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On the Prosody of Contrastive Topics in German Interviews

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Abstract

We investigate the prosodic realization of contrastive topics vs. non-contrastive, sentence-initial background expressions on a richly annotated corpus of German spoken interviews. The annotation of contrastive topics and other information-structural categories uses a recent discourse-analytic framework based on the concept of Questions under Discussion. We report that pitch accents on contrastive topics exhibit a significantly wider pitch range but not a later peak than those on background elements.

Index Terms: annotation, contrastive topic, corpora, German, information structure, interviews, pragmatics, Question under Discussion, rising pitch accent, spontaneous speech

1. Introduction: the pragmatics and prosody of contrastive topics

If *focus* (F) is the most important category related to information-structural prominence, then *contrastive topic* (CT, also known as *thematic contrast*) can be said to be the second-most important category of prominence. While a focus is the primary and obligatory variable of any non-fragmentary utterance, a contrastive topic – as the secondary variable – is only found in about 20%[1] of utterances. CTs are used by a speaker whenever the goal is to convey a complex message that needs to be broken down into several sub-messages, which are ordered along the lines of questions about contrastive alternatives, like the different *grades* in (1).

(1) Q_1: On which floor are the classrooms located?
$>$ $Q_{1.1}$: On which floor is the classroom for the first grade?
$>>$ $A_{1.1}$: The classroom for the [first]$_{CT}$ grade is on the [third]$_F$ floor.
$>$ $Q_{1.2}$: On which floor is the classroom for the second grade?
$>>$ $A_{1.2}$: The classroom for the [second]$_{CT}$ grade is on the [fourth]$_F$ floor.

Contrastive topics have been discussed both from a semantic-pragmatic [1, 2, 3, 4, 5] and from a phonological perspective, e.g. [6, 7]. This study is concerned with the prosodic realization of the presence or absence of contrastive topics in the pre-focal area of utterances taken from German spoken interviews. As for now, there exist a number of experimental studies dealing with the intonation of German CTs, for instance [7, 8, 9, 10, 11]. Introspective evidence has led theoretical linguists since [1] to the claim that CT constituents in English or German are realized by means of a rising pitch accent, or, varyingly, by means of a so-called *root contour* (a rising pitch accent preceded by a small trough), cf. [12, 13]. An empirical validation of these claims, however, has since remained a challenge, for a number of reasons. Most importantly, contrastive topics, while uncontroversial in textbook examples, have proven notoriously difficult to identify in actual corpus data. From a theoretical and terminological perspective, it can also be a problem to set off contrastive topics against other types of topics, such as non-contrastive sentence topics, shifted topics or frame setters.

For German, [10] postulate a difference between L*+H as a marker of contrastive topics, and L+H* for discourse-new and re-activated/shifted, non-contrastive topics (to which the authors somewhat unfortunately refer as "aboutness topics"). Moreover, "familiar" (i.e. given, continuing) topics are claimed to be marked by L*. These claims however, are inconsistent with the findings reported in an earlier experimental phonetic study by [9], who examined carefully constructed items, representing topics ("themes" in her terminology) in contrastive and non-contrastive contexts. She found that topics in both contexts were produced with rising accents. L*+H and L+H* accents were equally distributed in contrastive and non-contrastive contexts. However, contrastive topics were realized on average with a significantly higher peak. The duration of contrastive constituents was longer than of non-contrastive constituents; also the duration of the rise itself (measured as the distance between the minimum of the preaccentual trough and the peak) was significantly longer under the contrastive condition. Furthermore, the pitch peaks, which were usually reached on the poststressed syllable, showed a later alignment in contrastive contexts. The subtlety of the differences is not surprising in light of a recent production study on read German [14], which found that nearly all sentence-initial referents carried a rising prenuclear accent irrespective of their level of informativeness (here comprising information status and contrast). Nevertheless, the authors found slight but systematic phonetic differences in that *newer* referents were marked by a slightly wider pitch range and a slightly steeper rise than *accessible* and, in turn, *given* referents (which is in line with another study on read German by [15]). Interestingly, however, contrastive topics were produced as least prominent, since the contrast was already expressed by a parallel syntactic structure.

The goal of the current paper is to present the results of a pilot study of an investigation into the prosodic properties of contrastive topics in an annotated corpus of German radio interviews. Our motivation is to raise the question whether the seemingly distinctive prosodic realization of contrastive topics is a subject that can actually be scientifically investigated in actual spoken discourses or dialogues beyond the laboratory context. The study is also meant to explore the usefulness of a recent new approach to information-structural data analysis and annotation, the *QUD tree* framework [16, 17, 18].

[1]Estimate based on an analysis of the GRAIN interview corpus. Numbers vary depending on speaker and text genre.

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2. Corpus resource

2.1. Data

Our data analysis is based on a section of the GRAIN corpus of German interviews [19], a resource that was collected and processed semi-automatically, compiling weekly recorded interview dialogues between journalists ("hosts") and German politicians or other public figures ("guests"). Our selected data comprises 9 interviews, each just under 10 min. in length, amounting to 1053 spoken utterances in total. The corpus is annotated at various linguistic levels, containing, for instance, automatically generated features and labels for morphology, syntactic structure, segmental phonetics and phonology (phonemes, syllable boundaries, word boundaries, word stress etc.) as well as supra-segmental phonetic and phonological information (PaIntE intonation parameters, see Section 3.2, and GToBI(S) labels). Manual annotations include parts of speech, co-reference chains, information status and information structure labels as well as implicit Questions under Discussion (see next section). In our data sample there are 15 speakers in total, of which 8 female / 7 male, and 5 hosts / 10 guests.

2.2. Information-structure annotation with QUDs

As for the annotation of *contrastive topics (CT)* and other information-structural categories (*focus (F), background (BG),* and optional *non-at-issue (NAI)* material), we rely on a recent discourse-analytic framework based on the concept of *Questions under Discussion (QUD)*, cf. [20, 3, 21], i.e. the idea that every discourse unit is actually the answer to a (typically implicit) question, which can be recovered if utterances are interpreted within their context. The *QUD tree* framework [16, 17, 18] aims at transforming any kind of text (or spoken discourse) into a tree structure, by way of enhancing it with a QUD for each elementary assertion. It is these QUDs that determine both the information structure of the assertions and the topical organization (i.e. the discourse structure) of the entire text. An abstract sample QUD tree is shown in Figure 1. QUD reconstruction is constrained by strict, clearly defined information-structural principles, and it has been shown to be the currently most reliable method for the unrestricted annotation of information structure in corpus data [22]. The procedure is not language-specific and – since it only relies on universal pragmatic concepts like *givenness* and *contrastive parallelism* [23, 24, 25, 26, 17] – QUD trees have been applied to a number of European and non-European languages [17, 27, 28, 29]. This cross-linguistic applicability, and the fact that information structure is determined independently from prosodic factors (an exception is described in Section 3.3), is precisely what renders our annotated speech data attractive for empirical investigations of the pragmatics-prosody interface, as demonstrated in the remainder of this article.

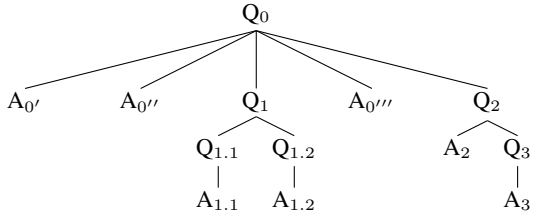

Figure 1: *QUD tree, with elementary discourse units/ assertions (A_i) and Questions under Discussion (Q_i)*

3. Analysis

3.1. Contrastive topics

The notion of *contrastive topic*, although pervasive in the literature, is problematic for a number of reasons. It falsely suggests a dichotomy between contrastive topics on the one hand and non-contrastive *aboutness* (or *sentence*) *topics* on the other hand, which most authors, e.g. [30, 31, 32, 33], limit to (the referents of) NP expressions. In fact, referring expressions (e.g. *im Januar* 'in January') can be used either non-contrastively, as in (2a), or contrastively, as in (2b), taken from [9].

(2) a. What about January?
[Im Januar]$_{\mathbf{T}}$ ist es frostig$_{\mathrm{F}}$.
January is chilly.
b. [Der Dezember]$_{\mathrm{CT}}$ ist [oft vergleichsweise mild]$_{\mathrm{F}}$.
December is often comparatively mild.
[Im Januar]$_{\mathbf{CT}}$ ist es frostig$_{\mathrm{F}}$.
January is chilly.

However, as [3] points out, while contrastive intonation clearly helps set off two alternative referents against each other, the location (exponent) of the relevant pitch accent need not coincide with the head noun of the referential NP, as shown in his example (3), in which the pitch accent falls on the adjectival modifier.

(3) The FEmale$_{\mathrm{CT}}$ pop stars wore CAFtans$_{\mathrm{F}}$.

This example shows why the notion of *contrastive topic*, at least when used as a label for an information-structural category, is misleading: like the category *focus*, it does not only apply to referential expressions. In fact, so-called contrastive topics, in their function as indicators of a complex discourse strategy, may appear on any type of expression, as witnessed in example (4) from the GRAIN corpus, whose prosodic realization is shown in Figure 2.

(4) [GRAIN: 2014-05-17, Giegold]
Q_1: {How should EU representatives act in the Ukraine crisis?}
$>$ $Q_{1.1}$: {What should one do?}
$>>$ $A_{1.1}$: [...] [muss man]$_{\mathrm{BG}}$ [die Gesprächsdrähte offen halten]$_{\mathrm{F}}$.
One should stay in touch.
$>$ $Q_{1.2}$: {What should one not do?}
$>>$ $A_{1.2}$: [Was man allerdings]$_{\mathrm{BG}}$ **[nicht]$_{\mathbf{CT}}$** [tun sollte, ist,]$_{\mathrm{BG}}$ [sich Herrn Putin um den Hals zu werfen]$_{\mathrm{F}}$
However, what one should not do is throw oneself at Mr. Putin.

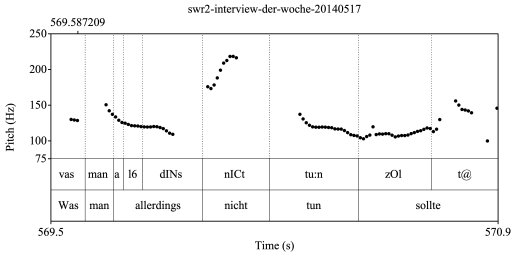

Figure 2: *CT, marked by rising pitch accent, on the non-referring expression **nicht** 'not'*

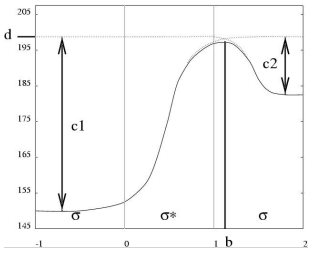

Figure 3: *The PaIntE function, adapted from [35]*

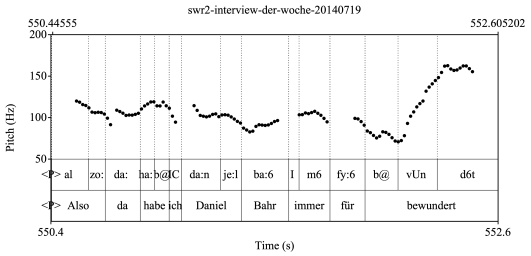

Figure 4: *Non-contrastive background area with prenuclear pitch accent on* ***da*** *'there' (and further ones on 'Daniel' and 'Bahr', as well as a nuclear focus accent on* ***bewundert*** *'admired')*

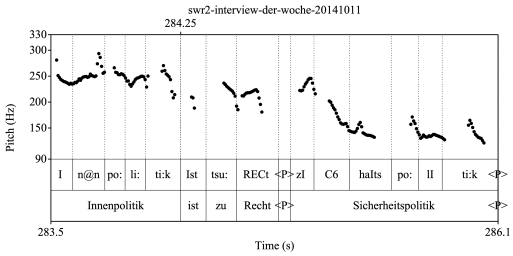

Figure 5: *Textually ambiguous example, first pitch accent on* ***Innenpolitik*** *'domestic policy'*

3.2. Parametrized intonation events (PaIntE)

Our prosodic analysis of CT-marked expressions rests on parameters from the PaIntE model [34, 35], which approximates the F_0 peak of each syllable in the form of a curve with six linguistically interpretable parameters: the steepness (or slope) of the rise/fall, the peak alignment, the amplitude (or range) of the rise/fall and the absolute peak height. The GRAIN corpus is fully (automatically) annotated for PaIntE parameters. In this study we investigate the $c1$ parameter, describing the amplitude of the rise in Hz, and the b parameter, representing the temporal alignment (a value between 0 and 1 indicating that the peak is located on the current syllable, a value greater than 1 that the peak is reached on the following syllable); compare Figure 3.

3.3. Corpus queries

Corpus queries were implemented using ICARUS [36, 37], a query tool for the exploration of richly annotated text and speech corpora. We searched for constituents annotated for CT containing at least one GToBI(S) pitch accent.[2] We set aside all items in which the CT phrase was preceded by a focus constituent.[3] In comparison, we consider sentence-initial pitch accents occurring on backgrounded expressions. As explained in Section 3.1, since CTs are not confined to referential topics, we see no point in comparing them only to non-contrastive referential topics, but instead simply examine whatever backgrounded element comes first. An example of a non-contrastive background is shown in Example (5) and Figure 4.

(5) [GRAIN: 2014-07-19, Gröhe]
Q_1: {What is the speaker's opinion about the fact that Daniel Bahr is running marathons?}
$>$ A_1: Also [da habe ich Daniel Bahr]$_{BG}$ [immer für bewundert]$_F$.
Well, for that I have always admired Daniel Bahr.

Since the textual annotations contained a number of errors, we manually checked the data and corrected them ahead of the analysis. A major difficulty is that CTs need not always come with an overt textual counterpart; in other words, contrasts can be implicit, generating a contrastive or scalar conversational implicature. In some cases the textual transcript of a spoken utterance is compatible with both a contrastive and a non-contrastive reading, even if context is considered. An example is shown in (6), and its phonetic representation in Figure 5. It is difficult to decide from the text alone whether the expression *Innenpolitik* 'domestic policy' should be interpreted contrastively, as in (6a), or not, as in (6b). In cases like these, the classification was based on how we interpreted the audio signal. (As for (6), we chose the non-contrastive interpretation.)

(6) [GRAIN: 2014-10-11, Özoguz]
A_1: [Damit Integration] nicht immer mit Innenpolitik verknüpft bleibt.
So integration doesn't stay linked to domestic policy forever.

a. Q_2: {What policy is what?}
$>$ $Q_{2.1}$: {What is domestic policy?}
$>>$ $A_{2.1}$: Denn [**Innenpolitik**]$_{CT}$ [ist]$_{BG}$ zurecht [Sicherheitspolitik]$_F$.
Because domestic policy is rightly security policy.
(Implicature: Some other policy is not security policy.)

b. Q_2: {What is domestic policy?}
$>$ A_2: Denn [**Innenpolitik** ist]$_{BG}$ zurecht [Sicherheitspolitik]$_F$.
(No Implicature)

This leaves us with 83 CT items, which either occur sentence-initially or are at most preceded by some background (BG) material, like in (4). These are compared against 85 non-contrastive initial BG expressions which carry an accent.

3.4. Statistical analysis

The statistical analysis was carried out using the R software environment [39]. We first analyzed the $c1$ parameter, which indicates the distance between the minimum and the maximum of the rise of the pitch accent, in Hz. Because of their physiological difference, we set apart female and male speakers. Using a

[2] The accent labels are predictions from an automatic labeler [38].

[3] [1] and [3] allow for the possibility that the default order CT-F is reversed, but we expect that this has an influence on the prosodic realization of the CT, which we ignore for the moment.

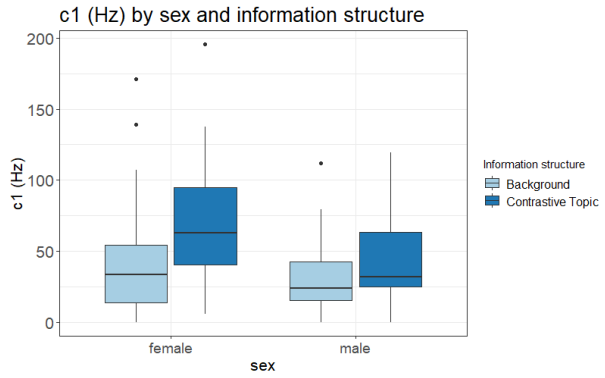

Figure 6: *c1 parameter (pitch range of the accentual rise in Hz) for female and male speakers, separated for* BACKGROUND *and* CONTRASTIVE TOPIC

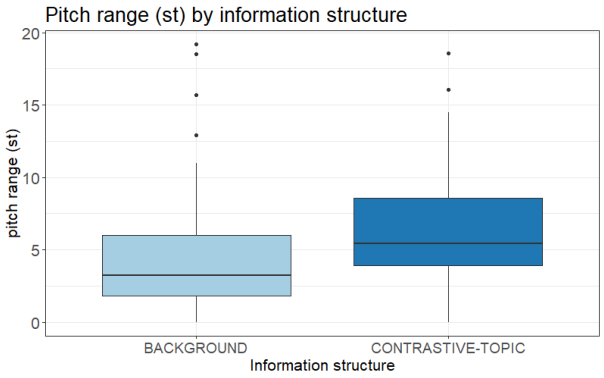

Figure 7: *Pitch range in semitones for* BACKGROUND *and* CONTRASTIVE TOPIC

likelihood-ratio test, we compared a linear mixed-effects model with SEX as fixed effect and SPEAKER as random effect to a null model only containing the random effect. The results are significant ($\chi^2(1) = 5.7331$, $p = 0.01665$) and show that – not surprisingly – female speakers produce rises whose amplitude is on average 17.5 Hz larger as compared to men.

Next we compared the above-mentioned model to a different one with INFORMATION STRUCTURE labels as additional fixed effect. This model shows that pitch accents on CTs on average have a 24.3 Hz larger amplitude, which is again a significant difference ($\chi^2(1) = 20.244$, $p < 0.001$). Figure 6 shows the difference between the $c1$ realization of CTs and BGs, separated for male and female speakers. Table 1 shows mean and standard deviation of the $c1$ parameter for female speakers. Table 2 shows the same for male speakers. Note the considerable amount of variation (sd between 25 and 37 Hz) in all cases.

IS category	count	mean	(sd)
BACKGROUND	52	41.05	(36.95)
CONTRASTIVE TOPIC	56	68.36	(37)

Table 1: *Mean and sd of* $c1$ *value (in Hz) for female speakers*

IS category	count	mean	(sd)
BACKGROUND	33	30.44	(25.37)
CONTRASTIVE TOPIC	27	46.57	(33)

Table 2: *Mean and sd of* $c1$ *value (in Hz) for male speakers*

IS category	count	mean	(sd)
BACKGROUND	85	4.29	(3.98)
CONTRASTIVE TOPIC	83	6.36	(3.72)

Table 3: *Mean and sd of pitch range in semitones for all speakers*

In order to normalize data from different speakers, we conducted a similar analysis for the $c1$ values converted into semitones. Again, we performed a likelihood-ratio test comparing a linear mixed-effects model with INFORMATION STRUCTURE as fixed effect and SPEAKER as random effect to a null model without the fixed effect. The results reveal a significant difference between BGs and CTs ($\chi^2(1) = 12.197$, $p < 0.001$), see Figure 7. On average, the range of pitch accents on CTs is two semitones higher than on BGs. Table 3 shows mean and standard deviation of this value for both information structure categories.

As mentioned above, the b parameter describes the peak alignment in a three-syllable window. To test whether contrastive topics had a later peak alignment, as was found by [9], we fit a linear mixed-effects model on the data with INFORMATION STRUCTURE as fixed effect and SPEAKER as random effect. A log-likelihood ratio test comparing this model to a null model with only SPEAKER as random effect revealed no significant difference ($\chi^2(1) = 1.2132$, $p = 0.2707$). Table 4 shows mean and standard deviation for the b parameter, separated by information structure category.

IS category	count	mean	(sd)
BACKGROUND	85	0.99	(0.74)
CONTRASTIVE TOPIC	83	1.09	(0.51)

Table 4: *Mean and sd of* b *values*

4. Conclusions and outlook

Our study shows the first steps toward a more comprehensive investigation of the prosody of information-structural categories in corpora of natural speech. Our first goal has been to find empirical evidence for the intuitive observation from the literature that German contrastive topics are often marked with a distinct rising pitch accent. In fact, we did find a subtle but significant difference in the pitch range of contrastive topics vs. non-contrastive background, a result that encourages more detailed investigations.

Our method involves a considerable amount of automatic prosodic pre-processing, manual discourse analysis and a sophisticated corpus and query infrastructure. Each of the steps can bring in unwanted technical or human errors, which may tarnish the results. It is therefore our next goal to improve each of the annotation steps, before we can address, as a more ambitious goal, the prosodic realisation of different types of focus. Furthermore, comparing the individual realization of contrastive topics and other categories can also potentially serve to investigate speaker-specific prosodic properties. To this end, however, it will be necessary to extend the data resource.

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