A Preliminary Analysis of Lebanese Arabic Intonation

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1. Introduction

This paper aims at describing the intonational patterns occurring in Lebanese Arabic. The dialect used is the one spoken in Tripoli. No study of Lebanese Arabic intonation (let alone the Tripoli dialect) has been previously carried out. Research on other varieties of Arabic is either impressionistic (ex. Haydar and Mrayati, 1985) or uses the British school tradition of intonational description (ex. Rammuny, 1989; Alharbi 1991; and Kharrat 1994). The framework adopted in the present study, on the other hand, is the Autosegmental-Metrical (AM) model of intonational phonology. The theory recognizes four major components for describing intonational patterns: Tonal composition or tune, relative prominence, phrasing, and pitch range[1].

The present paper concentrates on the tonal component of intonation description in Lebanese Arabic. It is outlined as follows: Section 2 summarizes the relevant tenets of the Autosegmental-Metrical theory as they apply to English. Section 3 gives a general description of the intonational typology of Arabic. Section 4 briefly outlines the data material used. Section 5 characterizes the various tunes found in the language recognizing an additional downstepping contour not identified in an earlier analysis of Lebanese Arabic tunes conducted by the present author (Chahal, to appear). Section 6 attempts to motivate some of the tonal categories preliminarily posited for the language on phonetic and phonological grounds. At this stage of investigation however, the pitch accent inventory should be interpreted as a description of the maximal number of *potentially* contrastive pitch accents.

2. Theoretical Framework

The Autosegmental-Metrical (AM) model of intonational phonology was first developed by Pierrehumbert (1980). It appeared in various revised versions (Beckman and Pierrehumbert, 1986; Pierrehumbert and Beckman, 1988; and Pierrehumbert and Hirschberg, 1990), the most recent manifestation of which is the ToBI transcription system (Silverman et al., 1992; Beckman and Ayers, 1994). The AM approach differs from other intonational theories on various theoretical points. It recognizes two distinct types of tonal events, those

[1] For an elaborate review of the AM model, refer to Ladd, 1996.

associating to rhythmically strong syllables, denoting the relative prominence pattern of an utterance (*pitch accents*), and those marking the edges of constituent phrases (*edge tones*).

2.1 Pitch Accents and Relative Prominence

The latest AM version —ToBI (Beckman & Ayers, 1994)— recognizes six pitch accent types for English: the monotonal H*, L* and !H* and their bitonal counterparts: H+!H*, L*+H, L+H*. The starred tones are associated with a metrically strong or stressed syllable. Phonetically, these starred pitch accents normally coincide with the temporal span of the stressed syllable to which they are associated. In bitonal accents, the starred tone appears on a stressed syllable whereas the other tone either precedes (leads) or follows (trails) the former at some fixed temporal distance without being associated to a particular syllable. The motivation for positing bitonal pitch accents in the AM approach derives from the importance of tonal alignment differences in the phonological characterization of pitch accents (see Bruce, 1977).

Pitch accents serve a "prominence-lending" function (Beckman, 1986, 1996). They contribute to the relative prominence pattern of an utterance. Among pitch accents, the last pitch accent in a phrase, the nuclear accent, carries the highest prominence in that phrase. Lexically determined prominence (i.e. lexical word stress or primary stress) also contributes to the relative prominence pattern of an utterance. These "stressed" syllables prove crucial to intonational description since they form the potential landing site for pitch accents.

2.2 Edge Tones and Phrasing

Unlike pitch accents, which reflect prominence patterns of the utterance by associating to certain stressed syllables, edge tones reflect the constituency phrasing levels through their association to the edges of prosodic levels or domains. They form "non-prominence lending pitch movements occurring at ends of phrases" and are "completely indifferent to the location of lexical stress" (Ladd, 1996). Edge tones thus serve a purely "delimitative function" (Beckman, 1996).

Pierrehumbert's taxonomy distinguishes two phrasing levels in English: the intermediate and intonational phrases. The intermediate phrase is a prosodic constituent occurring right beneath the intonational phrase. It is composed of a group of words bearing at least one pitch accent. The edge tone appearing at intermediate phrase boundaries is called a phrase accent. It controls the pitch shape between the last pitch accent of the intermediate phrase and the beginning of the next one. Conventionally, phrase accents are represented as H- or L-. The intonational phrase forms the highest level in the prosodic constituency hierarchy. It consists of one or more intermediate phrases. The edge tones appearing at the intonational phrase level are called boundary tones and are conventionally represented as H% or L%. These tones are phonetically

realized at the right edge of the phrase and are aligned with the last few unstressed syllables in that phrase. According to the Strict Layer Hypothesis (Nespor & Vogel, 1986), an intonational boundary coincides with an intermediate phrase boundary at the end of an utterance. This is why the tonal configuration at the ends of intonational phrases is complex- it is composed of two edge tones.

3. General Intonational Typology of Arabic

Arabic is an intonational language. It uses pitch post-lexically to give a certain meaning to the utterance as a whole. Arabic is also similar to the description of English outlined in §2 above, in that it displays tonal events which lend prominence to certain stressed syllables, and others which mark phrase edges. Both of these elements must be present in an intonational constituent. Arabic is thus different to other languages like French or Bengali, which may lack prominence-marking tones in an intonational phrase.

With respect to prominence lending tonal events, Arabic is a stress-accent language par excellence. The primary stress assignment of the Lebanese dialect follows the following rules:

i. Stress the ultimate syllable if it is a superheavy syllable (i.e. a CVVC[2]).
Ex. *jnai.**neet*** 'gardens', *xa.**liij*** 'gulf'.
ii. Otherwise stress a heavy penultimate syllable (CVV or CVC)[3].
Ex. *bi.**dee**.ye* 'starting point', *mes.**taw**.daE* 'warehouse'.
iii. Otherwise stress the antepenultimate (whether heavy or light).
Ex. ***mad**.ra.se* 'school', ***da**.ra.su* 'they studied'[4].

It is to these primary stressed syllables that pitch accents associate.

As to the edge-marking tones, Lebanese Arabic displays clear tonal configurations occurring at the edge of phrases pertaining to the two levels of intonational phrasing described for English. Both pitch accents and edge tones will be discussed in greater detail below.

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[2] Superheavy syllables (CVVC and CVCC) occur word-finally only. The Tripoli dialect of Lebanese Arabic does not permit CVCC syllables because it prohibits consonant clusters from occurring word-finally. It inserts a vowel in between the consonant cluster of a CVCC syllable and treats the superheavy syllable as a sequence of two syllables (CV and CVC) for the purposes of lexical stress assignment. Ex. **fta**.Het 'I opened', **shre**.bet 'I drank' (other dialects realize these as fa.taHt and shrebt).

[3] Disyllabic words having a non-superheavy ultimate, and a non-heavy penultimate, will still stress the penultimate.

[4] Apparent exceptions to the above rule of stress assignment involve morphologically complex words where stress assignment applies cyclically. Consult Kager (1995), Brame (1971) and Kiparsky (1979) among others for more information.

4. Material

The data presented in this paper consist of: (i) Two laboratory experiments (controlling for segmental effects and varying lexical stress and nuclear accent location) recorded by two speakers (one male and one female). (ii) One map-task dialogue, in which two other speakers of different genders participated. The data was digitised at 22KHz on a Sun workstation using Waves+. The corpus was segmentally labelled (using standard segmental criteria ex. Peterson and Lehiste, 1960) and transliterated based on El-Imam (1990) (see Appendix A). A ToBI-style transcription of the data was also carried out. The following section reports on the findings obtained based on this transcription and tries to motivate some of these results both phonetically and phonologically. The figures in Appendix B represent sample illustrations of the posited categories.

5. Main Lebanese Arabic Tunes

Five major contours occur in the current corpus:

Declarative tunes: declarative tunes in Arabic show a falling configuration at the edges of phrases, combined with minimally one high pitch accent (figure 1). In the controlled data set, this tune displays a typical hat pattern (figure 2), involving two high pitch accents one at the beginning and one at the end of the phrase (the latter bearing the most prominence).

Question tunes: question tunes in Lebanese Arabic (yes/no and wh-questions) consist of a high rising edge configuration, which is usually preceded by low pitch occurring on the nuclear accented syllable (figure 3). The nuclear accented syllable, however, can also display a rising configuration (figures 4 and 5). (see section 6.1 for an elaboration on these accents).

Continuation tunes: these types of tunes consist of a falling rising edge. They denote that a proposition is not finished and a continuation is in order. This edge sequence can combine with various nuclear pitch accents, including H* and L* (both illustrated in figure 6). The latter contour (with a preceding low nuclear pitch accent) is more stylized than the former, adding a nuance of extra politeness to the continuation.

Plateau tunes: this tune illustrates an edge pitch configuration which remains at mid level in the speaker's pitch range (figure 7). It can combine with various nuclear accents, the most common of which is a simple high pitch accent. The tune is usually used when speakers are thinking about their proposition while at the same time uttering it.

Downstepping tunes: some pitch accents occurring in what is mainly a falling tune display a local phonological pitch range effect called downstep. These high peaks are realized lower in the pitch range than expected from the general

phonetic effects of declination. They are normally preceded by a bitonal accent (figure 8).

Some !H* accents are preceded by a high prehead, i.e. by a period of high pitch not associated with a previous pitch or phrase accent. However, it is not clear whether this H+!H* accent, which also occurs in falling contours (figure 9), constitutes a tonal contrast with the monotonal !H* counterpart and denotes a separate tune.

6. The Tonal Inventory of Lebanese Arabic

Whereas the preceding section introduced the general tunes found in the corpus, this section outlines the possible tonal inventory of Lebanese Arabic based on this corpus. The Lebanese Arabic edge tone inventory resembles that proposed for English. It displays the two tonally-marked and phonologically distinct levels of phrasing analysed for English: the intermediate phrase and the intonational phrase.

The pitch accent inventory of Lebanese Arabic reveals six types of pitch accents also found in English. An extra H*+L accent is added, which has been abandoned in ToBI and which has not been recognised in an earlier investigation of tonal inventory conducted by the author (Chahal, to appear). It is crucial to note however, that the pitch accent inventory posited here is preliminary in that it displays the maximal number of *potentially* contrastive pitch accents. Further examination of paradigmatically different tunes in Arabic is needed before the inventory is pruned to the precise phonological contrasts. Future research should show that the selection of a particular pitch accent type from the posited pitch accent inventory and its subsequent insertion in nuclear position (with a particular edge tone sequence), will yield a categorical difference in the interpretation of the resulting tune.

6.1 Pitch Accents

The pitch accents observed so far in Lebanese Arabic are: H*, L+H*, L*, L*+H, !H*, H+!H* and H*+L. The phonetic realization of each and the phonological motivation for some of them are described below:

H*: is a simple tone target realized as a high peak, starting from a speaker's middle range. The peak usually occurs within the temporal span of the accented syllable (figure 6). H* is an unmarked accent abounding in the corpus.

L+H*: the bitonal counterpart of H*, corresponding to a sharp rise from a low point in the speaker's range to a high peak featured on the accented syllable (figure 8). This accent is often realized in an expanded pitch range suggesting that it is a marked pitch accent type.

In utterance initial position, L+H* is ambiguous with a simple H* accent (especially when sonorant segmental material is lacking) which might

discount its analysis as a separate phonological category. However L+H* does contrast with H* phrase-medially and finally. In the first intermediate phrase of figure 3 for example, in the word "lawwan", the pitch clearly falls to an L target on the onset of the accented syllable, before rising quickly to a peak on the rhyme of that syllable. Notice that "leezem" and "t?uul" also receive an L+H* analysis even though the peak in each case is not scaled as high as that in "lawwan". This is to prove that L+H* is not just an emphatic H* accent, i.e. a gradient realization of H*, but a separate phonological category which itself can be gradiently manipulated by emphasis effects.

Another evidence for the bitonal status of these rising accents lies in the following: Downstep has so far been observed only in the environment of a preceding bitonal accent (ex. figure 8). In line with Pierrehumbert and Beckman (1988), this is taken to mean that downstep in Lebanese Arabic is a *phonological* process (distinct from *phonetic* declination) which can only be triggered by a particular phonological category, namely bitonal accents[5].

L*: is a simple tone target realized as low in the speaker's pitch range. This tone is especially obvious in yes/no question contours, marking a clear valley or low plateau before a rise at the intonational phrase boundary (figure 3).

L*+H: the bitonal counterpart of the L* consists of a valley followed by a sharp rise. The L* valley usually corresponds to the onset of the accented syllable or the initial part of the rhyme whereas the latter part of the accented syllable carries the rise (figure 4). This phonetic configuration lends an L*+H pitch accent analysis. Yet this accent is so far observed only in yes/no question contours, preceding an H-H% intonational boundary. In this environment, it is often ambiguous with (i) an L+H* accent due to uncertainty in tonal alignment (figure 5) or (ii) a simple L*, the rise on the latter part of the accented syllable possibly constituting a simple interpolation to the H-H% edge. It is still unclear whether Lebanese Arabic categorically contrasts between the L+H* and L*+H in this position or whether L*+H is a phonetic variant of an underlying L*. L*+H gives a nuance of a more involved question than L+H* but shades of meaning cannot solely be relied on as determinants of phonological category. The accent is retained until further evidence determines its phonological status.

!H*: a lowered peak following a previous high peak, usually realized in the middle of a speaker's pitch range (see figure 8). The downstepped peak is significantly more lowered than a peak which is affected by declination. It only occurs after a bitonal accent. Following Pierrehumbert and Beckman (1988) downstep is a phonological process triggered by a bitonal accent.

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[5] Pierrehumbert and Beckman (1988) derive this analysis from African languages.

H+!H*: a step down on an accented syllable from a preceding high pitch, whereby the latter cannot be attributed to an H- phrase boundary or a preceding H* accent (figure 9). It is not yet evident whether this category creates a paradigmatically different tune when combined with various edge tone sequences. It is certainly less common than !H* (of which it might be a variant) but does occur in several intonational phrases in the map task dialogue.

H*+L: a peak realized in the middle of the speaker's range followed by a fall (figure 10). ToBI does not recognize H*+L because the accent is not regarded as phonetically (or phonologically distinct) from H* L-L%. This is why this accent was transcribed as H* in Chahal (to appear). However, in the current corpus, these particular bitonal accents are always followed by a downstepped !H*, as opposed to other monotonal H* accents which are not. In order to make the downstep trigger transparent and in order for the transcription to be phonetically consistent, the earlier abandoned notation H*+L is again adopted here. However more analysis is needed to determine the precise phonological status of this accent.

6.2 Edge Tones

Two tonally marked levels of phrasing are identified for Lebanese Arabic: An intermediate phrase level and an intonational phrase level.

The two phrase accents delimiting the edges of intermediate phrases in Lebanese Arabic are:

L-: a low phrase tone, which controls the pitch between the last pitch accent and the edge of the intermediate phrase. If this stretch is not large, a fall of pitch to a low part in the speaker's range will be observed (figure 1). If the stretch is long, L- creates a flat valley stretch between the nuclear and the edge of the intermediate phrase (see figure 11).

H-: a high phrase tone, which usually creates either a plateau-like region, or a slightly rising pitch for the stretch between a nuclear accent and the edge of the intermediate phrase (figure 1). The rising pitch shows evidence for the 'upstep' triggering function of the H- phrase (see figure 12 and 7 for the effect of H- on H% and L% respectively).

The two boundary tones demarcating the edges of intonational phrases are L% and H%. Intonational phrases are formed of at least one intermediate phrase. The last intermediate phrase occurring in an intonational phrase will have its phrase accent followed immediately by the boundary tone. In other words, the last intermediate phrase accent combines with the intonational boundary tones to yield the following configurations: L-L%, L-H%, H-H% and H-L%.

L-L%: this tonal sequence is realized either as a gradual fall to the lowest part of the speaker's pitch range (see figure 8) or as a low stretch of pitch at the edge of

the intonational phrase (see figure 11). The difference between these two shapes could be attributed to the effects of final lowering. It is expected that in the case of the gradual fall, the pitch is falling further to indicate some sense of finality, whereas in the second instance the pitch stays level and the sense of finality is not achieved. It is yet unsure whether the absence or presence of final lowering yields an intrinsic difference in meaning. It is also uncertain whether final lowering is local to intonational phrases with L-L% or whether it is belongs to higher domains of discourse.

L-H%: this tonal sequence represents a fall to a low part of the speaker's range followed by a rise. It is typical of continuation rise contours (see figure 6).

H-H%: this sequence consists of a high intermediate phrase tone which upsteps the following H% boundary tone to an even higher pitch than that reached by the L-H% boundary tone for example (compare the value of H% in figure 12 with that in figure 6).

H-L%: this sequence represents a high phrase accent, which is followed by an L% boundary tone. However, due to the upstep function of the H- phrase accent, the L% boundary is not realized as low as it normally would. The H- phrase accent upsteps the level of the L% boundary, causing the contour to stay flat, in a plateau-like shape, at mid-pitch level (figure 7).

6.3 Evidence for Two Levels of Phrasing

An intonational level of phrasing in Lebanese Arabic is quite evident. Various obvious tonal configurations or excursions occur at the edges of these phrases. Their boundaries are also perceived due to other phonetic cues such as preboundary lengthening and pausing.

The presence of an intermediate phrase constituent in Lebanese Arabic is more controversial. However, evidence for this level stems from both phonological and phonetic facts. Consider the sentence *layla Eallamet riima Eala ssellum (e)Ttawiile (l)yoom* uttered with a question tune and with narrow focus on the verb *Eallamet* (figure 12). The nuclear accent on "**Eal**" in "Eallamet" is analyzed as L+H* since a low tone target (featured on the onset of the accented syllable) precedes the peak (which occurs on the rhyme of that syllable). Notice however that the pitch keeps rising until the end of the verb, after which it stays on a high level until the end of the phrase where it rises again for the final intonational boundary.

The tonal mark or the rise apparent at the end of the verb cannot be relegated to a pitch accent prominence firstly because phonologically and perceptually the syllables following the nuclear accent are not accented. Secondly, the rise occurs on the final **un**stressed syllables in the word ([lamet] in "**Eal**lamet")- an infelicitous site for pitch accents. It could be argued that the nuclear accent is an instance of an L*+H making the floating H tone responsible for the perceived rise. However this is also an improbable argument because it is the rise, and

not the valley, that occurs on the rhyme of the stressed syllable, rendering an L* analysis phonetically unaccountable. Furthermore, the rise witnessed in the present example extends over three whole syllables—a timing relation which does not support an L*+H analysis (the tones of which occur in close proximity of each other).

The observed rise cannot equally be attributed to an intonational phrase boundary. If an intonational phrase boundary is posited at the end of the verb, how is the stretch of speech following the verb till the end of the utterance explained? One could argue that the latter constitutes another intonational phrase. However, no word in this stretch receives a pitch accent. In other words, the resultant constituent would be an intonational phrase which is not headed by a nuclear accent - the kind of intonational phrase which is found in French for example. This analysis contradicts all theories of Lebanese Arabic being an intonational stress-accent language, having head-marking tones. It is therefore also rejected. The only explanation of the observed behaviour of pitch movement is that there is an intermediate level of phrasing, the edge of which this perceived high tone is marking.

Phonetic evidence confirms the above phonological proposal for an intermediate versus an intonational level of phrasing in Lebanese Arabic. Intermediate phrases, like intonational phrases, are cued by a sense of disjuncture and phrase-final lengthening. However these are systematically less strong than those perceived on intonational phrases. Work in progress carrying out statistical measurements of these phenomena so far supports the difference in boundary strength between the two phrase types.

7. Conclusion

In this paper the tonal inventory of Lebanese Arabic is examined according to controlled and map-task data. Seven pitch accent types and two levels of tonally marked phrasing are recognized. The edge-marking tones are motivated phonetically and phonologically. The pitch accent inventory on the other hand should be interpreted as describing the maximal potentially contrastive pitch accents in the language. Where a phonological contrast has been decided, it was noted in the discussion. However a finer phonological analysis determining the other pitch accent contrasts in Lebanese Arabic is still needed and is in progress.

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Appendix A: Transliteration System
Adopted from El-Imam (1990).

Symbol	Articulation
h	voiced glottal fricative
?	glottal stop
E	voiced pharyngeal approximant
H	voiceless pharyngeal approximant
g	voiced uvular fricative
q	voiceless uvular stop
x	voiceless velar fricative
k	voiceless velar stop
sh	voiceless post-alveolar fricative
j	voiced post-alveolar fricative
r	voiced alveolar trill
y	voiceless palatal fricative
z	voiced alveolar fricative
Z	voiced alveolar emphatic fricative
s	voiceless alveolar non-emphatic fricative
S	voiceless alveolar emphatic fricative
d	voiced dental non-emphatic stop
D	voiced dental emphatic stop
t	voiceless dental non-emphatic stop
T	voiceless dental emphatic stop
f	voiceless labio-dental fricative
b	voiced bilabial stop
m	voiced bilabial nasal
n	voiced alveolar nasal
l	voiced alveolar lateral
w	voiced labio-velar approximant
u	high back rounded vowel
o	mid high back rounded vowel
i	high front unrounded vowel
e	mid high front unrounded vowel
a	low front unrounded vowel

Appendix B: Figures

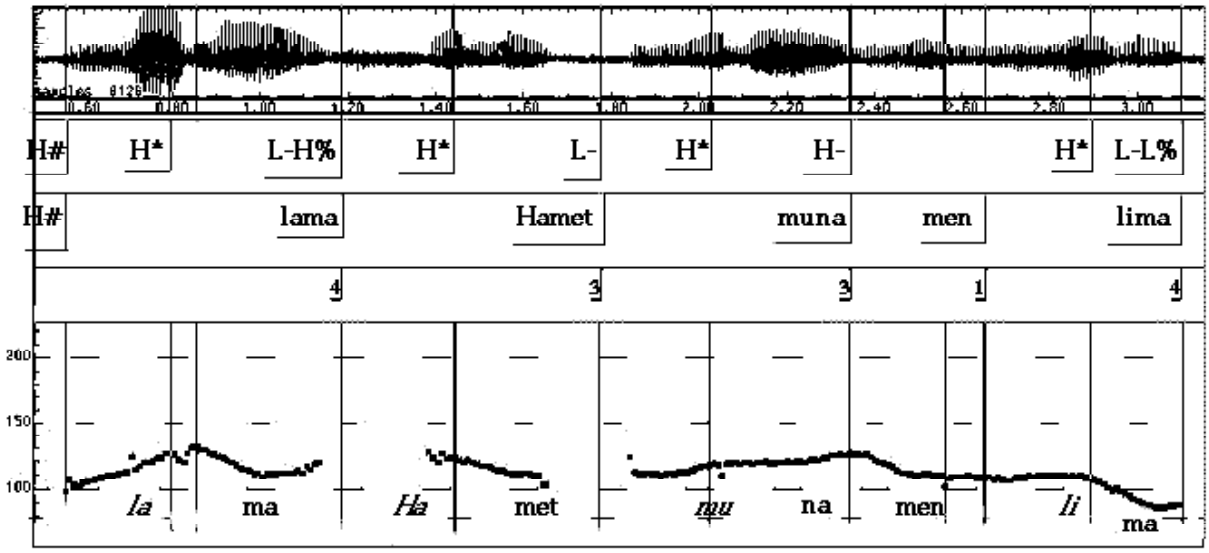

Figure 1. *//lama Hamet muna men lima//* ("Lama protected Muna from Lima"). This figure illustrates an L- boundary controlling a short stretch of speech (the first intermediate phrase in the second intonational phrase), an H- boundary triggering upstep (the second intermediate phrase in the second intonational phrase), and an H* L-L% declarative tune (final phrase).

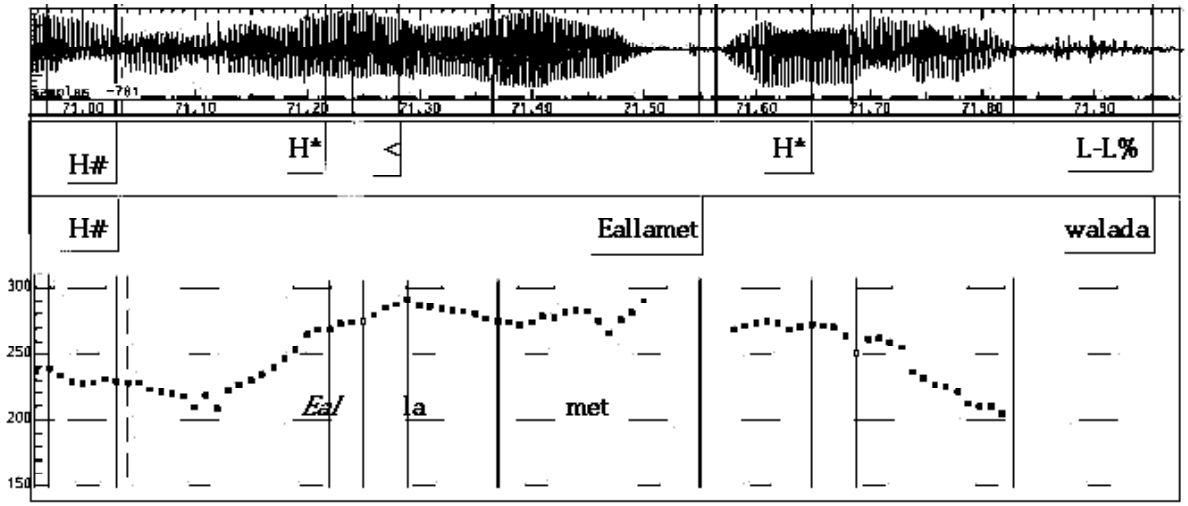

Figure 2. *//Eallamet walada//* ("she taught her child"). An instance of a hat pattern declarative tune (H* H* L-L%).

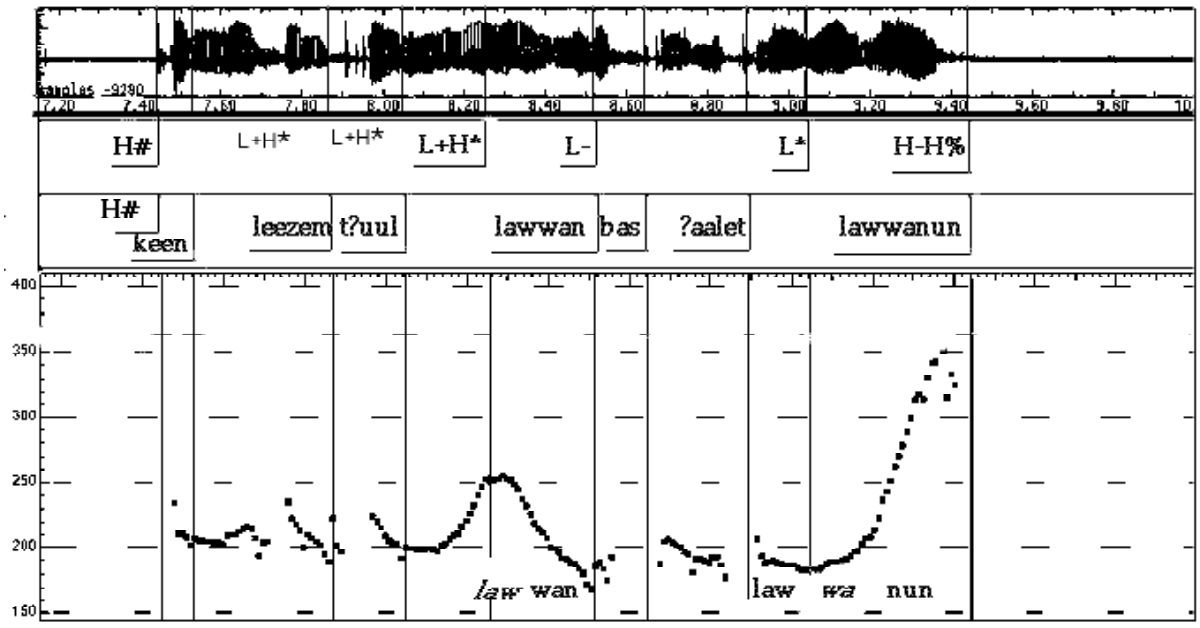

Figure 3. *//keen leezem t?uul lawwan/bas ?aalet lawwanun//* ("Was she meant to say "he coloured"/ but instead said "he coloured them"?). The first intermediate phrase illustrates an instance of L+H* accents. The second illustrates an instance of an L* accent followed by an H-H% boundary, a typical question tune.

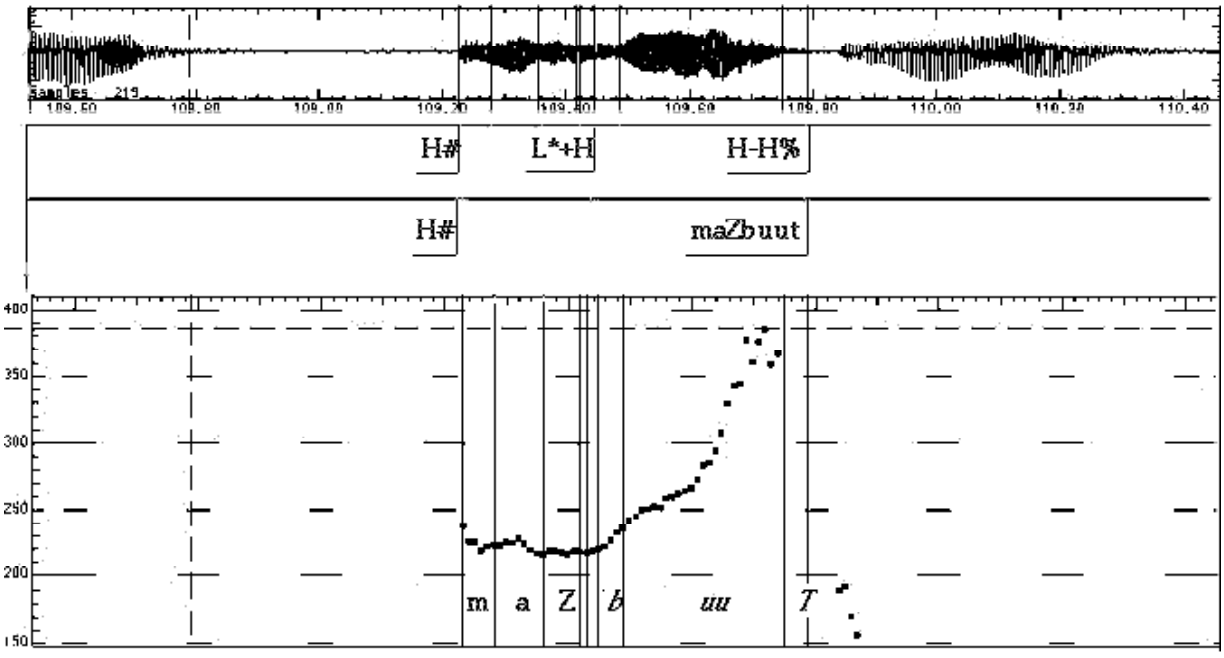

Figure 4. *//maZbuuT//* ("true"). The above graph illustrates an instance of an L*+H accent followed by an H-H% boundary- a possible variant of a question tune.

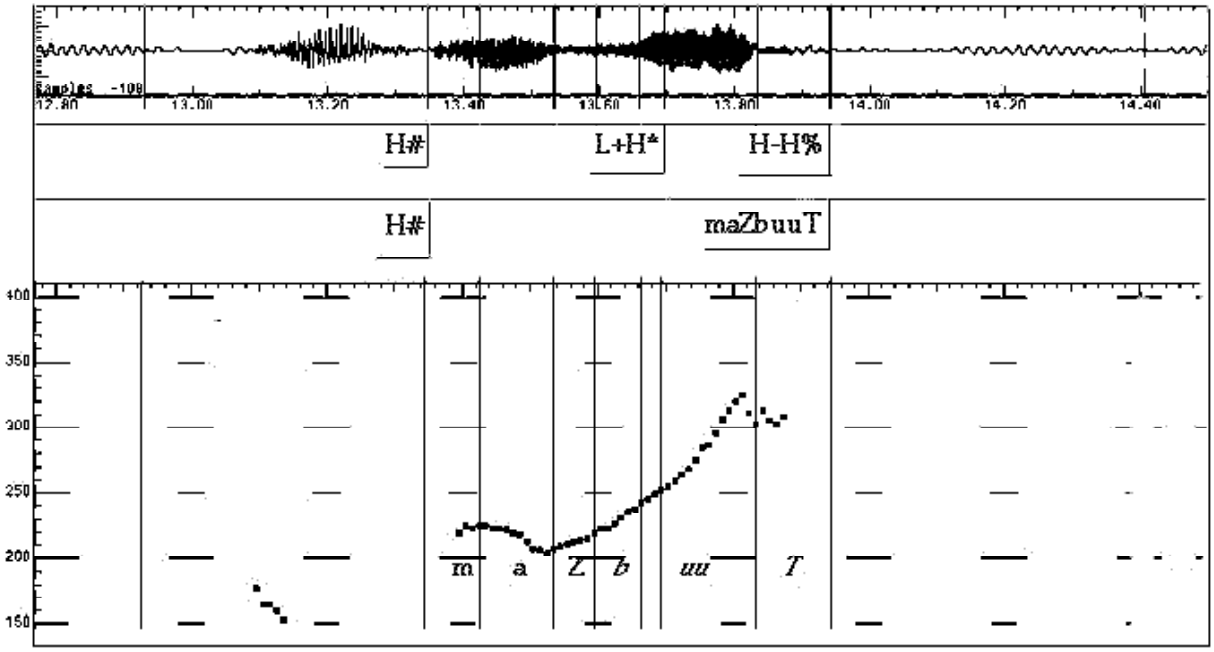

Figure 5. //*maZbuuT*// ("true"). The above graph illustrates an instance of an L+H* accent followed by an H-H% boundary.

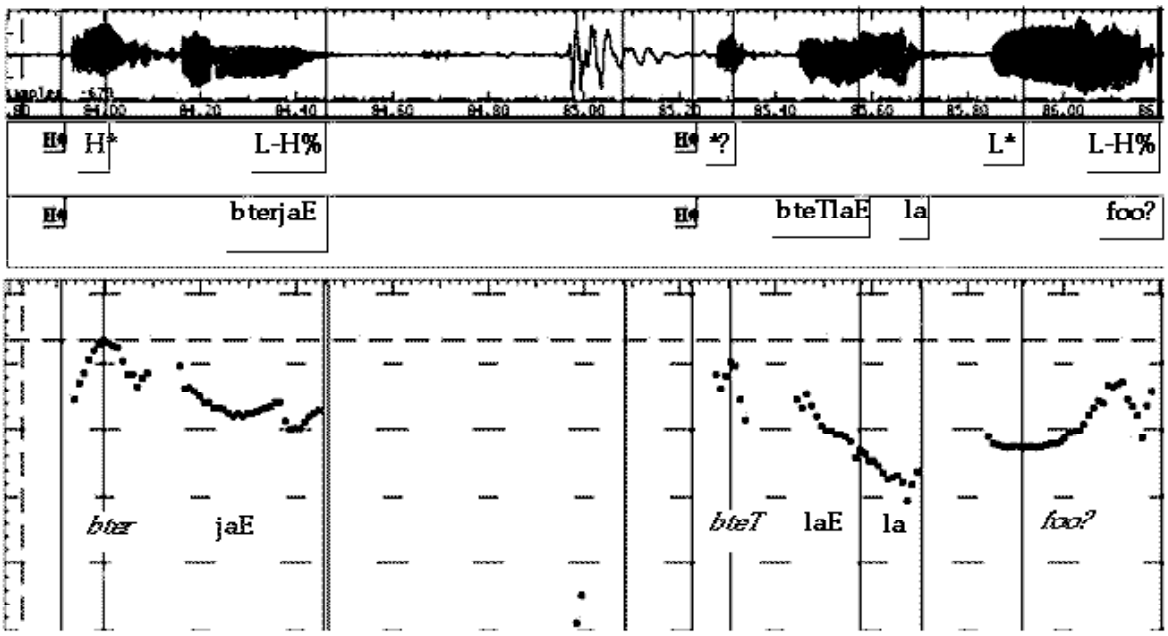

Figure 6. //*bterjaE//bteTlaE la foo?*// ("then// you go up"). The first intonational phrase illustrates an H* accent followed by an L-H% boundary, the second an L* pitch accent followed by an L-H% boundary. These are both continuation rise contours. Note: Italicized syllables on the graph represent lexically stressed syllables.

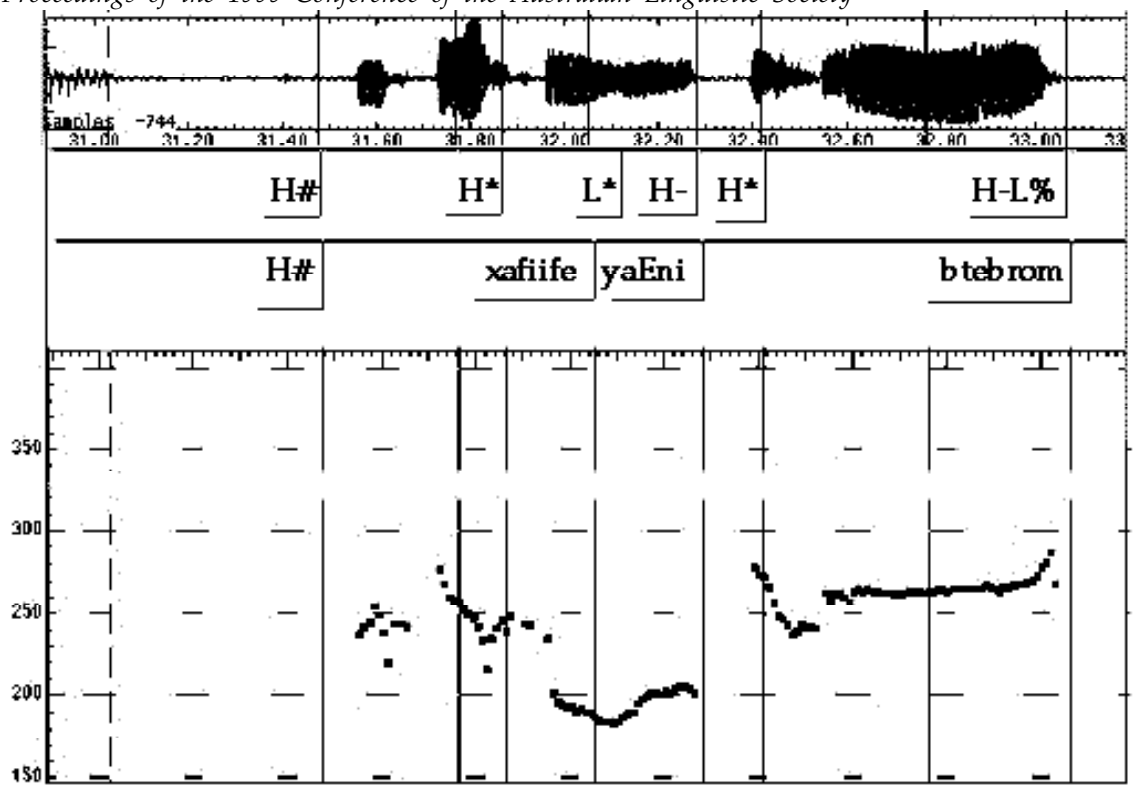

Figure 7. *//btebrom//* ("you turn") illustrates the upstepping function of H- on a following L% boundary tone. An instance of a H* H-L% plateau tune.

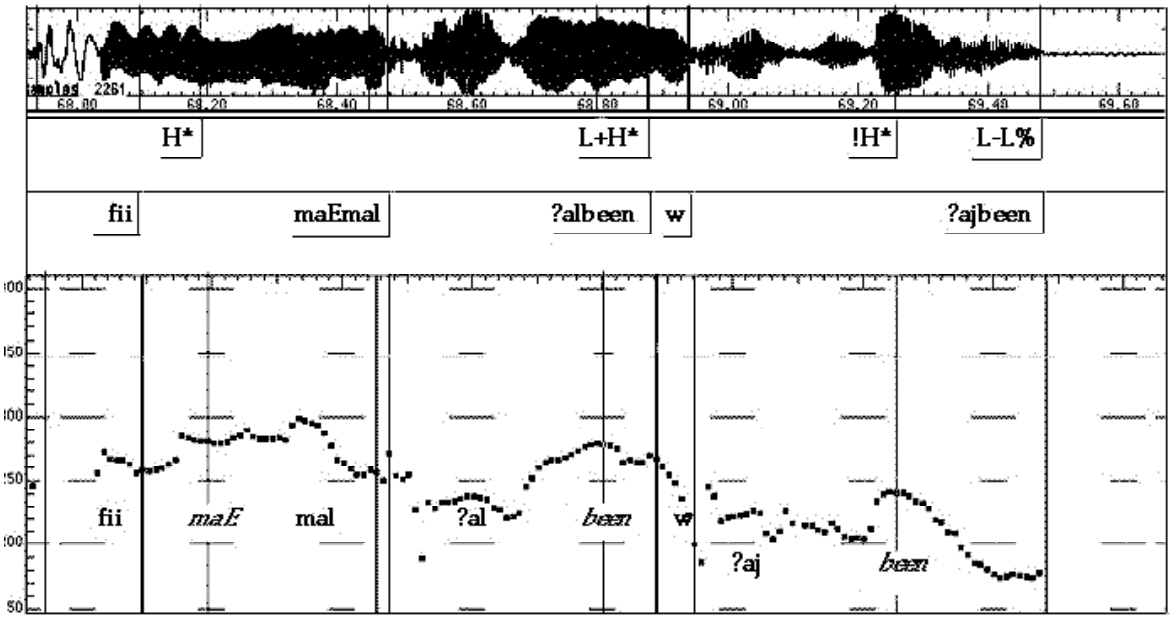

Figure 8. *//fii maEmal ?albeen w ?ajbeen//* ("there is a dairy product factory"). This phrase illustrates an instance of an L+H* followed by a downstepped !H* and an L-L% bounday.

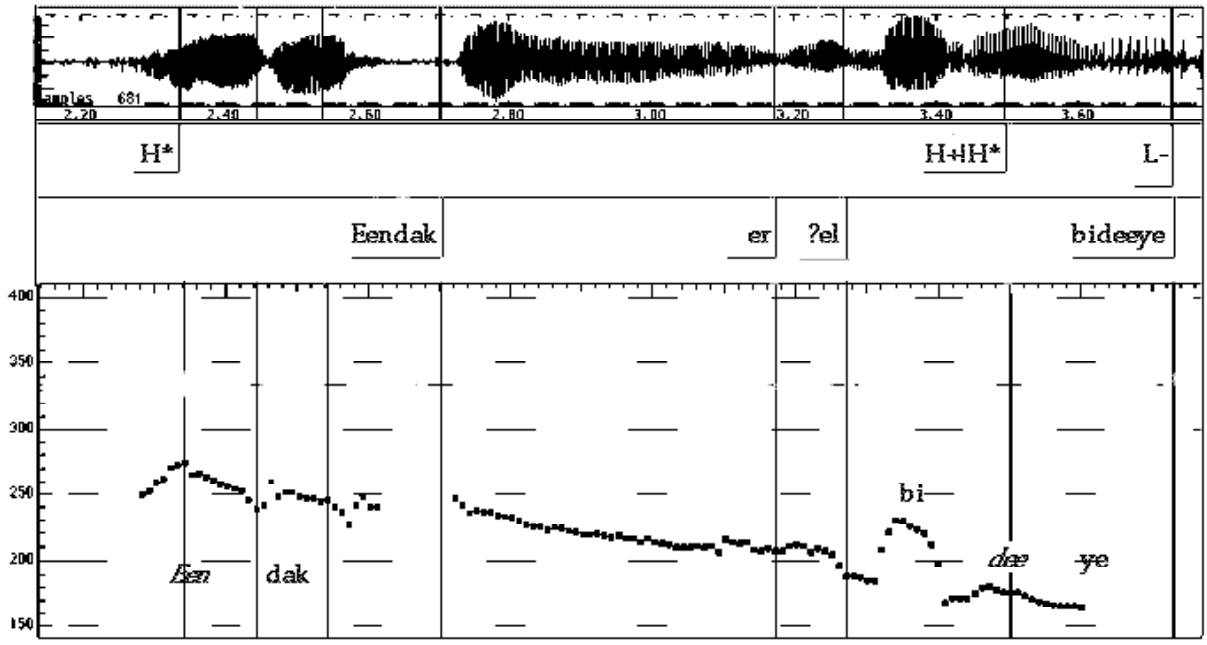

Figure 9. //*Eendak ?el bideeye*// ("do you have the beginning"). The above graph illustrates an instance of an H+!H* accent on the final word "bideeye" followed by an L- intermediate phrase boundary. Notice that the downstep occurs on "dee", which is the primary stressed syllable. The high pitch on "bi" is prenuclear pitch not ascribed to a previous H- phrase or an H* accent.

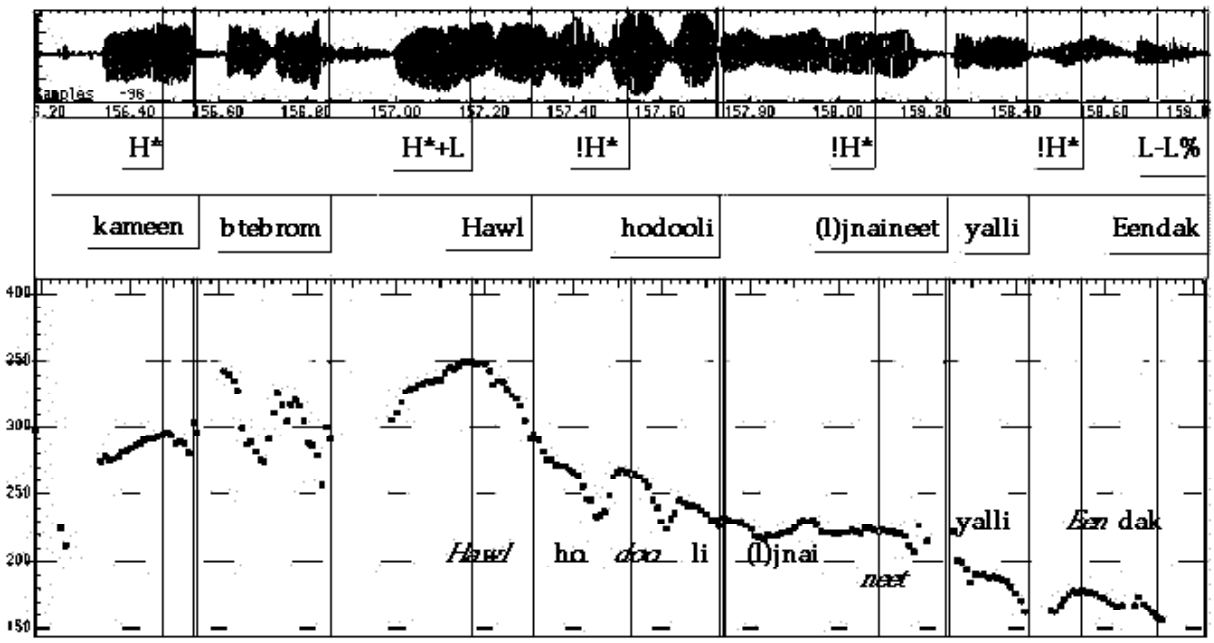

Figure 10. //*kameen btebrom Hawl hodooli (l)jnaineet yalli Endak*// (you also turn around those gardens that you have"). The above graph illustrates an instance of an H*+L accent followed by a series of !H* accents and an L-L% boundary.

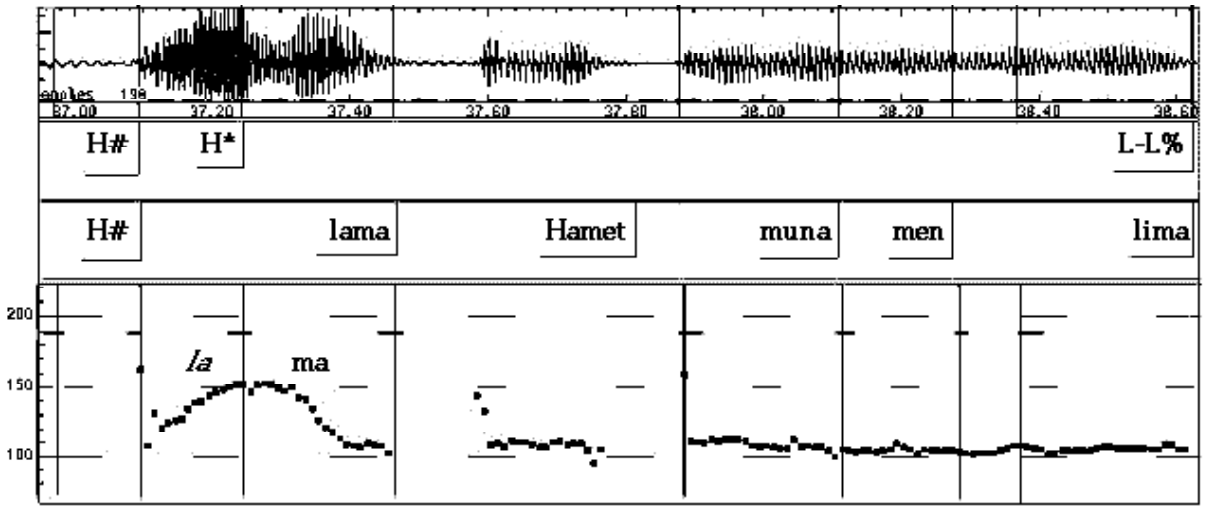

Figure 11. *//lama Hamet muna men lima//* ("Lama protected Muna from Lima"). This figure illustrates an instance of an L- tone controlling a long stretch of speech followed by an L% boundary.

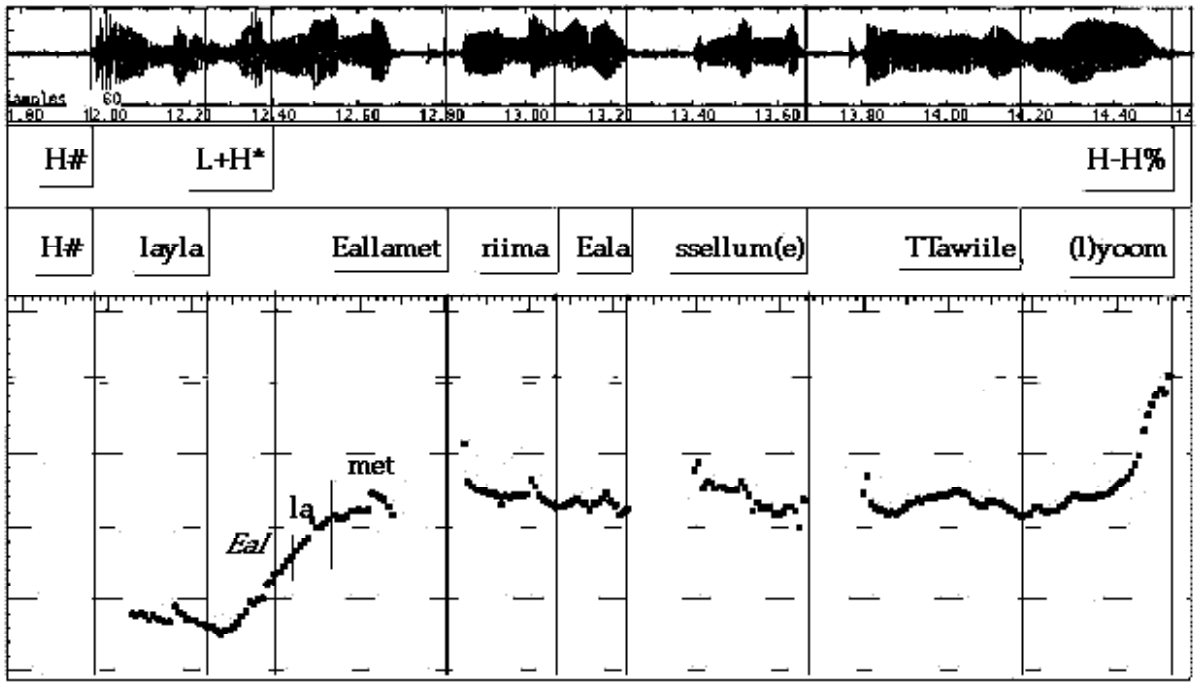

Figure 12. *//layla Eallamet riima Eala ssellum(e) TTawiile (l)yoom//* ("Layla taught Rima (a class) on the long flight of stairs today"). The above graph illustrates an instance of the upstepping function of H- on a H% boundary. Evidence for an intermediate level of phrasing.