



Modal particle meets prosody: Speech act modification in declarative questions

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Abstract

We present data from a production study in German that explores prosodic effects of subtle pragmatic meaning differences in the domain of speech acts. We study effects of the modal particle *wohl* in assertions and declarative questions (DQ), where *wohl* signals that the information conveyed (assertion) or proposed (DQ) is based on an inference that the speaker made on the basis of indirect evidence. We show that the presence of *wohl* in DQ has prosodic effects on the final boundary tone, and in the nuclear and post-nuclear regions. We argue that these effects signal reduced interrogativity: the speaker is less open towards the answer, signaling a bias for the truth of their own inference.

Index Terms: declarative question, modal particle, *wohl*, bias, attitudinal meaning, interrogative flip, evidentiality, final rise

1. Introduction

The illocution of an utterance has prosodic reflexes in many languages. This holds for basic illocutions like assertion vs. question, but also for subtler illocutionary characteristics like those of information-seeking questions vs. rhetorical questions, surprise questions, rejecting questions, or negative biased questions [1][2][3][4][5]. In the marking of such differences, prosody often ‘collaborates’ with other illocution-signaling means like syntax or the use of different types of particles. For instance, sentence-final particles show illocution-related prosodic characteristics in Cantonese [6][7].

In this study, we examine the prosodic characteristics of German assertions and questions that contain a clause-internal modal particle (MP). The MP we investigate is *wohl* ‘≈ presumably’, which like other MPs modifies the illocutionary meaning of the utterance in subtle ways, and like other MPs shows a different behaviour in assertions vs. questions: Although *wohl* can occur both in both speech acts, it makes slightly different semantic-pragmatic contributions. The overall issue we are therefore addressing is what prosodic effects the presence of *wohl* has in assertions vs. questions, and whether the observed effects can be explained as a result of the combination of the basic speech act meaning and the illocutionary modification signaled by *wohl*.

Investigating this issue contributes to exploring the more general matters of how prosody signals subtle pragmatic meanings in various speech acts, and how prosody in questions is used to contribute to the marking of the particular *question concern* [8], i.e. the specific motivation for asking a question, such as seeking confirmation, signaling bias towards a particular answer, or revealing the speaker’s emotional attitude. The data we present are from a production experiment where German native speakers produced context-embedded assertions and questions in declarative sentence form with and without *wohl*.

2. Modifying illocutionary meaning: German *wohl*

2.1. The meaning of *wohl*

In the semantic-pragmatic literature, two proposals have been made for the meaning of *wohl*: The MP has been argued (i) to signal weakened commitment towards the proposition *p* it takes scope over [9][10], or (ii) to signal that the evidence for the truth of *p* is indirect and has been inferred; thus, in this latter analysis, *wohl* is an *inferential evidential marker* [11], cp. [12]. As there are good reasons to assume that (ii) is the correct analysis [11][12], we will assume that *wohl* is an evidential marker signaling an evidence-based inference.

An interesting feature of the evidential meaning component of *wohl* is that it is subject to the so-called *interrogative flip* [13]: The evidence-based inference signaled by *wohl* is the speaker’s in assertions, and the addressee’s in questions with an interrogative syntax (e.g., polar questions, *wh*-questions) [9][10][11][12]. For instance, when Ben utters (the German version of) the assertion *Mia is WOHL at home*, he signals that he has indirect evidence for Mia being at home. When Ben utters the question *Is Mia WOHL hat home?*, he asks if the addressee has indirect evidence for Mia being at home. In the next subsection, we argue that this characteristic of *wohl* is not the same in questions with a declarative syntax, which we are investigating in the current study. We hypothesize that this lack of the interrogative flip has consequences for the prosody of declarative *wohl*-questions.

2.2. *Wohl* in declarative questions

For declaratives with *wohl*, [14] suggests that they can be used as assertions or as questions. [9] argues that the question interpretation is ‘only’ pragmatically inferred because combining the meaning of *wohl* with that of a declarative question (DQ) would be uninterpretable: [9] assumes that a DQ is only felicitous if the addressee is guaranteed to provide a conclusive answer (i.e., has strong commitment), whereas *wohl* in questions signals an expectation for weakened commitment (analysis (i) in Section 2.1). According to [9], the question meaning of declarative sentences with *wohl* only arises in situations where the addressee is a knowledgeable expert, i.e., is indeed guaranteed to provide a conclusive answer (but see [15][16][17]). Crucially, in such situations the declarative cannot be interpreted as an assertion: it would be weird to inform the knowledgeable expert about something they already know. This then triggers the indirect speech act interpretation of the *wohl*-declarative as a question. To illustrate, when Mia sees her friend Ben with a young woman in his arms, Mia can utter: *This is WOHL your girlfriend*. [9] argues that this utterance formally is an assertion, which is reflected in its intonation: it must end in a final fall, signaling an assertion

interpretation. Pragmatically, however, the utterance must be interpreted as a question. The reason is that it would be strange for Mia to tell Ben that the young woman in his arms is his girlfriend, for which claim Mia has indirect evidence [9].

This account has several problems. First, the suggested contextual restriction for a DQ with *wohl* (DQ_{wohl}) does not actually exist [18]. This is illustrated in (1), where Mia asks Ben a DQ_{wohl} without assuming that Ben is a knowledgeable expert, as is confirmed by Ben’s coherent reply.

- (1) Ben: Look, the guy from this morning is still standing by Ann's door.
 Mia: *Der weiß wohl nicht, dass sie im Urlaub ist?*
 he knows MP not that she in.the vacation is
 ‘Doesn’t he know that she is on vacation?’
 Ben: We could ask him.

The second problem is that [9]’s claim about the prosodic characteristics of DQ_{wohl} – that they can only have ‘assertion intonation’ – has never been tested. [18] explicitly call this claim into question. The results from our production experiment to be presented in Section 4 indicate that the claim cannot be upheld.

Still, DQ_{wohl} differ from other questions with *wohl* regarding their interpretation in a way that may be prosodically relevant: DQ_{wohl} do not show the interrogative flip (Section 2.1). Rather, the speaker of DQ_{wohl} expresses that they have witnessed or are witnessing indirect evidence, which is the basis for their inference that the proposition denoted by the declarative, *p*, is true, and they double-check their inference with the addressee. Let us illustrate the meaning effect of adding *wohl* in a DQ by first looking at the use of a DQ without *wohl* (DQ_{\emptyset}). In a situation where Mia is holding a train ticket to Berlin with Max’s name in her hands, she may ask her friend Ben the DQ_{\emptyset} *Max fährt nach Berlin?* ‘Max is going to Berlin?’. The information on the ticket is interpreted by Mia as direct evidence for Max’s going to Berlin, and she just double-checks that he indeed is going. The corresponding DQ_{wohl} is infelicitous in this situation because the evidence is not indirect. A DQ_{wohl} would be felicitous in a situation where Mia sees the suitcase of her colleague Jens, who regularly goes to Berlin, in the office. Then she may ask Ben *Jens fährt wohl nach Berlin?* ‘Jens is going WOHL to Berlin?’ Based on this more indirect evidence, Mia makes an inference and double-checks her inference with Ben. Upon hearing the question, Ben knows that Mia wants to double-check whether Jens is going to Berlin and that she has some indirect evidence for that.

We conclude that DQ_{wohl} do have both an interrogative and an informative component. Having an informative component is typical of biased questions [8][19], the specific informative component depending on the question type. Crucially, these components have prosodic reflexes, to which we turn next.

3. Prosody of DQs and other questions

The prosody of DQ_{\emptyset} has been investigated in several studies for German. DQ_{\emptyset} tend to end in a high boundary tone [20][21][22], but low boundary tones also occur [20][21][23]. There are prenuclear differences between DQs and assertive declarative sentences, with DQ_{\emptyset} showing earlier high pitch and shallower falls in pre-nuclear accents [23].

We hypothesize for DQ_{wohl} that the speaker’s inference process that is signaled by *wohl* leads to a speaker bias for *p*, which the speaker is somewhat reluctant to give up because it is based on personal reasoning about the indirect evidence. Research on the prosody of rejecting DQ [18][24] has shown that the speaker’s investment (bias) may have prosodic consequences [4], such as

nuclear accents that are higher in prosodic prominence along several dimensions (more L+H*, higher maximum F0, greater F0 excursion and longer duration). More generally, the speaker’s reduced openness towards the answer has been shown to be reflected in the final contour in questions with various morphosyntactic forms: it is less often rising or shows shallower rises [20][21][22]. Lower clause-final pitch has also been directly linked to lower degrees of interrogativity [22].

We also hypothesize that the lack of the interrogative flip for *wohl* makes a DQ_{wohl} ‘less’ interrogative (inquisitive) than a *wohl*-question with interrogative syntax. However, this is not a hypothesis that we are directly testing in this study because we only examine declarative sentences. Still, the lack of the flip might be another contributor to DQ_{wohl} showing fewer prosodic indicators of interrogativity than DQ_{\emptyset} . Although DQ_{\emptyset} can be asked in situations where there is unequivocal evidence (Section 2.2), the speaker essentially assigns responsibility to the addressee, the knowledgeable expert [16].

Regarding declaratives with *wohl* that are used as assertions, we do not expect prosodic reflexes of the presence of the MP. We are not aware of findings suggesting that inferential processes or evidentiality are prosodically marked in German assertions. These meaning components are rather far removed from the attitudinal meanings that are prosodically relevant in (modified) assertions such as various emotions, irony or sarcasm.

4. Production study

To test our hypothesis, we conducted a production study with 24 German native speakers (age mean: 25.9, range: 18-42, 8 male, 16 female), who were recorded in a sound-proof booth at the XLinC Laboratory of the University of Cologne and were paid or received course credit.

4.1. Method

The experiment had a 2×2 design, with the factors SPEECH ACT (assertion (ASS) vs. DQ) and WOHL (presence vs. absence of *wohl*), resulting in the four conditions Ass_{\emptyset} , Ass_{wohl} , DQ_{\emptyset} and DQ_{wohl} . (2) shows a sample item in all conditions. The target sentences were transitive declaratives, consisting of a trochaic subject noun (a proper name), followed by a modal verb (*will* ‘wants to’ or *soll* ‘is supposed to’), the local adverb *da* ‘there’, *wohl* (for Ass_{wohl}/DQ_{wohl}) or the temporal adverb *dann* ‘then’ (for $Ass_{\emptyset}/DQ_{\emptyset}$), and a trochaic lexical verbal infinitive. Punctuation indicated the intended basic illocution (‘.’ assertion; ‘?’ question), which was also backed by the context (see below). The targets were embedded in scripted dialogues between three speakers. Each dialogue was supported by visual information on the computer screen: first a scene-setting photograph covering the entire display appeared, headed by a scene title, and three speaker silhouettes distributed over the display. As the dialogue unfolded, speech bubbles containing the text spoken by the speakers appeared. Speakers 1 (female) and 2 (male) were prerecorded. Participants took the role of speaker 3, called *Alex* (= gender-neutral name). Alex’s speech bubble appeared after speaker 2 had finished his utterance. Participants pressed a button when they were ready for recording.

The context manipulation for the licensing of the target sentence in the different conditions was as follows. The last utterance in the turn of speaker 2 differed by SPEECH ACT: it was a tag question ($Ass_{\emptyset}/wohl$) or a belief statement ($DQ_{\emptyset}/wohl$). The text after the target sentence, spoken by Alex, differed by condition. Ass_{\emptyset} : Alex has first-hand knowledge of the truth of the proposition, i.e.,

direct evidence; Ass_{wohl} : Alex has hearsay knowledge about the proposition, i.e., indirect evidence; DQ_{\emptyset} : Alex requests confirmation of the proposition indicating interest in the answer; DQ_{wohl} : Alex requests confirmation of an inference regarding the proposition, which is based on personal reasoning.

(2) **Sample item** (Context abridged, English translation)

Sp 1: You know Susi, right? The antiquarian on Miller Street? She went on a mad shopping spree last week. She told you, didn't she?

Sp 2: Yes, her shop is far too small for all that stuff. She is thinking about renting a garage behind the ring road but she is worried about the transport. Alex, Susi talked with you about this, didn't she?

$Ass_{\emptyset/wohl}$ She also wants to store her China there, right? (German tag: *oder?* 'or')

$DQ_{\emptyset/wohl}$ I think, she wants to store her China there.

Alex:

$Ass_{\emptyset}/DQ_{\emptyset}$ *Susi will da dann Vasen lagern.!*

Ass_{wohl}/DQ_{wohl} *Susi will da wohl Vasen lagern.!*
Susi wants there then/MP vases store

Ass_{\emptyset} That's what she told me yesterday, yes.

Ass_{wohl} That's what her colleague told me.

DQ_{\emptyset} That would actually be quite good.

DQ_{wohl} She bought loads of those, after all.

The materials consisted of 12 different dialogues. All participants saw all dialogues in all conditions. The experimental items were interspersed with 16 filler dialogues containing polar questions, *wh*-questions, *wh*-exclamatives and negative rejections. The material was presented in four blocks, which were interrupted by short picture judgement tasks.

4.2. Data annotation

We recorded 1152 target utterances. After exclusion of speech errors (4.2%), there were 1103 utterances available for analysis. We segmented the target utterances by syllables and annotated accent types and boundary tones according to the GToBI guidelines. For the phonetic analysis, we pooled L+H* and H* pitch accents as 'high' accents, ignoring the few other high pitch accents that occurred ($n = 8$). We normalized F0 within speakers as semitones relative to each speaker's overall median F0 value. F0 was sampled every 10 ms using Praat [25] and transferred to R [26] using the package rPraat [27]. F0 tracking errors were inspected and manually corrected during the annotation.

We report the following measures: For the object, which was the default placement of the nuclear accent, we investigated duration and F0 excursion ($F0_{exc}$) on the level of the nuclear foot. The choice for the foot was motivated by our decision to pool H* and L+H* accents, the latter being often late-rising in German, so that a substantial portion of accent-related F0 targets are located in the post-tonic syllable. We only compared within identical contour types (see further below), which largely precluded comparisons between assertions and questions. For the subject, we investigated $F0_{exc}$ and duration on the foot level. For the post-nuclear area in contours with the most common nuclear accent location, i.e., on the object, we investigated mean F0 on the syllables following the nuclear foot, i.e., on the two syllables of the lexical verb. We also tested mean intensity for all segments but found no significant effects so will not report details.

The predictors SPEECH ACT and WOHL were contrast-coded with centered contrasts. Most models contained only a predictor for WOHL since comparisons were usually only possible within

speech acts, see below for further details. Participant and item were random factors. We included by-participant random slopes except where noted.

4.3. Results

We first give an overall impression of the data in terms of boundary tones and nuclear contours, see Figure 1. ASS show virtually no variation in boundary tones, irrespective of the presence of *wohl*: all but one utterance ended in L-%. DQ contained a variety of boundary tones: H-^H% (a high rise, usually following a L* pitch accent), L-H% (a low rise, usually following a (L+)H* accent), H-% (a high, level plateau), L-%, and H-L% (a boundary tone not found in Standard German, manifesting as a fall aligned with the final, unstressed syllable). H-L% was produced by only three speakers, two from the Riparian dialect area and one from Baden (cf. [28][29] on this boundary tone in these areas). Note that this H-L% is not generally restricted to questions but tends to occur in contexts in which Standard German often has high boundary tones (i.e., H-^H%, H-% and L-H%), e.g., in questions but also to mark the speaker's intention to continue speaking.

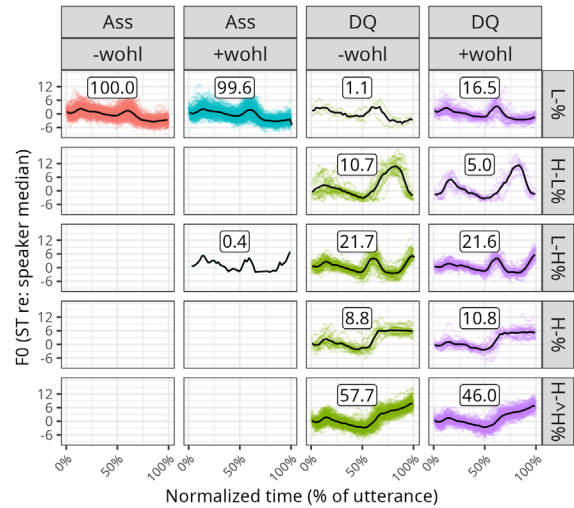


Figure 1: Time-normalized average F0 contours (black, with individual contours in colour) split by boundary tone (rows) and experimental conditions (columns). The number is the percentage of contours in each experimental condition.

Our statistical analysis revealed that the distribution of the **boundary tones** differed between DQ_{\emptyset} and DQ_{wohl} . In DQ_{wohl} there were fewer high rises (H-^H%) than in DQ_{\emptyset} (46% vs. 58%; $b = 0.42, SE = 0.16, z = 2.5, p < 0.05$), and more L-% (16.5% vs. 1%; intercept-only model: $b = -1.8, SE = 0.32, z = -5.4, p < 0.001$). The dialect-specific H-L% was produced by all three speakers in DQ_{\emptyset} , but by only one in DQ_{wohl} with any regularity (no model was fitted).

For **nuclear accents**, Table 1 shows mean $F0_{exc}$ and duration for various contours. For utterances with a falling contour, i.e., (L+)H* L-%, we fitted two types of models due to the lack of data for DQ_{\emptyset} . In the first type, we compared Ass_{wohl} and Ass_{\emptyset} : The presence of *wohl* led to a higher F0 excursion on the nuclear foot ($b = 0.15, SE = 0.08, t = 2, p < 0.05$), and to an increased duration ($b = 0.02, SE = 0.005, t = 4.2, p < 0.001$). In the second model type, we compared Ass_{wohl} and DQ_{wohl} : $F0_{exc}$ was higher in DQ_{wohl} ($b = 0.65, SE = 0.2, t = 3.2, p < 0.01$). Duration or intensity did not differ significantly between Ass_{wohl} and DQ_{wohl} .

For utterances with rising contours (only DQs), we found that nuclear accents in L* H-^H% contours had a smaller $F0_{exc}$ in DQ_{wohl} than in DQ_{\emptyset} ($b = -0.33$, $SE = 0.13$, $t = -2.5$, $p < 0.05$). The same was true for nuclear accents in (L+)H* L-H% contours ($b = -0.84$, $SE = 0.22$, $t = -3.9$, $p < 0.01$).

To investigate the source of the $F0_{exc}$ effects just reported, we fitted separate models for $F0_{max}$ and $F0_{min}$ on the nuclear foot. Summarizing the model results, in the falling (L+)H* L-% contours there was a non-significant tendency for higher $F0_{max}$ and for lower $F0_{min}$ in ASS_{wohl} compared to ASS_{\emptyset} ; furthermore, $F0_{max}$ was higher in DQ_{wohl} than in ASS_{wohl} . In the two rising contours, $F0_{max}$ was significantly lower in DQ_{wohl} than in DQ_{\emptyset} , while $F0_{min}$ did not differ.

Table 1: Mean $F0_{exc}$ (st) and duration (ms) with SD (in brackets) for the nuclear accent (object noun)

Contour	Condition	$F0_{exc}$	duration
(L+)H* L-%	ASS_{\emptyset}	4.74 (2.5)	345 (53)
	ASS_{wohl}	5.15 (2.6)	363 (64)
	DQ_{wohl}	6.87 (2.9)	368 (56)
L* H-^H%	DQ_{\emptyset}	4.08 (2.1)	356 (71)
	DQ_{wohl}	4.22 (2.1)	362 (69)
(L+)H* L-H%	DQ_{\emptyset}	8.70 (3.2)	361 (63)
	DQ_{wohl}	7.05 (2.5)	345 (54)

For the acoustic analysis of the **clause-final post-nuclear region** in rising contours in DQs, we pooled sentences with final plateaus (H-%) and sentences with high rises (H-^H%), including boundary tone as a factor, which, however, had no significant effect. We found that DQ_{wohl} had a lower mean $F0$ than DQ_{\emptyset} (intercept-only: $b = -0.36$, $SE = 0.09$, $t = -4.2$, $p < 0.001$). In other words, not only were high rises less common in DQ_{wohl} than in DQ_{\emptyset} , but those that did occur were also phonetically lower.

The subject in the **pre-nuclear region** almost always carried a pre-nuclear accent (97% of utterances). The acoustic analysis of these accents (Figure 2), revealed the following. $F0_{exc}$ showed both a main effect of WOHL and an interaction with SPEECH ACT: $F0_{exc}$ was smaller in utterances with *wohl* ($b = -0.15$, $SE = 0.06$, $t = -2.4$, $p < 0.05$), and this difference was larger in DQ than in ASS ($b = -0.11$, $SE = 0.05$, $t = -2.3$, $p < 0.05$). Duration showed only a main effect of WOHL: accented subjects were shorter in utterances with *wohl* (intercept-only: $b = -0.01$, $SE = 0.004$, $t = -2.3$, $p < 0.05$). Descriptively, accented subjects in DQ_{wohl} patterned with $ASS_{wohl/\emptyset}$, DQ_{\emptyset} having longer subjects.

5. Discussion

Our findings indicate that there are clear prosodic differences between ASS_{wohl} and DQ_{wohl} , confirming the suggestion in [18] that DQ_{wohl} do not carry ‘assertion prosody’, contrary to [9]. Whereas assertions with or without *wohl* overwhelmingly end in a falling nuclear contour, this is only true for 16.5% of the DQ_{wohl} , which otherwise end in rising contours, high plateaus or the speaker/dialect-specific H-L%. Another important finding is that DQ_{wohl} occur more frequently with a falling contour than DQ_{\emptyset} , suggesting that the modification of the question illocution does have prosodic reflexes. Overall, we found that in DQ_{wohl} there are fewer, and less strong interrogativity cues than in DQ_{\emptyset} . This is reflected in the fewer H-^H% and more L-% boundary tones, which have been argued to signal less open speaker attitude [20][21][22]. The rarer use of the speaker/dialect-specific

question-typical H-L% further supports this assumption. The lower mean $F0$ in the post-nuclear clause-final region in DQ_{wohl} vs. DQ_{\emptyset} may also be taken to signal reduced interrogativity [22].



Figure 2: Predicted $F0$ excursion (semitones) and duration (ms) for the subject noun.

Regarding pitch accents, our findings about reduced $F0$ excursion on nuclear and pre-nuclear accents in DQ_{wohl} in comparison to DQ_{\emptyset} align with previous literature showing that accents in DQ_{\emptyset} have greater $F0$ excursions than in assertions in these regions [23]: DQ_{\emptyset} display stronger interrogativity markers than DQ_{wohl} . Also note that we replicate the comparisons of DQ_{\emptyset} and ASS_{\emptyset} in [23] in our comparison of ASS_{wohl} and DQ_{wohl} .

Overall, we propose that the reduction of indicators of interrogativity in DQ_{wohl} vs. DQ_{\emptyset} are reflexes of the speaker requesting confirmation of a proposition towards which they are already biased because of an inference they made on the basis of indirect evidence, as laid out in Section 2. DQ_{\emptyset} , in contrast, check contextual evidence without the speaker necessarily having a previous bias [30].

An unexpected finding in our study was the increased $F0$ excursion of nuclear accents that was associated with the presence of *wohl* in assertions. Maybe the fact that the speaker of a ASS_{wohl} cannot be totally sure of the truth of the proposition p because there is only indirect evidence for it, leaves the truth of p open for debate, which is signaled by the higher pitch.

Our results for DQ_{wohl} vs. DQ_{\emptyset} align with a number of findings on other questions that differ from ‘regular’ information-seeking questions. For instance, German rhetorical questions differ from their information-seeking counterpart in that they occur more regularly with final plateaus than final rises (vs. information-seeking questions) [1]. Rhetoricity is of course linked to assertiveness: rhetorical questions do not ask for information, they give information. Rejecting questions, which make clear that the speaker does not accept what they see, show prosodic features both of rejections and questions [4].

6. Conclusions

In sum, our results contribute to the growing literature showing that subtle and not so subtle modifications of the illocution of a question have prosodic reflexes. We find that the *question concern*, i.e., the illocutionary goal of a question is reflected in the prosody of a question. Although the basic goal of a question is to decide about the truth of a proposition, the question concern typically comprises a variety of additional ingredients. In the case of DQ_{wohl} , speakers indicate that they have made an inference based on indirect evidence. In biased negative interrogatives they indicate that they have previous belief, which they double-check, or that they double-check evidence that they just perceived. In disbelieving or rejecting questions, the ‘informative’ meaning components are different yet again. Prosody contributes to signaling all these subtle differences in illocutionary meaning, which suggests a high sensitivity regarding the prosody-pragmatics mapping.

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