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What Linguists Always Wanted to Know about German and Did not Know How to Estimate

Abstract

This paper profiles significant differences in syntactic distribution and differences in word class frequencies for two treebanks of spoken and written German: the TüBa-D/S, a treebank of transliterated spontaneous dialogues, and the TüBa-D/Z treebank of newspaper articles published in the German daily newspaper ‘die tageszeitung’ (taz). The approach can be used more generally as a means of distinguishing and classifying language corpora of different genres.

1. Introduction

It has often been pointed out that spoken language differs considerably from written texts. The discussion of such differences has typically focused on phenomena characteristic of spontaneous speech, such as false starts, hesitations, slips of the tongue, self-corrections, and elliptical utterances. With the notable exception of studies by Biber and his associates (e.g. Biber 1988, Biber 1989, Conrad & Biber 2001), less attention has been paid to differences in syntactic distribution or differences in frequencies of word classes. The purpose of this paper is to conduct three case studies of the latter kind. The empirical basis for this investigation is provided by two treebanks of German—one of spoken and one of written language—that have been constructed at the University of Tübingen over the past ten years. The TüBa-D/S is a treebank of transliterated spontaneous dialogues that were collected as a part of the Verbmobil project on speech-to-speech machine translation from German to English and to Japanese. The subject domain of these dialogues is primarily the scheduling of business meetings. The TüBa-D/Z is a treebank of a newspaper corpus. The corpus consists of

issues of the German daily newspaper ‘die tageszeitung’ (taz) that appeared in April and May of 1999.

Both treebanks share virtually the same annotation scheme that has been documented by Stegmann & al. (2000) for TüBa-D/S and by Telljohann & al. (2003) for TüBa-D/Z. Part of speech assignment to lexical categories is provided by the Stuttgart-Tübingen tagset (STTS; Schiller & al. 1995), the standard inventory of parts-of-speech also used in the Negra and Tiger treebank developed independently of the Tübingen treebanks of German. Apart from phrasal and clausal annotations, the TüBa-D/S and the TüBa-D/Z treebanks include topological field annotations that identify the major grouping of constituents in the three different clause types of German.

The treebanks were collected primarily as resources for research in computational linguistics. They have been used for the training of statistical parsers and for computational anaphora resolution. However, the treebanks are also a valuable resource for research in theoretical linguistics. In particular, they are of sufficient size to provide meaningful comparisons of spoken and written language. The TüBa-D/S consists of a total of 38,342 trees with a total number of 361,436 tokens. The TüBa-D/Z treebank currently consists of 22,087 trees with a total number of 381,558 tokens. More information about the treebanks, including licensing terms, can be found at the following URLs: For TüBa-D/S, http://www.sfs.uni-tuebingen.de/en_tuebads.shtml, and for TüBa-D/Z, http://www.sfs.uni-tuebingen.de/en_tuebadz.shtml.

2. The distribution of noun phrases

This section will compare the distribution of phrases and syntactic categories in the two treebanks and will focus on the distribution of noun phrases. Table 1 shows the distribution of noun phrases in the two treebanks.

| | TüBa-D/S (spoken): | | TüBa-D/Z (written): | |
|--------------------|--------------------|--------|---------------------|--------|
| number of NPs | 86402 | | 74935 | |
| definite NPs | 1348 | 15.6 % | 28642 | 38.2 % |
| indefinite NPs | 24832 | 28.7 % | 23385 | 31.2 % |
| pronouns | 41132 | 47.6 % | 9506 | 12.7 % |
| proper names | 2487 | 2.9 % | 7153 | 9.6 % |
| relative pronouns | 391 | 0.5 % | 2746 | 3.7 % |
| reflexive pronouns | 2792 | 3.2 % | 2792 | 3.7 % |
| wh-questions | 1284 | 1.5 % | 711 | 1.0 % |

Table 1. Distribution of NPs

The treebanks differ considerably in the relative frequency of different types of NPs. The term “definite NP” refers to NPs that start with a definite determiner, a demonstrative, or a possessive pronoun. In the newspaper treebank, such NPs are the most frequent among all NP types while in the treebank of spoken dialogues, they make up only 15.6% of all NPs. The distribution of pronouns (personal, possessive and demonstratives) also differs significantly. In the TüBa-D/S (spoken) treebank, they make up almost half of all NPs while in the TüBa-D-Z (written) only 12.7% of all NPs are pronouns. Although proper names are less frequent in both treebanks, their distribution is again different for both treebanks, with proper names occurring three times more often in the TüBa/D-Z (written).

The term *indefinite NP* refers to all those NPs in the corpus that are not a member of any of the other classes listed in table 1. While definite NPs outrank indefinite NPs in the newspaper corpus, the spoken language corpus exhibits a very different relative distribution, with indefinite NPs occurring almost twice as often as definite NPs.

The relative frequencies of NP types in the two corpora are indicative of the respective domains of the corpora. The topic structure in the dialogues is less cohesive than in newspaper texts since task-oriented dialogues such as appointment scheduling and travel planning involve discussion of different subtasks. The different distributions of definite and indefinite NPs reflect these differences. Indefinite NPs are typically used to introduce new discourse entities while definite NPs refer to entities that are given in the discourse. With relatively cohesive texts, it is to be expected that definite NPs become more frequent relative to indefinite NPs while the opposite is true for less cohesive dialogues.

The discourse function of pronouns is similar to that of definite NPs. In their anaphoric use, pronouns refer to events or entities previously

introduced into the discourse. At first glance, the distribution of pronouns in the two treebanks (cf. table 2) is rather surprising. However, a closer look at the types of pronouns used in the two corpora shows that first and second person pronouns as well as polite (morphologically third person) pronouns are by far the most frequently used pronoun types in the dialogue treebank. That the second person familiar pronouns (*du, ihr*) appear less frequently than the polite pronouns (*Sie, Ihnen*) is a direct reflection of the politeness requirements of the particular kind of dialogues. The primary use of pronouns in the dialogue corpus is thus deictic rather than anaphoric. This is further highlighted by the fact that third person pronouns, which are typically used anaphorically (i.e. have a linguistic antecedent), make up only 10.5 % of all pronouns. By contrast, the deictic use of pronouns in the newspaper treebank is rather rare and is—we conjecture—largely restricted to direct speech environments such as quotations and headlines. Anaphoric third person pronouns make up the majority of all pronoun occurrences.

A related issue concerns the relative frequency of demonstrative pronouns in the treebanks. In the dialogue treebank, demonstrative pronouns represent 21.7% of all pronouns while in the newspaper treebank only 16.0% are demonstratives.

| | TüBa-D/S: (spoken): | | TüBa-D/Z: (written): | |
|-------------------|---------------------|-------|----------------------|-------|
| 1st personal: | 21880 | 53.2% | 1957 | 20.6% |
| 2nd person: | 186 | 0.5% | 83 | 0.9% |
| Polite: | 5933 | 14.4% | 514 | 5.4% |
| 3rd person (m/f): | 314 | 0.8% | 3194 | 33.6% |
| 3rd person (n): | 3999 | 9.7% | 2139 | 22.5% |
| Demonstratives | 8935 | 21.7% | 1518 | 16.0% |

Table 2. Distribution of pronouns

3. Direct and indirect questions

The discussion in section 2 has focused on distributional properties that can be identified on the basis of POS information and syntactic annotation at the phrasal level. In this and the following section, we will utilize topological field information to consider more fine-grained distinctions in syntactic distribution between the two treebanks.

The theory of topological fields (Höhle 1986) provides a layer of syntactic annotation between the level of individual phrases and the clause level. It is grounded in the placement of finite and non-finite verbs in different clause types of German. Consider the finite verb *wird* in (1) as an example.

- (1) a. *Peter wird das Buch gelesen haben.*
 Peter will the book read have.
 ‘Peter will have read the book.’
- b. *Wird Peter das Buch gelesen haben?*
 Will Peter the book have read?
 ‘Will Peter have read the book?’
- c. *dass Peter das Buch gelesen haben wird.*
 that Peter the book read have will.
 ‘... that Peter will have read the book.’

In non-embedded assertion clauses (V2), the finite verb occupies the second position in the clause, as in (1a). In yes/no questions (V1), as in (1b), the finite verb appears clause-initially whereas in embedded clauses (V final), it appears clause finally, as in (1c). Regardless of the particular clause type, any cluster of non-finite verbs, such as *gelesen haben* in (1a) and (1b) or *gelesen haben wird* in (1c), appears at the right periphery of the clause.

The positions of the verbal elements form the sentence bracket (‘Satzklammer’) which divides the sentence into an initial field (‘Vorfeld’), a middle field (‘Mittelfeld’), and a final field (‘Nachfeld’). The initial field and the middle field are divided by the left sentence bracket, which is realized by the finite verb or (in verbfinal clauses) by a complementizer field (‘C-Feld’). The right sentence bracket (‘rechte Satzklammer’) is realized by the verb complex and consists of verbal particles or sequences of verbs. This right sentence bracket is positioned between the middle field and the final field.

Table 1 show that wh-questions with nominal heads occur with roughly the same relative frequency in both treebanks. This seems rather surprising since one would expect that wh-questions would have a much higher occurrence in the TüBa-D/S treebank, considering the task-oriented dialogues it records. However, if one considers a more fine-grained classification of wh-questions into direct and embedded questions, then the

distribution of these two question types is characteristically different. Topological field annotation enables us to distinguish between these two question types. Direct wh-questions are V2-clauses, in which the wh-phrase occurs in the initial field while for indirect questions the wh-phrase appears in the C-field of a VL clause. As shown in table 3, 69.0% of all wh-questions with a nominal head are direct questions in the dialogue treebank while in the newspaper treebank only 30.7% are direct questions.

| | | TüBa-D/S (spoken): | | TüBa-D/Z (written): | |
|---------------|--------------|--------------------|------------|---------------------|------------|
| | | counts | percentage | counts | percentage |
| C-field | nominal head | 355 | 31.0% | 458 | 69.3% |
| | any head | 718 | 21.3% | 803 | 68.0% |
| initial field | nominal head | 790 | 69.0% | 203 | 30.7% |
| | any head | 2648 | 78.7% | 378 | 32.0% |

Table 3. Distribution of nominal phrases in initial field and C-field.

If one considers wh-questions with any head category, i.e. including also question words such as *wie*, *wo*, *wohin*, *woher*, *wann*, and *warum*, then the difference in distribution between the two treebanks is even more apparent: in the dialogue treebank, 78.7% of all wh-questions are direct questions while in the newspaper treebank, 32.0% are direct questions.

The distribution of nominal wh-questions and of all wh-questions among the two clause types is indicative of the two genres represented by the two treebanks, with direct questions naturally occurring more frequently in dialogue data. It is also instructive to compare the percentages of wh-questions among all categories that occur in the C-field and the initial field in the two treebanks.

| | TüBa-D/S (spoken): | TüBa-D/Z (written): |
|-----------------------------|--------------------|---------------------|
| wh-phrases in C-field | 16.1% | 10.1% |
| wh-phrases in initial field | 9.3% | 1.7% |

Table 4. Wh-phrases in C-field and initial field

In the dialogue treebank, 16.1% of all subordinate clauses and 9.3% of all verb-second clauses are questions, as opposed to 10.1% for subordinate clauses and 1.7% for verb-second clauses in the newspaper corpus. Again, these relative frequencies of questions in the two treebanks are a reflection of the text types involved.

4. Syntactic realization of the initial field

Topological field annotation also provides the necessary information to study the distribution of sentence-initial constituents and their grammatical function in verb-second clauses in general. In the previous section we have already seen that the relative frequency of *wh*-questions in the initial field differs considerably (9.3% in dialogue corpus versus 1.7% in the newspaper corpus). Table 5 gives a summary of the relative frequencies for all grammatical functions in the initial field for the two treebanks.

| | TüBa-D/S (spoken): | | TüBa-D/Z (written): | |
|---------------------------|--------------------|-------|---------------------|-------|
| ON (subject) | 14358 | 50.3% | 11585 | 52.1% |
| MOD (sentential modifier) | 7279 | 25.5% | 3179 | 14.3% |
| V-MOD (verbal modifier) | 2625 | 9.2% | 3891 | 17.5% |
| OA (accusative object) | 1682 | 5.9% | 848 | 3.8% |
| PRED (predicate) | 1460 | 5.1% | 495 | 2.2% |
| OS (sentential object) | 191 | 0.7% | 926 | 4.2% |
| ON-MOD (subject modifier) | 98 | 0.3% | 279 | 1.3% |
| FRONTED FIELDS | 23 | 0.01% | 190 | 0.9% |
| OTHER | 824 | 2.99% | 749 | 3.7% |

Table 5. Grammatical functions of initial field constituents

In both treebanks, approximately half of the initial field constituents are subjects (nominal as well sentential subjects). Objects, on the other hand, occur rarely. We conjecture that the higher percentage of objects in the dialogue corpus is due to the higher number of direct *wh*-questions that we discussed earlier.

Apart from subjects, modifiers make up the largest class of initial field constituents. The labels MOD, V-MOD, and ON-MOD refer to the classes of sentential modifiers, verb phrase modifiers, and subject modifiers, respectively. The frequency rank of these modifiers differs in the two treebanks, with sentential modifiers outranking other modifiers by a large margin. Among sentential modifiers, 91.6% are realized as adverbial phrases in the dialogue corpus, compared to 48.7% in the newspaper corpus. On the other hand, subordinate clauses make up 25.8% of all sentential modifiers in the newspaper corpus, but only 4.5 % in the dialogue corpus. These differences in distribution are once again a

reflection of the two genres involved: In the dialogue corpus, discourse connectives such as *dann* ('then'), *deshalb* ('therefore') or *also* ('thus') figure prominently among adverbial phrases while the higher presence of clausal modifiers in the newspaper corpus is indicative of the higher frequency of hypotactic constructions in newspaper texts.

Another difference between the two corpora concerns the relative frequency of fronted topological fields. These are cases where non-finite verbs are fronted alone or together with complements or modifiers or where parts of the middle field appear in the initial field. In the dialogue corpus such highly complex constructions are extremely rare (0.01% all of initial field realizations). While also rare in absolute terms (0.9%) in the newspaper corpus, they are much more frequent in the newspaper corpus than in the dialogue corpus. The example in (2) is a particularly complex example taken from the newspaper corpus where a verbal complex (*ausgenommen werden*) is fronted together with a final field PP-modifier. Examples such as (2) corroborate the claim of Müller (2003) that the initial field need not be realized by a single constituent in German.

- (2) *Ausgenommen werden von der neuen Steuer- und*
 exempted be of the new tax and

Sozialabgabepflicht sollten Zeitungsträger, Chorleiter oder
 social contributions should newspaper carriers, choirmasters or

Übungsleiter in Sportvereinen.
 trainers in sports clubs.

'Newspaper carriers, choirmasters, or trainers in sports clubs should be exempted from the new tax on wages and for social benefits.'

5. Conclusion and outlook

We have presented a case study of profiling two treebanks from two rather different domains. While it is premature to draw more general conclusions from a single case study, we believe that the kinds of distributional tests presented here could be used more generally as a means of distinguishing and classifying language corpora of different genres. If successful, such profiling could be used to construct balanced corpora or identify subgenres within a heterogeneous corpus.

We view the distributional tests that we have presented here as a natural extension of Biber's program of situating text types relative to multi-dimensional linguistic features, without necessarily subscribing to Biber's functionalist interpretation of such features. The extension to Biber's work lies in the granularity of linguistic annotations and features that informs the analysis. While Biber (1989) relies primarily on linguistic features that can be identified at the part of speech level, we have shown how deeper syntactic annotation can provide a much wider range of features, which in turn can support a more fine-grained classification of text types.

While the current study has relied on deep syntactic annotation of a corpus in the form of a treebank, it is important to note that the type of distributional information that we have profiled for the two treebanks can also be obtained by more shallow methods of analysis. Müller (2005) has shown that topological field information can be effectively combined with identification of so-called chunks, i.e. non-recursive syntactic phrases. Müller & Ule (2002) have developed a finite-state parser for German that has been used to automatically parse and partially annotate a very large corpus of German.

In sum, thanks to recent advances in computational linguistics, it is now possible to study interesting grammatical phenomena on the basis of large-scale, linguistically annotated corpora and to profile the distribution of grammatical functions and categories.

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