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The Role of Tonal Onglides in German Nuclear Pitch Accents

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Abstract

A perception experiment with native German listeners provided evidence for the relevance of the tonal onglide in nuclear accents – the pitch movement leading towards the target on the accented syllable. Listeners were able to distinguish between two pragmatic meanings of a short phrase (given/non-contrastive and new/contrastive) using the tonal onglide as the sole acoustic cue. On the basis of these findings, we argue that the onglide merits a phonological status in an intonation model of German and should not be regarded as merely phonetic detail.

Keywords

Intonation, leading tone, off-ramp, on-ramp, perception, pitch accent, pragmatic meaning trailing tone

1 Introduction

In Autosegmental-Metrical Phonology, intonation contours in West Germanic languages, such as English, Dutch and German, are composed of edge tones and pitch accents. The tonal composition of pitch accents, however, differs from one analysis to another. The very nature of autosegmental phonology makes it possible for the domain of tones associated with a particular syllable to extend beyond the borders of that syllable: Phonological association does not necessarily imply phonetic alignment. Furthermore, tonal targets are often obtrusions and may thus be perceived by virtue of tonal movements to and from them. The question we are concerned with in this article is whether the movement *towards* the target is relevant in terms of pragmatic meaning, and thus whether this movement should be represented in the phonology. An account that takes this movement *towards* the target into account has been referred to as an *on-ramp analysis*, and one that takes only the target and the movement *from* the target into account an *off-ramp analysis* (Gussenhoven, 2004).

Models in the tradition of the British School favour an *off-ramp* approach. Here, intonation contours are decomposed into smaller constituents: prehead, head, nucleus and tail. The meaning of the intonation contour over the whole phrase is primarily determined by the *nuclear tone*, consisting of the *nucleus* and the *tail* (Cruttenden, 1997). This tonal movement begins on the last

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accented syllable and continues until the end of the phrase. Although the meaning can also be influenced by the part of the contour that precedes the nuclear tone, this portion plays a rather subordinate role. A jump up from a lower level or a fall down from a higher level to the nucleus, that is, the transition between the so called *head* and the nucleus, does not contribute to the phonological category of the nuclear tone (cf. Couper-Kuhlen, 1986, p. 80). However, Crystal (1969, p. 218) remarks that the placement of 'prominence' within the nuclear contours can vary. As a consequence, a part of the tonal movement may occur before the beginning of the vowel in the accented syllable, for example, the rising part of a rise-fall nuclear tone may begin before the accented syllable. This is treated as phonetic variation, since the categorisation of the nuclear tone is not affected by this movement. Crystal refers to this transitional movement towards the target on the accented syllable as the *onglide*. We adopt this terminology here, leaving open for the moment the question as to its phonetic and phonological status.

The approaches of von Essen (1964) and Pheby (1975) in their accounts of German intonation have many elements of the British school. In von Essen's (1964) model, for instance, the main intonational meaning is carried by the tone on the accented syllable. In Pheby's (1975, p. 51) model, it is the contour on the last accented syllable and what follows. This analysis is very similar to the concept of the nuclear tone, a combination of the British School nucleus and tail (Cruttenden, 1997).

The approach of the American Structuralists can also be considered to be off-ramp. Here, intonation contours are analysed as consisting of levels, or static tones, that are combined in sequence to represent movements. Thus, the levels rather than movements are the primitives. As Pike (1945) notes, these levels are considered to be meaningless by themselves – only intonation *contours* (i.e., combinations of levels) bear meaning. The utterance-length intonation contour is divided into two components: the *precontour* and the *primary contour*. These are equivalent to the head and nucleus (and tail) in the British School. The beginning of a primary contour is a 'stressed' syllable, and every 'heavily stressed' syllable constitutes the beginning of a new primary contour (Pike, 1945, p. 27), which can consist of several syllables. Precontours also carry meaning, but the primary contour is said to have a stronger meaning than the precontour. Thus, the cut between the major part of an intonationally defined phrase and a previous minor part is at the same point for proponents of the British School and the American Structuralists. It is the beginning of the nuclear accented syllable – and even more importantly the beginning of the tonal movement starting on that syllable, even if the movement does not start at its very beginning. A movement that spans these two subdomains is considered to be a *transition*, and does not play a (major) role in determining the classification of intonation contours.

The framework of Autosegmental-Metrical Phonology (AM) treats intonation contours as sequences of levels, or targets (or in later analyses, *structures* made up of targets; Grice & Savino, 1995; Ladd, 2008; Pierrehumbert & Beckman, 1988). In this approach, there is a clear division of tones according to whether they have a prominence-lending or delimitative function. While *boundary tones* (also *edge tones*) are associated with the edges of phrases in the prosodic hierarchy, *pitch accents* are associated with metrically strong syllables, and serve to lend prominence to words containing these syllables. The association of a tone to a metrically strong syllable is expressed with a * symbol. If there is more than one tone associated with a pitch accent, only one of the tones is designated to be starred.

The issue that concerns us here is whether a model allows for a tone *before* the starred tone – a leading tone (e.g., L+H*), as well as a tone *after* it – a trailing tone (e.g., L*+H). An on-ramp analysis is characterised by the use of both leading tones and trailing tones, while an off-ramp analysis is restricted to the use of trailing tones. Although there is a broad consensus among different models within the AM framework on the analysis of the starred tone itself, there are considerable differences when it comes to the choice of an on-ramp or off-ramp analysis. One model that makes

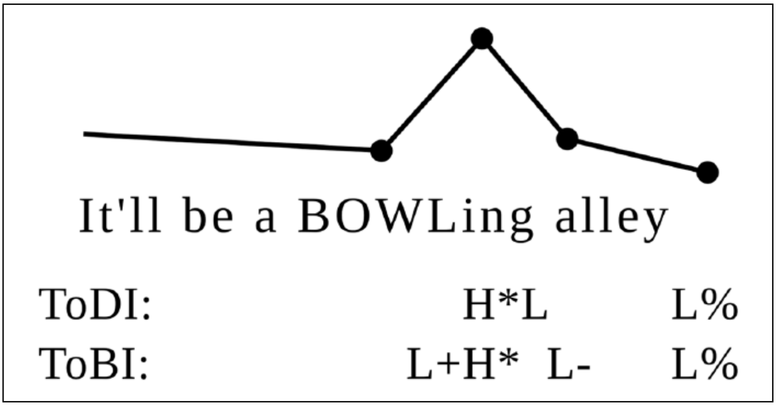

Figure 1. Transcriptions using ToDI (off-ramp) and ToBI (on-ramp); adapted from Gussenhoven (2004, pp. 127–128).

exclusive use of trailing tones and thereby builds upon the British off-ramp tradition is ToDI (Gussenhoven, 2005). Other models, such as ToBI, or, more specifically, MAE-ToBI (Beckman, Hirschberg, & Shattuck-Hufnagel, 2005), have both leading and trailing tones in their inventory. (Besides H* and L*, there are two pitch accents with leading tones, L+H* and H+!H*, and one with a trailing tone, L*+H.)

Among the AM models for German intonation, there are also differences in the bitonal pitch accents: GToBI, in line with the original ToBI for American English, employs both leading and trailing tones (Grice & Baumann, 2002; Grice, Baumann, & Benzmüller, 2005). Other models like Féry (1993), Mayer (1995) and Peters (2014) are in line with the British tradition, and with the Dutch ToDI system, in that they have only trailing tones. Some of these models (Féry, 1993; Mayer, 1995) have a leading tone in their inventory, but treat it as an exception that leads to a tritonal pitch accent, for example, HH*L. It is important to remember that there is a certain asymmetry in the designation of on-ramp and off-ramp: whereas an on-ramp analysis takes the tonal movement *before and after* the accented syllable to be relevant, an off-ramp analysis only concentrates on what *follows* the accented syllable.

Deciding which part of the pitch accent is meaningful plays an important role in deciding between on-ramp or off-ramp analyses. The main difference between these two analyses can be illustrated using an example from Gussenhoven (2004, p. 127), which is depicted in Figure 1.

Gussenhoven analyses this contour with an H*L accent on 'BOW' followed by a low boundary tone at the end of the phrase. The beginning of the rise on 'BOW' is not attributed to a tonal target. ToBI on the other hand represents the beginning of the rise as an L target which is the leading tone of an L+H* pitch accent. By employing an on-ramp analysis, ToBI considers the rise on 'BOW' to be a part of the pitch accent. ToDI, on the other hand, does not. In fact, Gussenhoven states explicitly that 'leading tones might exist in Dutch, though they must be rare if they do' (Gussenhoven, 2005, p. 126). By analogy to the notion of on- and off-ramp, we call the tonal movement towards the starred tone target the *onglide* and the tonal movement away from it the *offglide*.

IViE (Grabe, 2001), a transcription system based on the AM framework for British English intonation that favours an off-ramp analysis, nonetheless incorporates a mechanism for dealing with the onglide phonetically. The pitch accent types that are transcribed on the *phonological tier* of the system can have one or two trailing tones. In addition to the phonological tier, there is a *phonetic tier* in which the transcriber can add a target specification for the pre- and posttonic

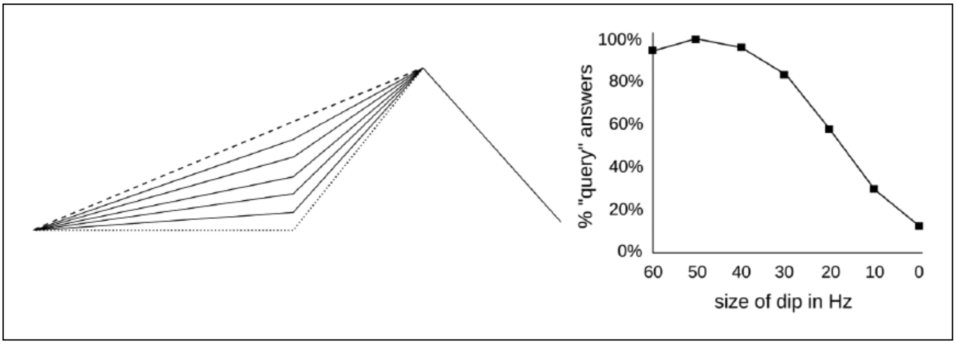

Figure 2. Stimuli and results from Grice and Savino (1995).
Left panel: Contours of the stimuli on 'lo mandi a Massimiliano' (you send it to Massimiliano) between a stylised command (dashed line) and a question (dotted line).
Right panel: Results of the experiment. The greater the onglide (= size of the dip in Hz), the higher the percentage of question (query) responses.

syllable. This level can be low (l), mid (m) or high (h). Thus, one possible transcription of an H*L accent that has a rise up to the accented syllable could be lH-l, where the first l indicates the level of the pretonic syllable, the H indicates the level of the tonic syllable, and the second l the level of the posttonic syllable (the '-' indicates interpolation). But this description is purely phonetic; a difference in the onglide does not contribute in any way to the classification of pitch accents. Hence, IViE's treatment of the onglide resembles that of Crystal (1969) discussed earlier.

As pointed out by Gussenhoven (2004, p. 128), the issue as to whether an on- or off-ramp analysis is justified in the description of intonation systems has so far attracted little empirical study. For Italian, also a language with stress accent (Beckman, 1986), Grice and Savino (1995) have shown that the tonal movement up to a high target on the accented syllable plays a major role in the categorisation of meaning. In a categorical perception experiment involving an identification task with resynthesised stimuli, subjects were asked to judge whether the stimulus they heard was an information-seeking polar question (query) or a command. Grice and Savino found that listeners were able to distinguish information-seeking questions from commands based solely on the pitch movement towards a constant high peak on the accented syllable. Consequently, they analysed the distinction as being reflected in the pitch accent types L+H* for questions and H* for commands.[1]

The left panel of Figure 2 depicts the construction of the stimuli in Grice and Savino's (1995) experiment. By systematically varying the target before the accented syllable they manipulated the magnitude of the rising onglide. The results are reproduced in the right panel of Figure 2: If there was a low target before the peak, the stimulus tended to be judged as a question; if the onglide was only slightly rising with no clear low target before the peak, the utterance tended to be judged as a command. The authors interpreted this finding as evidence for a leading tone and thus for the plausibility of an on-ramp analysis for Italian.

Chen (2011) reports evidence from production in favour of an off-ramp analysis of Dutch intonation. In her production study, she examines the realisation of peak accents in topic and focus conditions, measuring the properties of the rise and the fall. She finds two classes of peak accents that differ in their realisation of focus and topic conditions. When the accented word is under focus, the rise up to the peak on the accented syllable is steeper in one class, whereas the fall is steeper and the rise stays constant in the other class. She concludes that the former class can be described as H*, whereas the latter should be labelled H*L. Chen's experimental approach builds on the

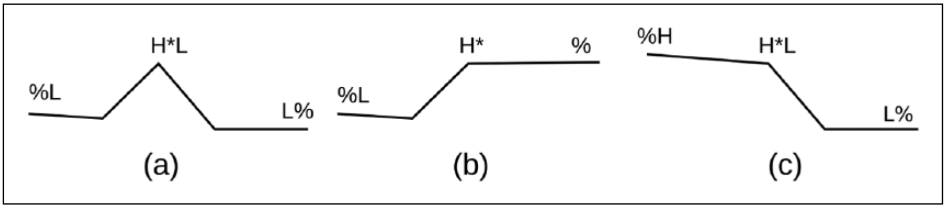

Figure 3. Resynthesized contours from Gussenhoven (2008).[2]

reasoning that pitch accents in one class will behave in a phonetically similar way, while pitch accents from different class will behave differently. However, it is unclear what the difference in meaning might be between the two classes. Furthermore, in her study, prenuclear and nuclear accents are pooled, making the results difficult to interpret.

Another empirical approach to the question as to the appropriateness of on- and off-ramp analyses is discussed in Gussenhoven (2008) – also for Dutch intonation. To assess which part of a high pitch accent is most important he compares the semantic judgements of the three contours depicted in Figure 3. In contour (a) both the rise and the fall are present. In the other two contours, either the rise (b) or the fall (c) is present. The contours are resynthesized with sentences containing words that can be interpreted in either a modal or a lexical sense, that is *alleen* (modal: 'just' or lexical: 'alone'; that is *Hij zit alLEEN (met die man) in het caFÉ* – lexical: 'He is alone (with that man) in the pub', modal: 'The thing is, he's in the pub (with that man)'). The resynthesized contours contained a pitch accent on the ambiguous target word (e.g., alleen) and a boundary after it. Subjects had to decide whether their interpretation was modal or lexical by judging on a scale how well a written paraphrase matched the sentence they heard. The results show that contours (a) and (c) pattern together whereas (b) does not. That is, (b) exhibits more ratings for a modal interpretation relative to the other two contours. However, it is also possible to interpret these findings in a different way: Contours (a) and (c) share what in other autosegmental metrical models would be analysed as a low edge tone (either a phrase accent or a boundary tone).

Thus, the question as to whether the prenuclear movement (the onglide) is meaningful is possibly eclipsed by the contribution to the meaning of the boundary tones (the offglide) in this case. In order to assess the contribution of the onglide, it is necessary to keep all other parts of the intonational contour constant. This is what we aim to achieve in the present study. Furthermore, despite the relatedness of Dutch and German, it is necessary to investigate the onglide in German separately, given that there may be differences across the two languages precisely in this respect.

Consider the two short German utterances given in Figure 4. Both utterances end in a low boundary tone. In the case of (a) the pitch *falls* down to a target on the accented syllable 'ni'. In the case of (b) the pitch *rises* up to a target on the accented syllable. There is thus a difference in pitch before the target of the starred tone is reached – a difference in the *onglide*. For the purposes of phonetic transparency this difference will be referred to henceforth with a leading tone: (a) as H+!H* L-% and (b) as L+H* L-%.[3]

Experimental data from Ritter, Krüger, Mücke, and Grice (2012) suggest that the onglide plays an important role for the identity of pitch accents in German. In that study, the onglide was measured as the difference in semitones between a point 30 milliseconds before the start of the accented syllable and the point on the accented syllable where a GToBI (Grice et al., 2005) label was placed, providing a measure of direction of the onglide and the magnitude of the change in F0. The results showed that contrastive focus is preferentially marked by accents with a rising onglide, whereas broad focus is preferentially marked by accents with a falling (or only very slightly rising) onglide, although not all

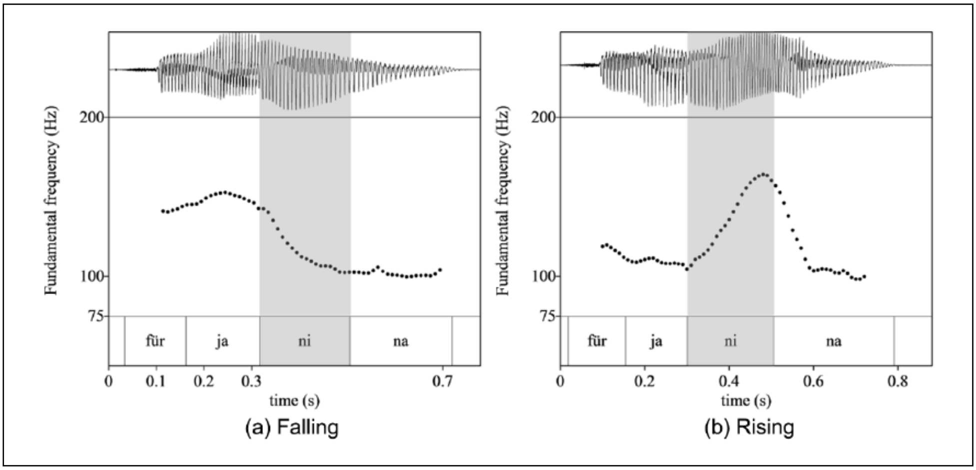

Figure 4. Two examples of the German utterance 'Für Janina' produced with (a) a falling and (b) a rising onglide. The accented syllable 'ni' is highlighted in grey.

speakers make use of this distinction. A perception experiment carried out with these data further confirmed the findings on the function of the onglide. However, since the stimuli were unmodified productions from a reading task, it was impossible to control for other acoustic parameters such as duration, intensity (sonority expansion) and vowel quality (hyperarticulation). In addition, many productions had a prenuclear pitch accent earlier in the phrase. This part of the signal could in principle have also carried information about the information status of the target word.

The study presented in this article isolates the tonal onglide and explores how far it has an impact on the perception of German nuclear pitch accents. If the onglide plays a significant role in the distinction of accent types, it should be possible to change the pragmatic meaning of an utterance by solely manipulating the pitch contour before the starred tone target. The background presented above leads us to the formulation of the following hypothesis:

> *Native listeners of German are able to distinguish pragmatic meanings using the tonal onglide as the only auditory cue.*

To test this hypothesis a perception experiment was set up in which listeners were presented with stimuli that differed only in their tonal onglides. All other cues were held constant. The target phrases only contained the nuclear pitch accent under scrutiny and no further prenuclear pitch accent.

2 Methods

2.1 Stimuli

We used stimuli with a resynthesised F0 contour in order to have maximal control over the onglide. As base stimuli, three short utterances by one German native speaker were used: *Für Janina* ('For Janina'), *Für Marlene* ('For Marlene') and *Für Ramona* ('For Ramona'). In German, prenuclear accents are common if there is an accentable syllable near the beginning of the phrase. Such accents are referred to as ornamental accents (Büring, 2007). To ensure natural-sounding stimuli, we thus

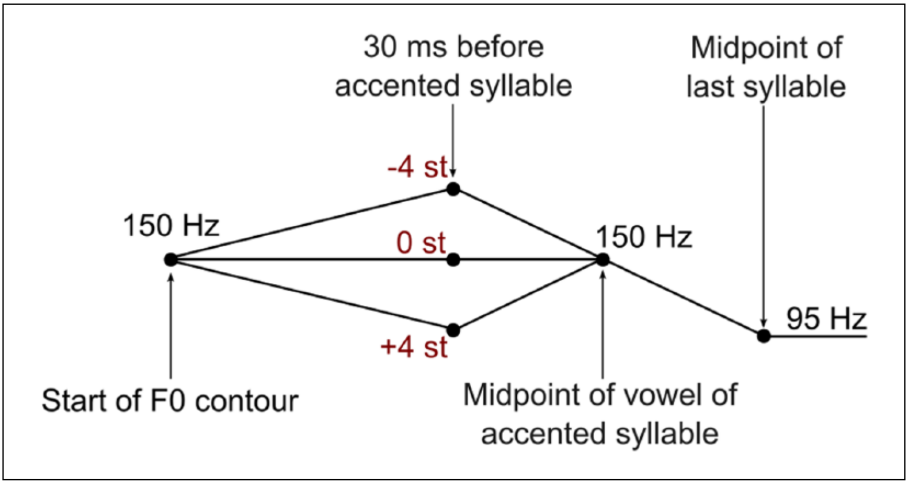

Figure 5. Manipulation of the pitch contours.

restricted the prenuclear context to a function word followed by an unstressed syllable. All base stimuli were produced in one phrase; the speaker intended to realise a monotone production of the pitch contour with a prominence on the name (e.g., *Janina*).

The resynthesised contours were constructed with a falling onglide, a rising onglide and a level onglide. The tonal target of the accented syllable, as well as the pitch contour after the accent, was kept constant (see Figure 5). Four points in the contour were manipulated. First, all contours began at a value of 150 Hz. Second, the target on the accented syllable (e.g., 'ni' in *Janina*) was located at the midpoint of the syllable's vowel. This produced a fairly neutral phonetic alignment. This point was also set to 150 Hz. Third, all contours ended in a low boundary tone, the target for which is reached at the midpoint of the last syllable (e.g., 'na' in *Janina*) and set to 95 Hz.

The crucial pivot differentiating the stimuli in the series was a point 30 milliseconds before the onset of the accented syllable. In the falling onglide case, the F0 contour falls from a high target (189 Hz) to a target four semitones lower on the accented syllable. In the rising onglide case, the contour rises from a low target (119.1 Hz) to a target four semitones higher. In the level onglide case, the contour is level. All manipulations were carried out in Praat (Boersma, 2001). A window of 30 milliseconds was used following the analysis of production data in Ritter et al. (2012).

2.2 Subjects

Twenty monolingual German native listeners (12 female, 8 male) took part in the experiment. Most of the participants were undergraduate students from a number of different disciplines. None of the subjects had extensive training in prosody.

2.3 Task, procedure

Subjects were presented with the resynthesised intonation contours along with a pair of small dialogues displayed on a computer screen. In Figure 6 a sample of a dialogue pair is shown. In dialogue (i), the target sentence provides an affirmative answer and contains given information. We refer to this as *given/non-contrastive*. In context (ii), the target sentence negates the proposition of

(i)

A: Ist das Paket für Janina?
Is the parcel for Janina?

B: Ja, **für Janina.**
Yes, for Janina.

(ii)

A: Ist das Paket für Sofie?
Is the parcel for Sofie?

B: Nein, **für Janina.**
No, for Janina.

Figure 6. Examples of mini-dialogues used in the experiment.

the preceding sentence. It contains new information and has a corrective focus with an explicit contrast. We refer to this meaning as *new/contrastive*. The listeners were asked to match the sentence they heard to one of two small dialogues. Since the text of the sentence matches both dialogues, listeners were explicitly asked to base their decision on 'how the utterance is pronounced'. To choose one of the two dialogues, subjects pressed either the key 'a' for the left context or the key 'l' for the right context on a German computer keyboard.

The experiment started with a short training phase to familiarise the subjects with the task. The training block contained two repetitions of the falling and rising stimuli of each target word – a total of 12 trials. After that, they listened to the stimuli in four blocks with a pause of 15 seconds between the blocks. Each block contained two repetitions of the stimuli. All contours occurred in every block; stimuli were randomised in each block. The whole experiment lasted about 15 minutes. The visual presentation of the contexts was reversed for 50% of the subjects (i.e., they saw new/contrastive on the left side, given/non-contrastive on the right side). The experiment was run on a notebook with PsychoPy (Peirce, 2007). Stimuli were presented through headphones. All sessions were held in a quiet room at the University of Cologne or at a participant's home.

2.4 Data

Each subject listened to eight repetitions of the sentences, so that there was a total of 72 items for each subject (3 names * 3 manipulations * 8 repetitions). Because nine items from one subject had to be excluded, due to technical reasons, the analysed dataset contained 1,431 items. Reaction times were recorded in addition to the responses.

3 Results

Figure 7 shows the proportion of ratings as new/contrastive as means for all subjects. A rising onglide was judged most frequently as encoding new/contrastive information (75%). On the contrary, a falling onglide was less often judged as encoding new/contrastive information (27%). Results for the level onglide lie in-between the two extremes (55%).

We built a mixed effects logistic regression model to assess the effect of onglide on the subjects' judgements using R (R Core Team, 2012) with lme4 (Bates, Maechler, & Bolker, 2012). The model we ran had response (binary choice: context i or ii) as dependent variable. As fixed effects, we entered onglide, gender, presentation order of the dialogues (left vs. right), base sentence and number of repetition (mean centred). As random effects, we had intercepts for subjects, as well as

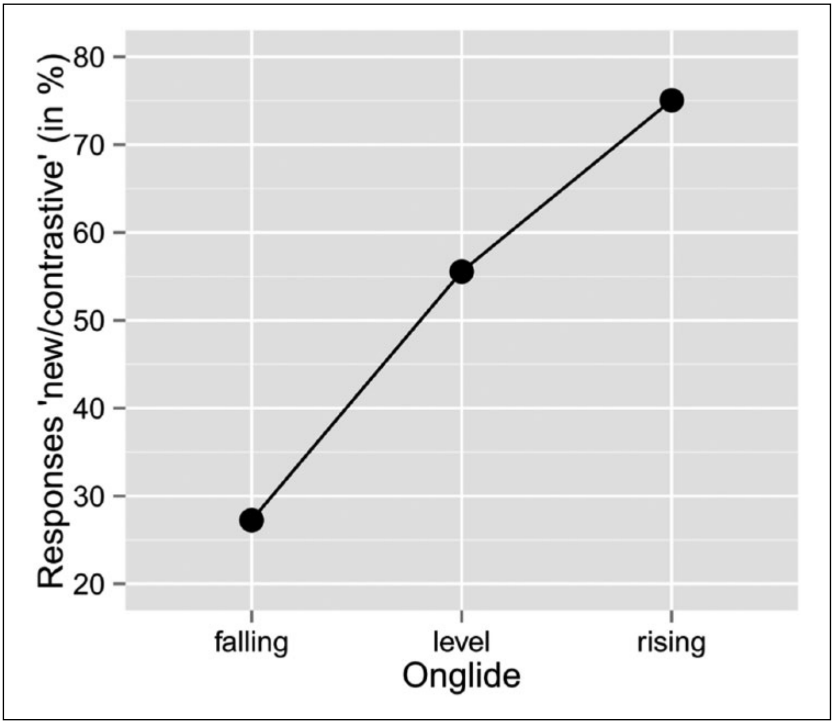

Figure 7. Mean responses as 'new/contrastive' (all subjects pooled).

by-subject random slopes for the effect of onglide. We then ran a likelihood ratio test of the full model against a null model without the effect of onglide. The results show that onglide has a significant effect on the response, $\chi^2(2) = 15.043$, with rising onglide having the highest probability of ratings as new/contrastive information (log odds: 3.04, SE = 0.74) and falling onglide with the lowest probability (log odds: –1.85, SE = 0.43). Level onglide lies in-between (log odds: 1.76, SE = 0.60, $p < 0.01$). Base had no significant effect on the response, $\chi^2(2) = 5.7957$, $p = 0.05514$; neither did gender, $\chi^2(1) = 1.622$, $p = 0.2028$, presentation order of the dialogues, $\chi^2(1) = 0.1768$, $p = 0.6741$, or repetition, $\chi^2(1) = 1.2421$, $p = 0.2651$.

A closer look at the individual results shows that there are different patterns across listeners. In Figure 8 the judgements are plotted as means for each subject. While there are some listeners who show the pattern that matches the overall means (highest ratings for rising, lowest for falling), there are also some subjects whose results deviate from the main trend: Either the pattern seems to be reversed (two subjects: 8 and 15), or there is hardly any difference between the onglide conditions (four subjects, e.g., 13). Among the other 14 listeners, there is variation in ratings for the level onglide. While for some listeners the level onglide behaves like the rising onglide (e.g., subject 2), for others it patterns with the falling onglide (e.g., subject 3). In other listeners, the results are in-between those for falling and rising onglide.

We also calculated the reaction times of all subjects, starting from the offset of the stimulus (see Figure 9). They were somewhat higher for the level onglide (2.22 seconds) than for the other cases (falling: 1.9 seconds; rising: 1.98 seconds). With a generalised linear mixed model log transformed reaction times were analysed with onglide; gender, presentation order of the dialogues, base sentence, and number of repetition were used as fixed effects. Intercepts for subjects and by-subject

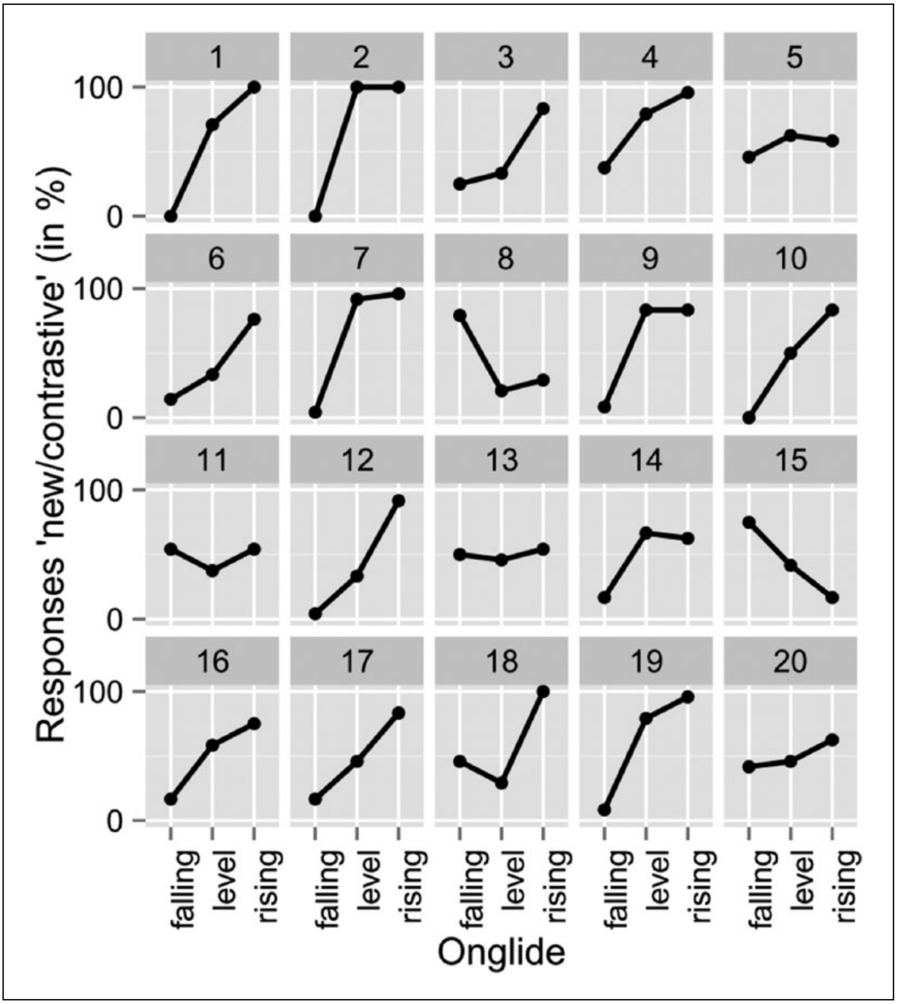

Figure 8. Individual responses from all subjects (means for each subject).

random slopes for the effect of onglide were used as random effects. A likelihood ratio test of the full model against a null model was carried out. The result points to a significant effect of onglide on the reaction times, $\chi^2(2) = 6.081$, $p < 0.05$. Level onglide had the longest reaction times (β = 0.98, SE = 0.03); the reaction times for rising (β = 0.90, SE = 0.78) and falling (β = 0.88, SE = 0.18) were lower. In addition, base had a significant effect on the reaction times, $\chi^2(2) = 13.642$, $p < 0.01$, with slowest reaction times for 'Janina' (descriptive mean: 3.24 seconds, β = 0.88, SE = 0.18), followed by 'Ramona' (descriptive mean: 3.15 seconds, β = 0.86, SE = 0.03), and 'Marlene' (descriptive mean: 2.90 seconds, β = 0.78, SE = 0.03). Also, an effect was found for repetition, $\chi^2(1) = 81.128$, $p < 0.001$ – reaction times decreased during the experiment (β = 0.77, SE = 0.01). No effect was found for gender, $\chi^2(1) = 0.4083$, $p = 0.5228$, or presentation order of the dialogues, $\chi^2(1) = 0.9415$, $p = 0.3319$. It has to be pointed out that reaction times were relatively long. This is likely due to the fact that the task involved interpretation and contextualisation, rather than the type of decision often required in experiments involving identification of stimuli.

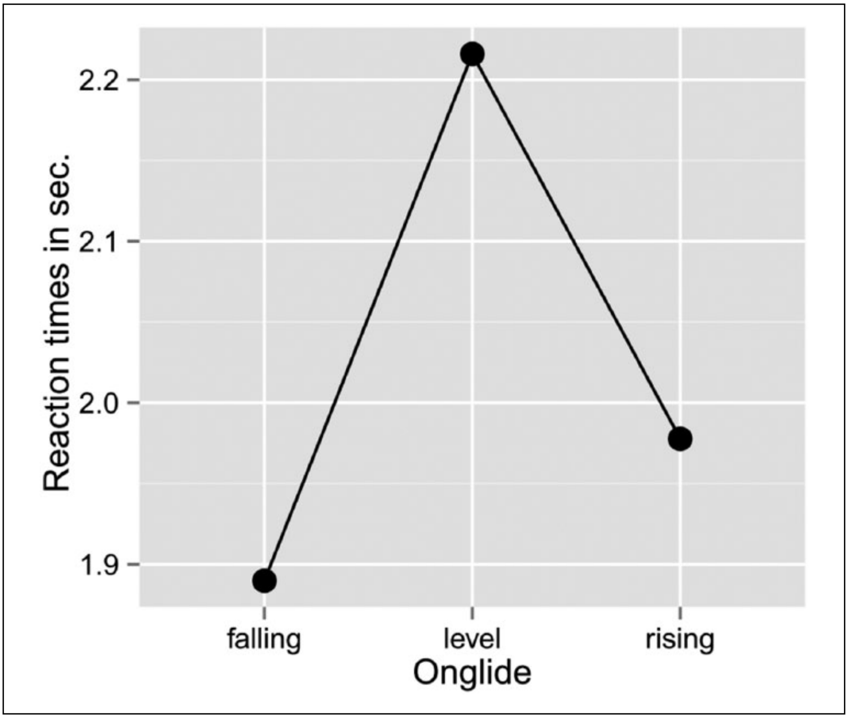

Figure 9. Mean reaction times (all subjects pooled).

4 Discussion

The results of the present study show that German native listeners are able to distinguish between two pragmatically different readings of the phrases (‘Für Janina’, ‘Für Marlene’, ‘Für Ramona’) using the tonal onglide as the sole acoustic cue. In particular, the experiment provided overall clear results for the falling and rising onglide, although there was some variation in the ratings across subjects (see Figure 7), mirroring the variation observed in production of similar contrasts in Ritter et al. (2012), and given the fact that intonation is particularly susceptible to individual variation (Niebuhr, D’Imperio, Gili Fivela, & Cangemi, 2011). Moreover, individual differences in perception are to be expected, especially when only one dimension is manipulated (Perkell et al. 2004).

It appears that listeners were not as certain in interpreting the level onglide as they were in the other two conditions. This was reflected in the longer reaction times measured for the responses to the stimuli in this condition. There are at least two possible reasons for this outcome. Although the level onglide condition approximates a simple H* pitch accent, it is possible that subjects perceived it as less natural than the other two contours. Indeed, for English it has been argued that a rising onglide is necessary for H*-type accents (Ladd & Schepman, 2003). Alternatively, the level onglide might not be appropriate in either of the two pragmatic contexts we offered to the participants. Results from Röhr and Baumann (2010, 2011) and Ritter et al. (2012) suggest that a context where the target word is in focus but contains non-contrastive, new information could be appropriate for a level onglide (e.g., if the contextualising question had been *Für wen is das Paket?* ‘Who is the parcel for?’).

Our main finding is that the pitch movement in the region before the H* tonal target (including the movement on the previous syllable) makes a major contribution to the interpretation of pragmatic meaning, warranting a phonological treatment in models of intonation. The tonal movement – the onglide – is directly encoded in on-ramp intonation models like ToBI for English (Beckman et al., 2005) and GToBI for German (Grice & Baumann, 2002; Grice et al., 2005), where it is represented as a leading tone, hence our choice for the phonetically transparent labels H+!H* L-% for the falling onglide and L+H* L-% for the rising onglide.

ToDI (Gussenhoven, 2005) and its German equivalent (Peters, 2014), as off-ramp approaches, do not make use of leading tones. However, these models have a way of deriving a tonal cluster including a tone preceding the starred tone, but only if there is a prenuclear accent. In this case, the trailing tone of a preceding bitonal pitch accent (e.g., L of a prenuclear H*L) can be displaced to a position immediately before the accented syllable (e.g., resulting in the cluster LH*L in nuclear position; Gussenhoven, 2005). Crucially, this approach cannot account for cases where there is no prenuclear accent, as is the case with our data. Gussenhoven argues that a contour with an H peak before the accented syllable in single-accent utterances is rare in Dutch, although he discusses a hypothetical example.

> If used on Dutch *Met de TREIN* (with the train 'By train'), *met* would have low pitch, *de* high pitch, while a fall from mid to low or low pitch, exactly as for downstepped !H*, would occur on *trein*. The pitch accent would be transcribed as H+!H*. (Gussenhoven, 2005: 126)

Based on equivalence of meaning between (i) H+!H* and (ii) !H* preceded by a high pitch (manifested as an H tone in a preceding pitch accent, H* or L*+H, or a boundary %H tone), Grice, Baumann, and Jagdfeld, (2009) argue that accents with leading tones are derived. In their analysis, the previous H tone in (i) and (ii) is derived from a common source, a floating H tone. That is, they argue that the H tone can surface as part of a prenuclear accent or as an initial boundary tone, with only very subtle differences in meaning between the various association patterns. What is important is whether the onglide is falling or not. By extension, we might assume that the same floating tone analysis holds for L+H*, although this was not explicitly discussed by Grice et al. Since we do not manipulate the contour after the tonal target on the accented syllable, our data do not bear on the analysis of the offglide (a trailing tone of the nuclear pitch accent or a final boundary tone).

Chen (2011) points out that the motivation for an on- or off-ramp analysis in the description of an intonation system, or the development of a transcription system, is not always transparent. She argues that the decision between on- and off-ramp might not be a theoretical matter but a typological difference between languages. In her view, the models not only differ with respect to what they consider to be part of a pitch accent; it is the intonation systems of the languages themselves that differ. As a consequence, for example, the intonation system of German could be seen as on-ramp, whereas the intonation system of Dutch could be seen as off-ramp.

However, in order to assign a language to a particular type, it is necessary to find out whether the language is exclusively describable in terms of either analysis. In the description of the intonation system of German, models have differed in their off-ramp or on-ramp characteristics (where on-ramp analyses are indeed mixed, in that they have leading *and* trailing tones in their systems). As discussed above, all approaches might be able to account for the same contours, but by using different mechanisms and with different degrees of phonetic transparency. In this light, it appears to be more a theoretical debate than a discussion of typological differences across languages. Nevertheless, one could argue that certain typological differences between languages can facilitate one or the other approach. For example, a late alignment of peaks could lead to a direct encoding of the onglide in the intonation model, that is, the use of leading tones. Although this does not account for the differences between ToDI for Dutch and GToBI for German, since Dutch, like German, is said to have a late alignment (Schepman, Lickley, & Ladd, 2006), it might account for the British School tendency to focus on the accented syllable and what follows, since the peak in British English tends to be fairly early in the syllable.

In this paper, we are calling into question whether the ‘off-ramp-on-ramp-divide’ is the right dimension along which models or even languages should be differentiated. The results presented rather suggest that, whatever analysis one chooses, it is important to look at what happens before the starred tone target. We have shown that in German this region is a meaningful part of the intonation contour and argue that it should be incorporated into a phonological account of the intonation system of German.

Thus, the results here provide evidence for extending the ‘window of analysis’ to the left, that is, before the target for the starred tone. This does not call into question the following tonal movement, which is of great importance for the meaning of an utterance, as discussed in the introduction. In our view, a sound analysis of intonation should take into account what is happening both before and after the tonal target on the accented syllable, so as to be able to capture important generalisations.

5 Conclusion

We have shown experimentally that native listeners of German make use of the tonal onglide – the tonal movement leading towards the target of the starred tone – as a cue for distinguishing between two distinct pragmatic meanings. This result strongly suggests that the onglide plays an important role in the intonation system of German, adding to the scarce evidence available on the issue of on- versus off-ramp analyses of intonation. We conclude that whatever the abstractness (floating tone, leading tone, displaced tone), the window before the target on the accented syllable is important, and thus needs to be taken into account in the analysis of the intonation of German.

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Notes

1. Although the curve is not as S-shaped as typically expected in categorical perception tasks, it has to be remembered that the experiment is about intonation which, according to Ladd and Morton (1997), can be said to be categorically *interpreted* rather than categorically *perceived*. This would explain the shape of the response curve.
2. This transcription in the reproduction is different from the original due to a typographic error in the original. This is the correct version (Carlos Gussenhoven, p.c.).
3. The early peak accent has also been annotated as H+L*. However, Grice et al. (2009) found that in early peak accents in similar contexts, the second tone was scaled more like !H* than L*, leading to a preference for H+!H*. L-% is shorthand for L-L% in GToBI.

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