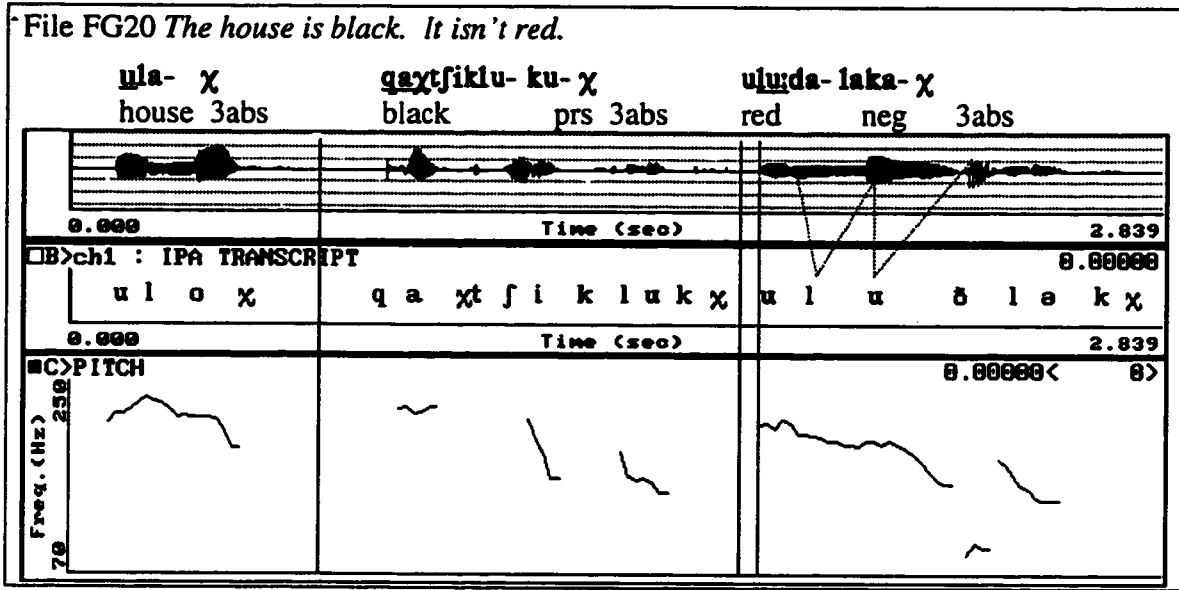


Figure 66: Neutral cascade-contour in sentences designed to show focus.

Underlined syllables in the morphological analysis indicate stress. A single vertical line indicates a word boundary. A double vertical line indicates a sentence boundary. Dotted lines indicate approximate sections of the waveform associated with the IPA transcript.

The second pattern, cascade intonation with syntactic focus marker, is illustrated in Figure 67. Focus is supplied in the syntax by the word *agatʃ*, 'only'. As in the previous example there is the impression of stress on the second syllable of *ulu:da-lakax*, contrary to the stress penultimate stress algorithm. There is no pitch prominence on *-lu:-*. The second sentence has a cascade contour with the impression of sentence stress on the final word, probably because of syllable duration. Syllable lengthening in *agatʃ* is more visible in the pitch track than in the waveform.

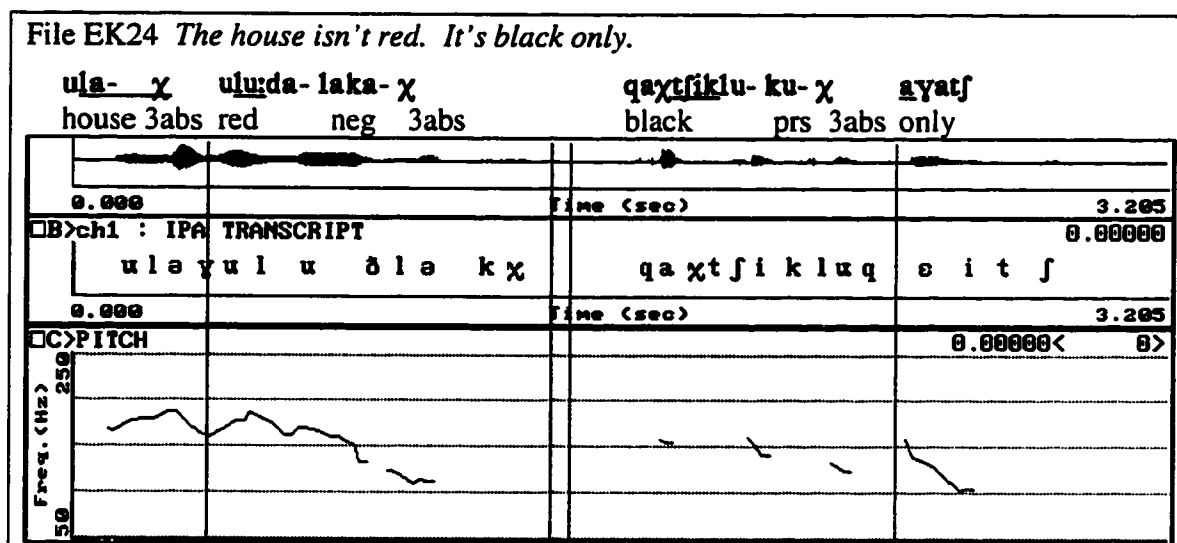


Figure 67: A cascade contour with a syntactic marker for focus, displayed as in Figure 66.

The third pattern, pitch prominence on penultimate syllables, is illustrated in Figure 68 where penult peaks are prominent on the verbs in both sentences. This suggests prominence contrasting the negative morpheme *-laka-* with the positive *-ku-*. There is a pitch peak on the *-la-* of *ulu:dalakaχ* but the penult peak of *qaxtfiklukux* occurs on ...*klu-*, which is part of the stem, not the positive morpheme. Listed in Table 28, files BS19a and b, responses to the same stimulus, contrast in both syntax and contour.

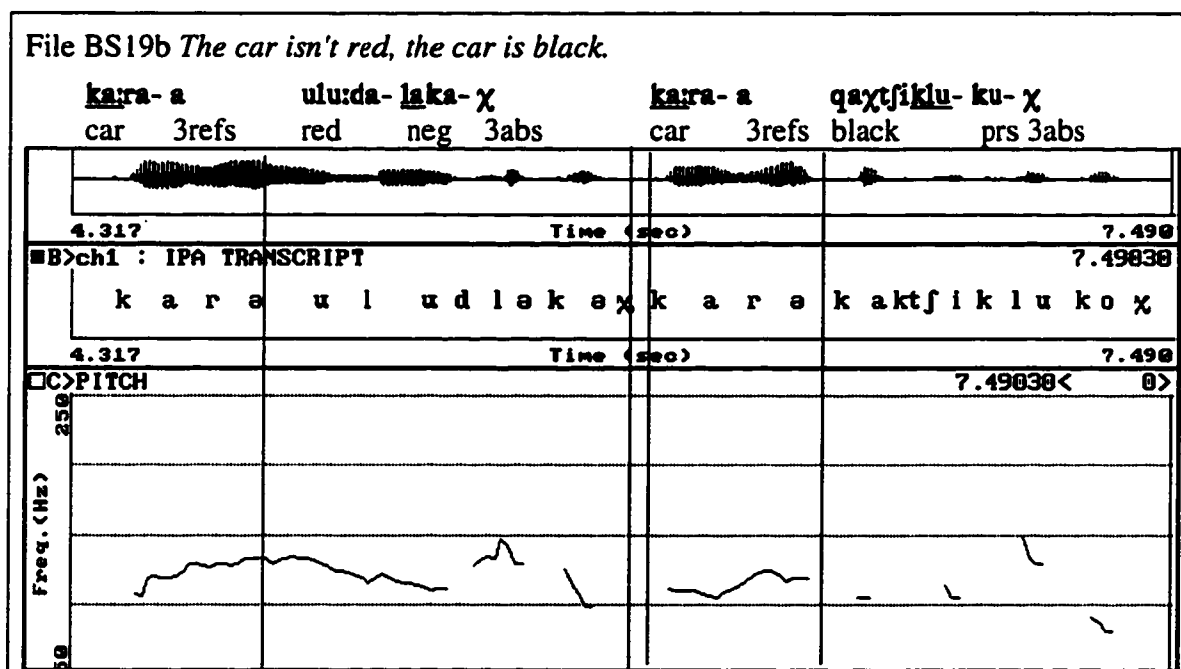


Figure 68: Penult peak in focus sentence, displayed as in Figure 66.

Figure 69 illustrates the counter-cascade intonation pattern. In the first sentence of GR18 the verb is higher than its preceding subject. Since cascade contour predicts that the pitch peaks of each successive word are lower, the higher peak on the verb might indicate focus by intonation prominence, calling attention to the 'red-' part of the color-verb. In the second sentence the verb is as high as the subject and the impression is that sentence stress is on the first, highest syllable of the verb **gaytfiklukuy**. Sentence stress in both sentences is on the verb stem, focusing color.

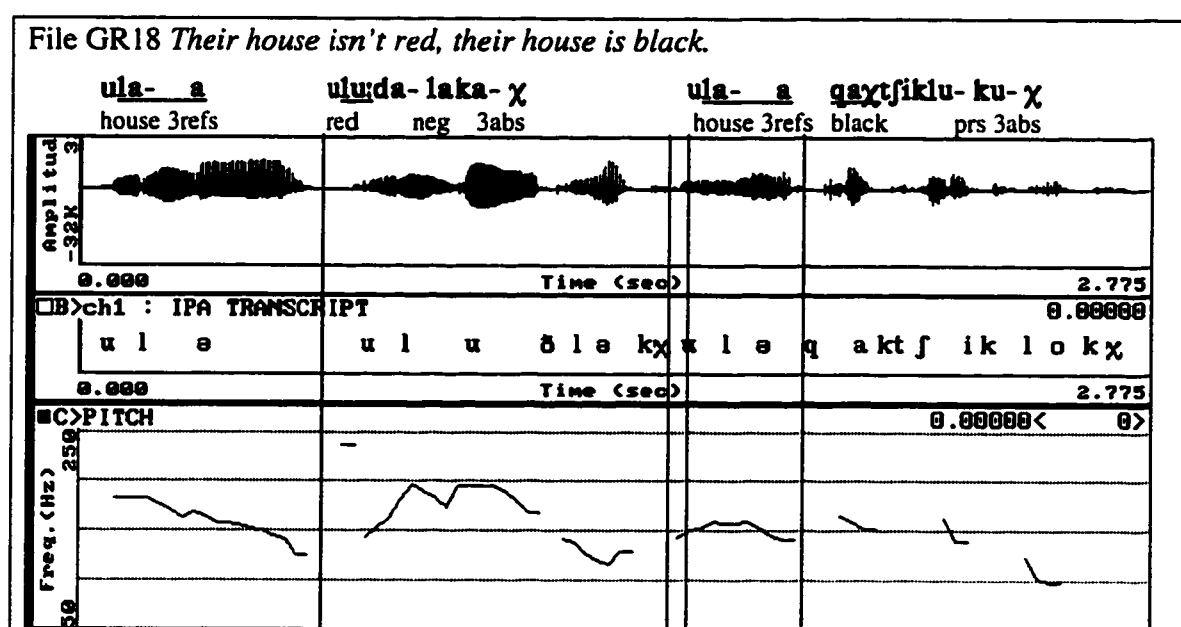


Figure 69: Counter-cascade contour in focus sentence, displayed as in Figure 66.

Discussion: Two of the patterns associated with focus sentences have no intonation prominence to mark focus: the neutral cascade contour and cascade contour which includes syntactic marking of focus. Two of the patterns associated with focus sentences do have intonation prominences that may be associated with focus: penultimate pitch peaks in verbs which suggest the contrast of positive with negative, and raising the initial peak of the verb higher than the subject to focus the verb stem. These last two patterns suggest that pitch accent tones may be part of the Unangan intonation system.

In focus sentences, penult peaks may be focusing attention on the polarity of the color-verb, that is, whether the subject is or isn't a particular color. The prominent syllable in the positive verbs, though, occurs in the stem, not the positive morpheme. This parallels the English realization of polarity emphasis. As in English polarity contrasts, in Unangan the negative morpheme receives emphasis; **-laka-** is associated with a penult peak, while the positive statement puts emphasis on the color-stem which is the new information. But in Unangan this prominence placement may be coincidental with the morphology. The negative morpheme has two syllables so that penult stress can occur in the morpheme while the positive morpheme is part of a single word-final syllable so cannot co-occur with penultimate stress.

Assigning a pitch accent to penult peaks to signal focus only in these contrast examples does not seem motivated since AK, BS, EF, and LM each use penult peaks throughout their data and the other speakers do as well. However, it may be the case that ALL the penult peaks throughout the data are examples of focus, a nuclear tone near the sentence end. This would be grounds for proposing pitch accent in Unangan, realized as a H\* that associates with the last stressed syllable of the sentence. We might expect though, that ALL sentences would have some H\*. Sentences without word-level prominence elsewhere should have a penult peak as a default nuclear tone. But this is not the case. Many sentences have simple cascade contour without penult peaks.

Cascade violations present a second type of intonation pattern which might be analyzable as pitch accent. In the focus corpus, cascade contour is violated in GR18, ES21, GF18, and BS19a. These examples share the same syntax. The subject is a 'possessed' noun with referential suffix and an anaphoric possessor. The verb has a color-stem. Note that MM17 also shares this syntax but does not have a cascade violation. In each of the cascade violations, the pitch peak of the verb is higher than that of the preceding word. This contributes to the impression of sentence stress on the verb stem, the color morpheme.

Accounting for cascade violations by proposing that words become prominent by association with pitch accents requires that the H\* associate with the stressed syllable of the word. But for GR18, ES21, GF18, the peak comes early in the word whereas the stress algorithm predicts penultimate stress. In these sentences the impression is that primary stress actually is near the word beginning. Recall that Bergsland (1997: 45) describes emphatic stress as primary stress occurring on the first syllable of a polysyllabic word and that is nearly the case for the verbs in the counter-cascade sentences. The exception is that sometimes the stress occurs on the second instead of the first syllable. These verbs have the highest pitch peak of the sentence and stress is shifted to near the beginning of the word to associate with the pitch peak. However, in discussing Unangan/s contours, Bergsland (1997: 44-45) makes no mention of a relationship between focus and pitch prominence and he correlates emphatic stress with lengthening of vowels and/or consonants, not pitch. We see an instance of this lengthening in Figure 66 where the stressed syllable of **ulu<sup>u</sup>da<sup>l</sup>aka<sup>x</sup>** is more than twice as long as other syllables in the example. Remember from §1.2.2.3 that Rozelle 1997 found long vowels in Unangan to be twice as long as short vowels, and stressed vowels, 1.2 times as long as unstressed vowels. The vowel in **-lu-** is at least three times as long as other vowels in this sentence and the consonant **l** is at least twice as long as the next longest **l**, the one in **ula<sup>x</sup>**. This illustrates the emphasis by lengthening consonants as well as vowels that Bergsland describes.

Besides their prominent pitch placement, the sentences with cascade violations all share the same relational morphology as the words made prominent in genitive structures, the referential suffix. However, while the prominent words in genitives have the referential suffix, the verbs are the prominent words in the contrast examples in this section.

Range adjustments to mark focus may be part of the Unangan system but they are not robustly exemplified here. RM25b has increased range on the word **kuryu:l**, 'no'. In AK33 the range of **ayatf** may be compressed or the range of the following word,

**axtukux**, may be expanded. Expanded range may be the factor that causes prominence on the words in the cascade violations.

### 3.4.2.2: Summary of focus intonation

To summarize the discussion of intonation focus, although none of the example sentences here share exact syntax and word choice, results of an examination of each example suggest the possibility of including pitch accent in the tone inventory of Unangan. 10/35 sentences in this data set have cascade contour and no indication of focus. 4/35 sentences have cascade contour with an additional word to mark focus. 13/35 sentences have cascade contour with penult peaks. 8/35 sentences violate cascade contour with pitch peaks on verbs where emphatic stress (duration) and pitch prominence are associated. The penult peaks can be dismissed as focus markers on the grounds that such peaks are found throughout the data, a phonetic account having been proposed in §3.3.1.4: Final lowering, and §3.3.2.4: Yes/no question contour. Alternatively, the use of penultimate peaks in the contrast sentences suggests that small sentence-final peaks may be pitch accents associating with word stress throughout the data. However, we might expect such pitch accents to be more prevalent than they are; not all sentences include penult peaks. The cascade violations may be instances of focus marked by pitch but they are few.

The hypothesis that pitch prominence is associated with focus is not robustly confirmed. The results of this section are suggestive but inconclusive. More data needs to be analyzed to determine whether penult peaks or cascade violations are indeed focus markers. But based on the analysis presented above, and despite the fact that no association between focus and pitch prominence caught the attention of Bergsland who worked with the language for over fifty years, I propose that a sparsely used H\* pitch accent be included in the Unangan tone inventory.

Table 29: Unangan tone inventory for multi-clause cascade contour declaratives, questions, NPs, and *focus* with phonetic implementation, and speaker intent.

Tone	Phonetic implementation	Speaker intention
H*	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is higher than the peak of the previous word in the sentence.	This is the most important word in this sentence.
H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is lower than the peak of the previous word in the sentence.	A word is starting.
L	Reach a trough near the word end that is the lowest in the word. This trough is lower than the trough of the previous word in the sentence.	A word is ending.
LH	Reach a trough near the word end that is the lowest in the word. This trough is shallower than the average trough.	A word is ending but it's closely related to the next word
↑H	Reach a peak near the word beginning after which no other pitch in the word will be as high. This peak is not lower than the peak of the previous word in the sentence.	A word is starting; it's related to and it's more important than the one just said.
L%	Sentence initially – start the sentence below the first word peak. Sentence finally – end the sentence at a pitch lower than the anticipated trough of the final word. Devoice final rhyme (or two.)	A major prosodic boundary is occurring: Sentence initially - 'here comes a series of small, related intonation units.' Sentence finally - 'this ends a series of small, related intonation units.'
H%	End the clause-final word in a rise. And/or Continue voicing to the end of the clause. Make the penult syllable higher than the antepenult.	A major prosodic boundary is occurring but it's closely related to the following prosodic unit.

This section reports meager evidence of pitch accent in Unangan, resulting in the addition of H\* pitch accent to the Unangan tone inventory. The following chapter will summarize all the conclusions drawn in this study.

## CHAPTER 4: CONCLUSION

This dissertation gives the first detailed description of the phonetics and phonology of the intonation system of Unangan (Eastern Aleut). It expands the prosodic analysis of the Eskimo/Aleut language family, allowing for comparisons within and outside the family. The findings here for Unangan intonation particularly parallel those reported for Central Alaskan Yup'ik which suggests that detailed intonation investigations of other languages in the family may help establish family relationships in the same way that segmental phonology, lexicon, and morpho-syntax have. This description will be of use to Unangan learners, all of whom, at this point, are second language learners, since an awareness of intonation patterns is crucial to natural sounding speech.

Four types of sentences were investigated: simple declaratives, yes/no questions, two clause relative sentences, and focus contrast sentences. Data was collected from twelve speakers. For each sentence, pitch tracks were generated with pitch measured every 20 milliseconds. For eight of the speakers these data were entered into a 'numerical database' for statistical analysis.

Declarative sentence analysis was carried out using the numerical database to generate smoothed batches of sentences or word types, generate range results, compute sentence slopes and determine sentence end measurements. Speech pitch range is reported for each speaker for future comparison with other languages. Sentences show declination but results regarding sentence planning are confounding since they suggest that women plan for sentence length both by starting higher and by sloping longer sentences less steeply but that men do not. Smoothed sentences indicate that each word has the characteristic contour: peak-trough. In a sentence, under the effect of declination, words are recognizable as a descending series of peak-troughs, the whole series referred to here as a 'cascade contour'. Sentence boundaries are marked by initial and final lowering. Final lowering is observable despite devoicing at the ends of declaratives.

In yes/no questions declination, surprisingly, was found to be steeper for questions than declaratives. Contours are much the same for the two types with a tendency in questions for a slightly bigger penultimate peak sentence-finally and a very small rise at the end. The major intonation difference between declaratives and yes/no questions is in sentence-final voicing which is weakened in declaratives but strengthened in questions.

Smoothings of two clause sentences indicate that sentence-internal clause-final boundaries tend to end higher than other sentence-medial word boundaries.

Smoothings and word-peak measurements for two-word genitives and noun-demonstratives indicate that within a noun phrase, the head, although second, has the higher peak, counter to the cascade contour. Examination of the pitch tracks of contrast focus sentences suggests that there may be an association between pitch prominence and focus.

A two-level intonational phonology can account for these patterns. Each word constitutes an intermediate phrase marked at the beginning with a H and at the end with a L phrase accent. Each sentence is marked at the beginning and end with a L% boundary tone. Sentence-initially L% is realized as rise to a delayed H on the first word. Sentence finally L% is realized as a steep drop in pitch. Yes/no questions and sentence-internal clauses end with a H% boundary tone, realized in questions as voicing and a tendency for a small final rise and realized clause-finally as a slight rise. The first word of a noun phrase ends in a LH phrase accent which causes an upstepped phrase accent,  $\uparrow H$ , at the beginning of the next word, the head of the phrase. Infrequently realized pitch accent tone is tentatively proposed and is limited to one type, H\*.

A comparison of Unangan intonation patterns with those of Central Alaskan Yup'ik, the other Eskimo/Aleut family member whose intonation has been most thoroughly analyzed, shows that in both languages, content words are isomorphic with small phrases. In Unangan the predominant word shape is H L while in CAY the predominant word shape is L H. In both languages declaratives and questions have essentially the same contour.

In both languages there is the suggestion of a contour indicating the noun phrase relationship. In both languages there is utterance-final devoicing. In both languages pitch accent tones are not robustly found though they may be present.

Unangan intonation patterns identified here support the following predicted universals:

- declination
- major syntactic constituency marking of sentences and clauses by falling tone associating with closed topics and rising tone associating with open topics
- (possibly) focus marking by pitch prominence.

Language specific patterns are:

- the isomorphy of words with intermediate phrases
- a characteristic peak-trough shape of words which is affected by sentence position.
- a characteristic 'cascade' contour for sentences.
- an apparent syntactic connection between noun phrase structure and intonation.
- a sparse use of pitch accents.

Further research will shed light on the question of the presence in the system of pitch accent tones. The analysis of the extemporaneous texts which have been recorded by each speaker will allow for testing of all the claims made above. The whole corpus will provide data for the investigation of other areas of prosody: a more thorough analysis of stress, pausing, duration, amplitude, and how these features are bundled in Unangan. The recorded Unangan data is only half a set. An additional twelve speakers of Unangas, Western Aleut, recorded the same word list, sentences and extemporaneous texts so the analysis and comparison of both dialects is possible. In addition, the groundwork is laid for a comparison between ancestral intonation and intonation in the English to which Unangan/s descendants have shifted.

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## **APPENDIX: PITCH TRACKS AND TRANSLATIONS OF ELICITED SENTENCES AND TEXTS FOR EACH SPEAKER**

Each of the files digitized for analysis in this study is presented here in order that readers may have access to all the data on which this study is based. Speaker responses are rendered orthographically with a broad translation and are also glossed morpheme by morpheme. Discrepancies between orthographic and IPA versions can be accounted for by the differences between underlying versus surface forms. Each display includes the waveform, an IPA transcription, a narrowband spectrogram and a pitch track. Because the spectrograms and pitch tracks were generated in the same window the spectrogram scale of 0-2000 Hz was displaced by the 70-300 Hz pitch track scale. The stimuli presented to speakers and the configuration settings used to generate these displays appear before the spectrograms. In the appendix the speakers are arranged in alphabetical order by their initials since their initials serve as referents in the dissertation text.

Audio tapes of these files are housed in the UCLA Phonetics Archives and in the Jacobs Research Fund Collection of the University of Washington Libraries' Manuscripts and University Archives. The UCLA materials include additional data (segment contrasts) and speakers (Unangas, Western Aleut) that are not represented in the University of Washington materials.

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Configuration settings used in generating CSL spectrograms/pitchtracks for the appendix.

```

SET FFT.LENGTH      512
SET FFT.PREEMPH    0.900 OFF
SET FFT.DISPLAY    0 80
SET FFT.WINDOW     BLACKMAN
SET FFT.SMOOTHING  BAR
SET FFT.FREQUENCY  0 0
SET FFT.FREQUENCY  0 80 %
SET LTA.QUIET      NO
SET CEPSTRUM.DISPLAY -10 10
SET CEPSTRUM.TIME  0.00 0.00
SET SPG.LENGTH     512
SET SPG.LEVEL      -1
SET SPG.SCALE      18.00 21.32 24.67 28.00
                   31.32 34.67 38.00 41.32 44.67 48.00
SET SPG.PREEMPH    0.800 ON
SET SPG.WINDOW     BLACKMAN
SET SPG.DISPLAY    0 2000
SET SPG.AXIS       LINEAR
SET SPG.CELL       8 8
SET SPG.PALETTE    1
SET LPC.LENGTH     20
SET LPC.ORDER      12
SET LPC.PREEMPH    0.900 ON
SET LPC.WINDOW     ON
SET LPC.TYPE
AUTOCORRELATION
SET LPC.FREQUENCY  0 0
SET LPC.FREQUENCY  0 80 %
SET FMT.CUTOFF     500
SET FMT.LENGTH     10
SET FMT.ORDER      12
SET FMT.PREEMPH    0.900 ON
SET FMT.WINDOW     ON
SET FMT.TYPE
AUTOCORRELATION
SET FMT.BWIDTH     OFF
SET FMT.DISPLAY    0 4000
SET FMT.DISPLAY    0 80 %
SET FMT.AXIS       LINEAR
SET PITCH.CLIPPING  15
SET PITCH.CUTOFF   25
SET PITCH.LENGTH   25
SET PITCH.ADVANCE  20
SET PITCH.RANGE    70 300
SET PITCH.DISPLAY  70 300
SET PITCH.PEAK     100
SET PITCH.PLOT     line
SET IMPULSE.RANGE  70 300
SET IMPULSE.PEAK   500
SET IMPULSE.OFFSET 0
SET IMPULSE.FLIP   NO
SET IMPULSE.ADJUST NO ADJUSTMENT
SET VX.FRAMING     MARKERS
SET VX.TOLERANCE   1
SET VX.OFFSET      12
SET ENERGY.LENGTH 20
SET ENERGY.ADVANCE 20
SET ENERGY.SMOOTHING NONE
SET ENERGY.DISPLAY 30 80
SET CAPTURE.RATE   10000
SET CAPTURE.ECHO   OFF
SET CAPTURE.LENGTH 8
SET CAPTURE.SOURCE MICROPHONE
SET CAPTURE.COUPLING 1 AC
SET CAPTURE.COUPLING 2 AC
SET CAPTURE.GAIN   3 0.0
SET CAPTURE.GAIN   4 0.0
SET NORMALIZE      ON
SET CLEAR          OFF
SET RELATIVE       ON
SET GRID           OFF
SET COLOUR         BLACK
SET FLTR.DIRECTORY C:\CSL50\FILTERS\
SET TIMIT.DIRECTORY c:\TIMIT\

```

Stimuli presented for speaker responses.

*Old men hunted sea mammals.*

*Did old men hunt sea mammals?*

*The mothers carried the girls.*

*Did the mothers carry the girls?*

*The girls laughed.*

*Did the girls laugh?*

*The big girls laughed.*

*Did the big girls laugh?*

*Cormorants' necks are long.*

*Are cormorants' necks long?*

*If boys try to kiss girls, tell their mothers.*

*If boys try to kiss, girls tell their mothers.*

*Their fathers carried rocks*

*When their fathers carried rocks, the girls laughed*

*We were out there.*

*The airplane came.*

*When we were out there, the airplane came.*

*Their house isn't red; it's black.*

Andronik Kashevarof

AK1

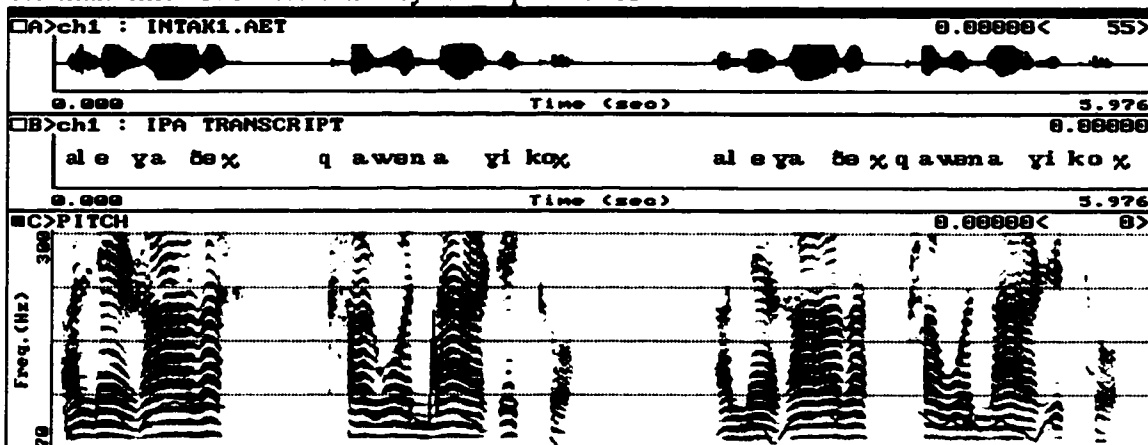
Aligaadat qawanaagikut.

*Old men hunted sealions.*

old man he tried for sealions

aliḡa- ada- x qawa- naaḡi- ku- ḡ

old man like 3abs sealion try to V prs 3abs



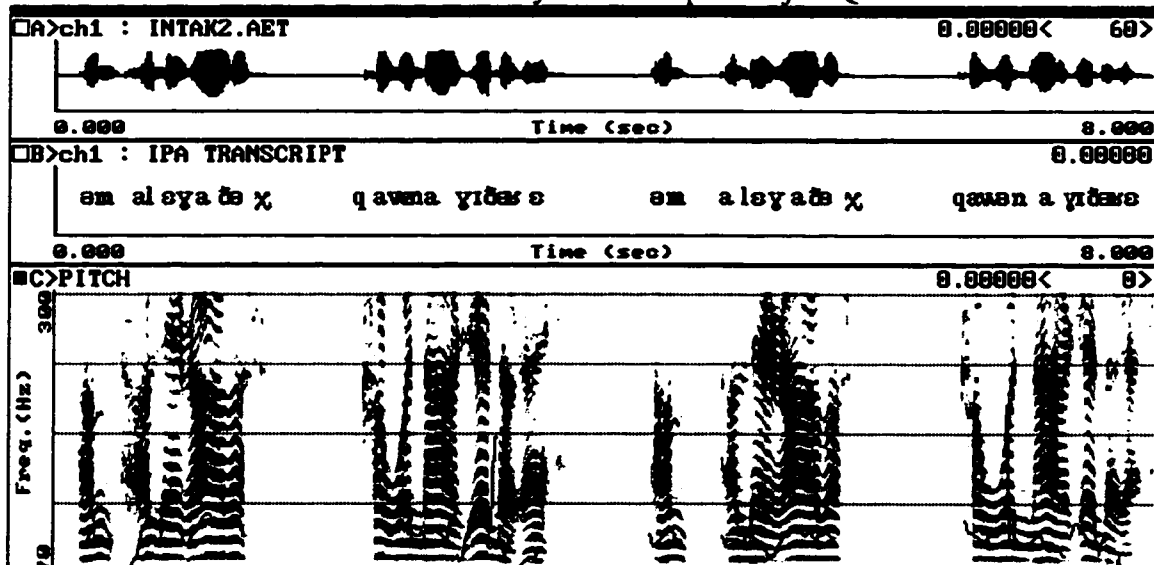
AK2

Aman aliḡaadat qawanaaginalix, ii? *Did old men hunt sealions*

that one (out of sight) old man he tried for sealions eh

aman aliḡa- ada- x qawa- naaḡi- na- lix ii

that one old man like 3abs sealion try to V rmt pst cnj Q

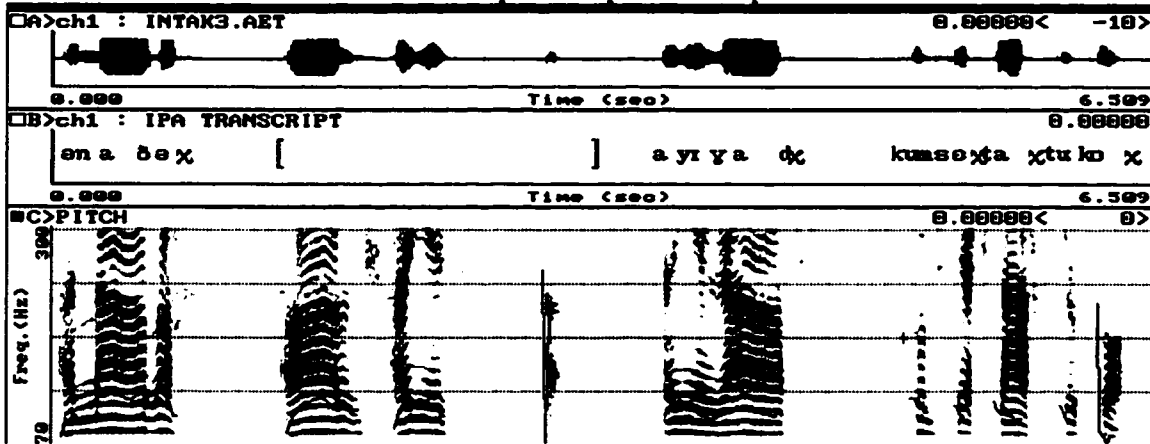


AK3

Aman ayagaadat kumsittaaktukut. *The mothers carried the girls.*

that one girl she carried again

aman ayaga- ada- x kumsi- xta- axtu- ku- x  
 that one wife like 3abs lift up temp was prs 3abs

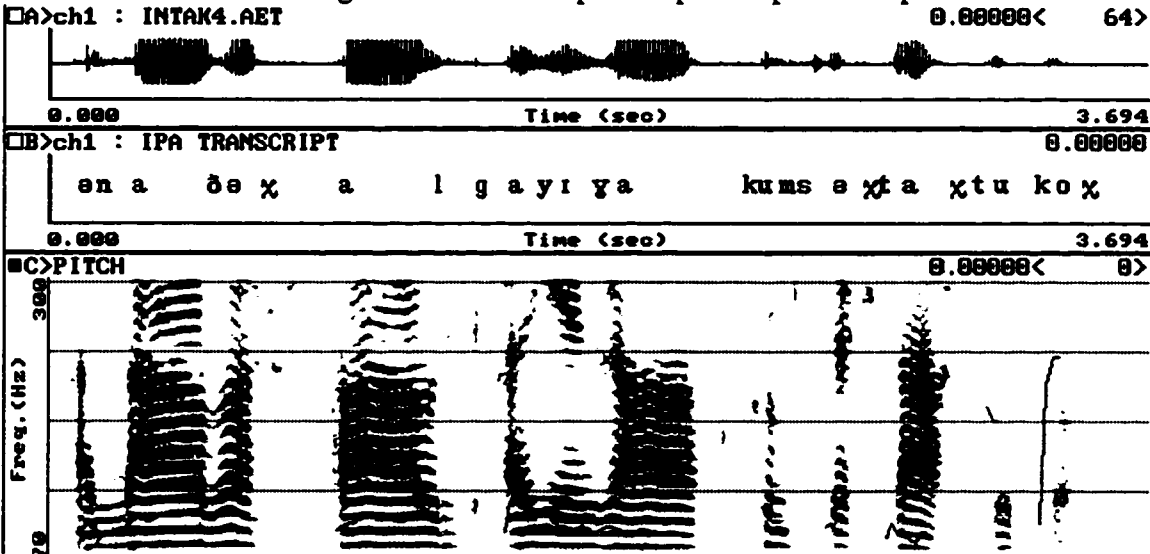


AK4

Anaadaɬ aalax ayagaadan kumsittaaktukut. *The mothers carried the girls.*

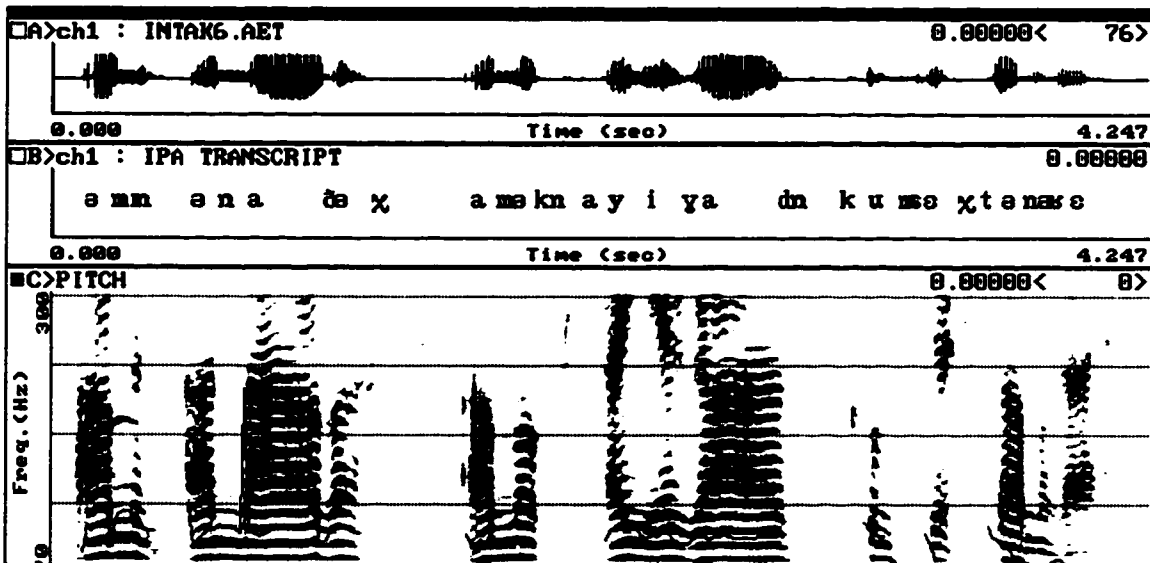
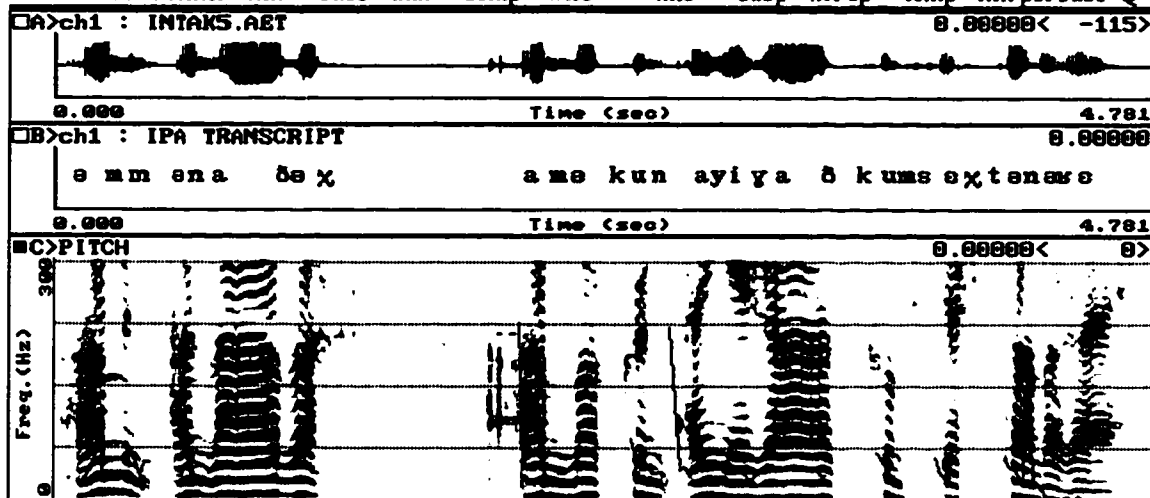
mother two daughters she carried

ana- ada- x aalax ayaga- ada- n kumsi- xta- axtu- ku- x  
 mother like 3abs two girl 3rfs 3abp lift up temp was prs 3abs



AK5, AK6

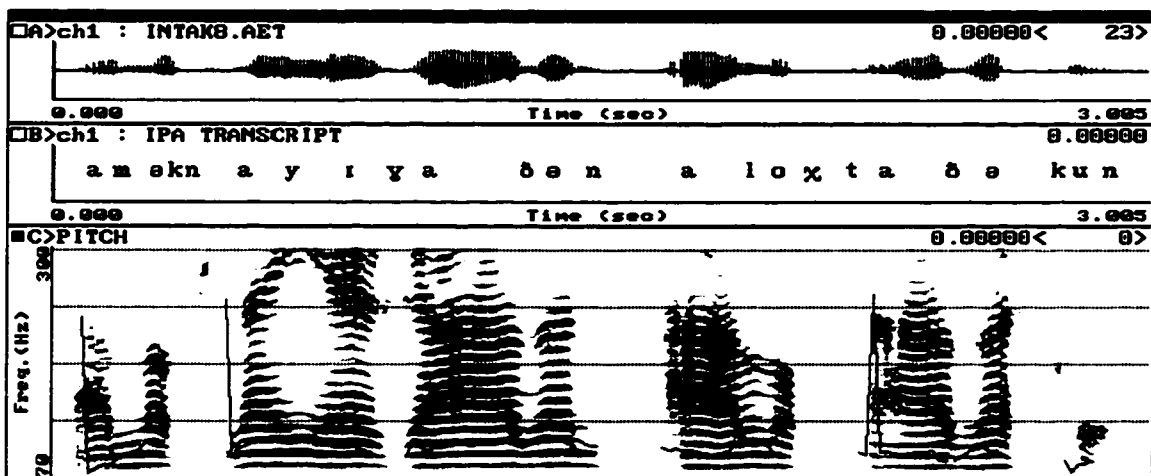
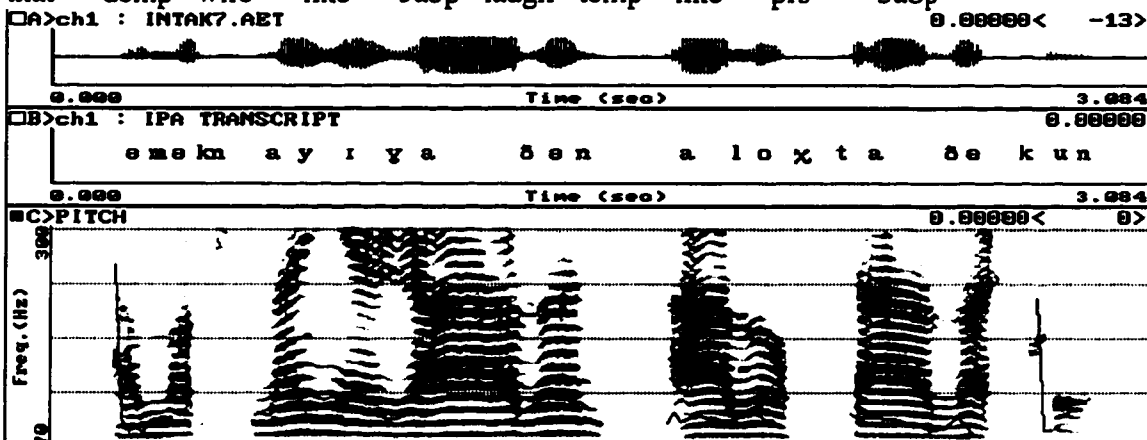
Aman anaadax amakun ayagaadan kumsixtanax, ii?  
 that one mother those girls she carried eh  
 ama- n ana- ada- x ama- kun ayaga- ada- n kumsi- xta- na- - x ii  
 that dems mother like 3abs that demp wife like 3abp lift up temp rmt pst 3abs Q



AK7, AK8

Amakun ayagaadan aaluftaadakun. *The girls laughed.*

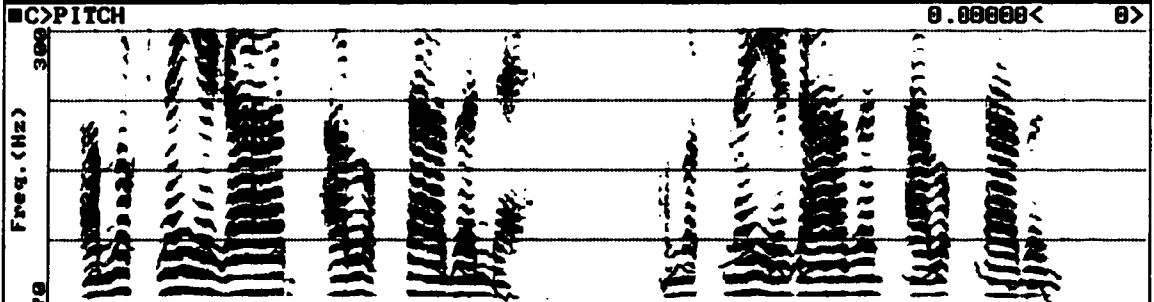
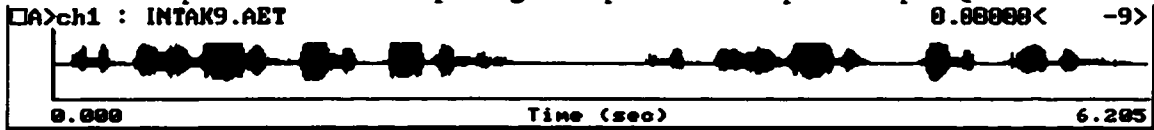
those girls they laughed  
 ama- kun ayaga- ada- n aalu- xta- ada- ku- n  
 that demp wife like 3abp laugh temp like prs 3abp



AK9

Amakun ayagaadan aaluftaadanan, ii? *Did the girls laugh?*  
 those girls they laughed eh

ama- kun ayaga-ada- n aalu- fta- ada- na- n ii  
 that demp wife like 3abp laugh temp like rmt pst 3abp Q



AK11, AK12

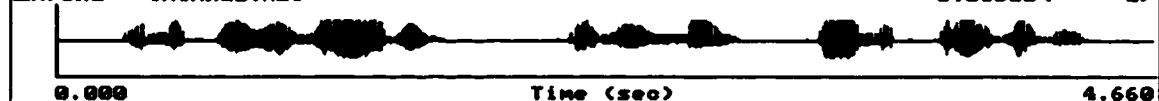
Amakun ayagaadan angunangin aaluftaadanan, ii. *The big girls laughed.*

those girls big ones they laughed eh

ama- kun ayaga- ada- n anguna- ngin aalu- fta- ada- na- n ii

that demp wife like rlp big 3refp laugh temp like rmt pst 3abp Q

□A>ch1 : INTAK11.AET 0.00000< 1>

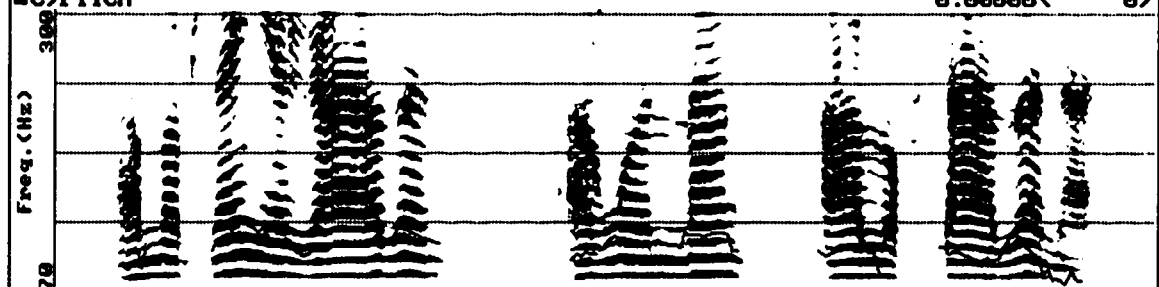


□B>ch1 : IPA TRANSCRIPT 0.00000

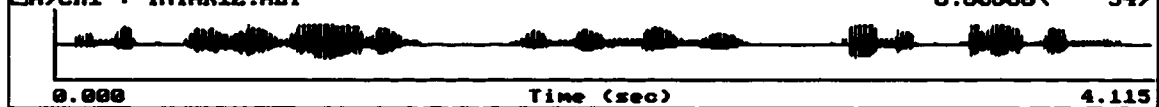
a məh a y i ɣ a ð ə n ə ɲ u n ə ɲ i n a l o ɣ t a ð ə n ə

0.000 Time (sec) 4.660

■C>PITCH 0.00000< 0>



□A>ch1 : INTAK12.AET 0.00000< 54>



□B>ch1 : IPA TRANSCRIPT 0.00000

a məh a y i ɣ a ð ə n ə ɲ u n ə ɲ i n a l o ɣ t a ð ə n ə

0.000 Time (sec) 4.115

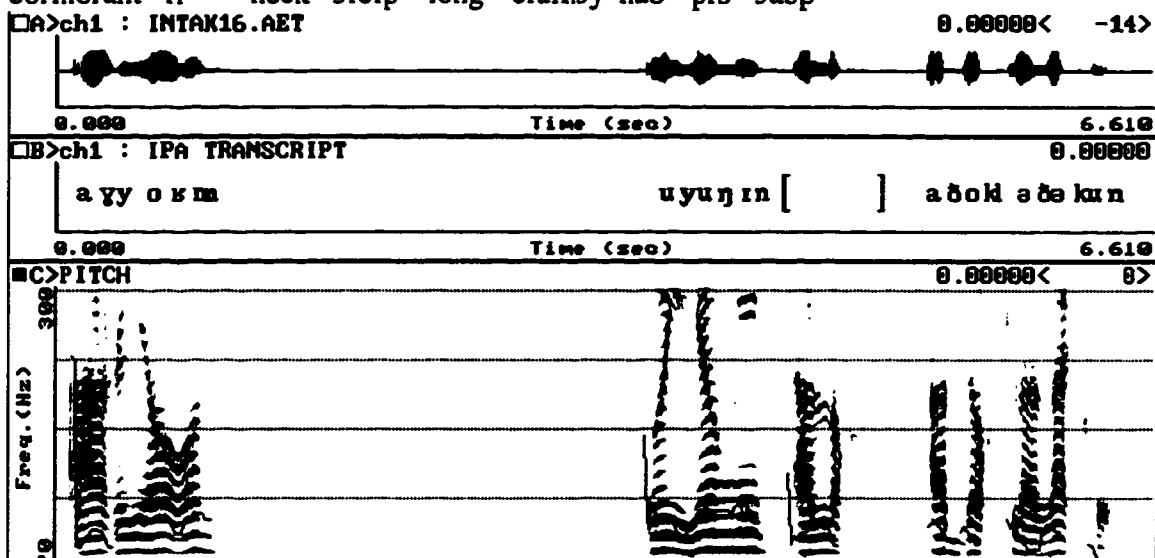
■C>PITCH 0.00000< 8>



AK16

Aagyuuḡim uyungin aduqladakuḡ. *Cormorants' necks are long.*

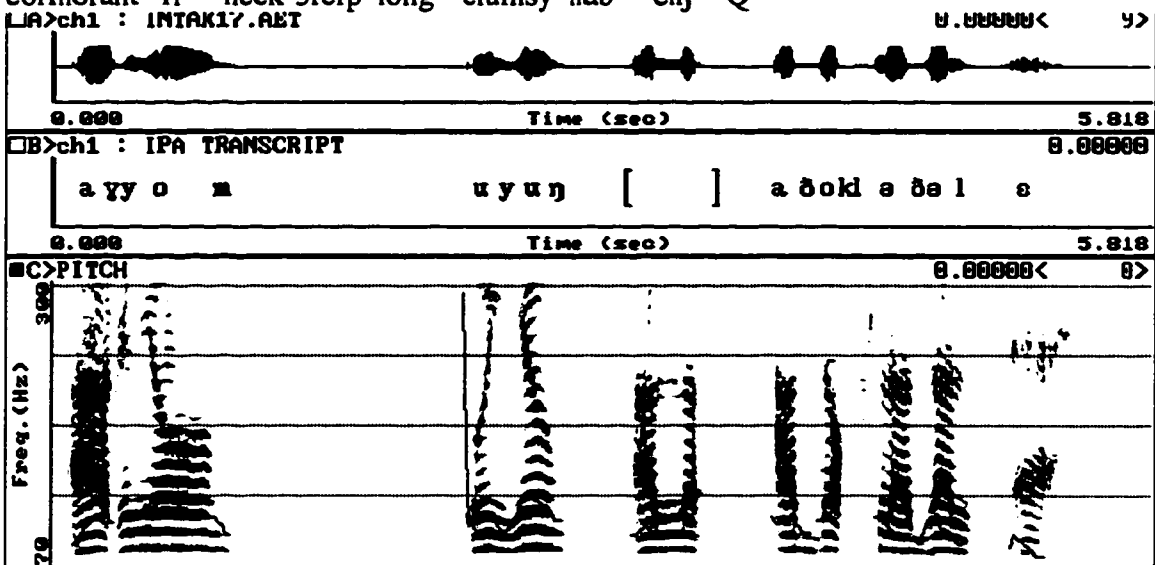
cormorants' their necks they are long  
 aagyuuḡi- m uyu- ngin adu- qla- da- ku- n  
 cormorant r1 neck 3refp long clumsy hab prs 3abp



AK17

Aagyuuḡim uyungin aduqladalix, ii *Are cormorants necks long?*

cormorants' their necks are they long eh  
 aagyuuḡi- m uyu- ngin adu- qla- da- lix ii  
 cormorant r1 neck 3refp long clumsy hab cnj Q



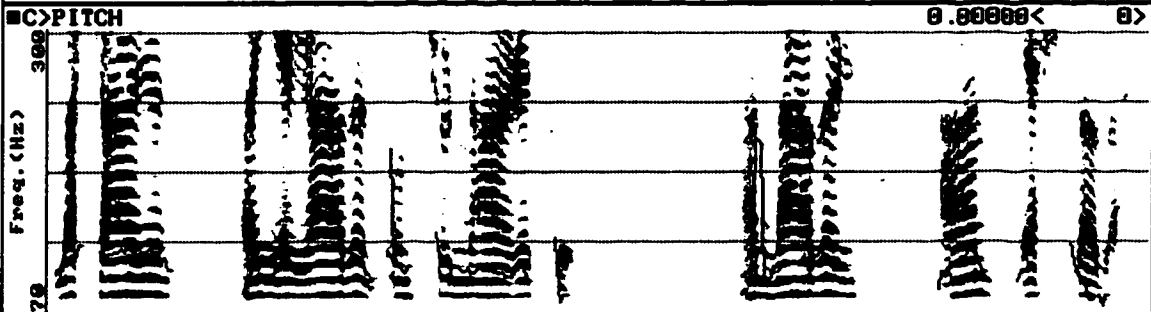
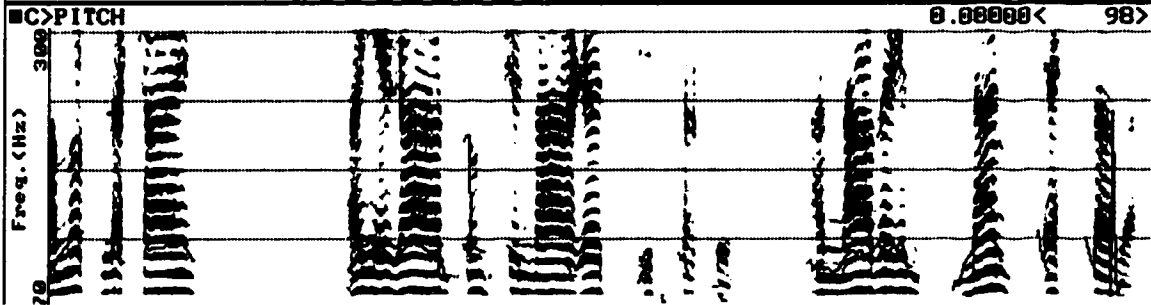
AK18, AK19

Amakun lakaayan ayagaadan umchunaagilix, *If boys try to kiss girls, —*  
 those boys girls if they try to kiss

ilixtakun, anaadagan ngaan ittada. *tell their mothers.*  
 it is said their mothers to tell

ama- kun lakaaya- n ayaga- ada- n umchu- naagi- lix  
 that demp boy 3abp wife like 3abp kiss try to cnj

ilixta- ku- n anaada- gan ngaan ixt- ada  
 be said prs 3abp mother rl to say imp



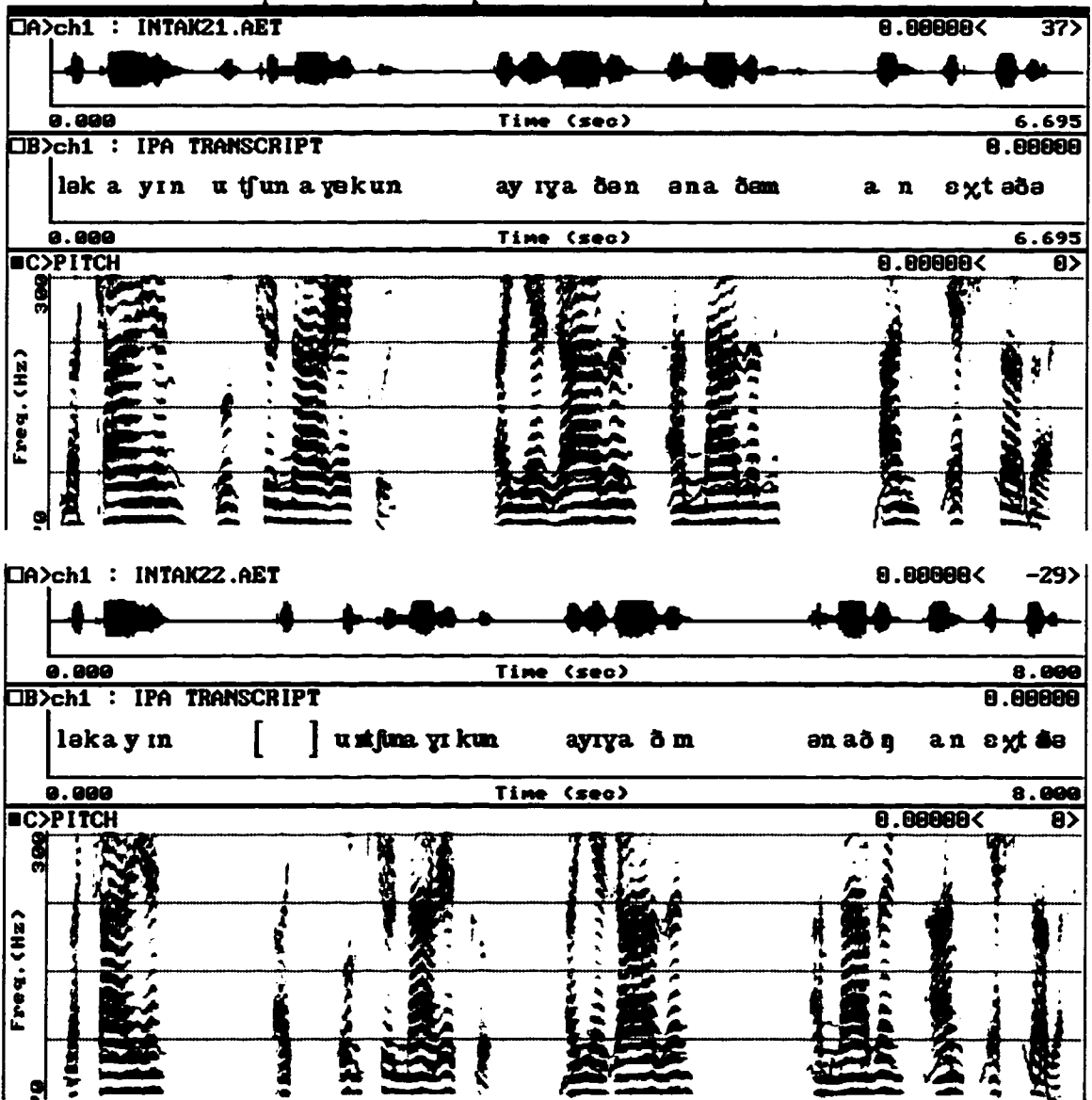
AK21

Lakaayan umchunaaḡikun, *If boys try to kiss, —*  
 boys they try to kiss

ayagaadan anaadangin aan ixtada. *girls tell their mothers*  
 girls their mother to tell

lakaaya- n umchu- naaḡi- ku- n  
 boy 3abs kiss try to prs 3abp

ayaga- ada- n anaada- ngin aan ixta- da  
 wife like 3abp mother 3refp to tell imp

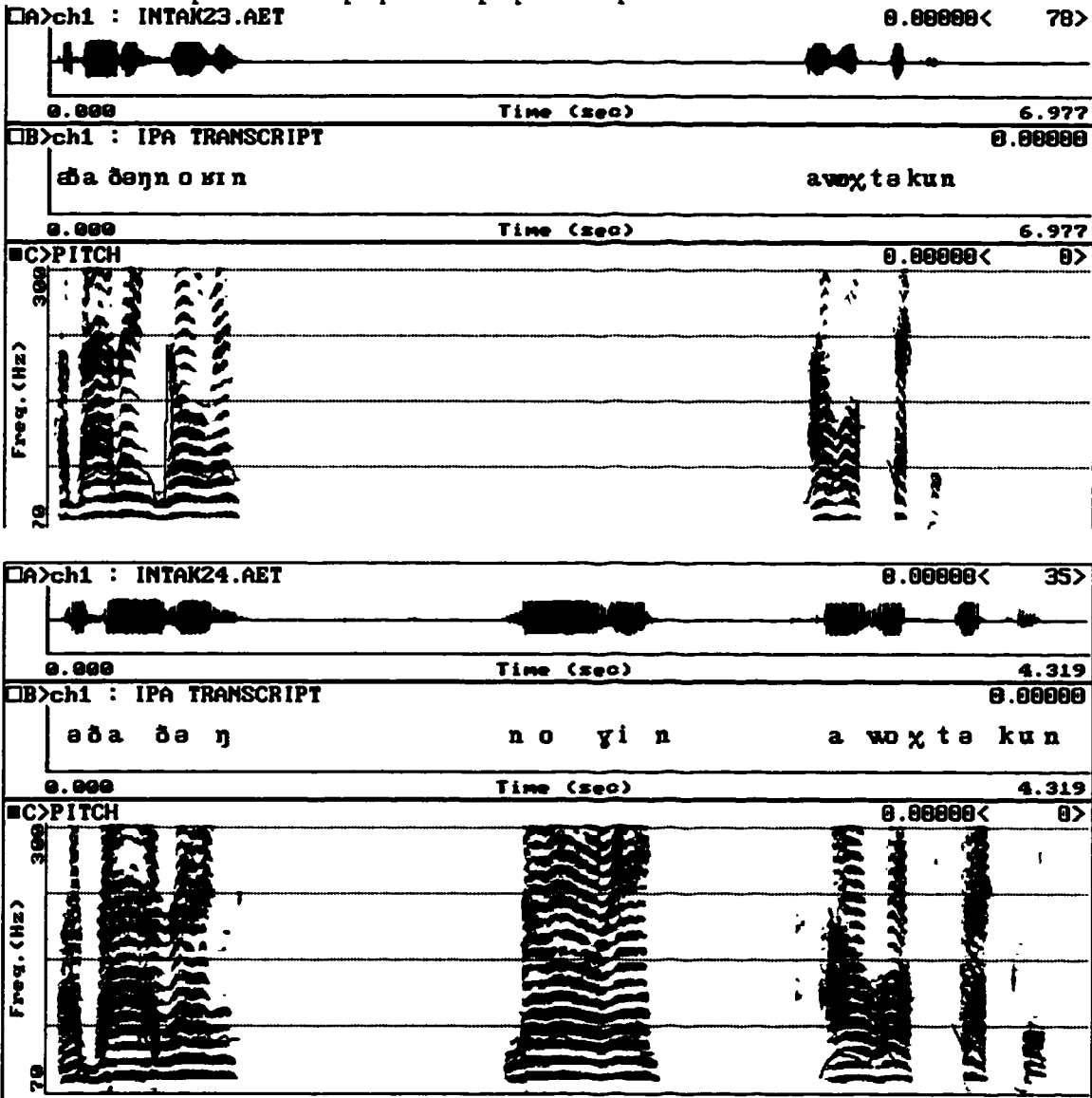


AK23, AK24

Adaadangin nuḡin aḡuḡtakun.  
 their fathers rocks they packed

*Their fathers carried rocks.*

adaada- ngin nuḡi- n aḡu- ḡta- ku- n  
 father 3refp rock 3abp pack tmp prs 3abp



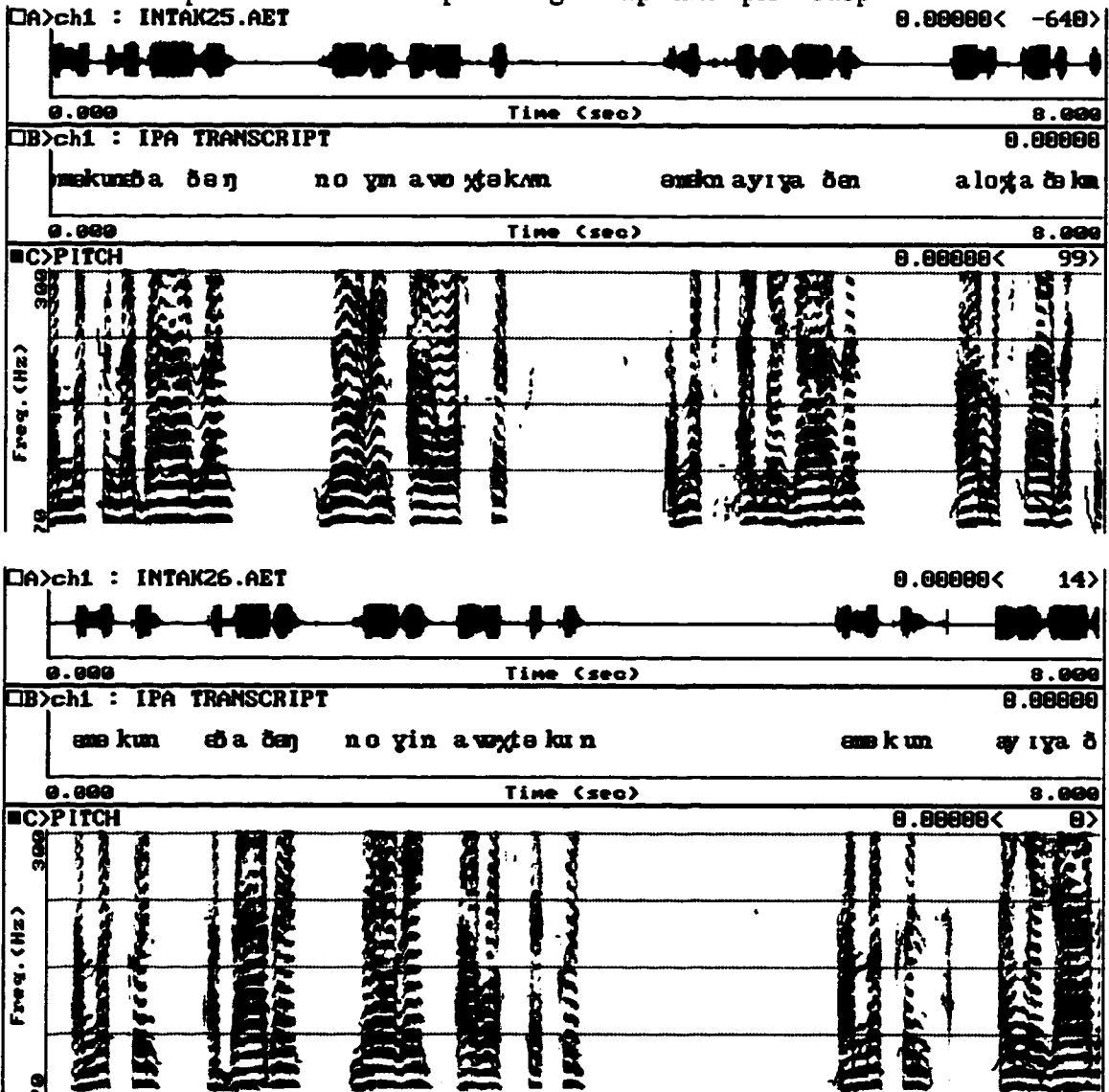
AK25, AK26

Amakun adaadangin nuġin aġuttakun,  
 those their fathers rocks they packed

amakun ayagaadan aaluftaadakun.  
 those girls they laughed

Ama- kun adaada- ngin nuġi- n aġu- ŋta- ku- n  
 that demp father 3refp rock 3abp pack temp prs 3abp

ama- kun ayaga- ada- n aalu- ŋta- ada- ku- n  
 those demp wife ike 3abp laugh temp like prs 3abp

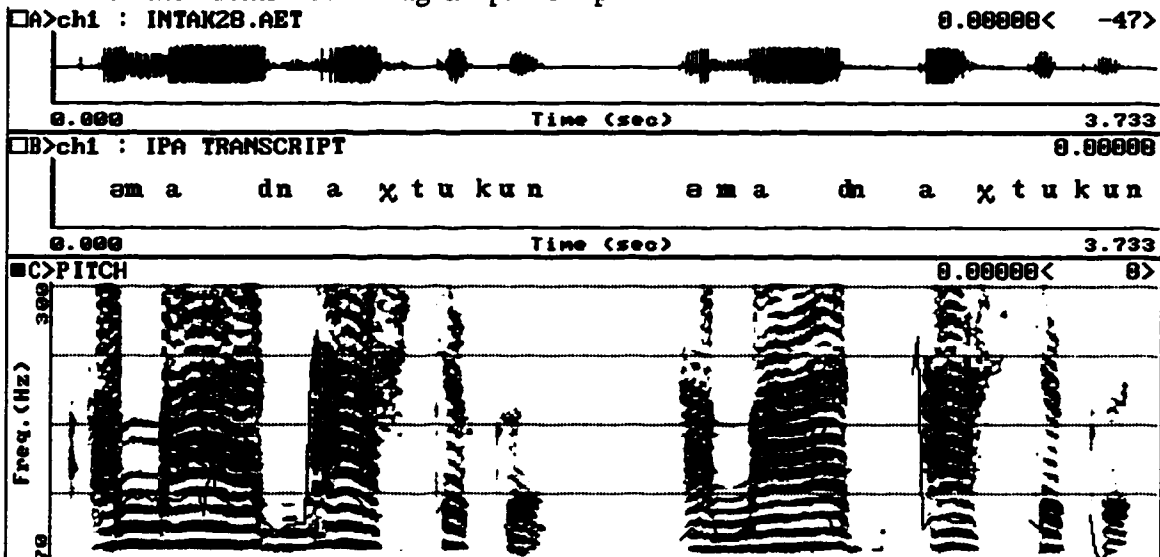


AK28

Amaadan axtukun.  
out there we were

*We were out there (camping)*

ama- ada- n a- axtu- ku- n  
out there like dems be V again prs 3abp

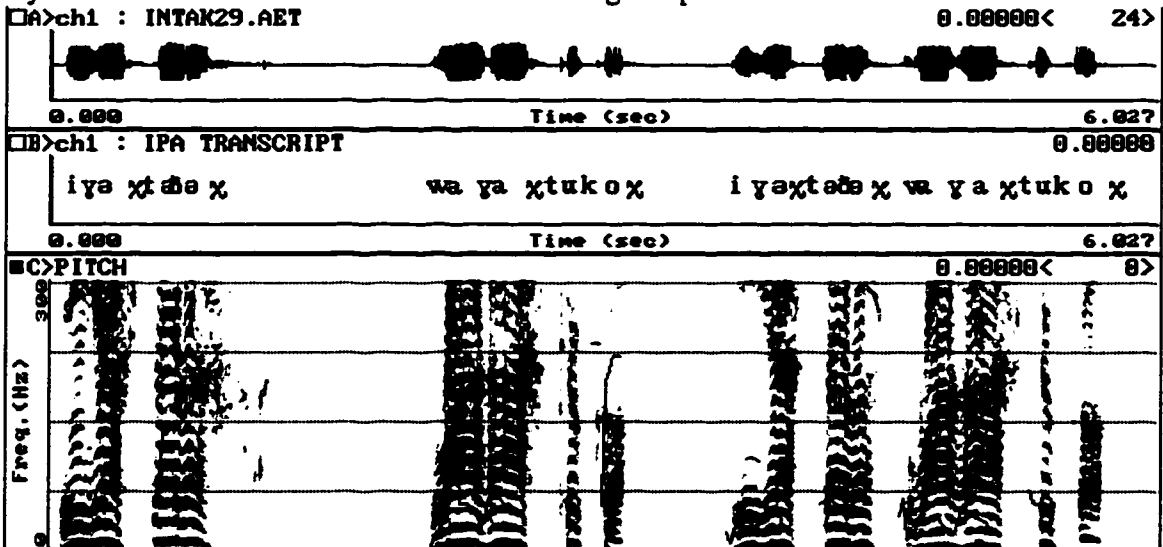


AK29

Igaɣtadaɣ waagaaxtukux.  
airplane it came here

*The airplane came.*

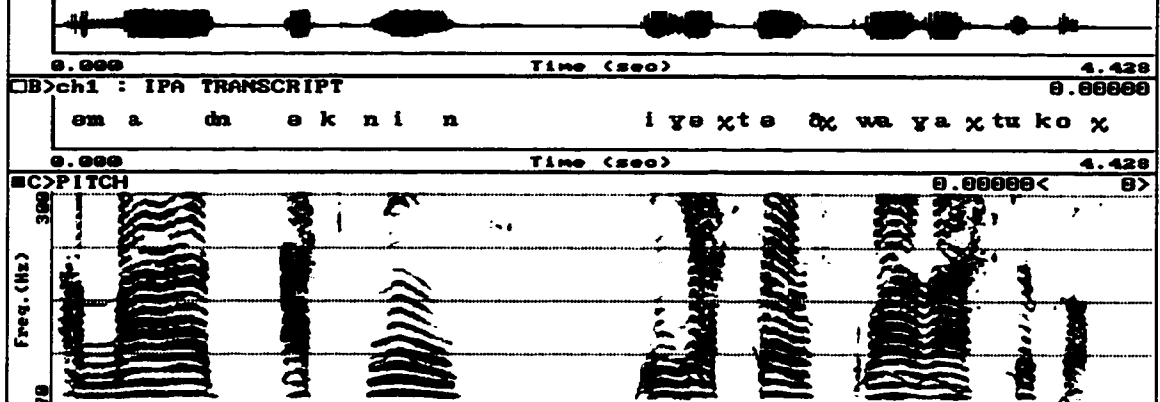
iga- ɣta- da- ɣ waaga- axtu- ku- ɣ  
fly skilled V-er hab 3abs come here V again prs 3abs



AK31

Amaadan akuniin, igattadax waagaastukux. When we were out there, —  
 out there we were for airplane it came again the airplane came.

ama- ada- n a- ku- niin iga- xta- da- x waaga- astu- ku- x  
 out.there like dems be prs fly skilled V-er hab 3abs come here V again prs 3abs  
 □A>ch1 : INTAK31.AET 0.00000< 77>

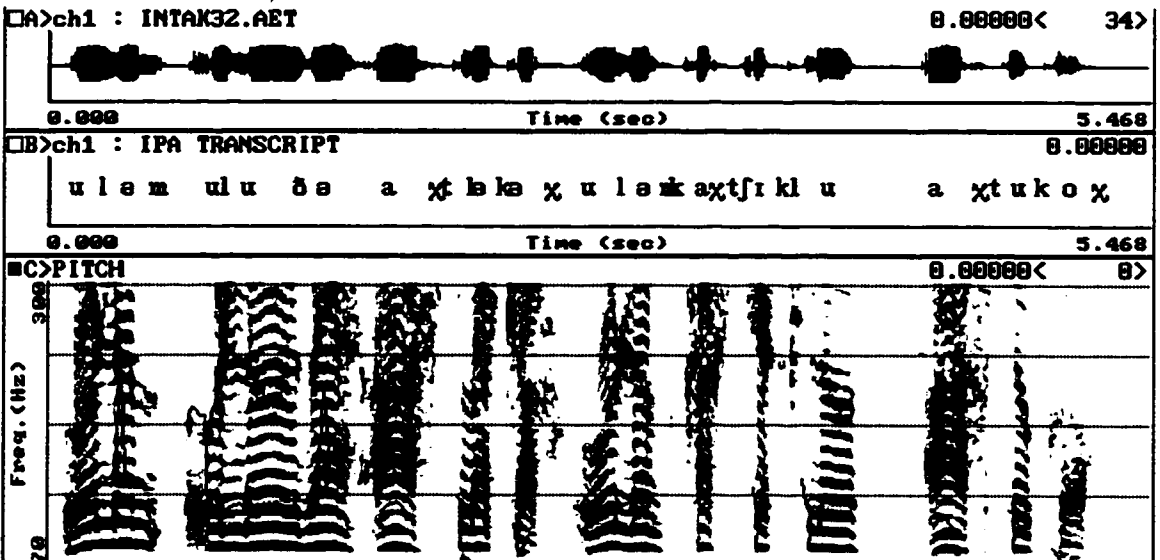


AK32

Ulam uluudaa aattlakax, ulam qaxchikluu aattukux.  
 house red one it is not house black one it is

ula- m uluuda- a a- axt- laka- x ula- m qaxchiklu- u  
 house rl red 3refs be to V again neg 3abs house rl black 3refs  
 a- astu- ku- x  
 be V again prs 3abs

*Their house isn't red, their house is black.*

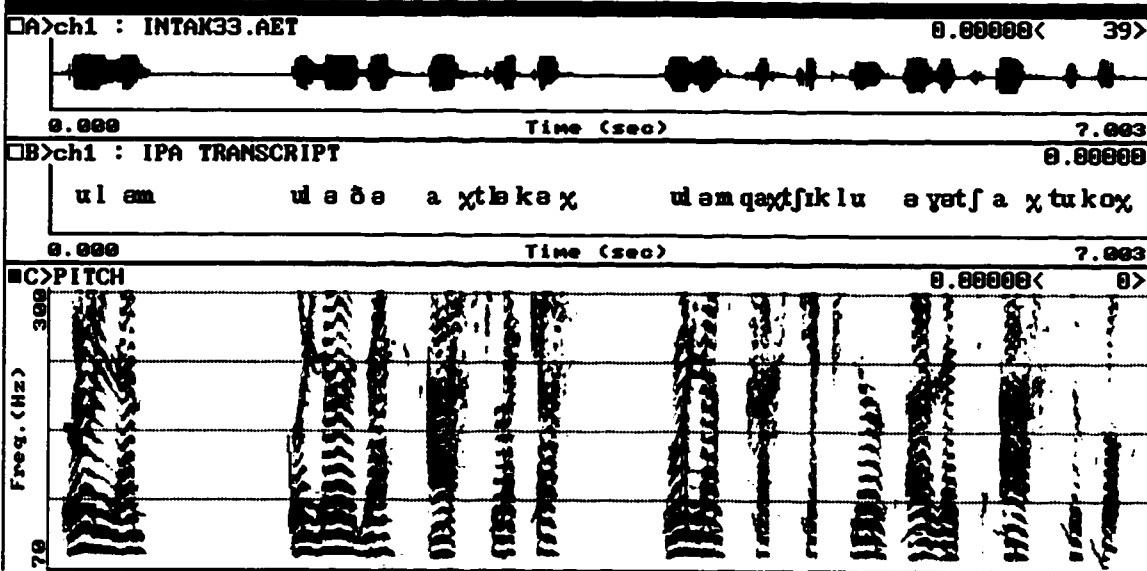


AK33

Ulam uluudas axtlakax, ulam qaxchikluu agach axtukux.  
 house red one it is not house black one only it is

ula- m uluuda- a a- axt- laka- x ula- m qaxchiklu- u  
 house rl red 3refs be V again neg 3abs house rl black 3refs  
 agach a- axtu- ku- x  
 only be V again prs 3abs

*Their house isn't red, their house is black.*



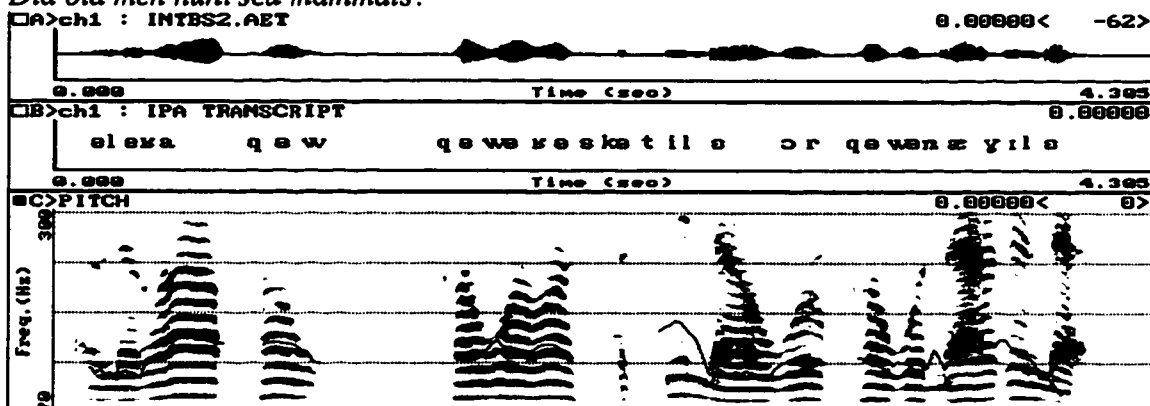
Bill Shane

BS2

Aliqaadan qawaŋ astatiliŋ, ii (or) qawanaaŋilix, ii?  
 old men sealion killed eh they hunted sealions eh

aliqa- ada- n qawa- ŋ astati- lix ii (or) qawa- naaŋi- lix, ii.  
 old man like 3refs sealion 3abs kill cnj Q sealion try for cnj Q

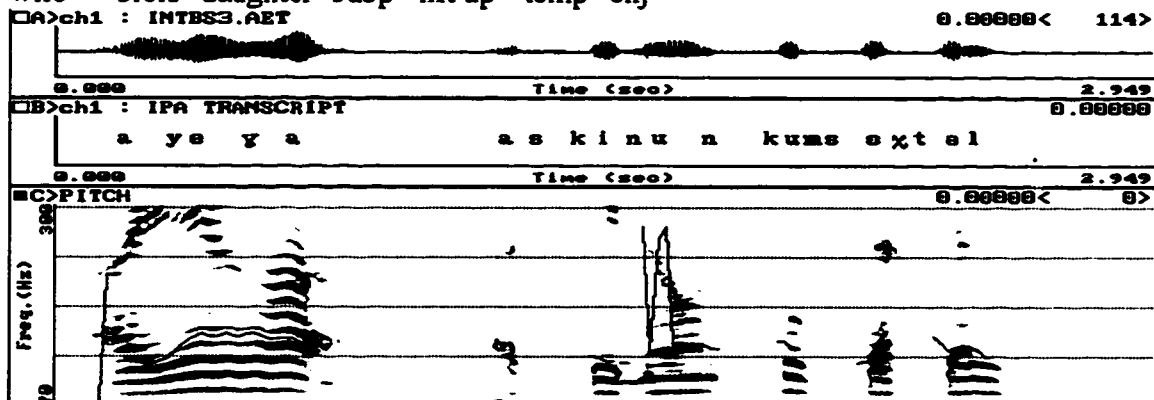
*Did old men hunt sea mammals?*



BS3

Ayagaa asxinun kumsittalix. *The mothers carried the girls.*  
 women daughters did they carry

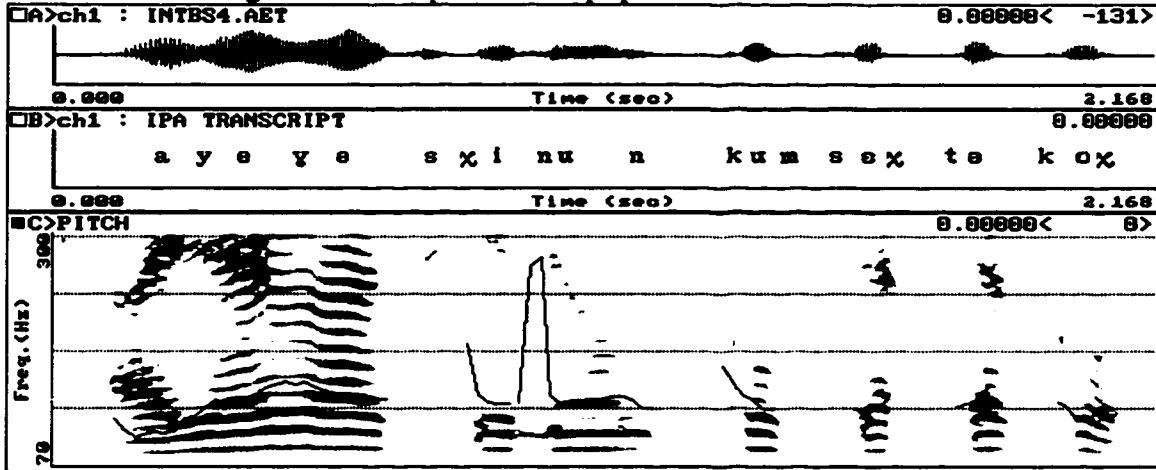
ayaga- a asxinu- n kumsi- ŋta- lix  
 wife 3refs daughter 3abp lift up temp cnj



BS4

**Ayaga asxinuum kumsittakux**      *The mothers carried the girls.*  
 woman daughters they carried

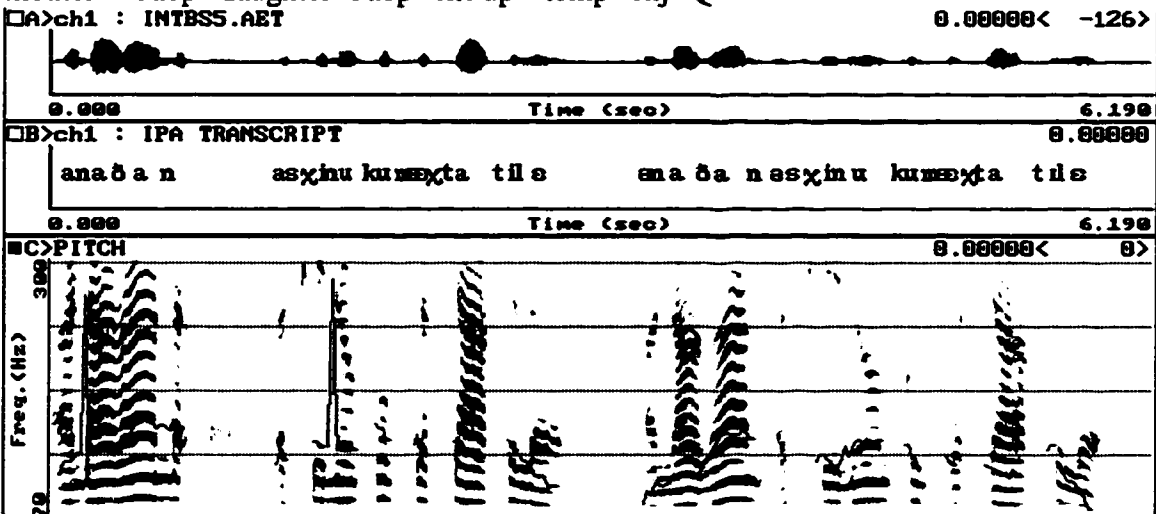
ayaga- a asxinu- u- m kumsi- xta- ku- x  
 wife 3refs daughter rl lift up temp prs 3abs



BS5

**Anaadan asxinun kumsittatlix, ii?**      *Did the mothers carry the girls?*  
 women daughters carried eh

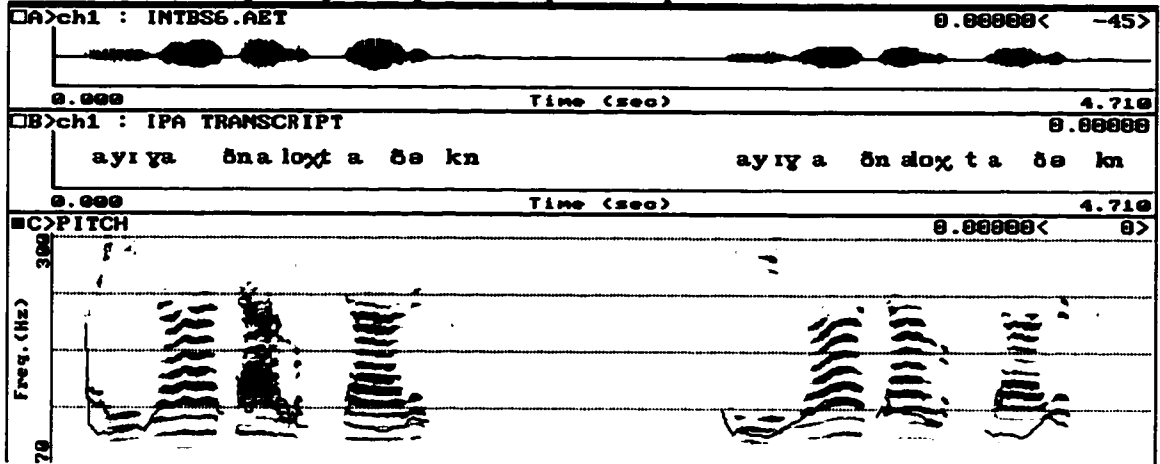
anaada- n asxinu- n kumsi- xta- lix ii  
 mother 3abp daughter 3abp lift up temp cnj Q



BS6

Ayagaadan aaluftaadakun. *The girls laughed.*  
 girls they laughed

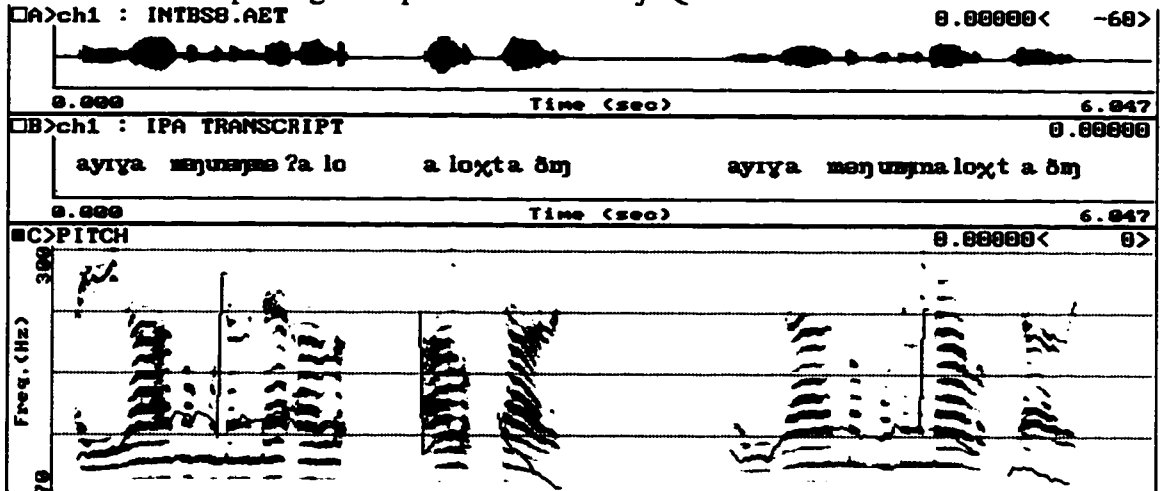
ayaga- ada- n aalu- xta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp



BS7

Ayagaadan aaluftaadaattilix, ii? *Did the girls laugh?*  
 girls they laughed eh

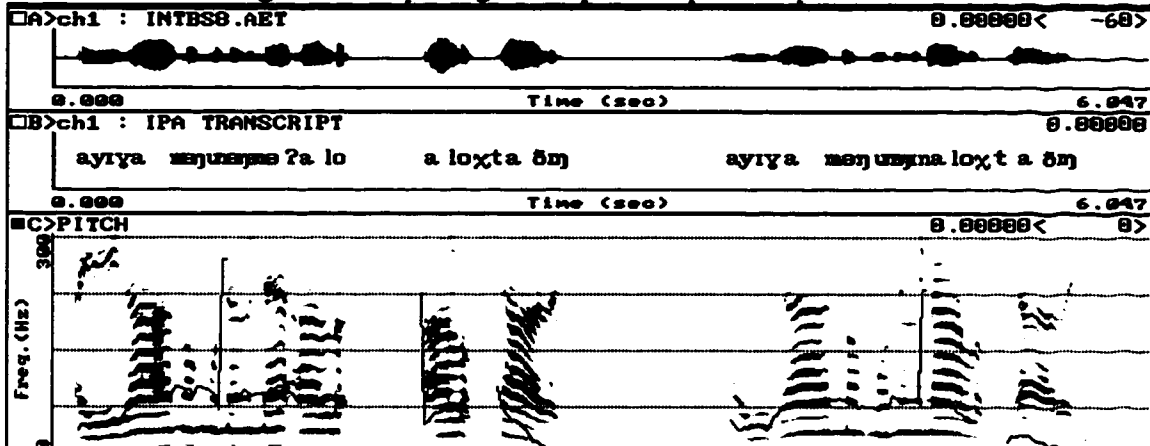
ayaga- ada- n aalu- xta- ada- axta- lix ii?  
 wife like 3abp laugh temp like dub cnj Q



BS8

**Ayagaadam**    **angunangin**    **aaluftaadakun.**    *The big girls laughed.*  
 girls            big ones            they laughed

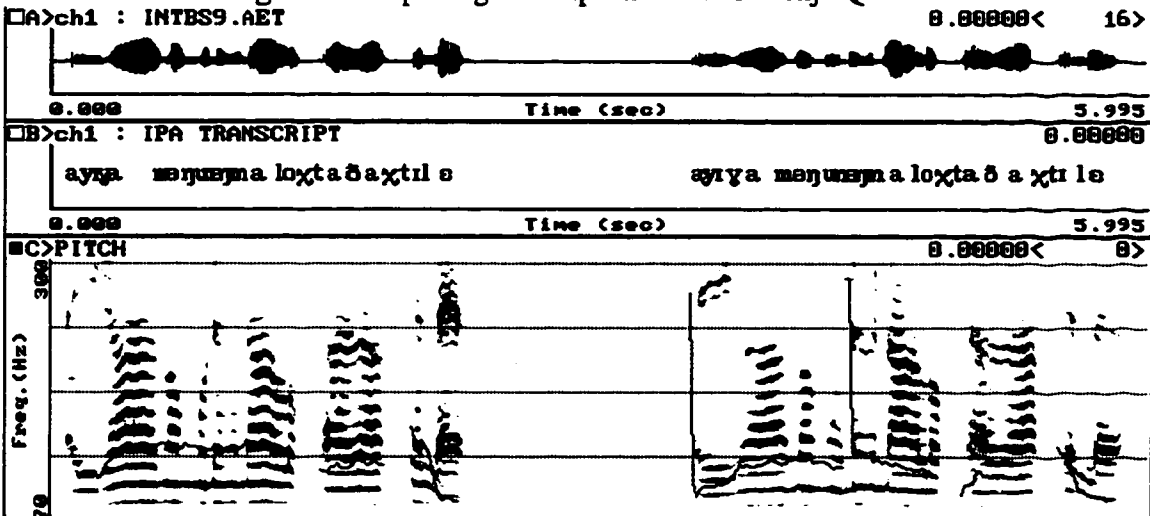
ayaga- ada- m anguna- ngin aalu- xta- da- ku- n  
 wife like rl big    3refp laugh temp hab prs 3abp



BS9

**Ayagaadam**    **angunangin**    **aaluftadaaftlix,**    *ii? Did the big girls laugh?*  
 girls            big ones            did they laugh            eh

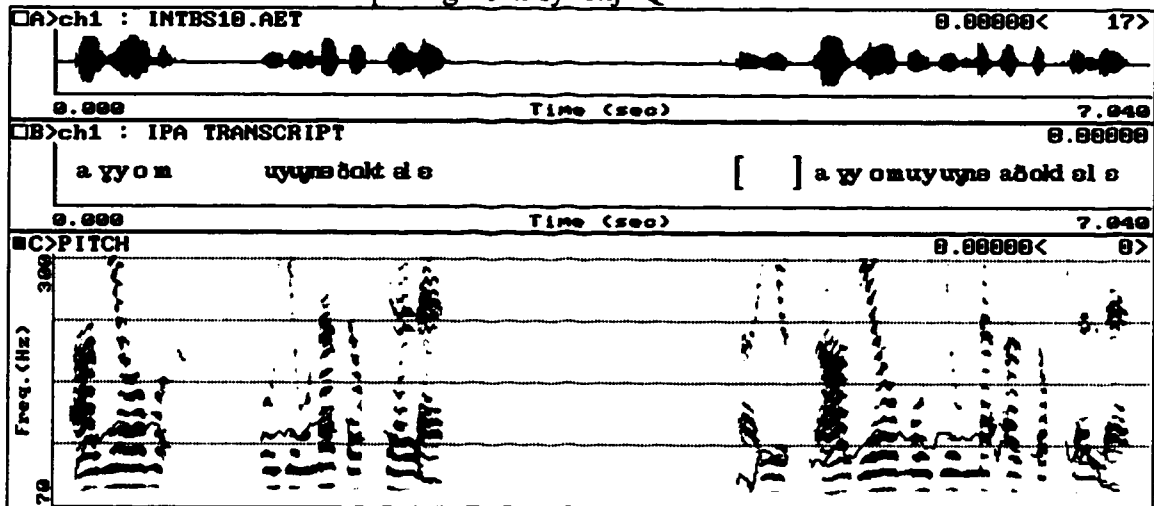
ayaga- ada- m anguna- ngin aalu- xta- ada- axta- lix ii?  
 wife like rl big    3refp laugh temp like dub cnj Q



BS10

Aagyuuḡim uyungin aduqlalix, ii? Are cormorants necks long?  
 cormorants' their necks are they long eh

aagyuuḡu- m uyu- nḡin adu- q1a- lix ii  
 cormorant rl neck 3refp long clumsy cnj Q

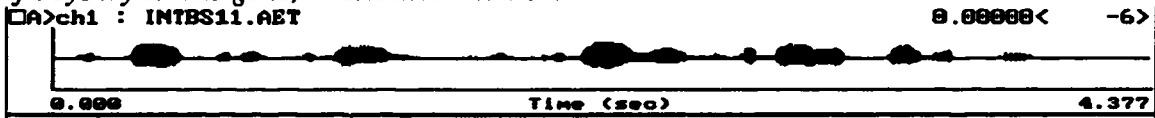


BS11, BS12

**Lakaayan** txin umchunaagiguun, anaadam ngaan ixtada.  
 boys her try to kiss mothers to them tell

lakaaya- n txin umchu- naagi- gu- u- n anaada- m ngaan ixta- da  
 boy 3abp 3s kiss try cnd 3abp mother rl to tell imp

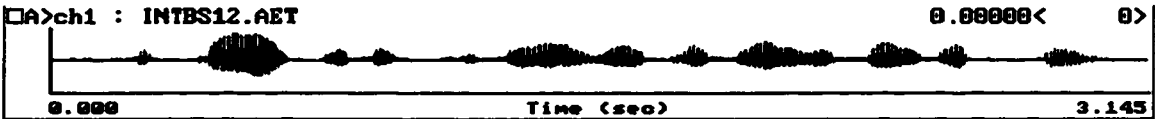
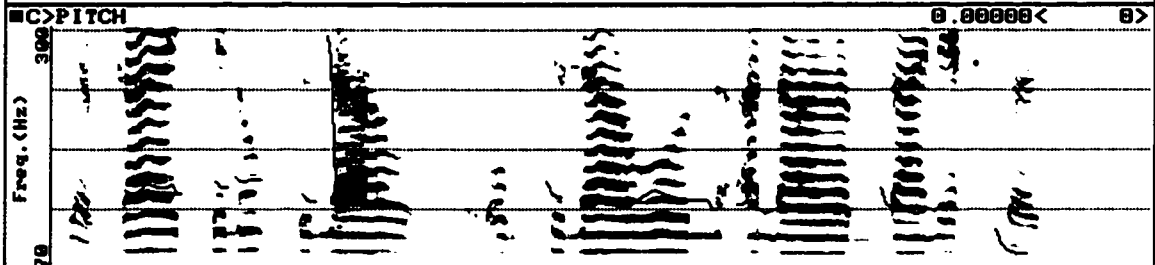
*If boys try to kiss girls, — tell their mothers.*



□B>ch1 : IPA TRANSCRIPT 0.00000

le ka ytinum tʃna ɔu] umʃin a ɣunə ən əðə mma ŋ əχ tə ɔ

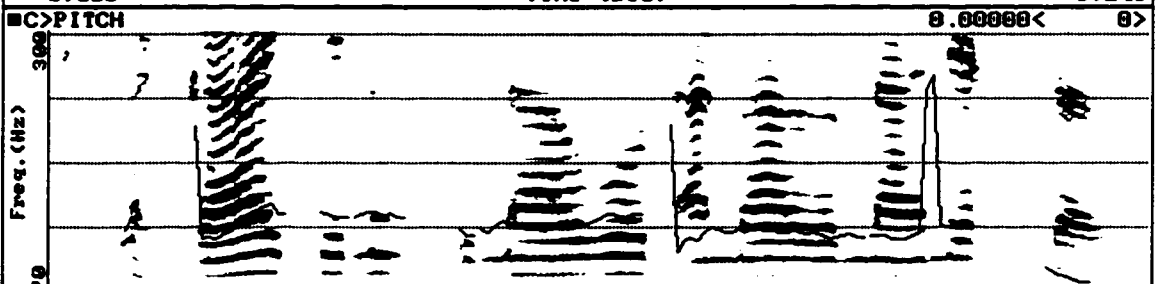
0.000 Time (sec) 4.377



□B>ch1 : IPA TRANSCRIPT 0.00000

le ka ytinum tʃna ɣunə n ə ɔə mma ŋ əχ tə ɔ

0.000 Time (sec) 3.145



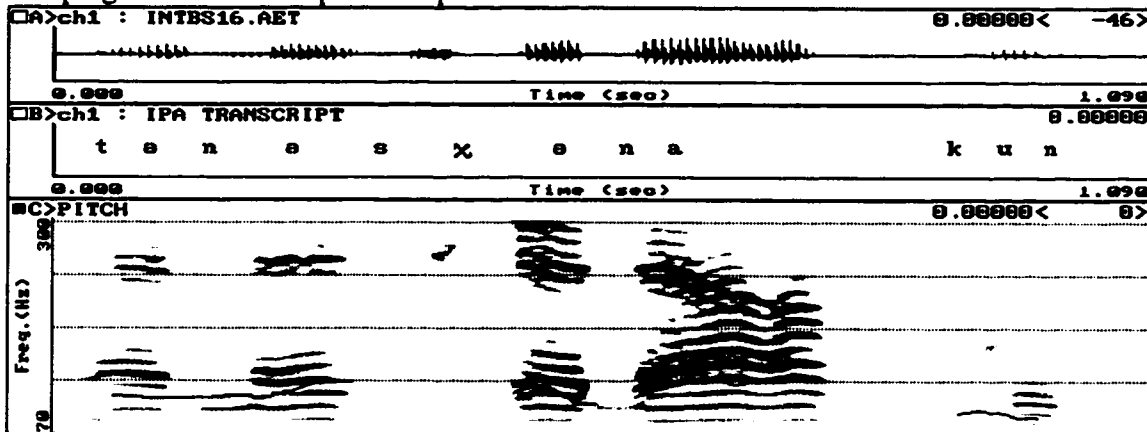


BS16

Tanasxen akun.  
camping area we were

*We were out there (camping)*

tanasxa- n a- ku- n  
camping area dems be prs 3abp

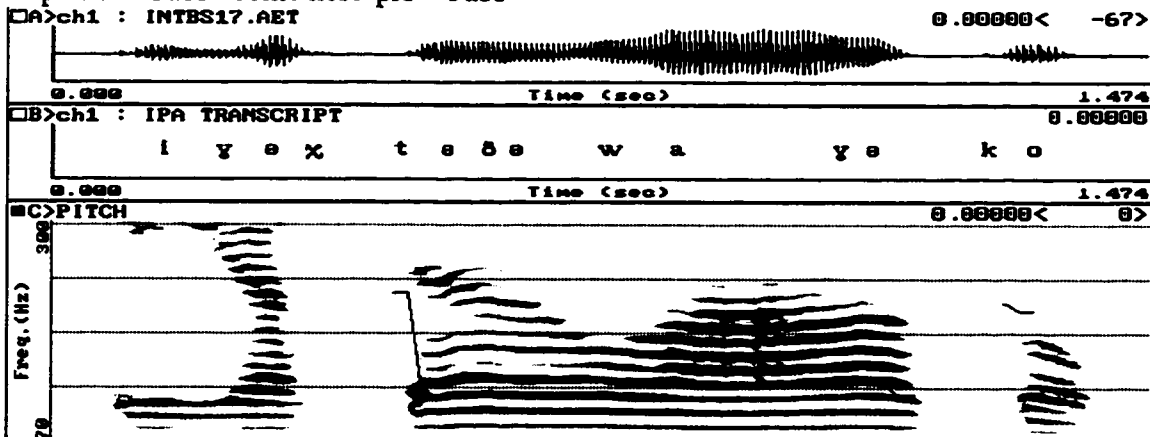


BS17

Igaɬtadaɬ waagaɬ.  
airplane it came here

*The airplane came.*

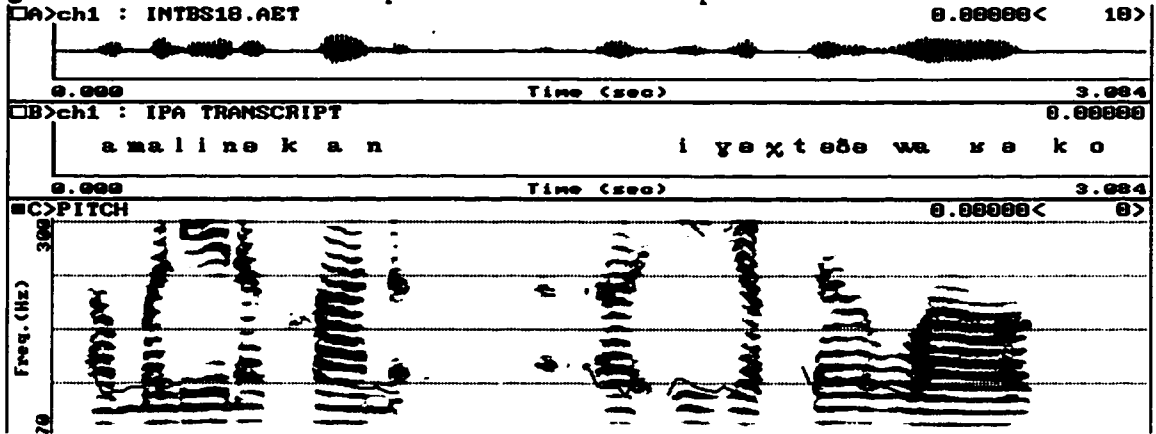
igaɬtada- ɬ waaga- ku- ɬ  
airplane 3abs come here prs 3abs



BS18

**Amaligan akuḡaan, iḡatadaḡ waḡḡakuḡ.** *When we were out there, —*  
 there at that time airplane it came *the airplane came.*

amaliga- n akuḡaan iḡatada- ḡ waḡḡa- ku- ḡ  
 go there dems then airplane 3abs come here prs 3abs

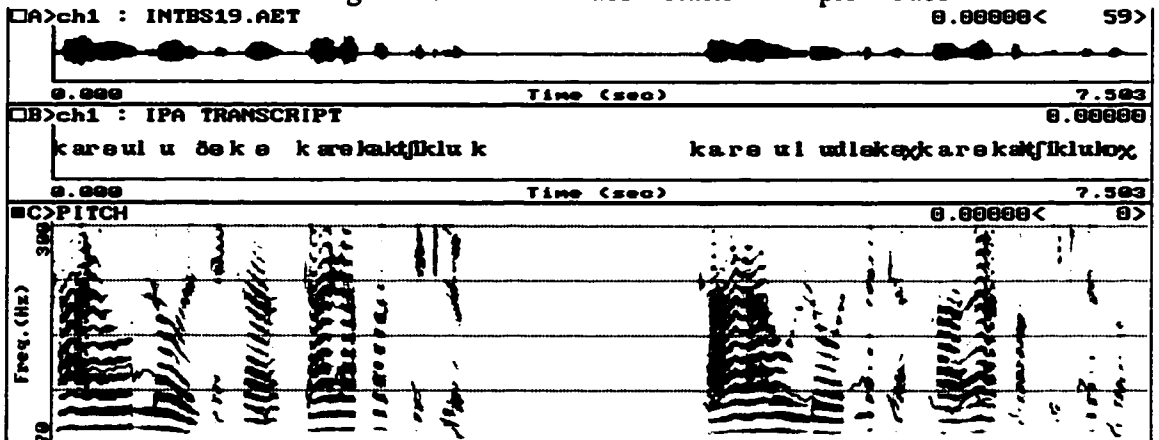


BS19

**Kaaraa uluudalakaḡ,** *The car isn't red,*  
 car red it is not

**kaaraa qaxchikluḡ.** *the car is black.*  
 car black it is

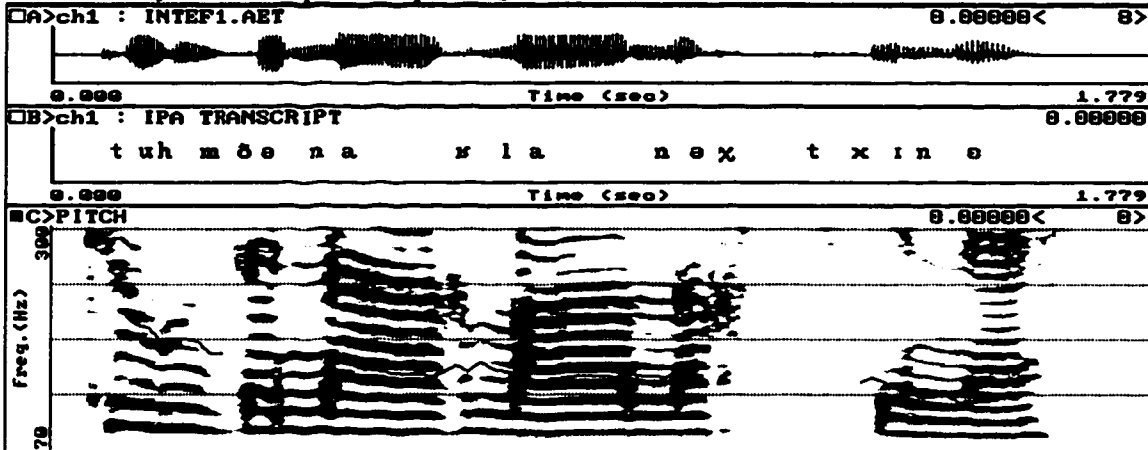
kaara- a uluuda- laka- ḡ kaara- a qaxchiklu- ku- ḡ  
 car 3refs red neg 3abs car abs black prs 3abs



Edna Floyd

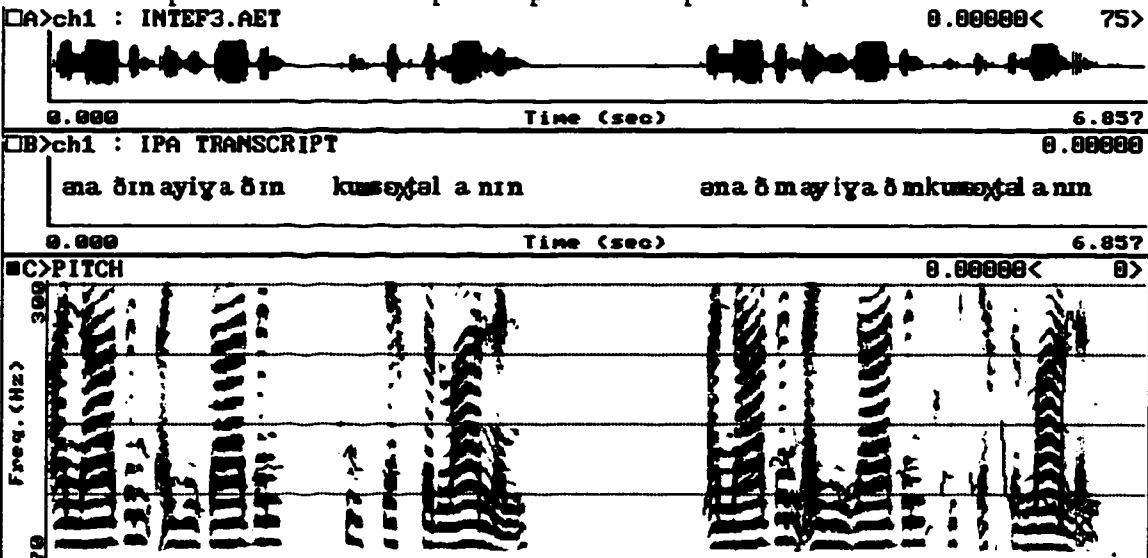
EF1

Tuhmdanaaḡilaḡanaaḡtxin, ii? *Did you try to shoot them?*  
 did they go shooting for them eh  
 tuhmda- naaḡi- laaḡana- aḡtxin ii  
 shoot try for rcnt pst 3Rp Q



EF3

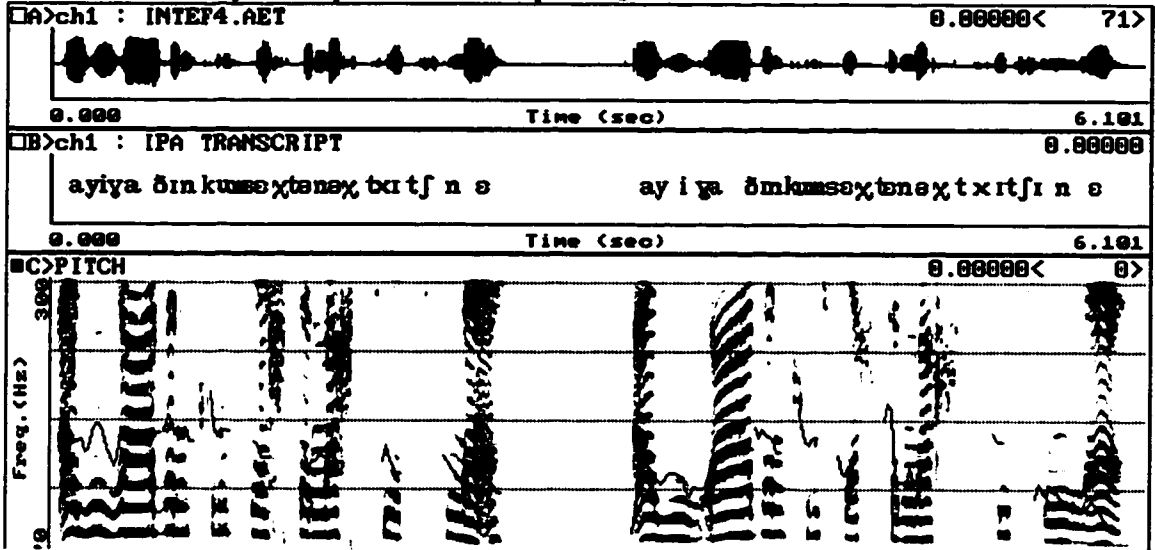
Anaadan ayagaadan kumsixtalaḡanan. *The mothers carried the girls.*  
 mothers girls they carried  
 anaada- n ayaga- ada- n kumsixta- laaḡana- n  
 mother 3abp wife like 3abp lift up rcnt pst 3abp



EF4

Ayagaadan kumsixtanaxichin, ii? *Did they carry the girls?*  
 girls did they carry eh

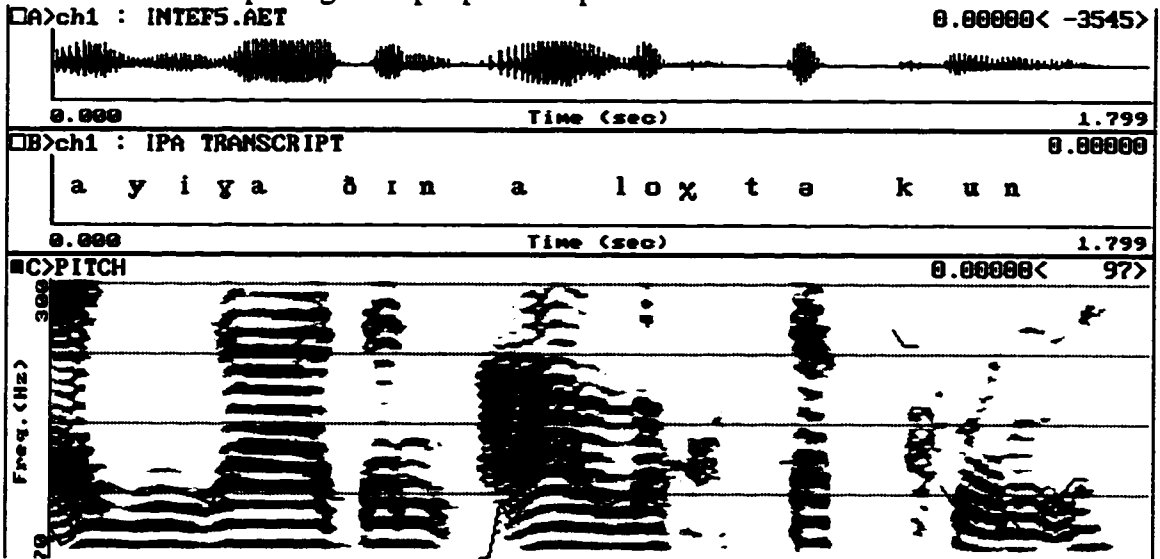
ayaga- ada- n kumsixta- naʔ- txichin ii  
 wife like 3abp lift up ?? 3Rp Q



EF5

Ayagaadan aaluxtakun. *The girls laughed.*  
 girls they laughed

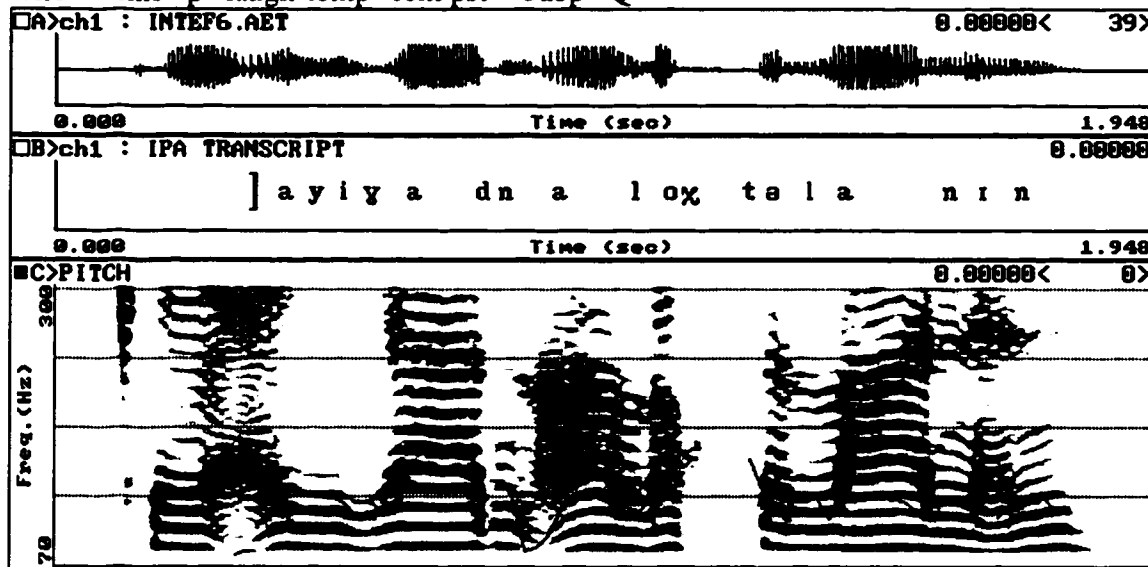
ayaga- ada- n aalu- xta- ku- n  
 wife like 3abp laugh temp prs 3abp



EF6

Ayagaadan aaluttalaaganan, ii? Did the girls laugh?  
 girls did they laugh eh

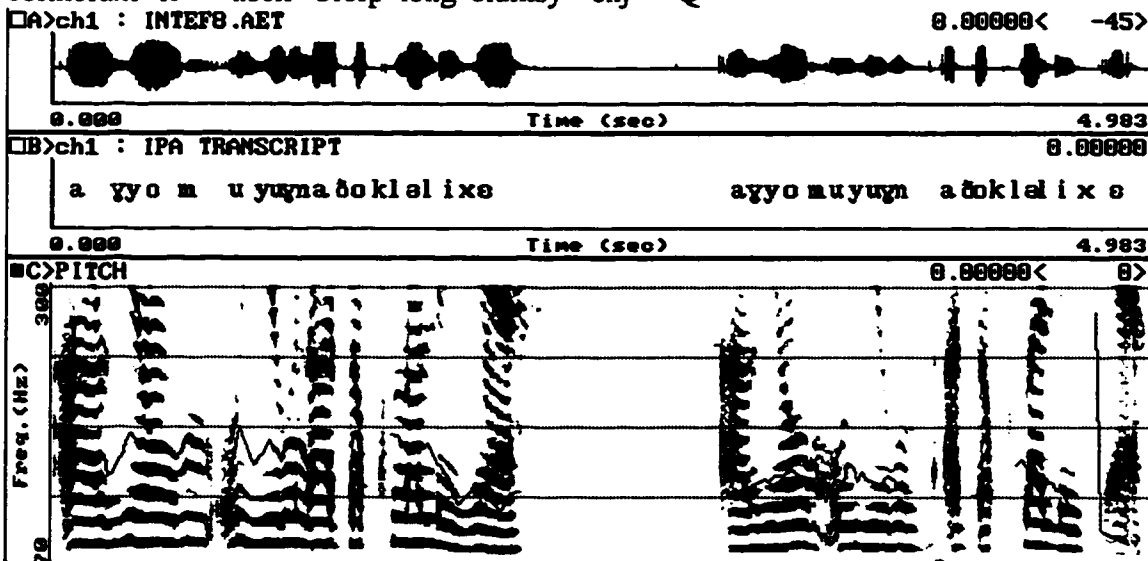
ayaga- ada- n aalu- xta- laaganan- n ii  
 wife like p laugh temp rent pst 3abp Q



EF8

Aagyuugiim uyungin aduqlalix, ii? Are cormorants' necks long?  
 cormorants their necks are they long eh

aagyuugi- m uyu- ngin adu- qla- lix ii  
 cormorant rl neck 3refp long clumsy cnj Q



EF9

Aang aduqlakun.  
yes they are long

*Yes, they are long.*

aang adu- qia- ku- n  
yes long clumsy prs 3abp



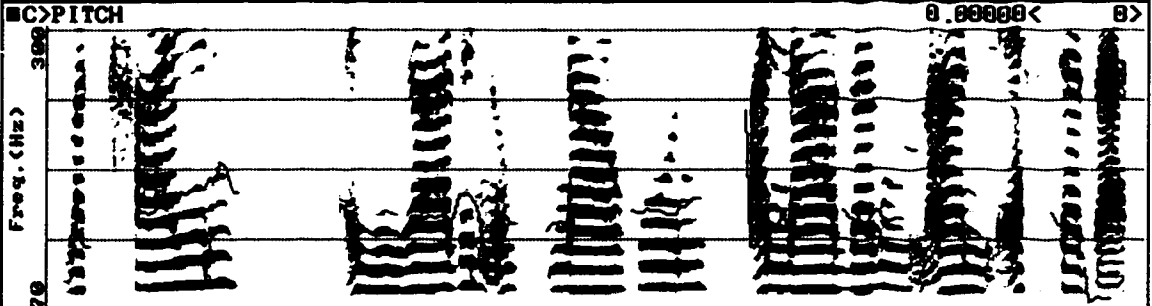
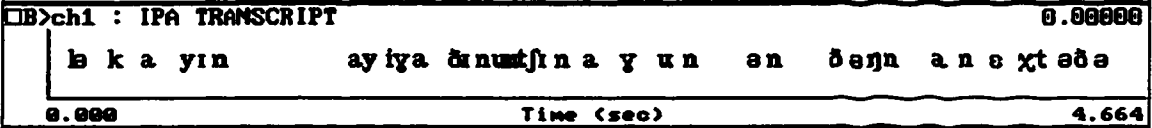
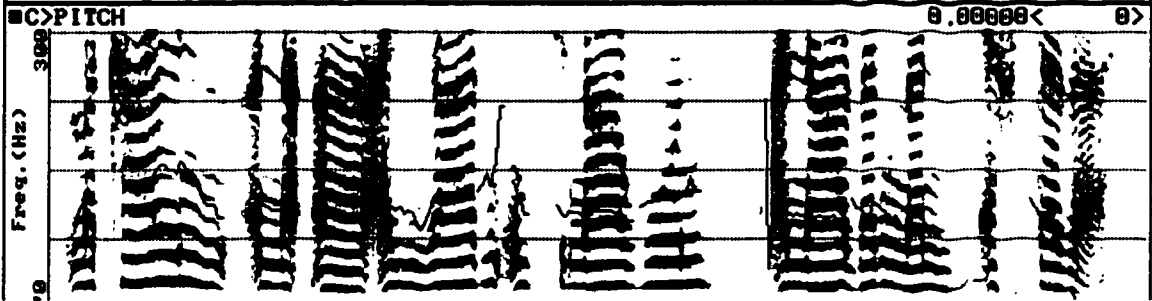
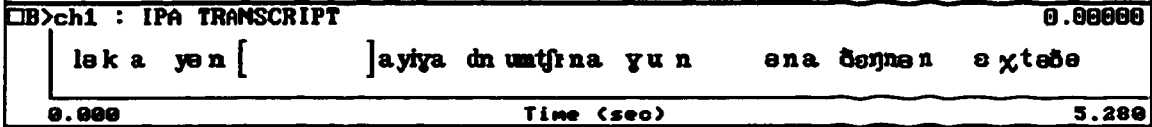
EF10, EF11

Lakaayan ayagaadan umchinaaguun, *If boys try to kiss girls, —*  
 boys girls they try to kiss them

anaadangin aan ixtada. *tell their mothers.*  
 their mothers to you tell

lakaaya- n ayaga- ada- n umchi- naagu- un  
 boy 3abp wife like 3abp kiss try 3Rs

anaada- ngin aan ixta- da  
 mother 3refp to tell imp



EF12

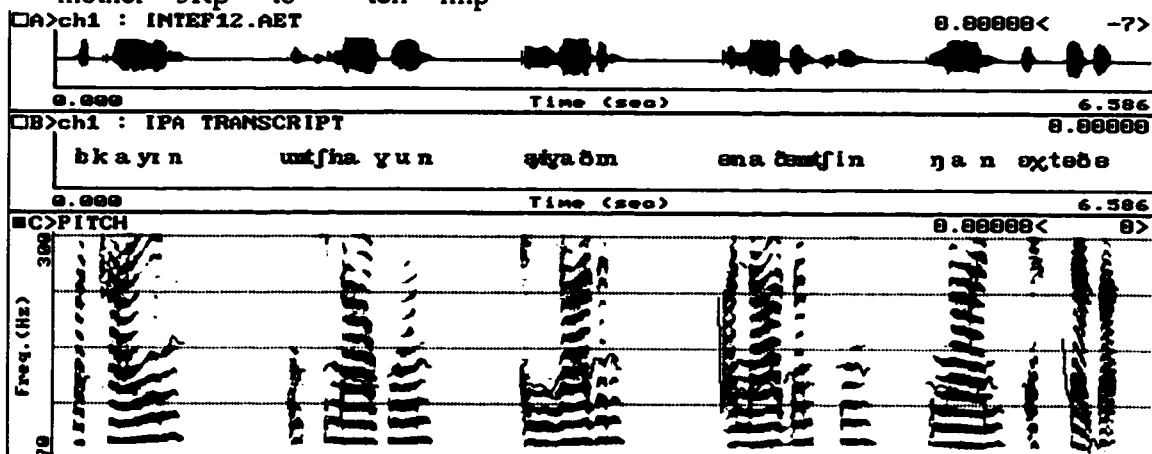
Lakaayan umchunaaguun,  
 boys they try to kiss them

*If boys try to kiss, —*

ayagaadan anaadamchin ngaan iftada. girls tell your mothers  
 girls their mothers to tell

lakaaya- n umchi- naagu- un  
 boy 3abp kiss try 3Rs

anaada- mchin ngaan ifta- da  
 mother 3Rp to tell imp

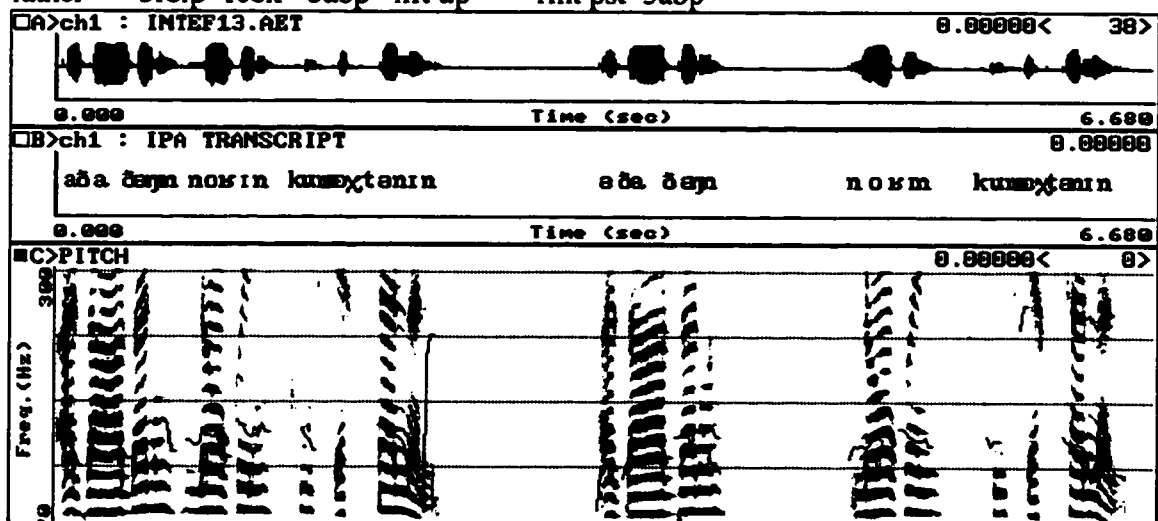


EF13

Adaadangin nuɟin kumsixtanən.  
 their fathers rocks they carried

*Their fathers carried rock.*

adaada- ngin nuɟi- n kumsixta- na- n  
 father 3refp rock 3abp lift up rmt pst 3abp



EF14

Adaadan nuġin kumsixtaguun,  
fathers rocks they carried them

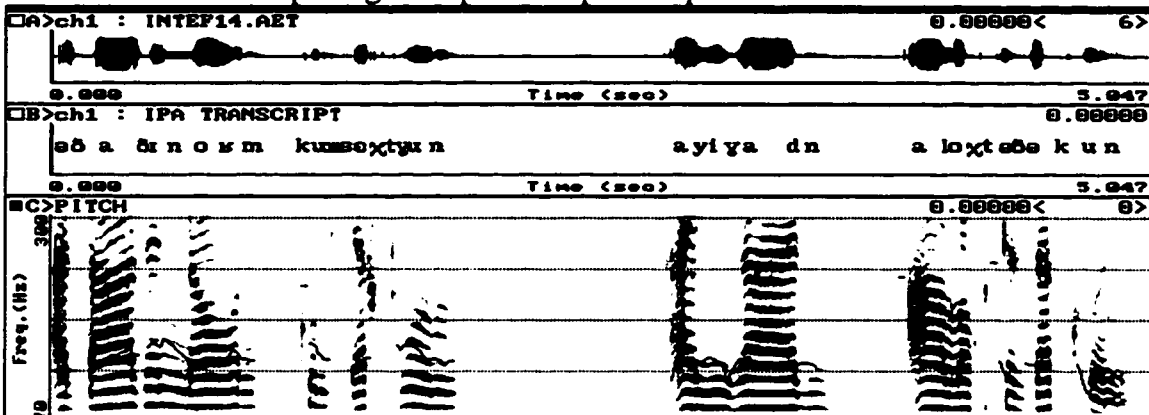
*When their fathers carried rocks, —*

ayagaadan aaluftaadakun.  
girls they laughed

*the girls laughed.*

adaada- n nuġi- n kumsixta- gu- un  
father 3abp rock 3abp lift up cnd 3Rs

ayaga- ada- n aalu- xta- ada- ku- n  
wife like 3abp laugh temp like prs 3abp

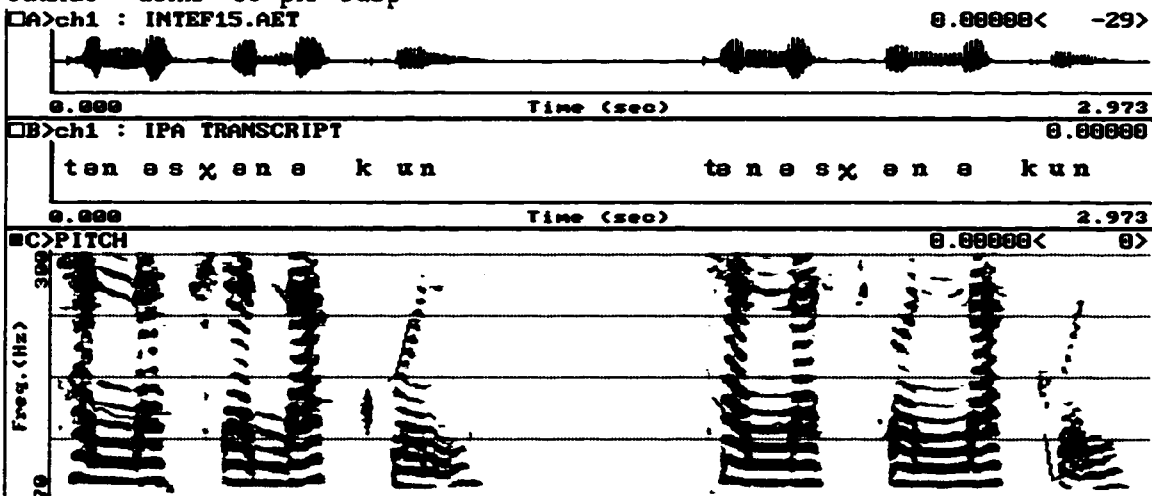


EF15

Tanasxan akun.  
outside we were

*We were out there (camping)*

tanaxa- n a- ku- n  
outside dems be prs 3abp



EF16

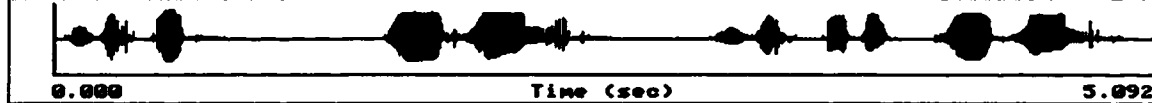
Igattadaɣ waagalaaganax.  
airplane it came here

*The airplane came.*

iga- xta- da- x waaga- laagana- x  
fly skilled V-er hab 3abs come here rcnt pst 3abs

▣A>ch1 : INTEF16.AET

0.00000< 27>



▣B>ch1 : IPA TRANSCRIPT

0.00000

igəxtəðx wa yla nə x igəxtəðəx wa yla nə x

▣C>PITCH

0.00000< 0>



EF21

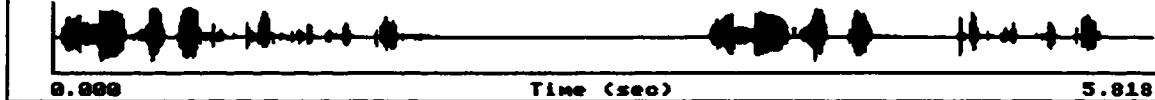
Uuluudalakar qaɣchiklukuɣ.  
red it is not black it is

*It's not red, it's black.*

uuluuda- laka- x qaɣchiklu- ku- x  
red neg 3abs black prs 3abs

▣A>ch1 : INTEF21.AET

0.00000< -10>



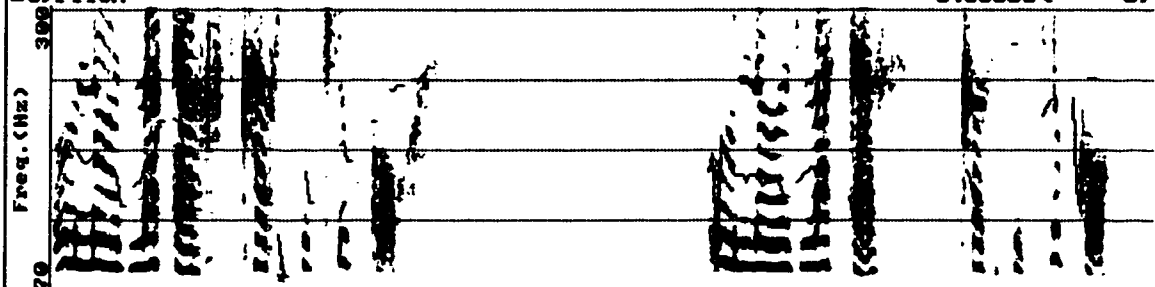
▣B>ch1 : IPA TRANSCRIPT

0.00000

ul u ðləkəx ka xɣɰklu kox ul u ðləkəx kaɣɰɰɰɰɰ kox

▣C>PITCH

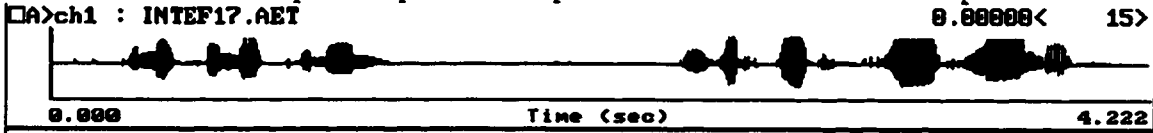
0.00000< 0>



EF17, EF18

Tanasxan akuniin, igaxtadax waagalaaqanaq. *When we were out there,*  
 outside we were for airplane it came *the airplane came.*

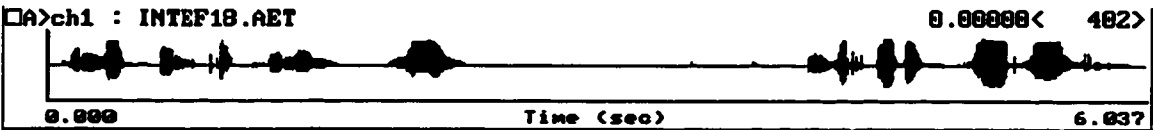
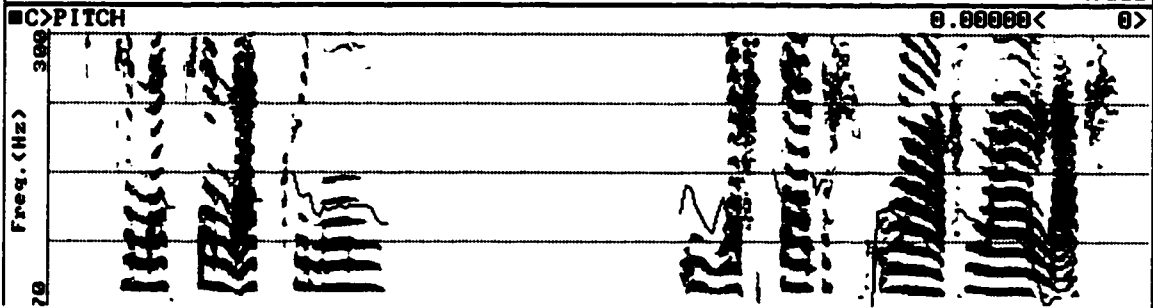
tanaxa- n a- ku- n- iin igaxtada- x waaga- laaqana- x  
 outside dems be prs 3abp for airplane 3abs come here rcnt pst 3abs



□B>ch1 : IPA TRANSCRIPT 0.00000

tanaxane kunin igaxtəðx wa ylane x

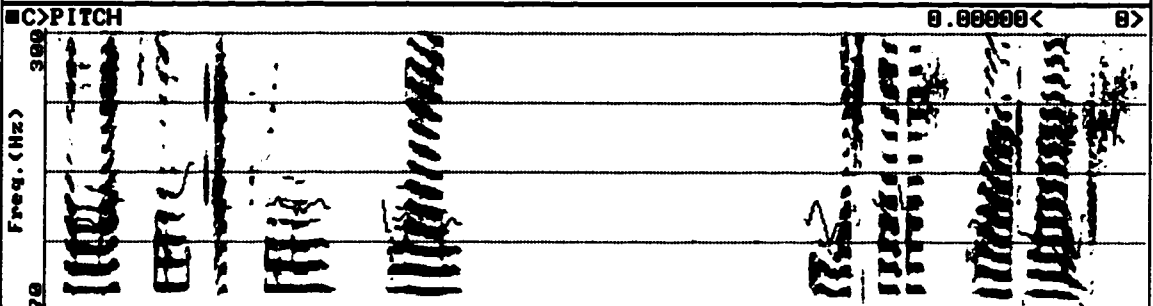
0.000 Time (sec) 4.222



□B>ch1 : IPA TRANSCRIPT 0.00000

tanəsxɪn əkuni njan igaxtəðx wa ylane x

0.000 Time (sec) 6.037

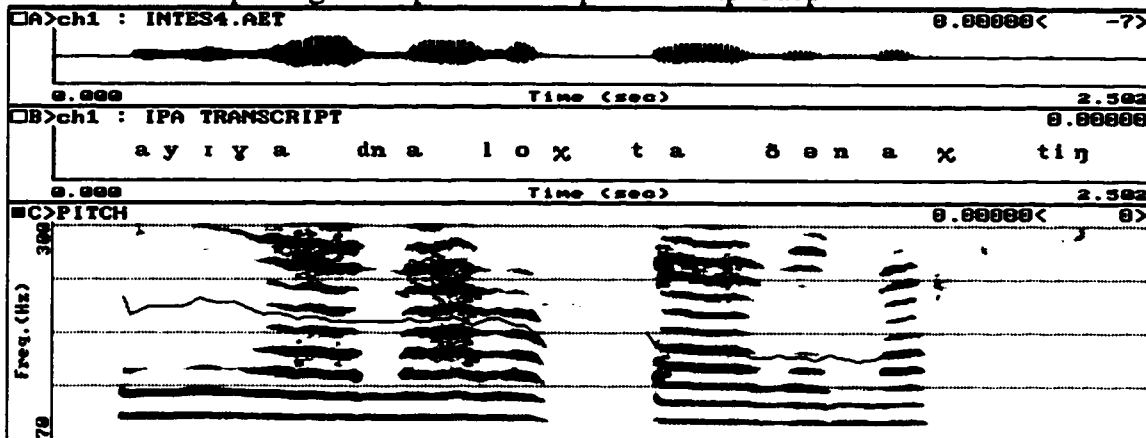


Edna Stepetin

ES4

Ayagaadan aaluftaadan aftan. *The girls laughed.*  
 girls laughing they were

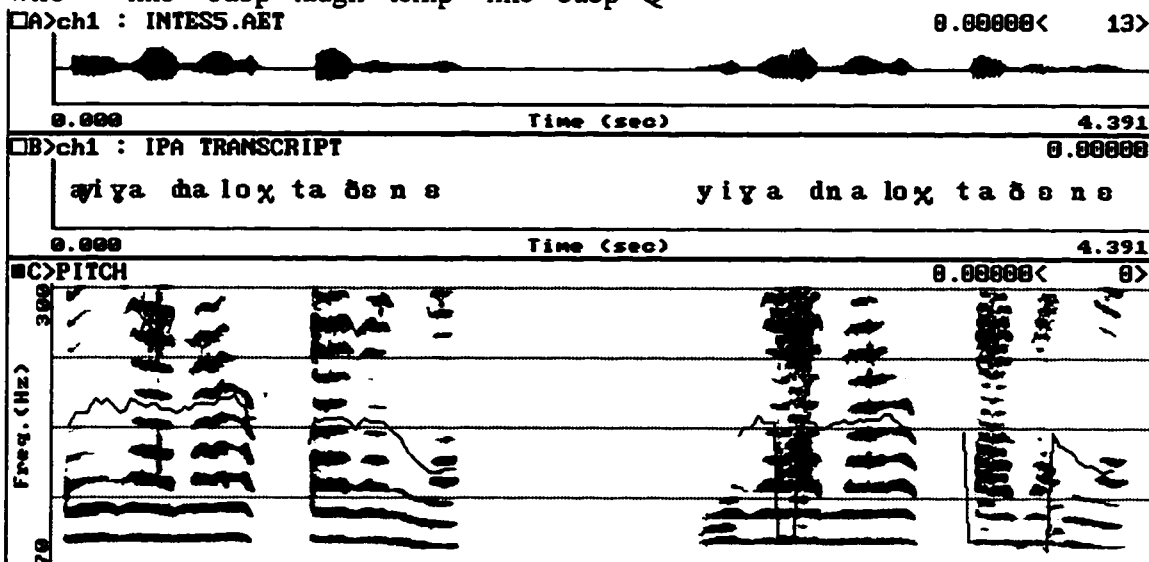
ayaga- ada- n aalu- xta- ada- n a- xta- n  
 wife like 3abp laugh temp like 3abp be temp 3abp



ES5

Ayagaadan aaluftaadan, ii? *Did the girls laugh?*  
 girls did they laugh eh

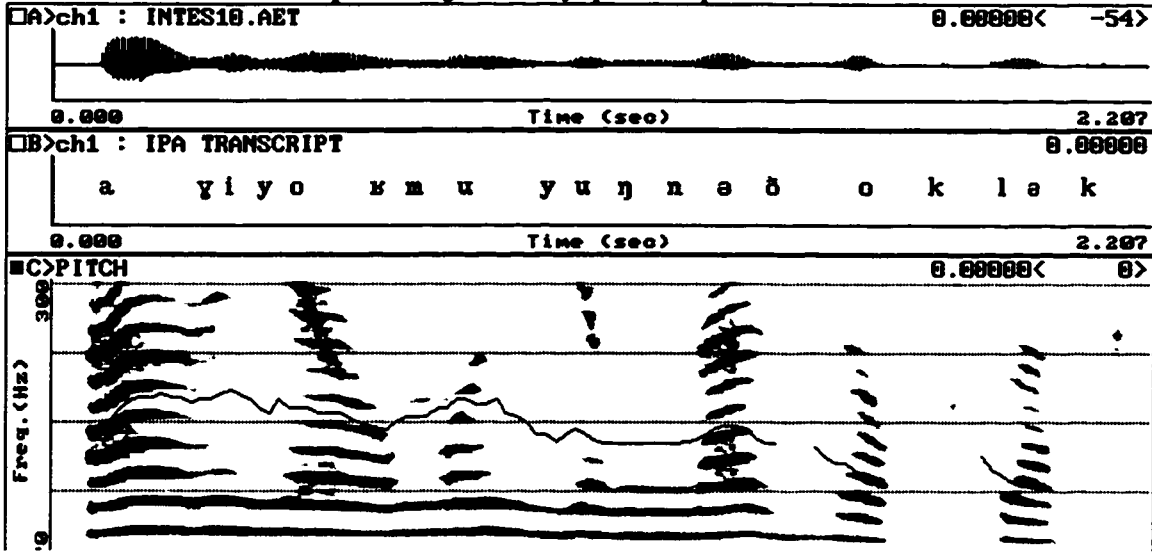
ayaga- ada- n aalu- xta- ada- n ii  
 wife like 3abp laugh temp like 3abp Q



ES10

Aagyuuḡim uyungin aduqlakun. *Cormorants' necks are long.*  
 cormorants their necks they are long

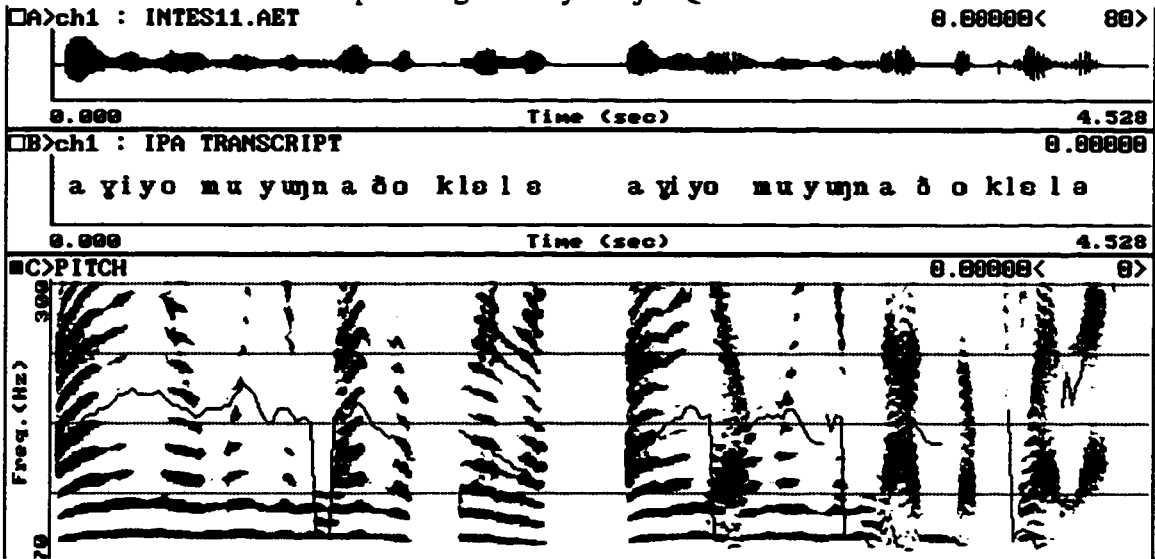
aagyuuḡi- m uyu- ngin adu- qla- ku- n  
 cormorant rl neck 3refp long clumsy prs 3abp



ES11

Aagyuuḡum uyungin aduqlalix, ii. *Are cormorants' necks long?*  
 cormorants their necks are they long eh

aagyuuḡu- m uyu- ngin adu- qla- lix ii  
 cormorant rl neck 3refp long clumsy cnj Q



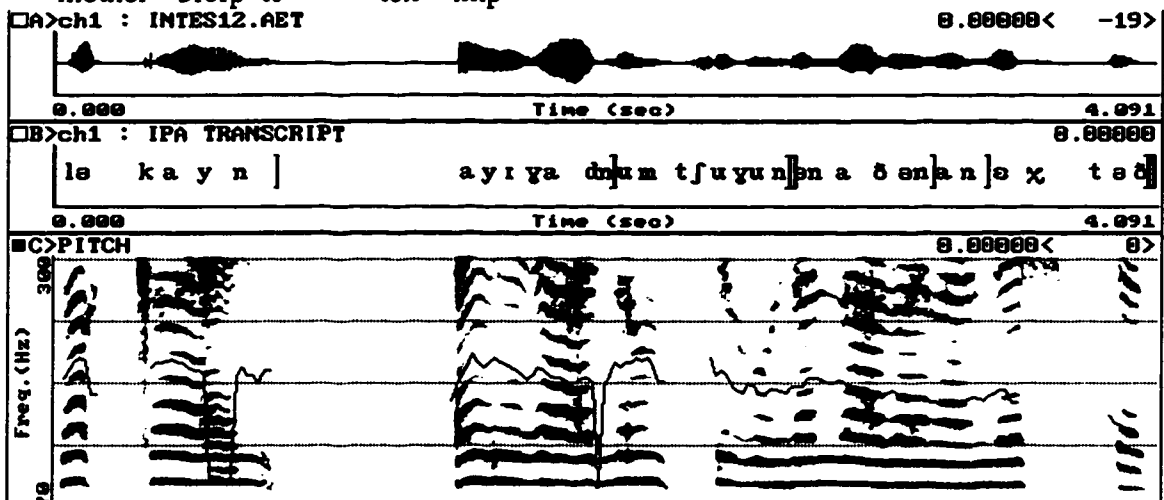
ES12

Lakaayan ayagaadan umchuguun, *If boys try to kiss girls, —*  
 boys girls they try to kiss

anaadan ngaan ixtada. *tell their mothers.*  
 mothers to you tell

lakaaya- n ayaga- ada- n umchu- gu- un  
 boy 3abp wife like 3abp kiss cnd 3abp

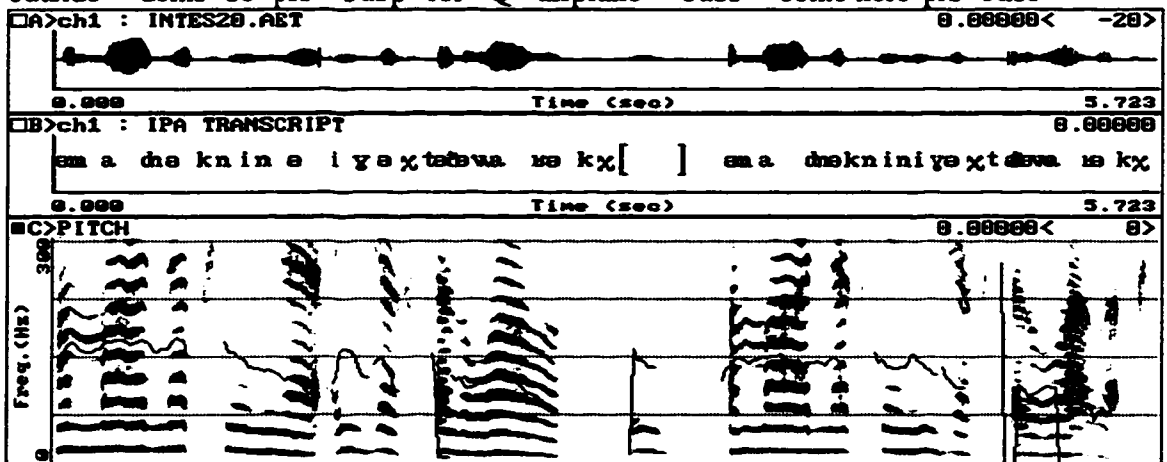
anaada- ngin ngaan ixta- da  
 mother 3refp to tell imp



ES20

Amaadan akuniin, ii igaxtadaʔ waagakuʔ. *When we were out there, —*  
 out there we were for eh airplane it came *the airplane came.*

amaada- n a- ku- n- iin ii igaxtada- ʔ waaga- ku- ʔ  
 outside dems be prs 3abp for Q airplane 3abs come here prs 3abs





ES17

Adaadan nuɟin kumsittakun,  
fathers rocks they carried

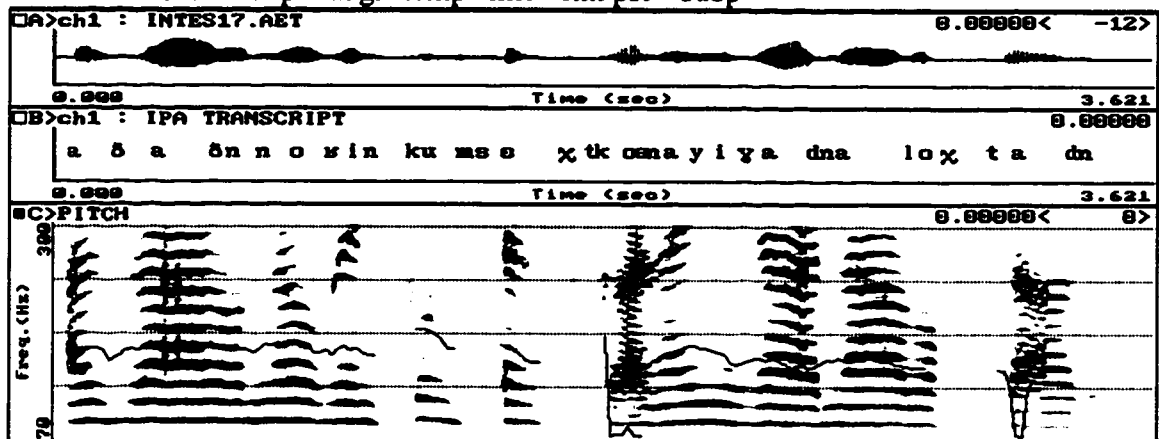
*When their fathers carried rocks, —*

ayagaadan aaluɬtsadanan.  
girls they laughed

*the girls laughed.*

adaada- n nuɟi- n kumsittakun- ku- n  
father 3abp rock 3abp lift up prs 3abp

ayaga- ada- n aalu- ɬta- ada- na- n  
wife like 3abp laugh temp like rmt pst 3abp

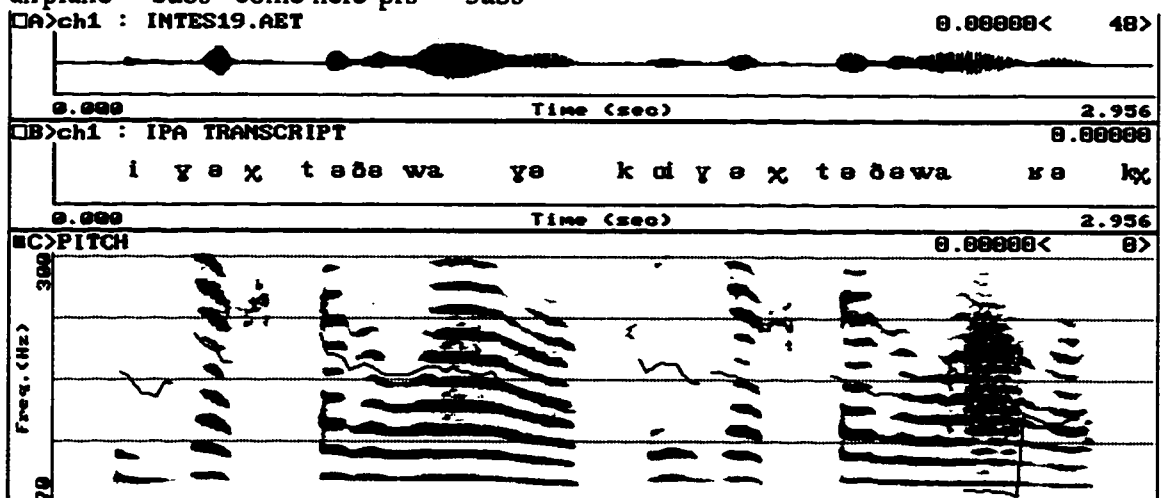


ES19

Igaɬtadaɬ waaga kuɬ.  
airplane it came here

*The airplane came.*

igaɬtada- x waaga- ku- ɬ  
airplane 3abs come here prs 3abs

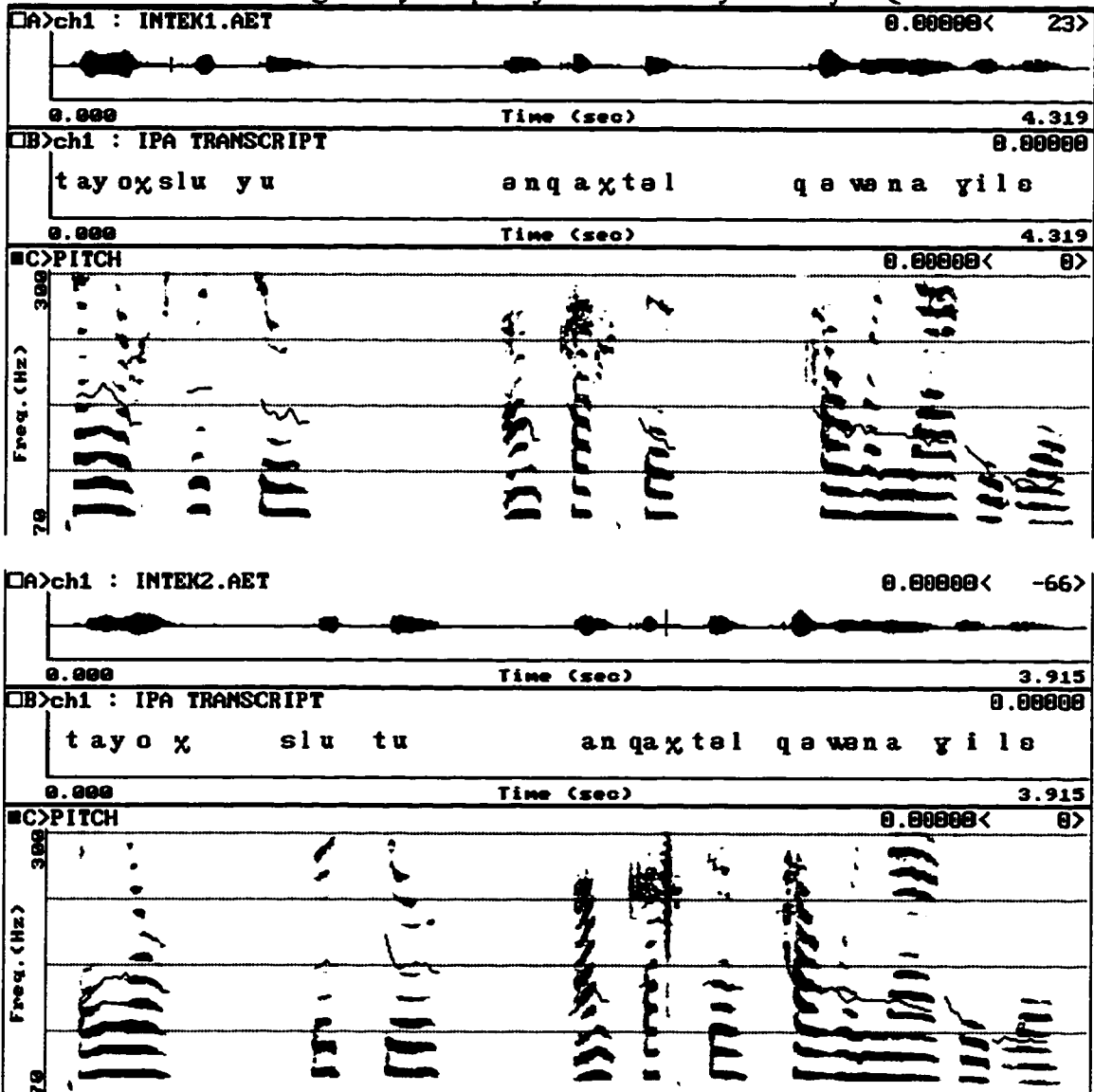


Ella Kashevarof

EK1

Tayağux slutuu angqaxtal, qawanaağilix, ii. *Old men hunted sea mammals.*  
 man aged go away for a while sealion did they try to get eh

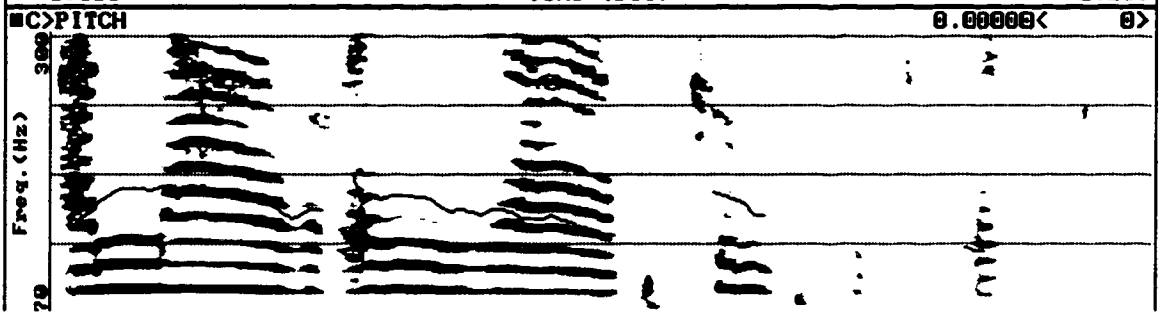
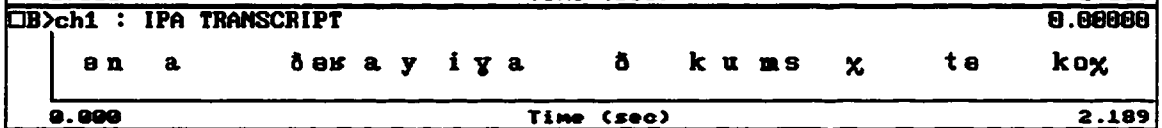
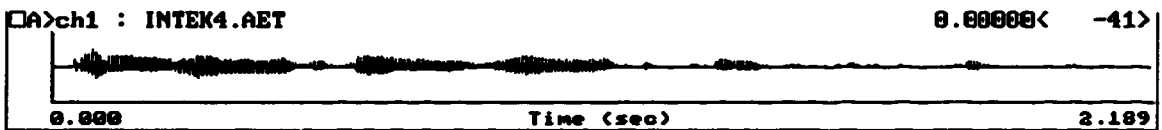
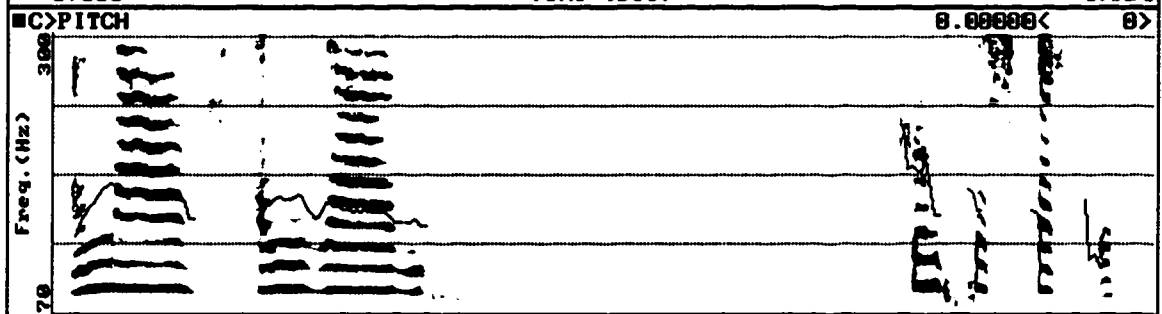
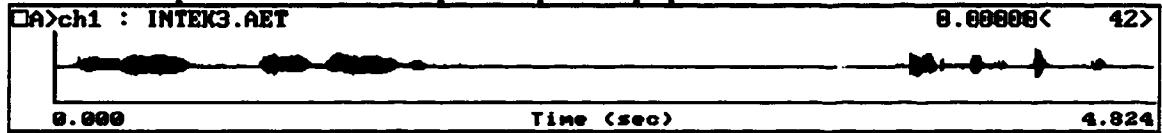
tayağ-u- x slutu- u angqa- xta- lix qawa- naaği- lix ii  
 man rl old 3refs go away temp cnj sealion try for cnj Q



EK3, EK4

Anaadan ayagaadan kumsitakuŋ. *The mothers carried the girls.*  
 mothers girls they carried them

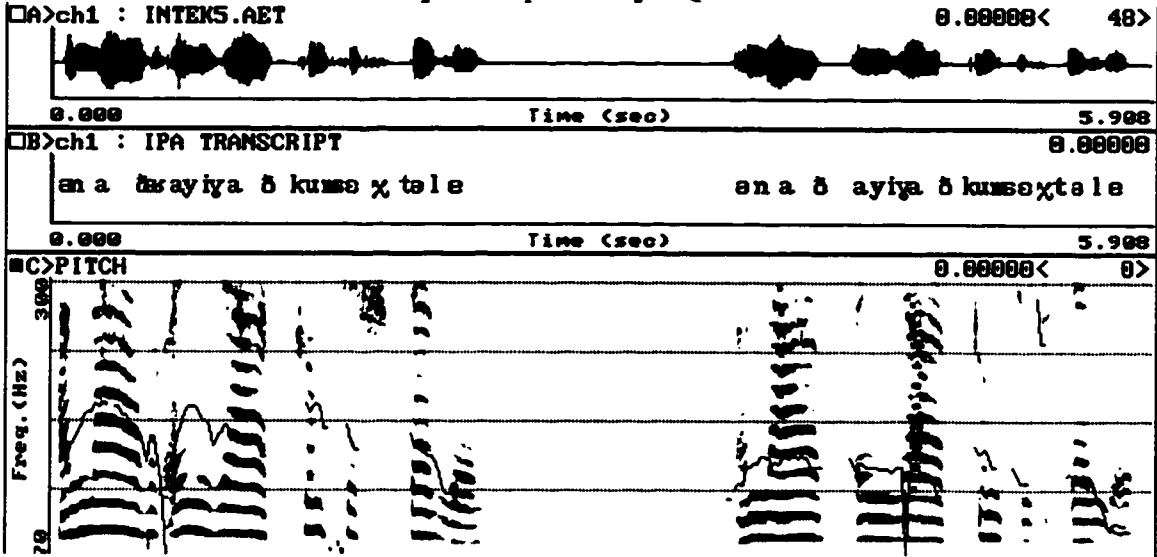
anaada- n ayaga- ada- n kumsi- ŋta- ku- ŋ  
 mother 3abp wife like 3abp lift up temp prs 3abs



EK5

Anaadax ayagaadan kumsixtalix, ii? *Did the mothers carry the girls?*  
 mother girls did they carry them eh

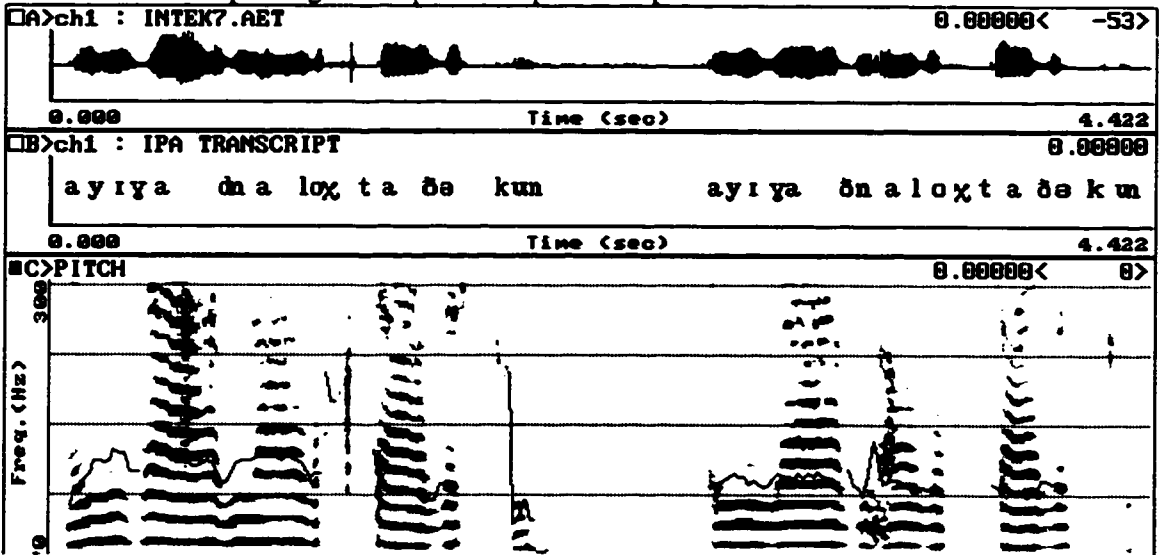
anaada- x ayaga- ada- n kumsixta- lix ii  
 mother 3abs wife like 3abp lift up cnj Q



EK7

Ayagaadan aaluftaadakun. *The girls laughed.*  
 girls they laughed

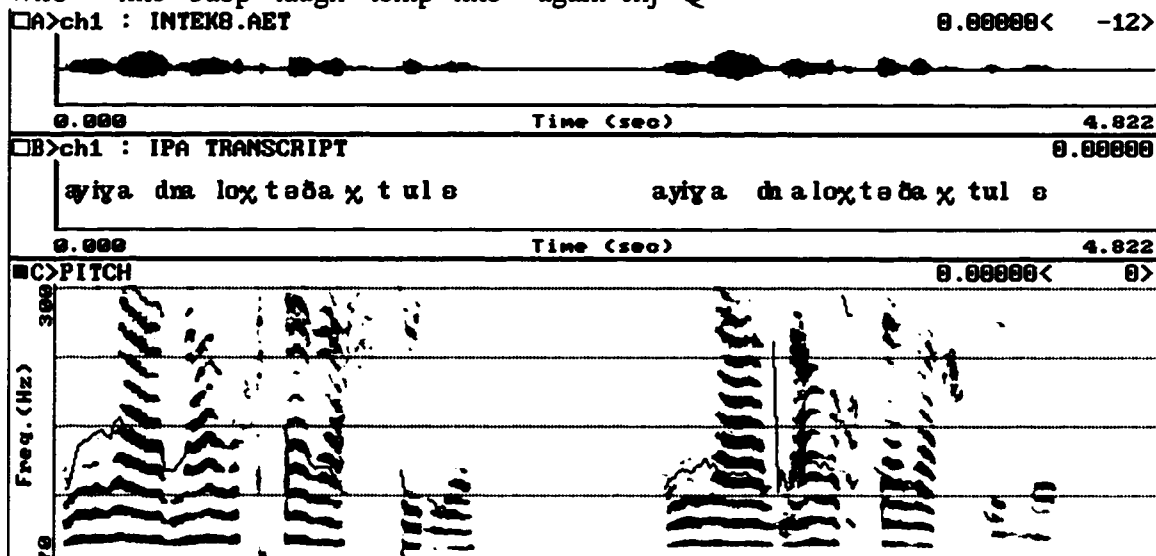
ayaga- ada- n aalu- xta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp



EK8

Ayagaadan aaluftaadaaftulix, ii? Did the girls laugh?  
 girls did they laugh again eh

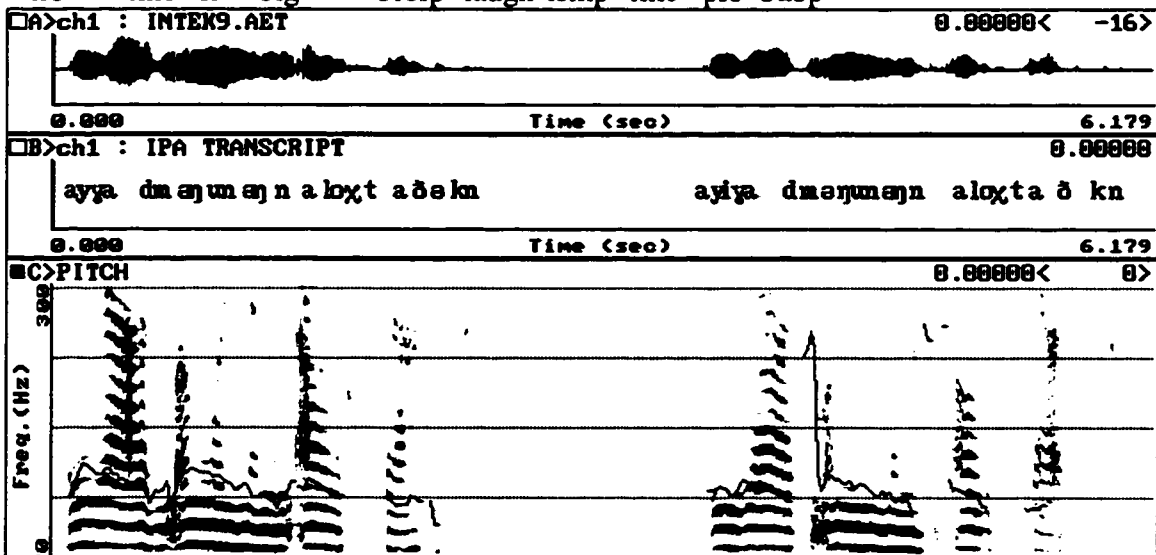
ayaga- ada- n aalu- xta- ada- axtu- lix ii  
 wife like 3abp laugh temp like again cnj Q



EK9

Ayagaadam angunangin aaluftaadakun. The big girls laughed.  
 girls big ones they laughed

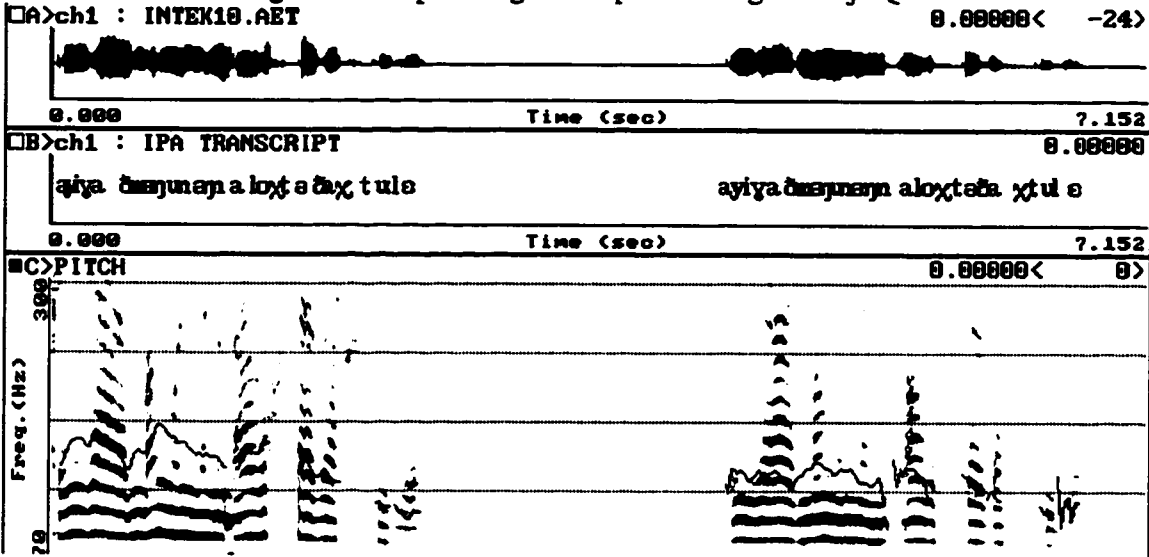
ayaga- ada- m anguna- ngin aalu- xta- ada- ku- n  
 wife like rl big 3refp laugh temp like prs 3abp



EK10

Ayagaadam angunangin aaluftaadaftulix ii. *Did the big girls laugh?*  
 girls big ones did they laugh again eh

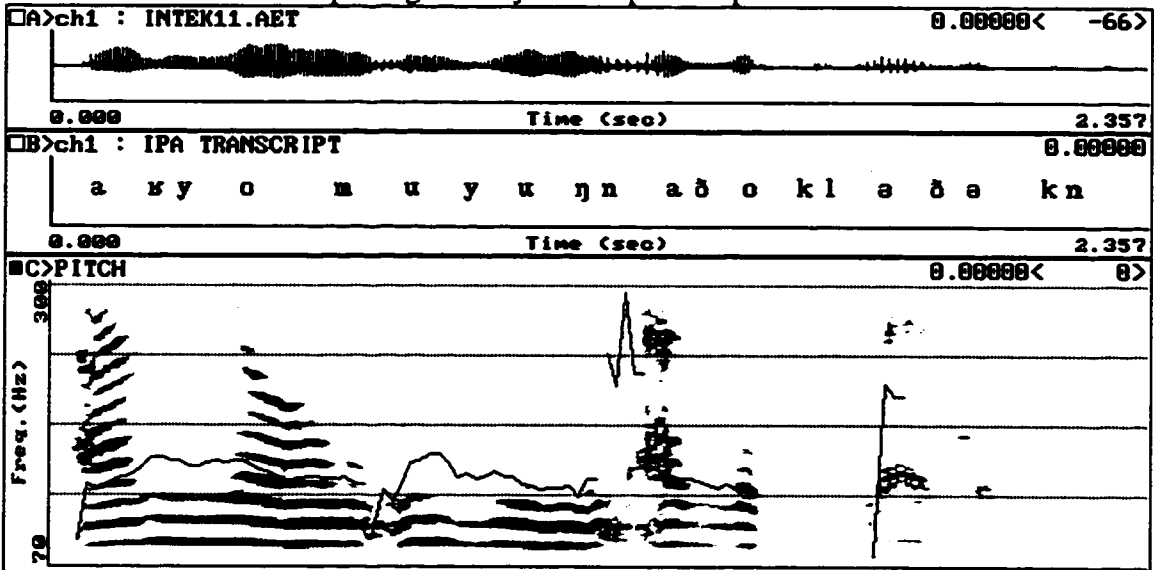
ayaga- ada- m anguna- nginaalu- xta- ada- axtu- lix ii  
 wife like rl big 3refp laugh temp like again cnj Q



EK11

Aagyuŋim uyungin aduqladakun. *Cormorants' necks are long.*  
 cormorants' their necks they are long

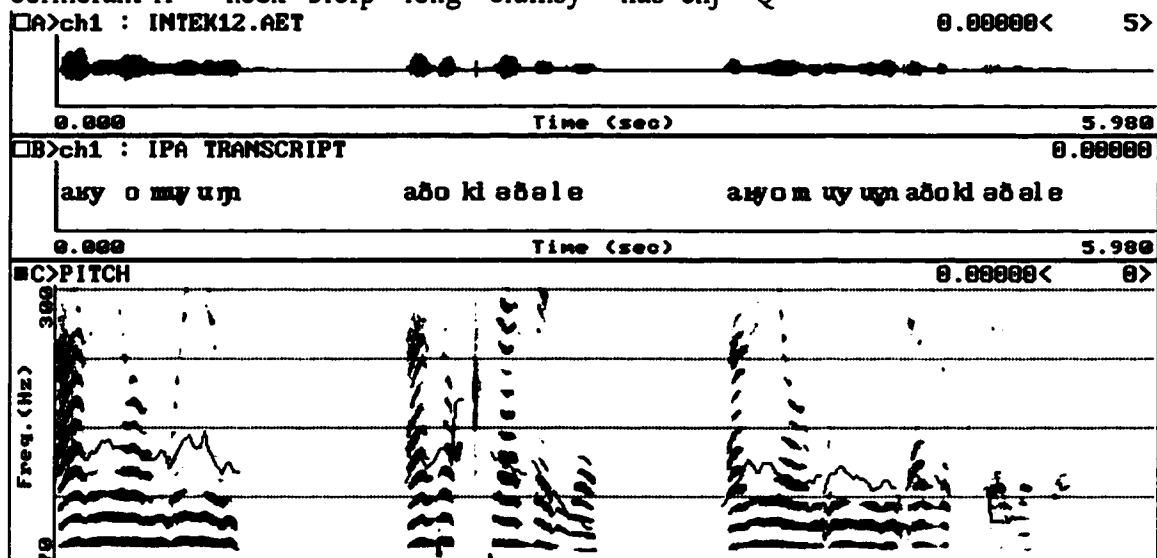
aagyuŋi- m uyu- ngin adu- qla- da- ku- n  
 cormorant rl neck 3refp long clumsy hab prs 3abp



EK12

Aagyugum uyungin aduqladalix, ii. *Are cormorants' necks long?*  
 cormorants their necks are they long eh

aagyugu- m uyu- ngin adu- qla- da- lix ii  
 cormorant rl neck 3refp long clumsy hab cnj Q



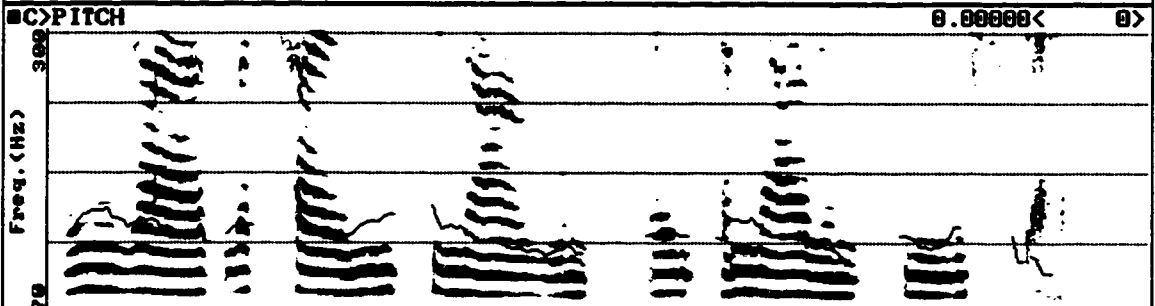
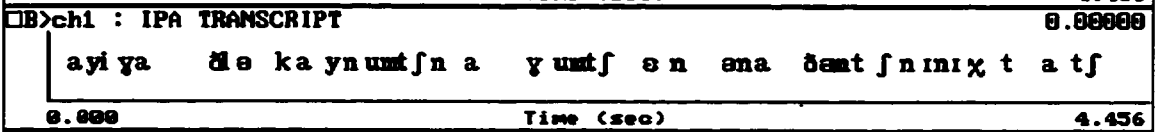
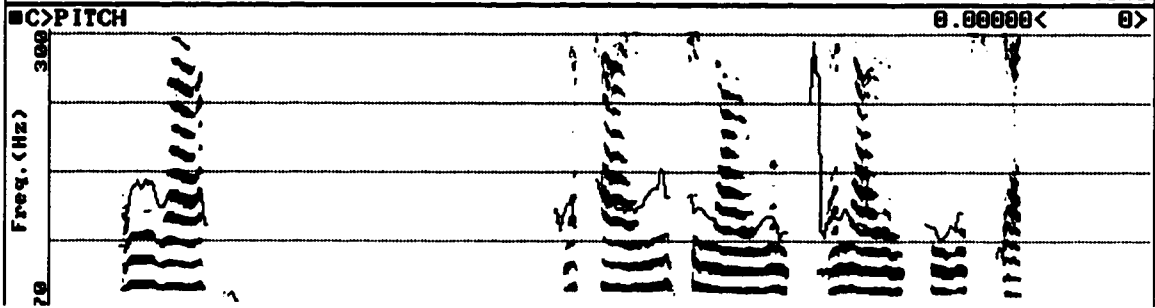
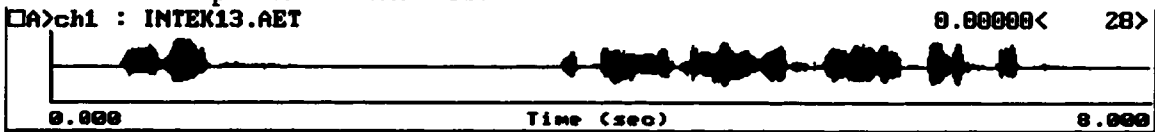
EK13, EK14

Ayagaadan lakaayam umchunaagi-gumchin, *If boys try to kiss girls, —*  
 girls boys they try to kiss them

anaadamchinaan ixtaachin. *tell their mothers.*  
 their mothers to you tell

Ayaga- ada- n lakaaya- m umchu- naagi- gu- mchin  
 girl like abp boy rl kiss try to cnd 3Rp

anaada- mchi- naan ixta- achin  
 mother 3Rp to tell 3s?



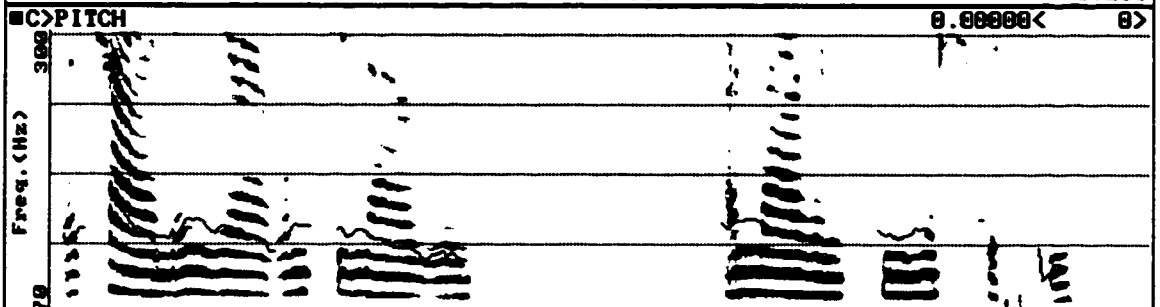
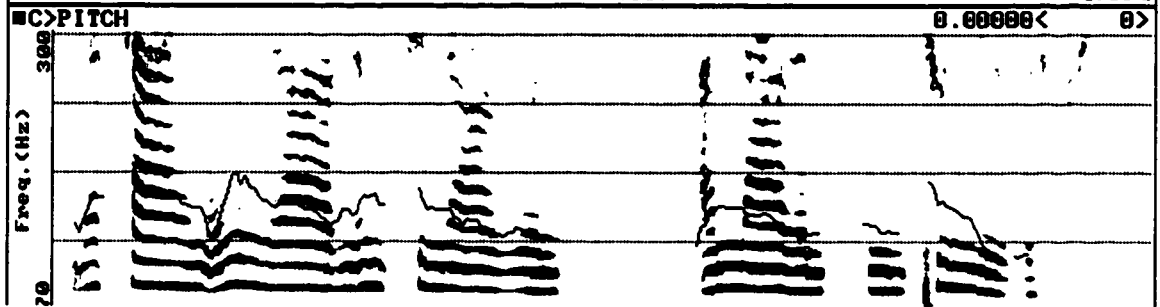
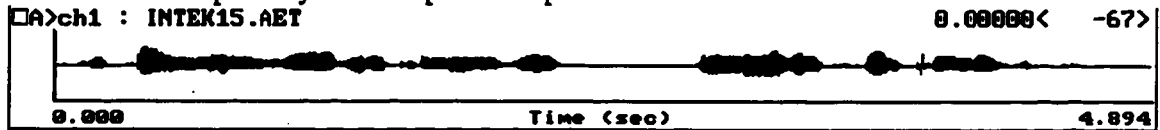
EK15, EK16

Lakaayan ayagaadan umchunaagiun, *If boys try to kiss, —*  
 boys girls if they try to kiss them

anaadamchin tunudakun. *girls tell their mothers*  
 their mothers they tell

lakaaya- n ayaga- ada- n umchu- naagi- gu- un  
 boy 3abp wife like 3abp kiss try cnd 3Rp

anaada- mchin tunu- da- ku- n  
 mother 3Rp say hab prs 3abp

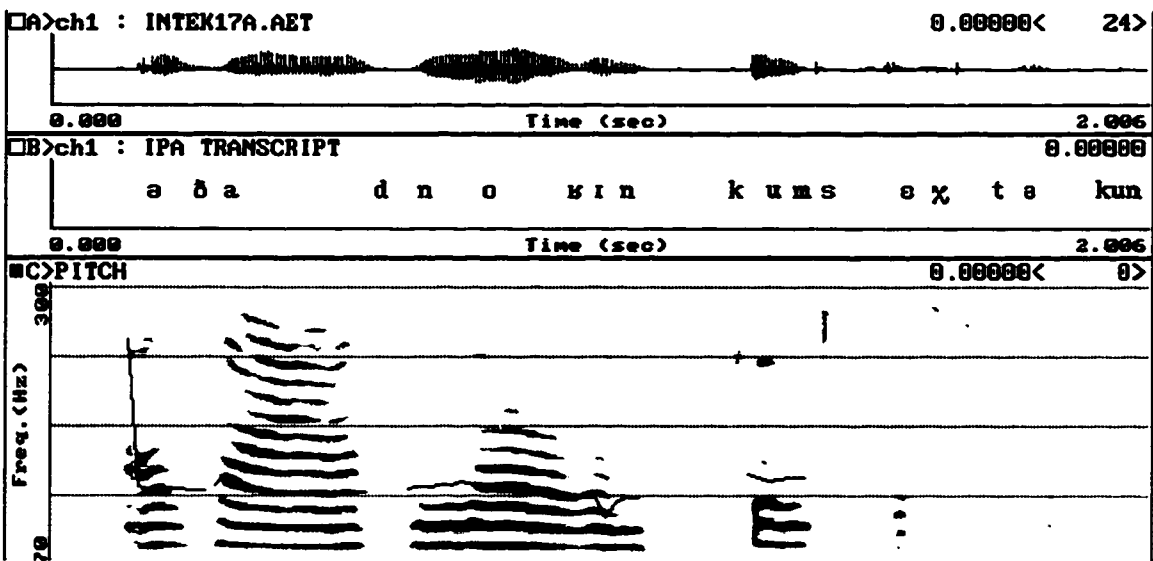
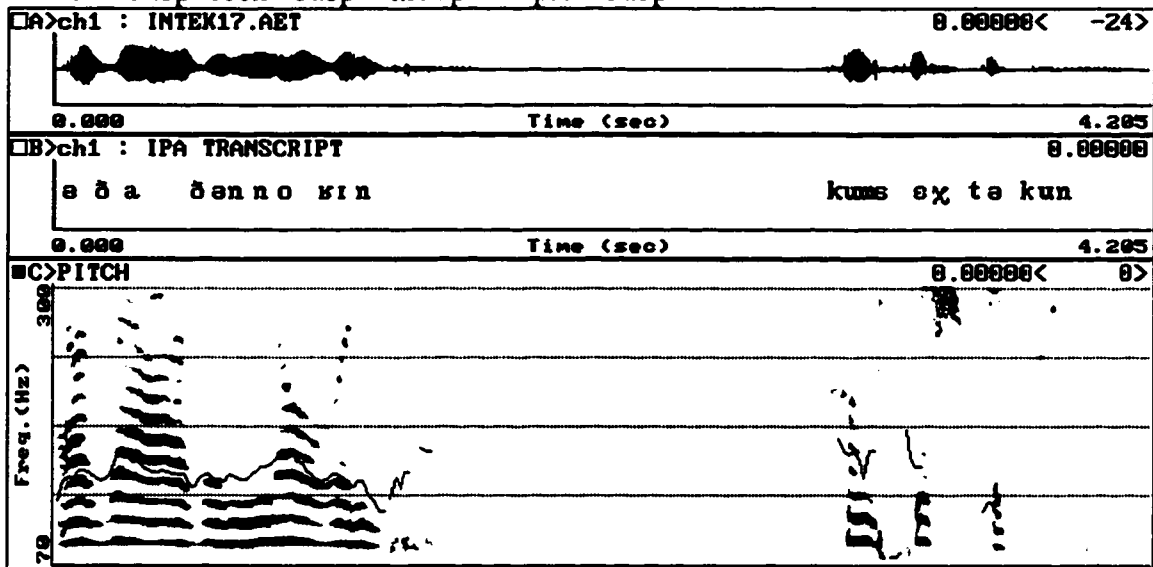


EK17, EK17a

Adaadan nuḡin kumsittakun.  
 their fathers rocks they carried

*Their fathers carried rock.*

adaada- n nuḡi- n kumsitta- ku- n  
 father 3abp rock 3abp lift up prs 3abp



EK18, EK19

Adaadan nuɣin kumsixtakungin,  
fathers rocks they carried for them

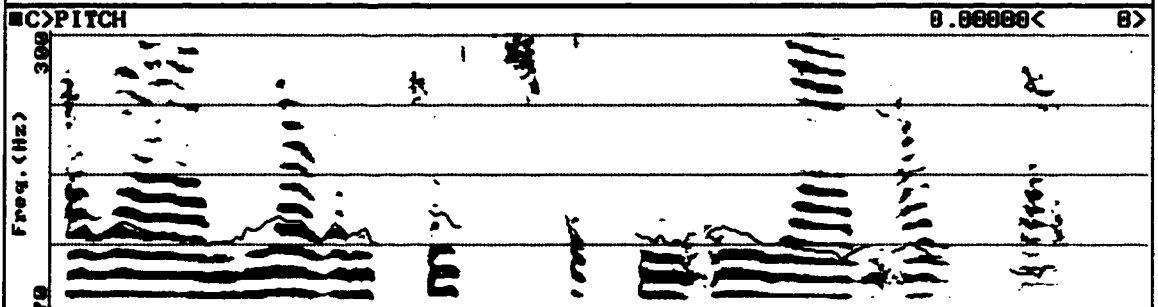
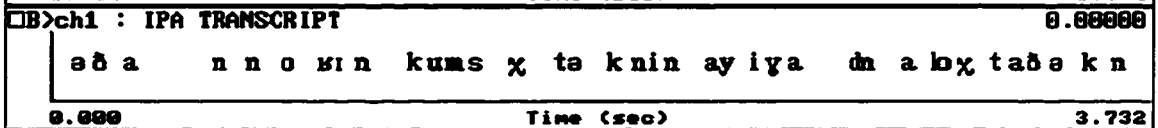
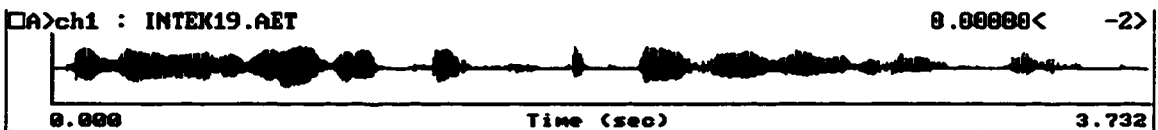
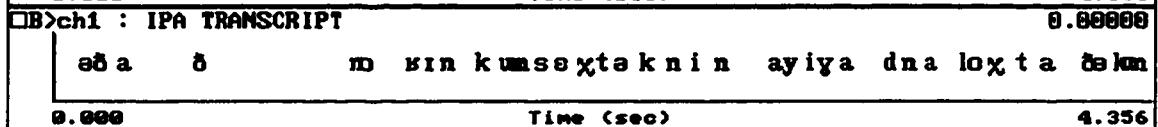
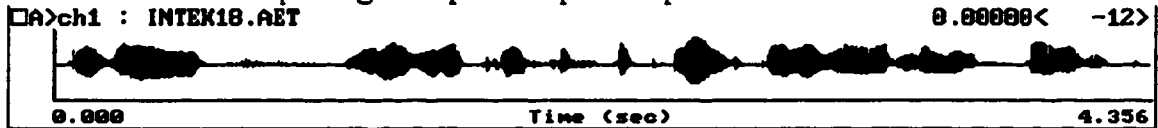
*When their fathers carried rocks, —*

ayagaadan aaluftaadakun.  
girls they laughed

*the girls laughed.*

adaada- n nuɣi- n kumsixta- ku- ngin  
father 3abp rock 3abp lift up prs for them

ayaga- ada- n aalu- xta- ada- ku- n  
wife like 3abp laugh temp like prs 3abp

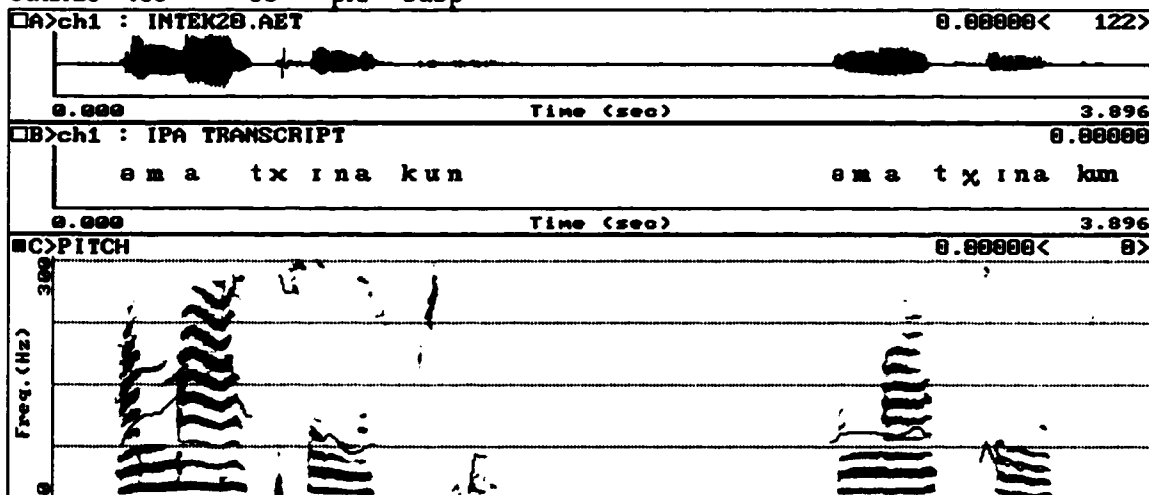


EK20

Amaatxan akun.  
 out there we were

*We were out there (camping)*

ama- atxan a- ku- n  
 outside loc be prs 3abp

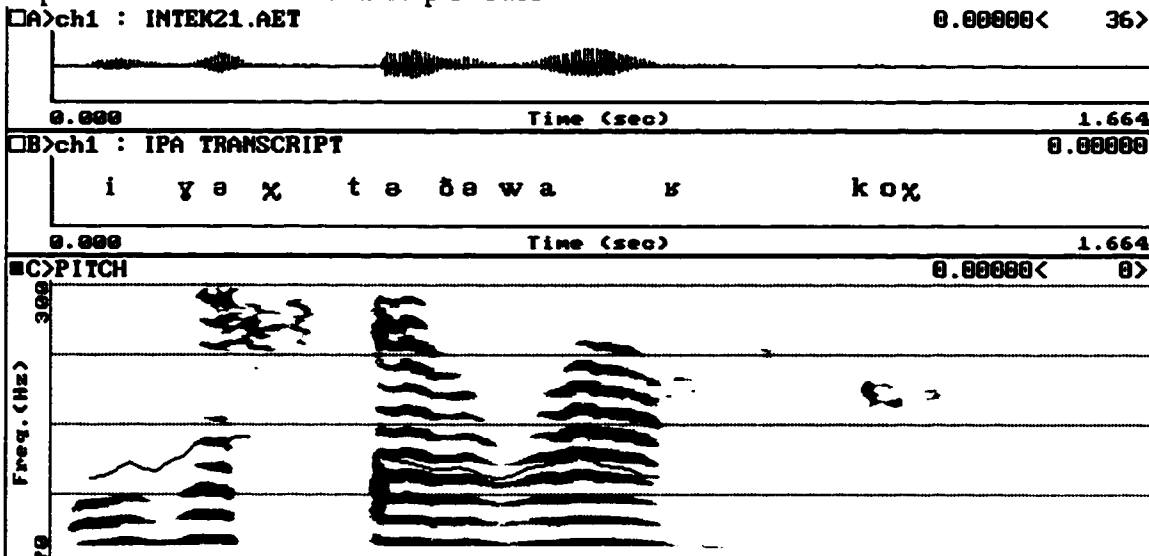


EK21

Igaɣtadax waagakux.  
 airplane it came here

*The airplane came.*

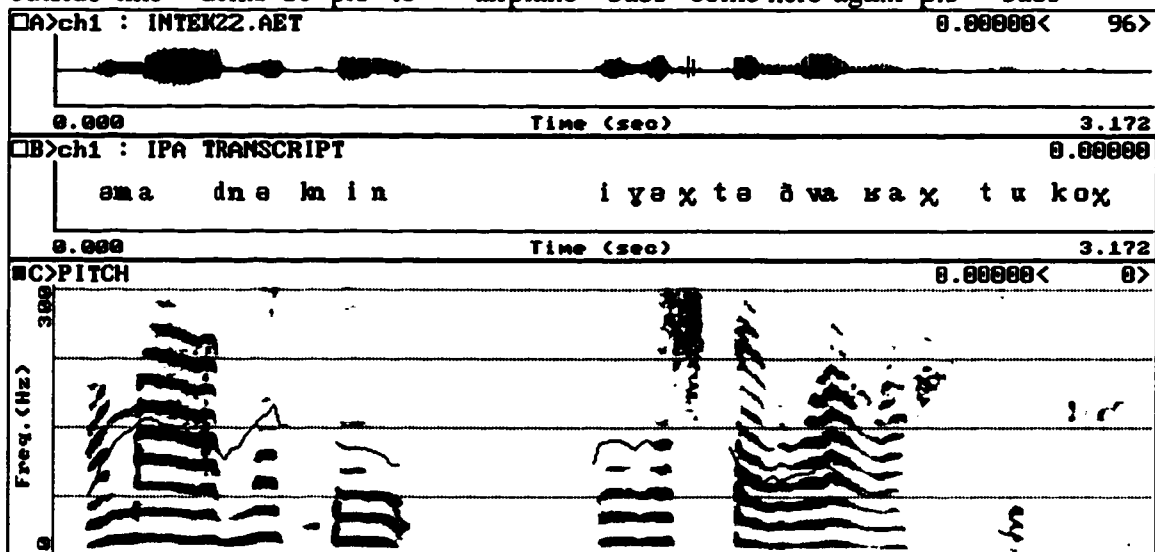
igaɣtada- x            waaga- ku- x  
 airplane 3abs        come here prs 3abs



EK22

Amaadan akuniin, igattadaɗ waagaattukuf. *When we were out there, —*  
 outside we were to airplane it came *the airplane came.*

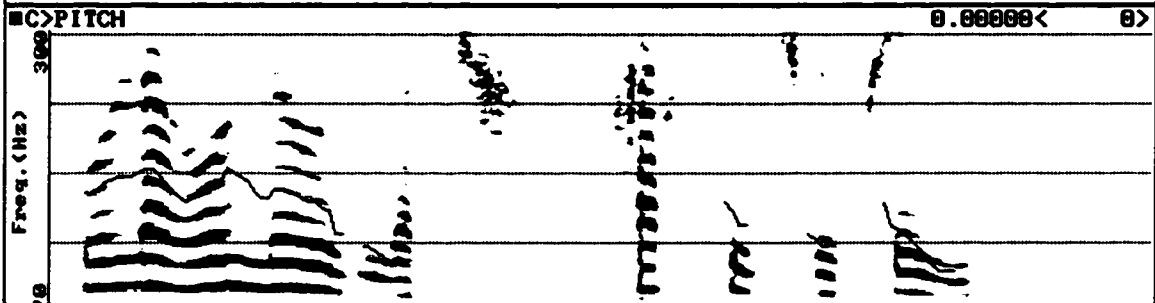
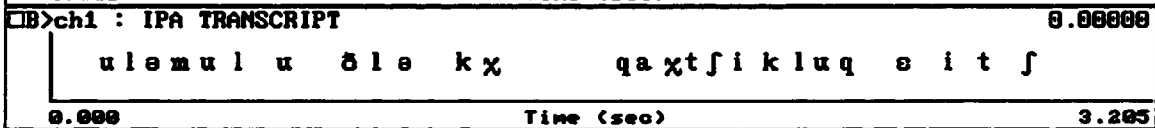
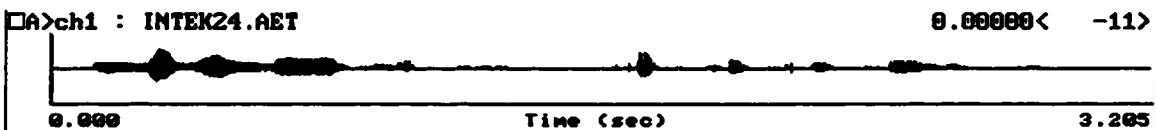
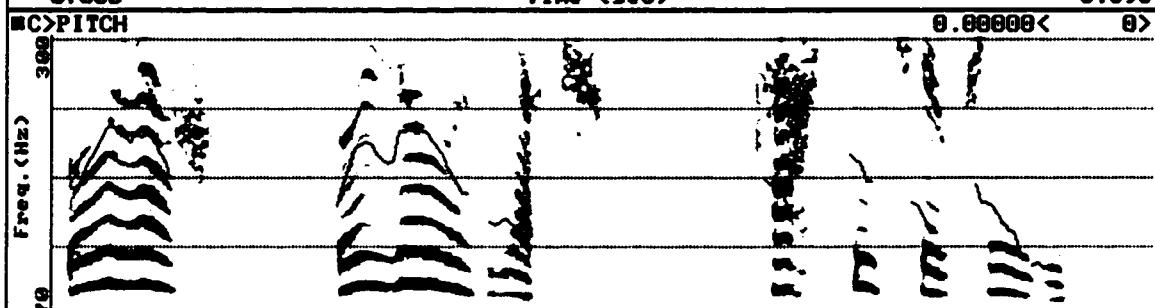
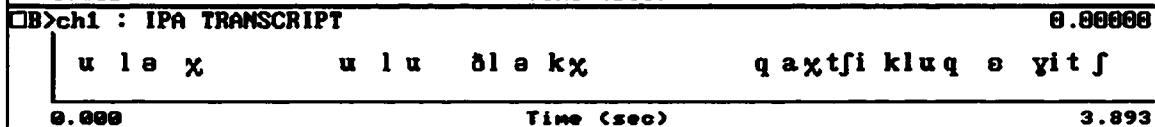
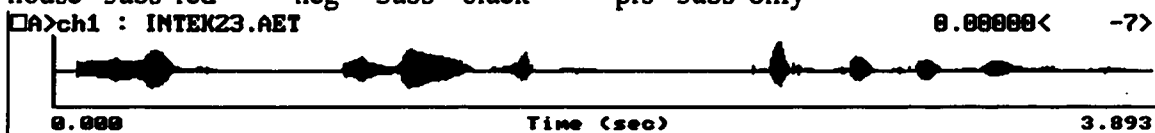
ama- ada- n a- ku- niin igattada- ɗ waaga- attu- ku- ɗ  
 outside like dems be prs to airplane 3abs come here again prs 3abs



EK23, EK24

Ulaʔ uluudalakaʔ; qaʔchiklukuʔ agach. *Their house is black, it isn't red.*  
 house red it is not it is black only

ula- ʔ uluuda- laka- ʔ qaʔchiklu- ku- ʔ agach  
 house 3abs red neg 3abs black prs 3abs only



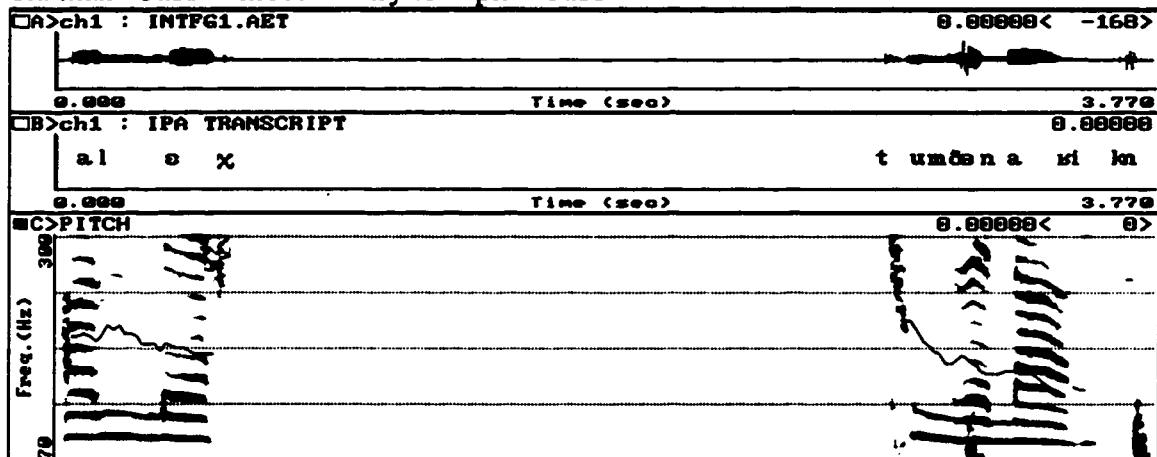
Fanny Galanin

FG1

**Alix tumdanaaġikun.***Old men hunted.*

old man he hunted

ali- x tumda- naaġi- ku- n  
 old man 3abs shoot try to prs 3abs

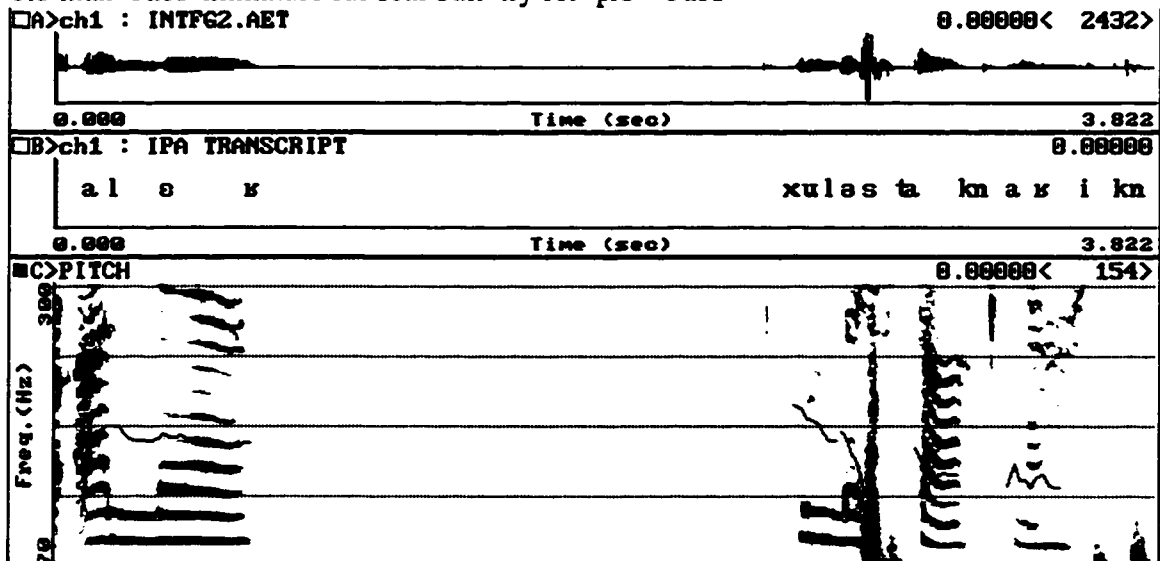


FG2

**Alix xulustaakanaaġikun.***Old men hunted.*

old man he tried for fur seal

ali- x xulustaaka- naaġi- ku- x  
 old man 3abs immature fur seal bull try for prs 3abs

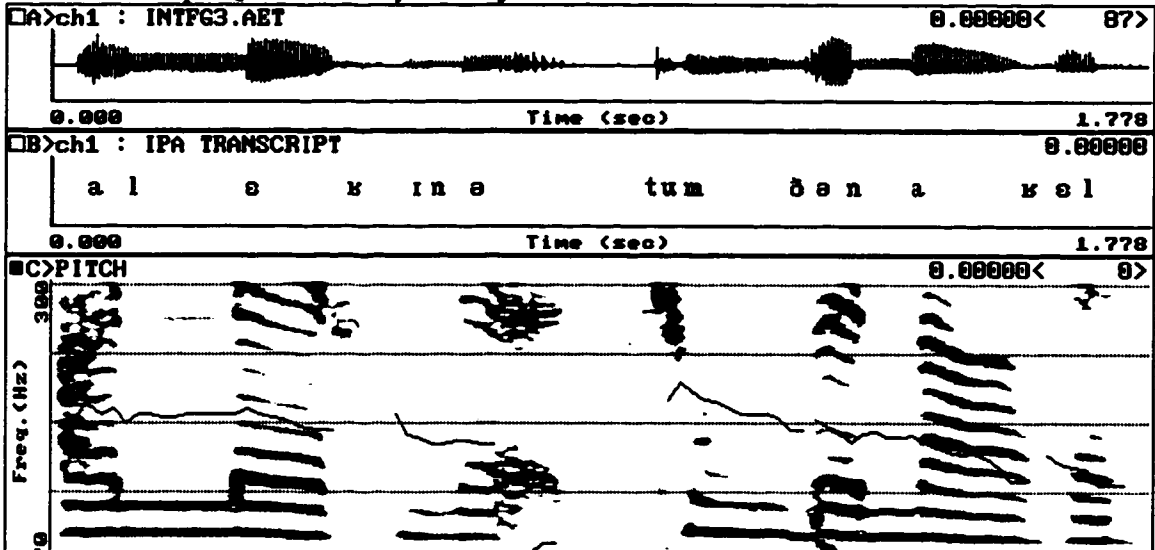


FG3

Aliḡin, ii, tumdanaḡlix?  
 old men eh did they hunt

*Did old men hunt?*

aliḡi- n ii tumda- naḡi- lix  
 one man 3abp Q shoot try to cnj

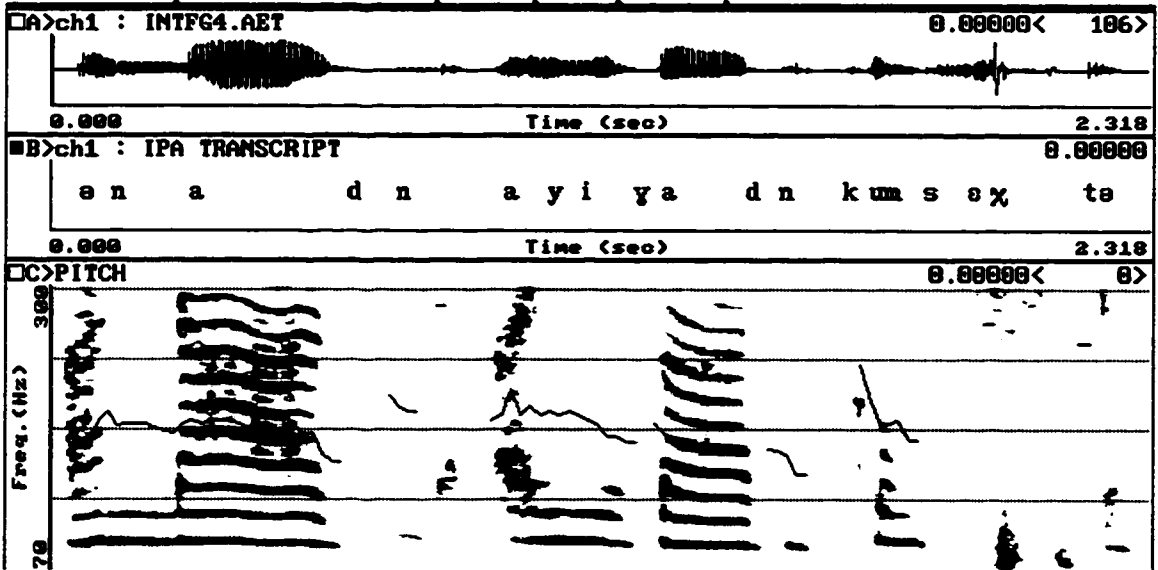


FG4

Anaadan ayagaadan kumsixtakun.  
 mothers girls they carried

*The mothers carried the girls.*

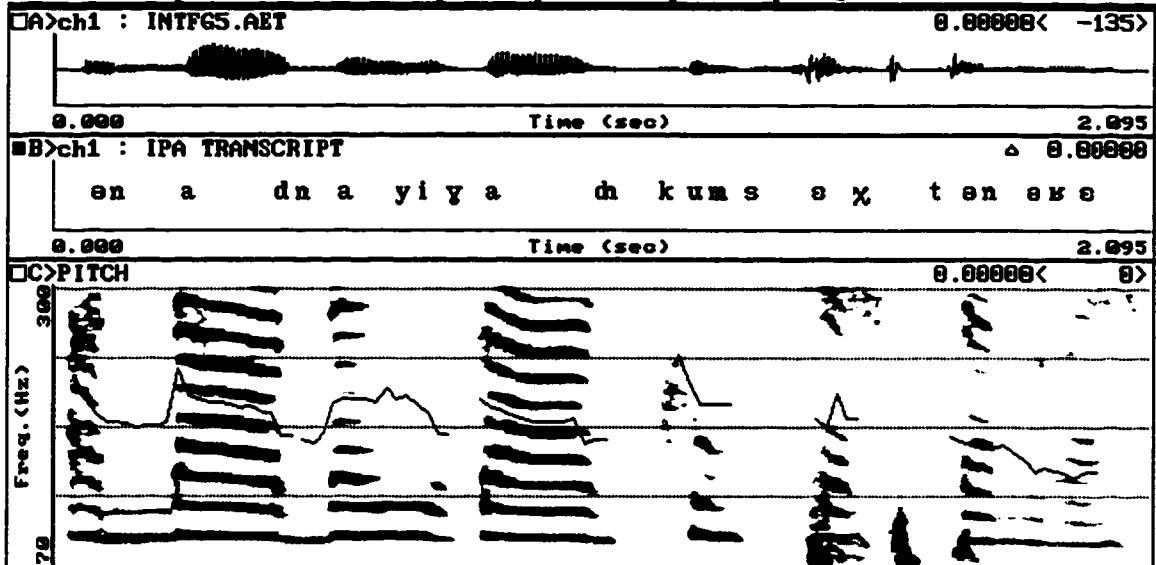
anaada- n ayaga- ada- n kumsixta- ku- n  
 mother 3abp wife like 3abp lift up prs 3abp



## FG5

Anaadan ayagaadan kumsittanan, ii? *Did the mothers carry the girls?*  
 mothers girls did they carry them eh

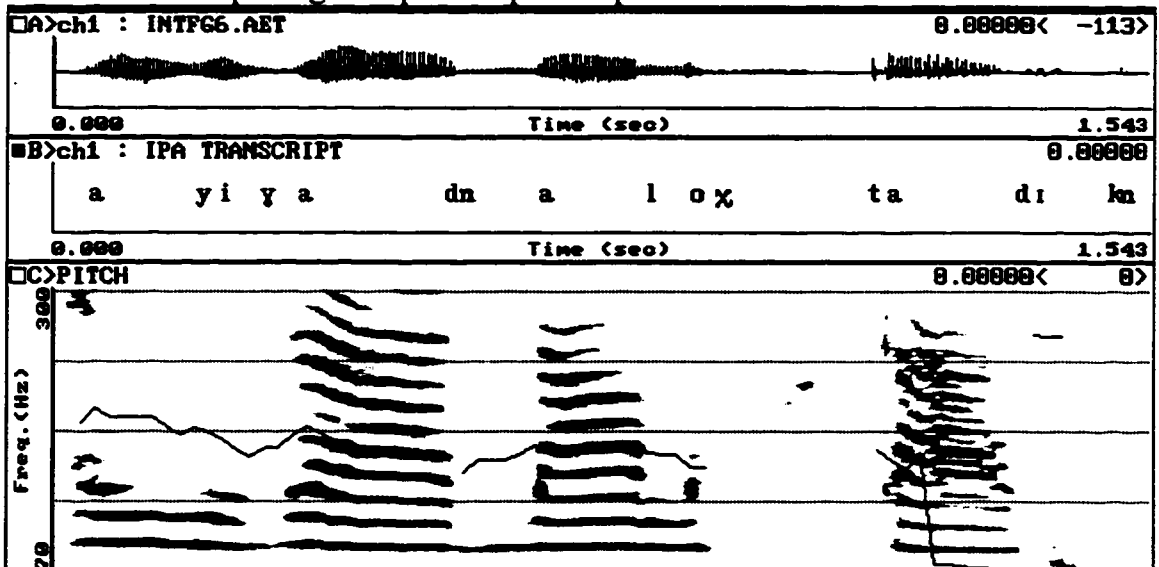
anaada- n ayaga- ada- n kumsitta- na- n ii  
 mother 3abp wife like 3abp lift up rmt pst 3abp Q



## FG6

Ayagaadan aaluṭtaadakun. *The girls laughed.*  
 girls they laughed

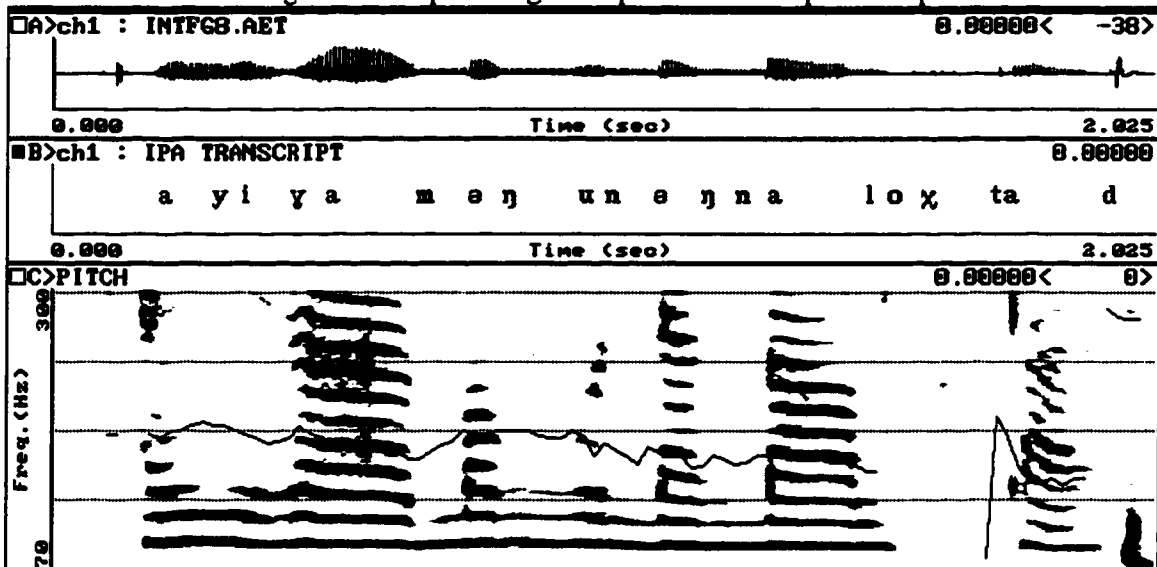
ayaga- ada- n aalu- ṭta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp



## FG8

Ayagaadam angunangin aaluftaadanan. *The big girls laughed.*  
 girls big ones they laughed

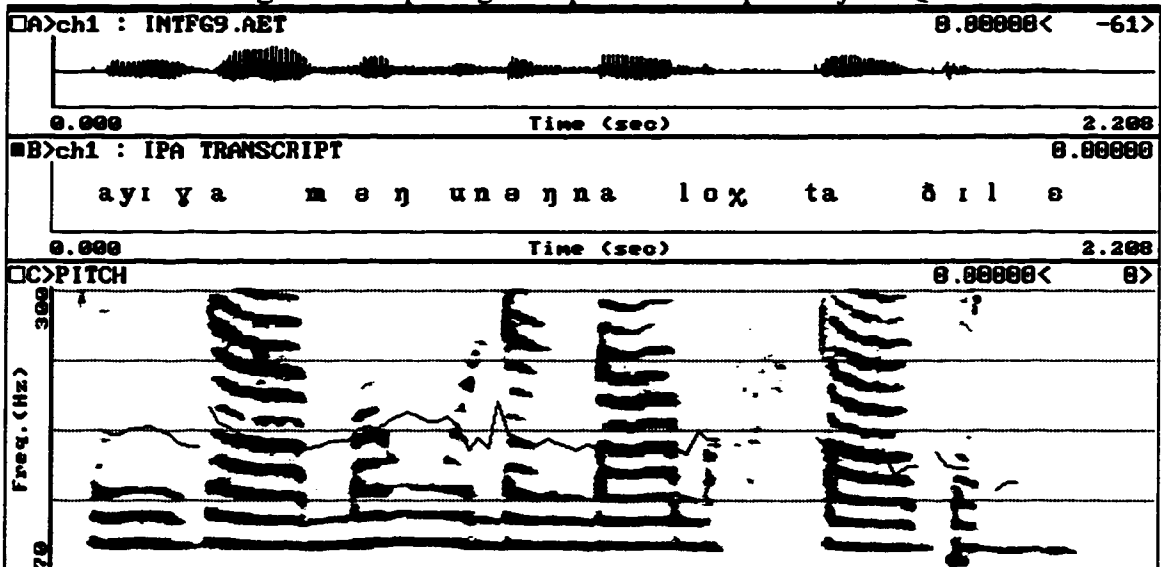
ayaga- ada- m anguna- ngin aalu- xta- ada- na- n  
 wife like rl big 3refp laugh temp like rmt pst 3abp



## FG9

Ayagaadam angunangin aaluftaadaliX, ii. *Did the big girls laugh?*  
 girls big ones did they laugh eh

ayaga- ada- m anguna- ngin aalu- xta- ada- na- liX ii  
 wife like rl big 3refp laugh temp like rmt pst cnj Q

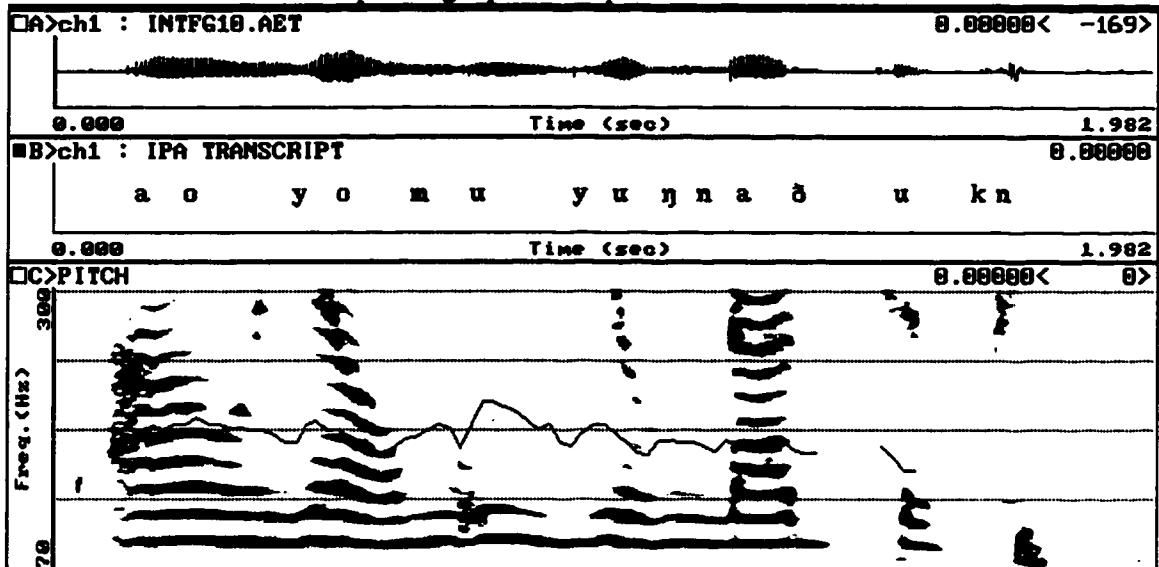


FG10

Aagyuuḡim uyungin adukun.  
 cormorants' heir necks they are long

*Cormorants' necks are long.*

aagyuuḡi- m uyu- ngin adu- ku- n  
 cormorant rl neck 3refp long prs 3abp

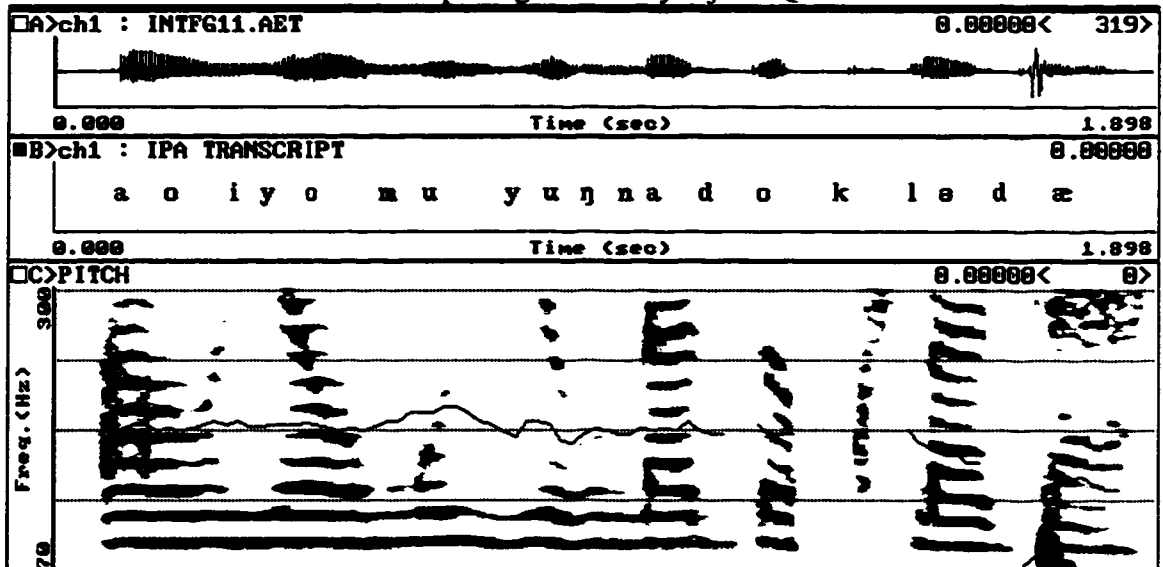


FG11

Aagyuuḡim uyungin aduqlalix, ii.  
 cormorants heir necks are they long eh

*Are cormorants' necks long?*

aagyuuḡi- m uyu- ngin adu- qla- lix ii  
 cormorant rl n12eck 3refp long clumsy cnj Q



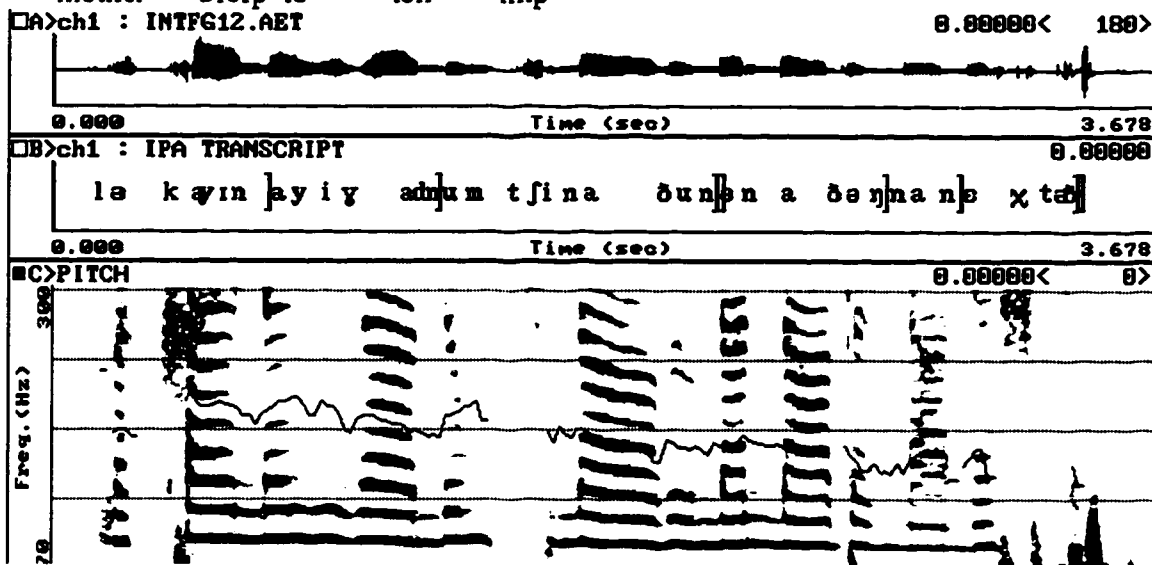
FG12

Lakaayan ayagaadan umchunaagidungin, *If boys try to kiss girls, —*  
 boys girls they try to kiss

anaadangin ngaan ixtada. *tell their mothers.*  
 their mothers to tell

lakaaya- n ayaga- ada- n umchu- naagi- du- ngin  
 boy 3abp wife like 3abp kiss try to fast 3refp

anaada- ngin ngaan ixta- da  
 mother 3refp to tell imp



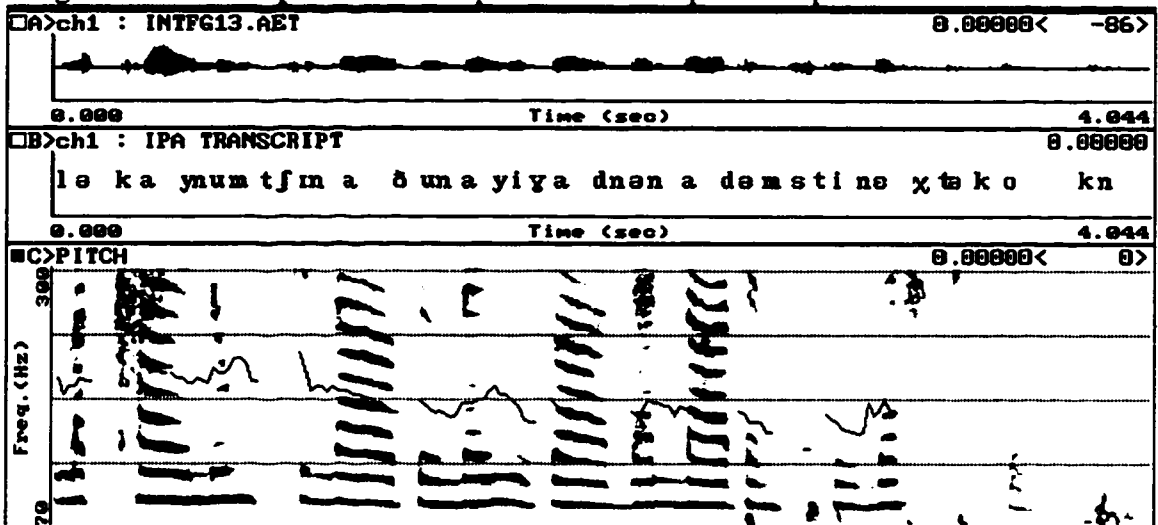
FG13

Lakaayan umchunaagidungin, If boys try to kiss, —  
 boys they try to kiss

ayagaadan anaadamchinaan ittakungin. girls tell their mothers  
 girls to their mothers they tell them

lakaaya- n umchu- naagi- du- ngin  
 boy 3abp kiss try to fast 3refp

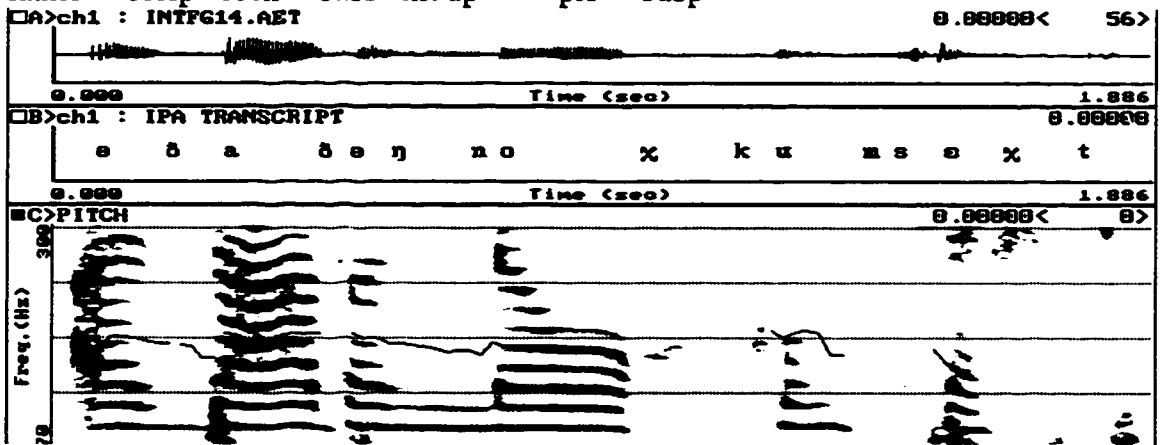
ayaga- ada- n anaada- mchin- aan itta- ku- ngin  
 girl like 3abp mother 3Rp to tell prs 3refp



FG14

Adaadangin nuɣit kumsitakun. Their fathers carried rocks.  
 their fathers rock they carried

adaada- ngin nuɣi- x kumsitakun  
 father 3refp rock 3abs lift up prs 3abp



## FG15

Adaadangin nuḡit kumsittakun,  
fathers rock they carried

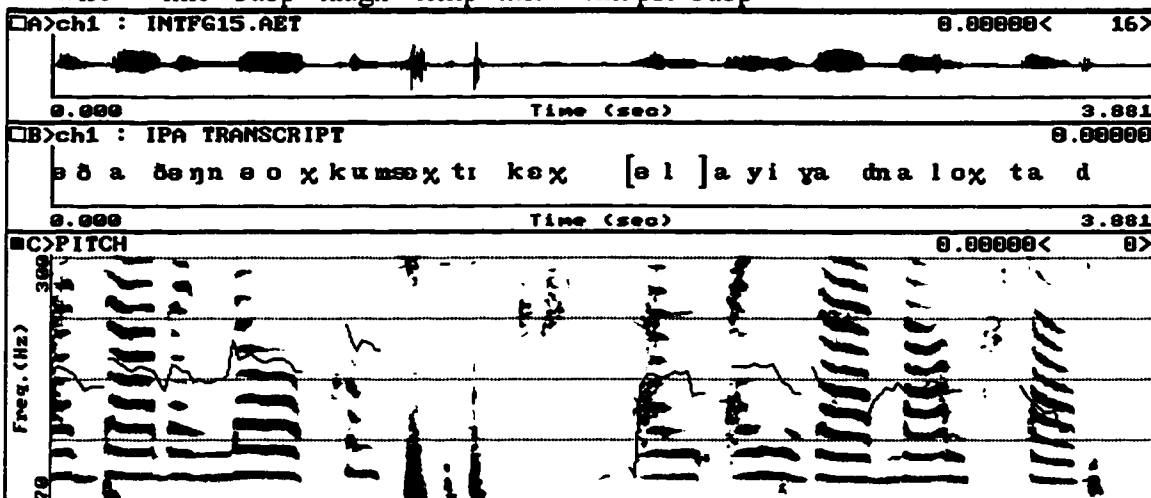
*When their fathers carried rocks, —*

ayagaadan aaluftaadanan.  
girls they laughed

*the girls laughed.*

adaada- ngin nuḡi- ḡ kumsixta- ku- n  
father 3refp rock 3abs lift up prs 3abp

ayaga- ada- n aalu- ḡta- ada- na- n  
wife like 3abp laugh temp like rmt pst 3abp



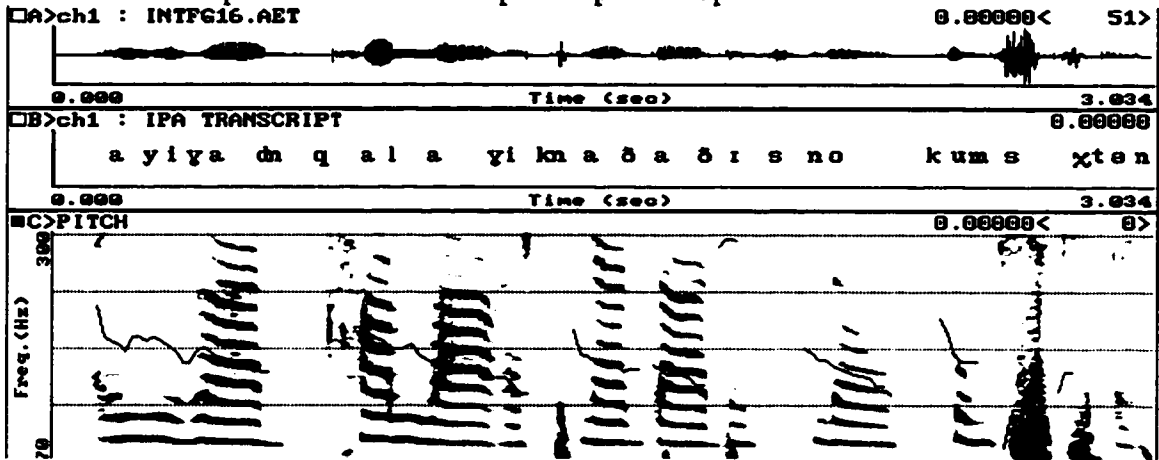
FG16

**Ayagaadan qaalaagikun,--** *the girls laughed --*  
 girls they made fun of

**adaadamchin nuḡit kumsittakun.** *When their fathers carried rocks,.*  
 their fathers rock they carried

ayaga- ada- n qaalaagi- ku- n  
 wife like 3abp make fun of prs 3abp

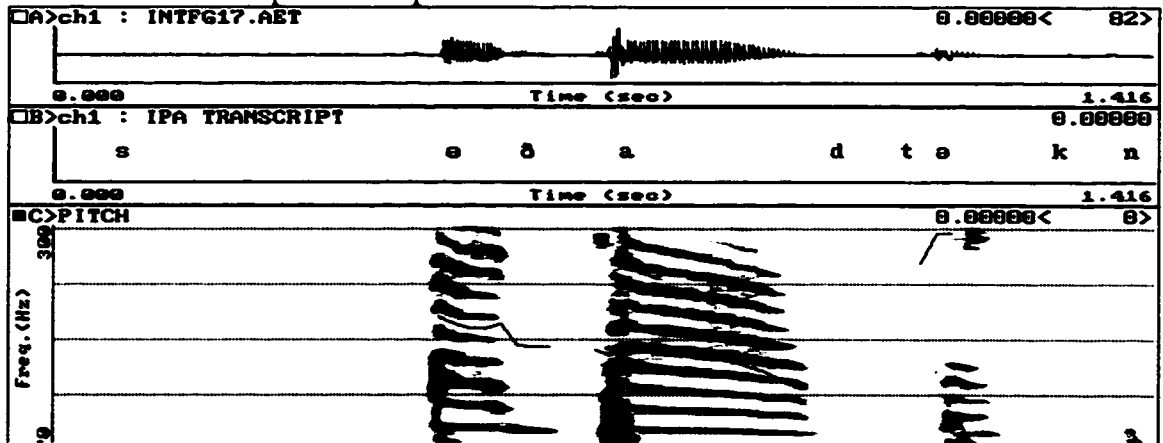
adaada- mchin nuḡi- x kumsitta- ku- n  
 father 3Rp rock 3abs lift up prs 3abp



FG17

**Sadaaltakun.** *We were out there (camping)*  
 we went outside

sada- ada- lta- ku- n  
 outside like ?? prs 3abp

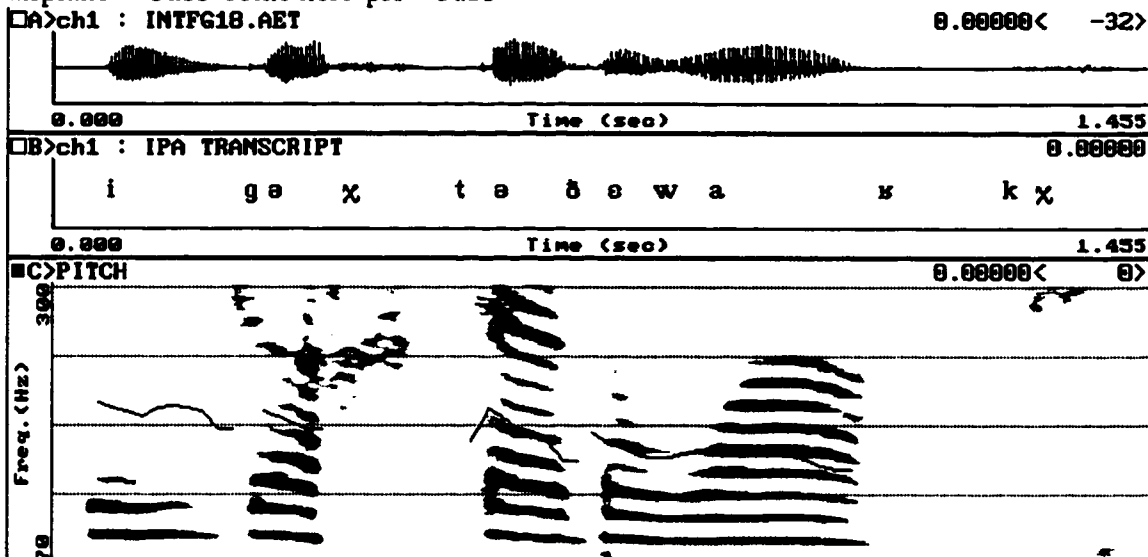


## FG18

Igaxtadaʔ waagakuʔ.  
airplane it came here

*The airplane came.*

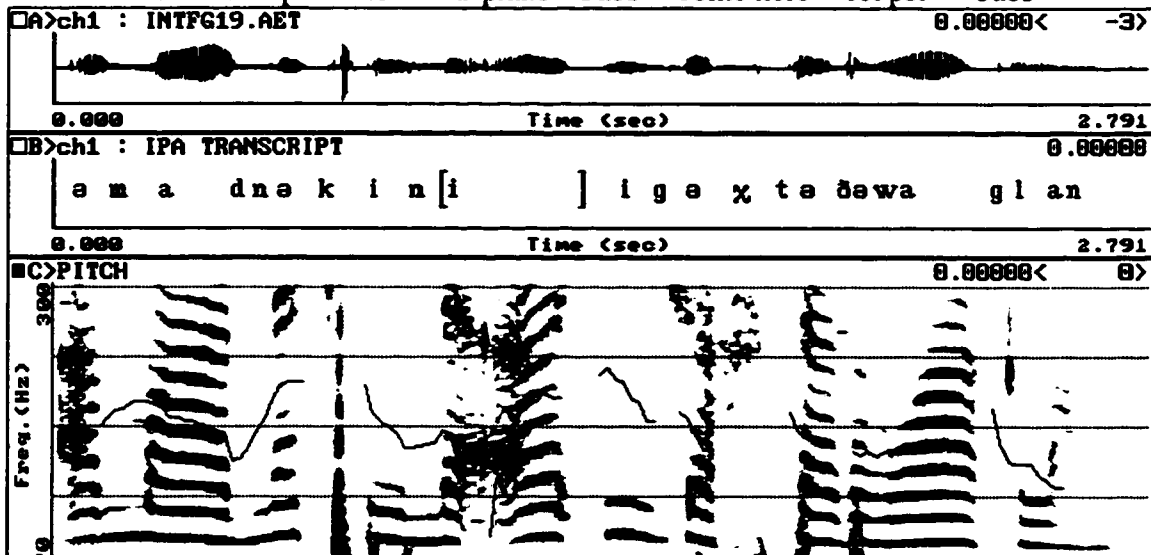
igaxtada- x waaga- ku- x  
airplane 3abs come here prs 3abs



## FG19

Amaadan akuniin, igaxtadaʔ waagalaaganax. *When we were out there,*  
outside we were to airplane it came *the airplane came.*

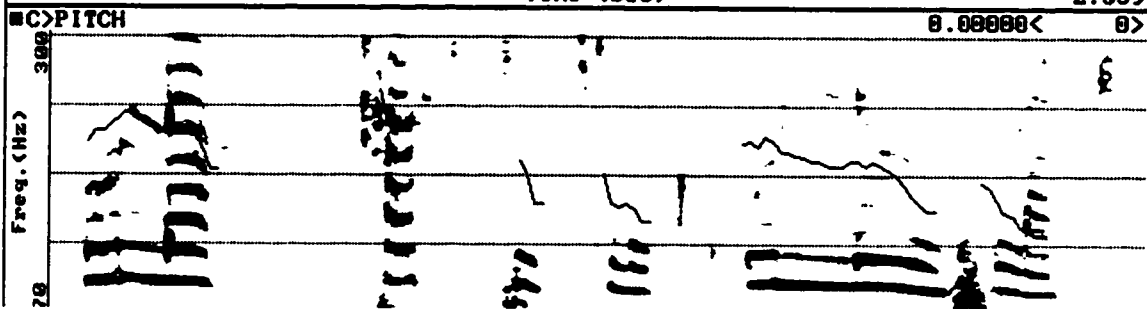
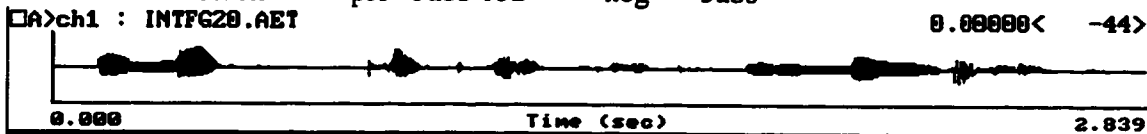
amaada- n a- ku- niin igaxtada- x waaga- laagana- x  
outside dems be prs to airplane 3abs come here rct pst 3abs



FG20

Ula<sub>x</sub> qaʔchiklu<sub>x</sub>, uluudalaka<sub>x</sub>, *Their house is black, it isn't red.*  
 house it is black red it is not

ula- x qaʔchiklu- ku- ʔ uluuda- laka- ʔ  
 house 3abs black prs 3abs red neg 3abs



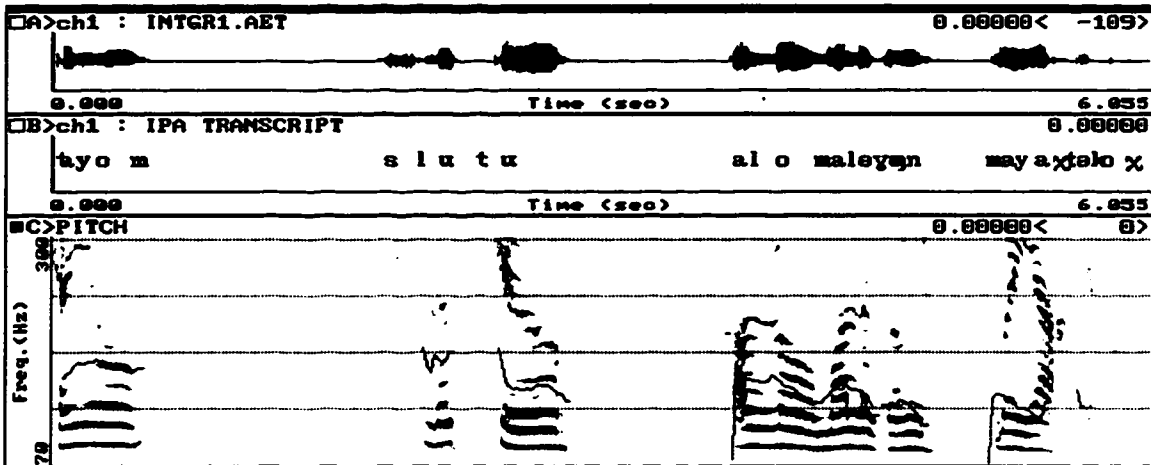
Gabriel Rukovishnikoff

GR1

**Tayağum slutuu alağum alagangin mayaattakut.**  
 man aged sea's it's animals he tried to hunt

tayağ- m slutu- u alağ- m alaga- ngin mayaa- xta- ku- x  
 man rl old 3refs sea rl animal 3refp hunt temp prs 3abs

*Old men hunted sea mammals.*

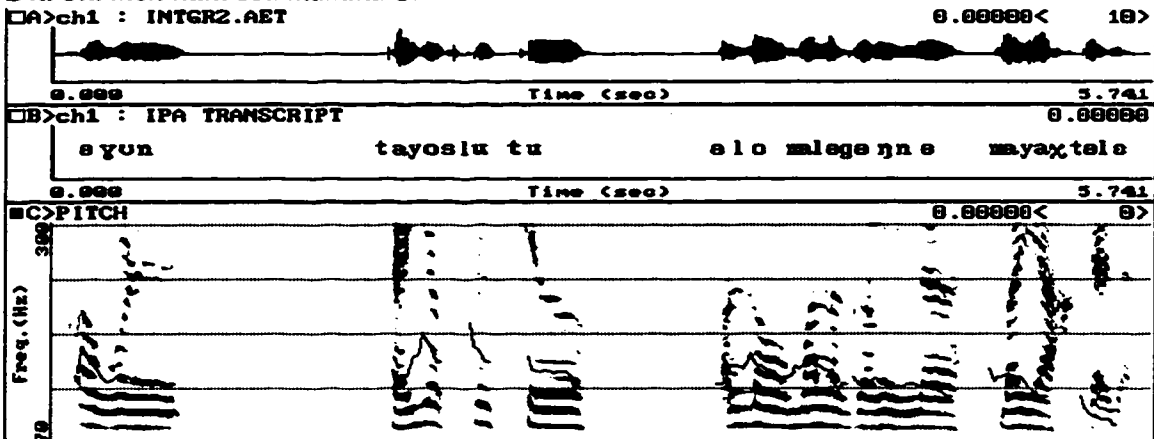


GR2

**Awan tayağum slutuu alağum alagangin mayaattalix, ii?**  
 that man aged sea animals did he hunt eh

awa- n tayağ- m slutu- u alağ- m alaga- ngin mayaa- xta- lix ii  
 that one dems man rl old 3refs sea rl animal 3refp hunt temp cnj Q

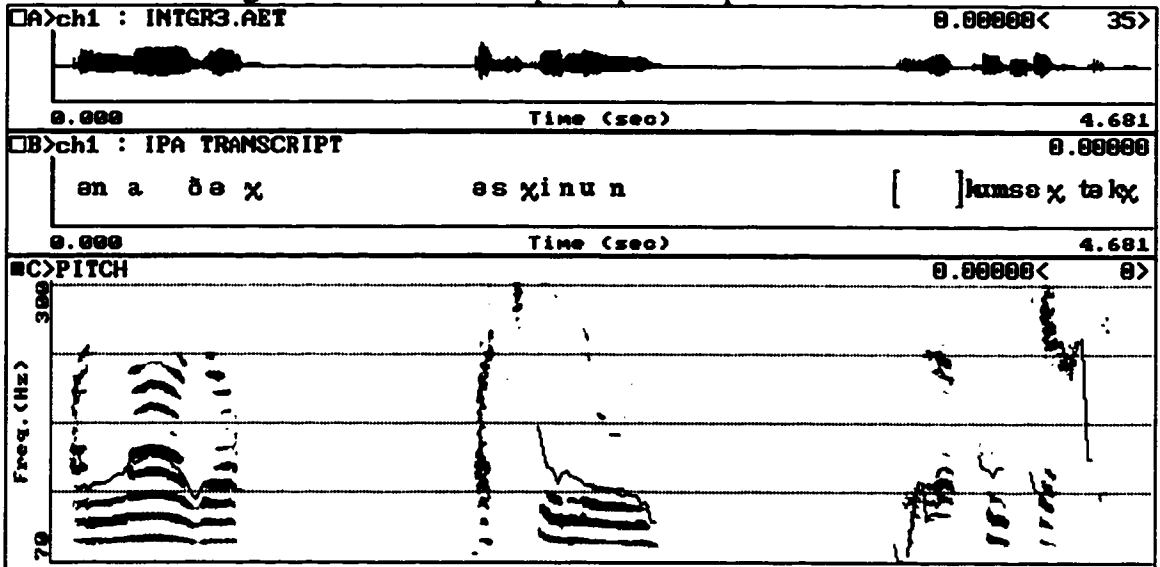
*Did old men hunt sea mammals?*



GR3

Anaadaɬ asxinuutxin kumsittakun. *The mothers carried the girls.*  
 mother their girl they carried

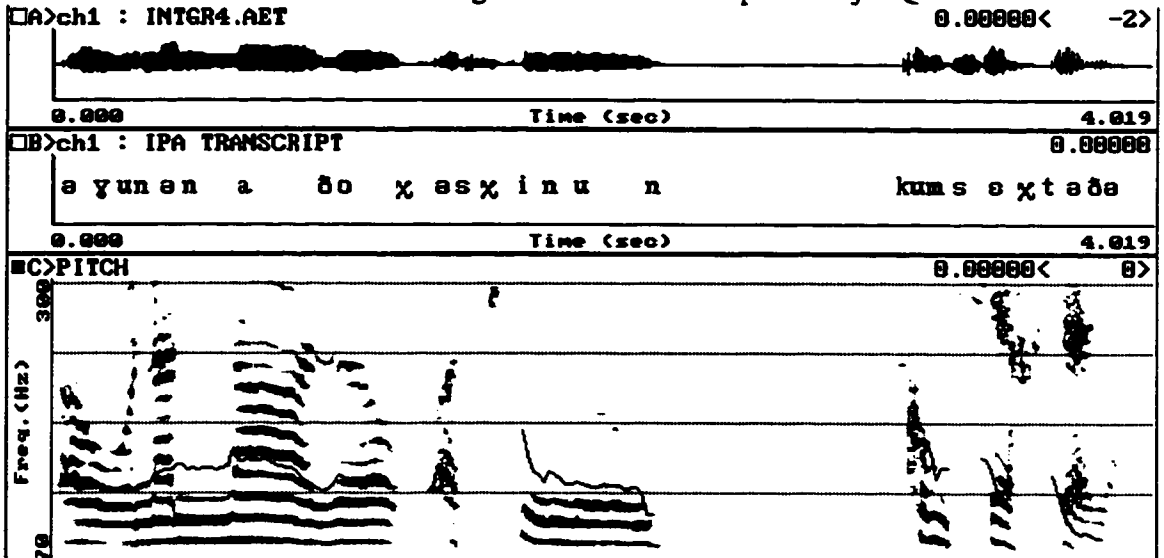
anaada- ʔ asxinu- utxin kumsiʔta- ku- n  
 mother 3abs daughter 3Rrefls lift up prs 3abp



GR4

Awan anaadaɬ asxinuutxin kumsittalix, ii? *Did the mothers carry the girls?*  
 that mother her girls did she carry eh

awa- n anaada- ʔ asxinu- utxin kumsiʔta- lix ii  
 that one dems mother 3abs daughter 3Rrefls lift up cnj Q

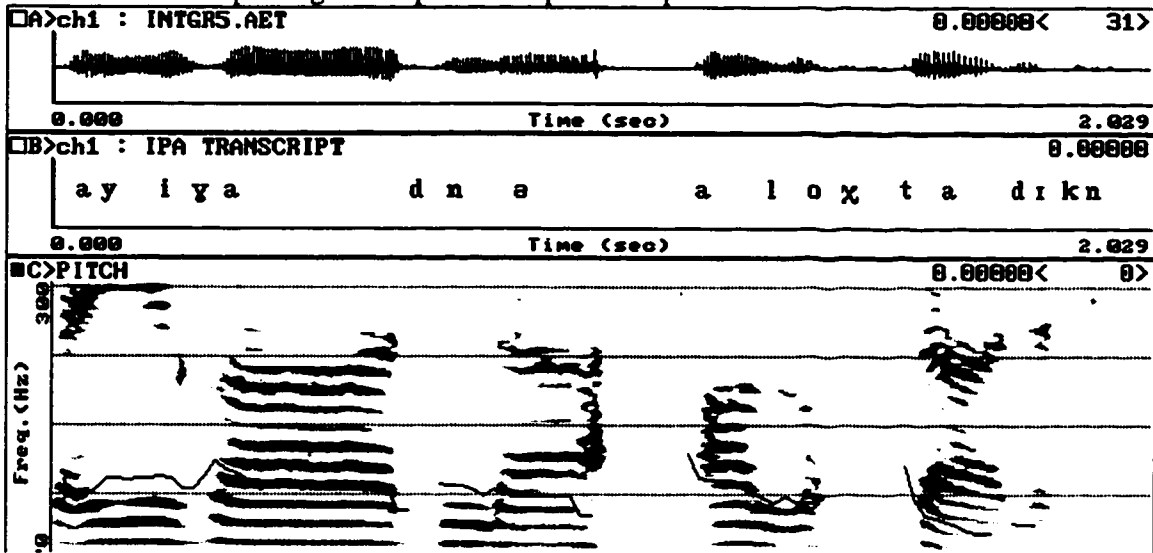


GR5

Ayagaadan aaluftaadakun.  
 girls they laughed hard

*The girls laughed.*

ayaga- ada- n aalu- xta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp

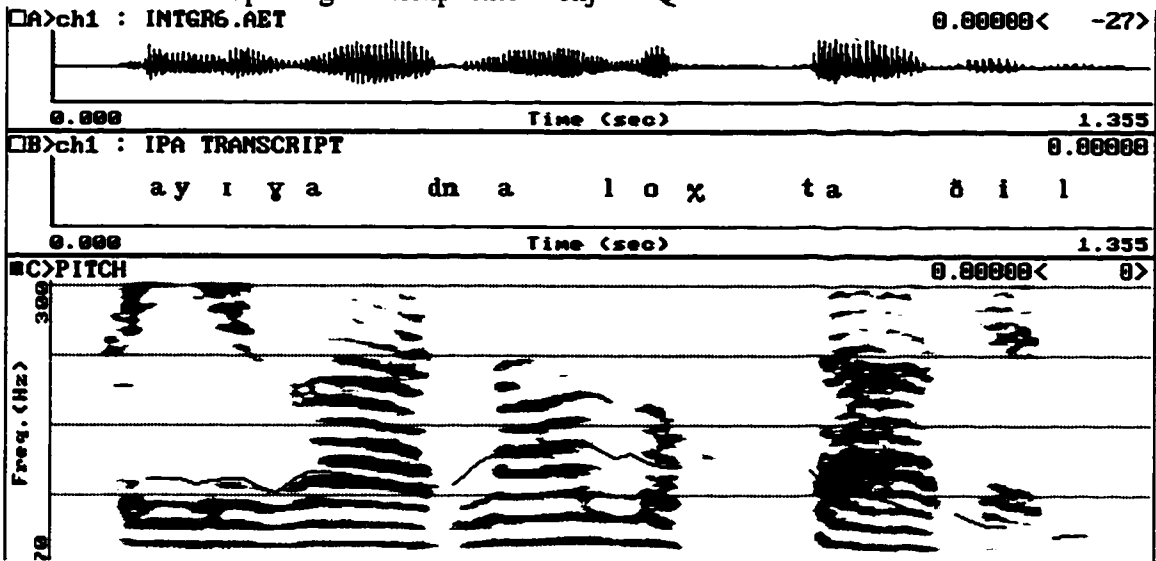


GR6

Ayagaadan aaluftaadaliX, ii?  
 girls they laughed hard eh

*Did the girls laugh?*

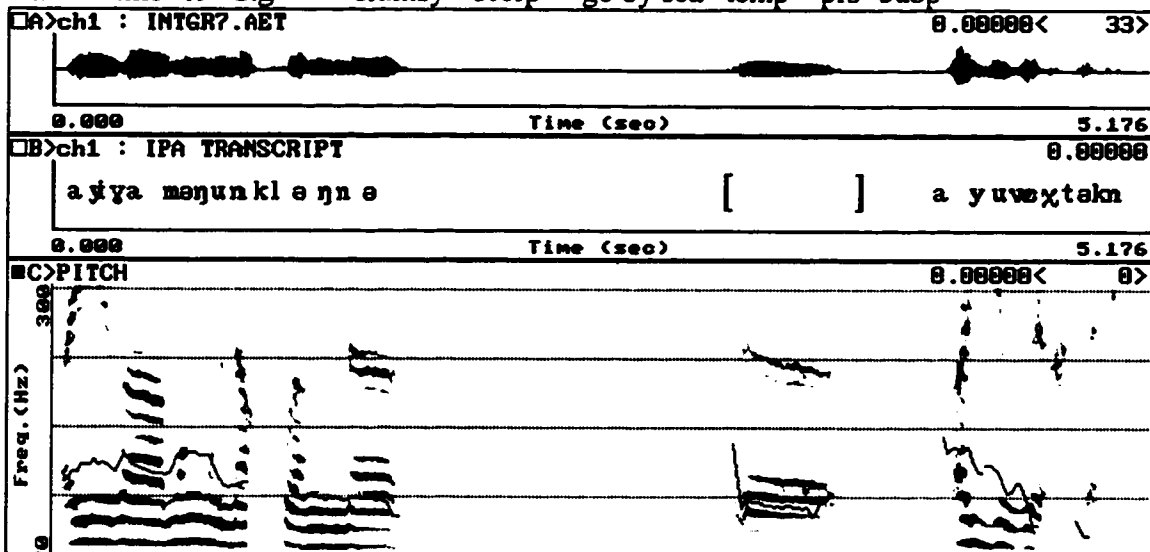
ayaga- ada- n aalu- xta- ada- liX ii  
 wife like 3abp laugh temp like cnj Q



## GR7

Ayagaadam angunaqlangin ayfatakun. *The big girls lwent out in the boat.*  
 girls big ones hey went out in the boat

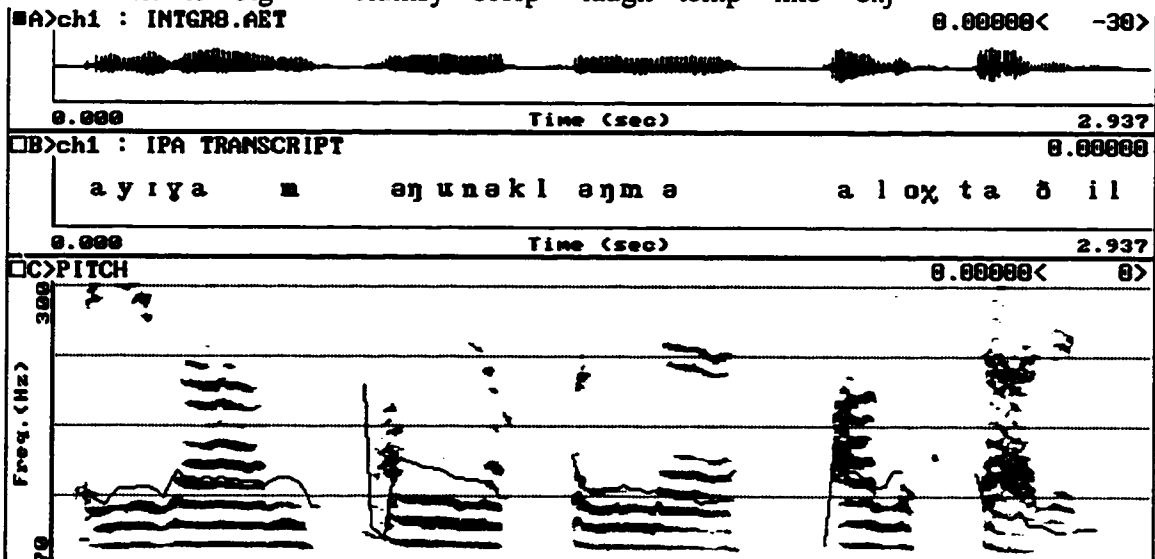
ayaga- ada- m anguna- qla- ngin ayfa- xta- ku- n  
 wife like rl big clumsy 3refp go by sea temp prs 3abp



## GR8

Ayagaadan angunaqlangin ii, aaluftaalix? *Did the big girls laugh?*  
 girls big ones eh did they laugh

ayaga- ada- m anguna- qla- ngin aalu- xta- ada- lix  
 wife like rl big clumsy 3refp laugh temp like cnj

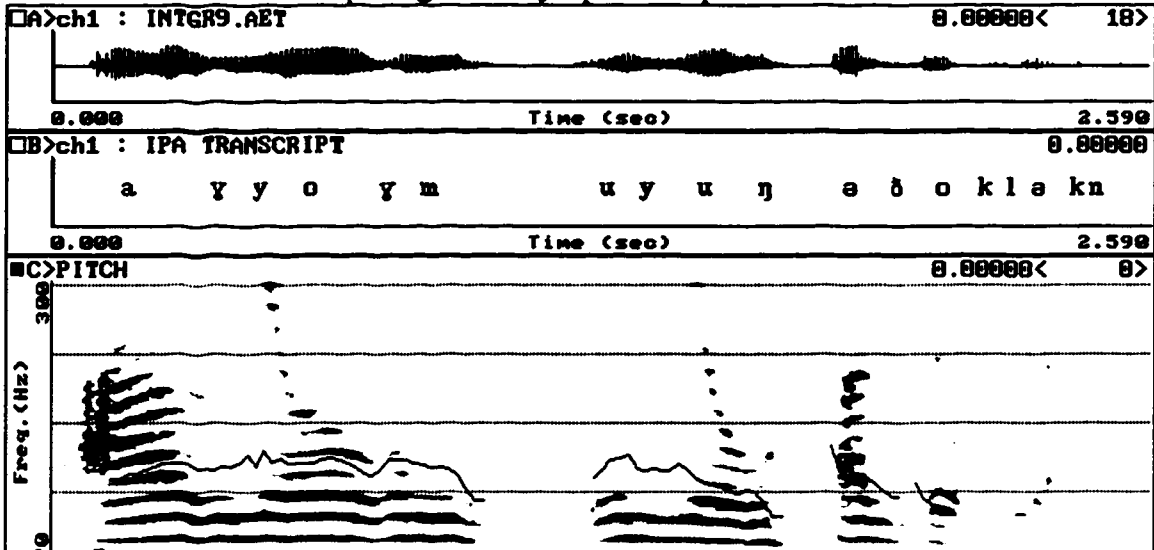


GR9

Aagyuŋim uyungin aduqlakun.  
 cormorants' their necks they are long

*Cormorants' necks are long.*

aagyuŋi- m uyu- ngin adu- qia ku- n  
 cormorant r1 neck 3refp long clumsy prs 3abp

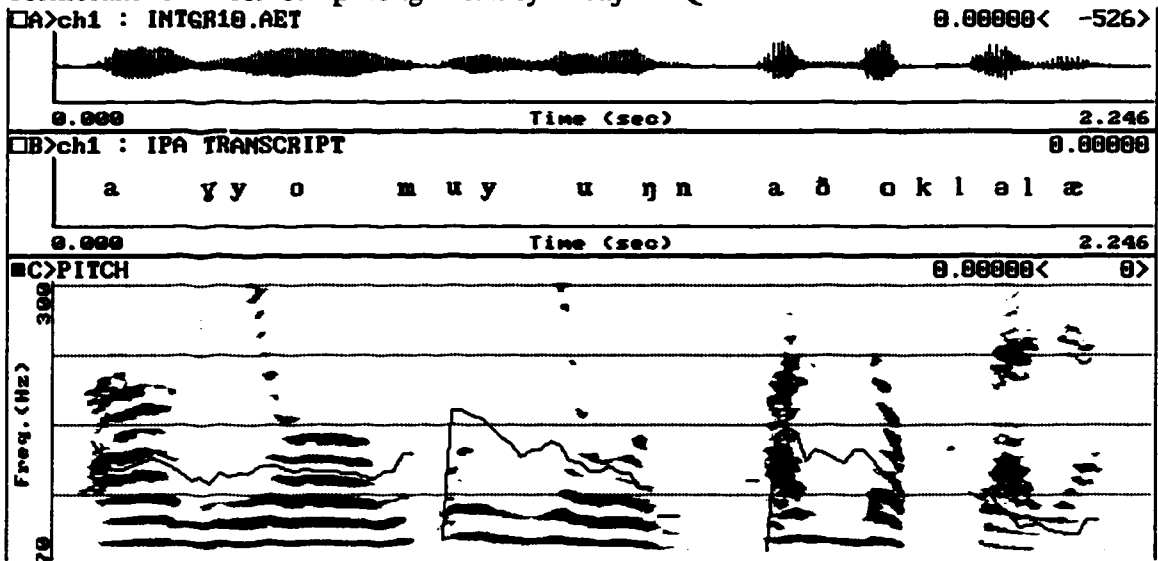


GR10

Aagyuŋim uyungin aduqladalix, ii?  
 cormorants' their necks are they long eh

*Are cormorants necks long?*

aagyuŋi- m uyu- ngin adu- qia- lix ii  
 cormorant r1 neck 3refp long clumsy cnj Q



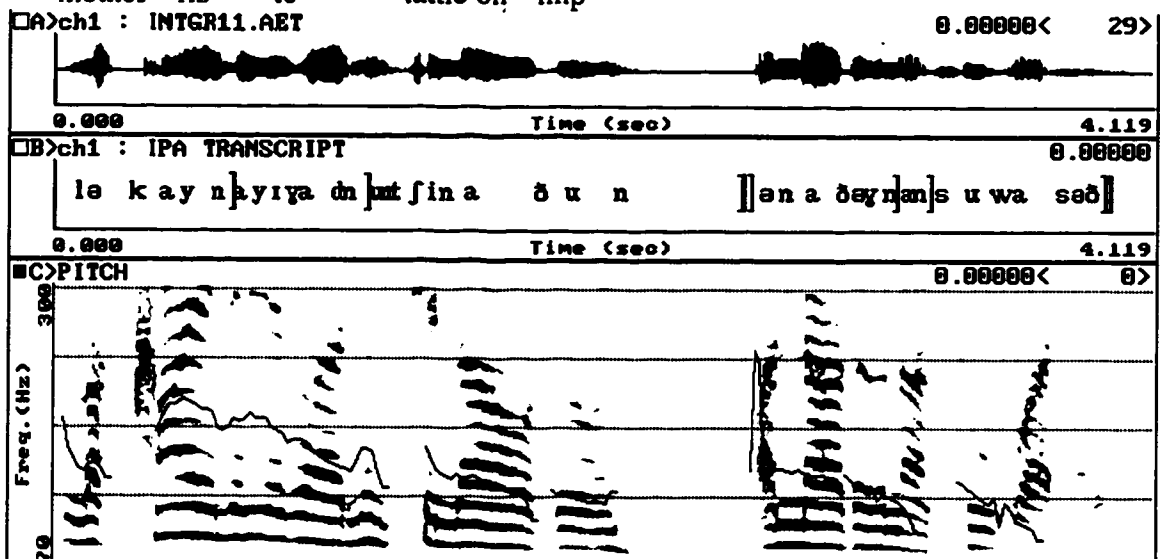
GR11

Amakun lakaayan ayagaadan umchunaagigungin, *If boys try to kiss girls, —*  
 those boys girls they try to kiss them

anaadanginaan sugaasada. *tell their mothers.*  
 their mothers to tattle

ama- kun lakaaya- n ayaga- ada- n umchu- naagi- gu- ngin  
 that demp boy 3abp wife like 3abp kiss try cnd 3refp

anaada- ngin- naan sugaasa- da  
 mother ris to tattle on imp



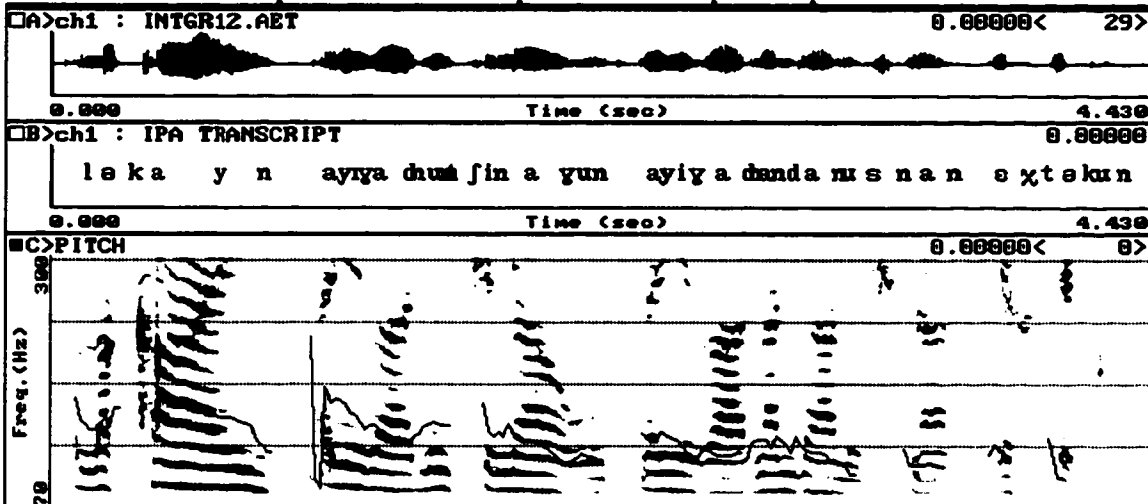
GR12

**Lakaayan**    **ayagaadan**    **umchunaaḡidumchin,**    *If boys try to kiss, —*  
 boys            girls            they try to kiss them

**ayagaadan**    **anaadamchinaan**    **iftakungin.**    *girls tell their mothers*  
 girls            to their mothers    they tell them

lakaaya- n    umchu- naaḡidu- mchin  
 boy        3abp    kiss        try to        2reflrp

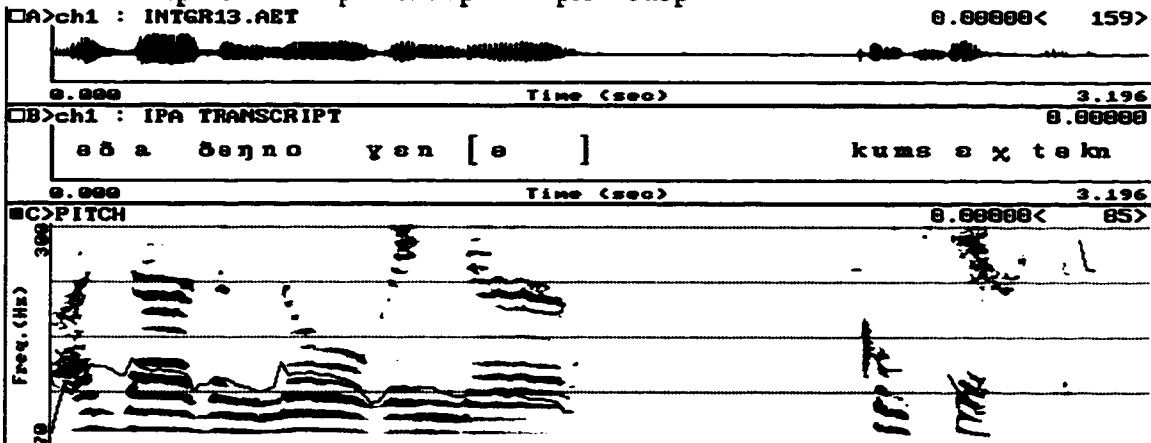
ayaga- ada- n    anaada- mchin- aan    iḡta- ku- ngin  
 wife    like 3abp    mother 2reflrp    to    tell    prs 3refp



GR13

**Adaadangin**    **nuḡin**    **kumsiḡtakun.**    *Their fathers carried rock.*  
 their fathers    rocks    they carried

adaada- ngin nuḡi- n    kumsiḡta- ku- n  
 father 3refp rock 3abp    lift up        prs 3abp



## GR14

Adaadangin nuḡit kumsiftakuḡaan,  
 their fathers rocks they carried them

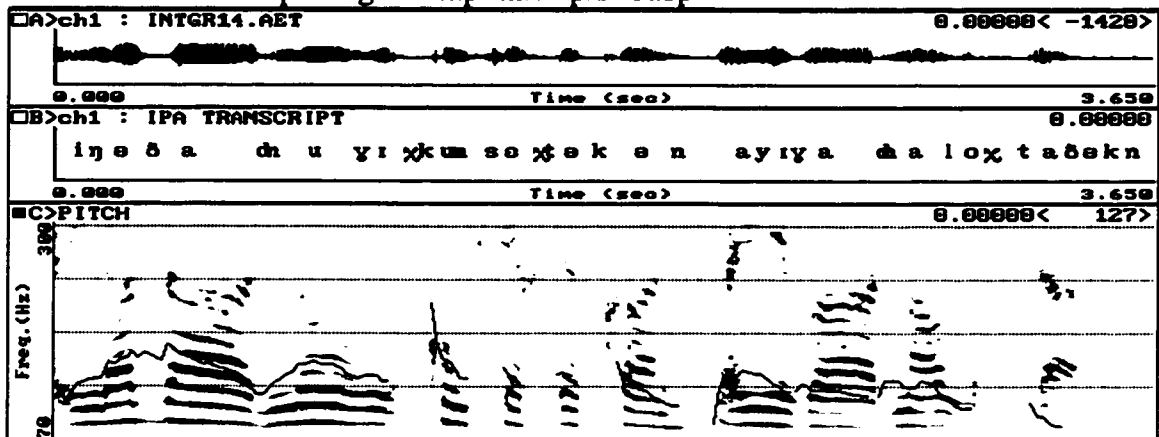
*When their fathers carried rocks, —*

ayagaadan aaluṭṭaadakun.  
 girls they laughed

*the girls laughed.*

adaada- ngin nuḡi- x kumsixṭa- ku- gan  
 father 3refp rock 3abs lift up prs ref3srel

ayaga- ada- n aalu- ṭṭa- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp

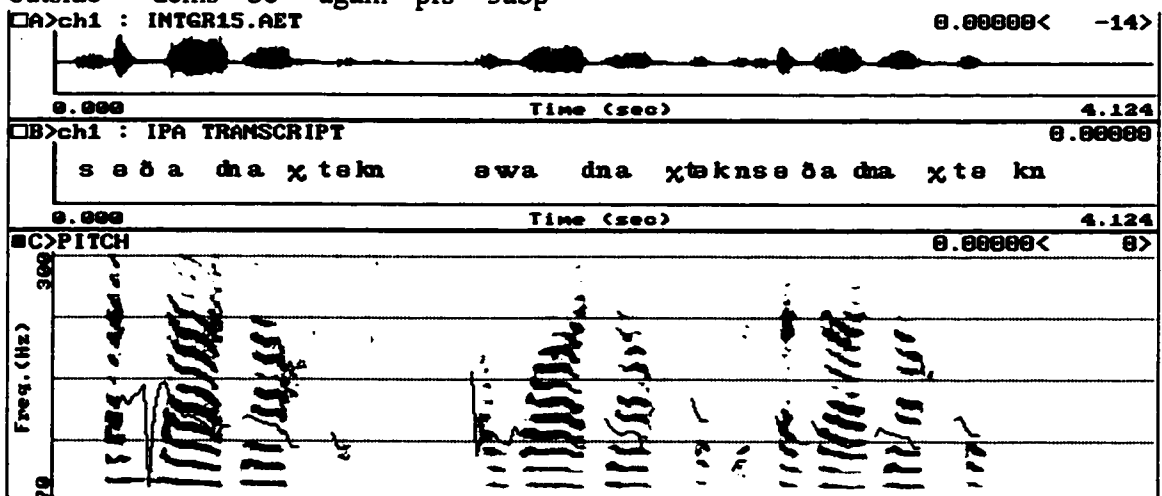


## GR15

Sadaadan aattukun.  
 outside we were

*We were out there (camping)*

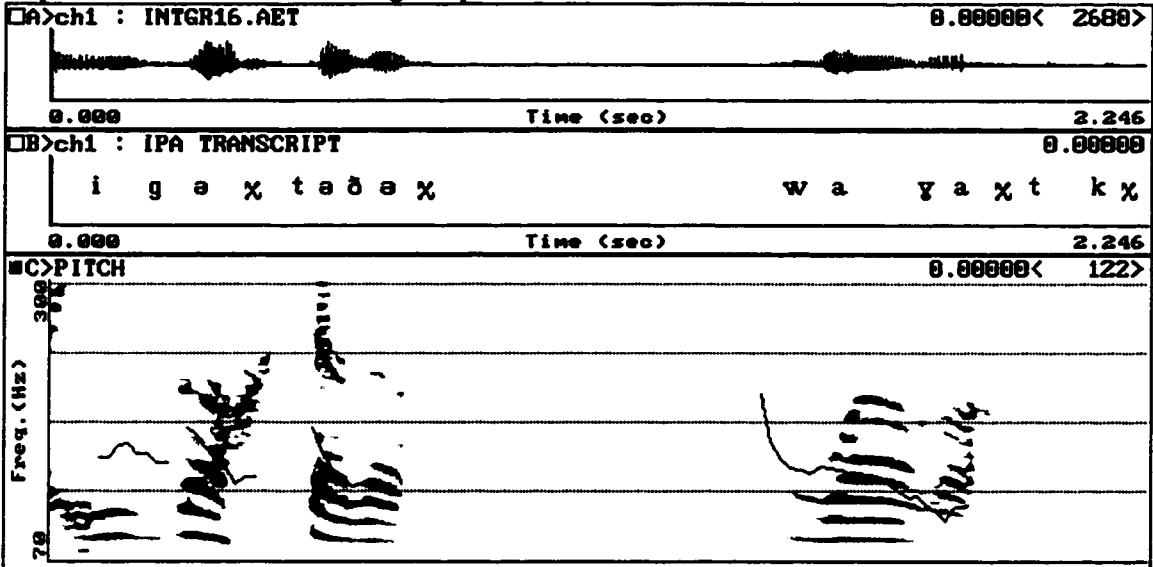
sadaada- n a- aṭṭu- ku- n  
 outside dems be again prs 3abp



GR16

**Igaɣtadax**      **waagaɣtukuɣ.**      *The airplane came.*  
 airplane      it came here

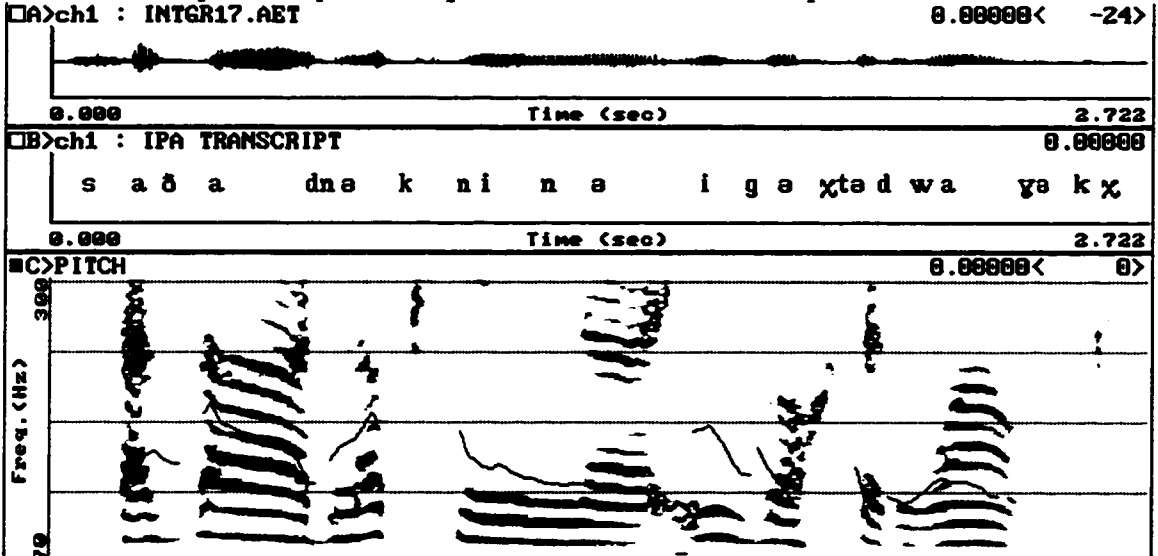
igaɣtada- ɣ      waaga-      aɣtu- ku- ɣ  
 airplane 3abs come here again prs 3abs



GR17

**Sadaadan**      **akuniin,**      **igaɣtadax**      **waagaɣakuɣ.**      *When we were out there, —*  
 outside      we were for airplane      it came      *the airplane came.*

sadaadan a- ku- n-      iin igaɣtada- ɣ      waaga-      ku- ɣ  
 outside be prs 3abp for airplane 3abs come here prs 3abs



GR18

Ulaa uluudalakat; ulaa qaʔchiklukut.

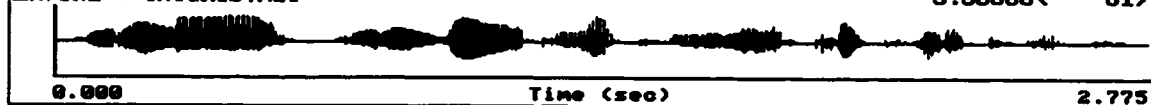
their house it is not red their house it is black

ula- a uluuda- laka- x ula- a qaʔchiklu- ku- ʔ  
 house 3refs red neg 3abs house 3refs black prs 3abs

*Their house isn't red, their house is black.*

□A&gt;ch1 : INTGR18.AET

0.00000&lt; 81&gt;



□B&gt;ch1 : IPA TRANSCRIPT

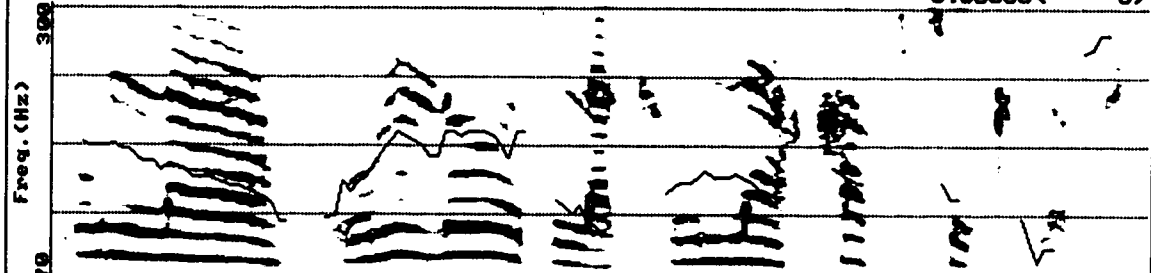
0.00000

u l ə u l u ʔ l ə k ʁ u l ə q a k t ʃ i k l o k ʁ

0.000 Time (sec) 2.775

■C&gt;PITCH

0.00000&lt; 0&gt;

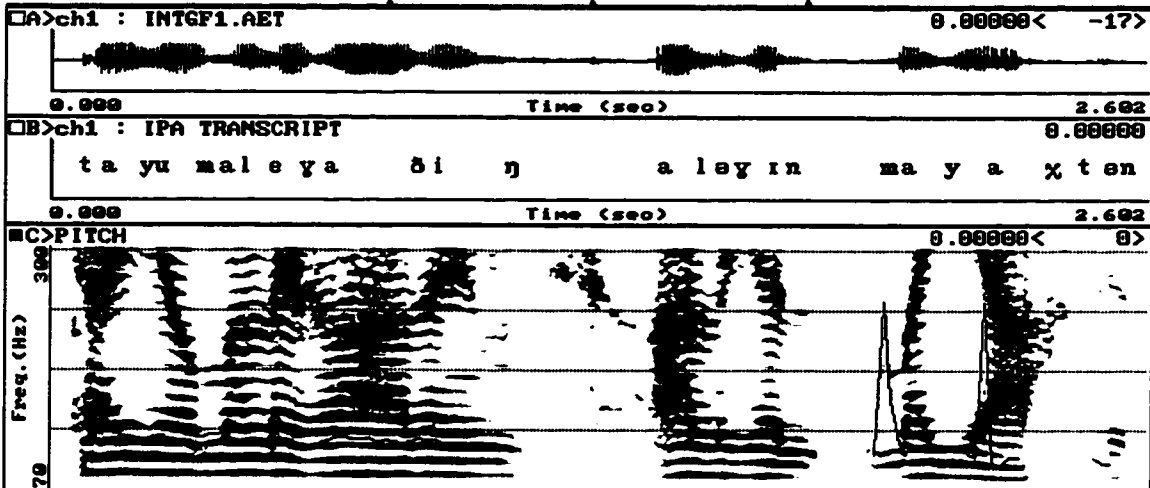


Gregory Fratis

GF1

Taayum algaadan aliġin mayaaftan. *Old men hunted sea mammals.*  
 old man animals old men they hunted

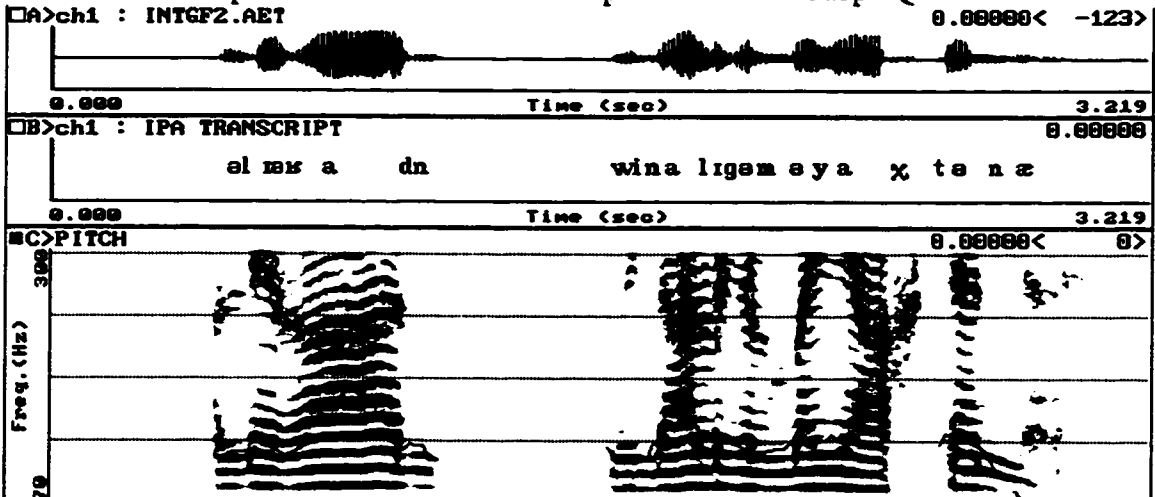
taayu- m alga- ada- n aliġi- n mayaafta- n  
 man rl animal small 3abp old man 3abp hunt 3abp



GF2

Algaadan wan aliġin mayaaftan, ii? *Did old men hunt sea mammals?*  
 animals this one old men hunted eh

alga- ada- n wa- n aliġi- n mayaafta- n ii  
 animal small 3abp this dems old man 3abp hunt 3abp Q

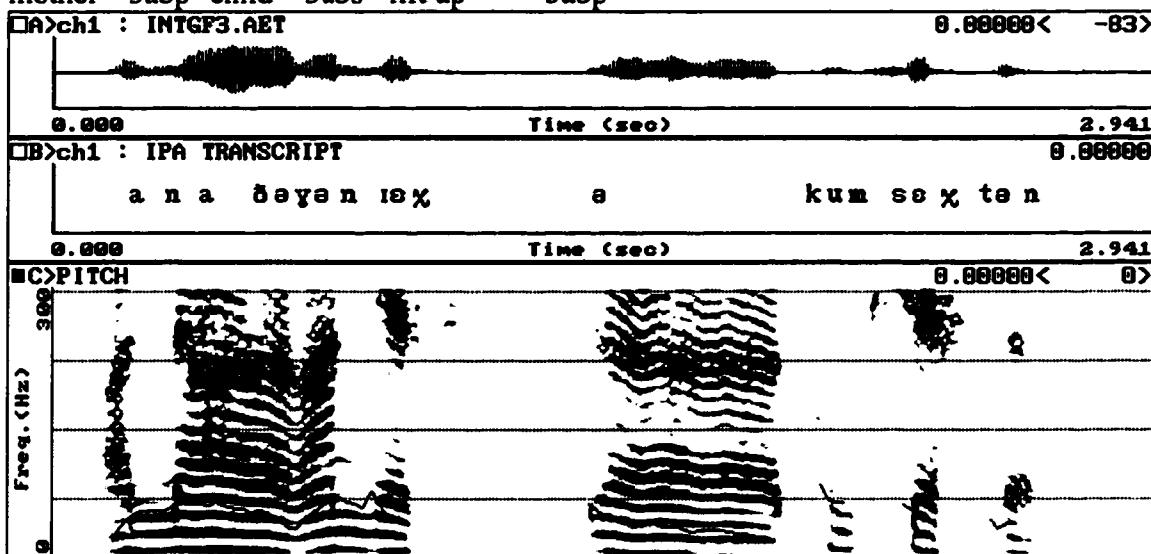


## GF3

Anaadan anix kumsittan.  
 mothers child they carried

*The mothers carried the girls.*

anaada- n ani- x kumsixta- n  
 mother 3abp child 3abs lift up 3abp

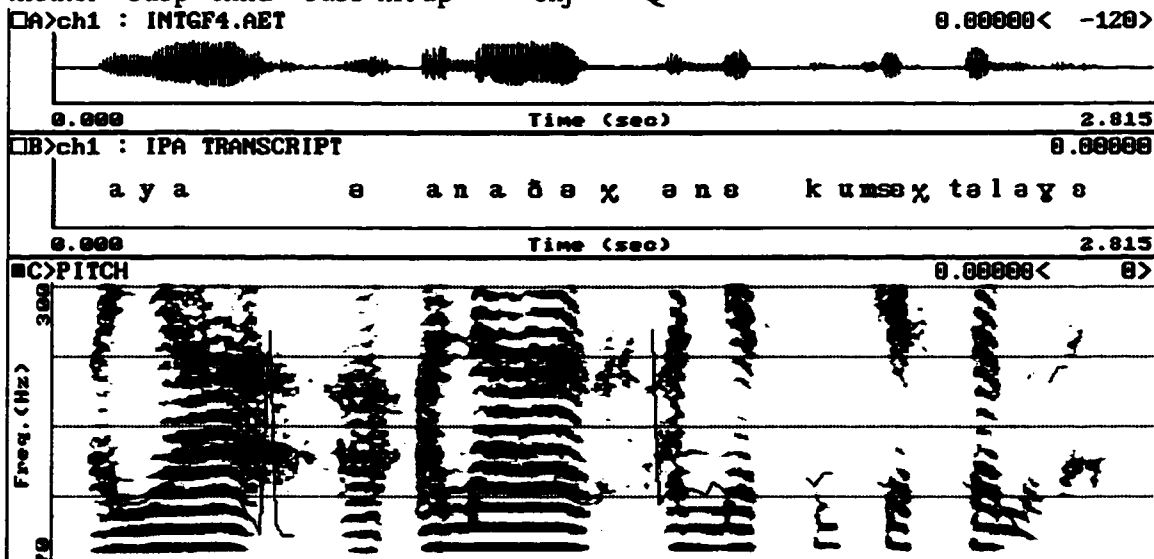


## GF4

Anaadan anix kumsittalix, ii?  
 mothers child carried eh

*Did the mothers carry the girls?*

anaada- n ani- x kumsixta- lix ii  
 mother 3abp child 3abs lift up cnj Q

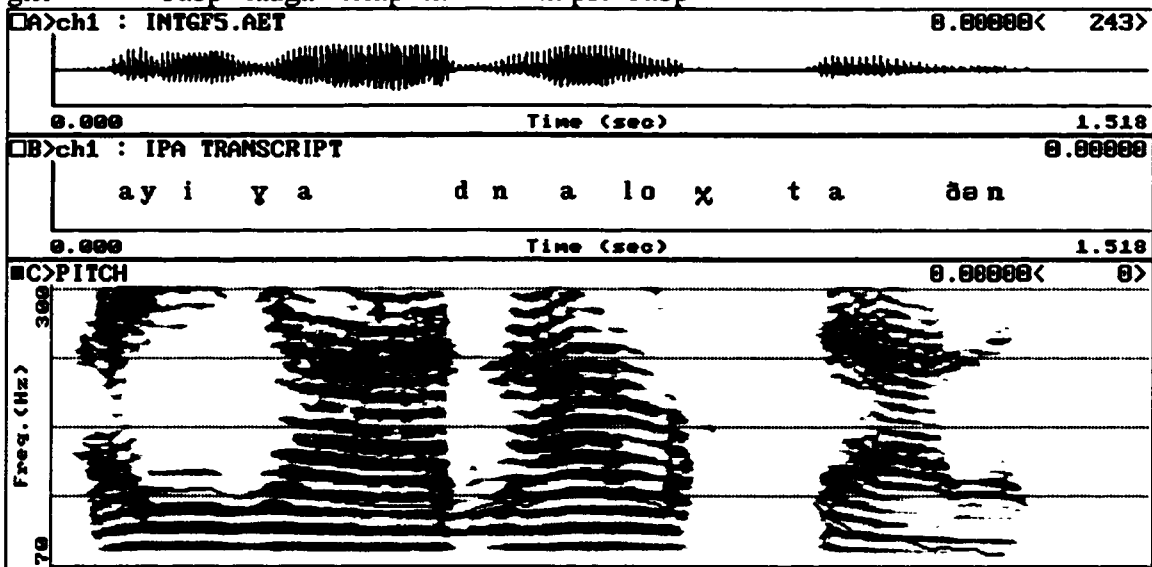


## GF5

Ayagaadan aalu<sup>3</sup>ta<sup>3</sup>ada<sup>3</sup>na<sup>3</sup>  
 girls they laughed

*The girls laughed.*

ayagaada- n aalu- xta- ada- na- n  
 girl 3abp laugh temp like rmt pst 3abp

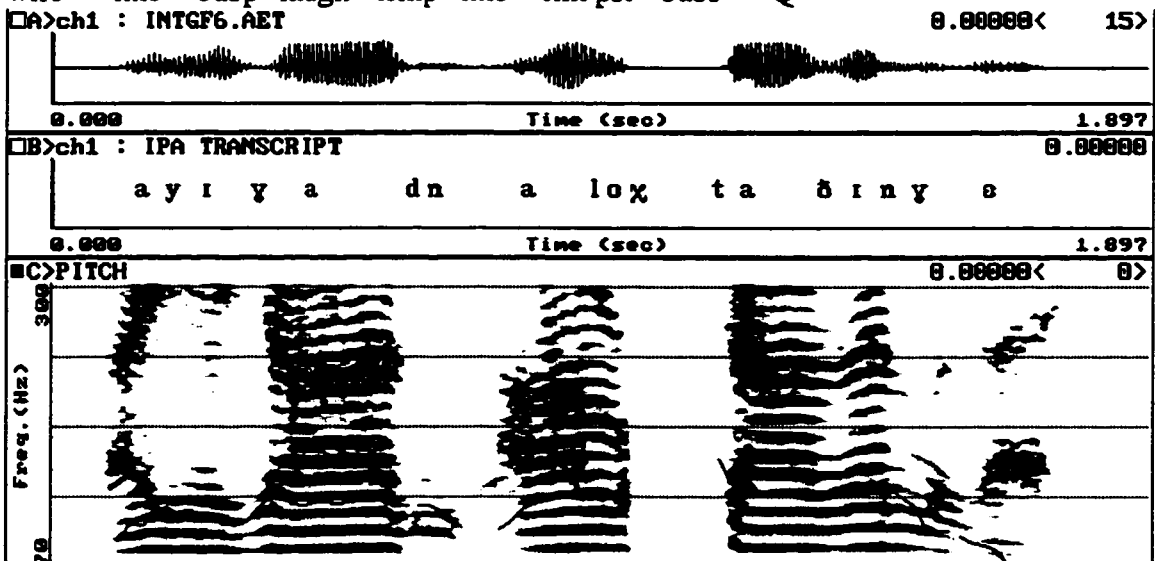


## GF6

Ayagaadan aalu<sup>3</sup>ta<sup>3</sup>ada<sup>3</sup>na<sup>3</sup> ii?  
 girls they laughed eh

*Did the girls laugh?*

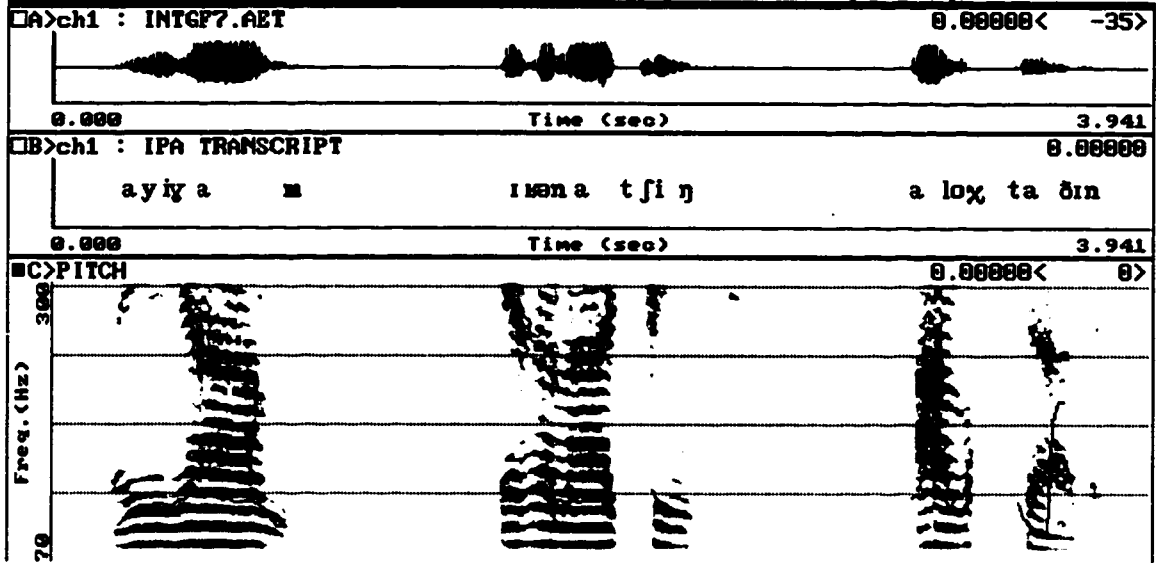
ayaga- ada- n aalu- xta- ada- na- x ii  
 wife like 3abp laugh temp like rmt pst 3abs Q



GF7

Ayagaadan iḡanaachin aaluḡtaadan. *The big girls laughed.*  
 girls big they laughed hard

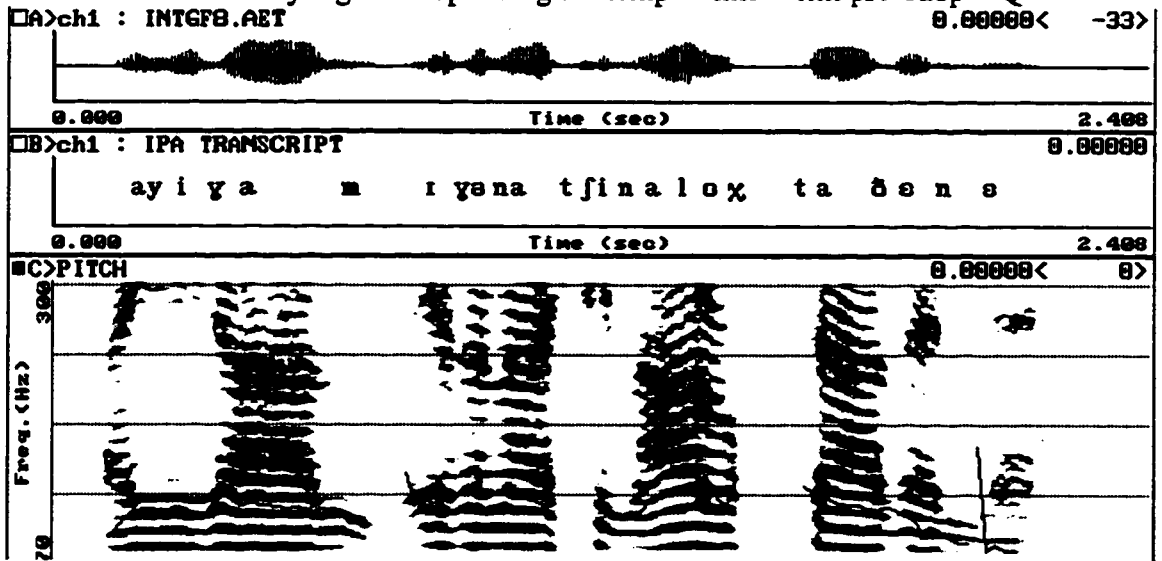
ayaga- ada- n iḡanaachi- n aalu- ḡta- ada- na- n  
 wife like 3abp very big 3abp laugh temp like rmt pst 3abp



GF8

Ayagaadan iḡanachin aaluḡtaadan, ii? *Did the big girls laugh?*  
 girls very big they laughed hard eh

ayaga- ada- n iḡanachi- n aalu- ḡta- ada- na- n ii  
 wife like rl very big 3abp laugh temp like rmt pst 3abp Q

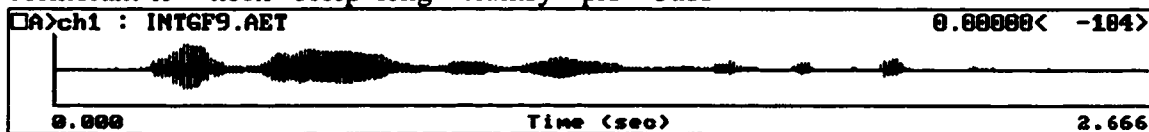


GF9, GF9a

Aagyuuŋim uyungin aduqlakuŋ.  
 cormorants' necks they are long

*Cormorants necks are long*

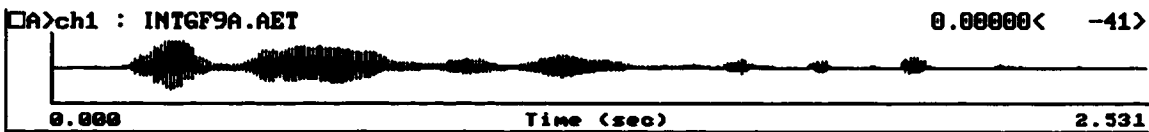
aagyuuŋi- m uy- ngin adu- qla- ku- ŋ  
 cormorant rl neck 3refp long clumsy prs 3abs



□B>ch1 : IPA TRANSCRIPT 0.00000

a y y o m u y u ŋ a ɔ k l ə k o ɣ

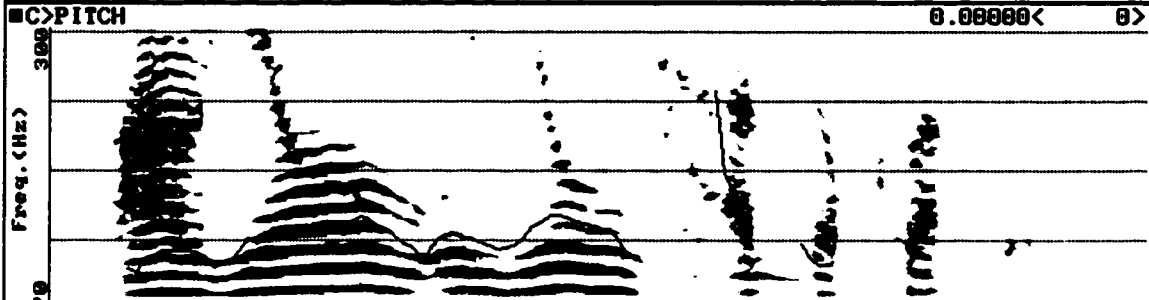
0.000 Time (sec) 2.666



□B>ch1 : IPA TRANSCRIPT 0.00000

a y y o m u y u ŋ a ɔ k l ə k o ɣ

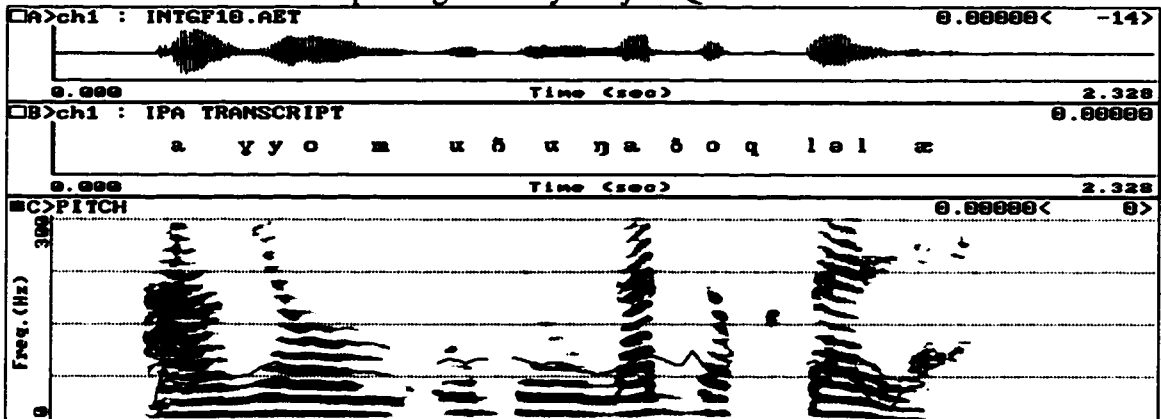
0.000 Time (sec) 2.531



## GF10

**Aagyuugiim uyungin aduqlalix, ii?**      *Are cormorants' necks long?*  
 cormorants' necks are they long eh

aagyuugi- m uy- ngin adu- qla- lix ii  
 cormorant rl neck 3abp long clumsy cnj Q



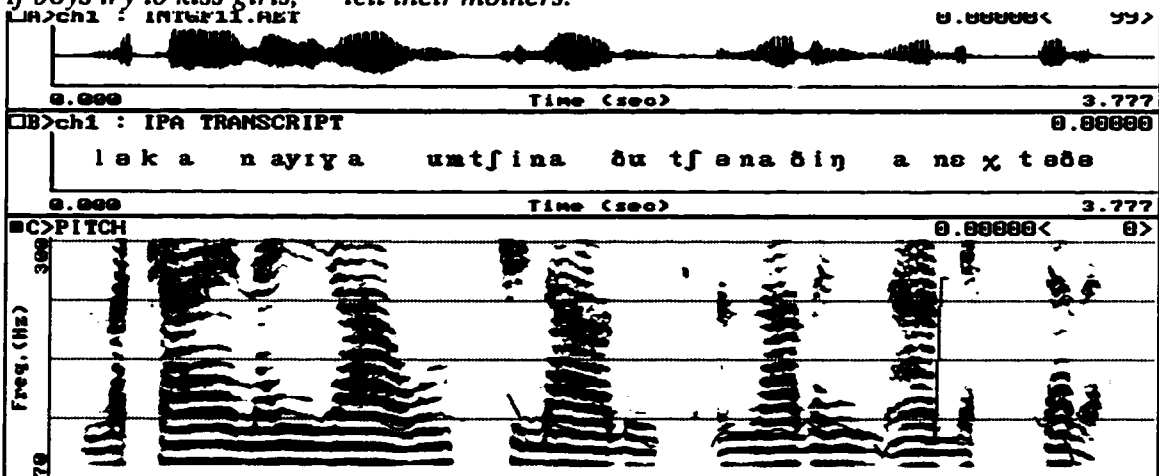
## GF11

**Lakaayan ayaga umchunaaxduchin**  
 boys girls try to kiss them

anaadangin ngaan ixtada.  
 their mothers o them tell

lakaaya- n ayaga- a umchu- naaxdu- chin  
 boy 3abp wife rl kiss try to rlp  
 anaada- ngin ngaan ixta- da  
 mother 3refp to tell imp

*If boys try to kiss girls, — tell their mothers.*

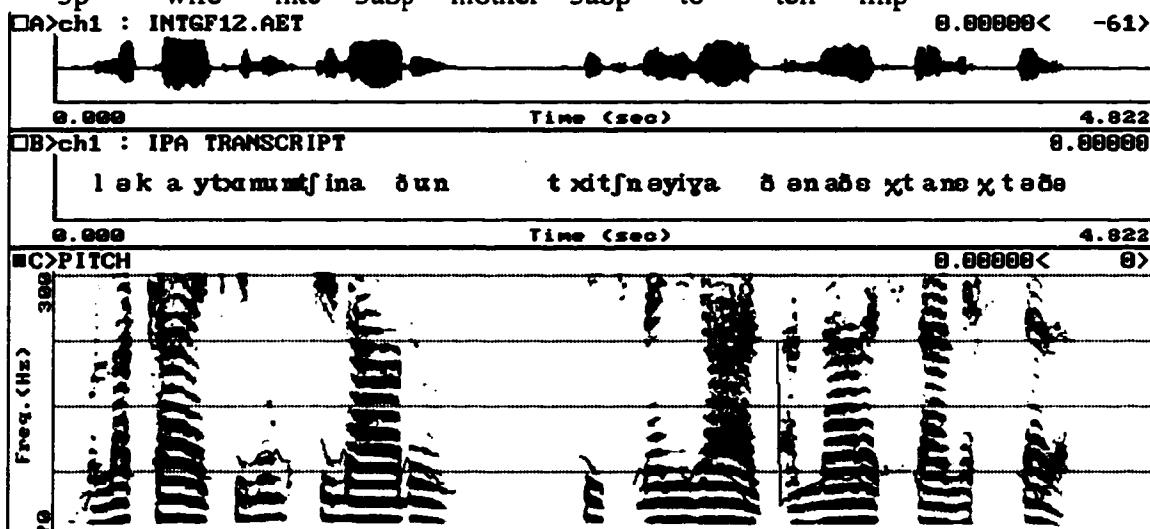


## GF12

**Lakaayan** txin umchunaaxdun, *If boys try to kiss, —*  
 boys she try to kiss

txichin ayagaadan anaadan ngaan ixtada. *girls tell their mothers*  
 they girls mothers to tell

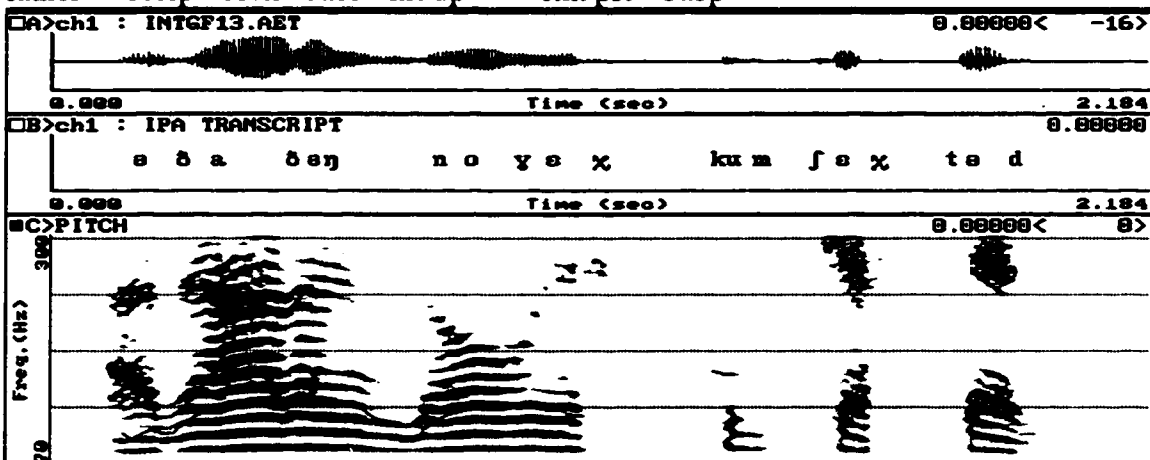
lakaaya- n txin umchu- naadu- n  
 boy 3abp 3s kiss try to 3abp  
 txichin ayaga- ada- n anaada- n ngaan ixta- da  
 3p wife like 3abp mother 3abp to tell imp



## GF13

**Adaadangin** nuɣit kumsixtanən. *Their fathers carried rocks.*  
 their fathers rock they carried

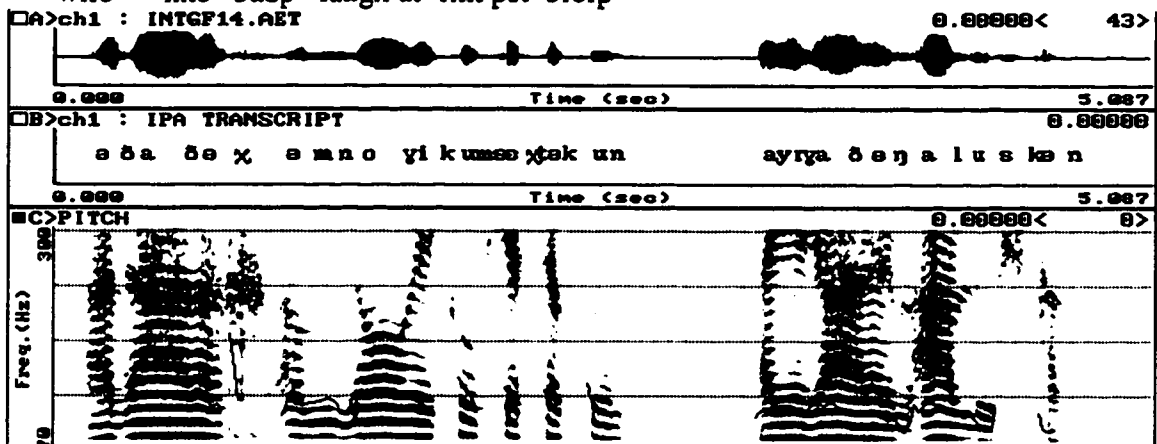
adaada- ngin nuɣi- x kumsixta- na- n  
 father 3refp rock 3abs lift up rmt pst 3abp



GF14

Adaadangin nuġit kumsixtakun, When their fathers carried rocks, —  
 their fathers rock they carried  
 ayagaadan aalusaqangin. the girls laughed.  
 girls they laughed at him

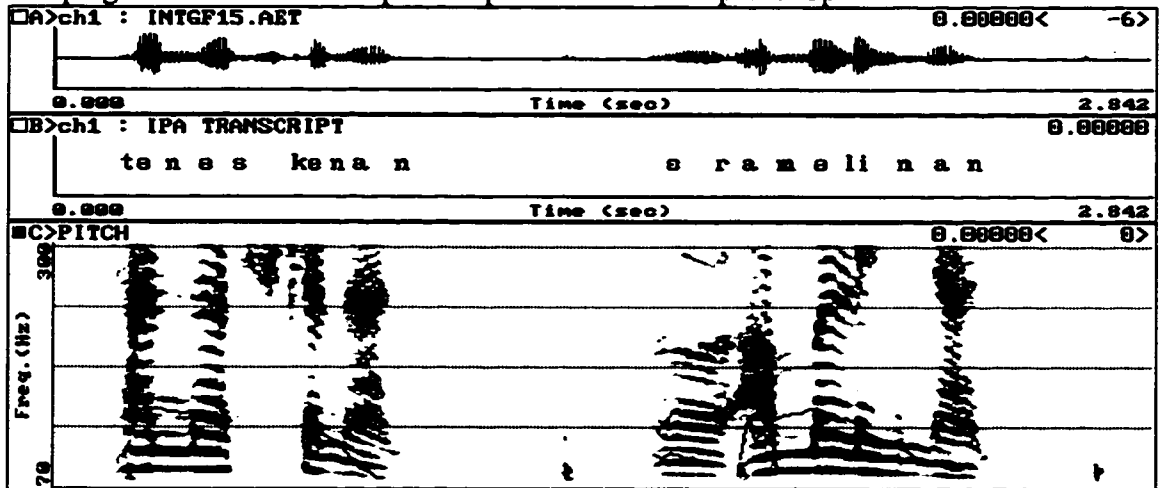
adaada- ngiñ nuġi- x kumsixta- ku- n  
 father 3refp rock 3abs lift up prs 3abp  
 ayaga- ada- n aalusa- qa- ngin  
 wife like 3abp laugh at rmt pst 3refp



GF15

Tanasxan anan amalinan. We were out there (camping).  
 camping area we were there we were

tanaxsa- n a- na- n amali- na- n  
 camping area dems be rmt pst 3abp to there rmt pst 3abp

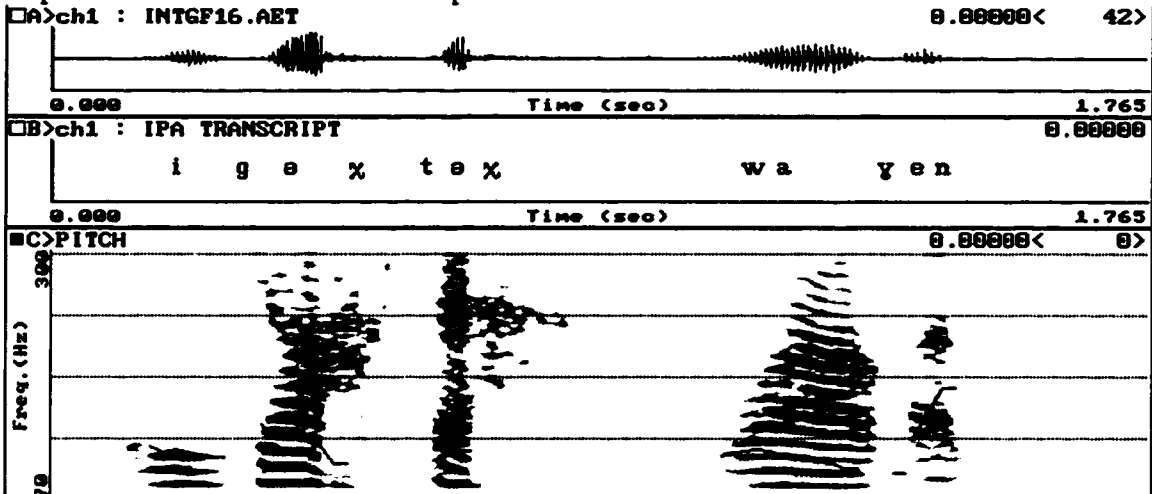


## GF16

Igaɣtadaɣ waagaɣnaɣ.  
airplane it came here

*The airplane came.*

igaɣtada- ɣ waaga- na- ɣ  
airplane 3abs come here rmt pst 3abs



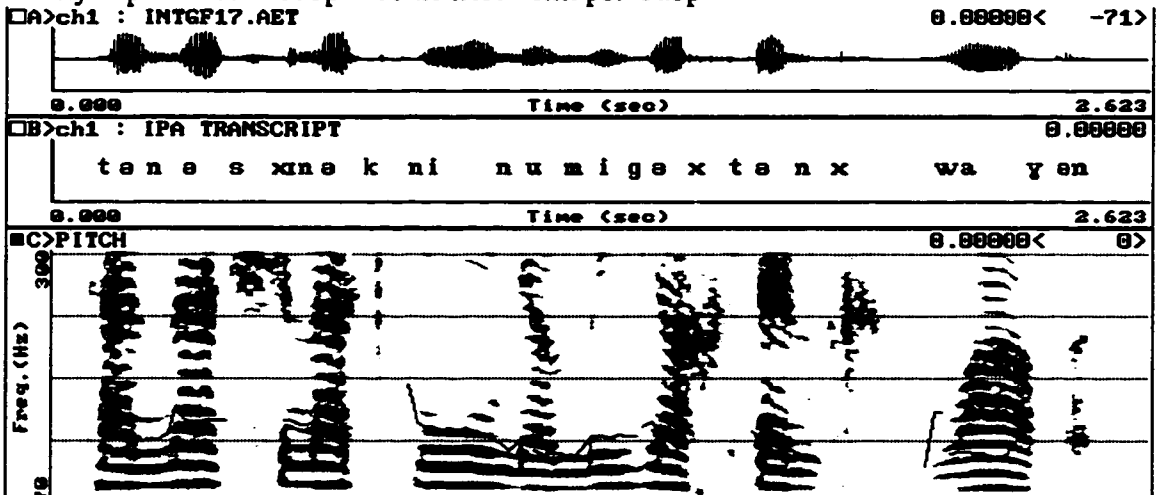
## GF17

Tanasxaɣ akuniin aman igatnan waaganan. *When we were out there, —*  
there we were that one passengers it came *the airplane came.*

tanaxa- n a- ku- niin ama- n  
camping area 3abp be prs 3Rrefs that one dems

iga- ɣta- na- n waaga- na- n

fly ps nom 3abp come here rmt pst 3abp

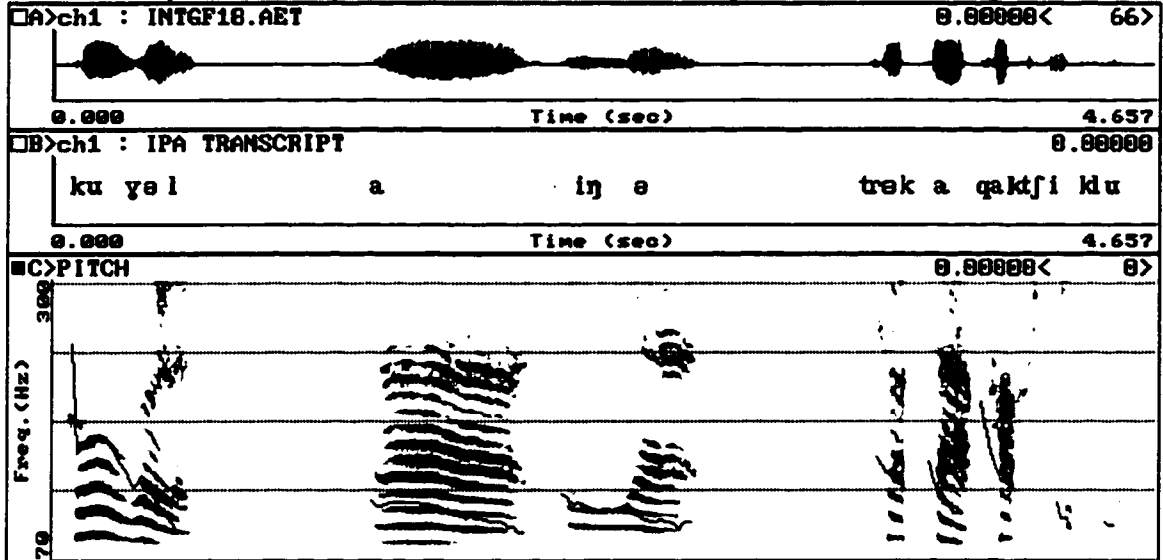


GF18

Kugul inga traka qaxchiklukut.  
 no that truck it is black.

*No, that truck is black.*

kugul inga traka- qaxchiklu- ku- t  
 no one just mentioned truck 3refs be black prs 3abs

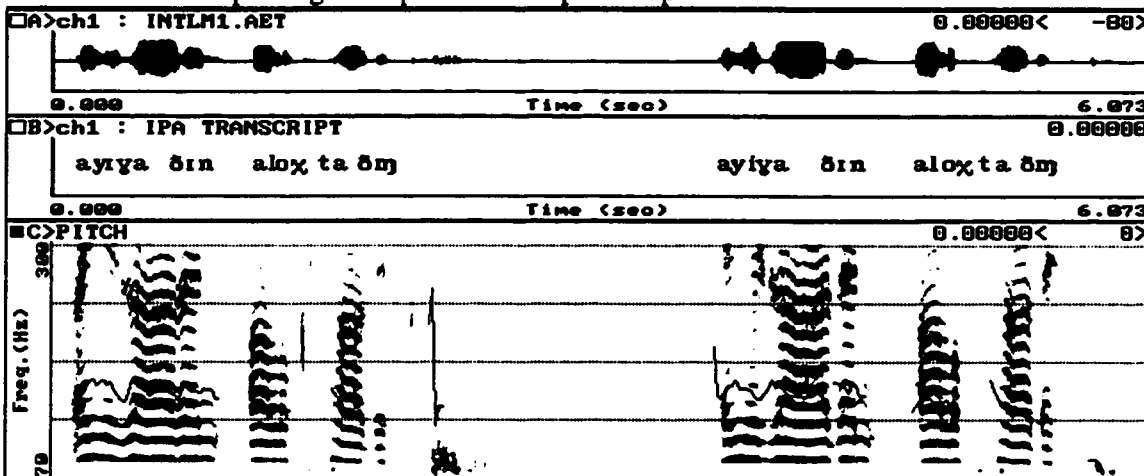


Ludmilla Mandregan

LM1

Ayagaadan aalu<sup>u</sup>taadan<sup>n</sup>. *The girls laughed.*  
 girls they laughed

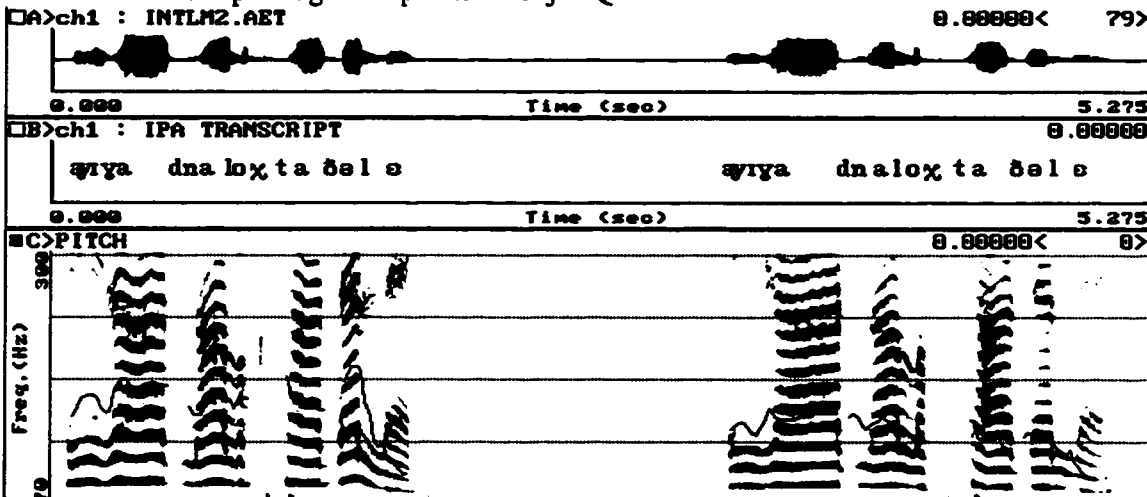
ayaga- ada- n aalu- <sup>u</sup>ta- ada- na- n  
 wife like 3abp laugh temp like rmt pst 3abp



LM2

Ayagaadan aalu<sup>u</sup>taadalix, ii? *Did the girls laugh?*  
 girls did they laugh eh

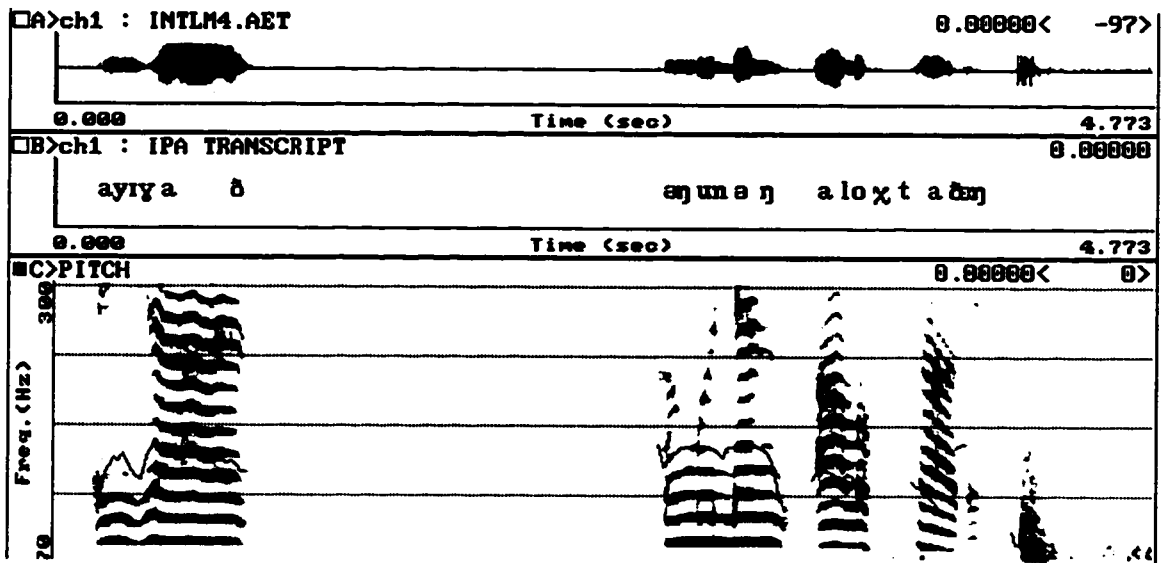
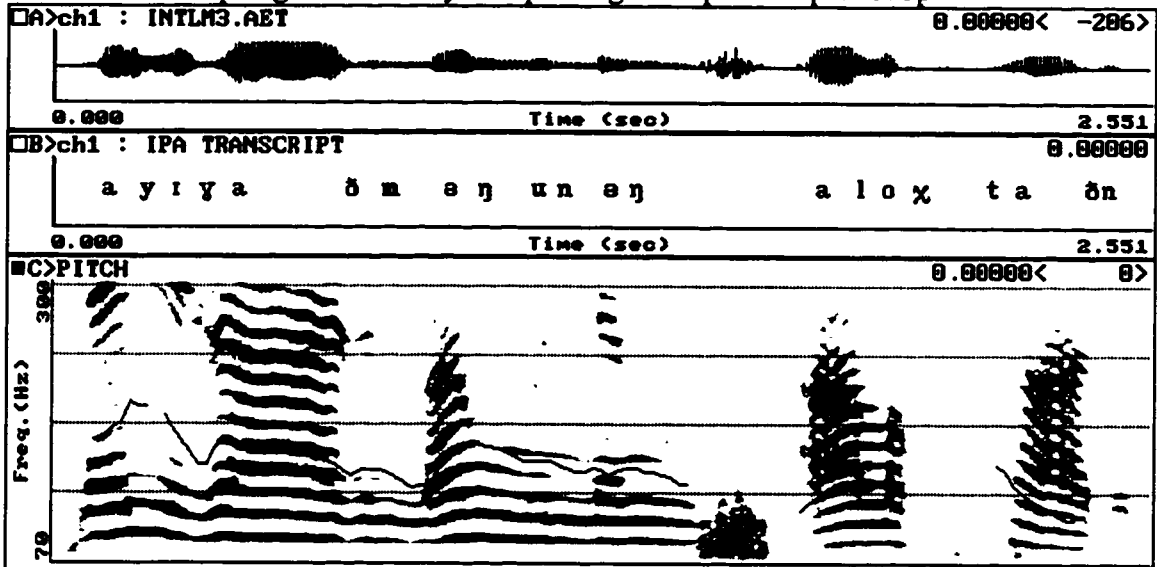
ayaga- ada- n aalu- <sup>u</sup>ta- ada- lix ii  
 wife like 3abp laugh temp like cnj Q



LM3, LM4

Ayagaadam angunangin aaluftaadakun. *The big girls laughed.*  
 girls big ones they laughed

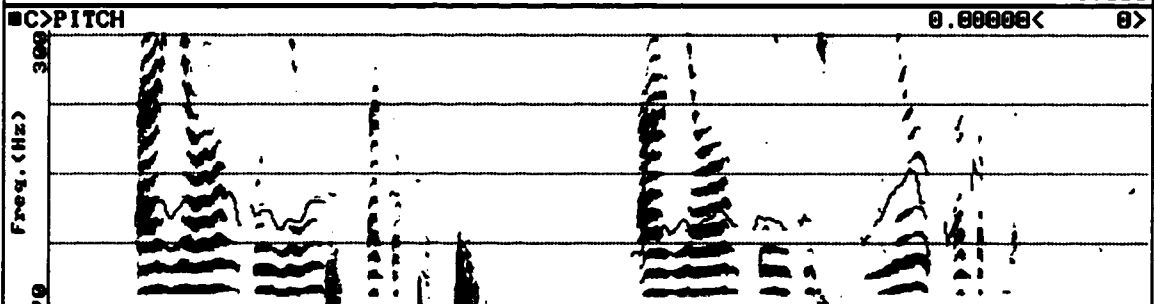
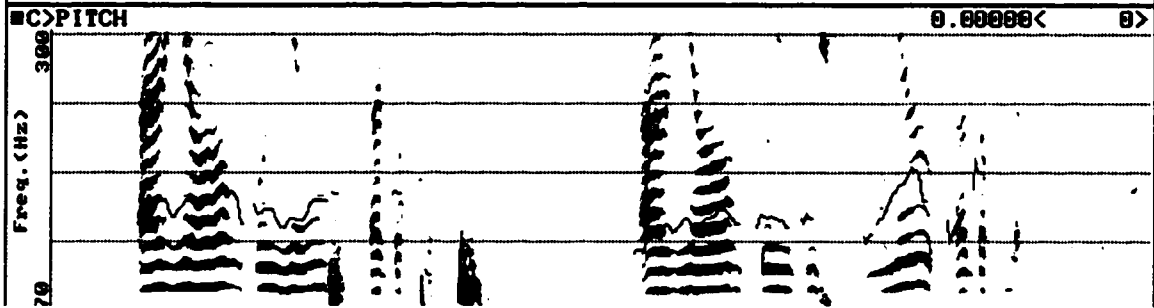
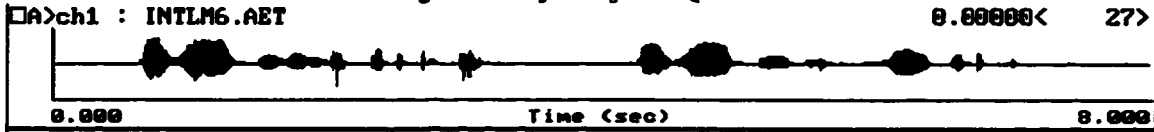
ayaga- ada- m anguna- qlu- ngin aalu- xta- ada- ku- n  
 wife like rlp big clumsy 3refp laugh temp like prs 3abp



LM6, LM7

Aagyuuḡim uyuu aduqlalix, ii. Are cormorants' necks long?  
cormorant its neck is it long eh

aagyuuḡi- m uy- u adu- qla- lix ii  
cormorant rls neck 3refs long clumsy cnj Q



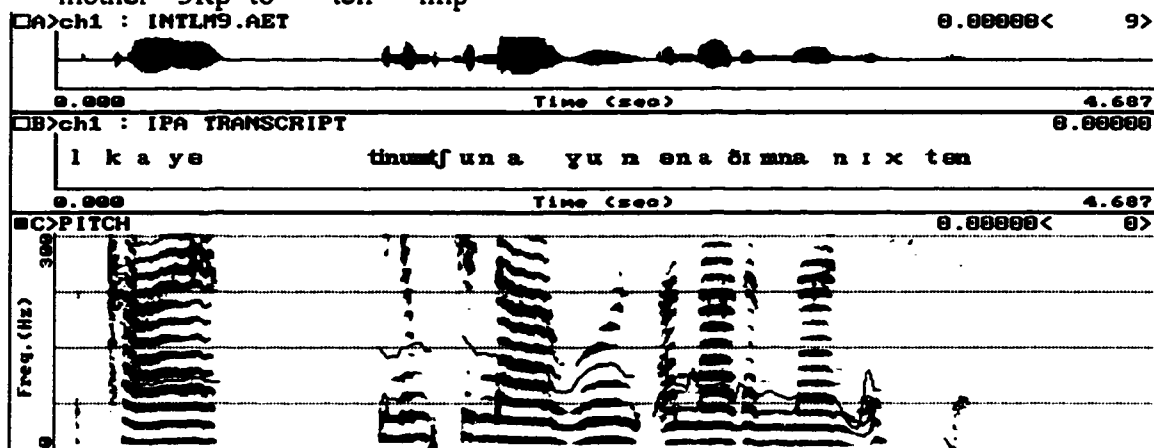
## LM9

Lakaayan txichin umchinaaḡigun, *If boys try to kiss girls, —*  
 boys them they try to kiss

anaadamnaan iḡtada. *tell their mothers.*  
 to their mothers you tell

lakaaya- n txichin umchi- naaḡi- gu- n  
 boy 3abp 3s kiss try to cnd 3abp

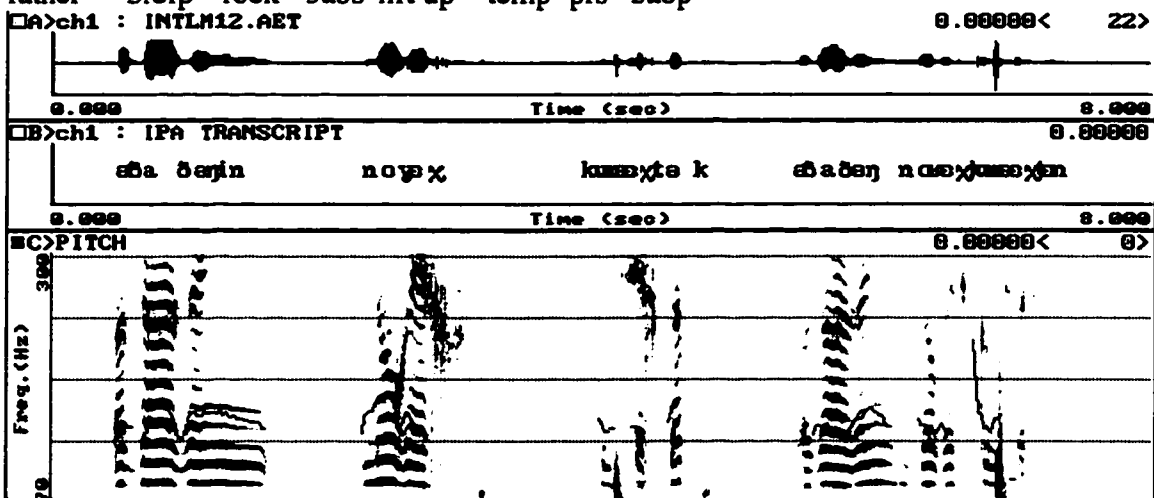
anaada- am- naan iḡta- da  
 mother 3Rp to tell imp



## LM12

Adaadangin nuḡiḡ kumsiḡtakun. *Their fathers carried rock.*  
 their fathers rocks they carried

adaada- ngin nuḡi- ḡ kumsi- ḡta- ku- n  
 father 3refp rock 3abs lift up temp prs 3abp

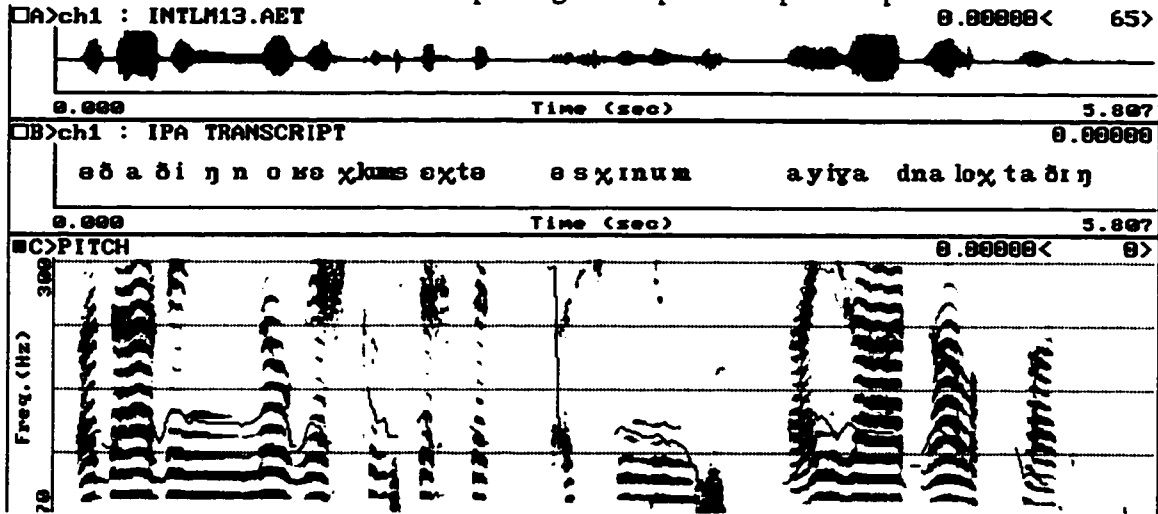


LM13

Adaadangin nuɣit kumsittakun, *When their fathers carried rocks, —*  
 their fathers rock they carried

(asxinum) ayagaadan aaluɣtaadattakun. *the girls laughed.*  
 children girls they laughed

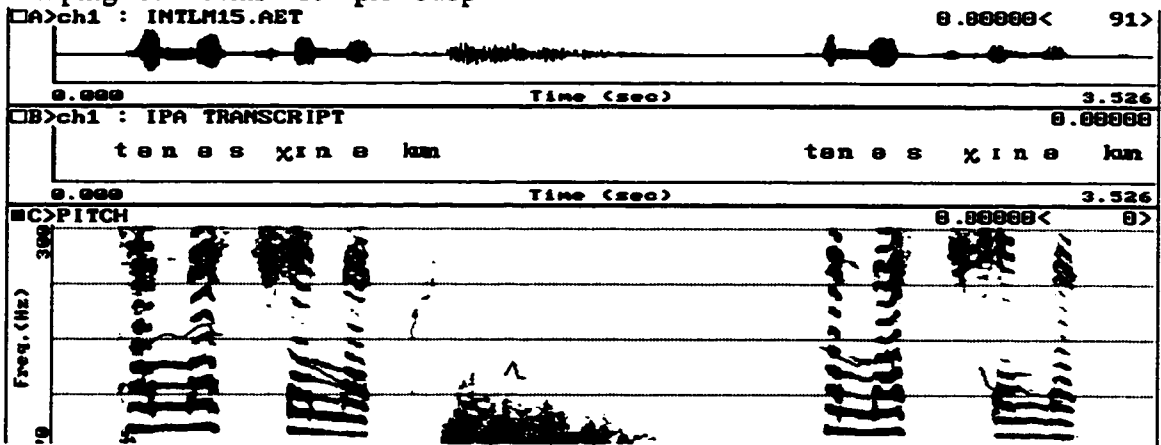
adaada- ngin nuɣi- ʔ kumsi- ʔta- ku- n  
 father 3refp rock 3abs lift up temp prs 3abp  
 (asxinu- m) ayaga- ada- n aalu- ʔta- ada- ku- n  
 child rl wife like 3abp laugh temp like prs 3abp



LM15

Tanasxan akun. *We were out there (camping)*  
 camping area we were

tanaxsa- n a- ku- n  
 camping area dems be prs 3abp

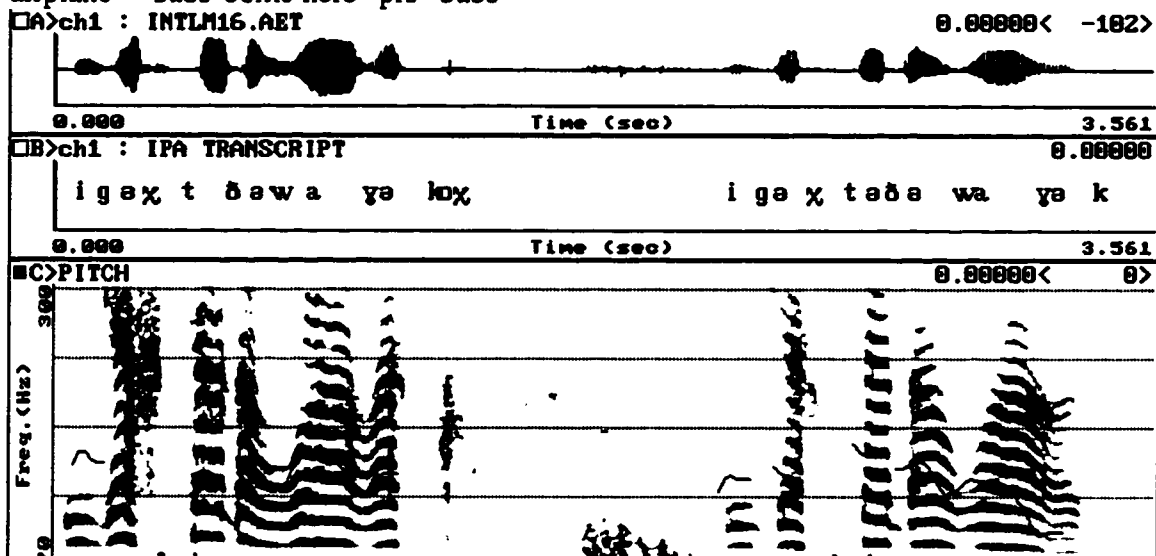


## LM16

Igaɣtadaɣ waagaɣakut.  
airplane it came here

*The airplane came.*

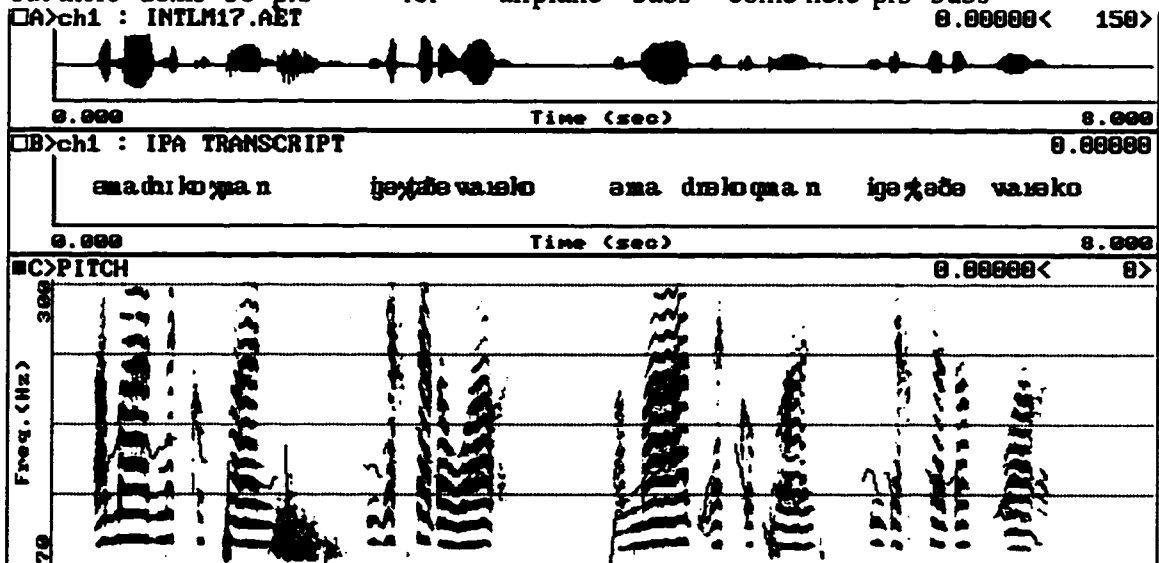
igaɣtada- ʁ waaga- ku- ʁ  
airplane 3abs come here prs 3abs



## LM17

Amaadan akutmaan, igatadaɣ waagaɣakut. *When we were out there, —*  
outside we were for airplane it came *the airplane came.*

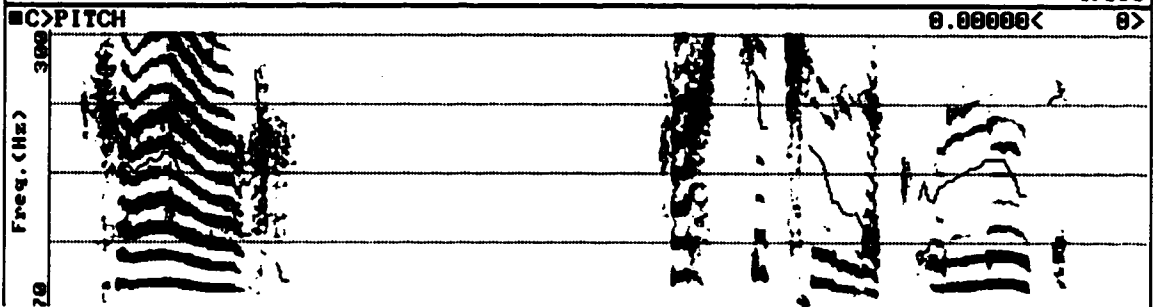
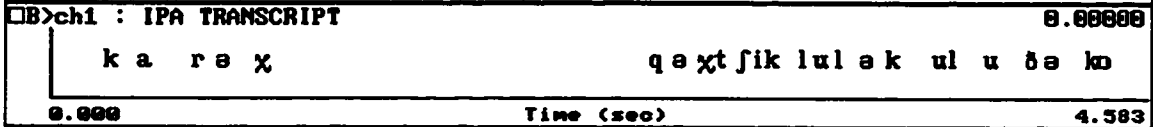
amaada- n a- ku- ʁm- aan igatada- ʁ waaga- ku- ʁ  
out there dems be prs for airplane 3abs come here prs 3abs



LM19

**Kaarax̣ qaxchiklulakax̣, uluudakux̣.      Their car isn't black, it's red.**  
 car      it is not black      it is red

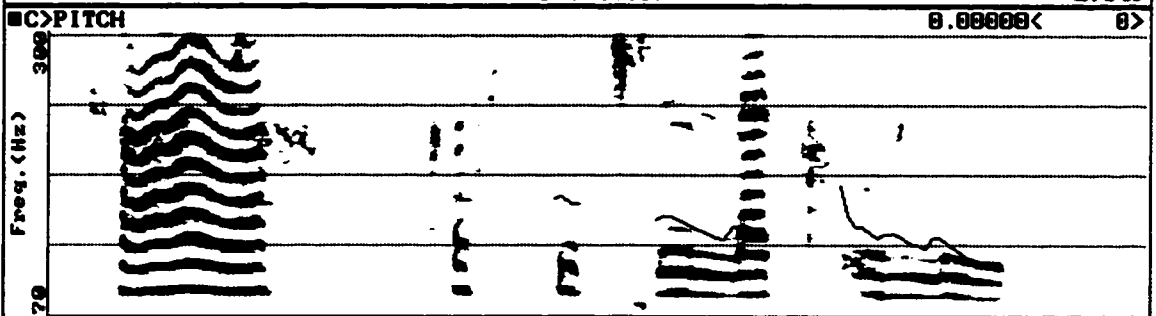
kaara- x̣      qaxchiklu- laka- x̣      uluuda- ku- x̣  
 car 3abs      black      neg 3abs      red      prs 3abs



LM20

**Kaarax̣ qaxchiklulakax̣, uluudakux̣.      Their car isn't black, it's red.**  
 car      it is not black      it is red

kaara- x̣      qaxchiklu- laka- x̣      uluuda- ku- x̣  
 car 3abs      black      neg 3abs      red      prs 3abs



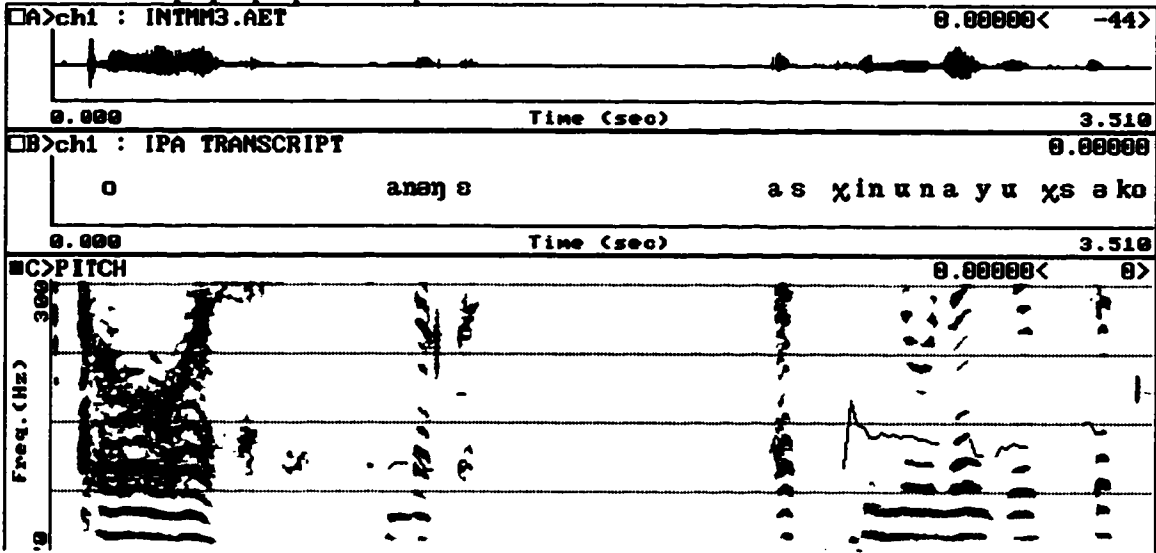


MM3

Astinun ayusakun.  
 children they carried them

*The mothers carried the girls.*

astinu- n ayusaku- n  
 child 3abp prop up 3abp

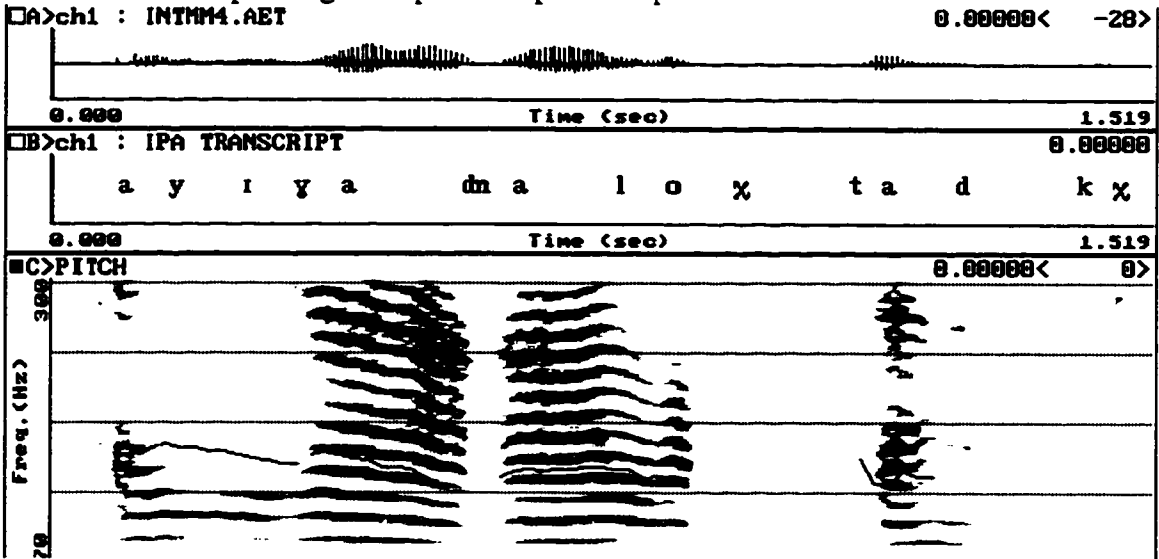


MM4

Ayagaadan aaluftaadakun.  
 girls they laughed

*The girls laughed.*

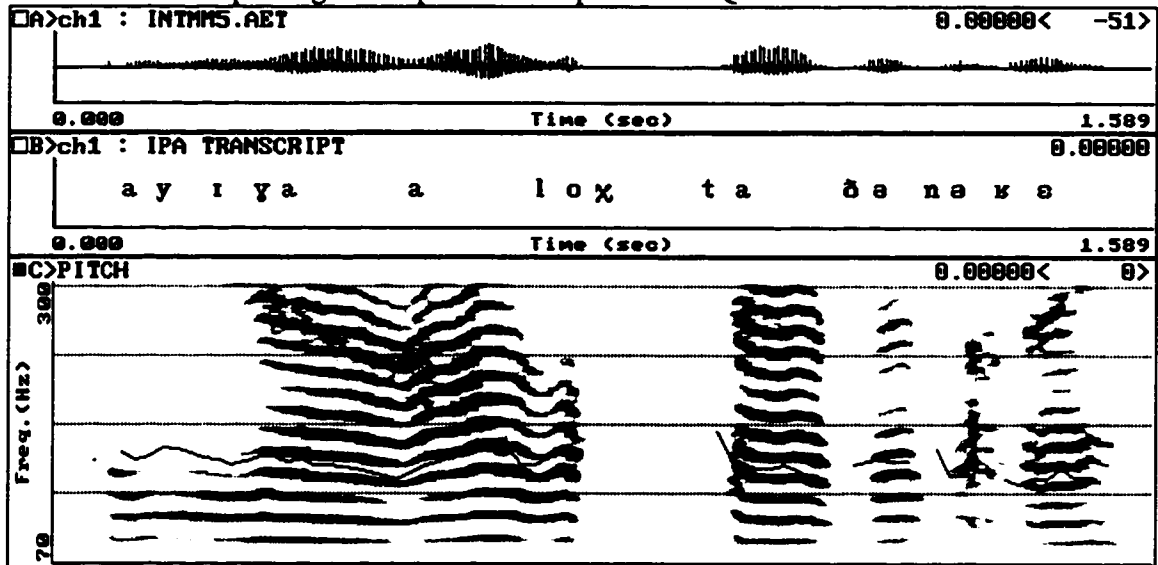
ayaga- ada- n aalu- χta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp



## MM5

Ayagaadan aaluftaadanat, ii? *Did the girls laugh?*  
 girls they laughed eh

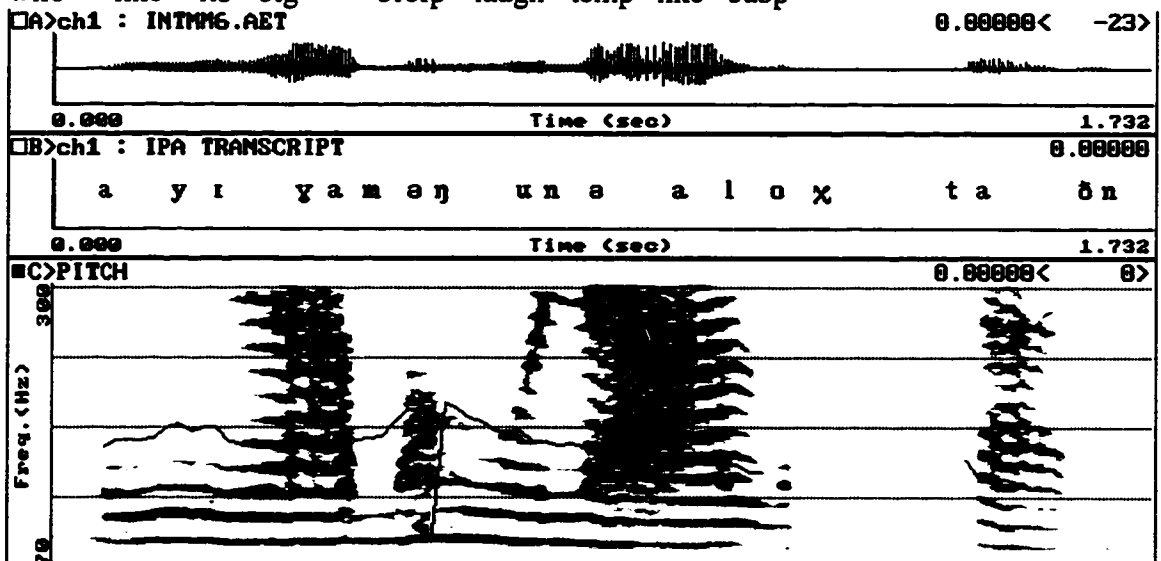
ayaga- ada- n aalu- xta- ada- na- x ii  
 wife like 3abp laugh temp like rmt pst 3abs Q



## MM6

Ayagaadam angunangin aaluftaadan. *The big girls laughed.*  
 girls big ones they laughed

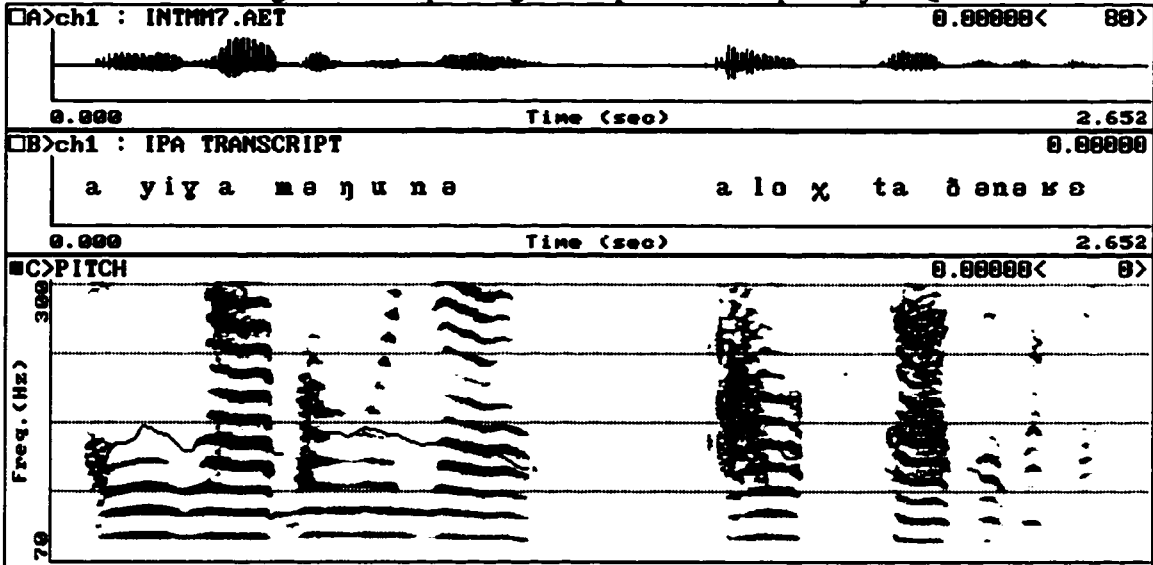
ayaga- ada- m anguna- ngin aalu- xta- ada- n  
 wife like rls big 3refp laugh temp like 3abp



MM7

Ayagaadam angunangin aaluftaanalix, ii. *Did the big girls laugh?*  
 girls big ones did they laugh eh

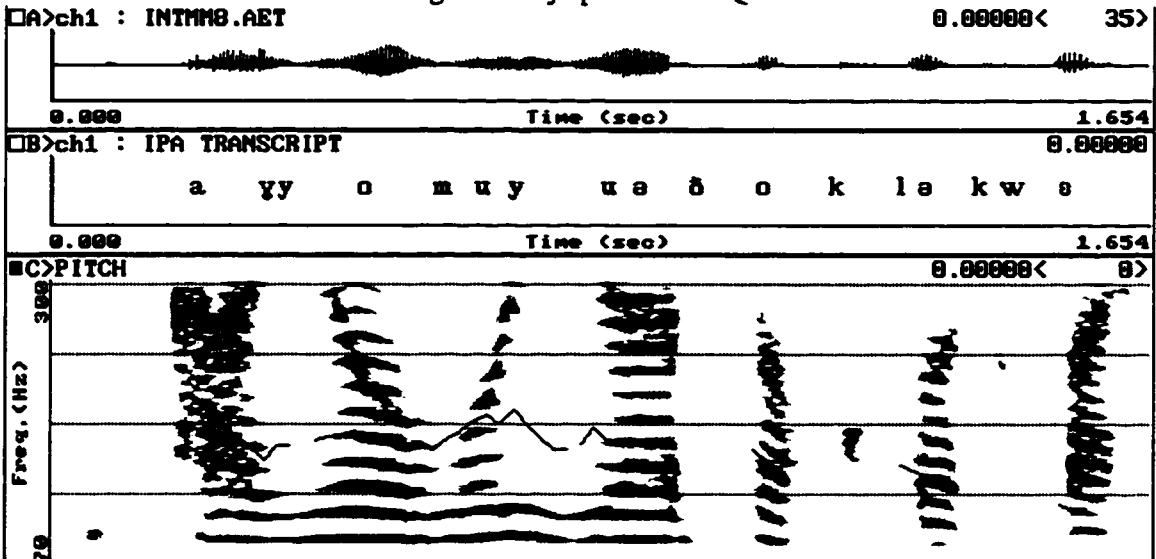
ayaga- ada- m anguna- ngin aalu- xta- ada- na- lix ii  
 wife ike rls big 3refp laugh temp like rmt pst cnj Q



MM8

Aagyuuŋim uyuu aduqlakuŋ, ii. *Cormorants' necks are long.*  
 cormorant's its neck it is long eh

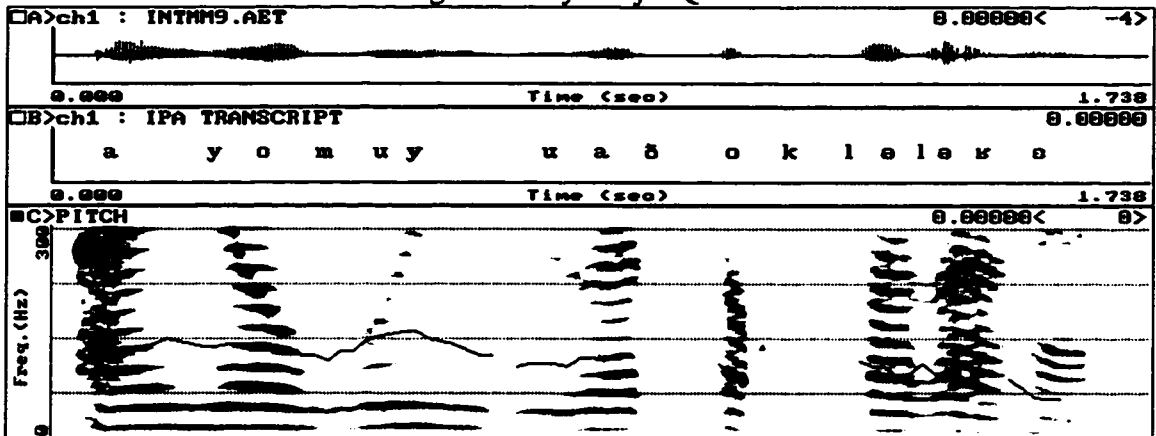
aagyuuŋi- m uy- u adu- qla- ku- x ii  
 cormorant rl neck 3refs long clumsy prs 3abs Q



## MM9

Aagyuugiim uyuu aduqlalix, ii. *Are cormorants' necks long?*  
 cormorant's its neck is it long eh

aagyuugi- m uy- u adu- qla- lix ii  
 cormorant rls neck 3refs long clumsy cnj Q



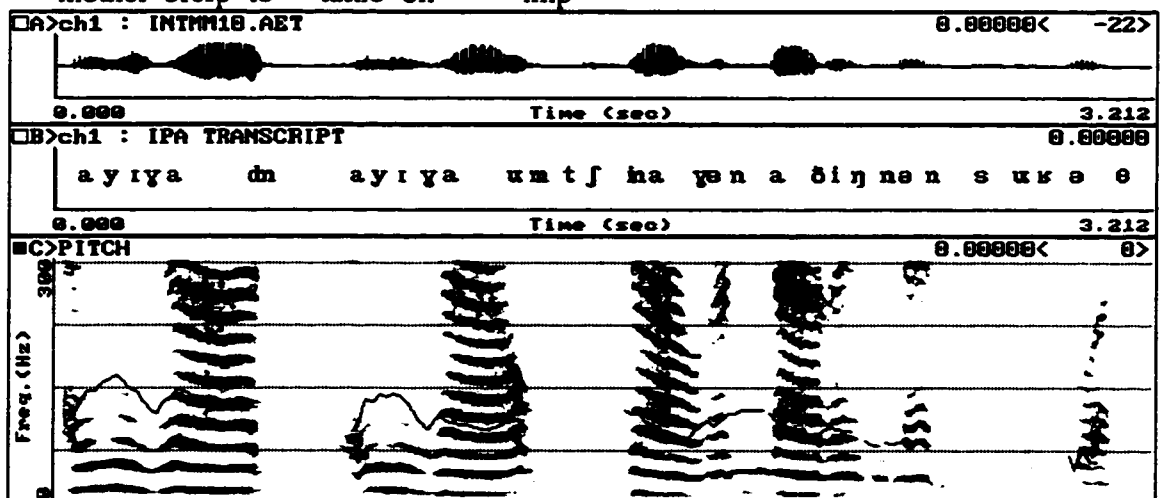
## MM10

Ayagaadan, (ayagaa) umchunaaguun, *If they try to kiss girls, —*  
 girls girls if they try to kiss

anaadanginaan sugaasada. *tell their mothers.*  
 their fathers to tattle on them

ayaga- ada- n (ayaga- a) umchu- naag- uun  
 girl like 3abp wife 3refs kiss try cnd

anaad- a- ngi- naan sugaas- ada  
 mother 3refp to tattle on imp

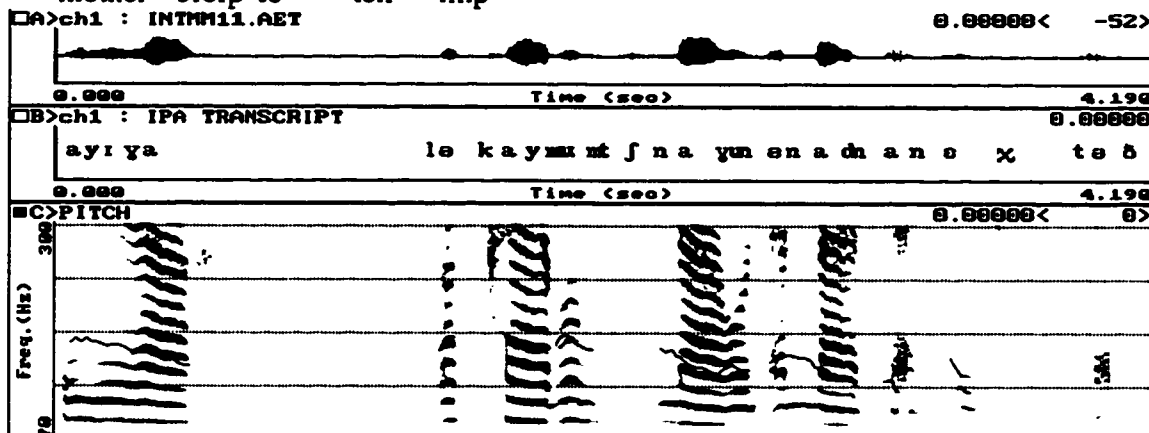


MM11

Ayagaadan lakaayam umchunaagungin, *If boys try to kiss, —*  
 girls boys they try to kiss them  
 anaadanginaan itada. *girls tell their mothers*  
 to their mothers tell

ayaga- ada- n lakaaya- m umchu- naagu- ngin  
 wife like 3refs boy rl kiss try to 3refp

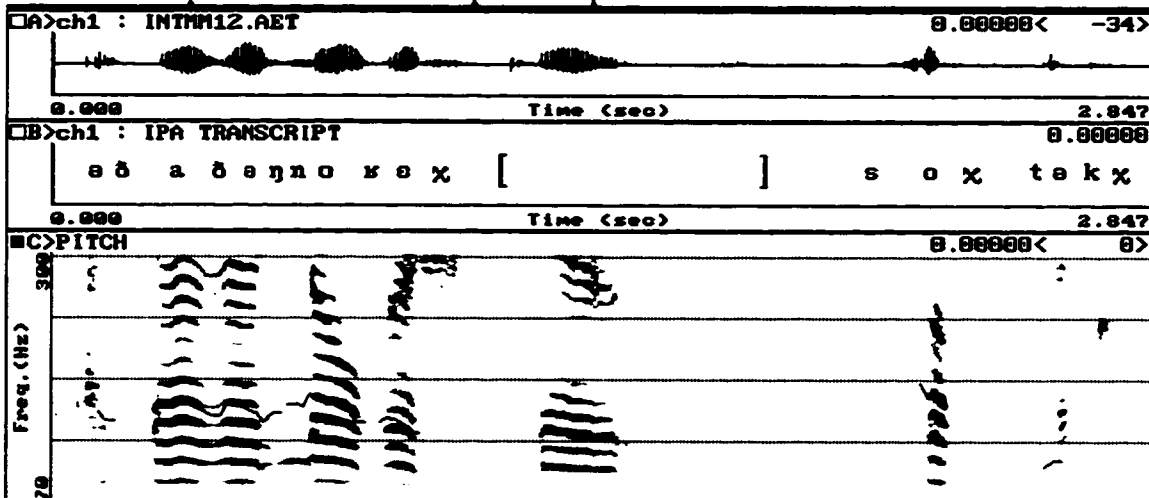
anaada- ngi- naan ixta- da  
 mother 3refp to tell imp



MM12

Adaadangin nuɣiɣ suɣtakun. *Their fathers carried rock.*  
 their fathers rock they held

adaada- ngin nuɣi- ɣ suɣta- ku- n  
 father 3refp rock 3abs hold prs 3abp



MM13

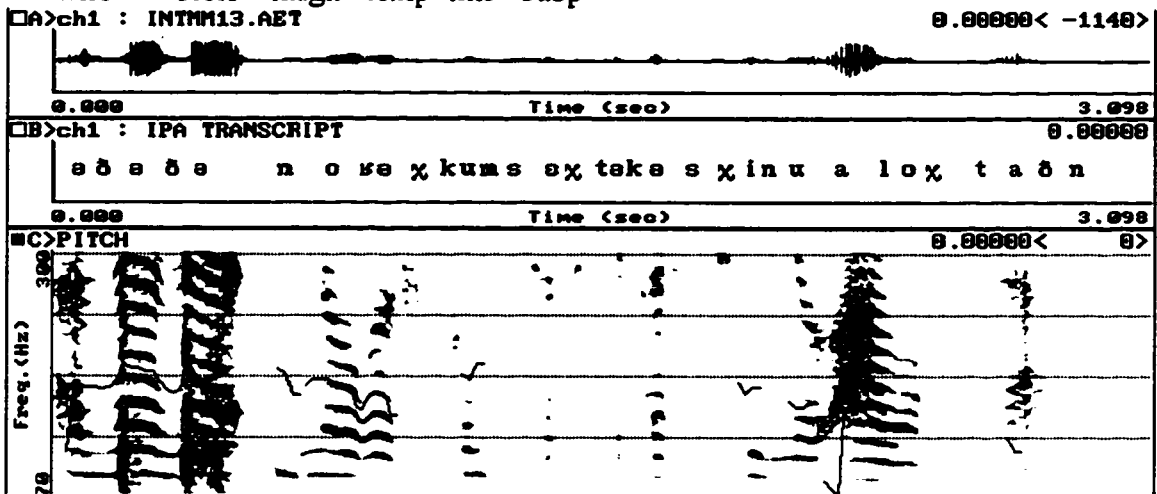
Adaadangin nuḡit kumsittakun,  
fathers rock they carried

*When their fathers carried rocks, —*

asxinungin aaluftaadan.  
girls they laughed

*the girls laughed.*

adaada- ngin nuḡi- x kumsitta- ku- n  
father 3abp rock 3abs lift up prs 3abp  
asxinu- ngin aalu- xta- ada- n  
wife 3refs laugh temp like 3abp

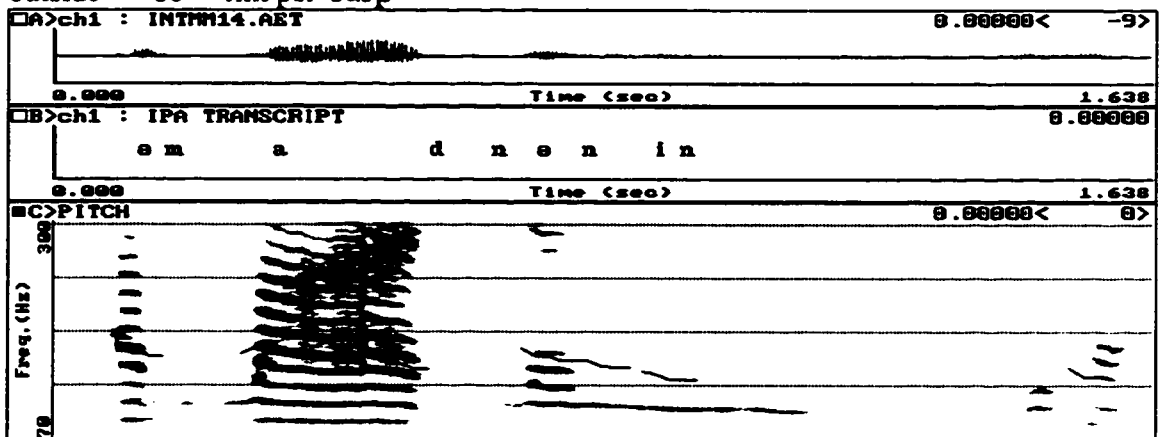


MM14

Amaadan anan.  
out there we were

*We were out there (camping)*

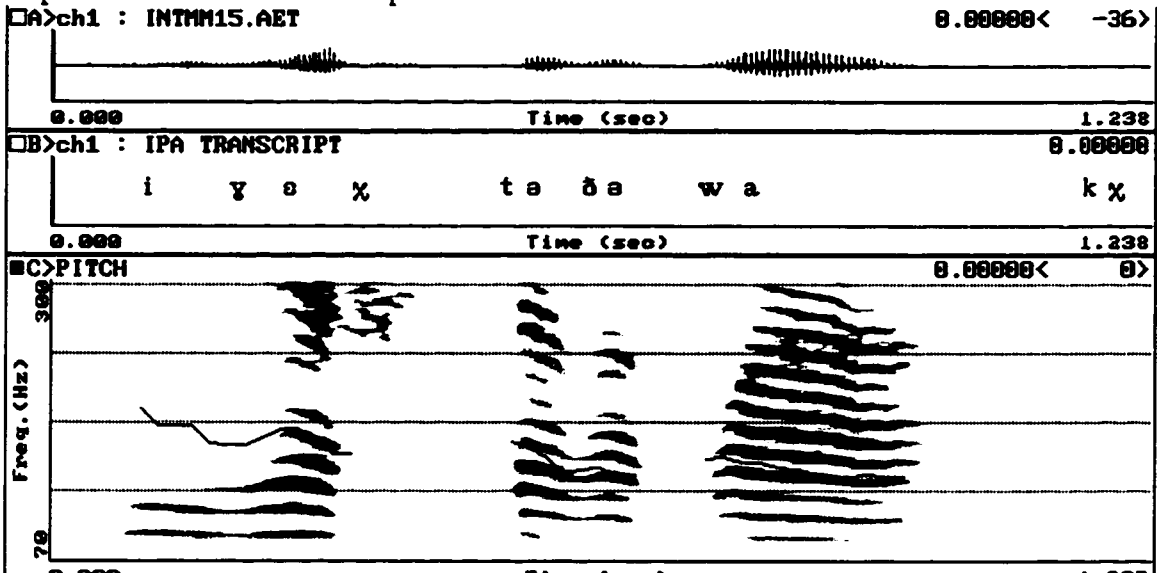
amaadan a- na- n  
outside be rmt pst 3abp



MM15

Igaɬtadaɬ waagaɬakɬ. *The airplane came.*  
 airplane it came here

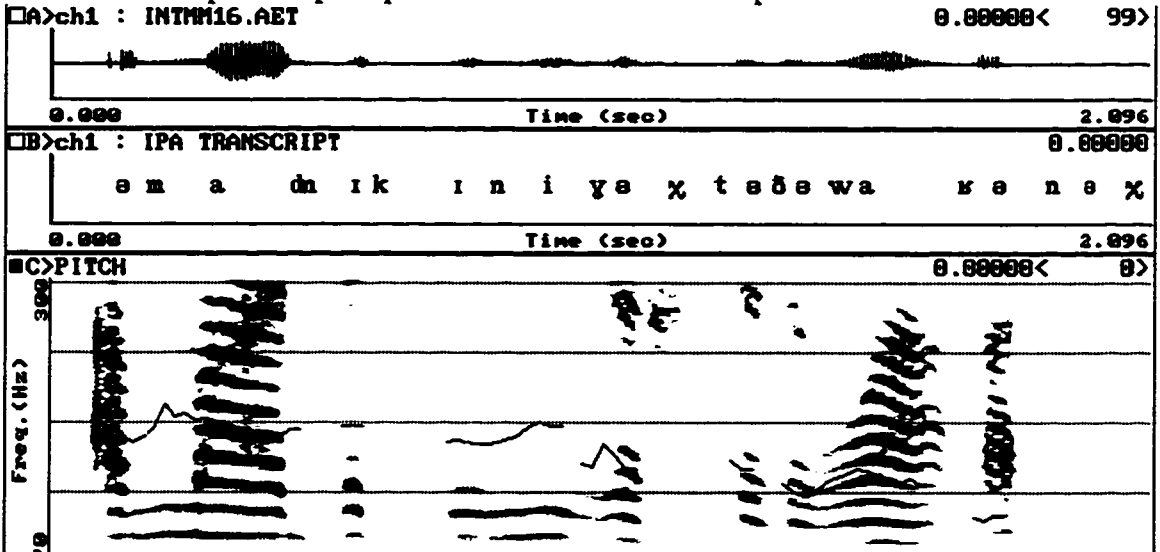
igaɬtada- ɬ waaga- ku- ɬ  
 airplane 3abs come here prs 3abs



MM16

Amaadan akun, igaxtadaɬ waaganax. *When we were out there, —*  
 outside we were airplane it came *the airplane came.*

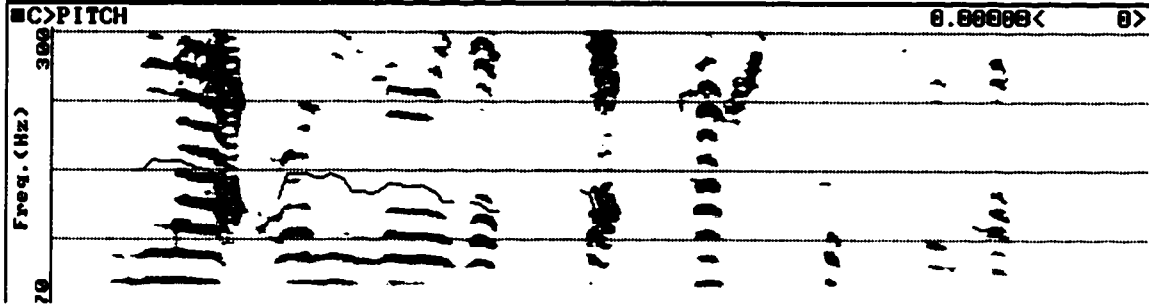
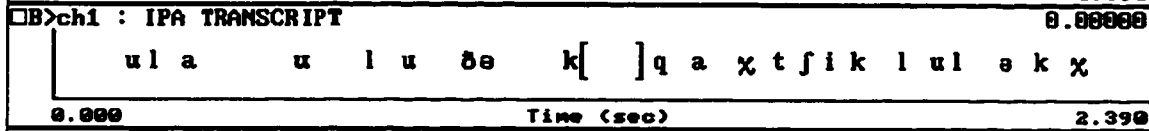
amaadan a- ku- n igaxtada- ɬ waaga- na- ɬ  
 outside be prs 3abp airplane 3abs come here rmt pst 3abs



MM17

Ulaχ uluudakuχ, qaχchiklulakaχ. *Their house is red, it isn't black.*  
 house it is red it is not black

ula- χ uluuda- la- ku- χ qaχchiklu- laka- χ  
 house 3abs red neg prs 3abs black neg 3abs

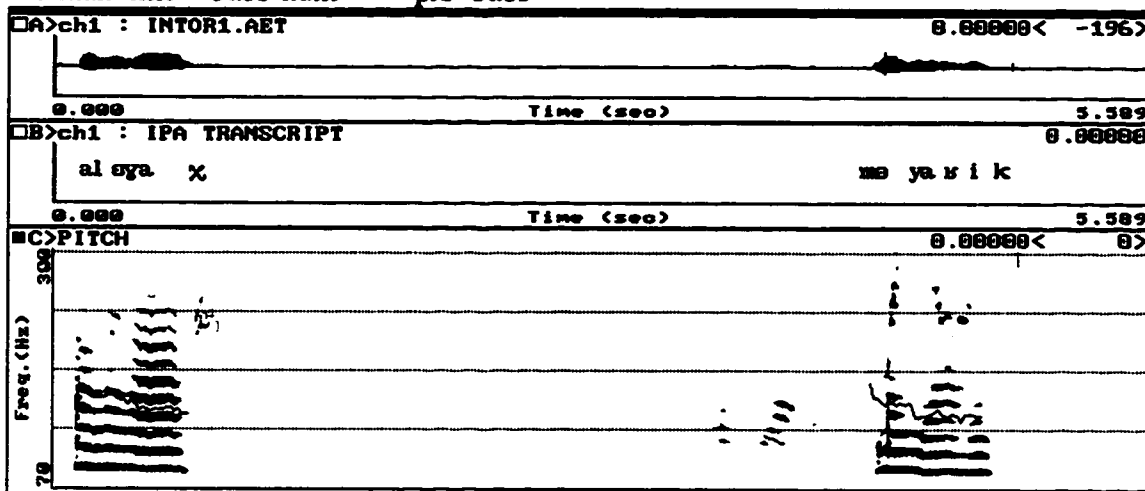


Olga Rukovishnikoff

OR1

Aliḡaadax mayaagikuḡ. *Old men hunted.*

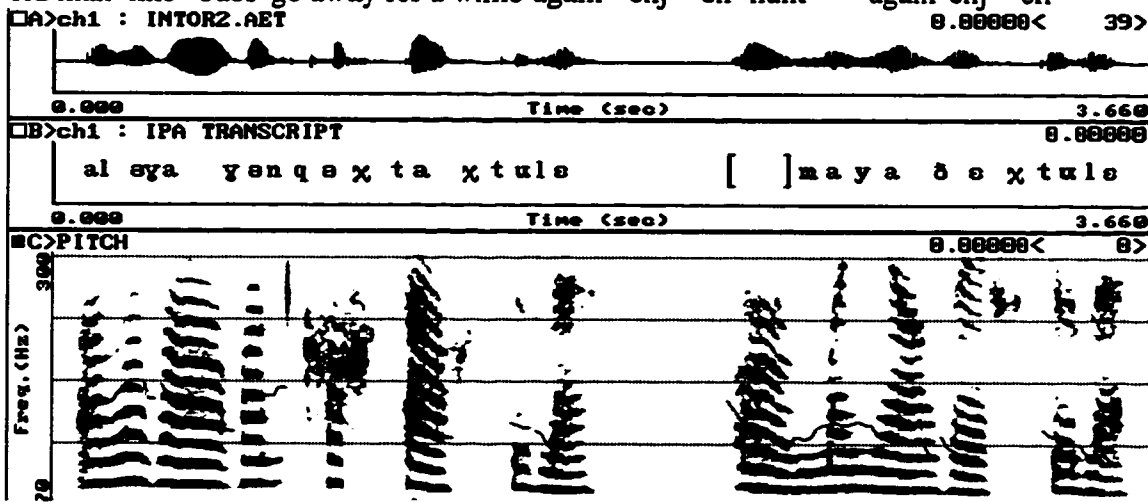
old man he hunted

aliḡa- ada- ḡ mayaag- ku- ḡ  
old man like 3abs hunt prs 3abs

OR2

Aliḡaadax anqaxtaaxtulix, ii; mayaagittulix, ii. *Did old men hunt?*

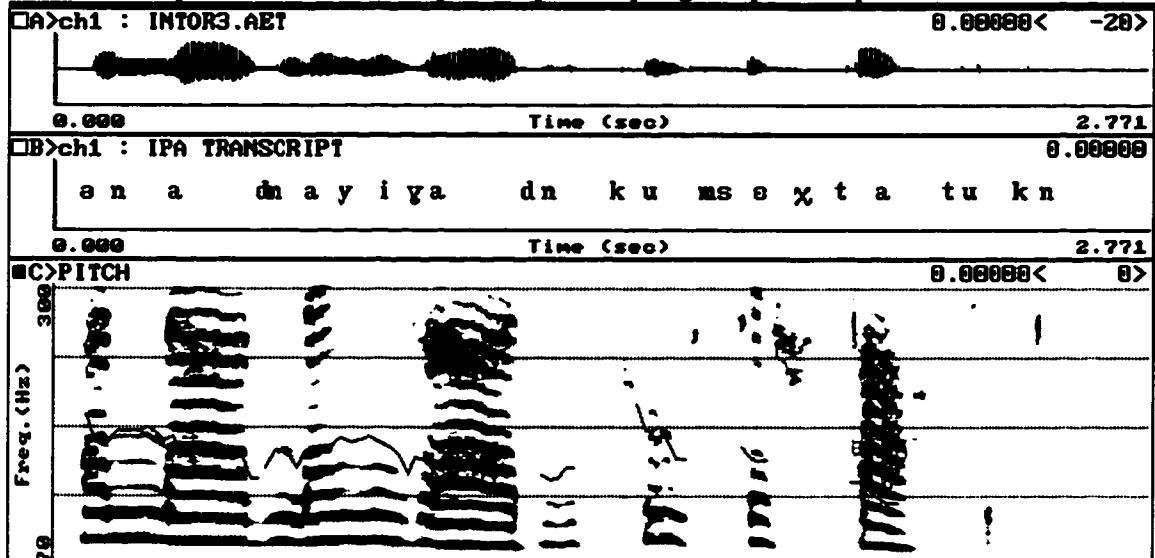
old man did he go away for a while eh did he hunt eh

aliḡa- ada- ḡ anqaxta- axtu- lix ii mayaag- ixtu- lix ii.  
old man like 3abs go away for a while again cnj eh hunt again cnj eh

## OR3

Anaadan ayagaadan kumsittaastukun. *The mothers carried the girls.*  
 mothers girls they carried

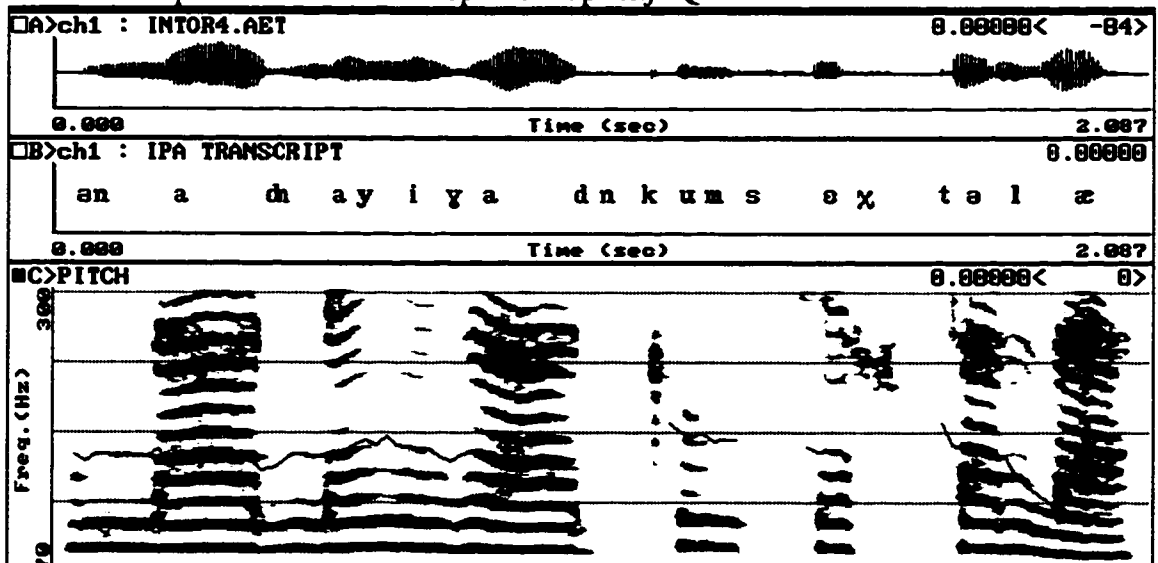
anaada- n ayaga- ada- n kumsi- xta- astu- ku- n  
 mother 3abp wife like 3abp lift up temp again prs 3abp



## OR4

Anaadan ayagaadan kumsittalix, ii? *Did the mothers carry the girls?*  
 mother girls did they carry eh

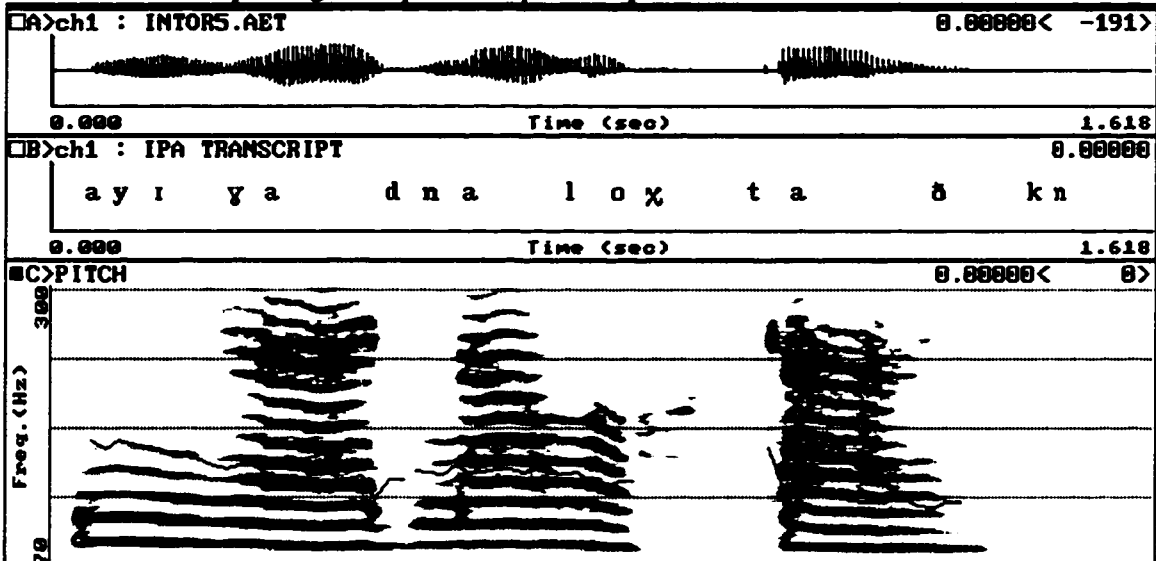
anaada- n ayaga- ada- n kumsi- xta- lix ii  
 mother 3abp wife like 3abp lift up cnj Q



OR5

Ayagaadan aaluftaadakun. *The girls laughed.*  
 girls they laughed

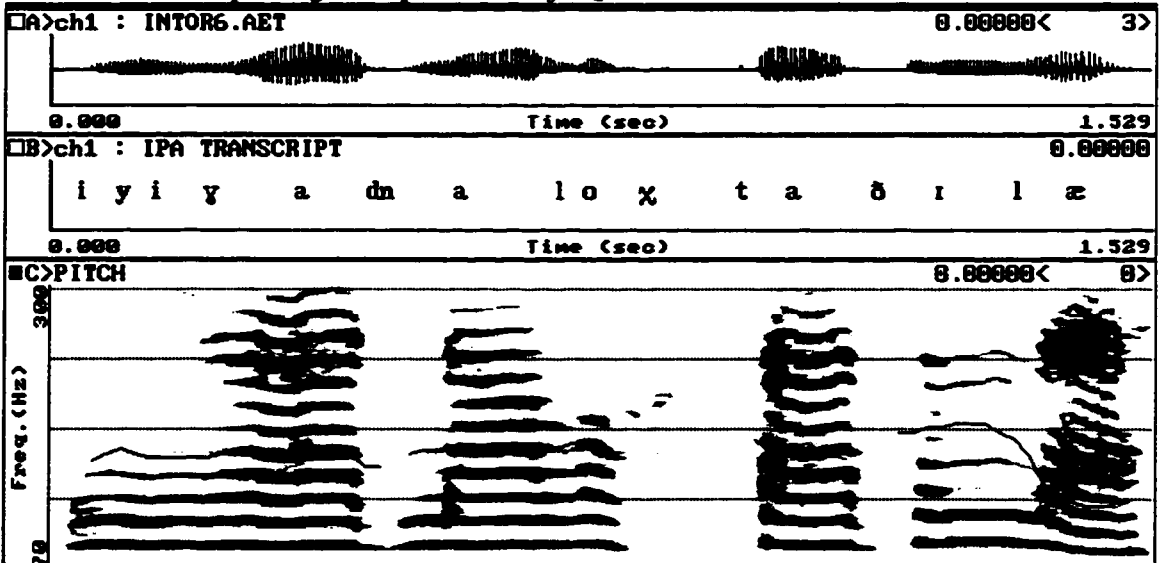
ayaga- ada- n aalu- xta- ada- ku- n  
 wife like 3abp laugh temp like prs 3abp



OR6

Ayagaadan aaluftaadax, ii? *Did the girls laugh?*  
 girls did they laugh eh

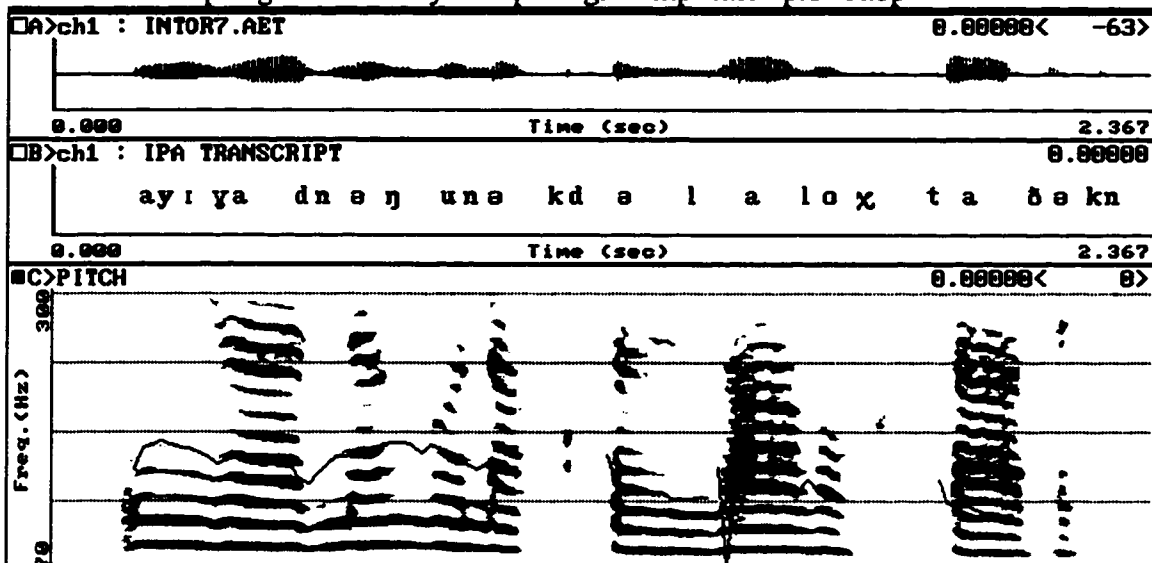
ayaga- ada- n aalu- xta- ada- lix- ii  
 wife like 3abp laugh temp like cnj Q



OR7

Ayagaadan angunaqlungin saluktaadakun. *The big girls laughed.*  
 girls big ones they laughed

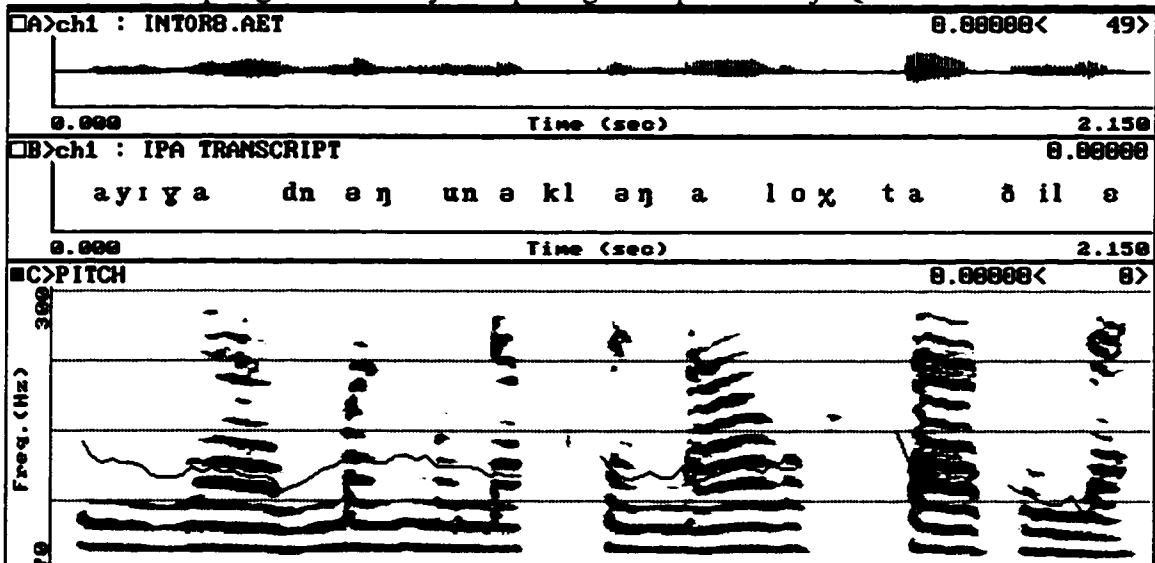
ayaga- ada- n anguna- qlu- ngin aalu- xta- ada- ku- n  
 wife like rlp big clumsy 3refp laugh temp like prs 3abp



OR8

Ayagaadan angunaqlungin saluktaadaftulix, ii. *Did the big girls laugh?*  
 girls big ones did they laugh again eh

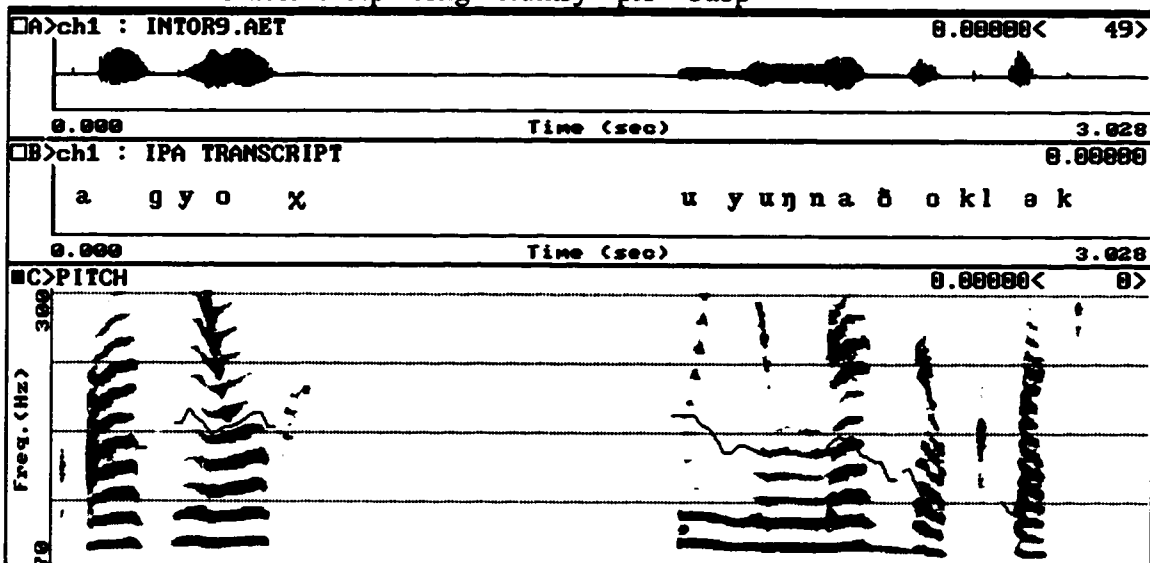
ayaga- ada- n anguna- qlu- ngin aalu- xta- ada- lix ii  
 wife like rlp big clumsy 3refp laugh temp like cnj Q



## OR9

Aagyuuḡiṯ uyungin aduqlakun. *Cormorants' necks are long.*  
 cormorants their necks they are long

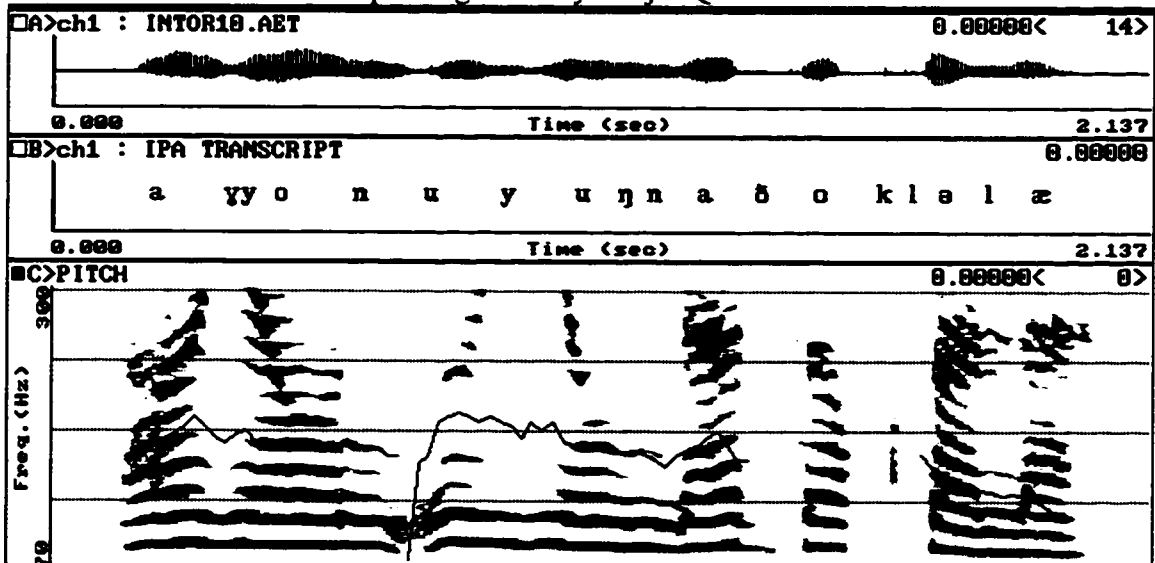
aagyuuḡi- ṯ uyu- ngin adu- qla- ku- n  
 cormorant 3abs neck 3refp long clumsy prs 3abp



## OR10

Aagyuuḡin uyungin aduqlalix, ii. *Are cormorants' necks long?*  
 cormorants their necks are they long eh

aagyuuḡi- ṯ uyu- ngin adu- qla- lix ii  
 cormorant 3abs neck 3refp long clumsy cnj Q





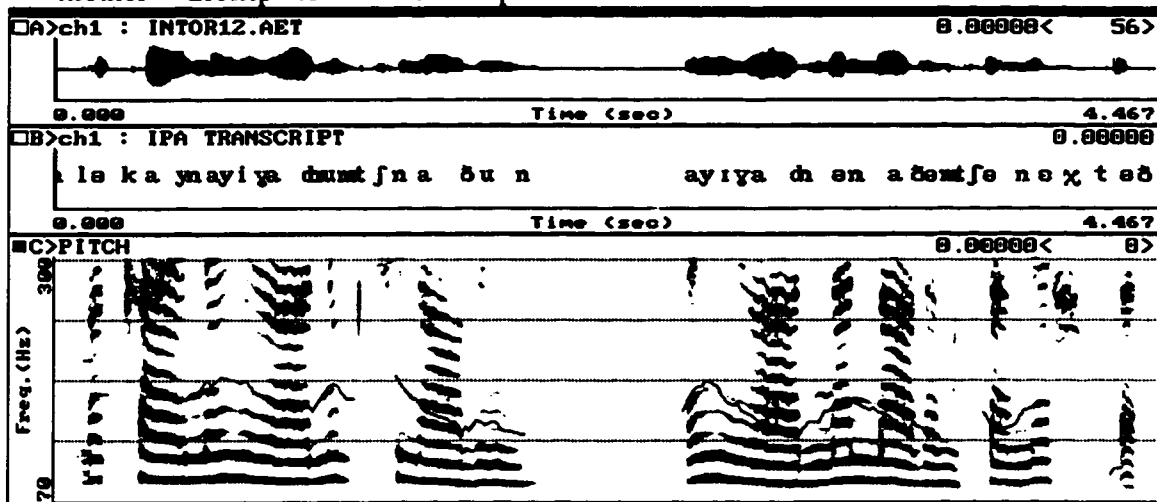
OR12

Lakaayan ayagaadan umchunaagidungin, *If boys try to kiss, —*  
 boys girls they try to kiss them

ayagaadan anaadamchinaan ittada. *girls tell your mothers*  
 girls to their mothers tell

lakaaya- n ayaga- ada- n umchi- naagi- du- ngin  
 boy 3abp wife like 3abp kiss try fast 3refp

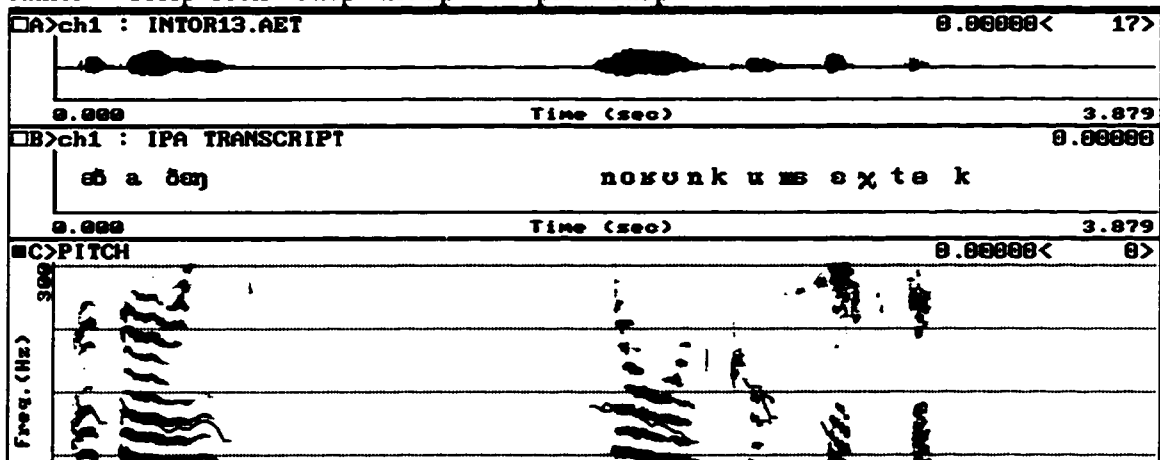
anaada- mchi- naan ihta- da  
 mother 2refrp to tell imp



OR13

Adaadangin nuġin kumsittakun. *Their fathers carried rock.*  
 their fathers rocks they carried

adaada- ngin nuġi- n kumsitta- ku- n  
 father 3refp rock 3abp lift up prs 3abp



OR14

Adaadangin nuḡin kumsittakun,  
fathers rocks they carried

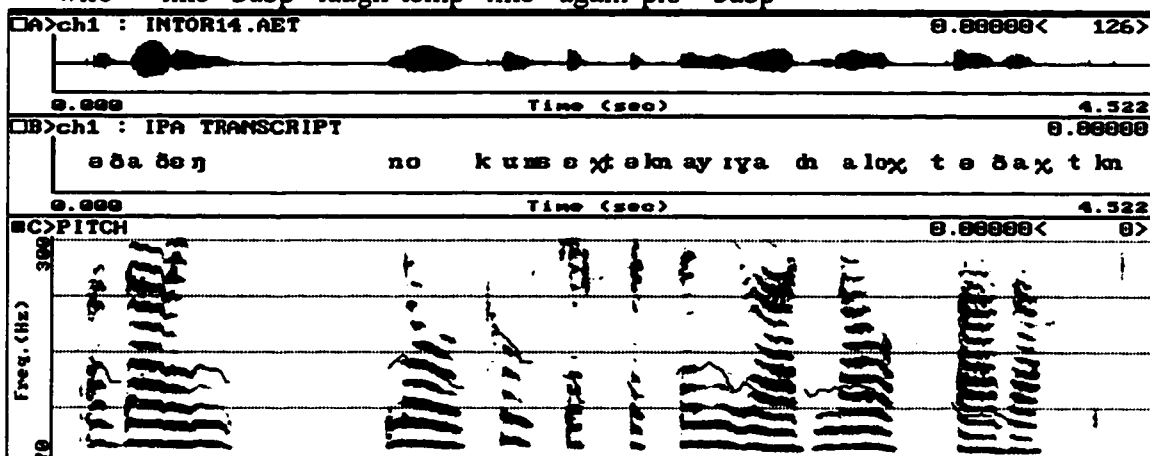
*When their fathers carried rocks, —*

ayagaadan aaluṭtaadaṭtakun.  
girls they laughed

*the girls laughed.*

adaada- ngin nuḡi- n kumsiṭta- ku- n  
father 3refp rock 3abp lift up prs 3abp

ayaga- ada- n aalu- ṭta- ada- aṭta- ku- n  
wife like 3abp laugh temp like again prs 3abp

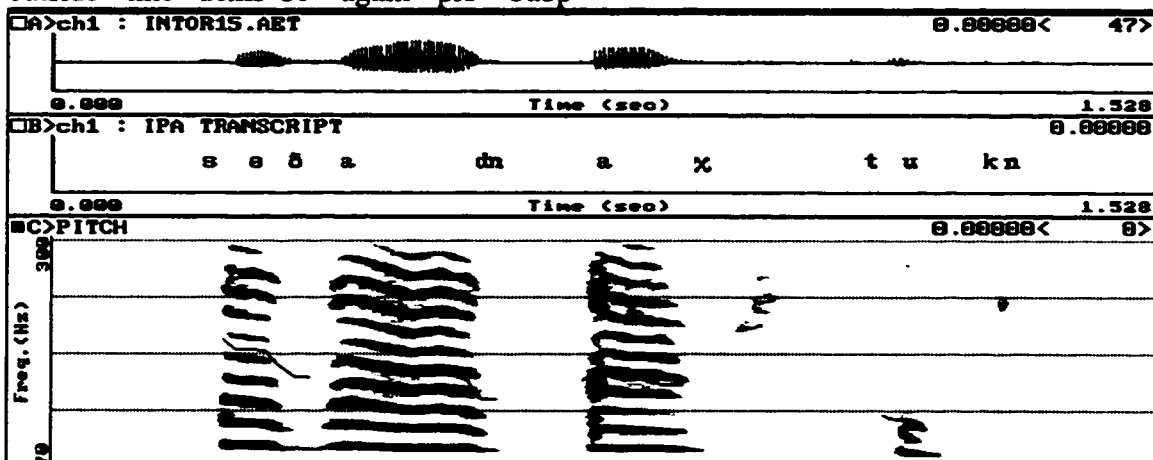


OR15

Sadaadan aṭtukun.  
outside we were

*We were out there (camping)*

sada- ada- n a- aṭtu- ku- n  
outside like dems be again prs 3abp

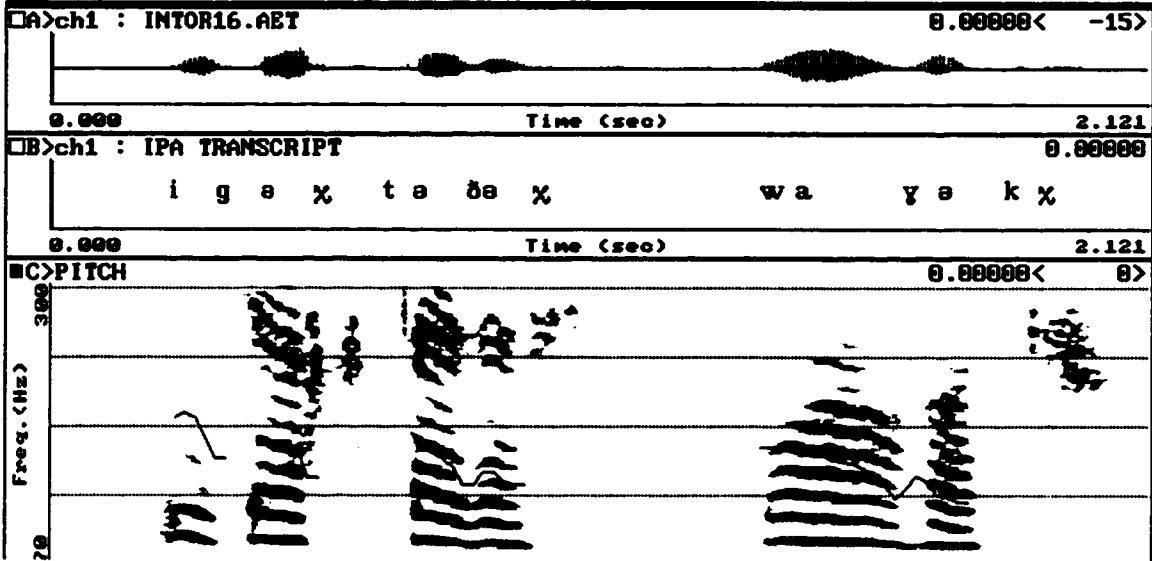


OR16

Igattadaŋ waagaŋakuf.  
airplane it came here

*The airplane came.*

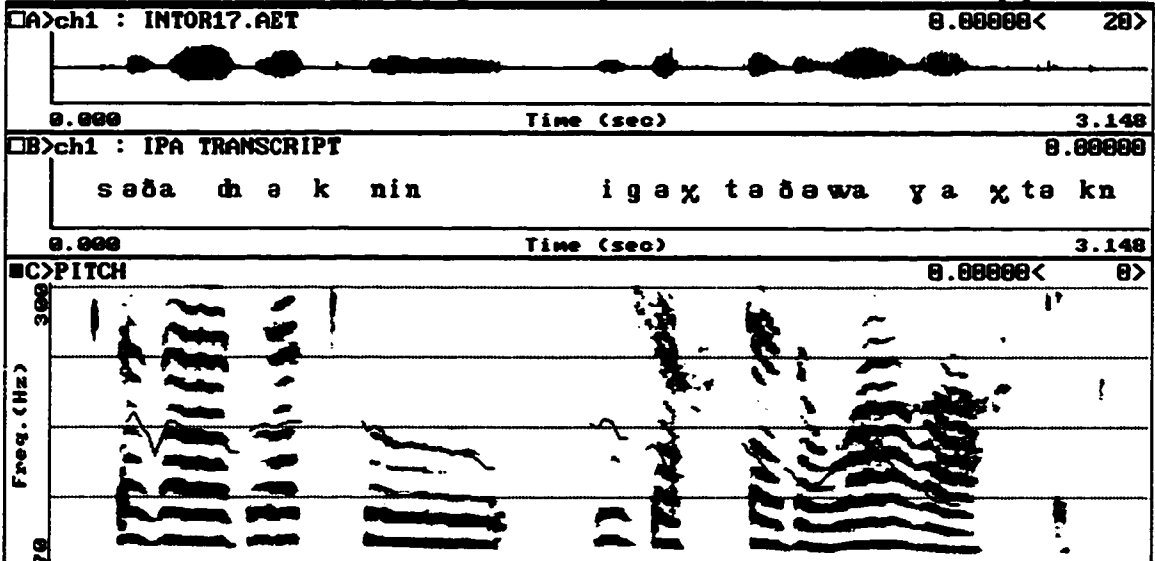
igaŋtada-ŋ waaga- ku-ŋ  
airplane 3abs come here prs 3abs



OR17

Sadaadan akuniin, igaŋtadaŋ waagaŋtakuf.      *When we were out there, —*  
outside we were for airplane it came      *the airplane came.*

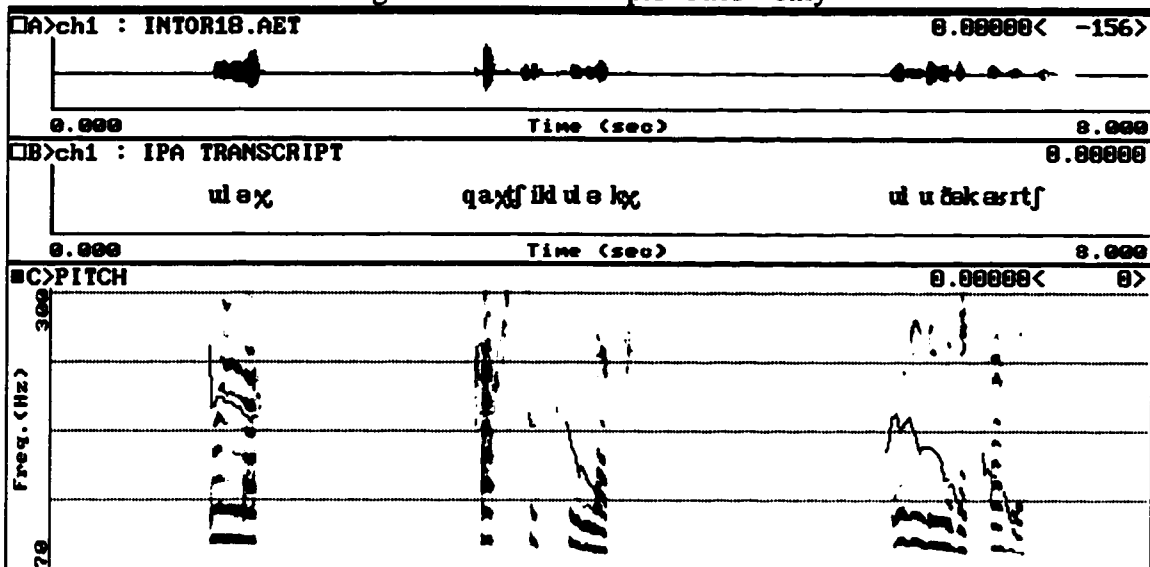
sada- ada- n    a- ku- n- iin igaŋtada-ŋ    waaga- ŋta- ku- ŋ  
outside like dems be prs 3abp for airplane 3abs come here temp prs 3abs



OR18

Ulaʔ qaʔchiklulakaʔ, uluudakux agach. *Their house isn't black, it's red.*  
 house it is not black it is red only

ula- ʔ qaʔchiklu- laka- ʔ, uluuda- ku- ʔ agach  
 house 3abs black neg 3abs red prs 3abs only



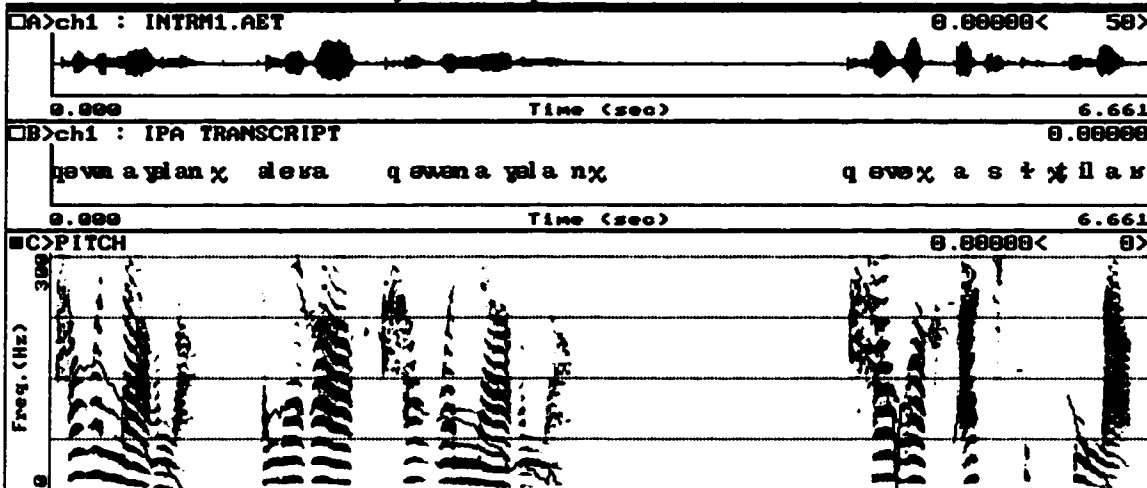
Rufina Mercurief

RM1

**Aliḡaadax qawanaaḡilaaḡanaḡ.** *Old men hunted sealions.*

old man he tried for sealions

aliḡa- ada- ḡ qawa- naaḡi- laaḡana- ḡ  
 old man like 3abs sealion try to rcnt pst 3abs

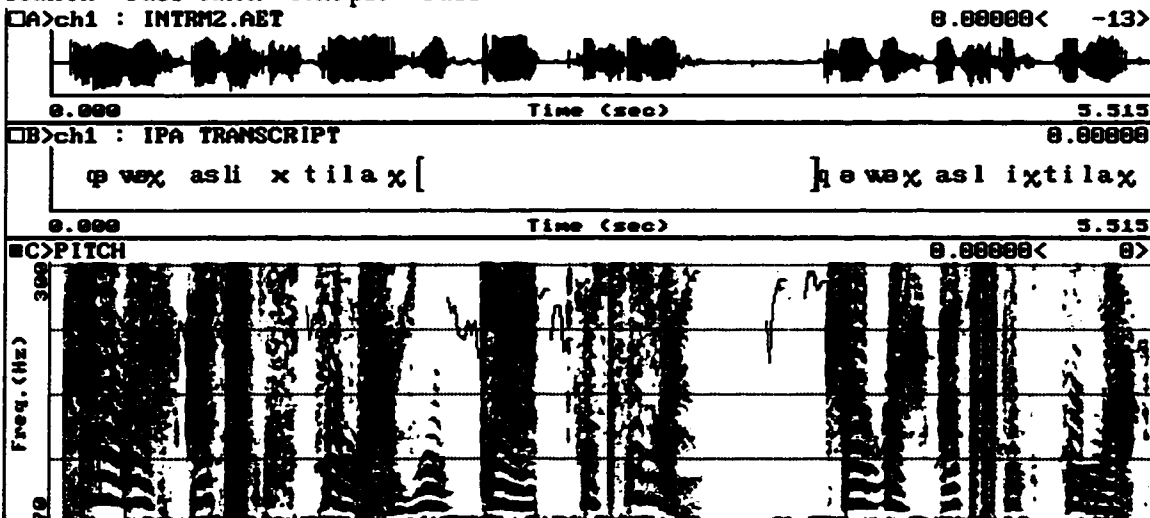


RM2

**Qawaḡ asliḡtlaaḡanaḡ.** *He caught the sealion.*

sealion he caught

qawa- ḡ asliḡt- laaḡana- ḡ  
 sealion 3abs catch rcnt pst 3abs

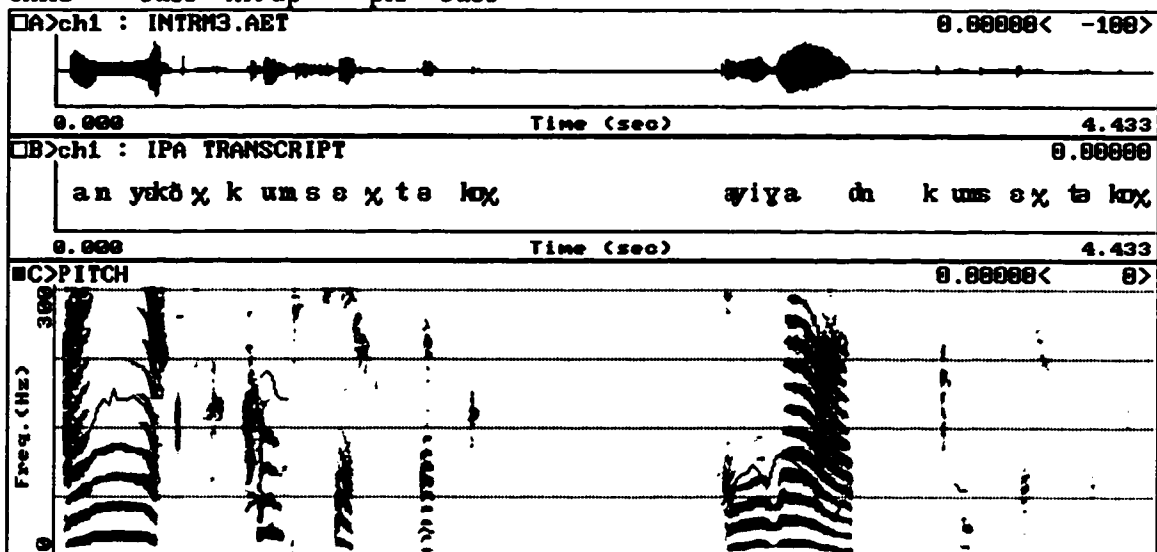


## RM3

Aniqdut kumsixtakuf.  
daughter she carried

*The mothers carried the girls.*

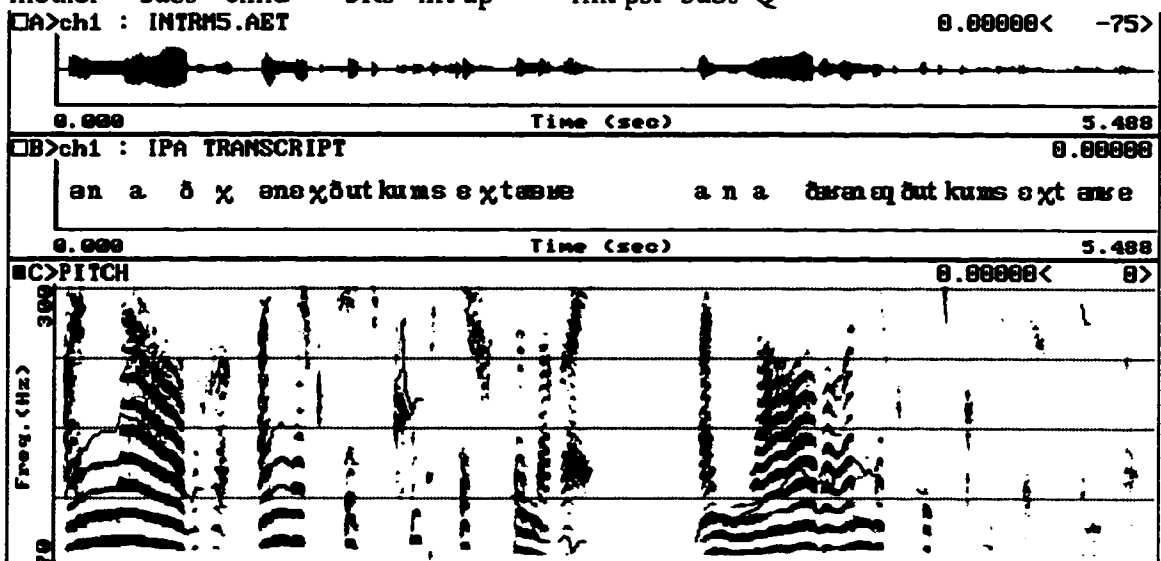
aniqdu- ʔ kumsixta- ku- ʔ  
child 3abs lift up prs 3abs



## RM5

Anaadax aniqdutexin kumsixtanax, ii? *Did the mothers carry the girls?*  
mother daughters did she carry eh

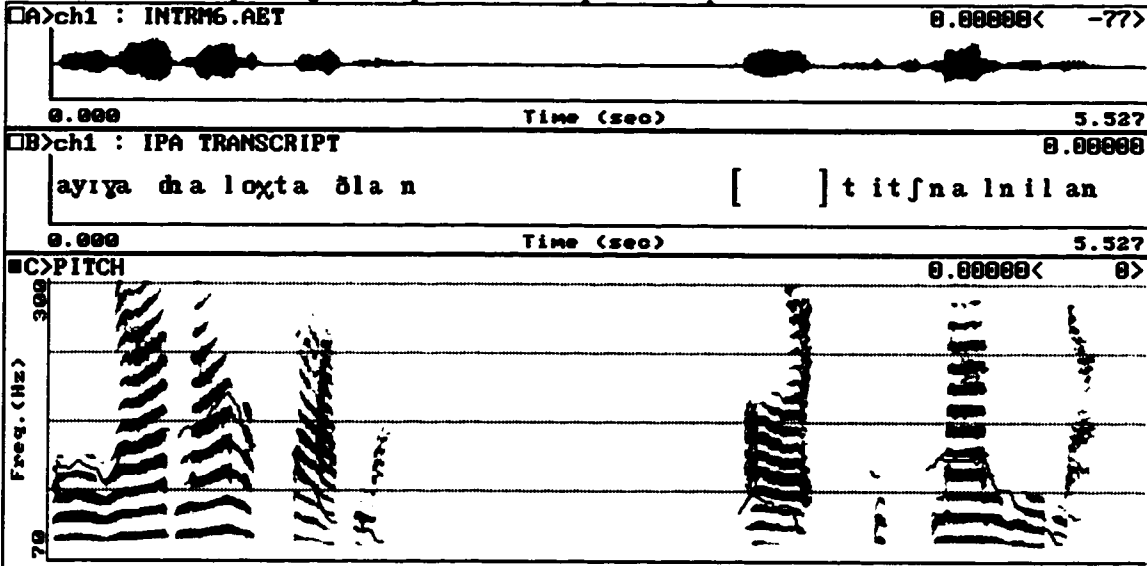
anaada- ʔ aniqdu- txin kumsixta- na- ʔ ii  
mother 3abs child 3Rs lift up rmt pst 3abs Q



RM6

Ayagaadan aalu<sup>ta</sup>ada<sup>la</sup>aga<sup>na</sup>n. *The girls laughed.*  
 girls they laughed

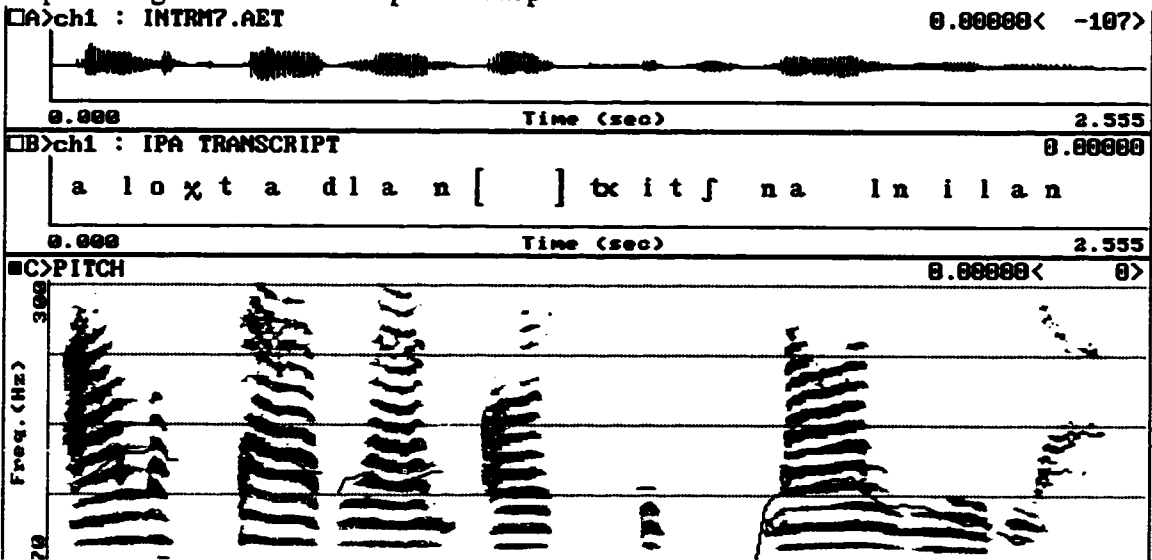
ayaga- ada- n aalu- <sup>ta</sup>- ada- laaga<sup>na</sup>- n  
 wife like 3abp laugh temp like rmt pst 3abp



RM7

Txichin aalunilaaga<sup>na</sup>n. *The girls laughed.*  
 themselves they laughed

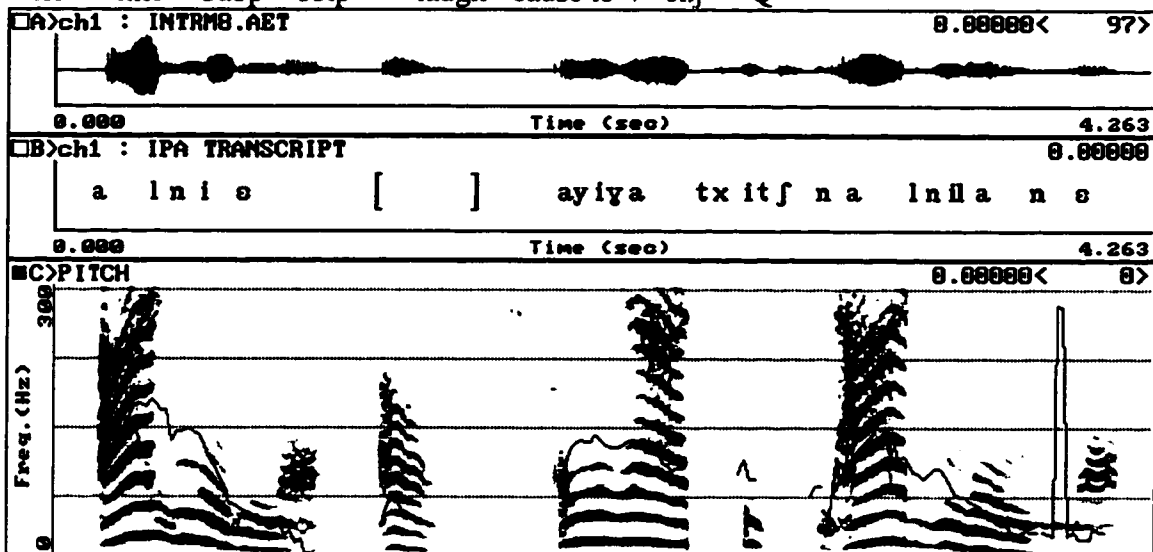
txichin aalu- ni- laaga<sup>na</sup>- n  
 3Rp laugh cause to V rmt pst 3abp



## RM8

Ayagaadan txichin aalunilix, ii? *Did the girls laugh?*  
 girls themselves did they make themselves laugh eh

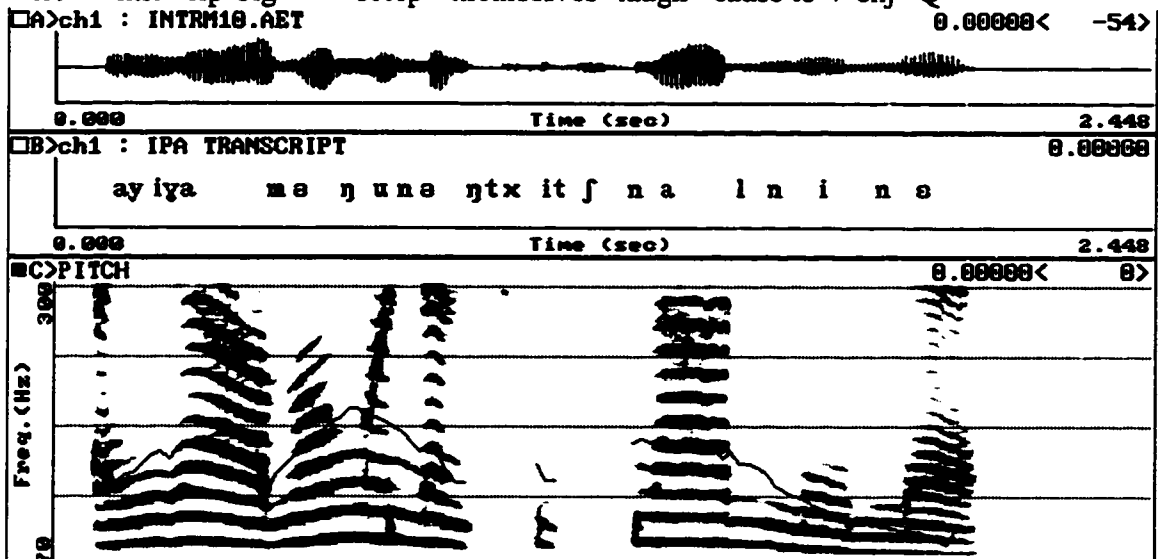
ayaga- ada- n txichin aalu- ni- lix ii  
 wife like 3abp 3Rp laugh cause to V cnj Q



## RM10

Ayagaadan angunangin txichin aalunilix, ii. *Did the big girls laugh?*  
 girls big ones themselves they made themselves laugh eh

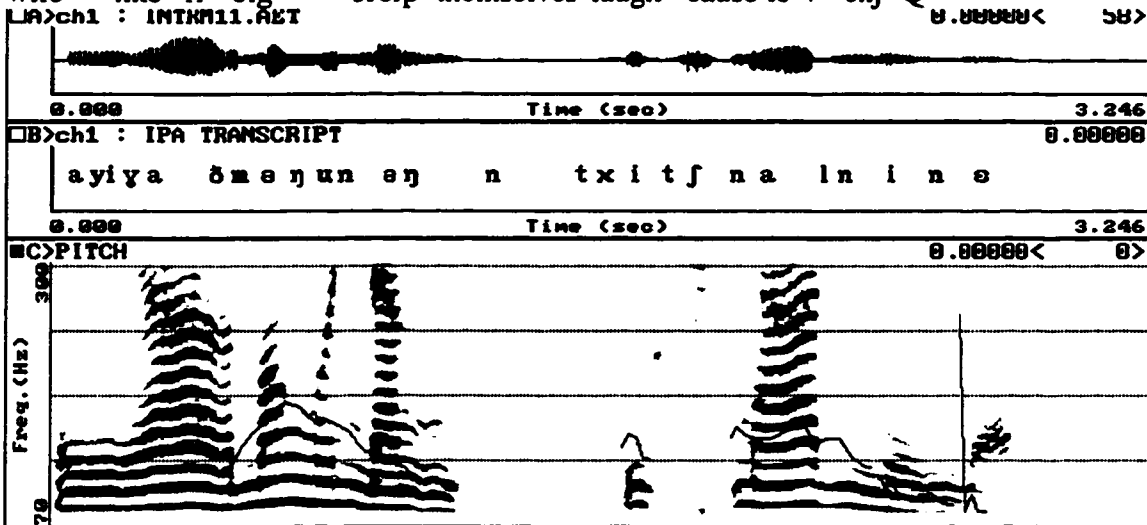
ayaga- ada- n anguna- ngin txichin aalu- ni- lix ii  
 wife like rlp big 3refp themselves laugh cause to V cnj Q



RM11

Ayagaadam angunangin txichin aalunilix, ii. *Did the big girls laugh?*  
 girls big ones themselves did they make themselves laugh eh

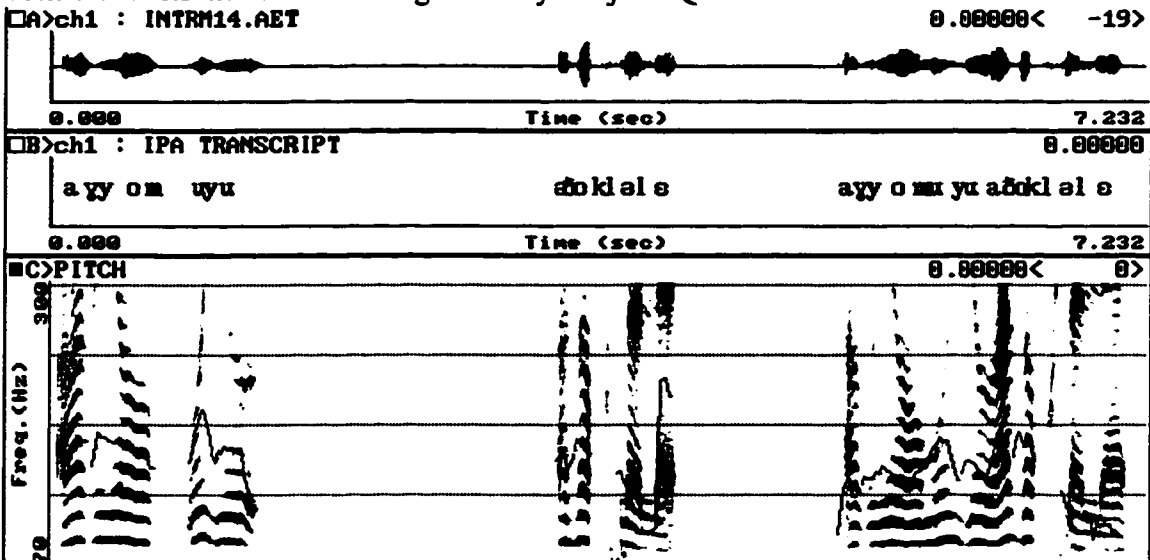
ayaga- ada- m anguna- ngin txichin aalu- ni- lix ii  
 wife like rl big 3refp themselves laugh cause to V cnj Q



RM14

Aagyugum uyuu aduqlalix, ii. *Are cormorants' necks long?*  
 cormorant's its neck is it long eh

aagyugu- m uyu- u adu- qla- lix ii  
 cormorant rls neck 3refs long clumsy cnj Q

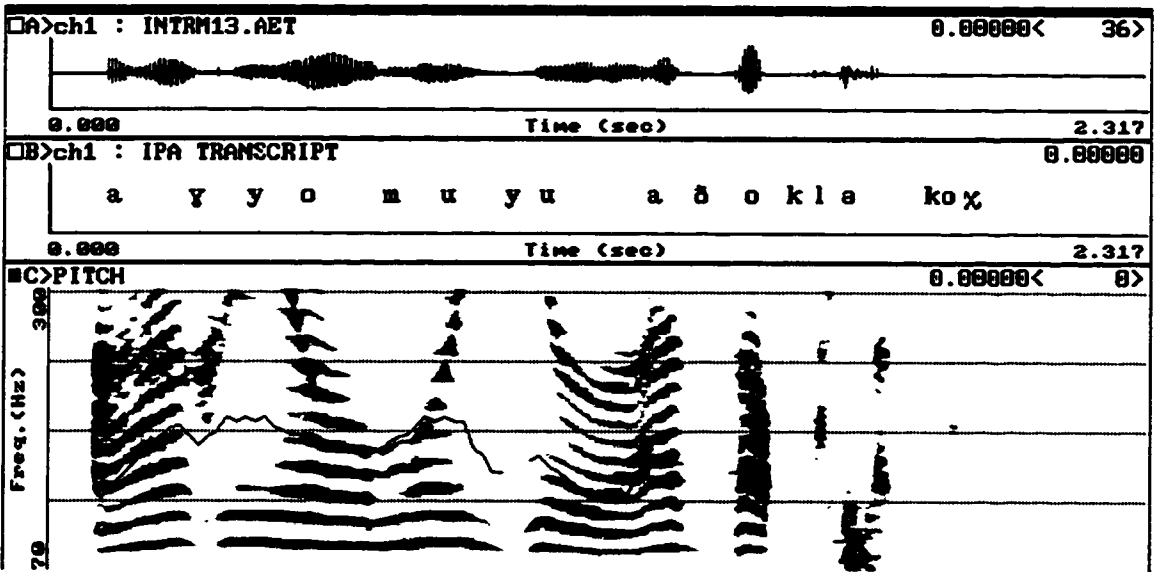
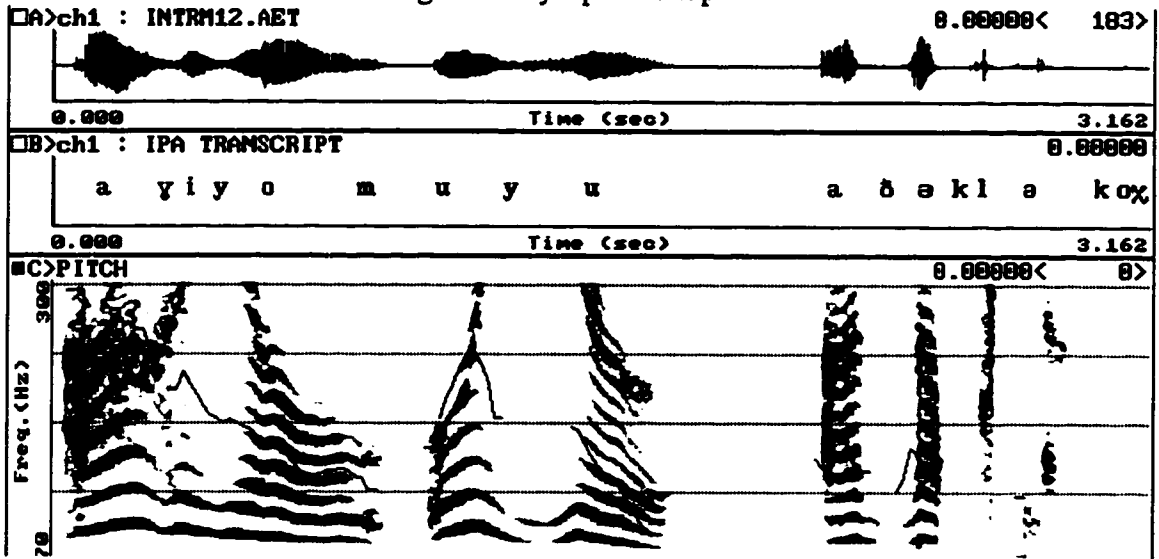


RM12, RM13

Aagyugum uyuu aduqlakut.  
 cormorant's its neck it is long

*Cormorants' necks are long.*

aagyugu- m uy- u adu- qla- ku- x  
 cormorant rls neck 3refs long clumsy prs 3abp



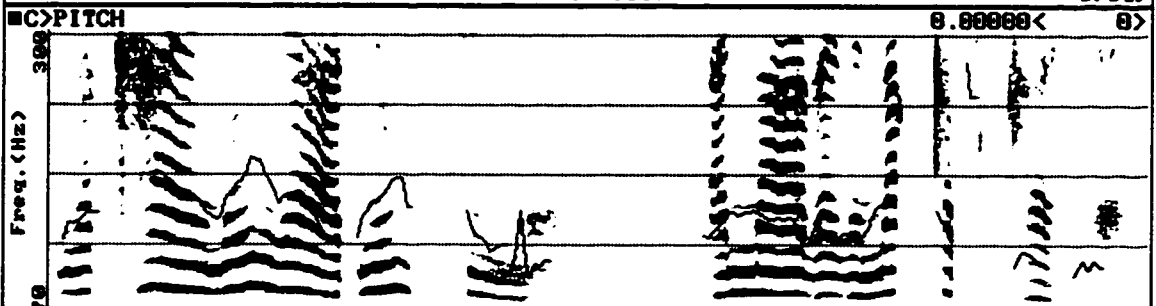
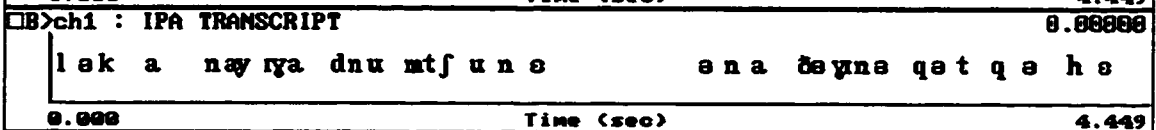
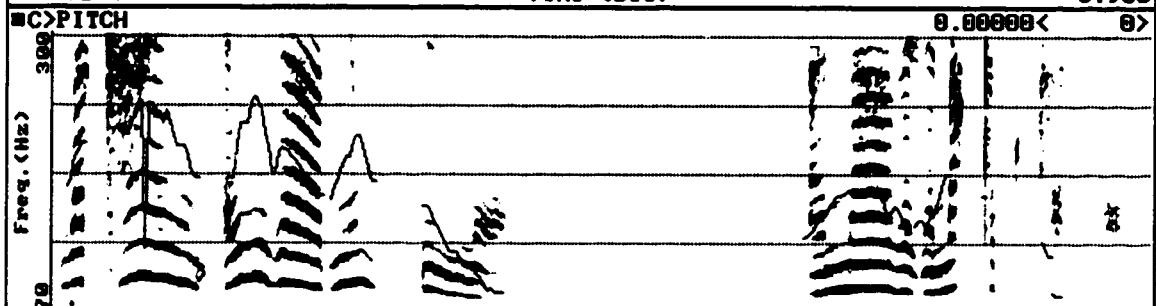
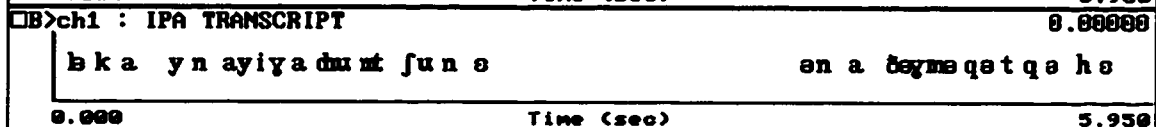
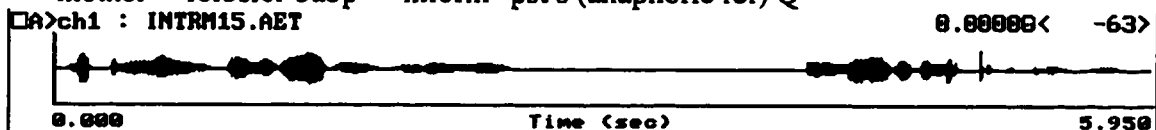
RM15, RM16

Lakaayan ayagaadan umchunaaqilix, ii, If boys try to kiss girls, —  
 boys girls they kiss eh

anaadagan aqataqaa, ii. tell their mothers.  
 their mothers inform them Q

lakaaya- n ayaga- ada- n umchu- naaqi- lix ii  
 boy 3abp wife like 3abp kiss try cnj Q

anaada- ga- n aqata- qaa ii  
 mother ref3srel 3abp inform pst s (anaphoric ref) Q



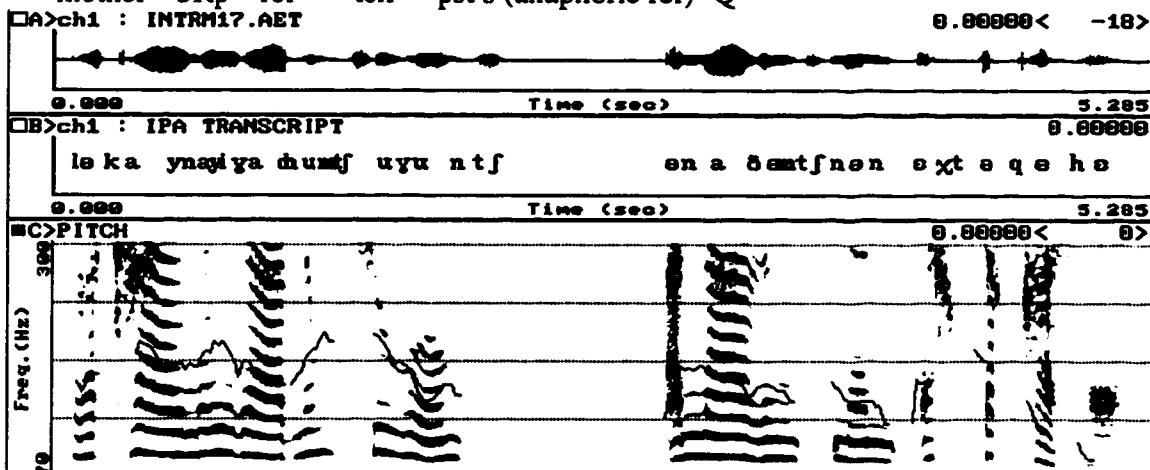
## RM17

**Lakaayan**    **ayagaadan**    **umchugumchin,**    *If boys try to kiss, —*  
 boys            girls            if they try to kiss them

**anaadamchin** **ngaan**                    **ixtaqaa, ii.**                    *girls tell their mothers*  
 their mothers to                    they tell them                    eh

lakaaya- n    ayaga- ada- n    umchu- gu- mchin  
 boy        3abp wife like 3abp kiss    cnd 3Rp

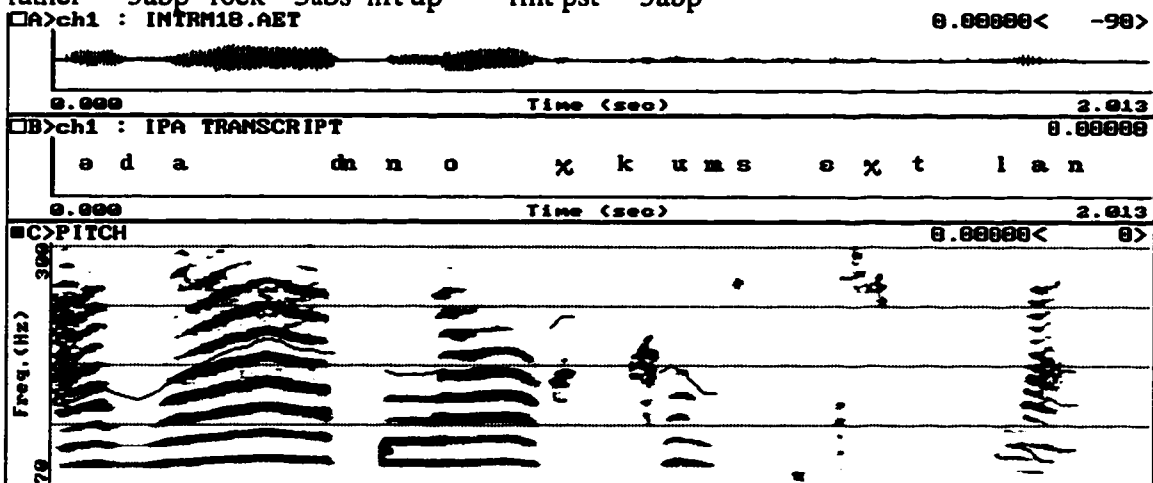
anaada- mchinngaan ixta- qaa                    ii  
 mother 3Rp for tell    pst s (anaphoric ref) Q



## RM18

**Adaadan**    **nuɣix**    **kumsittalaaganan.**                    *Their fathers carried rock.*  
 their fathers    rocks    they carried

adaada- n    nuɣi- x    kumsitta- laaganan- n  
 father 3abp rock 3abs lift up    rmt pst 3abp

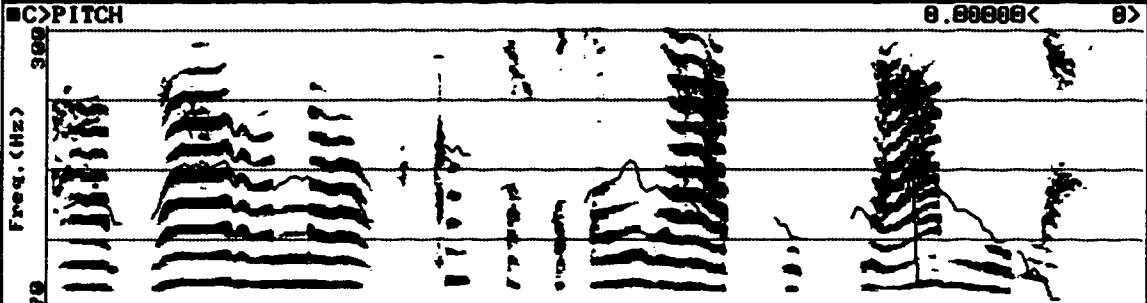
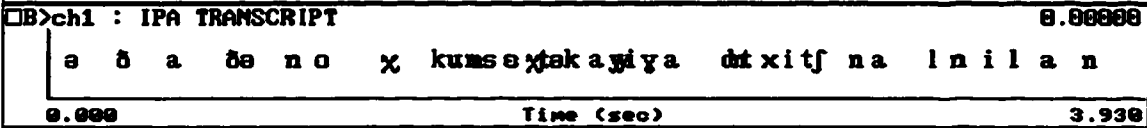
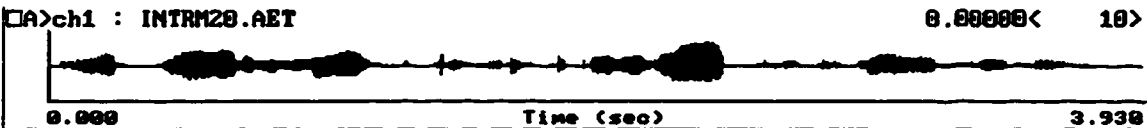
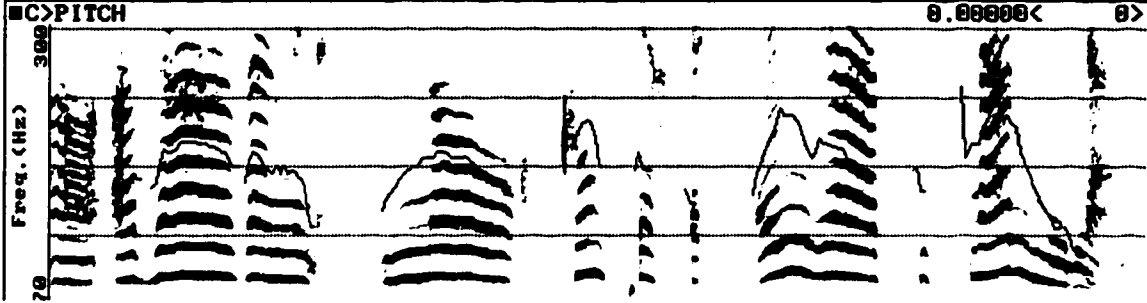
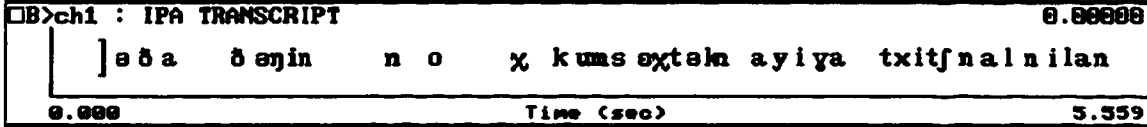
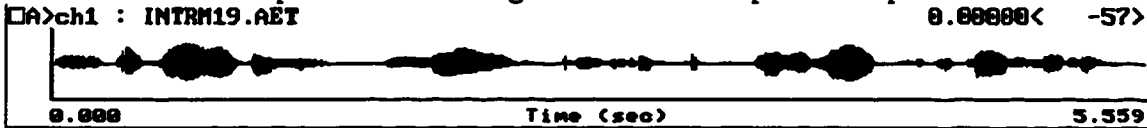


RM19, RM20

Adaadangin nuḡit kumsittakun, *When their fathers carried rocks, —*  
 fathers rocks they carried

ayagaadan tɔichin aalunilaaganan. *the girls laughed.*  
 girls themselves they caused to laugh

adaada- ngin nuḡi- ɣ kumsitɔta- ku- n  
 father 3Rabs rock 3abs lift up prs 3abp  
 ayaga- ada- n tɔichin aalu- ni- laaganan- n  
 wife like 3abp themselves laugh cause to V rmt pst 3abp

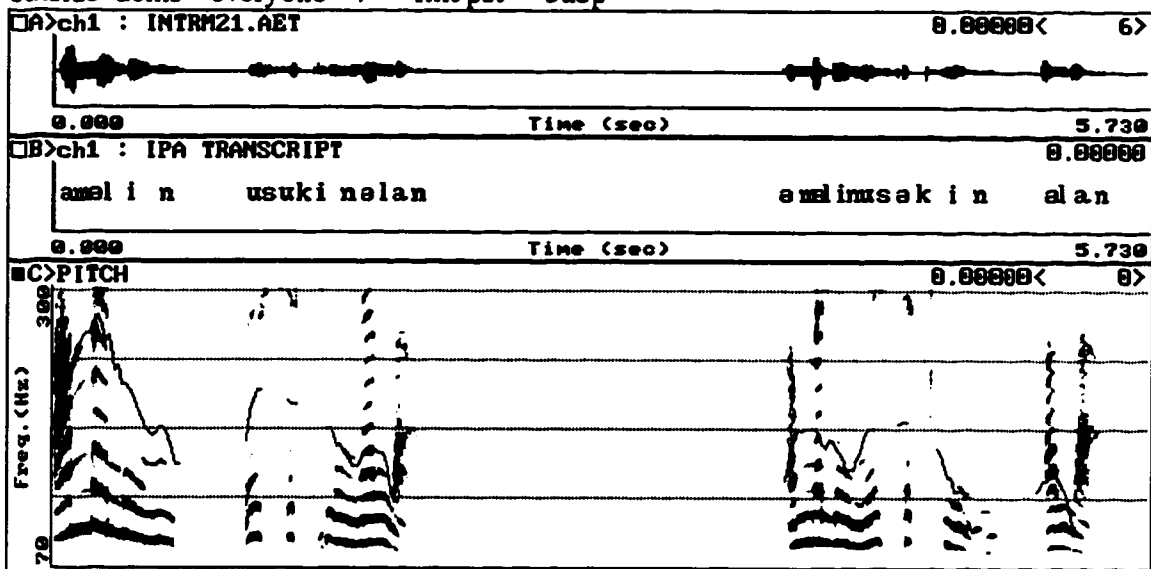


## RM21

Amalinen usukiin ilaaganan.  
 out there everyone there we were

*We were out there (camping)*

amali- nan usukiin i- laagana- n  
 outside dems everyone ? rmt pst 3abp

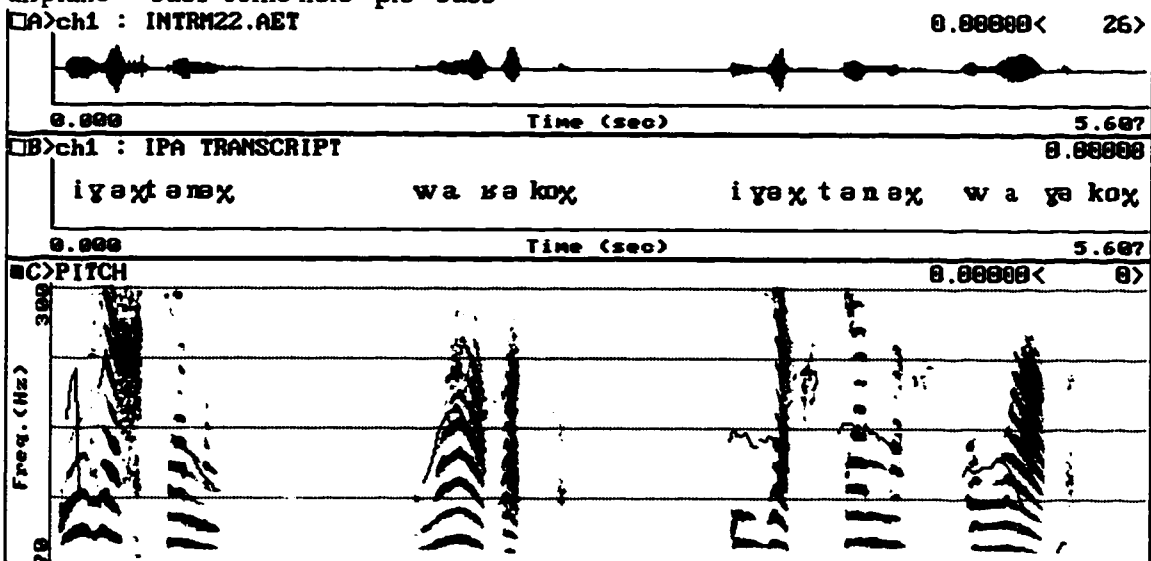


## RM22

Igaɣtadaɣ waagakuɣ.  
 airplane it came here

*The airplane came.*

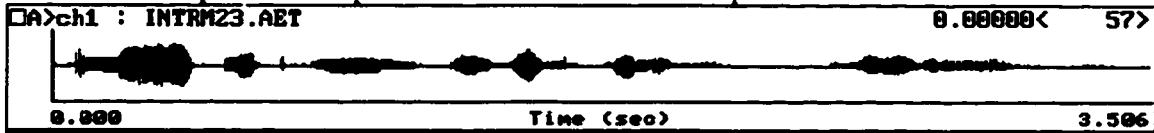
igaɣtada- ɣ waaga- ku- ɣ  
 airplane 3abs come here prs 3abs



RM23, RM24

Amaadan akuniin, igattadaɁ waagaalaaganax. *When we were out there, —*  
 outside we were to airplane it came *the airplane came.*

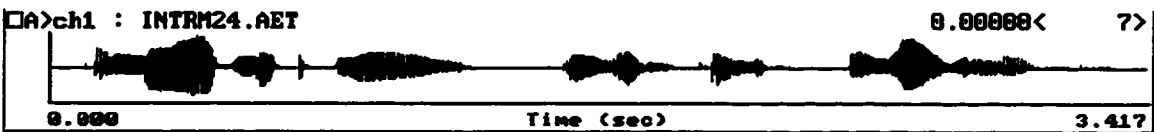
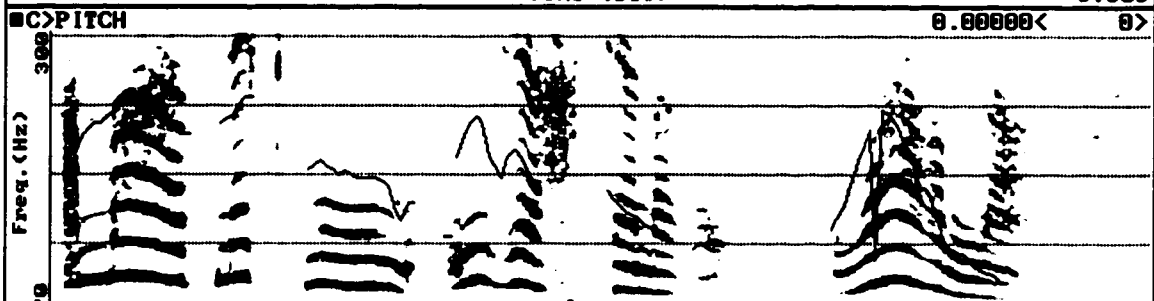
amaadan a- ku- niin igattada- x waaga- laagana- x  
 outside be prs to airplane 3abs come here rmt pst 3abs



□B>ch1 : IPA TRANSCRIPT 0.00000

ə m a d n ə k n i n i y ə x t ə n ə w a ɣ l a n x

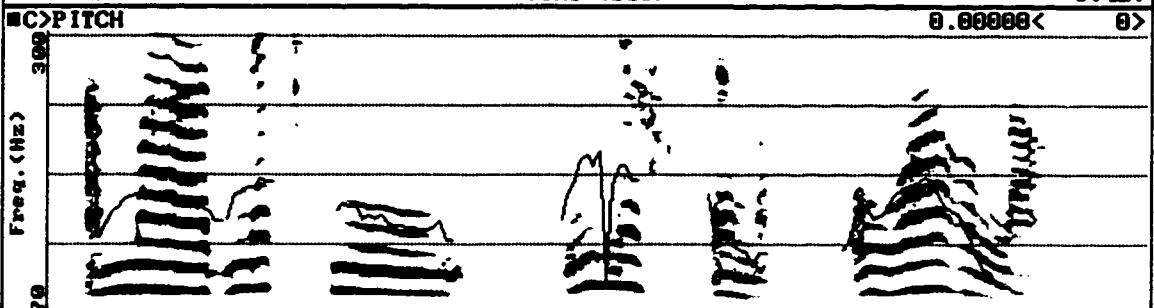
0.000 Time (sec) 3.506



□B>ch1 : IPA TRANSCRIPT 0.00000

ə m a d n ə k n i n i y ə x t ə n ə x w a ɣ l a n ə x

0.000 Time (sec) 3.417



RM25

Ulam uluudaʔ angaliʔtaa.  
house red one it is the color of

*Their house is red.*

ula- m uluuda- ʔ angaliʔta- a  
house rl red 3abs be the color of s (anaphoric reference)

Kuguu, uluudaʔ angaliʔtalakaʔ;  
no red one it is not the color of that

*No, it isn't red;*

kuguu uluuda- ʔ angaliʔta- laka- ʔ  
no red 3abs to be the color of neg 3abs

ingan qaʔchiklungin angaliʔtakuʔ.  
that black one it is the color of

*it's black.*

ingan qaʔchiklu- ngin angaliʔta- ku- ʔ  
loc black 3refp to be the color of prs 3abs

▣A>ch1 : INTRM25.AET

0.00000&lt; 3712&gt;



▣B>ch1 : IPA TRANSCRIPT

0.00000

uləm ul uðə aŋdɛʔ tə k u y ul ul uð aŋaʔ tɛ ləkʲ qaʔtʃ i kɛŋplɛ ʔakɔʔ

0.000

Time (sec)

8.000

▣C>PITCH

0.00000&lt; 212&gt;

