

The intonation's effects on speech intelligibility and attitudes

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Abstract

Intonation is a phenomenon that constitutes a large part of human communication. Despite this fact it is an area that is relatively unexplored, particularly in Swedish. This study examines whether the pattern of intonation affects the intelligibility of spoken language and how the listener perceives the speaker with five different attitudes to choose from. This is a quantitative cross section study where mail based questionnaires were used. 46 participants were included in the study, half of them listened to a recitation of a short text with lively intonation and the remaining half listened to the same text but recited with a monotone intonation. This study shows that there is a significant difference of speech intelligibility between the two different intonation patterns. Speech intelligibility is larger in the group who listened to the recording with lively intonation. There is also a significant difference between the participant groups regarding the evaluation of the attitudes *sympathetic*, *dedicated* and *irritated*. The results of this study are applicable in areas such as teaching, news casts and lectures.

Background

The idea of this study emerged when reading a chapter by Vaissière (2006) which was focused around the subject of intonation. It became clear that intonation is an area that has not been fully explored. Particularly few studies have been done on the subject in Swedish, even though it is a language with rich patterns of intonation which play im-

portant parts as communicative markers (Vaissière, 2006). Amongst other topics not much research has been done exploring any eventual connection between intonation and intelligibility. However, a study that was made by Francuz (2010) touches on the subject. Francuz conclusion was that intonation affects how well listeners comprehend newsreaders messages. Furthermore, a study made by Braun, Dainora & Ernestus (2011) showed that an unfamiliar intonation pattern slows down the processing of speech and thereby reduces intelligibility, which indicates the importance of intonation. Since intonation constitutes a large part of human communication this was an area that awoke our interest. Intonation gives the listener information about an utterance, such as if it is a question or a statement (Vaissière, 2006). Other functions of intonation are emphasis and the display of attitudes, for example if the speaker is ironic. It also functions as a marker for turn taking in conversations. Rebecca Hincks has done several studies where she puts emphasis on the importance of a varied intonation when giving lectures and doing presentations (Hincks, 2005; Hincks & Edlund, 2009). She has done research on how a varied intonation can be obtained in oral presentations held in one's second language through feedback. However, we wanted to explore whether there in fact is a significant difference in speech intelligibility depending on which type of intonation pattern one uses, a monotone or a lively. We also wanted to explore how a listener perceives a speaker

based on the pattern of intonation that is used.

Our hypothesis for this study was that speech with a monotone intonation would be less intelligible than speech with lively intonation. This belief arose from personal experiences where speech with a monotone intonation has been considered strenuous to listen to resulting in a decrease of interest of the speech. Furthermore, without varied intonation important communication markers such as emphasis and focusing becomes lost which makes it more difficult to obtain the message. We also hypothesized that speech with monotone intonation would be perceived as irritated, unsympathetic and uncommitted, whereas speech with a lively intonation would be perceived as dedicated, sympathetic and possibly naïve. Speech with a very lively intonation was also believed to be perceived as unnatural or artificial (Vaissière, 2006).

Method

To be able to answer these questions a male speaker reading a short text about chameleons was recorded in two settings, one with a lively intonation and the other one with a monotone intonation. The following data was collected from the program Praat. The mean value of the pitch, amplitude and duration was kept on approximately the same level in both of the recordings. The duration of the recordings was 64 seconds each. The pitch in the recording with lively intonation varied between 76 Hz and 210.6 Hz, the mean pitch was 114.7 Hz. The pitch in the recording with monotone intonation varied between 75 Hz and 143.4 Hz, the mean pitch was 104.7 Hz. The mean value of the amplitude in the recording with lively intonation was 72.5 dB and in the one with monotone intonation 74 dB.

The number of participants in this study was 46. Without knowing there was any other type of recording than the one they listened to, half of the participants listened to the recording with lively intonation and the other half to

the one with monotone intonation. The study was randomized with a restriction in the distribution in terms of gender. In the group who listened to lively intonation 9 participants were men and 14 were women. In the group that listened to monotone intonation 7 participants were men and 16 were women. An equal amount of participants in each group (8 people) knew the person who read the text on the recording since before. The age of the participants varied between 20-35 years. However, two of the participants were older than 40 years, one in each group.

The participants of both groups were asked to listen to the recording just once and then answer five questions concerning the content of the recorded text, three multiple choice answers were given to each question. The participants were also asked to fill in a form where they could rate from 0 (not at all) to 5 (very much) how they perceived the speaker. The attitudes the participants were asked to rate were: *sympathetic*, *dedicated*, *irritated*, *artificial* and *naïve*. We e-mailed the instructions to the participants and attached the sound file and questionnaires separately. Their answers were e-mailed back to the authors.

Two very different types of intonation patterns were used, a monotone and a lively, so that a clear result could be extracted. Two separate listening groups were chosen so that the participants would not hear the text read two times and thereby learn it. Furthermore, since the participants did not know there was a second recording, the purpose of the study remained hidden so it would not affect the results.

The text that was used in this study was chosen because it seemed to keep an appropriate level of difficulty, not too easy nor too difficult. The text was about chameleons which was considered a subject not completely unfamiliar to people nor was it too easy. Multiple choice answers to the questions were chosen so that it would not be too difficult for the participants to answer

the questions since they only were allowed to hear the recording once. Furthermore, multiple-choice answers made it easier to compare the results whereas open questions would have been more difficult to analyze. When deciding the rating scale for the attitudes, even steps were chosen so that the participants had to take a stand and not just choose the middle alternative. Attitudes were chosen that we associate with a monotone respectively lively intonation (Vaissière, 2006). The results of the test were analyzed in the program SPSS using the t-test for independent variables. The alfa-level was set at 0.05.

Materials

The recited text used in the study was in Swedish, the following text is a translation of that text:

The Chameleon

Surely chameleons can change their colour, but they do not do it depending on their environment. From the beginning they have a primary colour which makes them difficult to discover such as other gray, brown and green lizards. Moreover, they can change their colour and pattern depending on the temperature and the light conditions, which gives it a further camouflaging effect. But above all they change their colour depending on their mood – the main point is therefore communicative. For example, dark colours signals that the chameleon is stressed or/and aggressive, which every chameleon owner knows. Many of the changes are incidentally very colourful and therefore everything else but camouflaging. Furthermore, they cannot assume any colour, although very many.

There are other lizards that can change their colour, but far from as spectacularly as the chameleons. Some octopuses can camouflage themselves effectively by assuming the appearance of their environment, and they do it very fast, just like many people think chameleons do.

The extract was retrieved from Faktoider by Peter Olausson (2010).

The questionnaire the participants were asked to fill out after listening to the recitation contained the following questions, they are here translated from Swedish:

What are the chameleons primary colours?

- a) *The answer was not given in the text*
- b) *Black and brown*
- c) *Gray, brown and green*

Why does the chameleon change its colour?

- a) *Camouflage*
 - b) *Depending on mood*
 - c) *To scare off threatening enemies*
- Which is the most common colour that chameleons assume?*

- a) *A sand coloured nuance*
- b) *The answer was not given in the text*
- c) *Dark green*

What does every chameleon owner usually know?

- a) *That the chameleon assume a dark nuance when its aggressive*
- b) *That the chameleon can assume many different colours*
- c) *They are very sociable*

In what context does the chameleon get stressed?

- a) *When they are surprised*
- b) *The answer was not given in the text*
- c) *When their nest is threatened.*

Results

Results of intelligibility for lively intonation

Questionnaire (maximal score 5):

Max: 5
Min: 2
Mean: 4.04
Median: 4

Results of intelligibility for monotone intonation

Questionnaire (maximal score 5):

Max: 5
Min: 1
Mean: 3.17
Median: 3

Table 1. Results of the attitude form (scale 0-5) for lively intonation

	Sympathetic	Dedicated	Irritated	Artificial	Naïve
Max	5	5	2	5	4
Min	2	1	0	0	0
Mean	3.61	3.35	0.13	3	1.74
Median	4	3	0	3	1

Table 2. Results of the attitude form (scale 0-5) for monotone intonation

	Sympathetic	Dedicated	Irritated	Artificial	Naïve
Max	5	4	3	5	4
Min	0	0	0	0	0
Mean	1.87	1.22	0.87	2.43	1.22
Median	4	3	0	3	1

There is a significant difference between the two listening groups. The group that listened to the recitation with lively intonation scored a significantly higher mean sum on the questionnaire than the group that listened to the recitation with monotone intonation. More exactly 3.17 respectively 4.04, $p=0.010$. In terms of the attitudes *sympathetic*, *dedicated* and *irritated* the difference between the groups is also significant. The group that listened to the lively intonation estimated the attitudes *sympathetic* ($p=0.000$) and *dedicated* ($p=0.000$) higher and the attitude *irritated* ($p=0.008$) lower than the group that listened to the monotone intonation. There was no significant difference regarding the ratings of the attitudes *naïve* ($p=0.252$) and *artificial* ($p=0.205$) between the groups.

Discussion and conclusion

The results in this study support our hypothesis. The participants that listened to the monotone intonation scored a significantly lower mean sum on the questionnaire than the participants that listened to the lively intonation. This study shows that there is a connection between intonation and intelligibility. We have seen that a monotone intonation reduces intelligibility.

A few of the participants (8 in each group) were familiar with the person

who recited the text. This could of course have affected their judgments of the attitudes. However, this was compensated for by having an equal amount of familiar listeners in each group so that it would not influence the final results.

This study investigated recited text material and therefore it is difficult to tell how generalizable the results are to other modalities such as spontaneous speech.

The sound quality in the material was not optimal since there was some disturbing noise. On the other hand this noise was equally loud for each listener in both of the groups and should therefore not bias the results.

Since the test material was sent by email we have not been able to ensure that the participants followed the instructions and listened to the recording only once. We have also not been able to control the listening environment nor that the participants used equivalent equipment.

The results show that a significant difference in comprehension can be seen after only 64 seconds of speech. It is not difficult to imagine that listening to a long speech segment with monotone intonation would affect the listeners ability to maintain his or hers concentration and attention, which in turn would affect the intelligibility. But as

we have seen in this study, after listening to only 64 seconds of speech with a monotone intonation, a time frame during which a healthy young adult should be able to keep his or her concentration, the intelligibility is affected and decreases.

It would be desirable to do further research on this area and investigate how the intelligibility is affected in other modalities. The study made by Francuz (2010) showed that intonation affects how well listeners comprehend newsreaders messages. Therefore, results of future studies could possibly be applied in many areas, for example lectures, education and for newsreaders to maximize intelligibility.

Our ambition was to choose questions that were not too easy nor too hard, but of varied difficulty level. It is difficult to tell if the questions were well balanced since we did not use a neutral intonation pattern to compare with. If the questions were too unbalanced in difficulty level then we assume that the intonation pattern is of less importance for intelligibility.

The results of the attitude form support our initial hypothesis, the voice with lively intonation was perceived as more sympathetic and dedicated. However there was no significant difference in the attitude *naïve* between the two groups. One explanation for this result could be that *naïve* is hard to estimate because it is a word that is not as frequently used as the other attitudes in the study and people might have different connotations of the word.

The attitude *irritated* was estimated low in both groups but significantly higher in the group who listened to the monotone intonation compared to the other group. Before the study was performed we expected the attitude *irritated* to be estimated generally higher. An explanation for the current results could be that a monotone intonation is not associated with any form of engagement and therefore nor irritation.

There was no significant difference in the attitude *artificial* between the

groups but it was estimated relatively high in both groups. One explanation for this could be that an exaggerated intonation pattern, whether it is monotone or lively, is deviant in Swedish and therefore sounds artificial (Vaissière, 2006). A study made by Braun et al (2011) shows that unfamiliar intonation patterns slow down the processing of speech and thus reduces intelligibility. These findings correspond with our results.

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