Intonation in Kyuquot -- a Scratch on the Surface*

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0. Very little has been done on intonation in Northwest Indian languages, but certain universals of intonation have been proposed. One of these is the "unmarked breath group" described by Lieberman (1967). The purpose of this investigation was to determine whether or not this contour appears in Kyuquot, a dialect of Nootka, and in this paper it will be shown that Kyuquot does in fact demonstrate this intonation pattern.[1]

After a presentation of Lieberman's (1967) unmarked breath group, and definitions of intonation and the Kyuquot clause, the procedure of the investigation is discussed. Following this, the normal falling contour or unmarked breath group as it appeared in this sample is described, along with four other interesting intonational effects that were observed. A brief look at the combination of these secondary effects follows and suggestions as to further research concludes the paper.

1. Lieberman (1967) noted that the unmarked intonation pattern for declarative sentences is characterized by a sharp rise in fundamental frequency (Fo) at the beginning of the utterance, followed by a gradual fall toward the end, where there is usually a short, fairly sharp final drop. He called this contour the "unmarked breath group", and although Ohala and Hirano (1967) disproved his proposal for the physiological cause of this contour,[2] no one has disputed the existence of the normal, falling contour.

Intonation is not easily defined, but for the purposes of this study, movements in pitch which are neither lexically significant nor determined by phonetic co-articulatory constraints constitute intonation. In this paper,

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a syntactic unit containing only one predicate, will be called a clause. Complex sentences and other utterances containing more than one clause will all be grouped together under the term "multi-clause utterance". An utterance or breath group will be defined as the stream of speech from one pause for the intake of air up to and including the next. This distinction is necessary for this study as intonation is a feature of the utterance, not of the sentence or clause.

2. The nearest equivalent to Lieberman's "declarative" in Kyuquot, is the absolutive mood, so to test for the presence of the normal falling contour, a series of absolutive sentences were examined both auditorily and acoustically. To avoid special citation patterns of intonation a story was used, from a tape recording of Sophie Jules, a native speaker of Kyuquot, made by Suzanne Rose. Only one recitation of one story told by this person was used, and therefore the description of intonation patterns found may be idiosyncratic, or a special story-telling intonation may have been used throughout. Also, as the story is told in Kyuquot, the results cannot be automatically transferred to other dialects of Nootka.

2.1 Once the sample had been chosen, an attempt was made to group together on tape the sentences which had similar contours or salient features based simply on a perceptual analysis. Within each group, utterances were compared for their morphemes, phonemes, and semantic content. The non-intonational causes of pitch fluctuation (e.g., co-occurrence effects of certain phonemes) were thus eliminated, and the remaining groups were described and compared.

With help from Suzanne Rose, a specialist in Kyuquot, and from Mr. George Louie, a native speaker of Nootka, the groups were labelled as to potential affective causes.

2.2 In addition to this auditory analysis, an acoustic analysis was completed on each of the intonation groups that had been established as described above. To determine the phonetic correlates of the pitch contours found, oscillograms were made of all the sentences in the sample. Their Fo traces were then examined with reference to the pitch contour that had caused them.

Measurements of fundamental frequency over time were obtained using an F-J Electronics fundamental frequency meter[3] and these were converted to hard copy output by a Honeywell Visicorder single channel oscillograph.[4]

The speech sample was input from a tape recording to the Fo meter. In order to extract the Fo of a woman's voice using an Fo meter, the following procedure is typically used: A high pass filter is set at 180 Hz, and a low pass filter, operating in tandem, is set at 200 Hz. As the signal is fed into the Fo meter, any frequency falling within this range will not be damped, and frequencies just outside of it will be damped slightly. It is found that at this setting, an Fo as low as 130 Hz will pass the filter with some damping, but that its second harmonic (260 Hz) will be heavily damped. Thus, it is only the fundamental frequency of the woman's voice that passes through both filters. Each half-wave of the remaining fundamental cycle is then converted to a DC voltage by means of a frequency to voltage converter. The meter allows for either a linear or a logarithmic display scale for the Fo trace; in this experiment a linear scale was used.

From the Fo meter, the Fo trace was sent by line output to the oscillograph, which converted the trace to an oscillogram on direct print paper. The speed of the paper was set at ten centimeters per second, which allows the oscillogram to record fluctuations in frequency occurring as often as once every 5 milliseconds. The resulting oscillogram reads from right to left.

3. As expected, the most common intonation pattern among the absolutive sentences in the story was Lieberman's (1967) unmarked breath group, called here the "normal falling contour". Lieberman's description (see section 1) is of course only the overall tendency of the contour, and in any sentence the actual readings of fundamental frequency fluctuate noticeably, so that there are many rises in frequency as well as drops over the course of an utterance. In any given series of a rise in fundamental frequency, followed by a fall, followed by another rise, the highest frequency attained by the second rise will not be as high as that attained by the first rise. Thus if a line is drawn through the successive peaks of fundamental frequency

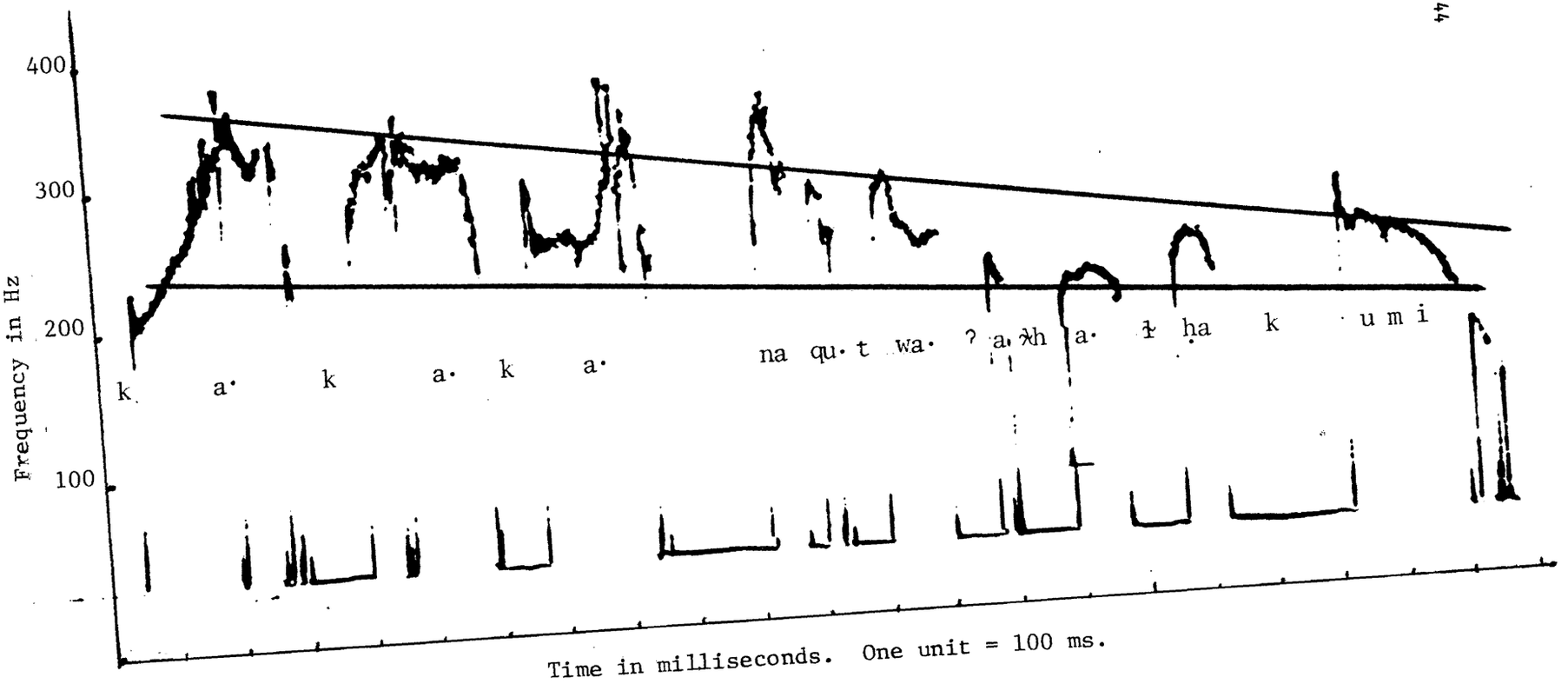


Figure 1. Oscillogram illustrating the normal falling contour. The sentence is:

/ka· ka· ka· naqu·t wa·?a·ɬ ha·ɬ ḥakumi/

"'Give me a drink!' he said to the princess."

in utterance and another connects successive "valleys", both lines will show gradual declination, with the peaks declining more rapidly than the valleys.

Figure 1 is an oscillogram of an intonation contour of this type. Lines have been drawn through the peaks and valleys of fundamental frequency.

Perceptually, this most common contour is simply a gradual but steady fall in pitch. Neither the sharp initial rise nor the sharp final drop are noticeable in a simple auditory examination. Based on this perceptual description then, the pattern can be called a "normal falling contour".

In most cases, where the pattern occurs in a multi-clause utterance, the contour extends over the entire utterance, so that the contour on any individual clause in the utterance is not a complete intonation unit in itself but a part of the whole intonation pattern at the utterance level. An exception to this will be discussed in section 4.2.

4. In addition to the normal falling contours described above, several secondary effects on intonation produced variations in the contour. These were: lengthened vowels; repetitions of entire clauses; a rise in pitch on locatives and deictics; and an utterance final rise in pitch indicating surprise on the part of the speaker. We will look at the special effects produced by each of these in turn, giving both auditory and acoustic descriptions.

4.1 A lengthened vowel seems to have the stylistic effect of intensifying the meaning of the word in which it appears. In most cases the lengthened vowel is one that is already phonemically long. In the sentence /ɬiciti··· ɬ ǰa·ni/, the gloss reads "she got really pregnant quickly". The individual morphemes in this sentence can be translated:

	ɬic - it	- (č)iil	ǰa·ni
pregnant -	at the body -	make ...	at first~for a while

Presumably the second word /ǰa·ni/ is what has been translated "quickly", but the point of interest is that none of the morphemes have the meaning

"really". It would thus appear that vowel lengthening here serves to intensify the meaning.

An acoustic description of this special effect is quite straightforward. The fundamental frequency drops as usual, but on the syllable which is lengthened, it falls only very gradually (30 Hz in 1.1 seconds in the most extreme example in the story). A phonetic analysis by oscillograph of a sentence of this type follows in Figure 2. In an auditory analysis of this pattern, the lengthened vowels maintain a level pitch.

4.2 A second special effect which can occur along with the normal falling contour and modify its shape somewhat is that of repetition of entire clauses within an utterance. Stylistically, one purpose of this repetition is to reinforce what has been said, for example, the sentence: "They wanted to catch up to him" which is repeated twice. It can also emphasize real repetition of events in the story; two of the utterances in the text consist simply of repetitions of the two clauses: "daytime, nighttime".

As would be expected, the perceptual effect of repetition of the same clause is that each pronunciation has the same pitch contour and level. Acoustically, however, the clauses have very similar Fo contours, but each successive repetition is slightly lower in Fo.[5] Two more differences between this contour and a normal falling contour are that the Fo declination is over a smaller total range, and that while the first repetition of the clause spans almost the entire Fo range, succeeding ones cover smaller ranges.

Figure 3 is an oscillogram which illustrates the effect of repetitive utterance. The reading of 250 Hz near the end of the oscillogram was picked up from the second formant when the first formant (Fo) dropped below the range of the Fo meter.

4.3 Deictics and locatives were taken into consideration only after several unusual variations in intonation had been noticed in utterances containing deictics in final position. Rose (personal communication) suggested that

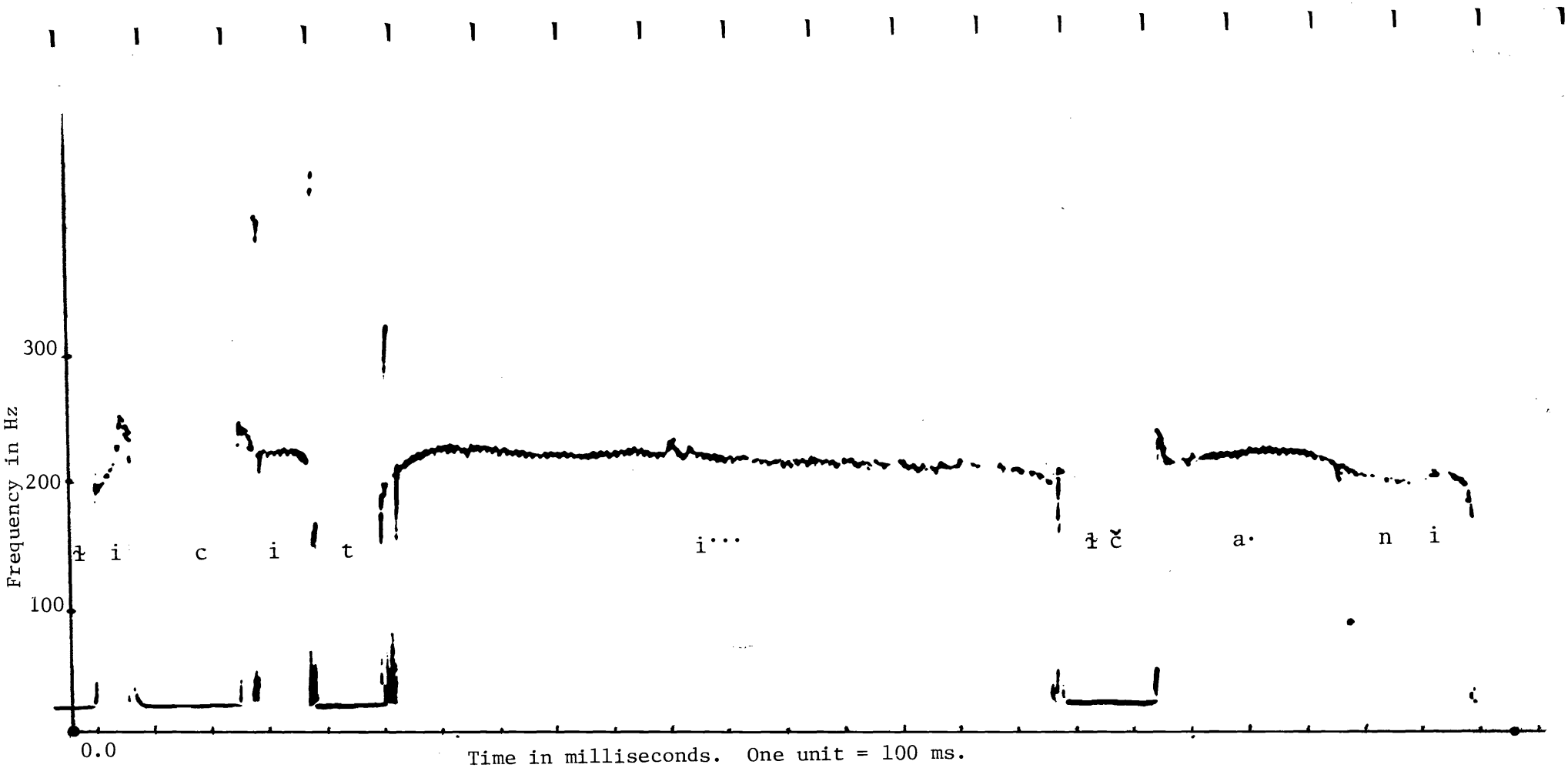


Figure 2. Oscillogram illustrating the effect of a lengthened vowel. The sentence is:

/ ɬiciti···ɬ ča·ni /

"She got really pregnant quickly."

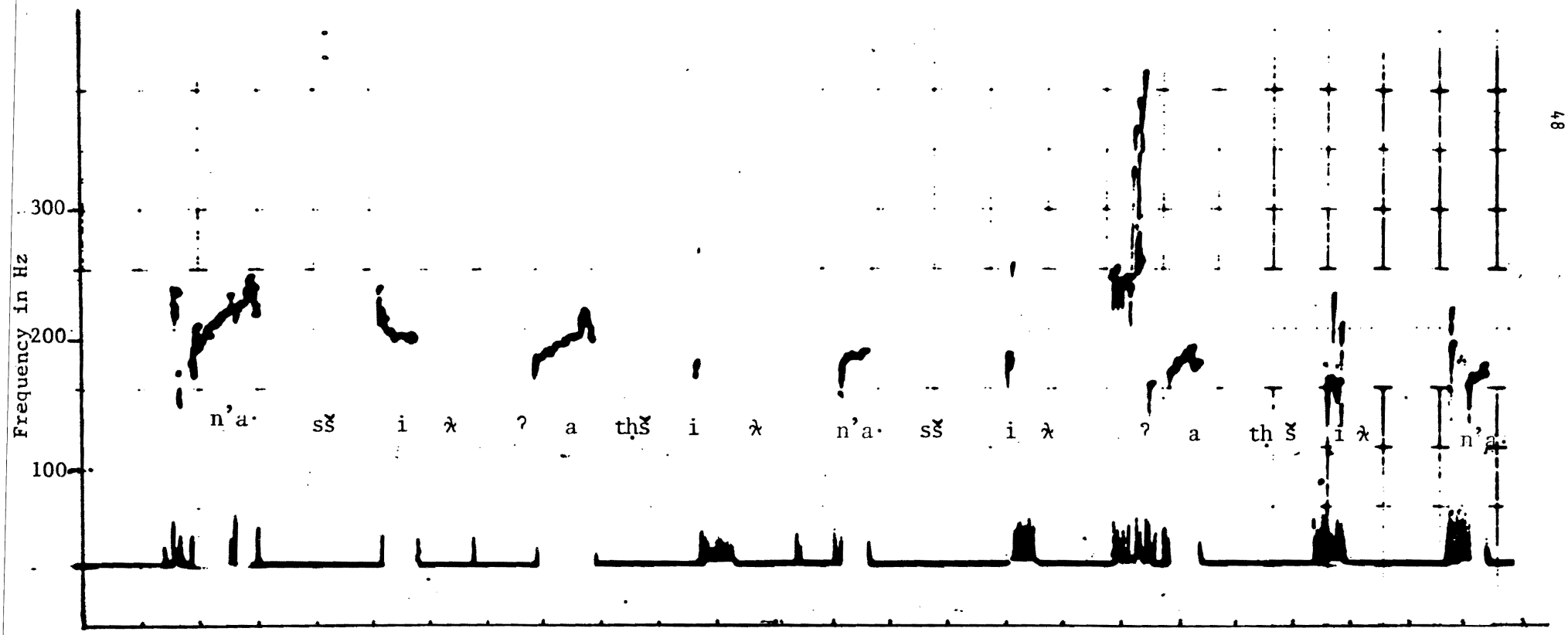


Figure 3. Oscillogram illustrating the effects of repetition of entire clauses. The sentence is:

/ n'a·sšiƛ ʔathšiƛ n'a·sšiƛ ʔathšiƛ n'a·/

"Night after night, day after day."

deictic markers and locatives in Kyuquot may fulfill an important structural function in stories, much as auxiliaries do in Kwakwala stories, according to Berman (1982). Since an item of structural importance could well cause special intonational effects, an attempt was made to relate the observed variations to the presence of deictics or locatives in a sentence.

Three general observations regarding the intonational influences of deictics and locatives could in fact be made. First, a deictic has no effect on intonation except when it occurs utterance-finally. Second, a locative affects intonation only when it occurs clause-initially and thus acts as a predicate, even when this clause is not utterance-initial. This may be because these are structurally salient positions, and deictics and locatives occuring elsewhere do not carry as much weight in discourse structure. Third, the effect of either is to raise pitch. For the sake of space, examples of these will not be given, but an example of an utterance final deictic in combination with other secondary effects is shown in Figure 5, in section 5.

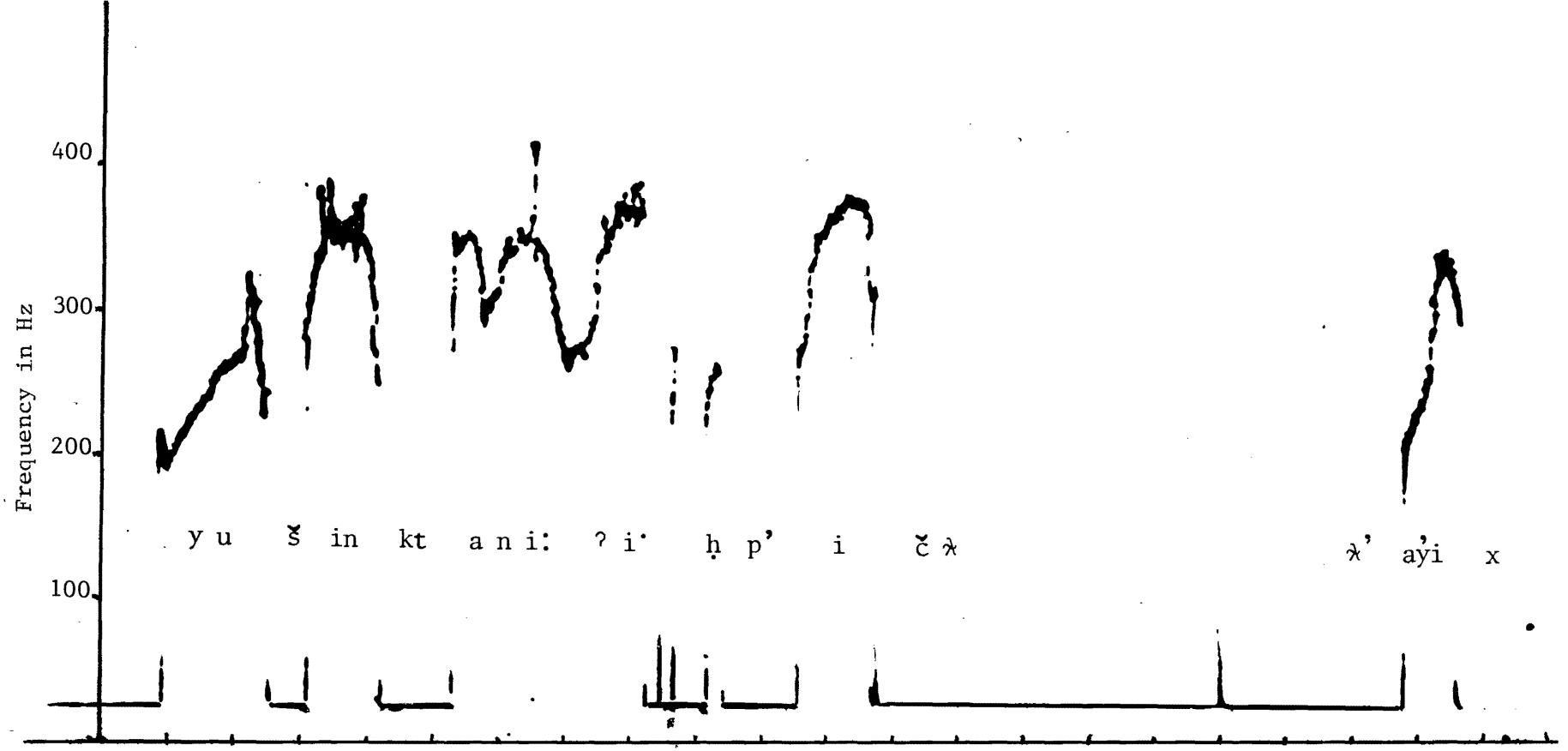
4.4 In thirteen sentences from the sample, a final rise in intonation was audible. The acoustic manifestation of this rising intonation pattern differs from that of a normal falling contour only in the final syllable, where instead of a drop in fundamental frequency there is a sharp rise followed by a sharp fall. The rise attains almost as high a level of fundamental frequency as the rise at the beginning of the utterance. An oscillogram of an utterance of this type is given in Figure 4.

Of the sentences in question only one indicates an element of surprise in the gloss. This is the one that ends with the morpheme / ʔih/, which is always spoken with a rising intonation according to George Louie (personal communication) and means that the speaker is surprised. This in itself would suggest a relationship between rising intonation and the element of surprise.

The remaining sentences were played in isolation from context to Mr. Louie, who was asked to "explain" them.[6] In all of them it appeared that rising intonation was caused, in these sentences at least, by surprise on the part of the speaker. An example of this is the sentence

/quʔišint ʔuḥčaːs qʷaː/

'It must have been raven'



Time in milliseconds. One unit = 100 ms.

Figure 4. Oscillogram illustrating the effect of surprise - rising intonation. The sentence is:

/(ču·) yušink tani: ʔi·ḥp'ičƛ ƛ'a'yix/

"He grew up quickly. Quickly."

Mr. Louie, after listening to the sentence on tape, explained, "They are surprised because it's raven."[7]

5. Several utterances in the text involved two or more of the above special effects. One of these was particularly interesting in that it illustrated the combined influences of vowel lengthening, a final rise for surprise and an utterance-final deictic. The final syllable rose to well above the height of the beginning of the sentence. In fact, the combined raising effects of the deictic and the surprise produced a generally rising contour of Fo through the whole utterance, with the final fall being extended by vowel lengthening. These effects were not observed anywhere in the cases where only one intonational pattern was present. Figure 5 is an oscillogram of this sentence.

George Louie was asked to say this sentence without the special contour. He was then asked what difference in meaning there was between the two sentences. His answer was "If you just say it like that [normal falling contour] it means he's paddling just over there [indicating a point about ten feet away]." With the special contour, the gloss provided was "So he took off, paddled away, far and fast."

Except for the sentence described above, the combining of two special effects merely produced an utterance which showed the influence of both of them; no other effects caused by the combinations themselves were observed.

6. We have discussed the normal falling contour as it appears in Kyuquot. along with four secondary intonational effects which are overlaid on the main pattern. For each one, a perceptual description and an oscillogram of the phonetic output has been presented. It must be remembered, however, that there are certainly other effects which could not be tested in the course of this study. These include the effects of stress, idiosyncratic intonation habits of the speaker, emotional attitudes other than surprise, and others. Several patterns were observed for which no explanation could be found, perhaps caused by one of the above factors.

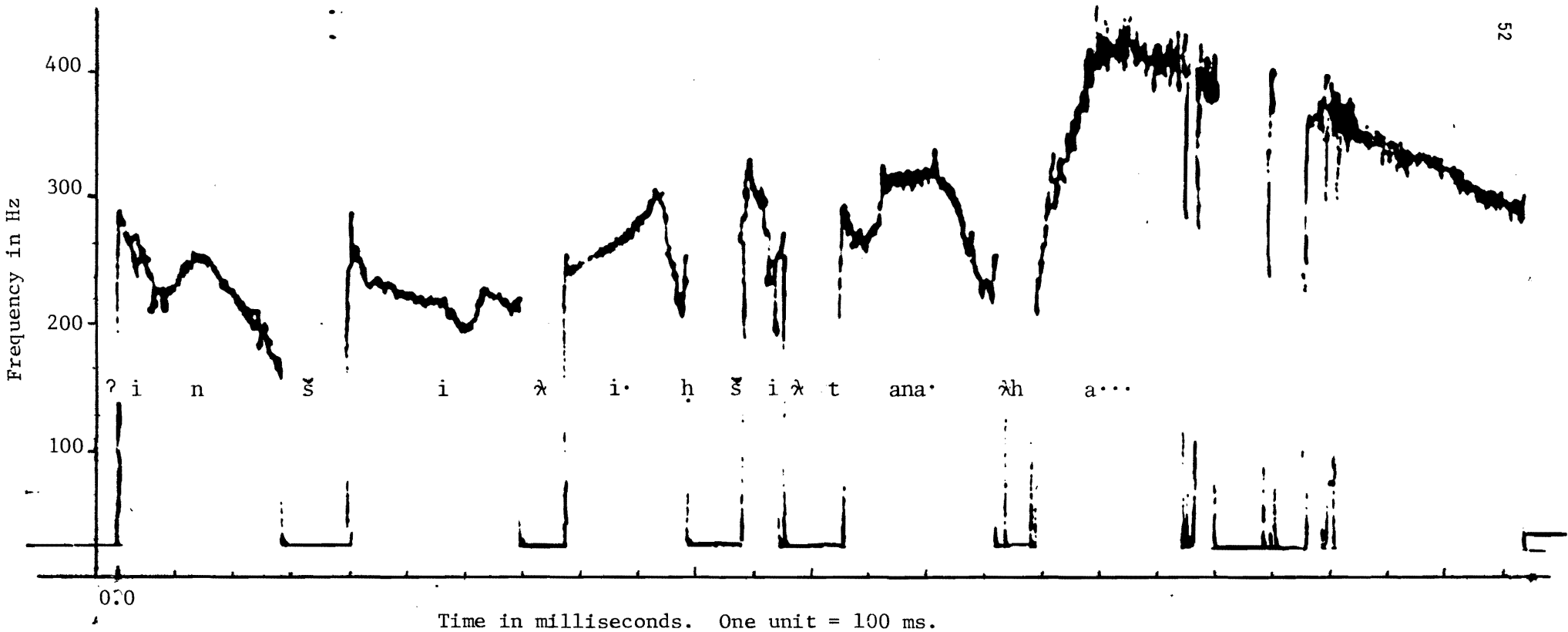


Figure 5. Oscillogram illustrating the combined effects of vowel lengthening, surprise, and an utterance-final deictic. The sentence is:

/ ʔinši ƛi ḥši ƛ tana·ƛ ha··· /

"So he took off, paddled away far and fast."

Above all, it is clear that much work remains to be done on the topic of intonation in Kyuquot. First, the observations described above apply only to one recitation of one story by one speaker of Kyuquot, and the results should therefore be retested in other contexts.

In addition to this, exploratory research must be done as to the nature of stress in Nootka; it is probably not primarily correlated with duration, as lengthened vowels are phonemically distinctive,[8] but perhaps it is strongly correlated with intensity and/or fundamental frequency. Studies involving instrumental measurement of intensity and fundamental frequency along with native-speaker surveys to obtain subjective judgements as to the placement of stress would be helpful. In this way the influence of stress could be isolated from other effects on intonation, and could be described.

Further studies on the discourse-level structure of Nootka will make it possible to give proper consideration to its effects in future studies of intonation. A study comparing citation-intonation of sentences to story-telling intonation would perhaps be revealing as well.

Obviously, this is only the beginning, and it is only after initial studies of this sort have been completed that the necessary further steps in the analysis and description of intonation in Kyuquot and Nootka will become clear.

NOTES

1. Following is a table of the Kyuquot consonant inventory, reproduced from Rose (1981).

TABLE 1: CONSONANT INVENTORY OF KYUQUOT

	Lab	Alv	Alv	Alv-pal	Lat	Vel	Lab-vel	Uvu	Lab-uvu	Phar	Lab-phar	Glot
Stop	p	t	c	č	λ	k	k^w	q	q^w			
Ejective	p̓	t̓	c̓	č̓	λ̓	k̓	$k̓^w$			ʕ		
Fricative		s		š	ɬ	x	x^w	(χ)		ḥ	$ḥ^w$	
Resonant	m	n		y			w					h
Glottal Resonant	m̓	n̓		y̓			w̓					ʔ

The bracketed consonant (χ) is a very rarely occurring segment, and (h^w) is actually a morphophoneme. The vowel phonemes of Nootka are: i, a, u, i·, a·, u·, and the marginal phonemes ɔ· and e·, which appear only in a very limited set of morphemes.

2. Lieberman (1967) claimed that decreasing subglottal pressure is mainly responsible for Fo declination, and Bolinger (1964) also proposed that the effort of speaking causes a rise in pitch by increasing the subglottal air pressure. Ohala and Hirano (1967), however, showed that several muscles were involved in the raising and lowering of Fo, and that the value of subglottal pressure is therefore only a minor factor in determining Fo.

3. For a more detailed description of this instrument see: Manual for Fundamental Frequency Meter. Published by F-J Electronics, Gentofte, Denmark.

4. For a more detailed description of this instrument see: Technical Manual - Instructions for Fiber Optics CRT Visicorder Oscillograph Model 1806A 1973. Published by Honeywell Test Instruments Division, Denver, Colorado.

5. Of course, this is not the case for every repetition of a clause within a given utterance, but the final repetition is always lower in fundamental frequency than the first, and there is a gradual Fo declination throughout the utterance.

6. When Mr. Louie was explaining the sentences with rising intonation from the story, he used the same intonation in his English sentences.

7. This translation reveals that Mr. Louie recognized the story even with the sentences played out of context.

8. Another area of study which was not examined here is the intonational effect of phonemic vowel length.

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