PalArch's Journal of Archaeology of Egypt / Egyptology

A PRELIMINARY ACCOUNT ON THE KHORTHA SPEECH PROSODY

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Atul Aman[1], Niladri Sekhar Dash[2], Amalesh Gope[3]-- A Preliminary Account On The Khortha Speech Prosody -- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(6). ISSN 1567-214x

Abstract

The present study aims to explore intonational properties with special reference to focus marking system (in-situ, wide focus) in Khortha. A prosodic account of other types viz., Affirmative, Negation, Conditional and Compound and Interrogative sentences are also examined in this study. We adopted the ToBI (Tones and Break Indices) framework for transcription, annotation and analysis of the Khortha speech prosody. Khortha, an Indo-Aryan language is the second most spoken language after Hindi in the state of Jharkhand, India, with approximately 80 million speakers (Census reports 2011). In order to analyse the Khortha intonation patterns, we elicited a dataset containing all the intonations phrases from ten (10) native speakers (8 males, 2 females) through controlled speech experiments in a noise-free set up in the nearby villages of Giridih in Jharkhand. The first part of the questionnaire consisted of four data sets which were intended to analyse the wide focus and in-situ focus sentences, whereas the second part consisted eight affirmative, eight negative, five conditional and compound sentences and eleven other types of interrogative sentences. The conclusive analysis reveals that the subject focus element recorded the highest F0 at around 250 Hz marked as L+H*. The object focus element also recorded a relatively higher F0 at around 250 Hz, but the preceding tone marked as the lowest F0 with a continuous stretch which results in a scooped L*+H bitonal accent. The lowest pitch is marked in the left periphery of the intonation phrase in the object focus and wide focus sentences. The other significant observations regarding the pitch contour of the types of sentences are also analysed elaborately in the full paper.

1. Introduction

The present paper gives a description of Khortha speech prosody, analysing the intonation patterns and focus marking in the language. It can be assumed that analysing its prosodic properties may help in authenticating its phonetic and phonological constructions properly. The present study is based on the controlled speech experiments on the

intonation patterns of the various sentences of Khortha used in day-to-day practices. The sentences were elicited from the native speakers of Khortha. The prosodic differences between sentences with a wide focus and in-situ focus are under analysis. The intonation patterns can be interpreted with the fundamental frequency (F0) which changes over the course of utterance within a complete intonation phrase. This study is conducted with ToBI (Tones and Break Indices), an important framework which has been adopted for similar studies in other languages.

1.1. Intonation and Focus

According to Ladd (2008), intonation refers to the use of suprasegmental phonetic features to convey the 'post-lexical' pragmatic meanings in a linguistically structured way. The other vital aspects of intonation study are 'pitch' and 'relative prominence' which help further in analyzing the 'Intonational phonology', referring to issues of post-lexical phonology and phonetic realization.

The focus in a sentence determines the structure of information, and with a change of focus from one element to another, the same sentence results in different utterances. Thus the focus is responsible for determining the exact meaning of a sentence at the surface structure. Under intonation focus, we classify the Broad focus and Narrow focus. Broad focus, also known as a wide focus, refers to the meaning coming from the entire sentence, while narrow focus refers to a specific element being emphasized in a sentence (Ladd, 2008, Gussenhoven 2004)

The narrow focus is restricted to specific word/s, and it is referred to as contrastive focus when that specific word is contrasted with a set of contextually given alternatives. A narrow focus on arguments and adjuncts occurs in 'pre-field' position, and when placed on a verb, it is called 'in-situ'. The 'in-situ' focus categorically emphasizes the focused word without shifting the focus either pre-lexical or post-lexical. In Khortha, we found the presence of wide focus and in-situ focus in various sentence types.

1.2. A Review of Existing Literature on Intonation and Focus

As the Khortha language belongs to the Indo-Aryan language family, the intonation properties of Khortha may have similarities with those of other dominant languages used in this region like Hindi and Bengali. Hence, a review of the available literature on intonation and focus in some other languages will be of help in understanding the intonation properties of Khortha as well.

Sengar & Mannell (2012), claim that Hindi, being an accentual phrase language, is marked by a rising pitch pattern similar to Bengali intonation proposed by Khan (2008). Jun (1996), in Sengar & Mannell, claim that a non-final phonological phrase receives a low pitch accent and a high phrase boundary. The high phrase boundary is marked as L*Hp, and the final phonological phrase is marked as H*L%, where L% is the low boundary tone of the intonation phrase.

Patil et al. (2008) specifies that the non-final Intonational phrase has a rising pattern marked as L*Hp and the final intonational phrase carries a falling pattern marked as H*L, which is not affected by any shift in focus. They clarify that despite Hindi having a property of post-focal compression, which is similar to other languages which keep on reducing the prominence of the non-nuclear focused element over the nuclear elements. However, in the case of content words, a rising pitch accent is required even at the post-focal position. In contrast to German and Bengali, the pre-focal elements in Hindi appear to be non-influenced under compression. It is possible that in order to avoid and minimise the prosodic difference between the pre-focal and focal elements, the pitch range of the focal constituent is compressing the dissimilative tonal effect of the down step phrase.

Khan (2008) examines that the pitch accents in Bangla can be realised as L* and H* or rising L*+H, where L* is realised as F0 minimum on the prominent syllable, whereas H* is realised as F0 peak, a characteristic of sarcastic speech or unexpected information. The scooped pitch accent (as given in ToBI), which marked as L*+H is realised as F0 minimum on the prominent syllable and a sharp rise in pitch in the following syllables. This pitch accent signifies focused elements. Khan‘s analysis is contrastive with the previous studies which explicitly state that Bengali does not bear bi-tonal pitch accents due to Obligatory Contour Principle (OCP), which is a hypothesis under the autosegmental phonology stating that two consecutive identical features are not accepted.

Hayes & Lahiri (1991) analysed the Bangla intonation system with two mono-tonal pitch accents H and L. Following Pierrehumbert (1988), they adopted the bi-tonal pitch accent L+H* for the down-step description. They highlighted that the phonological phrase controls the juncture effects. Further, they argue the same phrase, controlling the juncture effects in Bangla, also controls the intonation patterns in an intonation phrase.
In the following sections, a detailed account of the prosodic structure of the Khortha Intonation phrase will be given. The various acoustic experiments, which were carried out for identifying the focus marking in Khortha will also be discussed, which will be followed by an account of the data elicitation process. Since the analyses were carried out in the ToBI framework, it becomes necessary that we familiarise with the methodology first before going into the analyses.

1.3. Methodology

For analysing the prosodic structure of Khortha, the Tones and Break Indices (hereafter, ToBI) framework has been adopted. ToBI is used for transcription and annotation of speech prosody and formulation of the intonation grammar. It is a widely accepted set of rules on the phonology and phonetics of English Intonation proposed by Janet

Pierrehumbert, first, it was given in her PhD thesis in 1980, and later it was published in 1990. Here she has developed a model of intonation which includes a grammar of intonation patterns and an explicit algorithm for calculating the pitch contours in a speech based on intonation.
ToBI, being one of the prominent frameworks for describing the speech prosody and the intonational grammar in various languages like English, Japanese, Dutch, Bengali etc. inspired us to analyse the Khortha prosody and its intonational grammar within its frame.

ToBI is used to refer to the conventions used for describing the American English specifically. However, the system has also been defined for several other languages, e.g. J-ToBI refers to the ToBI conventions for Tokyo Japanese (Venditi, 2005), ToDI as an adaptation of ToBI was introduced to describe the Dutch intonation pattern (Gussenhoven, 2005). Another variation of ToBI is called IVie (Intonational variation in English), which was established to enable comparison between the several dialects of British English by Grabe, Nolan and Farrar (1998).

A full ToBI transcription comprises of six major components:

a. An audio recording of the speech data
b. An electronic record of F0 (Fundamental Pitch)
c. A tone tier for analysing the tonal events
d. An orthographic tier with words taken from actual utterances
e. A break index tier showing the strength of the junctures, and
f. A miscellaneous tier to mention the fillers, pauses or any other important information, as and when the need arises.

Later, Mary E. Beckman and Gayle M. Ayers (https://www.ling.ohio-state.edu/research/phonetics/E_ToBI/singer_tobi.html) gave the guidelines for ToBI labelling, on the basis of English utterances. It was devised by a group of speech scientists from various disciplines (electrical engineering, psychology, linguistics etc.) who wanted a common standard for transcribing a set of prosodic elements in order to share prosodically transcribed databases across the research domains. Insights into ToBI can also be found in the work of Silverman *et al.* (1990) who described the motivation for developing ToBI system. The earlier researchers described ToBI as a transcription for an utterance which consists minimally a recording of the speech, an associated record of the fundamental frequency contour and the symbolic labels for the events on the basis of following four parallel tiers.

1) A tone tier
2) An orthographic tier
3) A break-index tier, and
4) A miscellaneous tier

The conventions are specified for both the simple text-based transcription and the waves label files which associated with the time-aligned analysis records of the utterance. Each of these tiers will be described in the

following sections.

A. Mentioned below are the two types of tones which are marked in the tonal tier:

a. The phrasal tones, where the pitch events are associated with the intonational boundaries, and
b. The pitch accents, where the pitch events are associated with the accented syllables.

Thus, the tonal tier describes the nature of the accentual phrase or the intermediate phrase, the phonological phrase and the intonation phrase. The possible phrasal tones which can be marked along with the intonational boundaries are mentioned below:

(i) (L-) or (H-) phrase accents occurring at the boundaries of the intermediate phrases, and
(ii) (L%) or (H%), final boundary tones occurring at the boundaries of complete intonation phrases.

Apart from these two, a (%H) tone is also possible when a high pitch at the beginning of an utterance cannot be attributed to the 'H' (high) accent on the first or second syllable in the utterance.

There are instances where the intonation phrases are composed of one or more intermediate phrase plus a boundary tone. In such situations, we can apply two final tones at the final intonation phrase boundary, such as L-L%, L-H%, H-H%, H-L%, as mentioned in detail in Beckman and Elam (https://www.ling.ohio-state.edu/research/phonetics/E_ToBI/). The pitch accents as explained in their study in detail are mentioned below:

a) (H*) is the 'peak accent' marked on the uppermost part of the accented syllable in the intonation phrase, and
b) (L*) is marked on the lowest part of the accented syllable.
c) (L*+H) is called a scooped accent, where a low tone on the accented syllable is immediately followed by a sharp rise to the peak.
d) (L+H*) is called a rising pitch accent, where the lowest part of the speaker's pitch range is immediately followed by a sharp rise.
e) (H+!H*) indicates a clear step down onto the accented syllable from a high pitch. The (*) sign after H indicates the tone again rising to a high pitch accent.

B. The second tier in the system, the orthographic tier, is used only for the orthographic transcriptions of the pitch accents which have been examined prosodically in the tonal tier. This includes highlighting the pauses and fillers, e.g. 'er', 'um', 'uh' etc.
C. The Break and index tier represents the rating of the degree of a juncture perceived between an intermediate phrase and the end of the utterance. The parameters against which the values are assigned are mentioned below.

‘0’- This value is associated with the clitic groups which are phonologically dependent on another word or phrase.

For e.g. in the case of a Khortha phrase [kʰan***a-a***ʧʰa ho na] ‘Isn’t the food good’ the open front vowel [a] in [kʰan***a]*** is carried to the following intermediate phrase by ‘a’ in ***a***ʧʰa . (Refer figure 9)

‘1’- The given value is associated with the phrase medial word boundaries, for e.g. In the Khortha sentence [(dʰundʰi)$_1$ (ae rəhəl ho)$_4$] ‘The storm is coming’, the phrase medial boundary is observed after (dʰundʰi)$_1$. (Refer figure 3)

‘2’- The given value is associated with a disjuncture marked with a pause but with no tonal marks. For example, in the sentence [(tõe)$_2$ (kenhe hĩ)$_4$] ‘Where are you’? (Refer figure 7), the disjuncture after [tõe] is observed but there is no tonal boundary.

‘3’- This value is marked within an intermediate intonation phrase boundary which is marked by a single phrase tone affecting the region from the last pitch accent to the boundary. For example, in the sentence [(hame dəvəija)$_3$ (kinəlijo)$_4$]‘I bought the medicine’ (Refer figure 11) the tone of the first intermediate phrase till [dəvəija] affects the region till the intonation phrase boundary tone.

‘4’- This value is marked after the final intonation phrase boundary which is found at the end of each Khortha intonation phrase boundaries. For example, in the sentence [(tõe)$_2$ (kenhe hĩ)$_4$] ‘Where are you’? (Refer figure 7), we can find the intonational boundary tone marked with ‘4’.

D. The miscellaneous tier is a comment tier used for marking any optional events like ‘cough’ or ‘laugh’. However, this tier was not observed in our dataset, as our data elicitation was based on controlled speech experiments.

It can be noted that unlike IPA, ToBI is a completely different convention which varies from language to language. This is because different languages possess different prosodic properties. To summarize the points discussed in the works of Pierrehumbert and Beckman (1986)., the notable points of the ToBI are mentioned below

a. Only two tones, H (High) and L (low), are associated with the pitch accents. All other tonal contours are made up of a combination of H, L and some other modifying elements.
b. ToBI includes ‘Break Index’, which is used to mark the boundaries between prosodic elements.
c. Tones are linked to the stressed syllables indicated by an asterisk.
d. Phrasal accents are also noted, which signal the pitch at the end of each syllable.

1.4. Data Elicitation Process

For controlled speech elicitation, a questionnaire was prepared. Ten native Khortha speakers (8 males and 2 females) were selected for this purpose whose speech was recorded in a noise-free environment in the nearby villages of Giridih in Jharkhand. The native speakers were well-versed in the Hindi language, apart from their mother tongue Khortha. The age of the participants ranged between 25 to 45 years, and none of them had any past record of having any speech disorders.

The native speech data was recorded through a unidirectional head-worn microphone, connected to a Tascam linear PCM recorder, ensuring a constant mike to mouth distance. The participants have explained the nature and objective of the research work and before the recording session, they were given ample time to practice and feel comfortable. In the questionnaire, the intended focus points were highlighted. The questionnaire, which contained 44 sentences, was kept in front of them with a constant observation that they noticed and understood the focus points wherever necessary and accordingly provided their feedback while maintaining their natural intonation in answering those questions where the focus points were not highlighted. In order to get a maximum of four tokens for each sentence, the informants were asked to repeat each sentence four times, and this finally resulted in a total of 220 sentences. As each data facilitator produced 220 sentences, a total number of 2200 sentence tokens were elicited for the final analysis.

1.5. Questionnaire Preparation

To conduct the controlled speech elicitation, a questionnaire consisting of Khortha sentences of day-to-day use in various forms was prepared. The first part of the questionnaire consisted of four data sets, each consisting of three sentences. The three sentences included one wide focus sentence and two in-situ focus sentences targeting subject focus and object focus sentences separately. An example of the first part of the data set with three sentences is in order. In the example, for the in-situ focused sentences, the corresponding responses are also mentioned.

Wide Focus sentence

1. [həme dəʊəija kinəlijo] (I bought the medicine)
   हमें दवईया किनलियो |

Subject Focus sentence

2. **[ke]** dəʊəija kinəlke? (**Who** bought the medicine?)
   के दवईया किनल्के ?
   Response: **[həme]** dəʊəija kinəlijo. (**I** bought the medicine)
   हमें दवईया किनलियो |

Object Focus sentence

3. toĩ **[ki]** kinʰli? **(What** did you buy?)
   तोएं **की** किन्हली**?**
   Response: həme [**dəʊəija]** kinəlijo. (I bought the **medicine**)

हमें **दवईया** किनलियो |

The second part of the questionnaire included eight affirmative sentences, eight negative sentences, five conditional and compound sentences, and eleven other interrogative sentences comprising Wh-questions, Rhetorical Wh-questions and Wh-confirmatory questions.

1.6. Prosodic Structure of the Khortha Intonation Phrase

The prosodic structural framework adopted in the present study is based on the works by Ladd (2008), Pierrehumbert (1988), Hayes & Lahiri (1991), Khan (2014) and others. According to Ladd, the prosodic hierarchical structures are completely phonological in nature. It is observed that the Khortha prosody also shows a hierarchical structure. Selkirk (1978, 1986, and 2009), Nespor and Vogel (1986) and others have worked more elaborately on the hierarchical structures of prosody. Below is given the prosodic hierarchical structure of Khortha which is based on their works.

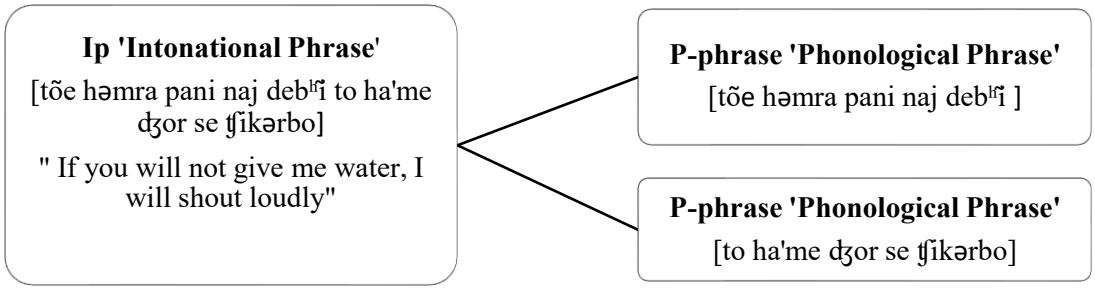


Figure 1. Part I: Schematic representation of Khortha Prosodic Structure (Ip to P-phrase)

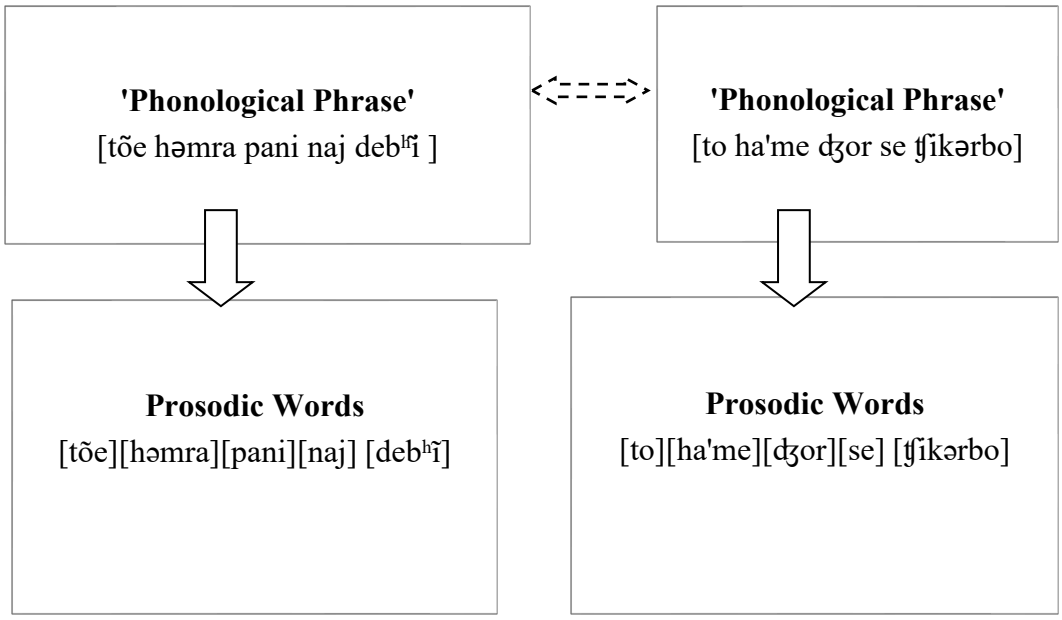


Figure 2. Part II: Schematic representation of Khortha Prosodic Structure

Considering part I and part II of the above diagram, it is noticed that the highest node in the prosodic hierarchy is an Intonational phrase (Ip), which is a sentence. This contains nodes marked as a phonological phrase (P-phrase). Under the P-phrase, juncture plays an important role to analyse the boundaries of the pitch contour of P-phrase. The intonation pattern doesn't have any role to play here. At the last step under the prosodic hierarchy, the phonological phrase contains Prosodic words and the prosodic words phonologically map the syntactic words.

1.7. Focus Marking in Khortha Affirmative, Negative, Conditional and Compound, and Interrogative Sentences

Acoustic experiments were conducted to identify the pitch contours in affirmative, negative, conditional and compound, and interrogative sentences in Khortha. The following section will give an illustration of the waveforms along with the pitch accents and intonation boundaries in each type.

1.7.1. Affirmative Sentence

a) $[(d^hund^hi)_p$ (ae rəhal ho$)_p]_{Ip}$

"The storm is coming"

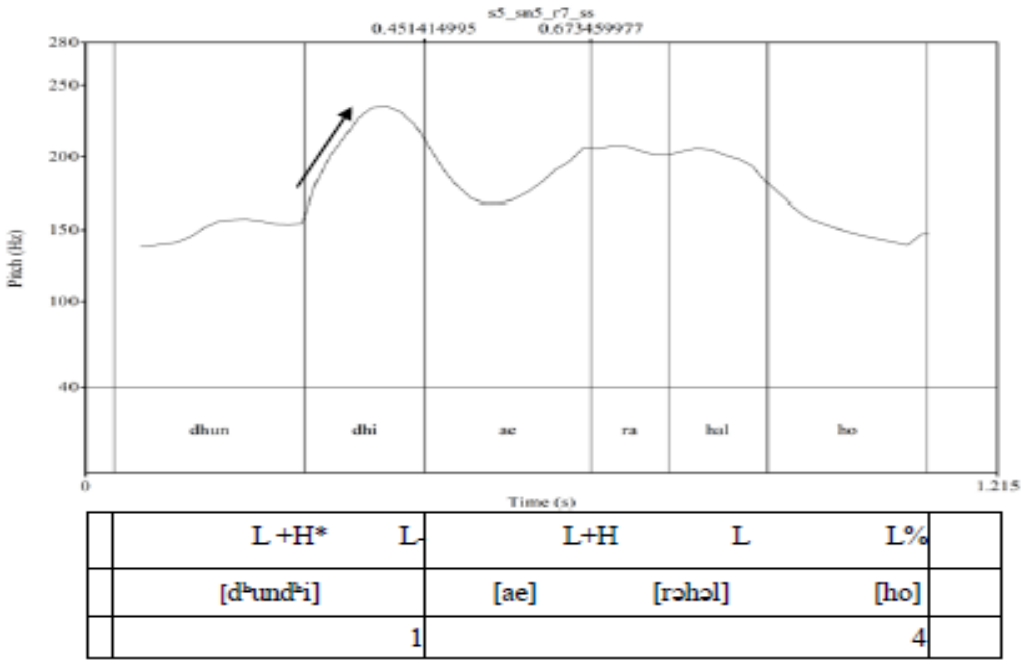


Figure 3. Waveform, F0 trace for the affirmative sentence (L+H*, L+H and L pitch accents and L% as a boundary tone)

In the above example, the bi-tonal pitch contour L+H* can be noticed at the subject position or the left periphery of the I-phrase. We can notice that the pitch rises up to 230 Hz with a slight downfall ending in a low phrasal

boundary. The pitch of the subsequent part of I-phrase rises from 160 Hz to 200 Hz with a relative downfall, ending at L % boundary tone.
The first P-phrase is annotated with the break index '1', which denotes the phrase medial word boundary, and the final intonation boundary is marked with '4', as it represents the last phrasal tone. Here, it can be noticed that the focus has been shifted to the left side of the Intonational phrase and the subject constituent of the complete phrase (d^hund^hi) is marked with a low phrase boundary tone (L-).

1.7.2. Negative Sentence

[(i həmər)$_p$ (kurija)$_p$ (naj ho)$_p$]$_{Ip}$
"This is not my house/hut"

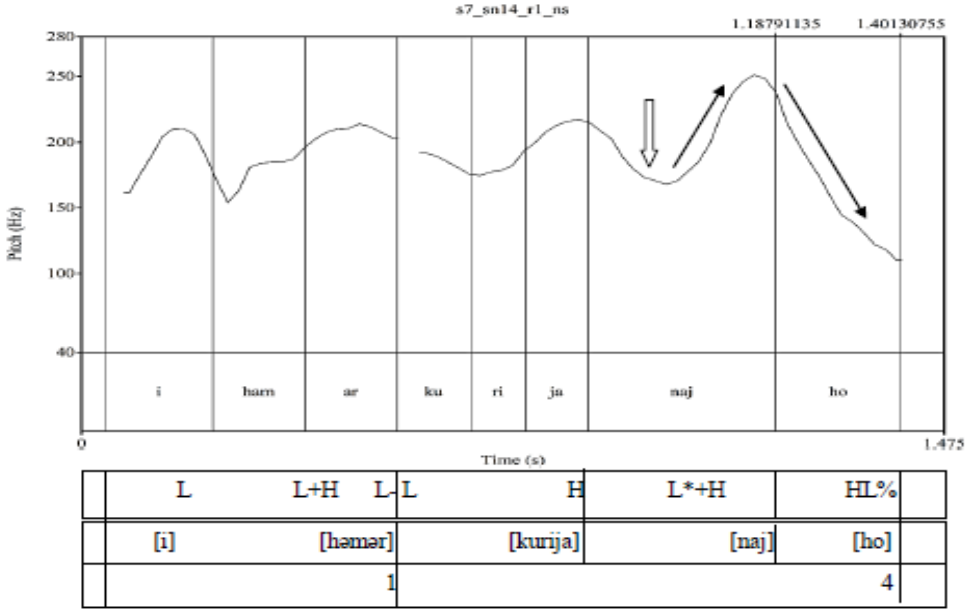


Figure 4. Waveform, F0 trace for the negative sentence (L, L+H, LH, L*+H pitch accents and HL% as a boundary tone)

In the above negative sentence, an L+H accent is noticed in the first P-phrase where a low F0 tone is followed by a slight rise, ending with a low accented phrase at the phonological phrase boundary. The second phonological phrase of the I-phrase gets a scooped accent (L*+H) where a low pitch accent is carried forward to the high pitch accent which is measured at around 250 Hz and continuing with a steep fall which is identified as an HL% boundary tone. This kind of boundary tone is noticed in the case of a response to a yes-no question. The first part of the P-phrase is annotated with the break index '1' as it denotes a word medial boundary and the final phrasal tone at the boundary is marked with '4'.

1.7.3. Conditional and Compound Sentence

[(tõe həmra pani naj deb^{h}ĩ)$_p$ (to hame ʤor se ʧĩkərbo)$_p$]$_{Ip}$
"If you don't give me the water, I will shout loudly"

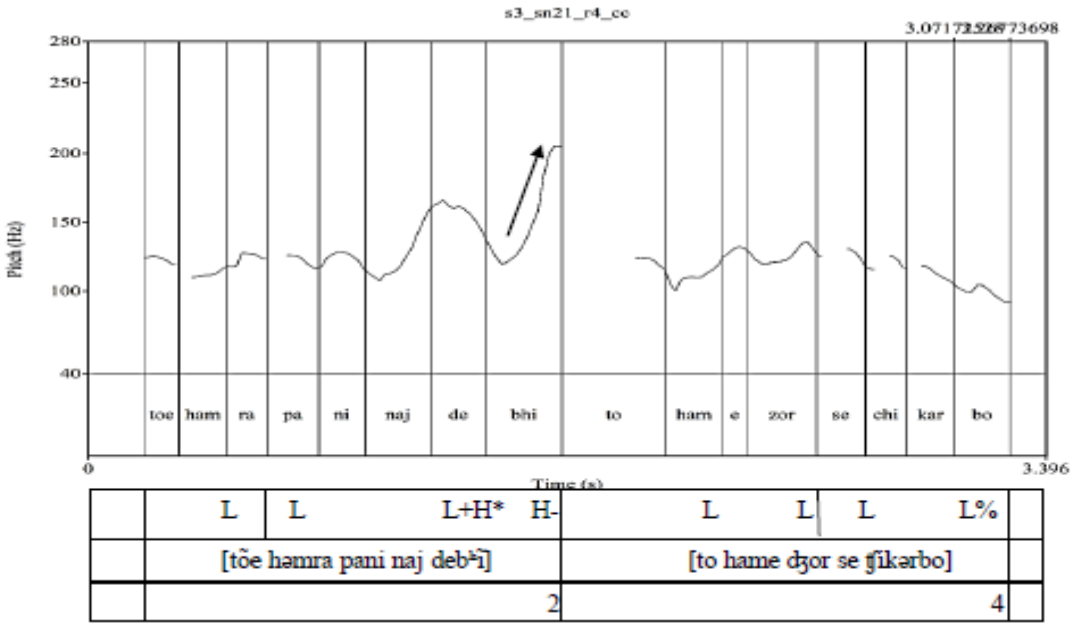


Figure 5. Waveform, F0 trace for the conditional and compound sentence (L, L, L+H*, L, L, L pitch accents and L% as a boundary tone)

For the above conditional and compound sentence, we find that there is a rising pitch accent in the left periphery of the phonological phrase where the F0 rises up to 220 Hz with a high pitch accent at the phrase boundary. The point to be noticed here is that the rightmost part of the intonation phrase realises a low tone ending in the low percent boundary tone. The break index tier for the leftmost phonological phrase is marked as '2', as there is a strong disjuncture which is marked by a pause and the final boundary is marked as '4'.

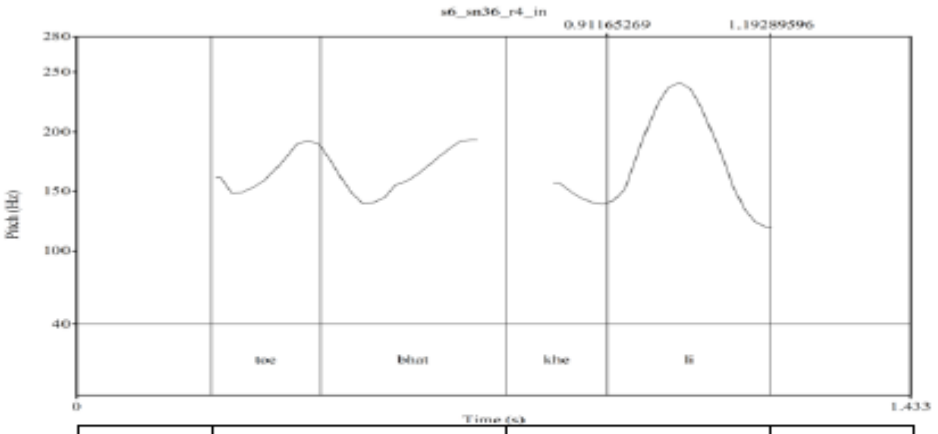
1.7.4. Interrogative Sentences

Three types of interrogative sentences were included in the questionnaire: yes-no questions, Wh-questions and confirmatory questions. The focus on the different types of interrogative sentences varies depending on their domain of modality. The yes-no questions, for instance, the domain of modality is the entire sentence. Hence, the pitch contour rises on the final prosodic word of the intonation phrase. Similarly, in the Wh-questions the highest pitch will be on the final syllable of the Wh-word. In the following section, the intonation focus in the various types of interrogative sentences will be discussed.

1.7.4.1. Yes-no Question

The yes/no questions are those questions which can be answered by yes or no and no definitive answer about a specific aspect of the question are required. The following example explains the pitch accent in yes/no questions in Khortha.

[tõe bʰat kʰelʰĩ]
"Did you eat rice?"



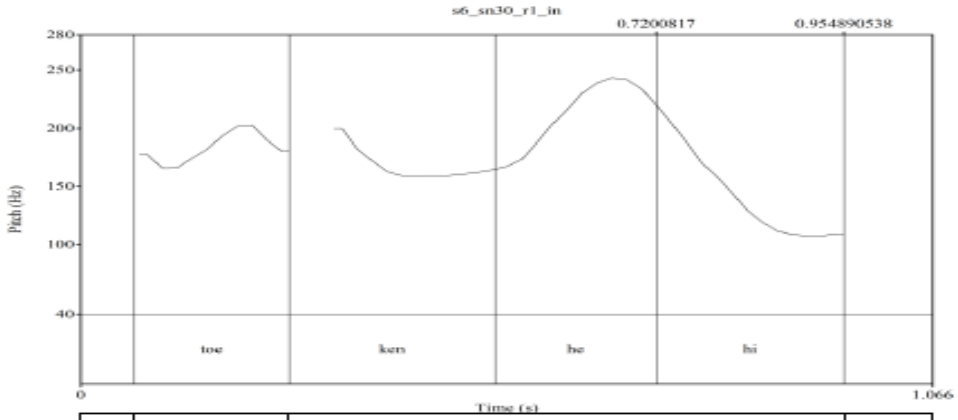
	[tõe bʰat]	[kʰelʱi]	
	L*H	L*H HL%	
	2	4	

Figure 6. Waveform, F0 trace for the yes-no question sentence (L*H, L*H as pitch accents and HL% as a boundary tone)

The above yes/no question shows a sudden rise from a low to a high pitch in the second phonological phrase marked as (L*H) marked at around 240 Hz. The final boundary tone is marked with a High-low tone. The break index tier marks the first phonological phrase as '2', as a strong disjuncture, marked by a pause, is noticed at this point; the final boundary tone is marked as '4', representing the final phrase boundary.

1.7.4.2. Wh-Question

[tõe kenhe hĩ]$_{Ip}$
"Where are you?"



	L+H	L*+H HL%	
	[tõe]	[kenhe hĩ]	
	1	4	

Figure 7. Waveform, F0 trace for the WH question sentence (L+H, L*+H as pitch accents and HL% as a boundary tone)

The above Wh-question sentence consists of two phonological phrases describing the pitch contour of the complete Intonation phrase. The accented focus is noticed at the WH element. The accented syllable lies at the right periphery of the second phonological phrase where a scooped accent with a continuous rise up to 250 Hz can be noted with no exceeding F0 valley, and finally resulting into an H pitch accent, and later a down-step to a high low boundary tone (HL%). The break index value is marked '1' for the first p-phrase with a phrase medial boundary, and '4' at the final boundary tone after the last phrasal tone.

1.7.4.3. Confirmatory Questions

The basic function of the confirmatory question is to elicit confirmation from the addressee over the whole or some part of the proposition. For measuring the pitch contour of the intonation phrases in Khortha, both these types of confirmatory questions were included in the questionnaire. The following section will consider first the confirmatory question which elicits confirmation from the addressee over a part of the proposition and then the one which elicits confirmation for the whole proposition.

A. [hame tohra se miləlijo, miləlijo na]
"I met you! Didn't I?"

Khortha, like Hindi and many Indian languages, uses 'na' as a confirmatory particle. In the above question, it is observed that the speaker wants the addressee to confirm only the idea given in the verb phrase, and which is why in the confirmatory tag only the verb phrase is repeated and is followed by the confirmatory particle.

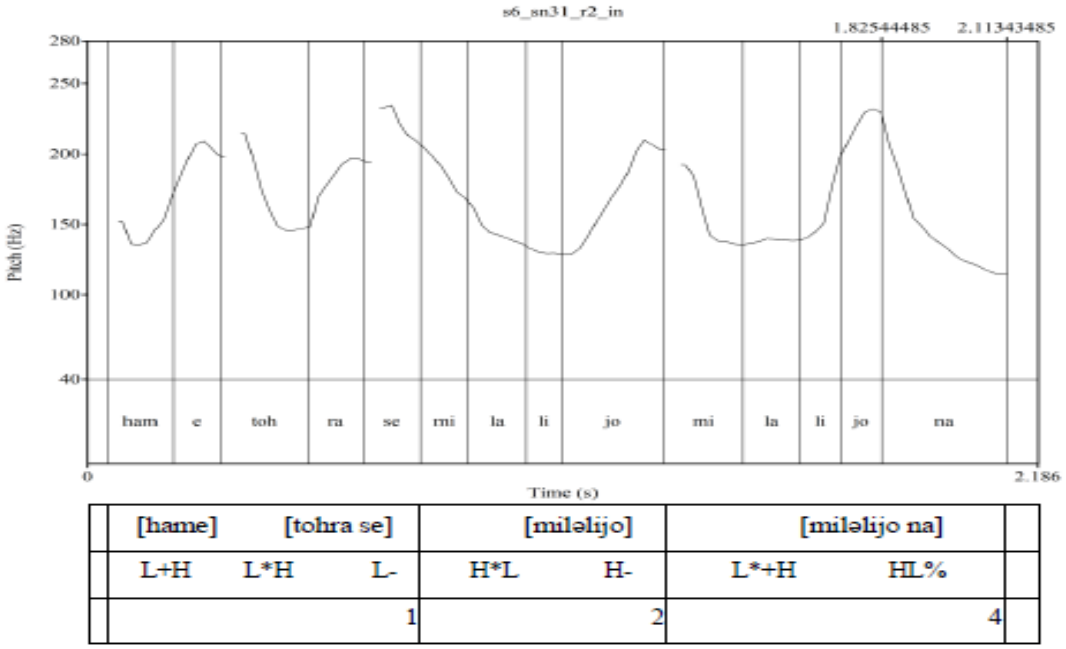


Figure 8. Waveform, F0 trace for the confirmative question sentence (L+H, L*H, H*L, L*+H as pitch accents and HL% as a boundary tone)

Here it is noticed that the third and the fourth syllable record the lowest pitch followed by a high tone, marked as L*H. The second p-phrase records the highest pitch at around 240 Hz followed with a low pitch and ending with a high tonal phrase boundary. The rightmost part of the complete phrase records a scooped pitch accent marked as L*+H. The boundary tone ends with a high to low intonation boundary. We can notice that the accented syllable in the second and third phonological phrases is marked with the highest pitch tone which is around 230-240 Hz. The break index tier classifies the first intermediate phrase as '1', as there is a phrase medial boundary. The preceding boundary is marked with '2', as a disjuncture is marked with a pause, with no tonal marks. The intonational boundary tone is marked with '4'.

B. [kʰana aʧʰa ho na]
"Isn't the food good?"

This is the second type of confirmatory question where the speaker wants the addressee to confirm the entire proposition i.e. kʰana aʧʰa ho (the food is good) and hence the confirmatory particle 'na' is placed after the whole proposition.

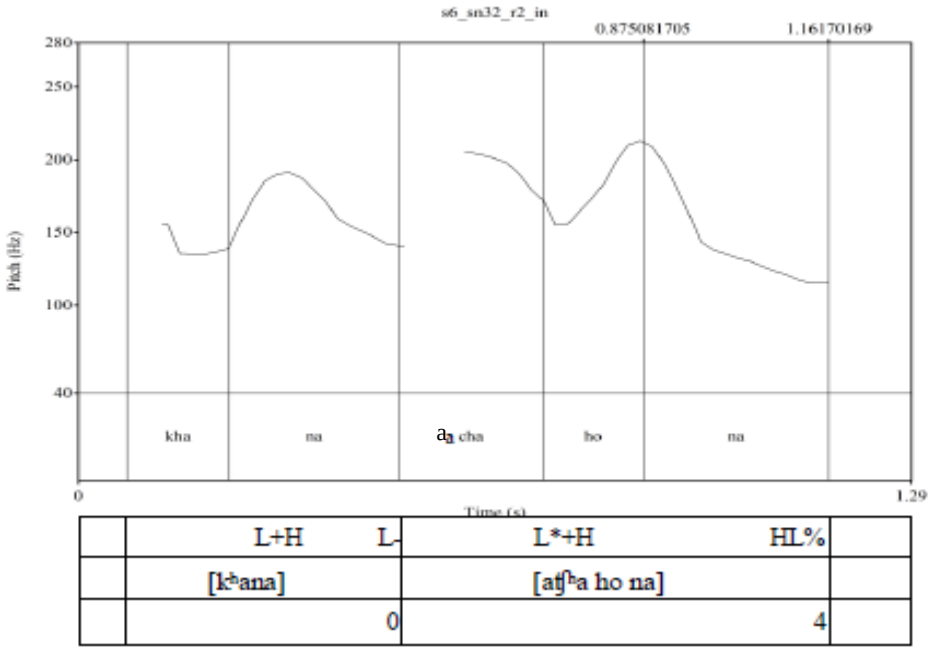


Figure 9. Waveform, F0 trace for the confirmative question sentence (L+H, L*+H as the pitch accents and HL% a boundary tone)

The third variety of the interrogatives is another type of confirmatory question where the speaker is expecting a confirmation about some aspect of the given proposition. This type of confirmative questions carries higher pragmatic value. In the given sentence the speaker is expecting the addressee's confirmation about the quality/taste of the food. In the sentence, regarding the break index tier of the pitch accents, a few important observations can be noted:

i. Following ToBI, since '0' can be marked 'for the cases of clear phonetic marks of clitic groups', in the given sentence, depending on '0' marking. 'kʰana' 'aʧʰa' forms a clitic group, because the vowel of the second syllable in 'kʰana' stretches to the next syllable, i.e. the first syllable of 'aʧʰa', forming a clitic group.

ii. In the example, the clitic group is dividing the entire intonation phrase into peripheries: left and right.

iii. A scooped pitch accent is recorded in the second phonological phrase where the lowest pitch accent is followed by a high pitch accent. Finally, the pitch accent ends up with a high low boundary tone, marked as '4', as the final phrase tone on the break index tier.

1.7.5. Object Focus Sentence

[hame dəvaija kinəlije]
"I bought medicine"

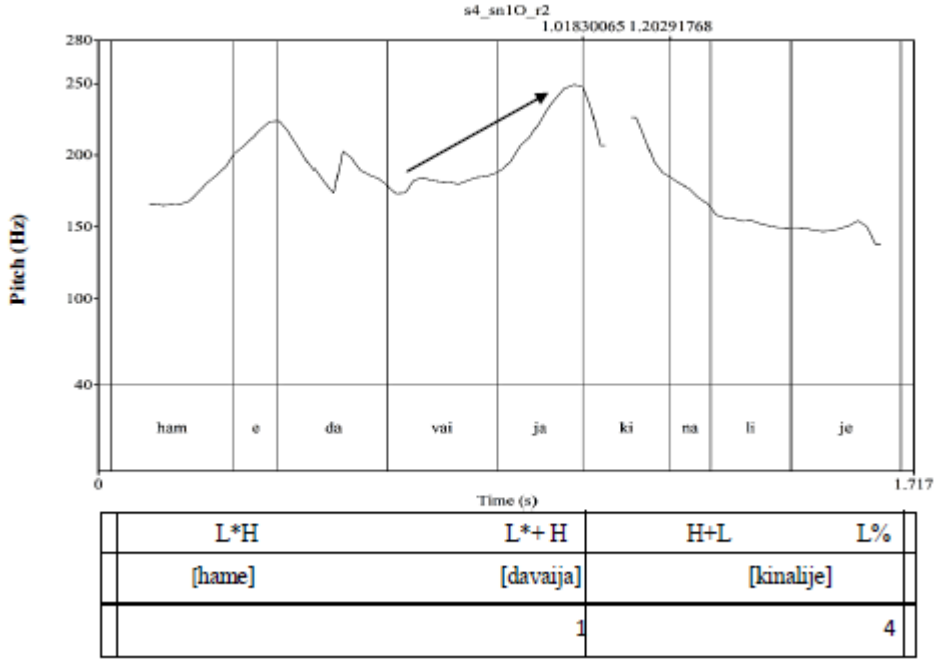


Figure 10. Waveform, F0 trace for the object focus sentence (L*H, L*+H, H+L as the pitch accents and L% as the boundary tone)

The above sentence is an 'object focus' because it shows an accentual pitch on the object /dəʋəija/. In the first phonological phrase, a rise in the pitch is noticed at around 230 Hz and 250 Hz, resulting in L*H and L*+H respectively. The focused pitch accent (L*+H) is at the nucleus position with the pitch rising up-to 250 Hz, without a further rise in the F0 valley. After 250 Hz, the pitch falls down to a low, resulting in a low boundary tone marked as L%. The break index tier '1' is indicated in the first phonological phrase at the medial word boundary, and the final intonation boundary tone ends at the juncture marked with '4'.

1.7.6. Subject Focus sentence

[hame dəvaija kinəlijo]
"I bought medicine"

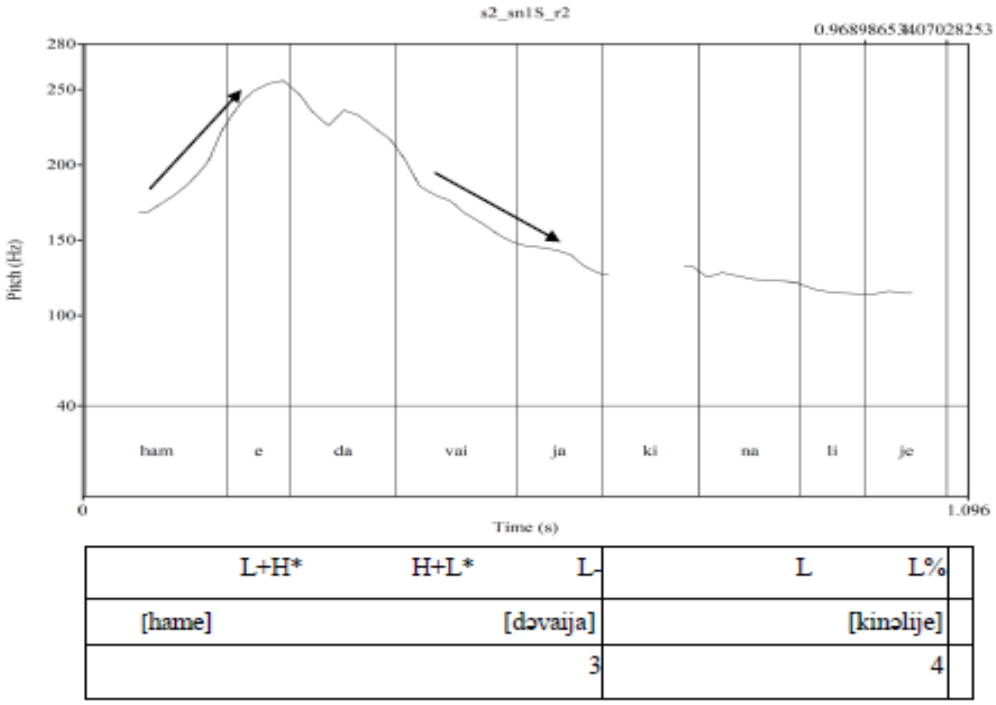


Figure 11. Waveform, F0 trace for the subject focus sentence (L+H*, H+L*, L as the pitch accents and L% as a boundary tone)

The sentence is a 'subject-focus' sentence because the accentual pitch falls on the subject /hame/. The highest and the lowest pitch values occur in the first phonological phrase, i.e. the left periphery of the intonation phrase. The highest F0 is marked at around 250 Hz, and the lowest F0 is marked at around 140 Hz, ending with a low phrase boundary. The intonation boundary is marked as a low boundary tone. The break index tier, marked with '3', occurs at the first phonological phrase boundary, and '4' at the final intonational boundary. The index tier value '3' marks the phonological phrase boundary, as a low phrase (L-). In the sentence, the phonological phrase boundary falls on /dəʊaija/, and the corresponding single phrase tone 'L affects the entire following region until the final intonation boundary.

1.7.7. Wide Focus sentence

[hame dəvəija kinəlijo]
"I bought the medicine"

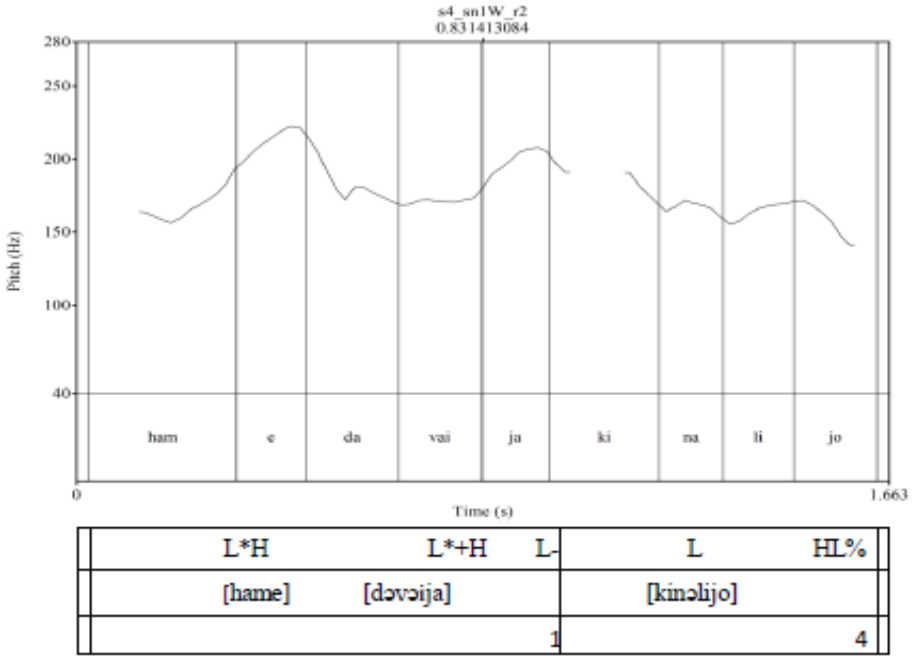


Figure 12. Waveform, F0 trace for the wide focus sentence (L*H, L*+H, L as the pitch accents and HL% as the boundary tone)

In the case of a wide focus sentence, we noticed that the pitch contour within the first phonological phrase is constantly rising from low to high pitch. The pitch accent right before the second phonological phrase records a scooped accent which follows a low phrase boundary tone marked as L-.

The later half records a low pitch contour, ending in a low percentage boundary tone. The break and index tier marks the first phonological phrase with '1' highlighting the phrase medial boundary, and the final intonation boundary tone is marked with '4'.

1.7.8. Conclusion

From all the focus-accented intonation phrase patterns, it can be noticed that the subject focus element recorded the highest F0 at around 250 Hz marked as L+H*. The object focus element also recorded a relatively higher F0 at around 250 Hz but the preceding tone marked as the lowest F0 (L*) with a continuous stretch results in a scooped L*+H bitonal accent. The lowest pitch (F0) is marked in the left periphery of the intonation phrase in the object focus and wide focus sentences. In the subject focus intonation phrase, the lowest pitch is marked just before the low phrase boundary marked as L-. The lowest pitch is measured around 150 Hz to 160 Hz. The boundary tones for the subject and object focus intonation phrases were recorded as L% whereas the wide focus intonation phrase was recorded as HL%.

The significant observations regarding the pitch contour of the sentences given in the questionnaire i.e., affirmative, negative, conditional/compound and the various types of interrogative sentences can be reviewed here.

(a) The highest F0 pitch accent can be noticed at the left periphery of the intonation phrase ending with the L% boundary tone. The peak of the pitch followed by a down-step is recorded at around 230 Hz. This result is noticed only in the case of affirmative sentences.

(b) In the case of negative sentences, the intonation phrase which highlights the negation property is marked with a scooped accent (L*+H). It is noticed that the boundary tone is marked as HL%, signifying a high tone followed by a low. The break index tiers are identical in the case of both affirmative and negative sentences. The first phonological phrase in both is marked by '1', indicating a phrase medial word boundary, and the full intonation phrase boundary, after the last phrasal tone, is marked as '4'.

(c) The conditional and compound sentences hold the highest pitch value at the first phonological phrase at around 220 Hz, with a high pitch accent at the word medial boundary. The boundary tone is realised as a low percent tone and the break index of the first phonological phrase is '2', which shows a strong disjuncture with a pause. Thus, the break index tier of the first phonological phrase here is different from that of the negative sentences, where it is marked as '1'. In conditional/compound sentences it is also noticed that the F0 lies at around 100 Hz to 220 Hz, which is the lowest F0 recorded among all type of sentences.

(d) Under the interrogative sentences, we found that the yes-no question starts with the lowest F0 with a slight rise in the pitch which is marked as L*H. Whereas, in the case of Wh-questions and confirmatory questions the intonation phrase starts with a low pitch accent with a stretch ending in a high pitch tone marked as L+H. Further, we found a scooped pitch accent (L*+H) in both the cases where the stress is highlighted.

A down-step resulting in a high to low intonation boundary tone (HL %) is marked in all the interrogative sentences.
The Wh-question records the F0 at 270 Hz which is the maximum of all types of interrogative sentences.
A '0' in the break-index tier is noticed only in the type B sentences of the confirmatory questions which indicate that a clitic group is phonologically dependent to another word or phrase.

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