

A study of question intonation in Polish

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THE PROBLEM

This investigation has been inspired by similar work carried out for Swedish and other languages by Eva Gårding and Gösta Bruce at the Department of Linguistics and Phonetics at Lund University. Audio tape recordings, oscillograms and spectrograms have been made with the help of the equipment of this department /Sona-Graph 7800, Spectrograph Kay Digital/.

The purpose of this paper is to try to add detail to the picture of question intonation in Polish. Intonation is used here as the tonal feature signalling sentence type, i.e. the fundamental frequency contour / F_0 contour/.

In this paper yes/no questions and question-word-questions /wh-questions/ have been investigated. There are two kinds of yes/no questions in Polish: lexically marked and lexically unmarked questions.

A. Lexically unmarked yes/no questions.

A statement can be changed into a question only by altering the falling intonation contour into a rising one in the final tonal segment of an utterance.

B. Lexically marked yes/no questions are introduced by an interrogative particle.

C. Wh-questions investigated in this paper are introduced by an interrogative pronoun.

In earlier research it has been stated that yes/no questions are characterized by a rising F_0 contour, wh-questions, on the other hand, have more or less the same falling F_0 contour as statements (c.f. Dłuska 1947, II 1976, Wodarcz 1962).

Gårding /1974/ points out that it is quite a common phenomenon with regard to question utterances that a lexically or grammatically marked question does not need to be further marked with the help of a tonal feature and can therefore have the same intonation as a statement.

These two assertions have been the point of departure for my investigation since both marked and unmarked question utterances exist in Polish.

It has been my intention to elicit the prosodic features that characterize intonation in natural, neutral questions.

My hypothesis is that in a given situation it is possible to have a neutral question intonation without any paralinguistic features.

The intonation can be seen as neutral even outside the VP where it is otherwise normally positioned (Gårding, 1974, Dukiewicz, 1977).

Sentence stress has been marked in the test material for two reasons:

- in order to position it as far as possible from the VP in some utterances,
- in order to investigate syllable length for some syllables which occur in the material several times in both focused and unfocused positions.

EARLIER RESEARCH

The correlation between stress and intonation in Polish was observed at the beginning of this century.

Benni /1916/ compares data evaluated by auditive and instrumental methods. His hypothesis is that a stressed syllable has a higher pitch in most utterances except questions, where the final, in Polish always unstressed, syllable receives a higher pitch.

Dłuska /1947, II 1976/ distinguishes two basic intonation contours: the falling (cadence) and the rising contour (anticadence). The falling contour characterizes statements and wh-questions, the rising contour characterizes other questions.

Jassem /1959 and 1962/ points out some regularities in pitch movements in Polish, postulating 6 nuclear tunes. Those are expanded by Staffen-Batogowa, 1966, to 26 intonation patterns. Jassem claims that Polish stress is tonal. In his both auditive and instrumentally based investigation Jassem examines four features: intensity, pitch, duration and quality. Jassem states that "relations in pitch are relevant for stress in Polish, relations in duration and intensity being incidental" (Jassem, 1959, 269).

Wodarz /1962/ discusses three types of intonation contours:

- 1) Terminal, as in statements and wh-questions
- 2) Continuative
- 3) Interrogative, as in yes/no questions and, when including speakers' attitudes, also in wh-questions.

In general the intonation curve falls on the last stressed syllable and lies below the level of the preceding syllables. In question utterances the final syllable, which is unstressed, is elevated and the intonation contour rises to a higher level than the other syllables within the question utterances.

Dukiewicz presents the results of a number of investigations on intonation in e.g. 1977, 1978, 1979, 1982. Concerning question intonation Dukiewicz examines turning points and asserts for yes/no questions a rising (or slightly falling-rising) F_0 contour and for wh-questions a strong falling-rising contour.

The correlation between stress and intonation was investigated furthermore by Dobrogowska /1978/ and Pluciński /1978/, the correlation between duration and intonation by Richter /1978 and 1980/.

Earlier research results show some differences in the description of question intonation especially concerning wh-questions.

The purpose of the present investigation is to try to give a more detailed picture of question intonation in Polish with regard to the above mentioned question type.

1. 4 yes/no questions and 4 wh-questions were examined regarding fundamental frequency.

2. By marking focus in the test material attempts were made to examine the effect of focus on the intonation pattern of yes/no questions.

3. The question of whether pitch and intensity peaks occurred in the same position as focus was also studied.

4. The syllable length was examined in three syllables which occurred both stressed and unstressed in the material.

Besides the basic question material, 6 statements were investigated /cf. below/.

MATERIAL

The test material consists of 6 statements and 8 questions. The phonematic structure is similar to the material used by Gårding and Bruce at the Department of Linguistics and Phonetics, Lund University (cf. Bruce and Gårding, 1978, Gårding, 1979, 1981, 1984).

The statements are composed of:

- a) six syllabic vowels: i, ɛ, e, a, o, u
- b) two nonsyllabic phonemes: j and w
- c) four consonants: m, n, l, b

Furthermore, in the questions the following consonants and consonant clusters are present: k, t, tʃ and ts. All voiceless consonants are located initially in the interrogative particle or in interrogative pronouns. For a description of Polish phonemes see Wierzchowska /1980/.

All words occurring in the test material have the lexical stress on the penultimate syllable.

The six statements are meant to give a situational background to the questions. It has been stated that a little girl named Alina and her mother like raspberries, my small raspberries. The statements and questions in the Polish original version are presented in Appendix 1.

The basic structure (S V O) has been extended right and left from the verb. The number of syllables in each utterance is presented below (Table 1 a).

Statements ST-2 and ST-3 have the same number of syllables but the focus varies as shown in Table 2 a.

Tab. 1 a.

	number of syll.	S	V	O
ST-1	8	3	2	3
ST-2	10	2+3	2	3
ST-3	10	2+3	2	3
ST-4	12	2+3	2	2+3
ST-5	14	2+2+3	2	2+3
ST-6	16	2-2+3	2	2+2+3

Tab. 1 b.

Yes/no questions	number of syll.	S	V	O	
A. unmarked	Q-1	8	3	2	3
	Q-2	10	2+3	2	3
	Q-3	9	1+3	2	3
B. marked	Q-4	13	1+2+3	2	2+3
	Q-5	6	1	2	3
C. WH- questions	Q-6	8	1 (0)	2 v	2+3 s
	Q-7	6	1	2	3
	Q-8	8	1	2	2+3

1=question
particle
or inter-
rogative
pronoun

All the fourteen utterances were written on cards. Focus was marked in order to achieve a maximal variation of sentence stress. The stressed word was underlined in red. Focus marking is presented here below.

Tab. 2 a.

	NUMBER of syll.	V
ST-1	8	-x x -x-
ST-2	10	x- - - - -
ST-3	10	.x., - - - - -
ST-4	12	- - - - - x - - -
ST-5	14	- - - - - - - - x-
ST-5	16	- - - - - - - - - - -

ST-3 : the stressed syllable precedes ST-3

ST-6 : subjects marked focus by themselves

Tab. 2 b.

	NUMBER of syll.	V
Q-1	8	-x- - - - -
Q-2	10	x- - - - -
Q-3	9	- - - - x - - -
Q-4	13	- - - - - x - - -
Q-5	6	x - - - - -
Q-6	8	- - - x - - -
Q-7	6	x - - - - -
Q-8	8	- - - x - - -

/cf. original versions, Appendix 1/

SUBJECTS

Two Polish speaking subjects, a male and a female, read the statements and questions at their normal rate of speech. Both were native Poles visiting Sweden for only a short time. Three other subjects, also native speakers of Polish, took part in the auditory test.

EXPERIMENTAL PROCEDURES

Recording I

First the two speakers were informed that there would be information about raspberries to be passed on. This information consisted of six sentences, each of them with additional information. To facilitate the reading the new information on some

cards was marked in red. Next the subjects pretended that they were calling somebody in order to get the information about the raspberries themselves. They had to ask some questions, which, owing to e.g. noise interference, had to come in a given order.

Recording II

The speakers were asked to repeat the information to another person, but they were told that it did not matter in which order the statements were repeated. The order of the statement cards had been randomized. Then the speakers had to repeat the questions to check the information once again (the order of the question cards had also been randomized).

Recording III

Both the six ST-cards and the eight Q-cards were mixed at random. The speakers mixed all the cards by themselves and read them in order to examine if they had all the fourteen utterances. They were asked before reading to note whether there was a question mark or full stop. The test material was recorded as follows:

1. Statements /ST-1 to ST-6/
2. Questions /Q-1 to Q-8/
3. Random statements
4. Random questions
5. Random statements and questions

The auditory test

1. Three other subjects listened to the recorded utterances. The listeners had to indicate simple pitch patterns for each utterance showing the auditory impression. Only three marks were given: rising /↗/, falling /↘/ and level /→/.

2. Each utterance was numbered.

3. The syllable the listeners perceived as focused had to be marked with x. Each recorded utterance was repeated as many times as the listeners wished.

4. The listeners were asked to examine utterances from No 29-42, i.e. recording III, of both the male and the female speaker, and to note down a full stop or a question mark.

5. Finally the listeners were asked to define their impressions about the paralinguistic features regarding question utterances.

Instrumental analysis

For each recorded sample oscillograms were made and the 84 fundamental frequency contours were examined with regard to

- 1a. F_0 minimal and maximal values
- b. F_0 values at the beginning and end of each utterance

2. The auditory pitch patterns were then compared with the pitch curves derived from the oscillograms, and the pitch contours for statements and questions were compared.

3. The difference between F_0 curves for yes/no questions and wh-questions was examined in more detail. The male voice in recording II was chosen (MR II) for its complete F_0 contour. The choice of recording II can be motivated as follows: It was expected that the most natural intonation would occur precisely in this part. Firstly: the questions were situationally based. Secondly: the questions came in random order so as to avoid the possibility of perhaps slightly unnatural intonation in recording I. Recording III, where statements and questions were mixed at random could not be accepted as natural speech acts. This recording, however, could be of interest for the evaluation of other aspects. It could be more important for comparing a) statement and question intonation and b) yes/no- and wh-question intonation.

4. The listeners' question patterns were transformed to oscillograms from which pitch curves and intensity curves were extracted.

5. Spectrograms were made for recording II MR.

6. Intensity peaks on oscillograms were compared to focus marks in the auditory patterns.

7. Duration of statements and questions was measured. Syllable length for three syllables was studied in both focused and unfocused positions. For the sake of comparison, additional spectrograms for four statements and three questions were made from recording III MR. The duration measurements with an accuracy of 0,01 sec. were made from oscillograms and compared to spectrograms.

RESULTS

The auditory test results

Full stops and question marks have been correctly placed. All the listening subjects have

- stated that the unmarked yes/no questions Q-1 and Q-2 express surprise, the other questions are described as neutral

- noted a rising pattern for both types of questions
- placed the focus mark x at the same syllable as positioned in the test material concerning questions.

Pitch curves and intensity curves have been extracted from the recordings judged auditively. The results are discussed below.

1. F₀ contours and F₀ intervals

1.1. The pitch curves show that all statements have a local falling, all questions a local rising fundamental frequency contour in the final part of the utterance /cf. Appendix 2A, B, C, D and 3A, B/.

1.2. In all the pitch curves, the F₀ rises on the vowel in the final unstressed syllable. The spectrograms show the same. The F₀ values in the beginning of the question utterances, the highest and lowest values of the final syllable compared to the whole question contour /recording II MR/ are presented below.

		a)	b)	c)
A.	Q-1	100-110	90-190	90-190
	Q-2	110-125	95-180	95-190
B.	Q-3	130-150	100-190	95-190
	Q-4	140-150	100-220	100-220
C.	Q-5	160-200	95-160	95-200
	Q-6	160-140-190	90-130	90-190
	Q-7	150-200	95-140	95-200
	Q-8	150-130-180	100-150	100-180

Tab. 3. a) F₀ movement at the beginning of the question
 b) F₀ movement on the final syllable
 c) F₀ (min) and F₀ (max) for the whole question utterance.

The local fall for the plosive b and the inter-vocalic glottal stop have not been included.

It has been found that the two types of questions are differentiated by interval values in the rising contour of the fundamental frequency in the final syllable.

For yes/no questions the values are between 85Hz and 120Hz thereby agreeing with the range for the whole question contour.

Wh-question curves show lower values than do yes/no questions: between 40Hz and 65Hz, and lower than the values for the whole question.

In wh-questions the highest values are in most utterances identical to the values for the vowel in the focused syllable. This, however, cannot provide sufficient support for the hypothesis in previous investigations that intonation contours in wh-questions and in statements are the same.

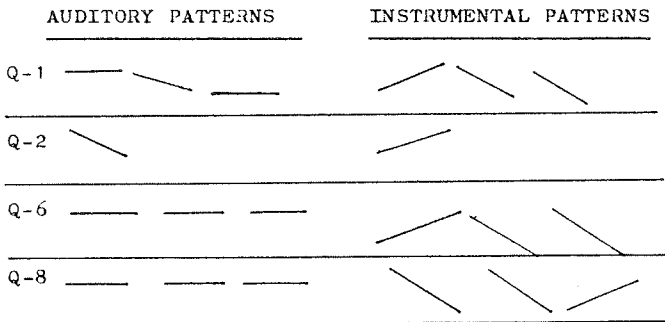
2. Auditory patterns and instrumental contours

The interval value of the rising contour in wh-questions seems to be great enough to be noticeable. All the listening subjects noted a rising pattern for wh-questions as well as for yes/no questions. There were no significant differences between the subjects regarding the F_0 contours for questions. However, statement contours differ.

As to the differences between the auditory patterns and the instrumental contours the following can be noted:

a) The contours are identical for Q-3, Q-4, Q-5 and Q-7 which indicates that the subjects have realized a rising in the fundamental frequency from 20Hz upwards.

b) In the other four questions the rising is not greater than 5-15Hz and has not been noticed. Here the auditory patterns differ from the instrumental contours. In the following the same marks are used as in the auditory test (see Appendix 2A-B-C-D).



In all the auditory patterns the pitch movements agree with those within the first three harmonics on the spectrograms.

3. Fundamental frequency values and focus

24 statement recordings and 24 question recordings of both male /MR/ and female /KVR/ have been studied.

The range for male voice /MR/:

F_0 (min) in ST: 85-100 Hz F_0 (max) in ST: 150-220 Hz
in Q : 80-100 Hz in Q : 160-220 Hz

The range for female voice /KVR/:

F_0 (min) in ST: 185-210 Hz F_0 (max) in ST: 325-390 Hz
in Q : 150-240 Hz in Q : 340-380 Hz

3.1. A different range for statements and questions has been observed only for KVR.

3.2. In all statements the focused syllable has received the highest F_0 value, cf. Table 3 a) below.

	MR			KVR		
	I	II	III	I	II	III
ST-1	x-165 100-165	x-170 85-170	x-190 100-190	x-350 180-350	x-360 190-360	x-360 190-360
ST-2	x-200 100-200	x-190 85-190	x-190 90-190	x-350 200-350	x-360 200-360	x-360 200-360
ST-3	x-170 100-170	x-160 80-160	x-170 80-170	x-350 195-350	x-325 210-325	x-360 190-350
ST-4	x-200 100-200	x-200 90-200	x-190 90-190	x-370 185-370	x-360 200-360	x-350 190-350
ST-5	x-190 90-190	x-220 100-220	x-200 80-200	x-370 210-370	x-390 200-390	x-350 200-350
ST-6	x-160 90-160	x-165 85-165	x-150 90-150	x-370 195-370	x-360 210-360	x-360 200-360

Tab. 4 a) $\bar{x}=F_0$ value for focused syllable
 F_0 (min) and F_0 (max)

3.3. For question utterances the conditions are quite different. As to yes/no questions the focused syllables have either the lowest F_0 value or are close to it. As to wh-questions the sentence stressed syllables often have F_0 (max) values. The funda-

mental frequency curve falls immediately after focus to the lowest value, cf. Appendix 2A and 2B for yes/no questions, 2C and 2D for wh-questions. See also Table 4 b) below.

x-values not always obtainable						
	MR			KVR		
	I	II	III	I	II	III
Q-1	x-140 90-180	x-110 90-190	x-100 100-180	x-160 160-340	x-240 200-360	x-290 200-360
Q-2	x-130 100-210	x-125 95-180	x-200 100-200	x-150 150-360	x-240 200-370	x-220 200-360
Q-3	x-100 100-190	x-100 95-190	x-100 80-180	x-185 185-360	x-240 190-370	x-230 200-370
Q-4	x-100 100-220	x-100 100-220	x-100 85-170	x-240 240-350	x-260 220-360	x-240 210-350
Q-5	x-220 100-220	x-200 95-200	x-190 95-200	x-350 210-350	x-360 190-370	x-330 200-330
Q-6	x-110 100-200	x-190 90-190	x-170 90-170	x-360 210-360	x-230 200-360	x-230 200-350
Q-7	x-190 90-190	x-200 100-200	x-220 90-220	x-360 220-360	x-370 195-370	---- 210-360
Q-8	x-100 100-190	x-180 100-180	x-110 90-200	---- 230-360	---- 230-380	---- 200-350

Tab. 4 b) $x=F_0$ value for focused syllable
 F_0 (min) and F_0 (max)

It can be stated that F_0 (min) and F_0 (max) values are related to focus in a different way for the two types of questions. An investigation of all question utterances shows that the highest F_0 values occur in yes/no questions in the final, unstressed syllable regardless of the focus-position. In wh-questions the highest fundamental frequency values often occur in the focused syllable.

4. The intensity study was limited to a comparison of sentence stress and intensity peaks.

4.1. In the intensity curves the focused syllable has the highest or second highest peak. These differences are probably due to the different intensity level of different vowels.

4.2. The focus marks in the material obtained by the auditive method are positioned at the same syllable as in the test material for question utterances. In statements there is some variation in the positioning of focus marks, especially in ST-3, /statement after focus/, and in ST-6 where focus was not marked in advance, cf. TEST MATERIAL.

5. Duration time for all utterances was examined. The results are presented below.

Tab. 5.

ST/Q	NUMBER No. of syll.	MR			KVR		
		I	II	III	I	II	III
Q-5	6	125	120	130	115	120	120
Q-7	6	125	120	130	115	110	120
ST-1	8	155	195	180	180	160	160
Q-1	8	140	140	150	150	150	140
Q-6	8	155	150	170	145	140	150
Q-8	8	150	140	170	125	140	140
Q-3	9	155	155	175	160	140	150
ST-2	10	190	160	160	220	190	190
ST-3	10	170	170	170	200	175	180
Q-2	10	180	165	180	190	190	170
ST-4	12	225	200	205	235	230	225
Q-4	13	215	208	208	220	210	215
ST-5	14	240	225	250	310	285	345 ^{x)}
ST-6	16	260	250	248	370	340	330

x) repeated phrase

On the whole the duration time increases with the number of syllables, but the more syllables the shorter time each unfocused syllable receives. In ST-1, where three words are focused in order to get introductory intonation, the duration time is naturally longer.

When comparing the recordings for MR it can be observed that during recording II MR the material was read at the highest speed. This could possibly be seen to confirm the expectations that recording II was correctly chosen to obtain the most natural intonation in questions /see Experimental procedures/.

For KVR the statements tend to take more time than for MR. However, questions tend to be produced faster.

6. Syllable length in focused and unfocused position

The values presented below were obtained from recording II MR discussed above. In order to check these values further, four statements and three questions were examined from recording III MR. The only difference is that the highest value for ma-, 28 cs, is not present there.

6.1. ma- occurs 19 times in statements and 13 times in questions. The duration time varies

- from 16 cs to 28 cs for focused syllable
- from 16 cs to 22 cs for unfocused

The length of the syllable ma does not seem to be influenced by whether the subject NP has sentence stress or not. Higher values can be found more often in the VP. The longest duration time for ma occurs in Q-4 which has the largest number of syllables.

For -li- similar values were found for stressed and unstressed syllables positioned in VP and outside VP. lu- is the first syllable of the verb. It occurs once as focused and lasts then 19 cs. It lasts from 10 cs. to 14 cs. as unfocused.

It has been found that the syllables discussed above tend to have a longer duration time in rhematic position. The longest duration time of all is found in the final and unstressed syllable in all question utterances: from 26 cs. to 30 cs.

SUMMARY

1. The results from the auditive investigation agree well in themselves and also with the results of the instrumental investigation regarding question utterances. All the listening subjects have defined the intonation in wh-questions as neutral.
2. Statement and question utterances have a clearly different fundamental frequency contour. This indicates that it is possible to recognize whether the produced utterance is a question or a statement only with the help of the intonation contours in the final segment of the utterance. This is valid for both types of questions.

3. However, the characteristic rising F_0 contour shows some differences for yes/no questions and for wh-questions. The differences are found in the F_0 interval values. In yes/no questions higher values are found for the final syllable of the utterance than for the same segment in wh-questions.

4. The maximal values for pitch occur in the same position as focus only in wh-questions. Regarding yes/no questions no changes of the F_0 curve could be observed when the position of sentence stress was altered.

5. The duration time for focused syllables tends to be longer than for other syllables. The longest duration time of all was found in the final unstressed syllable in questions.

The results in point 1, point 2 and point 5 agree with results arrived at by other researchers. The results in point 3 and point 4, however, throw light on the differences between the rising intonation contours in yes/no questions and in wh-questions. One cannot draw general conclusions since the investigated material is too limited. However, in both types of question utterances a tendency towards rising F_0 contours seems to be quite clear.

REFERENCES

- Benni, T. 1916. O akcencie polskim - spostrzeżenia i pomiary, Warszawa.
- Bruce, G. och Gårding, E. 1978 . A prosodic typology for Swedish dialects. In: Gårding, E., Bruce, G. och Bannert, R./eds./ Nordic Prosody II: 219-228. Department of Linguistics, Lund University
- Dłuska, M. 1947, II 1976. Prozodia języka polskiego. Warszawa.
- Dobrogowska, K. 1978. Badania zależności między akcentem a intonacją w mowie nieemocjonalnej. *Lingua Posnaniensis XXI* 1978 s 65-76
- Dukiewicz, L. 1977 Prozodyczne wyznaczniki komunikatywnej struktury wypowiedzi. In: *Polonica III* 1979, 5-15.
- Dukiewicz, L. 1978. Intonacja wypowiedzi polskich. Wrocław.
- Dukiewicz, L. 1979. Instrumental, Auditory and Funktional Analysis of Polish Intonation. In: *Slavica Lundensia 7 / 1979*.
- Dukiewicz, L. 1982. Stosunki intensywnościowo-iloczynowe między elementami fraz oznajmujących i pytajnych o różnej lokalizacji szczytu fonicznego. In: *Polonica VIII* 1982.
- Gårding, E. 1974. Kontrastiv prosodi. Lund.
- Gårding, E. 1979. Sentence Intonation in Swedish. *Phonetica* 36
- Gårding, E. 1981 Contrastive Prosody; A model and its application. *Studia Linguistica* 35, 1-2, 146-166. Lund.
- Gårding, E. and Bruce, G. 1981. A Presentation of the Lund Model for Swedish Intonation. *Nordic Prosody II*, 33-39. Trondheim.
- Gårding, E. 1984. Comparing Intonation. Working Papers 27. DEp. of Linguistics, Lund University.
- Jassem, W. 1959. The phonology of Polish stress, *Word* 15,
- Jassem, W. 1962 Akcent języka polskiego. Wrocław.
- Pluciński, A. 1978. Interdependencies between the Fundamental Frequency and the Intensity Level in Polish Colloquial Speech. In: *Lingua Posnaniensis XXI*.
- Richter, L. 1978. Wpływ pozycji w zestroju akcentowym oraz długości wyrazu na czas trwania głošek w języku polskim. In: *Lingua Posnaniensis XXI*, 91-114.
- Richter, L. 1980. Wpływ tempa mowy na czas trwania głošek w języku polskim. In: *Polonica VI*, 1980.
- Richter, L. 1982. Rola poszczególnych czynników w procesie percepcji intonacji w języku polskim. In: *Polonica VIII*, 1982.
- Steffen-Batogowa, M. 1966. Versuch einer strukturellen Analyse der polnischen Aussagemelodie. *Zeitschrift für Phonetik, Sprachwissenschaft u. Kommunikatinsforschung* 19, 398-440.
- Wierzchowska, B. 1980. Fonetyka i fonologia języka polskiego. Wrocław.
- Wodarz, 1962. Zur Satzintonation des Polnischen. *Phonetica* 8/62.

APPENDIX 1

THE ORIGINAL VERSIONS IN POLISH

1. STATEMENTS /ST/

ST-1 Alina lubi maliny.

ST-2 Mama Aliny lubi maliny.

ST-3 ...,mama Aliny lubi maliny.

ST-4 Mama Aliny lubi moje maliny.

ST-5 Mama małej Aliny lubi moje maliny.

ST-6 Mama małej Aliny lubi moje małe maliny.

2. QUESTIONS /Q/

Q-1 Alina lubi maliny?

YES/NO

Q-2 Mama Aliny lubi maliny?

QUESTIONS A.

Q-3 Czy Alina lubi maliny?

YES/NO

Q-4 Czy mama Aliny lubi małe maliny?

QUESTIONS B.

Q-5 Kto lubi maliny?

WH-QUESTIONS C.

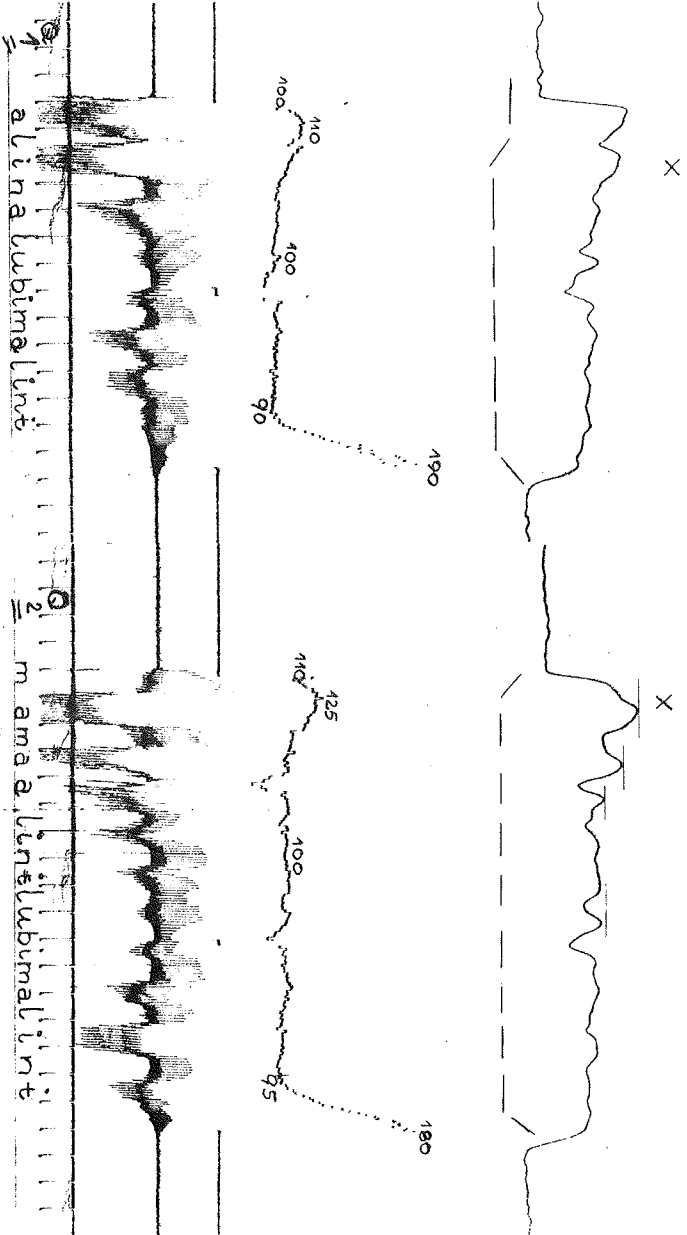
Q-6 Kto lubi małe maliny?

Q-7 Co lubi Alina?

Q-8 Co lubi mama Aliny?

All words in the test material have lexical stress on the penultimate syllable.

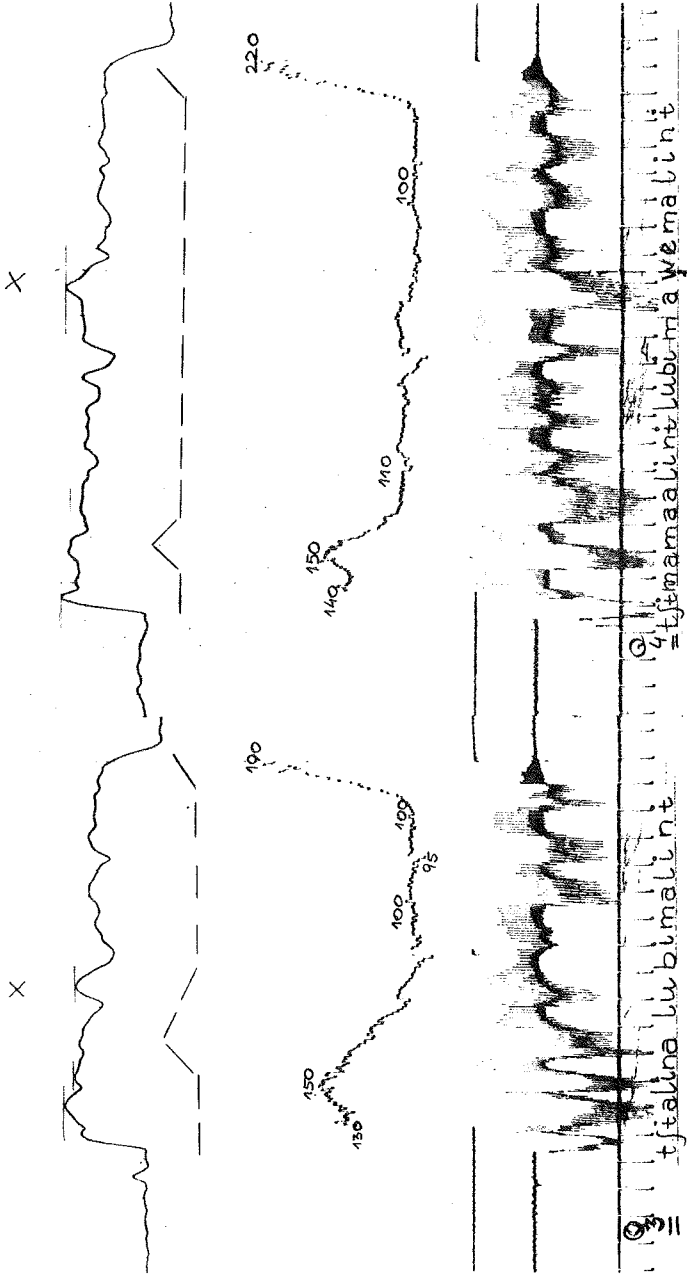
- A. Unmarked yes/no-questions
- B. Yes/no questions with a question particle
- C. Wh-questions



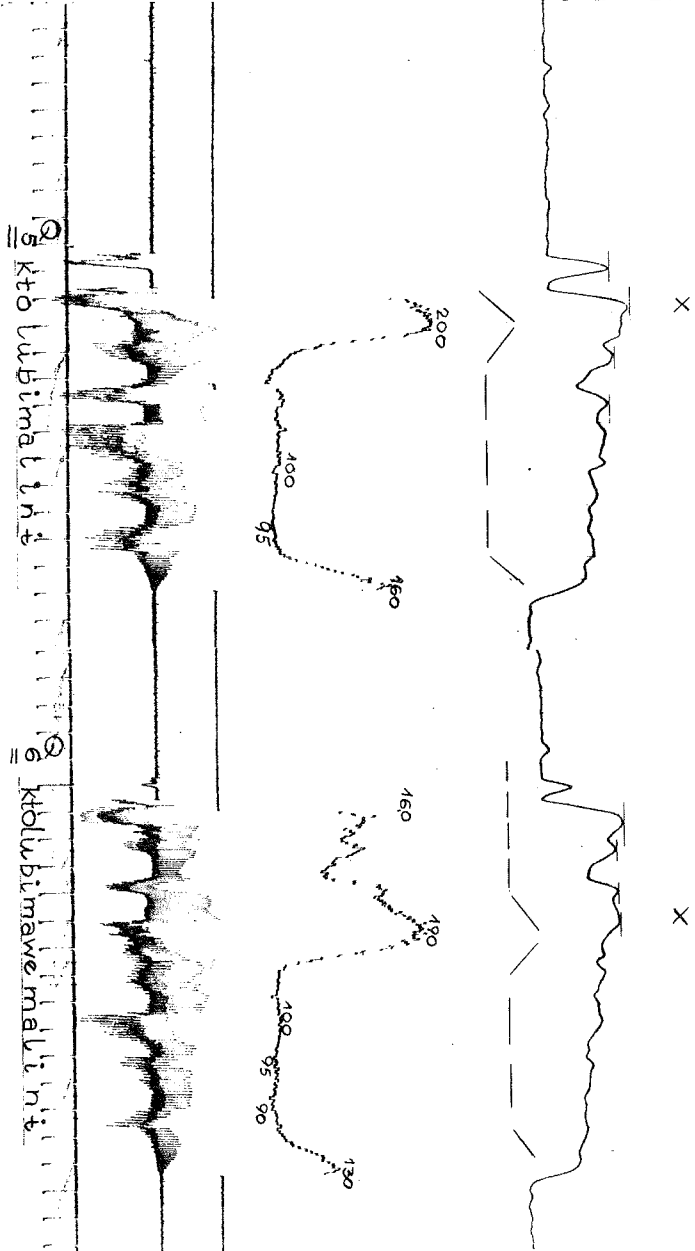
2.A.

YES/NO QUESTIONS WITHOUT QUESTION PARTICLE /UNMARKED/

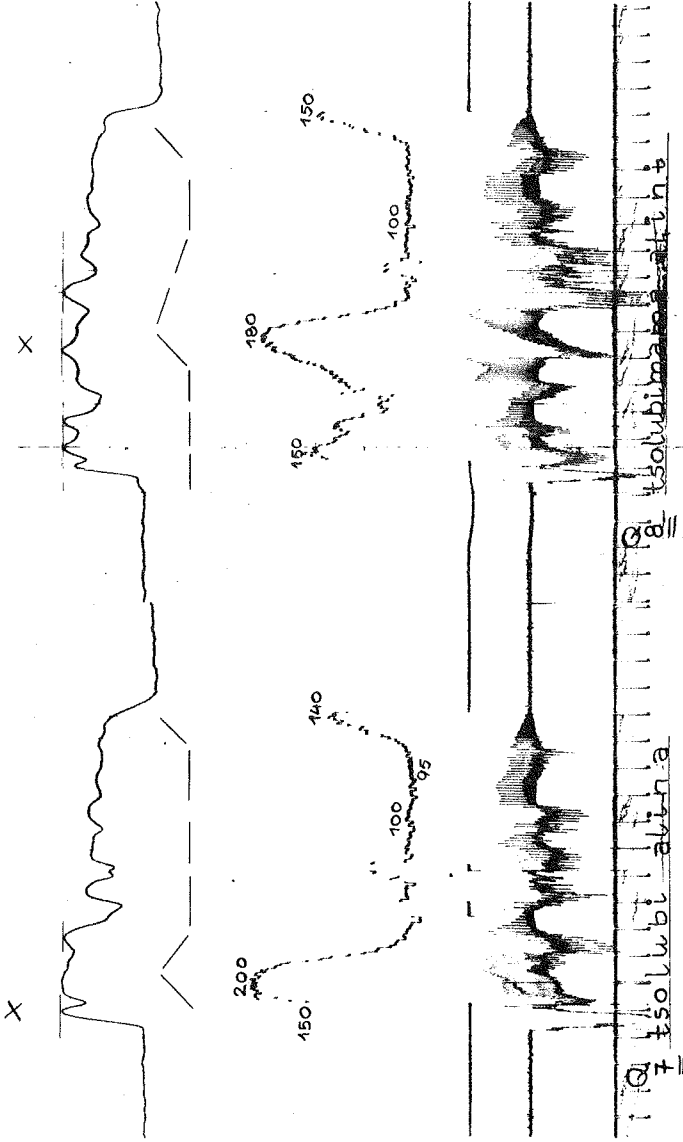
The audiotively based F₀ contours have been placed above the F₀ curves. Above the intensity curve the focus marking (x) has been carried over from the test material.



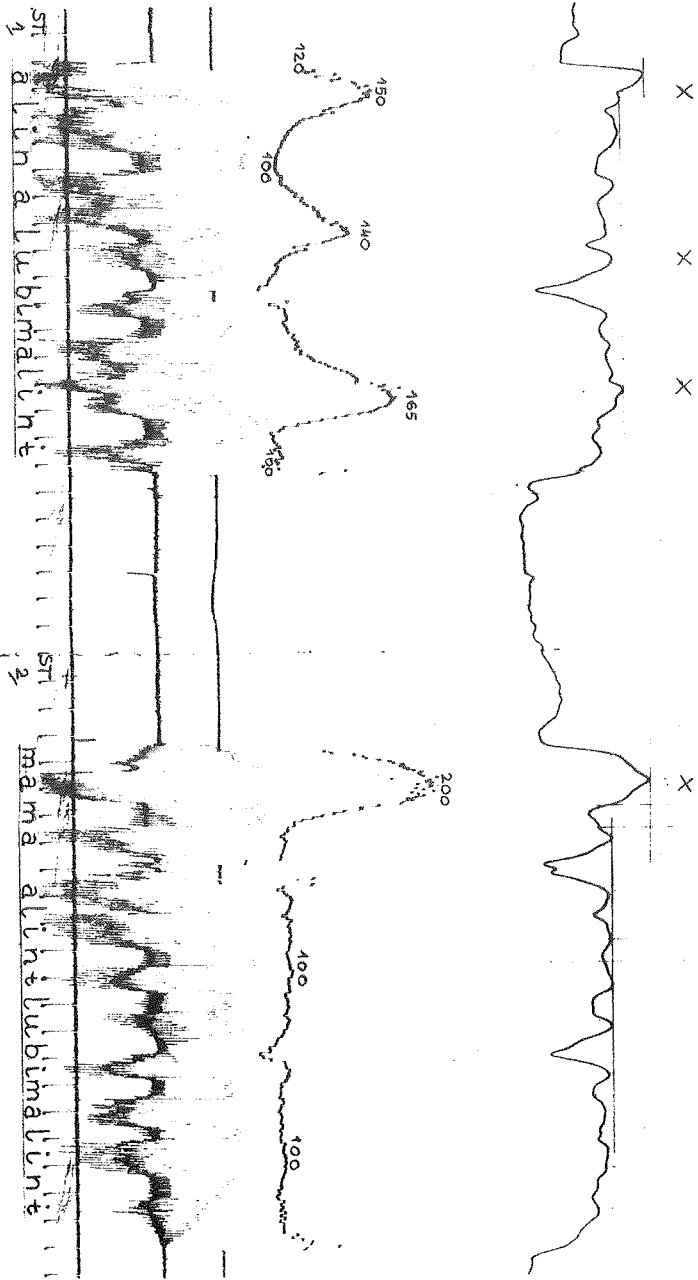
The auditive based F_0 contours have been placed above the F_0 curves.
Above the intensity curve the focus marking (x) has been carried over from the test material.



2.C. WH-QUESTIONS. Additively based F_0 contours have been placed above the F_0 curves. Focus marking (x) has been carried over from the test material.

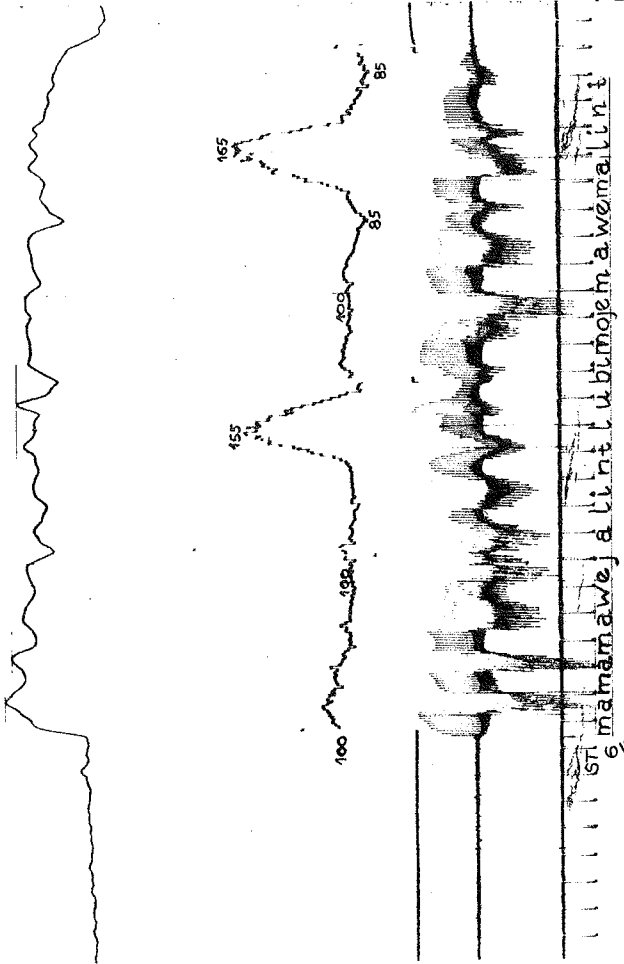


2.D. WH-QUESTIONS. Auditively based F_0 contours have been placed above the F_0 curves. Focus marking (x) has been carried over from the test material.



3.A. RANDOM OSCILLOGRAMS OF STATEMENTS

Focus marking (x) has been carried over from the test material.



3.B. STATEMENT OSCILLOGRAM FOR ST-6, WITHOUT FOCUS MARKED IN ADVANCE.