Prosodic encoding of sarcasm at the sentence level in Dutch

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Abstract

This study investigated the prosodic characteristics of sarcastic speech in Dutch. Twenty native speakers of Dutch produced sentences in a sarcastic and sincere way in a simulated telephone conversation task. Prosodic analysis at the sentence-level shows that in Dutch sarcasm is characterised by a longer duration, lower intensity, and less vocal noise compared to sincere speech. Utterance type and speaker gender influence the use of pitch and duration to realise sarcasm: pitch is lowered in some utterance types but raised in others, and female speakers expand pitch span, while male speakers use greater durational differences. These findings can partly be explained by referring to an emphasis-based theory of sarcastic prosody, whereby speakers draw attention to what is said by using a slower speech rate and clearer voice, and a distancing hypothesis, whereby speakers lower the intensity and pitch to distance themselves from the lexical meaning of the utterance.

Index Terms: prosody, sarcasm, Dutch, production, telephone conversation task

1. Introduction

Sarcasm can be described as a communicative intention whereby the speaker says something different from what they mean—usually the exact opposite. For example, when saying "Nice weather today" while it is raining outside, the speaker uses positive words to express a negative opinion. Sarcastic intent can be conveyed using various communicative signs, such as facial expression and eye movements [1], and linguistic cues like context, phrasing [2], and prosody. Previous production studies have investigated prosodic realisation of sarcasm in a range of languages (e.g., English [3], [4], German [5], French [6], [7], Italian [8], Japanese [9], and Cantonese [10]), revealing a significant role of prosody in the production of sarcasm, with both similarities and differences in the exact of use of prosodic cues across languages. Past perception studies have shown that prosodic cues are sufficient for native speakers to be able to identify sarcasm in content-filtered utterances [4], [11], suggesting that prosody is also important to the perception of sarcasm.

There has been no research on the prosody of sarcastic speech in Dutch. Although Dutch is typologically related to English, research on Dutch learners of English suggests there are differences between these two languages with regard to sarcastic prosody. For example, Chen and De Jong [12] found that utterances produced with sarcastic intent by advanced Dutch learners of English do not sound convincingly sarcastic to native speakers of English. A follow-up study by Smorenburg, Rodd, and Chen [13] has shown that explicit instruction helps to improve the prosodic realisation of sarcasm by advanced Dutch learners of English.

The present study has thus investigated the prosodic characteristics of sarcastic speech in Dutch by examining variation in production at the sentence level, a typical approach in previous studies ([4], [5], [8], [10], see [3] and [7] for exceptions). It focuses on what Anolli et al. [8] would describe as sarcastic banter: saying something positive with a negative meaning, but with a more playful intention in friendly conversation. Utterance type and speaker gender were taken into account because these two factors have been shown to influence the use of prosody in sarcastic speech (see sections 1.2 and 1.3).

1.1 Prosodic realisation of sarcasm across languages

Past studies have revealed both cross-linguistic similarities and differences in how sarcasm is expressed prosodically. In comparison to neutral or sincere speech, sarcastic utterances are marked by a longer duration (indicating a slower speech rate) in all languages that have so far been investigated (e.g., English, German, French, Italian, Japanese, and Cantonese). However, mean pitch is lowered and pitch span is narrowed in sarcastic speech in English and German [3], [4], [5] but they are raised or expanded in French and Italian [7], [8]. Cantonese speakers also use a higher mean pitch in sarcasm than in sincerity [10]. Intensity is raised in sarcasm in English [4] and Italian [8], but is lowered in German [5], French [6], Italian [8], Japanese [9], and Cantonese [10]. The harmonics-to-noise ratio or HNR, a measure of voice quality [14]–[16], has been found to be larger in sarcastic utterances than in sincere utterances in Cantonese but not in English. Voice quality is more variable in sarcastic speech than in sincere speech in German, whereby breathy voice predominates in sarcastic speech [5].

1.2 Variation related to utterance type

It has been suggested that certain structures, such as positive declaratives may be more suitable for sarcasm than, for example, tag questions [2], [17]. Chen and Boves [3] compared the prosodic characteristics of sarcasm in different utterance types, including positive declaratives, negative tag questions, and *wh*-exclamatives, in British English. They found that tag questions demonstrated the greatest number of prosodic markers in sarcasm as compared to sincere speech, and declaratives showed the fewest prosodic differences. These findings suggest a functional trade-off between prosody and syntax, in line with Haan's Functional Hypothesis [18], whereby the prosodic cues are used to a lesser extent in sentences with more syntactic cues for a certain meaning.

1.3 Variation related to speaker gender

Some previous studies on the production of sarcasm limited their group of participants to only males [8] or females [7]. However, gender may play a significant role in sarcasm use. For example, Katz et al. [19] found that reading times were slower when sarcastic statements were uttered by female characters

compared to male characters. This may be related to the fact that men tend to use sarcasm more frequently than women, leading to a delay in comprehension of sarcastic utterances if they are made by females [19], [20]. Chen and Boves [3] found gender-related differences in the use of sarcastic prosody in British English. Females used a lower mean pitch to indicate sarcasm, whereas males did not. Males only used a longer duration, and they did this to a greater extent than females. Chen and Boves suggested that male speakers use duration more than female speakers to compensate for the fact that they make little use of pitch, possibly due to a more limited vocal space to manipulate pitch in comparison to female voices.

1.4 Mechanisms behind sarcastic prosody

Several ideas have been put forward regarding the underlying mechanisms of sarcastic prosody, some of which can be connected to more general theories of irony use.

Cheang and Pell [10] explore the idea that aspects of the prosodic expression of sarcasm may be universal, as is the case for the expression of basic emotions. They suggest that as sarcasm often goes together with negative affect, the expression of negativity in the voice and face of the speaker (e.g. heightened tension) may influence the prosodic characteristics of sarcastic speech. These physiological aspects of negative affect should have a similar impact on speech across languages. However, this idea does not agree well with empirical evidence.

Haiman [21] suggests that slower speech rate may help "drawing listener focus to a particular excerpt of discourse" [6, p. 1402], in this case to the fact that the speaker's meaning deviates from the literal meaning, which is supported by Cheang and Pell [10]. Similarly, Anolli et al. [8, p. 273] describe the prosodic features of verbal irony as emphatic "caricatured stress" on the suprasegmental features of an utterance, which "allows one to convey, along with the message, the contradiction between the lexical meaning of the words and the speaker's communicative intention". They link one subtype of irony identified in their study to the "intensification hypothesis" [22], which states that irony enhances the opposite meaning of an utterance. These emphasis-based explanations of sarcastic prosody could also be connected to Kreuz and Glucksberg's echoic reminder theory [17]. According to this theory, sarcastic comments on a situation remind the listener of previous events, expectations, or norms, and thereby signal their criticism or disappointment in the current situation. For example, a statement such as "You're a fine friend!" can remind a friend that you expected them to help you and thereby indicates that you are disappointed they did not help. If we follow this theory, it may be that the prosody of sarcastic utterances is used to draw attention to the "echo" in a similar way in which prosody draws attention to the words that have an opposite meaning [10].

Another possible mechanism behind sarcastic prosody has been proposed by Niebuhr [5], who reports a higher degree of segmental reduction in sarcastic irony as compared to sincere sentences in German. He argues that when using sarcasm, speakers distance themselves from the literal meaning of their utterances. Based on the idea that "the articulatory effort invested by the speaker also signals his/her attitudes towards the dialogue partner or the content of the message" [5, p. 608], this dissociation leads to a higher degree of segmental reduction, as in routine statements such as "good morning". Perhaps such a distance from the meaning of the words can also explain other phonetic characteristics of sarcastic speech, e.g.

lower pitch in some languages, or reduced intensity range, which may reflect a reduced articulatory effort. However, other typical prosodic characteristics of sarcasm, such as slower speech rate, cannot be explained by this mechanism. This theory can be loosely grouped together with the "tinge hypothesis" by Dews and Winner [23], which proposes that irony is used to soften criticism or praise, thus weakening the communicative intention.

1.5 The current study

The current study investigates the prosodic features that characterise sarcastic speech in different utterance types (declarative, tag question, or *wh*-exclamative) at the sentence level in Dutch, by comparing sincere and sarcastic speech data acquired in a production experiment. In the light of earlier findings across languages, we hypothesised that compared to sincere speech, sarcastic speech has a different mean pitch, pitch minimum, pitch maximum, pitch span, duration, intensity and voice quality in Dutch. The exact use of these prosodic cues was expected to resemble patterns found in English and German. However, we did expect to find some differences between Dutch and English sarcasm, as suggested by research on advanced Dutch learners of English [12], [13].

We also expected that utterance type would affect the prosodic markers of sarcasm. Such an effect may be caused by a functional trade-off between structure and prosody, whereby utterance types that are often used in sarcastic speech (e.g. declaratives) are realised with fewer or smaller prosodic differences between the sincere and sarcastic condition than structures that are used less often for sarcasm (e.g. tag questions). In addition, we predicted gender-related differenced in the use of mean pitch and duration: females vary their pitch more than males, whereas males make more use of durational differences than females.

2. Method

2.1 Participants

Thirty-seven native speakers of Dutch participated in this study. We report the analysis of the production of 10 female speakers (aged 20-38) and 10 male speakers (aged 19-31), randomly selected from the participants, excluding two participants diagnosed with Autism Spectrum Disorder (ASD) [24]. Speakers received monetary compensation for their participation.

2.2 The simulated telephone conversation task and materials

We adapted Chen and Boves's [3] simulated telephone conversation task for our purpose. In this task, participants took part in an imaginary telephone conversation with a friend. They were asked to respond to context-setting remarks from the friend in either a sarcastic or a sincere manner. The sentences they were asked to produce were shown on PowerPoint slides. The telephone conversation task established a friendly, informal setting in which sarcasm may be used in everyday life.

Forty-five response utterances (15 sentence per utterance type) were embedded in the simulated telephone conversation task, each of which were to be produced in a sarcastic and a sincere manner, leading to a total of ninety trials. The response utterances and the context remarks in the sarcastic condition were mostly translated from the English materials used in [3].

Dutch does not have a literal equivalent to the English negative tag questions such as *isn't it*, *didn't he*, *haven't they*, etc. The question tag *hè* 'eh' was used instead because the semantics, syntactic position, and frequency of this tag are similar to the English negative tag questions [25]–[27]. The stimuli were checked for naturalness by three other native speakers of Dutch with no connection to the study. Examples of trials are given below ('sa' = sarcastic condition; 'si' = sincere condition):

(1) Declaratives
Remark (sa): *Mijn oom blijft die ene mop over die aap telkens opnieuw vertellen.* 'My uncle keeps telling that joke about the monkey again and again'
Remark (si): *Weet je nog dat mijn neef die geniale mop vertelde?* 'Do you remember my cousin telling that brilliant joke?'
Response: *Hij is echt hilarisch.* 'He's absolutely hilarious'

(2) Tag questions
Remark (sa): *Mijn zusje heeft me tegen mijn schenen getrapt.* 'My little sister kicked me in the shins'
Remark (si): *Mijn zusje heeft gisteren zo'n mooie tekening voor me gemaakt op school.* 'My little sister made a beautiful drawing for me in school yesterday'
Response: *Je zusje is echt lief, hè?* 'Your sister is really sweet, isn't she?'

(3) *Wh*-exclamatives
Remark (sa): *In die hardloopwedstrijd is Jaap natuurlijk als allerlaatste geëindigd.* 'Of course, Jaap finished dead last in that running competition'
Remark (si): *In die hardloopwedstrijd waar we het laatst over hadden heeft Joost het wereldrecord verbroken.* 'Joost broke the world record in the running competition we were talking about the other day'
Response: *Wat een geweldig resultaat!* 'What an amazing result!'

The context-setting remarks were recorded by a male native speaker of Standard Dutch in a sound-attenuated booth in the Phonetics Laboratory at Utrecht University. In the recording session, the speaker produced the contextual remarks in a conversation with an assisting interlocutor, who responded to the remarks to establish a natural dialogue setting.

2.4 Procedure

The production study was conducted in the Phonetics Laboratory at Utrecht University. The participants were seated in front of a computer screen in a sound-attenuated booth. First, they received written instructions explaining the task. In the first block of the experiment, the participants were asked to respond to the friend on the phone in a sincere manner. After the 45 sincere trials, they received new instructions for the second block of the experiment, consisting of the 45 trials with sarcastic responses. The participants were told that they could use intonation to indicate a sarcastic intention, without receiving explicit instructions on how to do this. Each block of trials was preceded by three practice trials.

In each trial, the context-setting remark and response were shown on a PowerPoint slide, along with the response type that was expected of the participant (i.e. sarcastic or sincere). The participants were instructed to listen to the remark from the friend via headphones by clicking on a speaker icon below the contextual remark on the screen. After listening to this remark, the participants were asked to respond with the utterance presented on the screen in the instructed manner. They could do this at their own pace and were allowed to correct themselves by producing the full sentence multiple times.

The order of the trials was semi-randomised, making sure that the same type of response utterance was not produced twice in a row in the experiment.

2.5 Data preparation

Each response sentence was annotated for the beginning and end of the sentence. Annotation was done using Praat [28]. The tool ProsodyPro [29] was used to export the mean pitch, pitch maximum, pitch minimum (all in Hz), pitch span (semitones), duration (ms), mean intensity (dB), and the harmonics-to-noise ratio (dB) from each sentence.

3. Statistical analysis and results

The effects of the experimental variables on each of the prosodic parameters were analysed with linear mixed effects models in R, using the lme4 package [30]. CONDITION (sincere vs sarcastic), UTTERANCE-TYPE (declarative, tag question, or *wh*-exclamative) and GENDER (male vs female) were included as fixed factors. PARTICIPANT and ITEM were included as random factors. For every prosodic parameter, the models were built in a step-wise manner by adding one main effect or interaction to each new model and comparing this to the winning model from previous comparisons, using the anova function. Main effects and interactions that did not significantly improve the model were removed. The summary of the best-fit model showed which main effects and interactions reached statistical significance. Because we are interested in the differences between sarcastic and sincere speech, only the interactions between CONDITION (sincere vs sarcastic) and other fixed factors are reported, as well as main effects of CONDITION in case there are no significant interactions. Interactions of CONDITION with UTTERANCE-TYPE and GENDER were further analysed using mixed effects models testing the effect of CONDITION on the different utterance types and/or genders.

3.1 Mean pitch

The best-fit model for mean pitch retained a three-way interaction of CONDITION x UTTERANCE-TYPE x GENDER (p < .001). Subsequent analyses revealed a significant main effect of CONDITION in the tag questions (β = -5.26, SE = 2.29, $t(267)$ = -2.30, p = .023) and *wh*-exclamatives (β = 28.53, SE = 3.41, $t(275)$ = 8.36, p < .001) produced by female speakers. In tag questions, female participants used a significantly higher mean pitch in the sarcastic condition (232 Hz) than in the sincere condition (227 Hz), whereas in *wh*-exclamatives they used a lower mean pitch in the sarcastic condition (233 Hz) as compared to the sincere condition (262 Hz).

3.2 Pitch minimum

The best-fit model retained a three-way interaction of CONDITION x UTTERANCE-TYPE x GENDER (p = .009). Subsequent analyses showed a significant main effect of CONDITION in *wh*-exclamatives by female speakers (β = 19.81, SE = 3.85, $t(275)$ = 5.15, p < .001), but not in the other utterance types produced by female speakers, nor any of the utterance types produced by male speakers. Female speakers used a lower pitch minimum in the sarcastic condition (150 Hz) than in the sincere condition (170 Hz) in *wh*-exclamatives.

3.3 Pitch maximum

The best-fit model for pitch maximum retained an interaction of CONDITION x UTTERANCE-TYPE (p = .003). Subsequent analyses revealed a significant effect of CONDITION only in the declaratives (β = -25.60, SE = 9.65, $t(552)$ = -2.65, p = .008). Participants produced declaratives with a higher pitch

maximum in the sarcastic condition (278 Hz) as compared to the sincere condition (252 Hz).

3.4 Pitch span

The best-fit model for pitch span retained a similar interaction of CONDITION x GENDER ($p = .005$). Subsequent analyses showed a significant main effect of CONDITION in the sentences produced by female speakers ($\beta = $ -1.80, $SE = 0.38$, $t(827) = $ -4.73, $p < .001$). The pitch excursion of female speakers was larger in sarcastic speech (14.5 semitones) than in sincere speech (12.7 semitones).

3.5 Duration

The best-fit model for duration retained significant interactions of CONDITION x UTTERANCE-TYPE ($p < .001$) and CONDITION x GENDER ($p = .025$). Subsequent analyses revealed a significant main effect of CONDITION on the durations of all three utterance types: declaratives ($\beta = $ -195.64, $SE = 13.26$, $t(552) = $ -14.76, $p < .001$), tag questions ($\beta = $ -87.33, $SE = 10.38$, $t(553) = $ -8.41, $p < .001$), and wh-exclamatives ($\beta = $ -191.02, $SE = 12.08$, $t(565) = $ -15.81, $p < .001$). All utterance types have a significantly longer duration in the sarcastic condition in comparison to the sincere condition, but the difference in duration is larger in the declaratives (1516 ms vs 1317 ms) and the wh-exclamatives (1397 ms vs 1207) than in the tag questions (1424 ms vs 1338 ms). Subsequent analyses of the interaction between CONDITION and GENDER demonstrated a significant main effect of CONDITION for both male ($\beta = $ -173.81, $SE = 10.42$, $t(836) = $ -16.67, $p < .001$) and female speakers ($\beta = $ -142.83, $SE = 10.01$, $t(826) = $ -14.27, $p < .001$). Again, both male and female speakers used a longer duration in the sarcastic condition than in the sincere condition, with the difference being larger for male speakers (1449 ms in sarcastic speech vs 1275 ms in sincere speech) than for female speakers (1442 ms in sarcastic speech vs 1299 ms in sincere speech).

3.6 Mean intensity

The best-fit model for intensity retained a significant interaction of CONDITION x UTTERANCE-TYPE ($p = .005$). Subsequent analyses showed a significant main effect of CONDITION in the declaratives ($\beta = 0.54$, $SE = 0.19$, $t(551) = 2.83$, $p = .005$), tag questions ($\beta = 0.38$, $SE = 0.16$, $t(553) = 2.37$, $p = .018$), and wh-exclamatives ($\beta = 1.26$, $SE = 0.19$, $t(565) = 6.68$, $p < .001$). All utterance types were produced with a lower intensity in the sarcastic condition than in the sincere condition, but the difference is more pronounced in the wh-exclamatives (60.0 dB in sarcastic speech vs 61.2 dB in sincere speech) than in declaratives (59.5 dB vs 60.1 dB) and least pronounced in the tag questions (60.6 dB vs 61.0 dB).

3.7 Harmonics-to-noise ratio (HNR)

The best-fit model retained a significant main effect of CONDITION ($p = .012$). The HNR was higher in the sarcastic condition (13.3 dB) than in the sincere condition (13.0 dB).

4 Discussion and conclusions

We have found that across utterance types and speaker genders, Dutch sarcastic speech is characterised by a longer duration (similar to English, German, Italian, French, Japanese and Cantonese), lower mean intensity (similar to German, French, Japanese and Cantonese, different from English and Italian), and higher harmonics-to-noise ratio (HNR) (similar to

Cantonese) in comparison to sincere speech. Further analyses of the data will focus on the role of pitch contours in sarcasm.

Furthermore, utterance type plays a role in the use of mean pitch, pitch minimum, pitch maximum, duration and mean intensity. Specifically, sarcastic and sincere speech differ in four of the outcome variables in wh-exclamatives (mean pitch, pitch minimum, duration, mean intensity), but in three of the prosodic variables in declaratives (pitch maximum, duration, mean intensity) and tag questions (mean pitch, duration, mean intensity). Furthermore, the durational difference between sarcasm and sincerity is most pronounced in declarative statements and the least pronounced in tag questions; the difference in mean intensity between conditions is the biggest in wh-exclamatives and the smallest in tag questions. The findings suggest that of the three utterance types, wh-exclamatives show the largest number and most pronounced prosodic cues to sarcasm, followed by declaratives, and tag questions. These results partly contradict the findings from British English by [3], who found the largest number of prosodic cues in tag questions, followed by wh-exclamatives, and finally declaratives, and thus do not appear to support the Functional Hypothesis [18]. However, no previous studies have investigated which utterance types tend to be used more for sarcasm than others in Dutch. It might be that in Dutch, tag questions with $hè$ are more readily used for sarcasm than wh-exclamatives, explaining less use of prosody to express sarcasm in tag questions than in wh-exclamatives. Further research is needed to fully understand the results on utterance type.

Moreover, female speakers manipulate their mean pitch, pitch minimum, and pitch span where male speakers do not show a significant difference between sarcasm and sincerity in these prosodic parameters. Interestingly, although both female and male speakers use a longer duration to signal a sarcastic meaning, male speakers do so to a larger degree. These differences may be caused by physiological characteristics of the male and female speech organs. If female speakers have a greater vocal range than male speakers, this might explain why they make use of pitch to signal sarcasm more readily than men do. However, there is no consensus in the literature on the question whether the female pitch range is larger than the male pitch range [31]. If there is indeed a difference between female and male speakers, female speakers' higher tendency to use pitch to signal sarcasm should be independent of language. Further studies are needed to support this hypothesis.

Considering the different theories of mechanisms behind sarcastic prosody, the current findings are compatible with several of the suggestions made in the literature. The longer duration and higher HNR seem to be best explained as prosodic means to place emphasis on the speaker's meaning, but the lowering of pitch and intensity are not compatible with this theory. The latter two prosodic markers of sarcasm are more in line with Niebuhr's [5] distancing hypothesis. Our findings thus suggest the different mechanisms proposed for prosodic characteristics of sarcasm are not all mutually exclusive and may play a role simultaneously.

5 Acknowledgements

6   References

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