

The Opacity of Modal Verbs in German: An ‘Optimal’ Answer to a Difficult Question

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Abstract

This paper aims at showing how it is possible – via theoretical foundation, corpus analysis and statistical methods – to explain and motivate (up to now purely subjective) interpretations of modal verbs in German. The foundation of the research design is theoretic and based on the assumption that – in contrast to other modal verb interpretations – sentences with epistemic modal verbs are characterized by a specific deictic relation. It will be shown that this premise allows for the (motivated) definition of a number of properties accessible on the linguistic surface, concerning for example the subject / the agent role, mode or the temporal-aspectual features of the infinitive. Through the methodology of statistics and Optimality Theory it will be shown – exemplified by the German modal verb *dürfen* – that some of the defined properties can actually (i.e. statistically significant) indicate a specific interpretation of the inflected verb that does not depend on purely subjective evaluations.

1 Introduction

The primary motivation for the following research question was originally situated in the field of Variationist Linguistics. In non-professional contexts and in the media it is often said that ‘Austrians’ are characterized by communicative ‘indirectness’ and excessive politeness. Especially in comparison to speakers from Germany they would withhold strong personal perspectives in formal communication. Accordingly, the so-called *List of Learning Goals concerning Politeness and Intercultural Differences in the German-speaking Areas*¹ of the Institute of ‘Austrian German’ assumes the following: “Speakers of Austrian German, in comparison to speakers from Germany, act more indirectly in formal communication [...]. [...] Considerable self-promotion is rather avoided in Austria”² (Muhr [16]).

¹ *Lernzielliste zu Höflichkeitskonventionen und interkulturellen Unterschieden im deutschsprachigen Raum* [translation E.S.]

² „Österreichische Sprecher sind im Vergleich zu deutschen Sprechern in der öffentlichen Kommunikation eher indirekter [...]. Die starke persönliche Selbstdarstellung und das Herausstellen eigener Leistungen wird in Österreich eher vermieden.“ [translation E.S.]

Those tendencies would be reflected inter alia in the variable use of modal verbs (cf. *ibid.*).

From an empirical perspective, these assumptions severely lack data-driven support. Amongst other things this is due to the methodical difficulties that appear as soon as empirical proof for such questions is intended. Modal verbs are characterized by a vast functional complexity: They do not always convey indirectness or subjective perspective. In fact, within the scope of politeness or indirectness only the epistemic interpretational variant must be taken under consideration: Only epistemic modal verbs label propositions as being unclear in their factual status (cf. Kotin [11]) or as personal inference (Arrese [5]) (1), their deontic interpretations do not (2):

(1) epistemic:

Für die Mieter muss es ein Schock gewesen sein. (Nürnberger Nachrichten)
,It must have been a shock for the tenant.‘

(2) deontic:

Ihren Führerschein muss die 43-Jährige nun abgeben. (Schwäbische Zeitung)
,The 43-year-old must hand in her driving licence now.‘

Taken into consideration only the linguistic surface, one cannot tell the difference between epistemic and deontic interpretations of modal verbs: The verb is inflected and demands a bare infinitive in both cases. Thus, as it is with other opaque elements, their interpretation is highly subjective and at first glance empirically very hard to come by. The lack of significant evidence, on the other hand, leads to highly doubtful assumptions as the ones mentioned above and subsequently to prejudices with socially relevant implications.

But also in the majority of linguistic publications dealing with modal verbs too little or no attention is paid to their difficult classification.³ Valuable contributions to the disambiguation of the different readings of modal verbs, however, came from the field of computational linguistics. The majority of these studies formulate features specific to a certain modal verb interpretation which are based on or subject to automatized corpus analyses. Most of this research has English as language of investigation. Ruppenhofer/Rehbein [17] for example ask annotators to make decisions regarding the interpretation of modal verbs in a sample of sentences and then try to elicit the characteristics of these sentences by means of a large-scale, automated corpus analysis. Their aim is to automatically generate

³ Notable exceptions would be (inter alia) Abraham [1]/[2], Abraham/Leiss [3], Diwald [6], Heine [8]/[9], Kotin [10]/[11], Leiss [13].

interpretations via the application of algorithms. The authors themselves note, however, that their study is only a first tentative attempt to automatize the evaluation of modal verbs, portrayed as a complex challenge. Marasović / Frank [15] take a similar approach as they compile an automatically generated list of properties. As indications for epistemic interpretations (only for *must* and *can*) predicates of attitude (*believe, not know, fear*) as well as specific characteristics of the subject are mentioned. The results of this study can partly be parallelized with the present study (see below). A German-focused investigation is Zhou et al. [19], also attempting to determine the semantic properties of the different modal verb uses. In contrast to Ruppenhofer/Rehbein the authors take a priori characteristics which they consider as being relevant to the interpretation of modal verbs. In all these investigations sooner or later the question arises if the chosen methodology can be seen as reliable since the automated search does not always produce unequivocal results. Especially semantic features such as the *Aktionsart* properties of the infinitive, temporal relations or the aspectual properties are difficult to grasp for automatized studies and automatized annotations of such features seem to produce high error rates. The following aims at showing how an adequate, more objective evaluation of epistemic modal verbs can be executed and why it is crucial for this task to avoid unidimensional approaches and instead combine theoretically based assumptions with empirical analyses.

2 What is epistemic modality – deictically speaking?

The idea is that specific deictic relations of epistemic modal verbs allow for the (motivated) definition of a number of properties typical for epistemic interpretations. But what exactly are those ‘specific deictic relations’ and how do they serve to distinguish the different interpretation of modal verbs?

It is claimed here that the basic difference between deontic and epistemic interpretations of modal verbs is grounded on their deictic relation. Deontic modal verbs combine their lexical content with a temporal-deictic component, pointing towards future events (expressed by the infinitive). In other word: Something that is obligatory, necessary etc. is always future-projecting from a *hic et nunc* perspective, regardless of the time of reference:

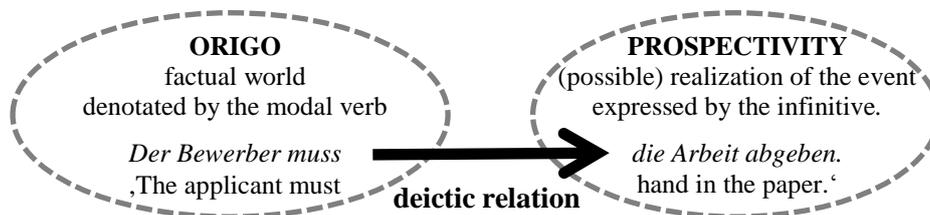


Figure 1: Deictic relation expressed by deontic modal verbs (Scherr [18])

This situation is totally different with regard to the epistemic interpretation: The lexical content of epistemic modal verbs is almost vanished up to the point where it just signalizes the strength of an inference (*dürfen, können, mögen, müssen*) or the source of a questionable statement (*sollen, wollen*). The deictic relation, however, is by no means future-projecting; instead it always indicates the reference to an event, which, in its factual status, is concurrent to the time of reference. In other words: The event evaluated in terms of its factual status is never located in a consecutive sequence but always concurrent or preceding with regard to the time of reference: The event expressed by the infinitive is (or is not) already realized. This information, however, is not accessible from the origos perspective; it is part of a *possible world* (Kratzer [12]).

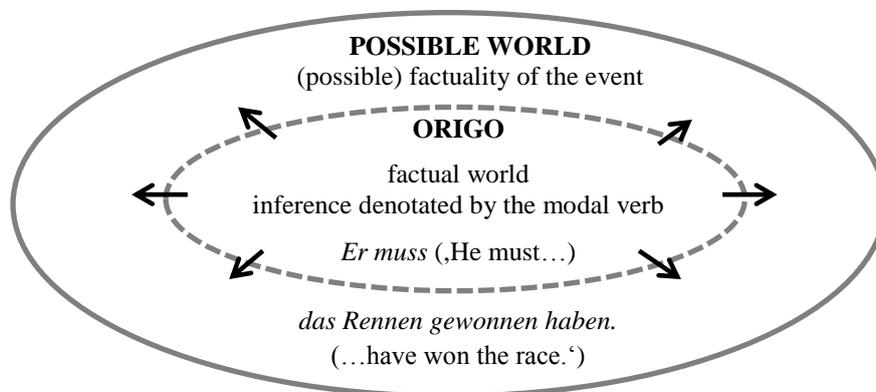


Figure 2: Deictic relation expressed by epistemic modal verbs (Scherr [18])

The question is: Why should one assume such a detailed and complicated basic interpretation of modal verbs, what is its explanatory value? It is the central characteristic, that epistemic modal verbs do not situate the event realized in the infinitive in a consecutive time period, which explains certain features accessible on the linguistic surface. The following list illustrates

some of them in exemplary selection⁴, followed by the tag used for annotation.

- *aktionsart* properties of the infinitive (INFZUSTAND)
Non-telic, non-agentive infinitives such as *sein* ('to be') or *haben* ('to have') tend to support a non-future-projecting deictic relation. Conversely, telic or strongly agentive verbs such as *abgeben* ('to hand in') or *weggehen* ('to leave') tend to support a deontic reading.
- Aspectuality of the infinitive (ASPINF)
Progressive forms such as the *Verlaufsform* stand in the way of future-projecting readings hence support the epistemic interpretation, c.f. *Er muss am Schlafen sein*. ('He must be sleeping.')
- Temporality and voice (INFKONSTREPI; *INFVORPASS)
Complex infinitives with perfective temporality are inherently stative, cf.: *Das muss weh getan haben*. ('This must have hurt'); Dynamic passive voice on the other hand delivers change-of-state-meaning with tendency towards a deontic interpretation: *Die Arbeit muss abgegeben werden*. ('The paper must be handed in.')
- Subject (*SUBJPERS1/2; *SUBJANI)
Combinations between modal verb and first or second person (singular/plural) subjects tend to evoke a directive meaning (*you have to, I can, you must not* etc.). Epistemic modal verbs with first or second person subject are accordingly rare. It is further assumed that inanimate subjects tend to restrict a directive, future-projecting deictic relation as they usually do not serve as agents in the narrow sense.
- Grammatical mode (KONJII)
Despite the functional complexity of the subjunctive, the coding of irrealis can be seen as one of its central purpose (cf. Fabricius-Hansen [7]). In other words: It prevents the implicature of an event being based on the actual, factual world (cf. Lötscher [14]). It is hence to be expected that inflected subjunctives tend to facilitate the epistemic interpretation.

⁴ Other features concern the (in)definiteness-properties or adverbial properties. For reasons of space I decided to disregard them for this paper.

3 Database and Methods

The crucial questions are a) whether the defined properties can actually (i.e. statistically significant) indicate a specific interpretation and b) to which degree they indicate a particular interpretation of the inflected (modal) verb, in other words: Whether they can be brought into a relevance hierarchy illustrating the degree of significance for an epistemic interpretation. For answering these questions a total of seven subcorpora (for each canonical modal verb *dürfen*, *können*, *mögen*, *müssen*, *sollen*, *wollen* and *werden* in its epistemic variant) was drawn from the project corpus *Variantengrammatik des Standarddeutschen*⁵, containing over 600 million words (tokens) illustrating the German *Gebrauchsstandard* in all of the German-speaking areas (press releases from Austria, Belgium, Germany, Liechtenstein, Luxembourg, South Tyrol and Switzerland). The seven subcorpora contain 300 epistemic and 300 non-epistemic examples each.⁶ The validity of this selection was checked by *Annotator Agreement* (Fleiss' Kappa with the result of $\kappa = 0.787536551$). As a next step, the previously defined properties were annotated manually in the seven subcorpora. An automated annotation was planned beforehand, due to high error rates, however, rejected. The significance of the occurrence of the single features was checked by the Chi-Square-Test and by means of (multivariate) Correlation Analysis: Only those features were taken into consideration which showed a significant frequency in the corpora (for each verb, $p = 0.1$) and which showed a correlation coefficient higher than $r \geq 0.4$ (substantial to very high correlation, cf. Albert / Marx [4]). The results of these calculations were determined separately for each verb and allowed for a ranking of significant features in accordance with their correlation coefficient. This coefficient displays the correlation of feature x with the epistemic interpretations of the respective sentences. For illustrative purposes the following table displays the results of the verb *dürfen*⁷ (features with $r \geq 0.4$ in bold):

⁵ Funding Austria: Austrian Science Fund (FWF) (project number: I 2067-G23); Germany: Deutsche Forschungsgemeinschaft (DFG) (project number EL 500/3-1); Switzerland: Schweizerischer National-fonds (SNF) (project number 100015L_134895). For further information cf. www.variantengrammatik.net [2018-09-01].

⁶ The consideration of epistemic and non-epistemic examples as well as the homogeneity of the corpora is crucial with regard to correlation analysis.

⁷ Table 1 is a simplified presentation of the results due to the limited features considered for the purpose of this paper.

verb	feature	<i>r</i>
<i>dürfen</i>	KONJII	0.98019606
	*SUBJANI	0.54671527
	*SUBJPERS1/2	0.21282896
	INFZUSTAND	0.42734305
	INFKONSTREPI	0.39857814
	*INFVORPASS	0.08471352

Table 1: Correlation coefficients of (some) significant features of *dürfen*

It seems that for the verb *dürfen* the information concerning grammatical mode (KONJII) is highly indicative for epistemic interpretation: With the modal verb in the subjunctive mode the interpretation is epistemic with a probability of 98%, in the clearest cases supported by (some of) the other relevant features such as the animacy of the subject (*SUBJANI) or the semantic or structural features of the infinitive (INFZUSTAND; INFKONSTREPI) (cf. (3)). It is just in cases where the subjunctive is used and all of the other features, however, speak in total against an epistemic interpretation, where the dominant feature may be overruled (cf. (4)). Both situations can very well be depicted with Optimality Theoretic methods:

(3) *Der herannahende Zug dürfte die Postlerin zu spät gesehen haben [...].* (Kronen Zeitung, Steiermark und Kärnten).

‘The approaching train may have noticed the postwoman too late.’

	KONJII	*SUBJANI	INFZUSTAND	INFKONSTREPI
E ♯				
*E	*!	*	*	*

(4) *Gerade in der Karnevalszeit trinken Jugendliche häufig hochprozentigen Alkohol, der ihnen nach dem Jugendschutzgesetz gar nicht verkauft werden dürfte.* (Rheinische Post).

‘It is especially during carnival season when high-proof alcohol is sold to adolescents which should not be sold to them according to the Protection of Young Persons Act.’

	KONJII	*SUBJANI	INFZUSTAND	INFKONSTREPI
E ♯		*	*	*
*E	*!			

Optimality Theory not only allows for the influence of differently weighted (principally violable) properties (*constraints*)⁸ but also the generation of so-called *rankings*, which illustrate the influencing factors, their varying relevance, and intend to allow combinations of features and *reranking* (cf. Scherr [18]).

Furthermore, with the aid of regression analysis it was tested which predictive force the features have for the interpretation of the modal verb. For *dürfen*, the regression analysis shows a coefficient of determination of 0.96, thus it can be assumed that the defined features can predict an interpretation with a probability of 96%. This in turn was tested against the evaluation of competent speakers. To that means, a questionnaire survey was carried out to check whether the calculated interpretation of the modal verb can be paralleled with the test person's assessments. This supportive pilot study in case of *dürfen* produced a result of $\kappa = 0.91$, which can be rated as excellent agreement between mathematical calculation and personal evaluation.

4 Some general findings

In a broader sense the illustrated approach may as well be applied to other semantic, pragmatic and/or functional questions. Within automated data analysis and computational linguistics it is especially these fields of interest which still imply major challenges. It should be pointed out that the theoretical motivation of defined features seems to be crucial: Only when the motivation of the selection of special features is clear, the specific challenges are obvious: For example the relevance of the infinitive can be located at a semantic (*Aktionsart*) as well as on a syntactic level (*features of voice/temporality*), as both strategies show more or less affiliation towards a specific deictic relation. By defining features of the linguistic surface which point to a qualitative assessment, the boundary between quantitative and qualitative research is certainly abolished (to a certain extent).

The results of this study, however, are also relevant for theoretical assumptions, which are time and again questioned in the course of the analysis. It appears, for example, that sometimes put forward features such as scope or other purely semantic features are not (yet) to operationalize. In this sense the collaboration between Computational Linguistics and the Humanities is essential. Up to now it seems that the purely automatized annotation is not leading to the strived results, at least for the aims of this study. Problems arise amongst others with features that concern purely semantic characteristics such as animacy of the subject or telicity of the verb.

⁸ Illustrated by the succession of features in the first row with the first one being the most influential.

Those features have manifold realizations on the linguistic surface which make an automatized annotation hardly reliable. Last but not least it should be noted that results should always be interpreted with high caution and the awareness that one is dealing with only interpretational preferences here, not with absolute, objective decisions. In addition to that, it should be noted that the findings suggest that each modal verb has very differentiated outcomes; thus it seems hardly possible to proceed on assumptions concerning *the* modal verbs and their interpretational variants.

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