PITCH RANGE IN POSITIVE AND NEGATIVE CONNOTED STATEMENTS OF GERMAN

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ABSTRACT

The present paper deals with the prosodic marking of negative and positive connoted statements in German. Data from one perception and two production experiments are presented. Global pitch range defined as the distance between F0-max and F0-min within an utterance was measured. The results provide evidence that negative connoted statements are prosodically expressed by means of higher F0-minima and lower F0-maxima compared to their positive counterparts. In a perception study the smaller pitch span of negative connoted statements was rated significantly more impolite than the positive ones. The results indicate that negative connoted statements in German are marked prosodically distinct, which is in line with the universal view of pitch range variation.

Keywords: pitch range, negative connoted statements, German, negative politeness

1. INTRODUCTION

This paper is about the prosodic expression of negative connoted statements. The term negative connoted statement covers for instance refusals, excuses, negative assessments, bad news, and similar speech acts. An example of a negative connoted statement as used in the present study is given in (1) where the assertion is about a failed exam. In (2) an instance of a positive connotation refers to a vacation in the near future, assuming that a vacation is a positive event.

(1) Anna hat die Prüfung nicht bestanden.
'Anna failed the exam.'
(2) Moni kann den Urlaub bald machen.
'Moni may have a vacation soon.'

Building on the theory of universal aspects of the interpretation of pitch variation (biological codes, [6]) the assumption is that speakers make use of universal aspects of prosody in communication. Hence a negative or positive connoted statement is expressed by means of distinct prosodic cues.

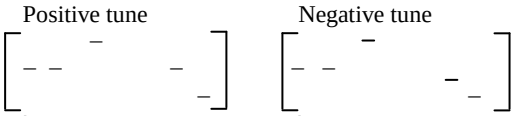
1.1. The biological codes in intonation

The Three Biological Codes [6] are those universal paralinguistic form-function relations and dimensions of meaning that refer to the production process of F0. [6] distinguishes the Frequency Code, the Production Code, and the Effort Code. The Frequency Code correlates with the size of the larynx and with the rate of vocal cord vibration. The Production Code refers to the intensity of the pitch and its decline from the beginning of a speech act to its end. The Effort Code finally refers to the amount of energy used in speech production.

One commonplace grammaticalisation of the Effort Code is the expression of focus. In German, for instance, focused elements are marked by prosodic prominence in terms of pitch register variation, intensity, and/or duration in order to attract more importance and attention for one statement compared with other ones, e.g. [5].

Another informational use of the Effort Code concerns the excursion size of the pitch range in relation to negation [6]. In Engenni, a two tone language belonging to the Kwa branch of the Niger-Congo family spoken in Nigeria, a distinct pitch range expresses negation [9]. A segmentally identical sentence gets a negative meaning only by modifying the pitch range (cf. Fig. 1).

Figure 1: Prosodic negation marking in Engenni [9], p. 67.



The child should go home. *The child did not go home.*

1.2. Pitch range in attitudinal speech

According to [4] there exists a connection between positive connoted statements and strong emotions such as joy, surprise, or anger and a higher pitch range. The question remains whether negative connoted statements also correlate with a particular prosodic realisation. Following the principle of negative politeness [3], which states that speakers

try to shape negative discourse contents both semantically and prosodically to be more inconspicuous, the conclusion would be that negative connoted statements require a reduction of prominence. If an increase of prominence in case of focus results in an increased pitch range [5], a reduction of prominence in case of negation may result in a compressed pitch range.

1.3. Research question

Based on the relation between pitch range and negation in Engenni [9], and building on the idea of the biological codes [6], we assume that pitch range variations are used for the expression of negative connoted statements. Furthermore, assuming that negative politeness results in a reduction of prominence, which in contrast to focussed elements may prosodically be expressed as a reduced pitch range, the hypothesis of this paper is that negative connoted statements are expressed by a narrower pitch span (lowering the F_0-maxima, and raising the F_0-minima of the whole statement). At the same time, positive connoted statements are realised by means of a larger pitch span.

2. THREE EXPERIMENTS

The hypothesis of a reduced pitch range was examined by means of one perception and two production experiments. A dialog experiment was conducted based on the assumption that the required social function of a reduction of prosodic prominence follows from the context of a discourse [1]. A reading study should provide another opportunity to receive controlled speech material. It can then be compared with the results of the dialog study to examine the influence of the pitch range variation without context. The perception experiment intends to verify the acoustic correlate of negative connoted statements found in production.

2.1. Experiment 1: Dialog

Given that the expression of negative connotation is a communicative function, the task to test any prosodic realisation is best achieved by means of performing a dialog. For that reason four dialogs have been created, all in all containing 20 positive and 20 negative connoted statements. The dialog structure follows the definition of [7]: Participants created dialogs with a view to certain conversation aims, whereby their ultimate ambition was to answer questions about the state of the world.

2.1.1. Speakers and recordings

Ten speakers from the Berlin / Brandenburg area (6 female, 4 male) participated in the production studies. Their ages ranged between 20 and 50 years.

Recordings took place in the participants' houses in order to ease the experimental situation. After a short period for familiarisation with the dialogs the task was to read out the part of speaker B as naturally as possible; speaker A was always the experimenter (cf. Fig. 2).

2.1.2. Speech materials

20 positive and 20 negative connoted statements were embedded in contexts. The items were constructed keeping the syntax as alike as possible and thereby assuring that intonation contours may be realised alike as well. The target sentences are not completely comparable though. An example of a dialog is given in Fig. 2.

Figure 2: Excerpt of dialog 1 with the 1st negative (1n) and the 1st positive (1p) connoted item**.**

A: Where have you been this morning during the first lesson? You already didn't show up yesterday?
B: I slept through again[1n]...
A: Did you work on the lecture until late last night again?
B: Yes, but fortunately it is over now. I finished it yesterday![1p]

2.1.3. Measurements

For each target sentence F0-maximum and F0-minimum was measured in Praat [2] using a Praat script. Obvious pitch errors such as octave jumps or creaky voice have been corrected by hand. 800 data points for experiment 1, and 480 for experiment 2 were obtained. An ANOVA with Speaker as random factor and Connotation (positive/ negative) as fixed factor was carried out.

2.1.4. Results

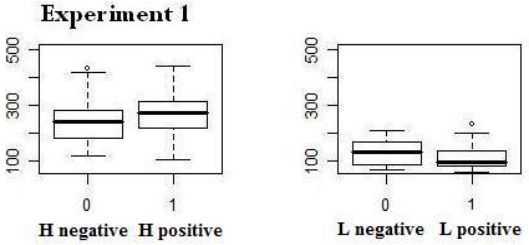
Figure 3 shows a boxplot comparing the F0-max (left panel) and F0-min (right panel) on negative and positive connoted sentences. Overall, F0-max is lower, and F0-min is higher on negative connoted statements than on positive connoted statements.

Mean F0-max in the positive connoted items is 269 Hz. On average this is 36 Hz higher than the mean F0-max in the negative connoted statements,

which is 233 Hz. Mean F0-min on the positive connoted sentences is 111 Hz. On average this is 16 Hz lower than the mean F0-min value on the negative connoted items, which is 127 Hz.

A one-way ANOVA with Connotation as fixed factor and Subject as random factor revealed significant differences between positive and negative connoted statements for F0-max ($F(1,9) = 44.9$, $p < 0.001$) and F0-min ($F(1,9) = 8.6$, $p < 0.05$). The dialog experiment, as the most appropriate method of testing the speaker's behaviour in natural conversation, thus confirmed the hypothesis that pitch range is reduced on negative connoted items.

Figure 3: Boxplot comparison of F_0-max (right) and F_0-min (left) in the positive and negative items of experiment 1.



2.2. Experiment 2: Reading

Given that the target sentences of experiment 1 differ in their structure, a second experiment with controlled, hence comparable data was conducted.

2.2.1. Method

The same 10 speakers as in experiment 1 participated in experiment 2. The subjects were asked to read the target sentences. All together, 12 positive and 12 negative connoted target items were mixed with filler sentences. The positive and negative content was achieved by means of quantifiers and adverbials (cf. (1) and (2) above). The same F0 measurements as in experiment 1 were conducted.

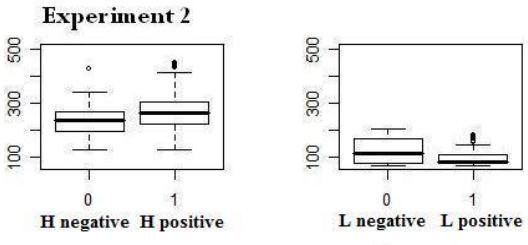
2.2.2. Results

Figure 4 shows a boxplot comparing the F0-max (left panel) and F0-min (right panel) on negative and positive connoted sentences. Overall, F0-max is lower and F0-min is higher on negative connoted items than on positive connoted statements.

Mean F0-max on the positive connoted items is 266 Hz. On average this is 35 Hz higher than mean F0-max on the negative connoted statements, which is 231 Hz. Mean F0-min on the positive connoted sentences is 97 Hz. On average this is 21 Hz lower than mean F0-min in the negative connoted items, which is 118 Hz.

A one-way ANOVA with Connotation as fixed factor and Subject as random factor also revealed significant differences between positive and negative connoted statements for F0-max ($F(1,9) = 15.1$, $p < 0.01$) and F0-min ($F(1,9) = 10.2$, $p < 0.05$). The reading experiment with controlled speech material, yet without context, provided equivalent results in comparison to the first experiment and thus confirms the assumption that pitch range is reduced.

Figure 4: Boxplot comparison of F_0-max (right) and F_0-min (left) in the positive and negative items of experiment 2.



2.3. Perception experiment

Listeners do have an intuitive knowledge about the pitch range variations that speakers apply [10]. Accordingly, a perception study will clarify whether the acoustic differences of negative and positive connoted statements are perceived as reliable cues to negation [8].

2.3.1. Method

14 listeners from the Berlin / Brandenburg area (8 female, 6 male) that did not partake in the first two experiments participated in the perception study. Their age ranged from 20 to 50 years.

24 recorded target items were taken from the first production experiments. Only items were chosen that make sense without a context. All together 6 "good" and 6 "bad" positive connoted items as well as 6 "good" and 6 "bad" negative connoted statements were chosen. Good and bad refer to the acoustic means found in experiment 1, i.e. a good positive connoted stimulus had a high F0-max and a low F0-min. Items were presented via headphones with 10 sec. breaks between them. During the break listeners were asked to answer a questionnaire on whether the item they heard sounded polite / appropriate or impolite / inappropriate on a scale from one (good) to six (bad).

2.3.2. Results

The exploitation of the perception study first of all revealed a preference of the subjects for statements with positive content (Table 1). But one can also detect differences within the positive, and respectively the negative sentences. The so called "good positive" items with high F_0-max and low F_0-min received a better rating than the "bad positive" ones. Likewise, the "good negative" items with lower F_0-max and higher F_0-min got a better rating.

A 2 x 2 ANOVA with Connotation and Goodness as fixed factors and Subject as random factor revealed a significant main effect for Connotation ($F(1,13) = 34.3$, $p < 0.001$), and for Goodness ($F(1,13) = 5.7$, $p < 0.05$). Post-hoc t-tests showed a significant difference between the "bad" and "good" positive sentences ($df = 83$, $t = 2.4$, $p < 0.05$), yet not for the negative ones ($df = 83$, $t = 1.6$, $p = 0.12$).

Table 1: Mean ratings for type of sentence (from 1/polite to 6/impolite).

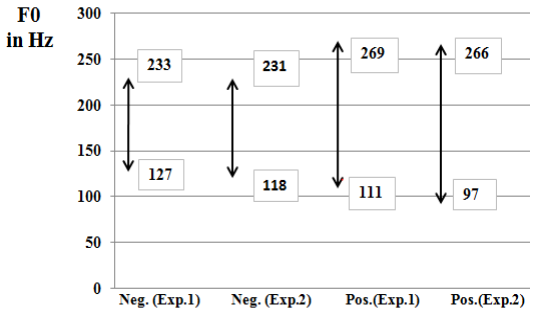
Sentence	Mean
Good positive	2.4
Bad positive	2.8
Good negative	3.6
Bad negative	3.9

3. GENERAL DISCUSSION

All in all, the three experiments confirmed the hypothesis that negative connoted statements are realised prosodically distinctly compared to positive ones. There is a difference concerning the pitch range in negative and positive connoted statements. The F0-max of the positive items is on average scaled higher than the F0-max of the negative items. On the other hand, the F0-min of the negative sentences is on average scaled higher than the F0-min of the positive statements. The differences in F0-max and F0-min result in different pitch spans. Figure 5 clarifies that the pitch span in positive connoted statements is higher than the pitch span in negative connoted speech acts.

From a perception point of view, the acoustic distinction has been shown to be perceived. Sentences that were realised according to the acoustic means were rated as significantly more polite by the subjects of the third experiment. These findings indicate that the pitch range on negative connoted items is pragmatically relevant in a discourse. Speakers make use of the reduction of prominence via pitch range, and listeners are able to perceive it.

Figure 5: Comparison of the average pitch span of all negative and all positive connoted statements**.**



In sum, negative connoted statements are prosodically marked by a smaller pitch range. One can assume that in German this characteristic results from the pragmatic principle of negative politeness. Speakers are not only able to express prominence with the help of accents and focus but also, according to the Effort Code, they can use reductions of prominence in order to weaken negative connoted statements in certain contexts that socially necessitate a reduction. Furthermore, this confirms Gussenhoven's assumptions [6] concerning the speakers knowledge about the communicative relevance of the Biological Codes.

4. ACKNOWLEDGEMENTS

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