Some remarks on the Annotation of Quantifying Noun Groups in Treebanks

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Abstract

This article is devoted to the problem of quantifying noun groups in German. After a thorough description of the phenom ena, the results of corpus-based investigations are described. Moreover, some examples are given that underline the necessity of integrating some kind of information other than grammar sensu stricto into the treebank. We argue that a more sophisticated and fine-grained annotation in the treebank would have very positve effects on stochastic parsers trained on the treebank and on grammars induced from the treebank, and it would make the treebank more valuable as a source of data for theoretical linguistic investigations. The information gained from corpus research and the analyses that are proposed are realized in the framework of SILVA, a parsing and extraction tool for German text corpora.

1 Introduction

There is an increasing number of linguists interested in large syntactically annotated corpora, i.e. so-called *treebanks*. Treebanks consist of language samples annotated with structural information - centrally, the grammatical structure of the samples, though some resources include categories of information other than grammar sensu stricto. Data contained in treebanks are useful for diverse theoretical and practical purposes: Combining raw language data with linguistic information offers a promising basis for the development of new, efficient and robust natural language processing methods. Real-world texts annotated with different strata of linguistic information can serve as training and test material for stochastic approaches to natural language processing. At the same time, treebanks are a valuable source of data for theoretical linguistic investigations about language use. The data-drivenness of this approach presents a clear advantage over the traditional, idealised notion of competence grammar.
According to Skut et al. (1997) treebanks have to meet the following requirements:

1. descriptivity:
   - grammatical phenomena are to be described rather than explained;
2. theory-independence:
   - annotations should not be influenced by theory-specific considerations; nevertheless, different theory-specific representations should be recoverable from the annotation;
3. multi-stratal representations:
   - clear separation of different description levels; and
4. data-drivenness:
   - the annotation scheme must provide representational means for all phenomena occurring in texts.

The most important treebank for English nowadays is the *Penn Treebank* (cf. (Marcus et al., 1994)). Many statistical taggers and parsers have been trained on it, e.g. Ramshaw and Marcus (1995), Srinivas (1997) and Alshawi and Carter (1994). Furthermore, context-free and unification-based grammars have been derived from the Penn Treebank (cf. (Charniak, 1996) and (van Genabith et al., 1999)). These parsers, trained or created by means of the treebank, can be applied for enlarging the treebank.

For German, the first initiative in the field of treebanks was the *NEGRA Corpus* (cf. (Skut et al., 1998)) which contains approximately 20.000 sentences of syntactically interpreted newspaper text. Furthermore, there is the *Verbmobil Corpus* (cf. (Wahlster, 2000)) which covers the area of spoken language.

TIGER (cf. (Brants et al., 2002)) is the largest and most exhaustively annotated treebank for German. It consists of more than 35.000 syntactically annotated sentences. The annotation format and scheme are based on the NEGRA corpus. The linguistic annotation of each sentence in TIGER is represented on a number of different levels:

- part-of-speech (pos) information is encoded in terminal nodes;
- non-terminal nodes are labelled with phrase categories;
- the edges of a tree represent syntactic functions; and
- secondary edges, i.e. labelled directed arcs between arbitrary nodes, are used to encode coordination information.

Syntactic structures are rather flat and simple in order to reduce the potential for attachment ambiguities. The distinction between adjuncts and arguments is not expressed in the constituent structure, but is instead encoded by means of syntactic functions.

In this article, we attend to the question of how to analyze and annotate quantifying noun groups in German in a way that is most informative and intuitive for treebank users, i.e., linguists as well as NLP applications. In the following section, we first give an overview of the different kinds of quantitative specification in German. In the following section, the general structure of quantifying noun groups is depicted and subclasses are introduced. We concentrate on the description of measure constructions and count constructions. In the third section, we show how these constructions are annotated in TIGER and NEGRA so far and why the existing annotation is not sufficient for linguistically more demanding tasks. We make several refinement proposals for the annotation scheme. A grammar induction experiment shows the benefit that can be gained from the proposed refinements. In section 5, some concluding remarks follow.

The information gained by corpus-based research is used in the framework of *SILVA*, a finite-state based symbolic system for parsing and for the extraction of deep linguistic information from unrestricted German text. Since, this paper presents research that is part of the agenda for developing SILVA, our analyses are tributary to this overall goal. And, since our parsed output should be a reasonable basis for linguistically more demanding extraction tasks, a highly informative annotation is one of our main goals.

2 Indications of Quantity - Variants of the Quantitative Specification

In order to apprehend a non-discrete, amorphous substance, such as *Lehm* (*loam*), as a discrete object and therefore to make it countable, and in order to integrate discrete entities, such as *Blumen* (*flowers*), in one more complex unit, there are mainly two possibilities in German:

1. building a noun group:

   (1) ein Klumpen Lehm
   a clump loam
   'a clump of loam'

   (2) ein Strauß Blumen
   a bouquet flowers
   'a bouquet of flowers'

   or

2. building a compound:

   (3) ein Lehmklumpen
   a loam clump
   'a clump of loam'

(4) ein Blumenstrauß
a flower bouquet
'a bouquet of flowers'

.

In the context of parsing and structure annotation, the latter possibility does not pose any problems, whereas the first one calls for further investigation with a view to a workable strategy concerning the analysis and annotation of such constructions.

2.1 The Structure of the German Quantifying Noun Group (quanNG)

The German quantifying noun group (*quanNG*) is composed of a numeral (*Num*), a nominal constituent used for quantification (*quanN*) and a nominal constituent denoting the quantified element or substance (*ElemN*) (cf. figure 1). Thus, quanNG consists of a quantifying constituent (e.g. , *ein Klumpen* in example 1) and a quantified constituent (e.g. , *Lehm* in example 1).
With respect to the nouns that can function as the head of the quantifying constituent *quanN*, we distinguish four classes of quantifying noun groups:

1. numeral noun constructions;
2. quantum noun constructions;
3. count constructions; and
4. measure constructions.

These four main classes are subdivided into several syntactically and semantically motivated subclasses (see table 1). A more detailed description of the respective classes is presented in the following sections.

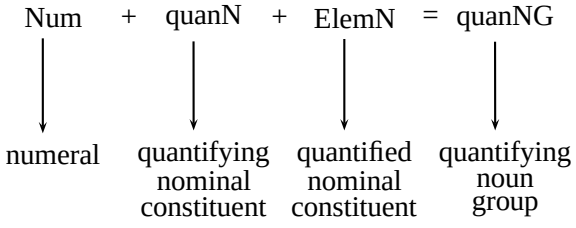

Figure 1: Structure of a Quantifying Noun Group

2.2 Four Classes of Quantifying Noun Groups

The quantifying aspect to the meaning of the complex noun group quanNG is contributed by a quantifying noun quanN. Starting from the specific nature of these quanN, we differentiate between four classes of quanNG. Depending on whether the head noun of the quanN can only yield a contribution to the quantitative aspect of the complex noun phrase, as it is the case with *Kilogramm* (*kilogram*) or *Million* (*million*), or if the contribution to the meaning of the complex noun phrase is of quantitative nature only in certain contexts, as it is the case with *Tasse* (*cup*), or *Schritt* (*step*), there arise cases of ambiguity we are faced with in the context of structure analyzing and annotation.

2.2.1 Numeral Noun Constructions and Quantum Noun Constructions

In German, in addition to the numerals, there are some nouns such as *Dutzend* (*dozen*) or *Million* (*million*), that bring out specific indications of number and that do not go beyond this quantitative aspect (in contrast to *Paar* (*pair*)). quanNG with such a noun as head of quanN are called *numeral noun constructions*.
Quantum noun constructions can be characterized by two observations:

1. they cannot be freely combined with numerals; and
2. they express indefinite quantities.

Numeral noun constructions and quantum noun constructions are mentioned here only for the sake of completeness[1].
In the context of this article, we concentrate on measure constructions and count constructions.

2.2.2 Measure Constructions and Count Constructions

Measure Constructions For the description of measure constructions the concept of measurement, as known from the theory of measurement (cf. (Suppes, 1963)), is used. By virtue of measure constructions, a real number *n* is assigned to

[1] Interested readers are referred to Wiese (1997) for a detailed description of these construction types.

CATEGORY	EXAMPLES
(1) numeral noun construction	Dutzend (*dozen*), Million (*million*)
(2) quantum noun construction	Menge (*number*), Unmenge (*vast number*), Unsumme (*amount*), Vielzahl (*multitude*)
(3) count construction:	
(a) count noun construction:	
(i) numeral classifier construction	Stück (*piece*)
(ii) shape noun construction	Tropfen (*drop*), Laib (*loaf*), Scheibe (*slice*)
(iii) container noun construction	Glas (*glass*), Tasse (*cup*), Kiste (*crate*)
(iv) singulative construction	Halm (*blade*), Korn (*grain*)
(b) sort noun construction	Sorte (*kind*), Art (*type*)
(c) collective noun construction:	
(i) configuration construction	Stapel (*stack*), Haufen (*heap*)
(ii) group collective construction	Herde (*herd*), Gruppe (*group*), Paar (*pair*)
(4) measure construction:	
(a) measuring unit construction (muc):	
(i) abstract muc	Meter (*meter*), Grad (*degree*), Euro (*euro*)
(ii) concrete muc:	
- container noun construction	Glas (*glass*), Tasse (*cup*), Kiste (*crate*)
- action noun construction	Schluck (*gulp/mouthful*), Schritt (*step*)
(iii) relative muc	Prozent (*percent*)

Table 1: Categorization of quanNG with respect to quanN

a measure object *u* that determines the value of a property *P* (such as weight or temperature). In the context of measurement, *u* is correlated to a set *m* of measure objects (such as weights), whose quantity directly or indirectly indicates the value of the measured property *P*. The correlation to *m* is made up by virtue of a measure function *M*, that maps *P(u)* onto *m*.

The possible properties *P* are called *dimensions* and the measure function is called *measuring unit*. *m* is an indication of quantity such as *30 kilograms*. There exist two specification relations between *m* and *u*:

(5) vier Kilogramm Gewicht
four kilogramm weight

'four kilograms of weight'

(6) vier Kilogramm Eisen
four kilogramm iron

'four kilograms of iron'

In example 5 the dimension is explicitly given, in example 6 the dimension is not explicitly given, but can be inferred from the measure function *M* (*Kilogramm*) and the measure object *u* (*Eisen*).

m is restricted concerning the compatibility with dimension denoting nouns, verbs, and adjectives. Thus, indications in *metres* can only be combined with spatial dimensions such as *height* or *length*, but they cannot be combined with temporal relations. These restrictions can be modelled by assuming that there are *scales* and *degrees* functioning as abstract entities that are correlated by dimensions and objects (cf. (Cresswell, 1977)). Scales and degrees are to be considered as means for the formal analysis of quantity-related phenomena. A reasonable possibility to comprehend degrees as abstractions over objects seems to be the assumption that a degree is a class of objects that cannot be differentiated wrt. the considered dimension. A scale is a totally ordered set of degrees. Indications of measurement are predicates over degrees or degree distances. Degrees of different scales cannot be compared with each other. However, entities can be measured with the help of different measuring units wrt. to one and the same dimension. That means, there are different measure functions (such as *euros* and *dollars*) that are linked to each other depending on the respec-

Scale	Measuring Unit	Dimension	Adjective	Verb
length	Meter (*meter*)	length	lang (*long*)	
		height	hoch (*high*)	
		width	breit (*wide*)	
		thickness	dick (*thick*), stark (*strong*)	
		distance	weit (*far*)	
		depth	tief (*deep*)	
area	Hektar (*hectare*)	area	groß (*large*)	
volume & mass	Liter (*litre*)	capacity		fassen
	Gramm (*gramme*)	weight	schwer (*heavy*)	wiegen (*weigh*)
time	Jahr (*year*)	duration of situation	lang(e) (*long*)	dauern (*last*)
		period of validity	gültig (*valid*)	laufen (*run*), gelten (*hold*)
		age	alt (*old*)	
value	Euro (*euro*)	value	wert (*worth*)	
		price	teuer (*expensive*)	kosten (*cost*)
page	Seite (*page*)	length	lang (*long*), dick (*thick*), stark (*strong*)	umfassen (*comprise*)
	Mann (*man*)	(team) strength	stark (*strong*)	umfassen (*comprise*)
temperature	Grad Celsius (*degree celsius*)	temperature	warm (*warm*), heiß (*hot*), kalt (*cold*)	
proportion	Prozent (*percent*)	relative size		

Table 2: Scales, Measuring Units and Dimensions

tive dimension (such as *price* or *hire*).

By means of corpus investigations, we designed eight scales. For each of these scales, we collected the belonging measuring units (i.e. the measure functions) together with the dimension denoting adjectives and verbs referring to the same scale. Whereas for the dimension *weight* there exist a dimension denoting noun as well as a dimension denoting adjective and a dimension denoting verb, there are other dimensions for which there are lexical gaps. Table 2 lists our scales together with an exemplarily chosen measure unit and the belonging dimension(s) and lexemes[2]. The scales presented in table 2 are conceived with a view to syntactic analysis. Since *mass* and *volume* look alike wrt. their surface realizations, i.e. the sets of dimension denoting adjectives and verbs referring to the scales of mass and volume overlap to a considerable degree, we do not differentiate between these two scales in the context of analysis. In our parsing system the incompatibility of different scales is reflected in lexicalized grammar rules: adjectives referring to the weight scale can only take as measure argument measurement indications containing a measuring unit referring to the same scale. This is especially important in order to be able to distinguish an indication-of-quantity-reading (cf. example 7) from a reading as a measure argument of an adjective (cf. example 8).

[2]Several derived dimensions such as “frequency” or “density” are not considered.

(7) <NP> <NP> drei Hektar </NP> <NP>
three hectare
weites Land </NP> </NP>
wide land

'three hectares of wide land'

(8) <NP> <AP> drei Hektar große </AP>
three hectare large
Felder </NP>
fields

'three hectare large fields'

The measure constructions can be divided wrt. the nature of the used measuring units into abstract, concrete and relative measuring unit constructions.

Abstract Measuring Unit Constructions Abstract measuring unit constructions contain an abstract measuring unit as quanN. These abstract measuring units are defined in the frame of physical theories and they are always restricted to a certain scale. By virtue of different scales, measuring units can be categorized. The units of one and the same scale can be converted into each other.

Concrete Measuring Unit Constructions Apart from the abstract measuring units there are a number of concrete measuring units. The concrete measuring unit constructions can be subdivided into

1. container noun constructions; and
2. action noun constructions.

Container nouns can be used as measuring units that are definable by virtue of the capacity that can be assigned to the concrete object. In the case of action noun constructions, the measurement acting as the basis for the definition of the measuring unit is the capacity restriction of the respective action.
From a linguistical point of view, the distinction of abstract measuring unit construcitons and concrete measuring unit constructions is important insofar as:

1. dimension denoting nouns are preferably combined with abstract or at least heavily standardized measuring units; and
2. if mass nouns are directly combined with numerals, such as *zwei Kaffee* (*two coffees*), this construction cannot be understood as an abbreviation of an abstract measuring unit construction, such as *zwei Liter Kaffee* (*two liters of coffee*), but, instead, it must be understood as an abbreviation of a concrete measuring unit construction, such as *zwei Tassen Kaffee* (*two cups of coffee*).

Relative Measuring Unit Constructions Relative measuring units such as *Prozent* (*percent*) serve to specify relative sizes. Relative measuring units are not restricted to a certain scale.

Count Constructions Count constructions contrast to mass constructions. Count constructions do not serve for the measurement of certain substances, but, for the numerical quantification of discrete entities. That means, the number assignment does not identify values of a certain property *P*, but, it refers to the number of discrete entities. Restrictions concerning the compatibility are dependent on the properties of the denotates of the nouns they refer to.
Depending on quanN, the count constructions can be subdivided into three construction types:

1. count noun constructions;
2. sort noun constructions; and
3. collective noun constructions.

Count Noun Constructions The count noun constructions are again split up wrt. the nature of the respective quanN into:

1. numeral classifier constructions;
2. shape noun constructions;
3. container noun constructions; and
4. singulative constructions.

`Numeral classifiers` only play a marginal role in German since also the direct combination of a count noun with a numeral functions as an indication of counting. In other languages, numeral classifier constructions occur far more often (cf. (Bond, 1996)).

In German, `shape nouns` such as *Scheibe* (*slice*) or *Laib* (*loaf*) specify spatial (shape) properties of the object. Even if it is possible to cut *a loaf of bread* into *15 slices of bread*, the adequacy of the usage of *a loaf of bread* or *15 slices of bread* depends on the actual state of the object referred to. Thus, shape nouns only reflect object-inherent properties. This distinguishes shape noun constructions from abstract measuring unit constructions: It is irrelevant whether we describe a roast as *1 kilo of meat* or as *two pounds of meat*. In the latter case, it is not necessary that we have two separate portions of meat. Count constructions with shape nouns as count units have a complex semantic structure: The object of the numerical quantification is an entity of a certain substance with a certain shape. Thus, the construction denotes objects that are identified by virtue of two conceptual components, namely "shape" and "substance". The referees of the shape noun and the substance noun form one complex concept, whose instances are numerically quantified. These combinations can typically also be expressed with the help of a meaning-conserving compound.

`Container nouns` have a special status within the quanN, since they belong to the absolute nouns and only their usage in quantifying constructions transforms them into relational nouns that need the completion by Num and ElemN. The container nouns can be used outside the quanNG to refer to the corresponding concrete entities. We distinguish between three readings of container noun constructions:

(9) Er nahm ein Glas aus dem Schrank.
He took a glass out the cupboard.

'He took a glass out of the cupboard.'

(10) Auf dem Tisch stehen drei Glas/Gläser
On the table stand three glasses/glass
Wasser.
water.

'Three glasses of water are on the table.'

(11) In der Karaffe sind drei Gläser/Glas
In the carafe are three glasses/glass
Wasser.
water.

'In the carafe are three glasses of water.'

In example 9 *Glas* is an absolute noun denoting the physical object. In examples 11 and 10 it refers to indications of quantity. But, whereas in example 10 it deals with the concrete quantity of water which is in the given containers, i.e. the glasses, in example 11, it deals with a conventionalized quantity of water corresponding to the conventional standard size of the container of the given kind, i.e. the glass. The difference between the latter examples reflects the difference between container noun constructions as count constructions (cf. example 10) and container noun constructions as measure constructions (cf. examples 11).

Often, count constructions with container nouns as count unit and measure constructions with container nouns as measuring unit are not distinguishable from each other, since the quantification of a set of equally large (filled) containers always also identifies the volume of their content. Thus, it is not always possible to decide, if, with a given construction, containers are numerically quantified or if the volume of their contents is measured. Concrete measuring units, in contrast to container nouns as count units, often occur in a number-unmarked form. But, first, this is not always the case, and, second, a missing number marking is only a hint for a measure construction; the reverse inference cannot be drawn: a plural noun can function both as count unit and as measuring unit (cf. example 12, where a plural container noun undoubtedly functions as measuring unit).

(12) Eine Kugel Vanilleeis, ein Glas
One ball vanilla ice cream, one glass
Ananassaft und **zwei Gläser Milch**
pineapple juice and two glasses milk
im Mixer mischen.
in the mixer mix.

'Mix one ball of vanilla ice cream, one glass of pineapple juice and **two glasses of milk** in the mixer.'

Sort Noun Constructions Sort noun constructions allow for indications of quantity based on sortal distinctions.

Collective Noun Constructions Among the collective noun constructions we distinguish between

1. configuration constructions; and
2. collective noun constructions.

The `configuration constructions` are similar to shape noun constructions insofar as the configuration noun as well as the shape noun carries annotation of a certain shape. But, in contrast to the shape nouns, collective noun constructions do not denote an individuating operation, but a collectivizing operation.
In addition to the collectivizing effect, the quanN in `group collective constructions` carries certain social and functional aspects.

3 The Quantifying Noun Group in TIGER and NEGRA

In accordance with the TIGER annotation scheme (cf. (Albert et al., 2003)), in TIGER (and also in NEGRA), quantifying noun groups are annotated as sequences of nouns, i.e. entirely flat. Moreover, there is no distinction between quantifying noun groups and other kinds of noun groups composed of several nominal constituents, i.e., *ein Liter Wasser* (*one liter of water*) is annotated the same way as *eine Art Seife* (*a kind of soap*) and *die Bahn AG* (*the Bahn AG*).

3.1 Proposals for a refinement of the annotation scheme

Starting from the observations and problems described in the preceding sections, we propose certain partly syntactically, partly semantically motivated refinements of the TIGER annotation scheme.
First of all, the quantifying noun group should not be annotated as a sequence of nouns, but ElemN should be a separately built up noun phrase, attached to quanN, which in turn constitutes a complex noun phrase together with Num. With this annotation, we reflect the fact, that quanNG can be considered as a loose appositive syntagma (cf. (Krifka, 1989)). quanNG as a complex noun phrase should get a label signalling that it is an indication of quantity.

Second, the determination of the head of quanNG has to be rethought: from a syntactic point of view, quanN functions as head, from a semantic point of view ElemN functions as head. We plead for the annotation of a complex head consisting of both, the head of quanN and the head of ElemN. The decision for always assigning a two-place head to quanNG is quite important if we deal with elliptic constructions. In sentences, such as example 13, we do not want to infer that the boy eats a plate, and in sentences, such as example 14, we want to infer that the coffee is in a certain container.

(13) Der Junge ißt einen großen Teller.
The boy eats a big plate.
'The boy eats a big plate (of x).'

(14) Sie bestellten zwei Kaffee.
They ordered two coffees.
'They ordered two (cups of) coffee.'

Moreover, in the context of quanNG it should be annotated if the involved ElemN functions as count noun or as mass noun. In measure constructions, singular count nouns always get a mass noun reading. This information is quite useful wrt. theoretical linguistic investigations.
A similar question is the differentiation between container nouns as count units and as measuring units. Again, this distinction would allow for fine-grained linguistic research using a treebank as a valuable resource.
Because of the minor lexical content of count and measuring units, indications of quantity can only be combined with few adjectives. Therefore, there are cases, in which the adjective does not refer to quanN, but directly to ElemN (cf. example 15).

(15) einige schäumende Gläser Bier
some foamy glasses beer
'some glasses of foamy beer'

In these cases, we should have a link signalling that *schäumend* does not refer to the glass, but to the beer. That means, that despite surface order and agreement phenomena (*schäumende* does not congrue with *Bier*), the information that the adjective modifies ElemN and not quanN should be

contained in the treebank.
Concerning the refinement proposals so far, in most of the cases the annotation requires manual work. Another ambiguity that has to be resolved in a treebank concerns all nouns that do not only have a quanN-reading, but that can also be used outside the quanN and then refer to the respective concrete object. If we find a sequence of two nouns and the first one could be a quanN, we have to decide whether it is a quanNG or not. Sometimes, this problem could be solved by means of subcategorization information. But, considering two sentences, such as sentences 16 and 17, we cannot distinguish the two readings on purely syntactic grounds.

(16) Er stiftete drei Tafeln Schulen.
He donated three blackboards schools.
'He donated three blackboards to schools.'

(17) Er stiftete drei Tafeln Schokolade.
He donated three bars chocolade.
'He donated three bars of chocolade.'

For sentence 16, a concrete-object-reading should be annotated (as depicted in figure 2), whereas for sentence 17 an indication-of-quantity-reading should be annotated (as depicted in figure 3). In the parsing system of SILVA, we use lexicalized rules in order to exclude an indication-of-quantity-reading for sentence 16. Lists containing information about quanN and their potential ElemN were gained by corpus investigation. Even if they are, of course, not exhaustive, they could serve as a starting point for a (semi)-automatic annotation of indications of quantity containing a noun as head of a quanN that can refer to a concrete obect.

4 Using information about indications of quantity for grammar induction

In a first experiment, we enriched NEGRA with information about

1. our scales together with their respective adjectives (cf. table 2); and
2. nouns that could yield a concrete-object-reading as well as an indication-of-quantity-reading together with typical ElemN following them.

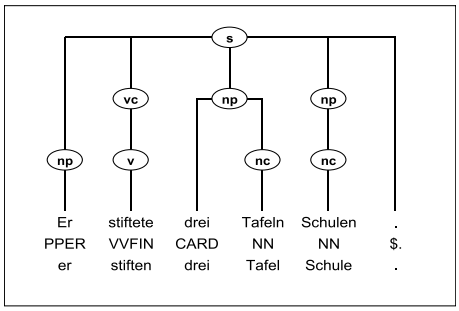

Figure 2: Concrete-Object-Reading

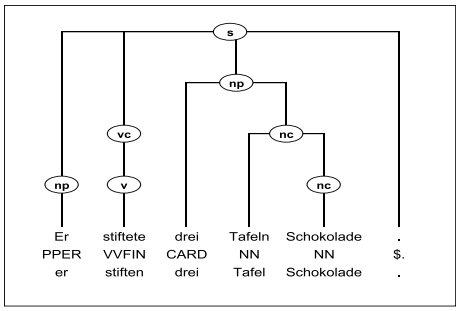

Figure 3: Indication-of-Quantity-Reading

Starting from the enriched TIGER we used *BitPar* (cf. (Schmid, 2004) and (Schiehlen, 2004)), an efficient parser for treebank grammars in order to induce a grammar and parse the treebank.
Without the additional information BitPar reached an F-Value of 76.17%. After adding the information the F-Value increased to 76.27%. Obviously, this is not a tremendous improvement of performance, but looking at the absolute numbers, we get a more differentiated picture: there are 11 constructions containing an indication of measurement functioning as measure complement of an adjective. Before adding the information about the scales and the respective adjectives, only 3 constructions were rightly annotated; after having added the information, 6 constructions were rightly annotated.
That indicates that the annotation can help increase the performance, and it does not lower the performance, which is not self-evident.

5 Conclusions

In this article, we described the German quantifying noun group in some detail. We proposed a fine-grained, semantically motivated clas-

sification of German quantifying noun groups. We argued that a more sophisticated treatment of these construction types could help improving the treebank considerably. We illustrated the problem of ambiguity between concrete readings and indication-of-quantity-readings as well as the problem of measure arguments or indications of quantity. Moreover, we showed how the latter problem is solved in a corpus-based parsing approach. We outlined some ideas for the refinement of the TIGER annotation scheme in order that it meets requirements in the context of linguistically demanding extraction tasks. We concluded with the presentation of a first experiment using the more fine-grained information for grammar induction.

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References

Stefanie Albert et al. 2003. *TIGER-Annotationsschema*. Technical Report. University of Potsdam, Saarland University, University of Stuttgart.

Hiyan Alshawi and David Carter. 1994. Training and Scaling Preference Functions for Disambiguation. *Computational Linguistics*, 20(4):635-648.

Francis Bond, Kentaro Ogura and Satoru Ikehara. 1996. Classifiers in Japanese-to-English Machine Translation. *Proceedings of the 16th International Conference on Computational Linguistics*, 125–130.

Sabine Brants, Stefanie Dipper, Silvia Hansen, Wolfgang Lezius, George Smith. 2002. The TIGER TreeBank. *Proceedings of the Workshop on Treebanks and Linguistic Theories, Sozopol*.

Eugene Charniak. 1996. Tree-bank grammars. *Proceedings of the National Conference on Artificial Intelligence (AAAI)*.

Max J. Cresswell. 1977. The semantics of degree. *Montague Grammar*, 261–292. Barbara H. Partee (Ed.). Academic Press, New York.

Joseph van Genabith, Louisa Sadler and Andy Way. 1999. Semi-Automatic Generation of F-Structures from Treebanks. *4th International Conference on Lexical Functional Grammar (LFG-99)*.

Manfred Krifka. 1989. *Nominalreferenz und Zeitkonstitution. Zur Semantik von Massentermen, Pluraltermen und Aspektklassen*. Fink, München.

Mitchell P. Marcus, Beatrice Santorini and Mary A. Marcinkiewicz. 1994. Building a Large Annotated Corpus of English: The Penn Treebank. *Computational Linguistics*, 19(2):313–330.

Lance Ramshaw and Mitchell P. Marcus. 1995. Text Chunking Using Transformation-Based Learning. *Proceedings of the Third Workshop on Very Large Corpora*, 82–94.

Michael Schiehlen. 2004. Annotation Strategies for Probabilistic Parsing in German. *Proceedings of the 20th International Conference on Computational Linguistics*.

Helmut Schmid. 2004. Efficient Parsing of Highly Ambiguous Context-Free Grammars with Bit Vectors. *Proceedings of the 20th International Conference on Computational Linguistics*.

Wojciech Skut, Brigitte Krenn, Thorsten Brants and Hans Uszkoreit. 1997. An Annotation Scheme for Free Word Order Languages. *Proceedings of the Fifth Conference on Applied Natural Language Processing (ANLP-97). Washington, DC, USA*.

Wojciech Skut, Thorsten Brants, Brigitte Krenn and Hans Uszkoreit. 1998. A linguistically interpreted corpus of German newspaper text. *Proceedings of the Conference on Language Resources and Evaluation LREC, Granada, Spain*.

B. Srinivas. 1997. Performance evaluation of supertagging for partial parsing. *Proceedings of Fifth International Workshop on Parsing Technology*, Boston, USA.

P. Suppes and J. L. Zinnes. 1963. Basic Measurement Theory. *Handbook of Mathematical Psychology*, 1. R. D. Luce (Ed.). Wiley, New York.

Wolfgang Wahlster. 2000. *Verbmobil:Foundations of Speech-to-Speech Translation*. Springer.

Heike Wiese. 1997. *Zahl und Numerale*. Akademie Verlag, Berlin.