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FEATURES OF INTONATION IN BEDOUIN ARABIC NARRATIVES OF THE GALILEE (NORTHERN ISRAEL)

Introduction

This paper is dedicated in sincere friendship to Prof. Heikki PALVA on his 60th birthday. Since part of Prof. PALVA's work treats Galilee Arabic and Bedouin dialects (mainly Jordanian ones), we shall combine these elements in the present paper in an examination of one aspect of Galilee Bedouin dialects.

Our topic is intonation, which is one of the components of speech prosody. More specifically, we shall concentrate here on the study of intonation in spontaneously narrated stories. Since our speakers were two men and two women, sex-based linguistic differences are also to be considered. Before delving into our subject we shall briefly present a survey of the background information necessary for the points to be discussed below: intonation, the speakers, linguistic material and the method of work. Following these we shall describe our findings. From our material and using a new method of work, we hope to draw some interesting conclusions.

Intonation

Intonation can be considered a technical term to refer to speech melody, or pitch modulations during speech (cf. NASH 1973). As such, intonation is an aspect of speech prosody, which is often described as including two parts: suprasegmentals and para-linguistic or extra-linguistic features. Suprasegmental elements also include, besides intonation, e.g., stress and rhythm (cf. e.g. LEHISTE 1970).

Intonation is basically difficult to investigate, since its structures (patterns, contours) vary and normally extend beyond a single segment to the phrase, clause, up to complete (independent) utterances (sentences) and spoken sections (parallel to the paragraphs in the written medium). In addition, its structures relate not only to the unit, but may also depend on previous or following contextual units which may have been produced by a different speaker.

The study of intonation has gained ground in linguistics, beyond the directly related fields of phonology and phonetics (cf., e.g., SCHUETZE-COBURN & al. 1991). In PIERREHUMBERT (1980), for example, further developed in, e.g., PIERREHUMBERT & HIRSCHBERG (1990), intonation contours are connected with a compositional theory of meaning, using pitch accent, phrase accent and boundary tones as units to describe and convey the relationships between the utterances in the sequence. Works on syntax (e.g., SELKIRK 1984) and semantics (e.g., STEEDMAN 1993) also take into account intonation contours to mark distinctions between similar grammatical patterns.

Intonation has been studied in recent decades in many languages, to some extent of completion (e.g. T'HART & al. 1990, CRYSTAL 1969, O'CONNOR & ARNOLD 1973, BOLINGER 1985). There is still no uniformity among scholars as to the correct method of description of intonation, or as to the inventory of patterns used in many languages. Still, a number of basic facts about it are generally accepted.

Among these fundamentals we find that intonation is partly automatic (being dependent on our physiological organs and their operation) and partly voluntary (T'HART & al. 1990). It is language-specific, with specific semantic and syntactic functions in each language. It is gradually learnt from infancy during the speakers' youth and thus marks their speech community (being part of native speakers' linguistic competence), and as such it may also distinguish male from female speech (CRYSTAL 1969). Two types of units are now distinguished in some research works: intonation units and declination units reflecting the (functional) linguistic and (formal-structural) acoustic angles, respectively.

Basically, two intonation tunes are distinguished in many languages: **1.** one with a rising pitch at the end of an utterance indicating that the utterance is incomplete in some sense. The precise role of this rise has been often semantically-syntactically described as indicating a member in a list, a question awaiting an answer, a subordinate clause in the sentences, etc. (but is not limited to these: cf. the Scottish intonation patterns of Edinburgh studied, e.g., by BROWN & CURRIE & KENWORTHY 1980) **2.** The other tune has a falling pitch at the end of an utterance, which typically indicates its end. It is also usually associated with a statement from the syntactic-semantic point of view.

The difference between rises and falls is partly physiologically motivated (LIEBERMAN 1967), since the falling pitch partly depends on the fall in sub-glottal pressure involved with the decreasing air pressure toward the end of an utterance. Thus, it is common to numerous languages. Inter-language differences, then, relate not to these fundamental elements (rises/falls) but to language-specific modifications of rises/falls in terms of degree and timing. This description seems valid for various dialects within the Arabic-speaking world which may be considered separate languages.

The intonation of modern Arabic dialects has been discussed to some extent in a few qualitative and quantitative studies such as, e.g., BLOCH 1965, AL-ANI 1970, RAMMUNY 1989, NORLIN 1989, AL-HARBI 1991, EL-HASSAN 1988. In fact, the existence of prosodic differences between sedentary and Bedouin Arabic dialects already appears in, e.g., CANTINEAU (1937), though this study is essentially not a prosodic study of any tribal group.

Such studies usually discuss the basic types of intonation patterns, mainly statements and "yes-no questions" (following syntactico-semantic structures). AL-HARBI's (1991) discussion of intonation is comprehensive, but being dedicated to Kuwaiti dialects, its similarity to other Arabic dialects is yet to be shown.

In the present study we shall focus on the intonation contours of a group of dialects and a type of discourse that have not been studied so far, to the best of our knowledge.

We shall investigate the intonation contours of spontaneous narratives by four Galilee Bedouin Arabic-speakers, two men and two women. We present our findings aided by figures of the patterns, trying to relate them mainly to syntactic structures (sentence types) and tables of some quantitative statistical data.

The subjects

For the present work we selected four Bedouin speakers from the Bedouin tribes in the Galilee in the northern part of Israel. The dialects of these speakers are described in ROSENHOUSE 1980, 1982, 1983, 1984, and we use here published texts to facilitate readers' reference to them. The speakers were as follows:

1. Warda Lheeb. At the time of recording she was about 45 years old, from the village of Tuuba (near the Sea of Galilee).
2. ʔumm Muusa ʕaraamsha, an elderly woman (about 55 years old at the time of recording) from the &araamsha tribe in the north of the Galilee, near the Lebanese-Israeli border.
3. D̲iyaab Mizʕil ʕaraamsha, an old man (about 70 years old at the time of recording) from the same tribe and village as the above speaker.
4. ʕaaTef D̲iibaan Hajaajra, an old man (about 70 years old at the time) from the Village of Beet Zarziir in the Lower Galilee.

The linguistic material

The speech material analyzed for this paper includes a spontaneously told story by each of the above speakers. The stories under discussion are the following:

- Warda Lheeb — ROSENHOUSE 1984, 214-218, *"A Bedouin law case"*,
- ʔumm Muusa ʕaraamsha— ROSENHOUSE 1980, 40-43, *"The Bedouin and the ġuula"*,
- D̲iyaab Mizʕil ʕaraamsha — ROSENHOUSE 1983, 52-57, *"Stealing Tobacco in the Turkish Period"*,
- ʕaaTef D̲iibaan Hajaajra — ROSENHOUSE 1984, pp. 228-234 (not all the story) *"The story of ʕaraar and ʕumeer of the D̲eeġam"*.

This material is rather special in the field of intonation studies in the following respects:
1. Quantity: We treat here a natural speech unit, i.e., a large part of a spontaneous story, and thus the bulk of material assembled from each speaker is large, including a few written pages, or a few hundred words per speaker (W Lheeb: 337 words, ʔM ʕaraamsha: 305 words, D̲M ʕaraamsha: 520 words, ʕD̲ Hajaajra: 434 words).
2. Variety: Being a story, the material yields a large variety of intonation patterns, reflecting complex discourse units.
3. Kind: This material is unlike many studies which use single sentences read aloud from a sheet of paper in a laboratory.

The small number of speakers is not enough for a statistically valid study of significance, but for a first description of the issues studied here it is sufficient.

In addition, the recorded material presented some major problems for our analysis. Since the spontaneous recordings were not made under laboratory conditions but in the "field", they are not as clean as desirable for a linguistic computerized analysis; in addition, intensity levels were not controlled. However, as usual, these facts did not affect pitch extraction to a great extent, though they made the work difficult at times. Since passages that were not analyzable due to noise were excluded from this study and intensity is not studied here in any case, these limitations do not appear to have adversely affected our results.

The method of work

Our material was first analyzed (in sentence units) by the Kay Elemetrics 5500 sonograph at the laboratory of the Institut für Kommunikationsforschung und Phonetik at the University of Bonn. The data of the material were then re-adapted for pitch analysis. Normally, digital pitch analysis yields the results in the physical values called Hertz, representing the number of cycles per second of the sound wave at the glottal source; but since the human hearing system does not function linearly, a number of computer programs in a Matlab environment were written by Isaac ROSENHOUSE to convert the Hz. values into the logarithmic scale of (musical) semi-tone (ST) values (cf. BAKEN 1987, T'HART & al. 1990). These programs also yield graphic intonation contours of the analyzed utterances and statistical calculations.[1]

The stories, as mentioned, were divided into sentences and parts of sentences in numerous smaller and larger syntactic structures, according to the research questions. The measured pitch values (in Hz.) were each saved in a separate file and fed into the computer program for transformation into STs. Other parts of the programs written by I. ROSENHOUSE use the data of utterances (in Hz. or STs) for various statistical analyses used as the basis for our figures below.

Many interesting questions may arise in such a study such as: the most frequent intonation patterns in each speaker's story; the differences in structures of intonation

1 To enable graphic presentation we have added time values (ms.) for each FO value (Hz.) according to fixed criteria of vowel-length according to syllable structure and word-accent placement as found in the literature. As indicated in the literature (e.g. KOHLER 1991, T'HART & al. 1990), timing, of course, affects the perception of intonation. However, this pilot study is meant to focus on some major features of intonation patterns and contrasts between male and female speakers, without taking into account other physical factors, i.e., time and intensity, nor perception of intonation. The present technique is therefore considered adequate.
To convert the Hz. values into STs, the computer program applies the following equation, accepted in the literature (cf., e.g., BAKEN 1987:127):

$$F_2 = \sqrt[12]{2^n F_{basic}}$$

where: F = the frequency value in Hz.
F_{basic} = the lowest frequency of the speaker's speech range in our sample.
To calculate the pooled T-test statistic comparing the means of two groups (men vs. women), the following statistic was used:

$$\frac{\bar{X}-\bar{Y}}{Sp \cdot \sqrt{0.5+0.5}} = T$$

where: $\bar{X}$ = the mean of the speakers in the first group
$\bar{Y}$ = the mean of the speakers in the second group

$$Sp = \frac{S_1^2 + S_2^2}{2}$$

where $S_{1,2}^2$ is the variance between the members of the groups
0.5 =l/n with n (the number of speakers in each group) = 2.

patterns between the male and female speakers; rates of differences between male-female intonation patterns in terms of STs; and linguistic correlation between intonation patterns and certain syntactic structures, i.e., noun and verb phrases, clauses and sentences, on the one hand, and statements, questions and other semantico-syntactic structures. Some of these issues are examined below.

Results

As expected, intonation structures in these Arabic dialects follow some universal features of intonation, and some others are more dialect-specific features. A summary of our qualitative and quantitative observations follows.

1. Intonational patterns. Patterns may be simple or complex. Usually simple patterns appear in simple, short utterances (sentences or sentence parts). Complex patterns may often be divided into a number of simple ones. (See Figs. 1, 2).

(Some descriptions in the literature define the simple patterns as basic rise or fall patterns, while a complex pattern combines both a rise and a fall in one element, which may even be located on one syllable. We do not restrict the terms simple/complex to basic units (intonemes), but rather refer to the contour of the whole utterance. Essentially, there is not much difference between these terms.)

2. Contour directions. Contour directions are rising or falling, as marked by their ends, in these dialects as well as in others described in the literature. Parts of contours may rise or fall within the pattern, changing a contour's internal direction (such changes create the complex patterns mentioned above). (See Figs. 3, 4.)

3. Levels of rises and falls. In the literature three (e.g., EL-HASSAN 1988) or four pitch levels (for example, FASHAL 1991, following ANBER 1970) have been described for Arabic intonation. For the Bedouin dialects studied here we prefer to describe the pitch range at four ST levels, each comprising about 4 STs, as in FASHAL 1991 and ANBER 1970. These levels are qualitatively described there as low, medium, high, and very high. The delimitation of the levels is rather given to tolerances of ±1-2 STs, according to the tendencies of individual speakers (Figs. 5, 6).

4. Pitch variation. In the stories examined here pitch variations are rather large within, as well as between, sentences. The average range value is about 11 STs, which is equivalent to the men's pitch modulation in Fashal, 1991, and Anber, 1970. The T-test result comparing the two groups of speakers is not significant, but some difference exists (cf. Table 1 below).

5. Intonation units. A pitch-phrase, or intonation unit, using a more accepted term, can comprise one word or more. This well-known fact is corroborated in this study. In Arabic, being a relatively synthetic language, very short utterances (syntactically and intonation-wise) are very frequent since one word may constitute a complete sentence (and include S:V:O), e.g. */jaabo/* 'he brought it'. We see very clearly also the extent of mixture of such varied structures of intonation-units in the spontaneous narratives studied here.

6. Independent intonation units. A pitch-phrase can be "independent", i.e., separated from the previous and following phrases by a pause (ROSENHOUSE 1994), or "dependent", i.e., not thus separated. (The terms "dependent" and "independent" do not carry here any syntactic meaning.) When it is "independent" the pitch may fall to the speaker's base frequency, and go up again at the beginning of the following pitch-unit (in a "reset", see 12 below). When it is "dependent" the pitch at the end of the unit usually does not fall much.

7. "Final" and "non-final" contours. These are basic terms in the intonation structure of these Bedouin dialects, as in many other languages. We must distinguish, however, two types of "non-final" contours: 1. with a rising tone. 2. with a falling tone sequence. The "rising non-final" contour is used in, e.g., yes-no questions and other incomplete utterance types. The "falling non-final" contour is used in the "dependent" utterances mentioned above, where the fall does not reach the speaker's "base tone" as in the "final" contour (see below).

The questionable and ambiguous quality of the non-final quality of a fall is felt, in the writer's subjective judgment, when the fall does not reach the "low range" of a speaker's pitch range, i.e., the fall reaches the range of 4-6 STs of his/her speech range, i.e., the boundary zone between the low and medium pitch ranges. If the fall begins from a higher level (from above 12 STs) of one's speech range this may suffice for it to be perceived as a final tone; but if the slope of the fall is not so great (e.g., from 8 ST to 4 ST on the scale) this may still be perceived as a non-final fall.

This feature raises some questions: what is the source of the mechanism of this tendency — is it just the four levels that affect perception of a contour as final or non-final? Does it depend upon the slope of the fall in the utterance (it may also depend on the time domain)? Does it make any difference whether we deal with an isolated utterance or one which appears in a complete paragraph (i.e., intonational context)? How accurate or fine are such level distinctions? These questions should be probed by a systematic examination of the perception of native speakers/listeners of the dialect (as was done, for example by T'HART & al. 1990), and have to remain unresolved at this stage.

8. Classification of intonation features. Thus we may classify intonation contours into four partly overlapping, partly interrelated components representing the following features: dependent/independent; final/non-final; continuous/non-continuous; falling/rising. A contour may thus be, e.g. [non-final, dependent, continuous, falling], or [final, independent, non-continuous, falling]. This is somewhat similar to the classification into low and high falls or rises used in the literature (e.g., O'CONNOR & ARNOLD 1973). However, we add here the observation that finality/non-finality of a contour is not always equivalent to non-continuousness/continuousness, respectively. In other words, there may be a fall from the high pitch to the medium one, rather than to the low pitch; such an option is not always mentioned in the literature, but is very clear in these speakers' narratives.

A rising tone in these Bedouin dialects will always be non final continuous, however, with the degree of the rise ranging between medium and high pitches. Rises are used, e.g., in yes-no questions (Fig. 7), and in lists or phrases contained within the sentence framework (Fig. 8). From this point of view, differences between falling and rising contours are great.

Many utterances start, however, in the high pitch range and make a similar impression to that of rises; such high-pitch utterances, then, may fall not to the speaker's base pitch but remain somewhere in the middle range of the speaker's voice range, creating the effect of non-finality (cf. Fig. 9).

9. Intonational complexity. Some sentences/utterances show large fluctuations in pitch modulation, while others are more evenly structured and sound more "neutral" or "monotonous". This structural complexity has often to do with semantic complexity (the more semantic implications, the more modulations). It is, however, in part also linked to the sex of the speaker included in our samples, i.e., the women's modulations are larger than those of the men (see STD of frequencies in, e.g., Table 1 below).

10. Final and non-final context. Such contours appear in various syntactic environments: at the end of a complete sentence or a phrase, between the logical subject and predicate in an ordinary as well as a cleft sentence (Fig. 10), between the protasis and apodosis in complex sentences (i.e., between the main clause and the subordinated clause) (Fig. 11), and in counting or listing items or events (Fig. 12). Thus, it seems that syntactic units in themselves do not affect the intonation contour; rather, syntactic units represent various levels of the semantic make-up of the discourse, i.e., the spoken utterance in its narrower or wider context, and these affect the intonation contours.

11. Intonation contour structure. In ordinary statements pitch is higher at the beginning of an utterance than at the end (Figs. 4, 5). This fact is partly related to physiological factors, since at the beginning of the utterance the speaker's lungs are full of air, which is forcefully pushed out (LIEBERMAN, 1967). Most of the utterances in our samples belong to this group.

12. Resets. Resets are sudden rises of the pitch level at the beginning of new "intonation units" within an utterance (cf. T'HART & al. 1990, CLARK 1994), which really form the up-and-down modulations within an utterance. This principle is also valid for phrases and clauses within a sentence, and not only for complete sentences. (This feature shows that not only physiological elements control speech, since unit-internal pitch rises require deliberate effort by the speaker during speech production.)

13. Yes/no questions. This type of question may end with a rising tone (Fig. 7); often this rise does not appear at all before the last word of the sentence. In our sample, yes-no questions do not always end with a rise (Fig. 13). This produces, in our subjective perception, a rather strange effect. Such examples may be due to additional semantic implications involved in the utterance, or to dialectal features. More information is needed to fully understand this phenomenon.

14. Other questions. Non-yes/no questions and rhetorical questions place the highest pitch on the interrogatory particle (at the beginning of the question or wherever it occurs), and the rest is usually as in statements, i.e., with a partly or fully falling tone towards the end of the utterance (Figs. 14, 15).

15. "Saying sentences". Saying sentences, such as 'he said', are very frequent in our samples. This structure always appears at the beginning of the utterance in these dialects (contrary to, e.g., English), and is followed by direct speech (Figs. 1, 3, 5). It is also distinct from the point of view of intonation, always having a lower pitch (frequency) than the following direct speech. This feature distinguishes this structure—V:O-clause—from other (S)VO structures of regular sentences in Arabic. (In e.g. CRYSTAL 1969 such a "saying sentence" is considered the prehead of the intonation unit.)

16. Addressing and parenthetical patterns. An addressing (e.g., "Oh, Granny") or some other parenthetic sentence member has usually a lower pitch (frequency) than the environment, which often creates the impression of a "final" tone even before the end of the sentence. When the pitch of the address is contrary to the general direction, it has specific motivation or function. If this address does not occur at the end of the utterance, the beginning pitch of the following phrase is higher than the end of the vocative or parenthetical in a "reset", as described above (and cf. KUTIK & COOPER & Boyce 1983).

17. Pattern differences. As in other languages, the degrees of pitch modulations vary not only with syntactic structures (complete sentences, noun phrases, one-word phrases/clauses etc.), but also with semantic contents and subjective (emotional) attitude to the message (the unit). This may be part of the source of individual pitch differences between speakers (including men vs. women) of the same language.

18. Highest/lowest pitch values. Usually the highest frequency is located on the stressed syllable in the stressed word of the utterance, and the lowest one is placed on an unaccented syllable at the end of the utterance. Clearly, however, these highest and lowest frequency values do not necessarily represent the average frequency of the utterance or even most of its frequency values. Sometimes a word contains both the highest and the lowest pitch values of the whole utterance. Thus, the single highest or, more important, the lowest frequency is not always found in the semantically most salient word in the utterance, and does not contribute much to the general perception of the intonation movement or contour.

19. Pauses. In spontaneous texts such as those examined here some parts of the sentence appear after long pauses, sometimes in what seems to be an "afterthought". Although from the semantic and syntactic respects they are part of the utterance, from the intonational point of view these may be independent units, as described above. This factor should be taken into account within a comprehensive description of prosody, but it will not be discussed here (however, cf. ROSENHOUSE 1994).

20. Pitch range and STs values. In an utterance, pitch range is often above 10 STs, sometimes reaching approximately 15-16 STs (i.e. 1.25-1.3 octaves). The average is, however, about 11 STs, a little less than an octave. The contour structure in an utterance may fall or rise in steps (e.g., a step per phrase), so that the range is not perceived to be so large.

Table 1 shows that in terms of STs and their standard deviations, there is not much difference between the speakers, either men or women. The average value of the ST range in the speech of these subjects is about 10.5 STs, though women's values are somewhat higher than the men's.

In FASHAL 1991, 12 subjects (6 males, 6 females) employed at the Egyptian broadcasting service were recorded reading the news. Their range in ST was 9-13 (males) and 12-16 (females) (FASHAL 1991:71). So, these Bedouin speakers' range is within the lower range, which seems to be "appropriate" for the men's speech range, but not for the

Statistical results of pitch data of four speakers. Table 1.

	Men	Women
n (no. of files):	121	103
average frequency (Hz):	151.991	239.028
standard deviation (Hz) (of n files):	37.1454	60.8785
average range/file (ST):	10.447	10.8827
standard deviation (ST) (of n files):	3.17236	3.79163
T-test comparing men vs. women: 2.4*		

* representing observations of 2 speakers x 2 groups; not statistically significant.

women's one. Still, these women's speech does not appear to be less "lively" or "dynamic" than that of news announcers reading literary Arabic texts from paper. Indeed, the standard deviation (in HZ) of the frequencies used by women is much greater than that of the men. Examination of the ratio between the average frequency of each speaker's pitch and his/her standard deviation value as shown in Tables 2, 3, reveals higher values for the women than for the men:

ʔMʕaraamsha: 21.583%; WLheeb: 21.9% vs.

Ḏ̱Mʕaraamsha: 16.97% AHajaajra: 18.457%

This finding presents an interesting angle to the comparison between men's and women's intonation in our recordings.

We should be careful in our conclusions concerning comparison with FASHAL's results, since differences may be due to different methods of analysis, the number of subjects, the nature and quantity of the linguistic material, and the fact that we are dealing with a different language variety.

21. Individual pitch results. Tables 2 and 3 present the individual pitch features of each of our speakers when separately analyzed (an "inside analysis") and divided according to sex.

Summary of men's statistical pitch data. Table 2.

	Hajaajra	Ḏ̱Mʕaraamsha
n (no. of files):	64	58
average frequency (Hz):	181.547	130.838
standard deviation (Hz) (of n files):	33.4614	22.1872
average range/file (ST):	11.0863	9.68015
standard deviation (ST) (of n files):	3.39347	2.76112

Summary of women's statistical pitch data. Table 3.

	WLheeb	ʔMʕaraamsha
n (no. of files):	54	50
average frequency (Hz):	210.101	271.581
standard deviation (Hz) (of n files):	46.2032	58.6215
average range/file (ST):	10.4987	11.1653
standard deviation (ST) (of n files):	3.90758	3.74944

These data present rather large inter-speaker differences of pitch range, as the absolute pitch values (Hz.) show on the one hand, and as indicated by the standard deviation values for both frequencies (in Hz.) and ST ranges, on the other hand. This result is only to be expected, since men's voices are different from women's voices due to physiological factors, at least.

22. *Analysis of statements and questions.* Another aspect we examined was the effect of the type of utterance on pitch. Since most of the sentences in the narratives are statements, the results shown in Tables 4, 5 are not much different from those in Tables 2, 3 (questions, exclamations and internal parts of the utterance were excluded from Tables 4, 5). The values for the average pitch and ranges in men's questions (Table 6) look a little different from those of their statements (Table 4). The number of questions in the women's stories was very small (2 and 5), and the separate results are therefore not shown here. But Table 7 compares the statistical results of the two groups of speakers (men's vs. women's questions).

The average frequency value of questions in the ʕaraamsha speaker's sample (Table 6) is nearly the same as it is in his statements. This result may be attributed to the fact that the questions were more of the "rhetorical" and "wh-" types of question, rather than "yes-no" questions, which are supposed to have a high rise at the end. Hajaajra's average frequency is, however, somewhat higher in the questions than in the statements, as would be expected. This shows (again) individual differences between the speakers' questions (and statements, and speech in general).

The pitch range (in ST and their STD) is smaller in both men's questions (Table 6) than in the statements (Table 4), and a little smaller also in the women's joint results for questions (Table 7) than in their statements (Table 5). Also this fact should be related to the fact that there are fewer "yes-no" questions than "wh-" and "rhetorical" ones in this sample.

Summary of men's statistical pitch data for statements. Table 4.

	Hajaajra	DMʕaraamsha
n (no. of files):	57	60
average frequency (Hz):	178.848	131.253
standard deviation (Hz) (of n files):	32.9923	22.2842
average range/file (ST):	10.5337	9.10932
standard deviation (ST) (of n files):	3.19987	2.99293

Summary of women's statistical pitch data for statements. Table 5.

	WLheeb	ʔMʕaraamsha
n (no. of files):	54	40
average frequency (Hz):	210.592	271.189
standard deviation (Hz) (of n files):	45.6195	54.5668
average range/file (ST):	10.3937	10.4901
standard deviation (ST) (of n files):	4.20658	3.9775

Summary of men's statistical pitch data for questions. Table 6.

	Hajaajra	DMʕaraamsha
n (no. of files):	11	8
average frequency (Hz):	196.113	131.798
standard deviation (Hz) (of n files):	31.1918	18.446
average range/file (ST):	8.26251	6.73796
standard deviation (ST) (of n files):	3.46861	1.6006

Summary of men's and women's statistical pitch data for questions. Table 7.

	Men	Women
n (no. of files):	19	8
average frequency (Hz):	160.061	279.358
standard deviation (Hz) (of n files):	40.4628	86.3335
average range/file (ST):	7.62216	9.76916
standard deviation (ST) (of n files):	2.87758	4.81648

A comparison of the results of the men's and the women's questions as groups (Table 7) reveals that the average frequencies for men (men: 160 Hz.) fall between the separately calculated frequencies of each speaker (cf. Table 4 for men's questions: 178 Hz. and 131 Hz. vs. Table 2 for men: 181 Hz. and 130 Hz.). Women's questions have a little higher value (Table 7: 279 Hz.) than the material taken together as seen in Table 3 (for women: 210 Hz. and 271 Hz.).

When examining these values in the light of the results shown in Table 1 we also see that questions alone have higher standard deviation values than all the material taken together, both for the men and the women (men's standard deviation: Table 1: 37 Hz., Table 7: 40 Hz.; women's standard deviation: Table 1: 60Hz.; Table 7: 86 Hz.). Also the ratio between the average and the standard deviations is larger in the questions than in the material as a whole.

The average ranges in STs is lower in the men's group than in the women's group, and so are their standard deviations (in STs).

All these figures show at least marked differences between these men's and these women's behaviour in asking questions.

Since we are dealing with a small number of questions and speakers we do not wish to generalize from them to more definite conclusions.

23. *Rising/falling contours.* The next set of tables (Tables 8-11) presents the results of a different angle on the data: the texts (including the questions) have been re-divided into units that contain only rises or only falls, and these were calculated for each of our speakers.

The results of Table 8, 9, 10, 11 indicate at least the following facts:

1. There are differences between average results of rises and falls in all the speakers' data — the rises have indeed higher average values than the material as a whole and the falls have lower means than the material as a whole (cf. the averages in Tables 1, 2, vs. 8, 9; 1, 3 vs. 10, 11). This result is what would be expected.

2. The standard deviations of the rises or falls are in many of the cases very different from those of the material as a whole (Tables 1, 2 vs. 8, 9; 1, 3 vs. 10, 11). This means

that the structures of falls and rises vary between speakers.

3. The average range (in STs) in either rises or falls is smaller than the average of all the files together for each speaker and for all of them. This result is similar to those obtained for the questions (Table 7, 8) but more marked. This seems to reflect the asymmetrical structure and distribution of the utterances.

Summary of men's statistical pitch data for rises. Table 8.

	Hajaajra	DMʕaraamsha
n (no. of files):	56	66
average frequency (Hz):	185.537	134.772
standard deviation (Hz) (of n files):	30.4854	21.9686
average range/file (ST):	6.61223	6.38456
standard deviation (ST) (of n files):	2.84831	2.7814

Summary of men's statistical pitch data for falls. Table 9.

	Hajaajra	DMʕaraamsha
n (no. of files):	76	83
average frequency (Hz):	178.995	132.176
standard deviation (Hz) (of n files):	34.0342	33.8301
average range/file (ST):	8.65975	6.93827
standard deviation (ST) (of n files):	3.33032	2.89539

Summary of women's statistical pitch data for rises. Table 10.

	WLheeb	ʔMʕaraamsha
n (no. of files):	54	52
average frequency (Hz):	214.237	275.251
standard deviation (Hz) (of n files):	45.195	54.4981
average range/file (ST):	6.04562	7.58932
standard deviation (ST) (of n files):	2.9537	3.12386

Summary of women's statistical pitch data for falls. Table 11.

	WLheeb	ʔMʕaraamsha
n (no. of files):	45	41
average frequency (Hz):	208.445	265.833
standard deviation (Hz) (of n files):	47.4679	61.5924
average range/file (ST):	9.69577	10.2417
standard deviation (ST) (of n files):	4.28605	3.78471

24. T-tests for frequency ranges in STs. We ran T-tests to compare men's and women's ranges (in STs) for some of the aspects studied above. All the T-tests were statistically insignificant. (For example: men's vs. women's data as given in Table 1: T = 0.176; men's vs. women's questions: T= 0.765.) This can be attributed to the small number of speakers in each group.

Discussion and Conclusions

Intonation is studied at present as an inherent part of the language system. It is mainly dealt with as part of phonetics or phonology but it also constitutes an area of semantic studies. It is also discussed as an important discourse component. There is no doubt of the importance of intonation in the production and perception of speech, in language structure and use.

We have examined here the intonation of 4 Bedouin speakers of three Bedouin Arabic dialects from the Galilee area in the north of Israel. This study yields some observations about the structure of intonation in these texts, representing these dialects. Our observations are partly similar to those found in the literature about other intonation systems, but some are specific to this sample. The findings are not final, since the number of speakers is so small, but they may at least serve as points to be corroborated or refuted in further work. The main findings are:

1. There seem to be four levels of pitch which are relevant to speakers of these dialects. The range of each pitch level can be assumed, at least for the time being, to be 4 STs (following ANBER 1970), as the analysis of various utterances show.

2. The scale (in ST) can reach as high as about 20 STs, but in an utterance usually up to 15 STs occur (e.g, ranging between 5-20, 3-18 STs etc.) and about 11 STs on the average. In this sense (STs) there is hardly any difference between the men's and the women's speech ranges.

3. There is a falling non-final contour, which means that the four pitch levels (mentioned above) comprise two middle-pitch ranges (middle and high), besides the low and (very) high ones.

4. We suggest that "phonologically" 4 classes of intonation features ("intonemes") can be defined: levels, (contextual) dependence, finality, and continuation. They are partly overlapping and may combine to form many surface structures. (They are equivalent to ± C/V features accepted in phonology.)

5. The material studied suggests that syntactic units *per se* should not be studied for intonation, since the devices are similar for different syntactic elements and the functioning of both smaller and larger syntactic units follow similar principles. Semantics (including meaning units, affections and roles) seems to be the hidden force driving the system.

6. The difference between men's and women's intonation contours are not mainly expressed in speech range, partly at least since it is limited by physiological factors (the voice register). The differences we have found here emerge from the fact that women's speech includes more pitch modulations and variations than does men's speech. This tendency is revealed by the standard deviation values of the average frequencies of each speaker.

To sum up, this paper presents, rather as a pilot study, some interesting features of intonation in the spontaneous speech of Bedouins of the Galilee. The T-tests carried out for this study have not led to statistically significant results. Still, certain tendencies of distinctions between men and women in the use of intonation have come up. Further work with more speakers is much needed to refine the crude results described here. Another interesting aspect would be to compare these results with intonation features in other Arabic dialects.

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APPENDIX: FIGURES

Fig. 1. W Lheeb 10 *gaal: widdi aš-šeex* '(he) said: I want the Sheikh'

Fig. 2. ḎM ʕaraamsha 40 *yiduur aS-SiyaaH. yxaḎḎuun al-balad. kiif ensarag. kiif raaH kiif ja* 'the shouting goes round, they rock the town, how it was stolen, how he/it went, how it/he came'

Fig. 3. W Lheeb 19.1 *gal-lo: al-Hagg yiʕela* 'he said to him: justice will rise (prevail)'

Fig. 4. ʕ Hajaajra 47.2 *afras minniihom* '(he was) a better horseman than they (were)'

Fig. 5. W Lheeb 34 *gal-lo: ʔani jiit min gabul 4-5 sniin aštari saʕar* 'he told him: I came here 4-5 years ago to buy (sheep's) hair'

Fig. 6. ʔM ʕaraamsha 25 *minti b-ʕarabna ya Habbaaba ta-Hitta (a)ʕaarfič ween* 'you are not in our Bedouin (tribe), Oh, Granny, so that I (can) know where (you live)'

Fig. 7. ʕ Hajaajra 5.2 *teʕerfi l-lguun ʔintiy?* 'do you know (what are) trays?'

Fig. 8. ʔM ʕaraamsha 27.1 *ʕugub-ma tehanna we-(tu)-tijawwaz* 'after you enjoy (are blessed) and get married'

Fig. 9. ʕ Hajaajra 54.1 *gal -lha: la, maa yxaalif* 'he said to her, "no, it does not matter" '

Fig. 10. ʕ Hajaajra 35.1 *al-geSiir čeef widdo yilHag?* 'the short one — how will he reach (it)?'

Fig. 11. ʕ Hajaajra 11 *haatam al-lguun ta-nšuufhen* 'fetch (m.pl.) the trays so we can see them'

Fig. 12. ʔM ʕaraamsha 12.6 *alli twaSSi ʕala badla* 'who ever orders an outfit'

Fig. 13. ʔM ʕaraamsha 17.2 *jiit ba-s-salaama?* 'have you come safely?'

Fig. 14. W Lheeb 30.1 *m-šaan ʔeeš?* 'because of (for) what?'

Fig. 15. Hjajra 36.1 *če gaal ʕaraar?* 'what did ʕaraar say?'

Fig. 1 Fb= 100 Intonation curve of utterance

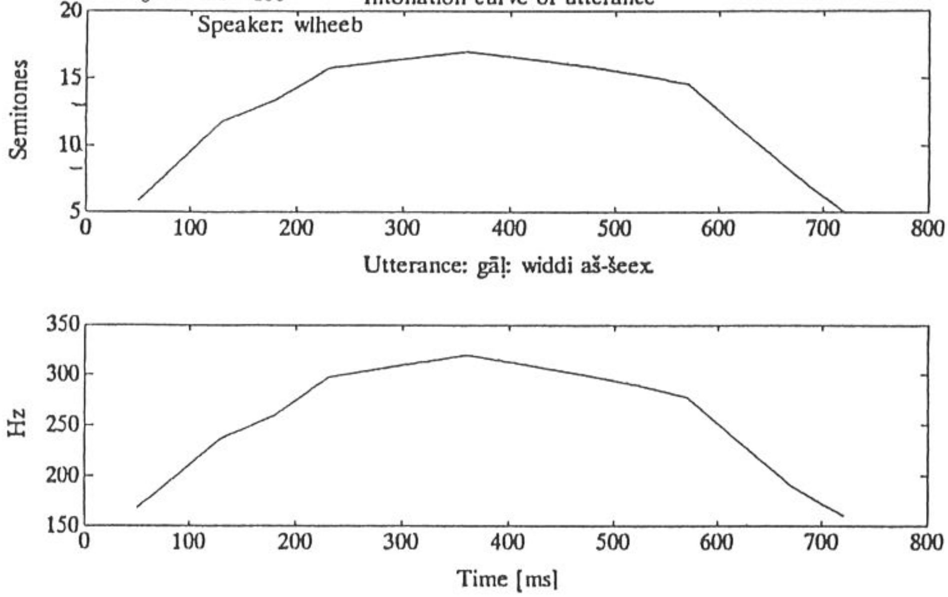

Fig. 2 Fb=65 Intonation curve of utterance Speaker: DMAramsha

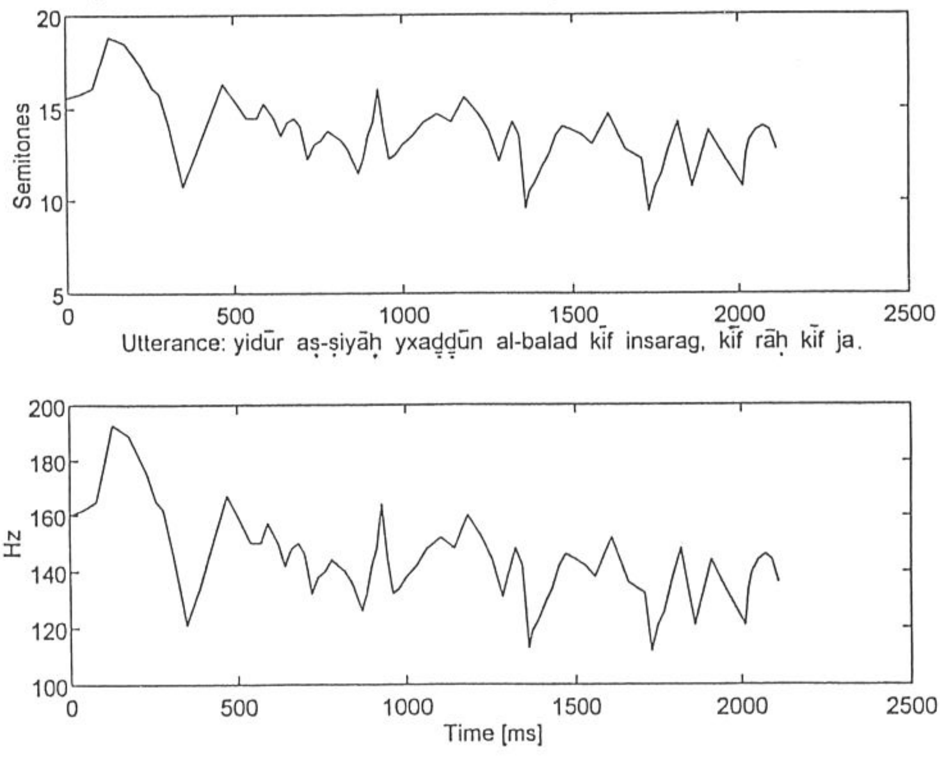

Fig. 3 Fb=100 Intonation curve of utterance Speaker: wlheeb

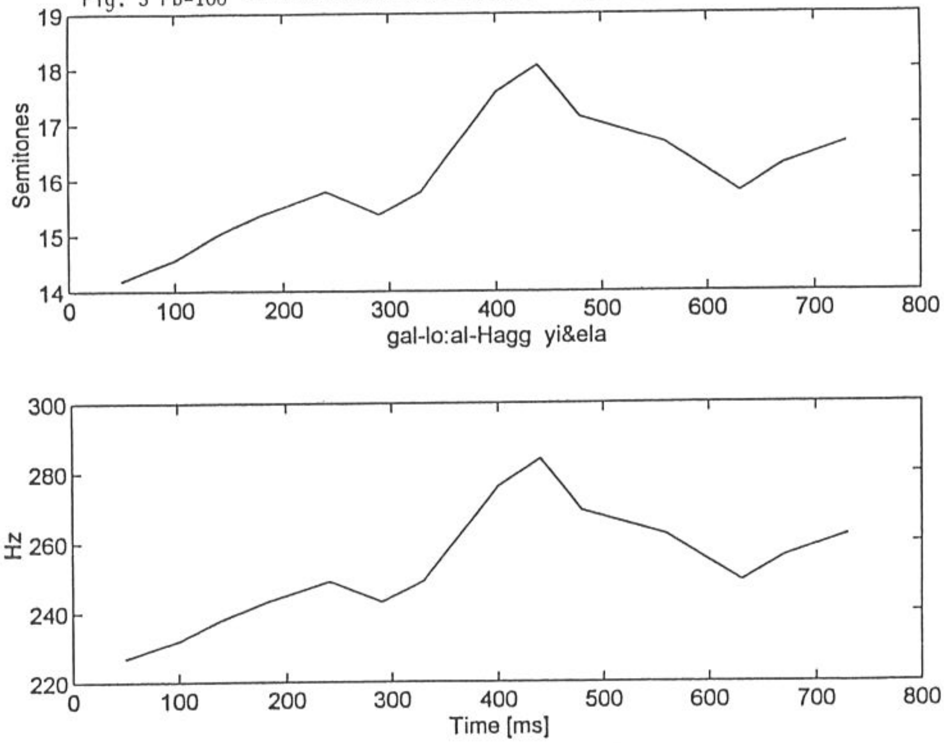

Fig. 4 Fb=84 Intonation curve of utterance Speaker: AHajajra

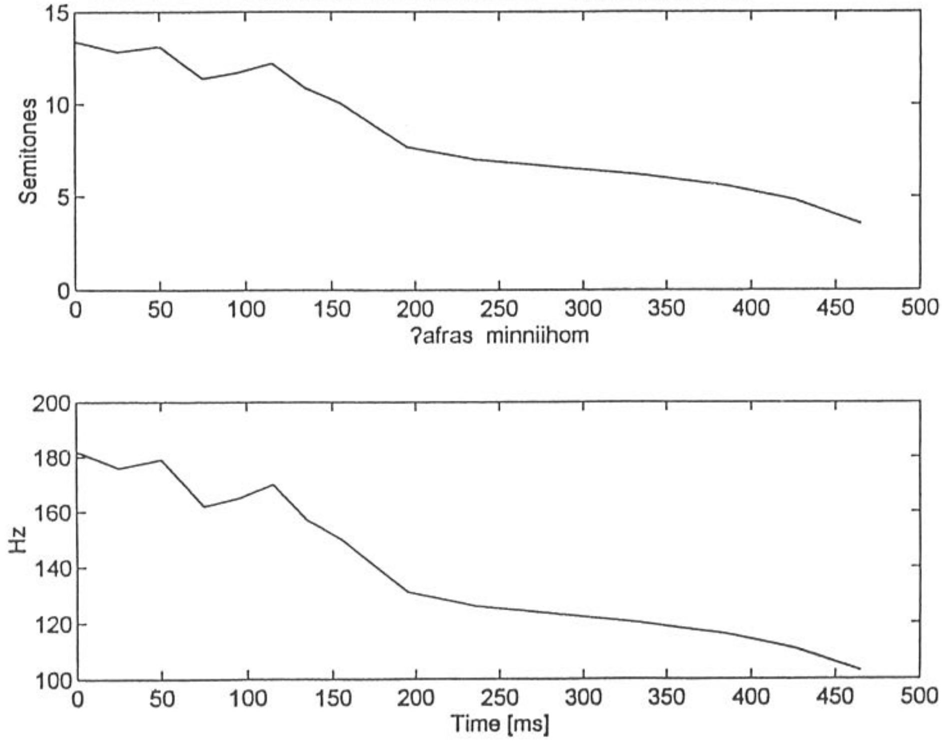

Fig. 5 Fb=100 Intonation curve of utterance

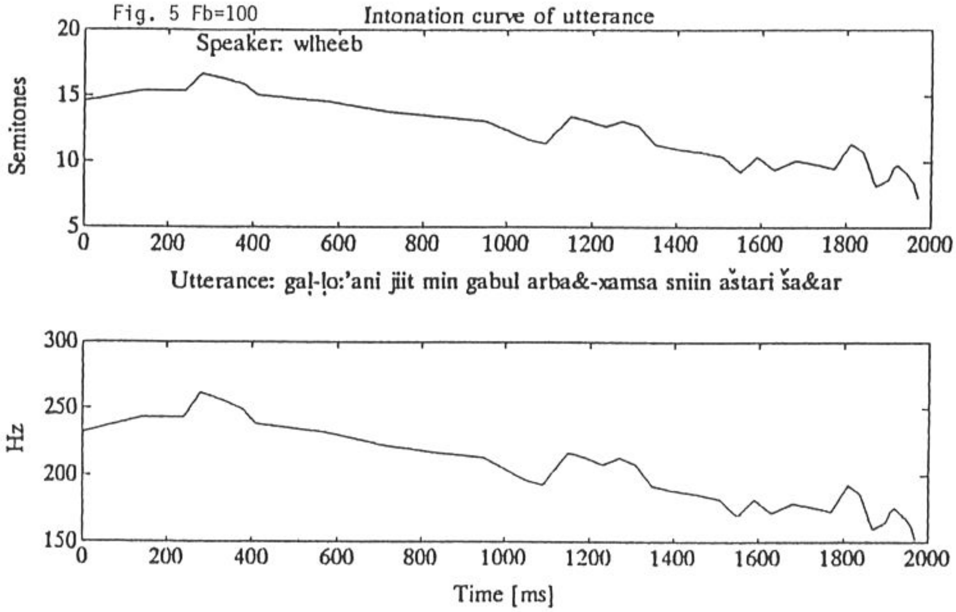

Fig. 6 Fb=150 Intonation curve of utterance

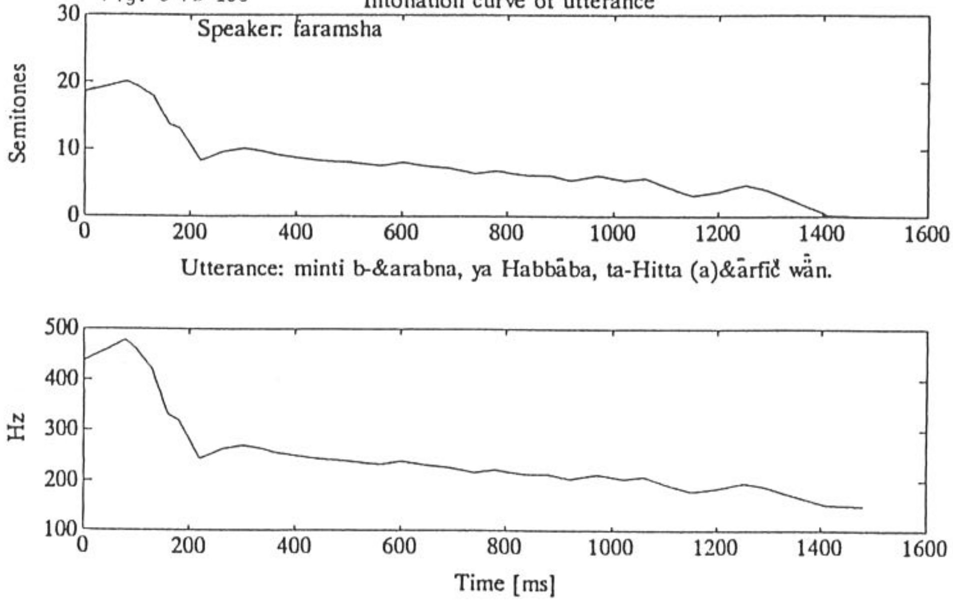

Fig. 7. Fb=84 Intonation curve of utterance Speaker: AHajajra

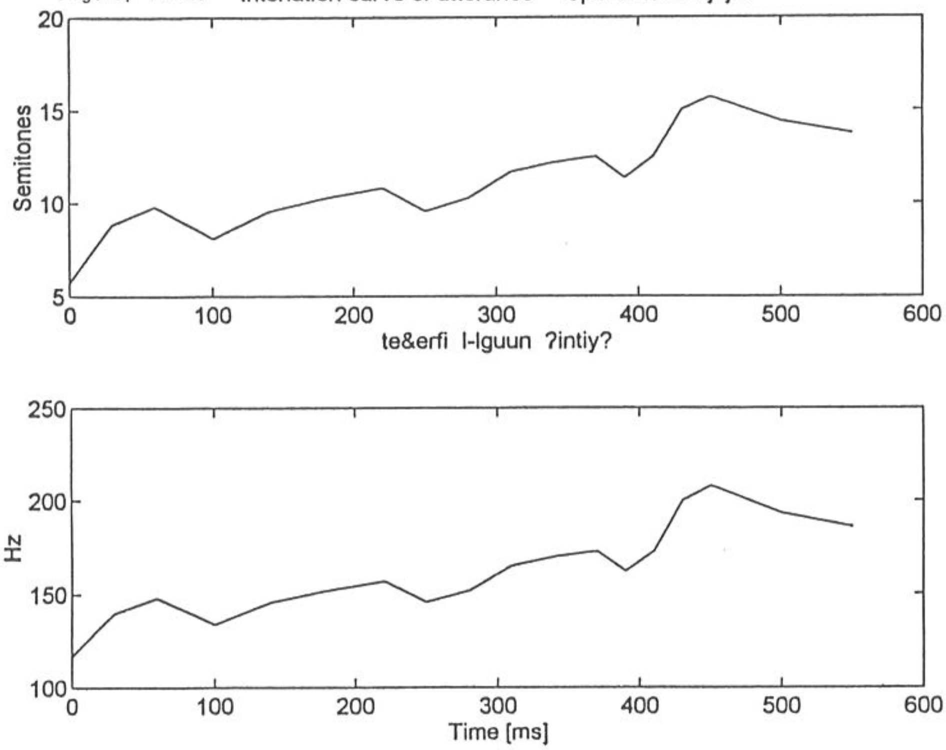

Fig. 8. Fb=150 Intonation curve of utterance Speaker: faramsha

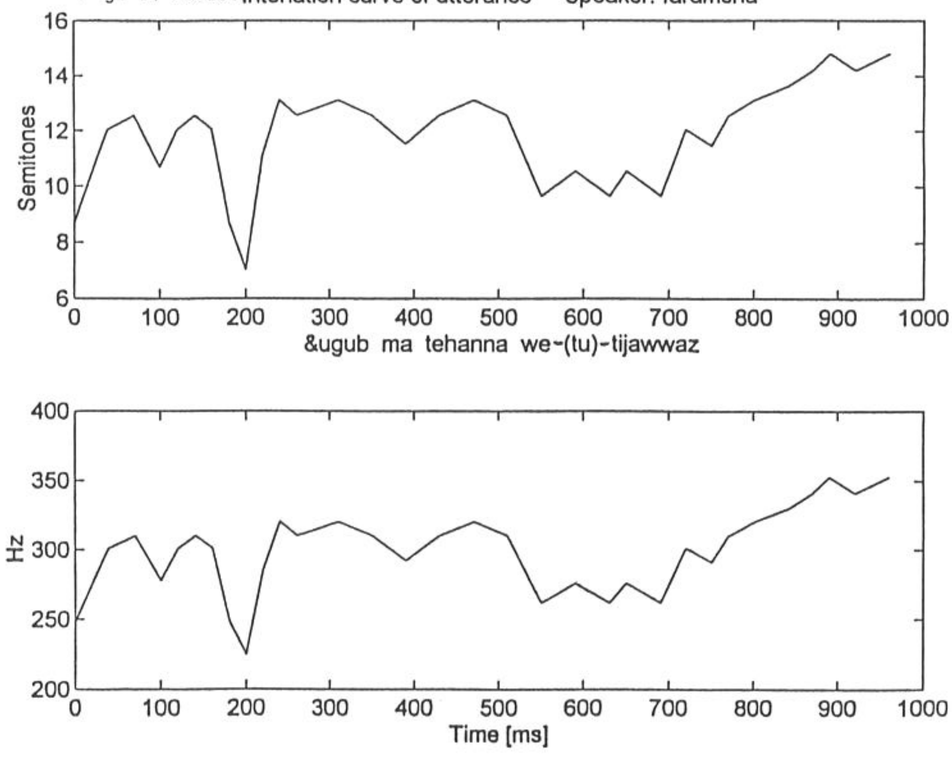

Fig. 9 Fb=84 Intonation curve of utterance Speaker: AHajajra

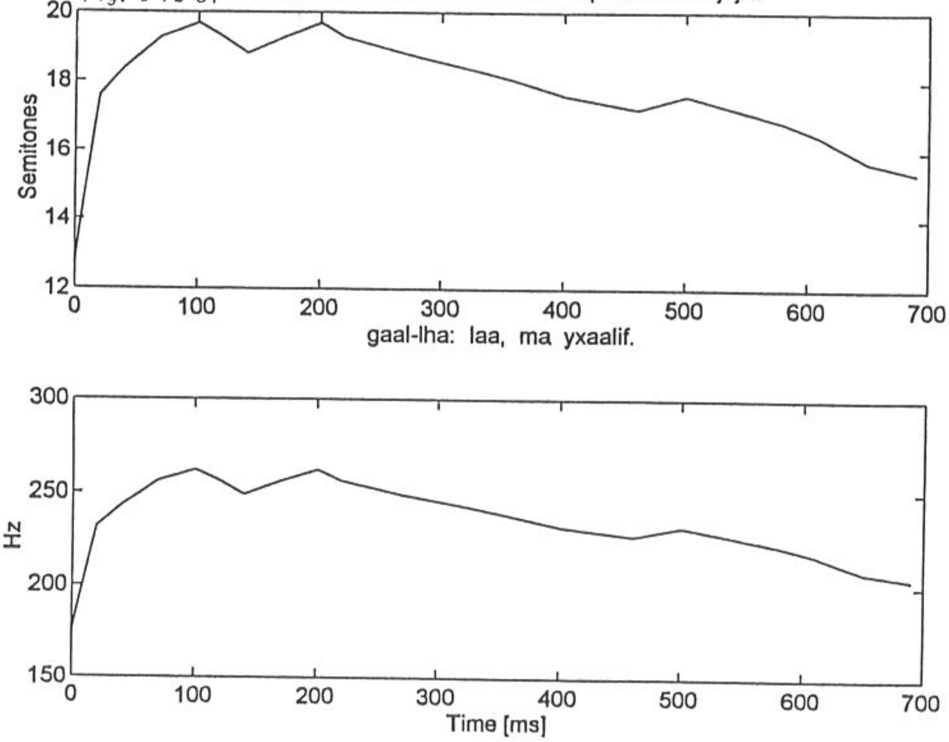

Fig. 10 Fb=84 Intonation curve of utterance Speaker: AHajajra

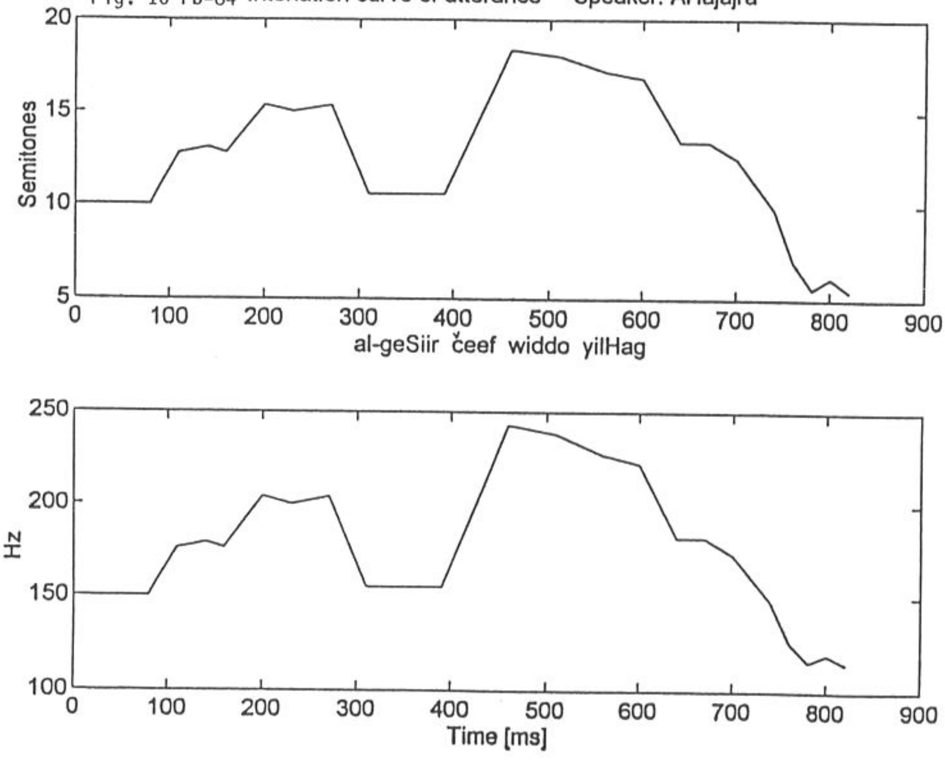

Fig. 11 Fb=84 Intonation curve of utterance Speaker: AHajajra

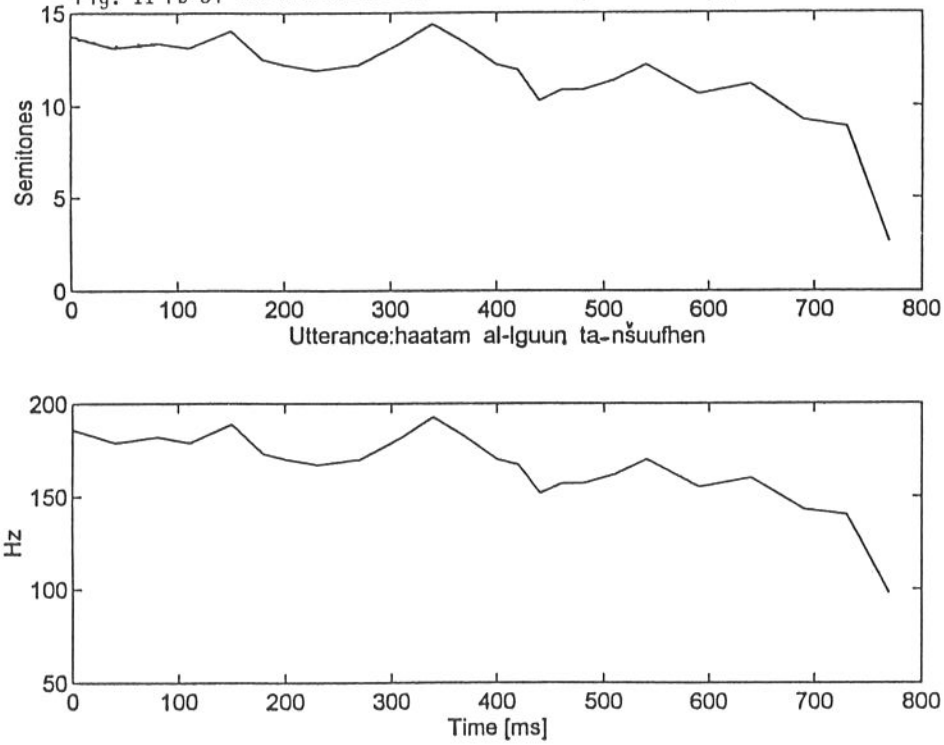

Fig. 12 Fb=150 Intonation curve of utterance Speaker: faramsha

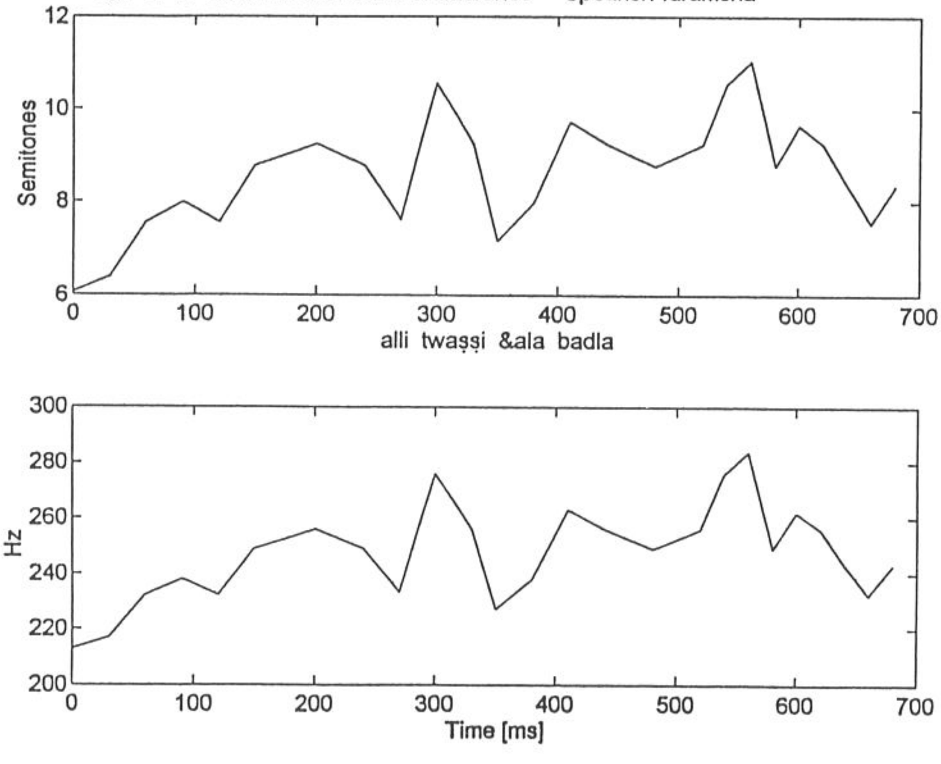

Fig. 13 Fb=150 Intonation curve of utterance Speaker: faramsha

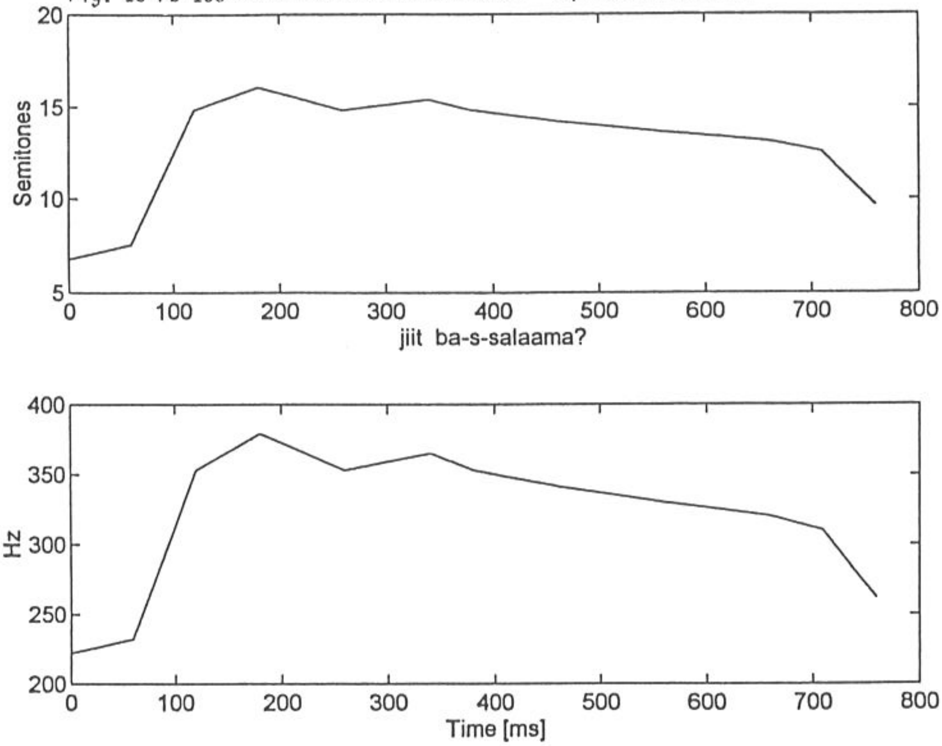

Fig. 14 Fb=100 Intonation curve of utterance Speaker: wlheeb

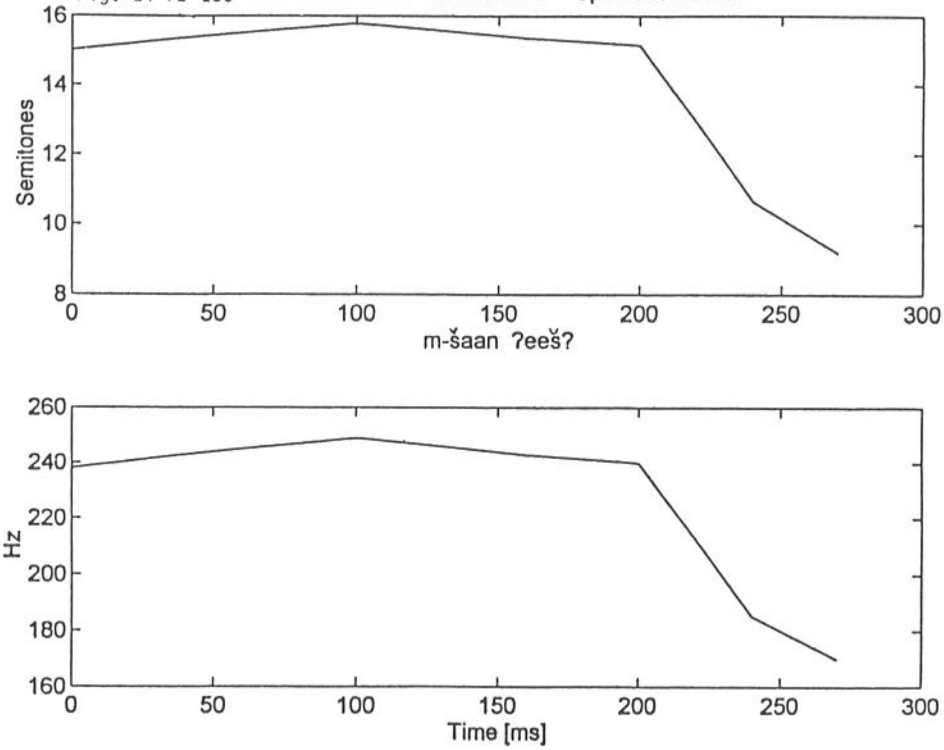

Fig. 15 Fb=84 Intonation curve of utterance Speaker: AHajajra