PROSODIC CORRELATES OF CERTAINTY - UNCERTAINTY IN UTTERANCES WITH MODAL WORDS

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ABSTRACT

This study was directed at the interaction of lexical and prosodic means affecting the perception of the speaker´s degree of certainty. Russian material was used to test groups of Russian native speakers as well as German test persons having no knowledge of Russian. Several experimental sessions were conducted varying the kind of stimuli presentation but not the stimuli themselves. The comparison of the results as well as the analysis of some F0 features showed some factors that seem to determine the listeners´ respones. As for native test persons, the essential information was conveyed by the lexical markers of epistemic modality. They seem to be quite stable against several intonational contours that occured in the stimuli. A significant correlation between listeners´ judgement of degree of certainty and the mean F0 characteristics was found. This correlation seems to affect native test persons as well as non-natives when lexical information is missed. Moreover, non-native listeners focus their attention to the final part of intonational contour.

1. INTRODUCTION

Among the attitudes a speaker conveys with his/her utterance epistemic modality seems to be an obligatory component of at least declaratives and interrogatives. In a more psycholinguistic sense, epistemic modality can be described as the degree of certainty a speaker ascribes to the underlying proposition.

It is commonly assumed that the degree of certainty may be expressed by lexical means as well as by prosodic cues [1, 2]. The goal of this study is (1) to ascertain the connection between lexical and prosodic markers of epistemic modality, and (2) to specify the impact of some F0 characteristics on the perception of epistemic „force“. For this purpose, a series of experiments directed at the perception of the degree of certainty was carried out.

Afterwards¸ the experimental results were correlated with some F0 features of the stimuli.

2. EXPERIMENTS

1.1. Methods

All experiments showed the same design: Listeners had to judge the degree of certainty conveyed by the stimuli on a scale of five step down categories - from „absolutely certain“ up to „absolutely uncertain“. The procedure was conducted on PC individually for each test person. The experiments were prepared and conducted on a PC using the software programme VERSTEU [3].

Psychologically, we interpreted the scale as consisting of intervals. But for statistical purposes, the rating scale was interpreted as an ordinal one because it could not be judged whether the width of all intervals was identical. This led to some restrictions concerning the applicable statistical methods. As for mean value, the median Me was calculated for every stimulus. The interpersonal variance of reactions was determined in terms of interquartile distance.

1.2. Stimuli

The stimuli were extracted from microdialogues produced by a male native speaker of Russian. They answered the question who something did. The stimuli utterances had the structure *modal word (+/-) Ivanova.* For example: *Verojatno Ivanova (Probably Ivanova).* The speaker was encouraged to produce the target utterances with a neutral attitude. Afterwards, the utterances were evaluated regarding their naturalness and acceptability. A set of 17 utterances was selected.

1.3. Experiment 1: written material

The first experiment addressed the representation of epistemic modality in the internal lexicon of native speakers. The test persons were presented written stimuli varied by lexical markers of epistemic modality only. The average results (Me) of 23 Russian native test persons are given in Table 1, column 3. They show a good interpersonal agreement. The results prove a hierarchical structure of lexical markers consisting of several degrees of certainty [4]. The structure is to be characterized by intervals (zones) that should be differentiated within by further semantic criteria. The mean values (Me) obtained for each visually presented stimulus serve as the basis of comparison with data of experiment 2.[1]

1.4. Experiment 2: spoken material

Experiment 2 was carried out on the basis of spoken material. Our attention was focused on the degree to which test persons´ judgement of „epistemic force“ changed by prosodic features of the stimuli. For this reason, the verbal structure remained the same as in the preceeding test, as well as the group of participants.

The results of test 2 are given in column 4 of Table 1. 10 of 17 stimuli (59%) retained the same mean value as in the previous basic experiment. 7 stimuli (41%) were allocated a higher or lower degree of certainty. The statistical significance of the Me differences was verified with the Wilxocon test (p=0,05).

Despite their significance, none of the mentioned deviations exceeded one degree (interval) of certainty. This fact is to be stressed with regard to the quite different F0 contours

1	2	3	4	5	6
No	Stimuli	Exp. 1: Me (t); R	Exp. 2: Me (sp-n); R	Exp. 3a: Me (sp-n-f); R	Exp. 3b: Me (sp-n); G
1	Ivanova.	1	1	3	3
2	Vidimo Ivanova.	3	3	3	2,5
3	Nu Ivanova.	2	2	3	2
4	Skoree vsego Ivanova.	3	3	4	3
5	Nu Ivanova že.	2	1	2	1
6	Po-vidimomu Ivanova.	4	3	3	1,5
7	Očevidno Ivanova.	3	3	2	1
8	Naverno Ivanova.	4	3	3	2
9	Možet byt' Ivanova.	4	4	3	4
10	Navernjaka Ivanova.	2	2	3	2,5
11	Vozmožno Ivanova.	4	3	3	2,5
12	Konečno Ivanova.	1	1	1	4
13	(Da) vidno Ivanova.	3	3	4	4,5
14	Verojatno Ivanova.	4	3	3	1
15	Dumaju Ivanova.	3	4	4	4
16	Kažetsja Ivanova.	4	4	4	4
17	Po-moemu Ivanova.	3	4	3	4

Table 1. The degree of certainty (mean values Me) determined in tests with written material (t), Russian subjects (column 3), with neutrally spoken material (sp-n), Russian subjects (column 4), with filtered neutrally spoken material (sp-n-f), Russian subjects (column 5), and with neutrally spoken material (n-sp), German subjects (G) without knowledge in Russian.

the stimuli are uttered with. Therefore, we assume the following: The prosodic shape of an utterance can modify the degree of certainty in both directions. But this influence seems to be rather narrow for native speakers. Obviously, the strongest impact on the listeners´ decision do have the modal words.

1.5. Experiment 3: masking lexikal information

The results of experiment 2 forced the idea to exclude lexical information maintaining the F0 contour of the stimuli. This was done in two ways: a) by presenting filtered material to native speakers, and b) by presenting the unfilterd material to non-native test persons.

1.5.1. Experiment 3a: The elimination of lexical information was achieved by lowpass filtering of the previously used stimuli with a boundary frequency of 300 Hz.

A group of 26 native Russian speakers not identical with the previous test group took part in this experiment. The procedure was the same as in the sessions before.

The results are presented in column 5 of Table 1. We compared them with the results of experiment 2. 8 stimuli fell into the same rating interval, 3 showed a higher degree of certainty (one interval), 5 - a lower degree of certainty. The stimuli that got Me=3 or Me=4 in experiment 2 were most stable. This fact should be pointed out in considering the assumption that the salient information on epistemic degree seems to be conveyed by lexikal markers. As stated before, the F0 contours of the stimuli varied quite remarkable although all of them belonged to declaratives.

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1.5.2. Experiment 3b: The experiment with non-native listeners had exactly the same design as the second one conducted with Russian test persons. 6 German listeners participated in this test. The average results quoted in Table 1, column 6, show matchings with the natives´ judgements (stimuli 3, 4, 5, 9, 15, 16, 17), or only slight deviations (stimuli 2, 10, 11) as well as more salient differences (stimuli 1, 6, 7, 8, 12, 13, 14). It is supposed that these results are mainly based on prosodic clues.

3. F0 ANALYSIS

At first, an analysis of F0 contour was provided for each stimuli. With regard to the study of Ward and Hirschberg [6], our attention was focused on the last stressed syllables. As mentioned before, the intonation contours varied from an unmarked fall in the final stressed syllable over monotonic contours covering the whole utterance to raising F0 movement in the final stressed syllable. This diversity is not uncommon for Russian dialogue replies [7]. But the character of the final F0 movement seems to affect the responses of non-native listeners far more than those of native ones. For example, stimulus No. 13 shows a steep LH movement on the last accented syllable -no- (Iva'nova). The preceeding part of the F0 contour is monotonic with F0 values lying in the low part of speakers register. Native test persons were not influenced by this shape as long as they could make use of the lexical information (see Table 1). Non-native test persons rated the stimulus clearly lower (Me=4,5), and even natives ascribed a lower degree of certainty (Me=4) to the stimulus when they were confronted with filtered material. But not all of the stimuli that that were

given Me=3 or Me=4 ratings in the experiment with non-native listeners showed a marked terminal F0 contour.

Looking for another correlate of listeners´ responses, the stimuli were grouped in accordance with the results obtained in rating experiment 2. For these groups, the mean F0 values were calculated. Figure 1 shows a clear correlation between the mean F0 value and the degree of certainty represented by the stimuli. The lower the degree of certainty an utterance conveys the higher its mean F0 value. It increases from 126 Hz for stimuli with Me=1 until 188 Hz for stimuli with Me=4. The statistical significance of the differences between the average F0 values was verified by the t-Test of WELCH [4].

The analysis of the F0 range reflects an analogue correlation between epistemic degree and F0 dispersion: the lower the degree of certainty of the stimuli the wider their F0 range, and vice versa. However, these results have to be further examined on the basis of more natural and extended material.

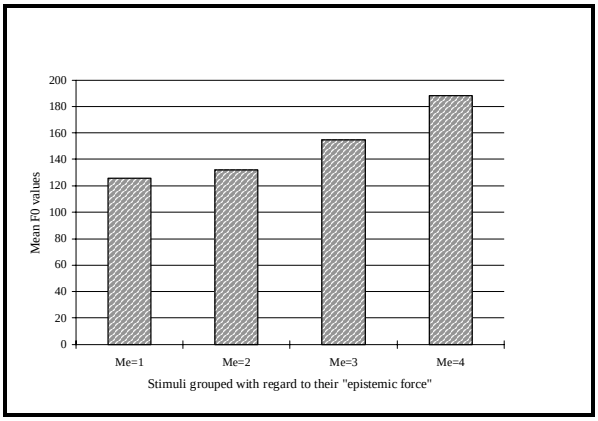

Figure 1. Correlation between mean F0 value and perceptive rating of „epistemic force“(results of experiment 2)

4. CONCLUSION

In general, utterances with verbal markers of epistemic modality get their „epistemic force“ mainly from the modal words. Nevertheless, the degree of certainty expressed by several modals can be modified by prosodic means. But as far as native listeners are concerned , the modifications mentioned here lead to rather small deviations under normal conditions.

The impact of prosodic features seems be much stronger for people that cannot use lexical information. But even in this situation we have to notice differences in the responses of native and non-native listeners. The latter seem to operate strongly with the terminative F0 contours; the first seem to use more integral information that is to be studied in more detail. But despite these differences, both groups of test persons base their judgement of degrees of certainty at least partly on the mean F0 values which provide a clear acoustic differentiation between several stimuli groups.

NOTES

The material is available on the following website:
http://www.ruhr-uni-bochum.deLiLab/Akustische Zitate.

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