An HPSG account for German numeral classifiers

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Abstract

This paper analyzes German numeral classifier phrases within HPSG, focusing on their morphosyntax and semantics. I differentiate between sortal and measure classifiers, which, despite being structurally identical, contribute differently semantically. In a German classifier phrase ([Num CL NP]), the classifier serves as the head, with the counted NP as its complement and requires a specifier to form a complete classifier phrase. This specifier can be realized by a determiner in the traditional sense but also by a numeral. Additionally, numerals are treated as underspecified for a specifier or a modifier, allowing for a flexible combination of determiner, numeral, and other modifier elements in the structure.

1 Introduction

In contrast to languages with rich classifier systems, such as Chinese, Japanese, or Thai, German would not be considered as a typical classifier language. But indeed there are elements in German that are suspected to be a numeral classifier (see Allan 1977, Lehrer 1986, Krifka 1989, Aikhenvald 2000, Lehmann 2000) such as *Stück* 'scl'[1], compared to the Mandarin Chinese classifier *tou* 'scl' below.

(1) a. zwei Stück Vieh
        two scl   cattle
        'two heads of cattle'

     b. liang tou niu
        two   scl cattle
        'two heads of cattle'

However, research on German classifiers has been relatively marginal, especially regarding their structural analysis. Unlike Mandarin Chinese, where the absence of inflection complicates the debate on branching structure ([Num [CL N]] or [[Num CL] N], see Her & Tsai 2020 and Jiang et al. 2022), the rich variation in German w.r.t. declension offers an interesting perspective on the formal study of classifiers. This paper aims to focus on the morphosyntax and semantics of German classifiers and provides an analysis in the framework of Head-driven Phrase Structure Grammar (HPSG, Pollard & Sag 1994, Müller et al. 2021). Minimal Recursion Semantics (MRS, Copestake et al. 2005) is used for the semantic analysis.

The paper is structured as follows: in Section 2, I provide a brief overview of classifiers in German. Next, *Stück* 'scl' and *Scheibe* 'slice' are selected as examples of sortal and measure classifiers, respectively, and will be discussed in Sections 3 and 4. These sections will progressively address the combinations of classifiers with counted

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[1]The following abbreviations are used in the paper: N=noun, NP= noun phrase, Mod=modifier, Num=numeral, CL=classifier, SCL=sortal classifier, MCL=measure classifier, PL=plural, c–n=count noun, DAT=dative, SG=singular, GEN=genitive, WK=weak, PST=past, AKK=akkusative, NOM=nominative, ST=strong, NEU=neutral, FEM=feminine, MAS=masculine, Det=determiner, Spr=specifier, PASS=passive.

NPs, as well as their interactions with numerals or determiners. In the last section, I draw the conclusions of this paper.

2 Classifiers in German

In a study of German numeral classifiers, the first question that needs to be confronted is: what precisely constitutes a numeral classifier? Drawing on the key properties outlined by Lehrer (1986: 110–115), Craig (1992: 280–282), and Lehmann (2000: 249), a typical numeral classifier: a) combines a cardinal numeral (or a quantifier) and a counted nominal; b) is chosen predominantly based on semantics. By these standards, *Stück* 'scl' in (1a) can be considered as a classifier. It enables the connection of a numeral and a mass noun.[2] The choice of *Stück* 'scl' is semantically constrained: *Kuh* 'cow' cannot combine with *Stück* 'scl' to express a counting sense as in (2).[3] This also demonstrates that classifiers and number-gender systems are not mutually exclusive. Therefore, classifiers in German should also be considered within the broader context of cross-linguistic classifier research.

(2) zwei Stück Kuh
     two scl   cow
     'two pieces of cow' (not 'two cows')

The discussion of German classifiers typically traces back to the numerative construction: A noun phrase consisting of three members (a numeral, a noun (N1) used as a unit of measurement or counting, and another noun (N2) being measured or counted) is known as a numerative construction (Krifka 1991: 401). Based on the semantic contribution of N1 they can be further divided into six subcategories (Löbel 1986, Krifka 1989, Gunkel et al. 2017).

(3) a. measuring constructions
         zwei Liter$_{N1}$ Bier$_{N2}$
         two liter   beer
         'two liters of beer'

     b. container constructions
         zwei Flasche-n$_{N1}$ Milch$_{N2}$
         two bottle-PL   milk
         'two bottles of milk'

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[2]As noted by an anonymous reviewer referencing Little et al. (2022), some studies suggest that classifiers function to bridge numerals and atomic nouns, i.e., count nouns. Based on this, the reviewer questions whether classifiers truly exist in German, as *Vieh* is not a count noun. However, there is both theoretical and empirical research (Krifka 1995, Chierchia 1998, Craig 1992, Zhou et al. 2024) that generally agrees that classifiers are primarily used with mass nouns, enabling them to be counted.

Given the ongoing debate regarding the distinction between count and mass nouns in prototypical classifier languages such as Chinese, this paper does not adopt this distinction as a cross-linguistic criterion for identifying classifiers. Instead, it focuses on summarizing the nouns following *Stück* in German, emphasizing that *Stück* in a counting (rather than partitive) sense is generally followed by mass nouns.

[3]It is acceptable with a partitive reading.

c. counting constructions
zwei Scheibe-n$_{N1}$ Brot$_{N2}$
two slice-PL   bread
'two slices of bread'

d. classifier constructions
zwei Stück$_{N1}$ Vieh$_{N2}$
two SCL   cattle
'two heads of cattle '

e. collective constructions
zwei Hundertschaften$_{N1}$ Polizei$_{N2}$
two group.of.hundred   police
'two hundred police'

f. kind constructions
zwei Sorte-n$_{N1}$ Bier$_{N2}$
two kind-PL   beer
'two kinds of beer'

Among the six categories mentioned, *Liter* 'liter', *Flasche* 'bottle', *Scheibe* 'slice', *Hundertschaften* 'group.of.hundred', and *Sorte* 'kind' all perform additional semantic operations on N2 during the counting process, meaning that N1 specifies the form in which N2 is quantified.

In this paper, I treat N1 that do not contribute extra semantic content as sortal classifiers (see *Stück* 'SCL' in (3d)), and all other types of N1 are considered as measure classifiers (MCL, represented by *Scheibe* 'slice' in (3c)). This paper focuses on the structure of German numeral classifier phrases and will therefore center the discussion on *Stück* 'SCL' and *Scheibe* 'slice.MCL' as prototypical examples of different types of numeral classifiers in German. Other numeral classifiers share the same syntactic structure but differ in aspects such as the morphological variations of N1 and N2.

In addition to the semantic differences, the immediate morphosyntactic difference between (3d) and (3c) is that there is no morphological change[4] in a sortal classifier. *Scheibe* 'slice.MCL' retains its marking as a count noun because of the plural cardinal relation *zwei* 'two', whereas *Stück* 'SCL' has no such markings.[5] Although *Stück* has a plural form *Stücke*, this form does not apply to classifier phrases [Num CL N].

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[4]As one reviewer pointed out, while *zwei Stücke Vieh* 'two pieces of cattle' is possible, *Stück* 'SCL' here is not functioning as a classifier but rather as part of a partitive construction. This paper focuses exclusively on classifiers.

[5]Please note that I do not claim the lack of plural marking to be a sufficient condition for identifying sortal classifiers, nor do I assert that all measure classifiers have plural marking. The absence of plural marking in their use as classifiers is one of the important characteristics of sortal classifiers and can be seen as an example of decategorialization (Lehmann 2000: 253). The representative measure classifier analyzed in this paper, *Scheibe* 'slice.MCL', retains plural marking; however, some measure classifiers, such as *Meter* 'meter.MCL' and *Pfund* 'pound.MCL', do not exhibit plural marking. Since this study focuses on *Stück* 'SCL' and *Scheibe* 'slice.MCL' as representatives of different types of classifiers to analyze the structure of classifier phrases, it does not delve further into the subclassification of measure classifiers.

Arguably, the nouns *Stück* 'scl' and *Scheibe* 'slice.mcl', both of which have grammatical gender (4) and can be employed as classifiers, are located at different stages of grammaticalization, as in (5) from Lehmann (2010: 442-443). Given that their properties as nouns in German remain intact (grammatical gender), the treatment of classifiers as subtypes of *noun* is reasonable.

(4) a. das   Stück Vieh
        the.NEU SCL   cattle
        'the head of cattle'

     b. die   Scheibe Brot
        the.FEM slice.MCL bread
        'the slice of bread'

(5) generic noun → measure classifier → sortal classifier

In German, nouns are classified as count or mass nouns. This should also be taken into account when integrating classifiers into this system. Both sortal classifiers and measure classifiers can be directly associated with numerals, thus categorizing them as count nouns. Since the lexical meaning of a measure classifier is more pronounced, any measure classifier i.e. a meas(ure)-cl(assifier)-n(oun) is also a n(ouny)-n(oun). Combining the count/mass distinction and classifiers, I assume a hierarchy of nominal HEAD values in Figure 1: *Vieh* 'cattle', *Stück* 'scl', *Scheibe* 'slice.mcl' and *Tisch* 'table' have the HEAD values of *mass-n*, *sort-cl-n* (sortal-classifier-noun), *meas-cl-n*, and *lex-n* respectively. *n-n* is further divided into *meas-cl-n* and *lex-n* and a lexical rule is assumed to change for instance the *Scheibe* 'slice' (*lex-n*) to *Scheibe* 'slice.mcl' (*meas-cl-n*).
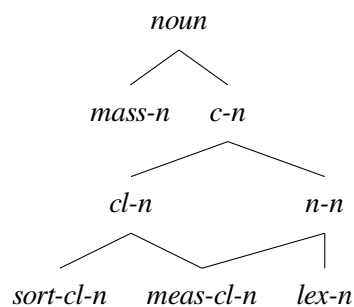

Figure 1: Hierarchy of nominal HEAD values

In general, only mass nouns need to be made 'countable' with the help of other elements, i.e. classifiers in this study, when expressing a quantitative meaning, since count nouns can be used directly in conjunction with numerals. Therefore it is not

surprising that in (3) N2 are nouns without plural inflection.[6] Only *cl-n* can enable mass nouns to appear in a numerative construction, the combination of classifiers (N1, *cl-n*) and mass nouns (N2, *mass-n*) will be discussed in the next section in detail.

3 Combining classifiers and the counted NP

After clarifying the HEAD value of a classifier, this section will discuss the structure of a classifier phrase, beginning with the combination of classifiers and the counted NP.

So far only the case where N1 and N2 are juxtaposed (Kobele & Zimmermann 2012: 265) is mentioned in the paper, meaning that N1 and N2 have the same case inflection, for instance, dative, as in (6a). But there are actually some measure classifiers that allow N2 to be combined with it in genitive case (6b) or with the aid of a preposition *von* 'of' (6c), in other words, N2 is N1's attribute.

(6) a. mit zwei Scheibe-n   köstlich-em   Brot
         with two slice.MCL-PL.DAT delicious-SG.DAT bread
         'with two slices of delicious bread'

     b. zwei Scheibe-n   köstlich-en   Brot-es
         two slice.MCL-PL delicious-SG.GEN bread-SG.GEN
         'two slices of delicious bread'

     c. zwei Scheibe-n   von diesem köstlich-en   Brot
         two slice.MCL-PL of   this.DAT delicious-DAT.WK bread
         ' two slices of this delicious bread'

Regarding sortal classifiers, if the classifier phrase functions as the complement of a preposition that requires the dative case, such as *mit* 'with' in (7a), N2 is unequivocally in the dative case. As for N1, the sortal classifier without morphological changes, can be underspecified for the CASE value, which means, it is also dative. Sortal and measure classifiers exhibit the same structural features. In contrast, N2 with prepositions like (7b) involves a partitive *Stück* 'piece' which will not be addressed in this paper.[7]

(7) a. ein Garten mit 300 Stück krank-em   Vieh
         one garden with 300 SCL   sick-SG.DAT cattle
         'a garden with 300 head of sick cattle'

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[6]Indeed, the number of N2 varies according to the detailed subtypes of the classifier's have. In the case of measuring structures, counting constructions, and classifier constructions (Krifka 1989: 12), N2 must be a mass noun, but the HEAD value of N2 is underspecified in the case of container constructions and collective constructions. In this paper, I treat *Scheibe* 'slice.MCL' as a representative of most kinds of measure classifiers, taking into account the semantic differences between sortal and measure classifiers.

[7]All referenced and marked newspaper examples cited in this article are drawn from the German Reference Corpus (DeReKo).

b. ein-em gut-en   Stück vom   Vieh des   Rittergut-es
   one-DAT good-DAT.WK piece of.DET cattle DET.GEN manor-GEN
   ' a good piece of the manor's cattle'

<div align="right">(Braunschweiger Zeitung, 23.03.2009)</div>

Considering the other semantic components (Löbel 1986: 77–87) brought by (6b), (6c), and (7b), I follow Krifka (1989: 15), limiting myself to the juxtaposed structure (6a) and (7a) that is more focused on the function of quantitative information.[8]

3.1 Headedness of a classifier phrase

Since N1 and N2 are combined juxtaposed, this inevitably brings up the discussion of the headedness of a classifier phrase, that is an NP. The case of measure classifiers like *Scheibe* 'slice.MCL' is more straightforward, since the verb and *Scheibe* 'slice.MCL' (the subject) agree in number, that is plural in (8).

(8) a. Auf dem   Teller der   Frau   lieg-en zwei kleingeschnitten-e
        one the.DAT plate the.GEN woman lie-PL two chopped-NOM.WEAK
        Scheibe-n   Brot
        slice.MCL-PL bread
        'On the woman's plate are two slices of bread that have been cut into small pieces.'

<div align="right">(Braunschweiger Zeitung, 21.05.2010)</div>

     b. 1955 kam-en   0,82 Stück Vieh auf einen   Einwohner
        1995 come.PST-PL 0.82 SCL   cattle on one.AKK inhabitant
        'In 1955, there were 0.82 head of cattle per inhabitant.'

<div align="right">(St. Galler Tagblatt, 24.01.1998)</div>

As for sortal classifiers, although *Stück* 'SCL' does not exhibit morphological inflection to provide direct evidence of its status as the head in (8b), its role as the head is evident, as *Vieh* 'cattle' cannot be plural. Furthermore, since phrases like *ein- nach d- ander-* 'one after the other' in (9) can only refer in gender to *Stück* (neutral) and not to *Rhabarber* (masculine). Thus, it can be concluded that *Stück* 'SCL' is the head of the classifier phrase. (For more on this test, see Höhle 2019: 52 and Müller 2002: 49.)

(9) a. Drei Stück   Rhabarber   wurden eines   nach dem
        three SCL.NEU rhubarb.MAS pass.PST one.NOM.NEU after the.DAT.NEU
        anderen   klein geschnitten.
        other.DAT.NEU small chopped
        'Three pieces of rhubarb were cut into small pieces one by one.'

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[8]As noted by one reviewer, (6b) represents a regular instance of a partitive measure construction. As previously mentioned, this paper does not address the partitive reading of *Stück* 'SCL' and maintains a reserved stance on the relationship between partitive and counting readings. For readers interested in further exploration, Zimmer (2015) and Schäfer (2018) provide a detailed discussion.

    b. * Drei Stück   Rhabarber   wurden einer   nach dem
        three SCL.NEU rhubarb.MAS PASS.PST one.NOM.MAS after the.DAT.MAS
        anderen   klein geschnitten.
        other.DAT.NEU small chopped
        Int: 'Three pieces of rhubarb were cut into small pieces one by one.'

The alternative, where *Vieh* 'cattle' is the head of the NP, is not possible. If that were the case, one would have to make a mass noun open to the numerals, which is subversive to the basic logic of German grammar: only count nouns can be used directly with numerals. In our case, *cl-n* is a subtype of count nouns, so *Stück* 'SCL' can be the head of the NP and all is safe.

Thus, morphosyntactically, the classifier is always the head of the German classifier phrase (NP). But semantically there is a problem that requires attention. There are examples in the DeReKo (*Das Deutsche Referenzkorpus* 'The German reference corpus') where *Stück* 'SCL' can be preceded by adjectives modifying N2, see (10). As a sortal classifier, *Stück* does not provide an extra lexical contribution, and it's only the *Vieh* 'cattle' that gets sick or dies.[9]

(10)   a. ein tot-es   Stück Vieh
          one dead-ST.NOM/AKK.NEU SCL   cattle
          'a dead head of cattle'

                                                (Neue Zürcher Zeitung, 29.05.2004)

    b. ein-em   krank-en   Stück Vieh
          one-DAT.NEU sick-WK.DAT SCL   cattle
          'a sick head of cattle.'

                                                (die tageszeitung, 02.10.2009)

If *Stück* 'SCL' is the head, then this semantic connection of modifiers preceding the classifier and N2 needs to be possible. This can be regarded as a special feature of sortal classifiers as "functional" nouns: In CONT (11a), a sortal classifier takes the IND of N2 as its argument and shares the IND of N2. If there is an adjective modifying N1, it still modifies the IND of N2.[10] This is an important difference between sortal and measure clasifiers. A measure clasifier will also take the IND of N2 as the argument of

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[9]The adjectives modifying measure classifiers before the measure classifier have a different meaning, as in (i). In (i.b) it is still about a counting-*Stück*, whereas *Stück* in (i.a) is partitive, hence (i.a) will not be discussed in this paper.

(i)   a. ein groß-es   Stück Schokolade
      one big-NEU.ST.SG SCL   chocolate
      'a large piece of chocolate'

   b. ein süß-es   Stück Schokolade
      one sweet-NEU.ST.SG SCL   chocolate
      'a sweet piece of chocolate'

[10]A similar method of index inheritance can be found in Bender & Siegel (2005: 631) and Levine (2010: 271) about the analysis of parasitic heads.

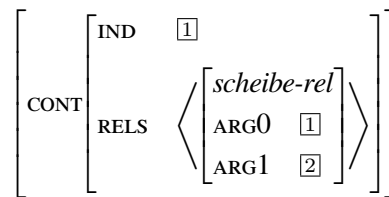for instance *scheibe-rel* (11b), but it still has its own distinct IND that can be modified by other adjectives, such as *kleingeschnitten* 'chopped' in (8).

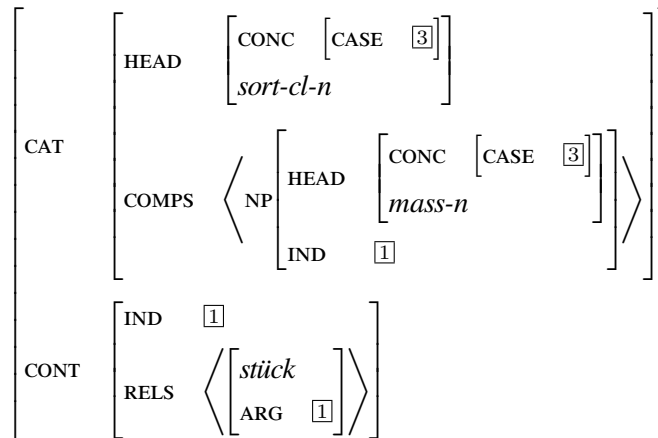(11)   a.   Sample CONT of a sortal classifier

$$
\left[\text{CONT} \left[\begin{array}{ll} \text{IND} & \boxed{1} \\ \text{RELS} & \left\langle \left[\begin{array}{l} \textit{stück-rel} \\ \text{ARG} \quad \boxed{1} \end{array} \right] \right\rangle \end{array} \right] \right]
$$
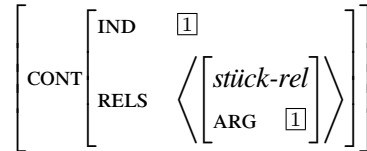
     b.   Sample CONT of a measure classifier

$$
\left[\text{CONT} \left[\begin{array}{ll} \text{IND} & \boxed{1} \\ \text{RELS} & \left\langle \left[\begin{array}{ll} \textit{scheibe-rel} \\ \text{ARG0} & \boxed{1} \\ \text{ARG1} & \boxed{2} \end{array} \right] \right\rangle \end{array} \right] \right]
$$

After clarifying the headedness question of a classifier phrase, it is possible to give a more detailed answer to the juxtaposed combination. N1 and N2 seem to be combined by juxtaposing, but in fact, this combination should be realized through a *head-complement-phrase*, N1 is the head and N2 is the complement. An important point that distinguishes *cl-n* from *lex-n* is that classifiers need a noun to fulfill their counting function. And this noun (N2) needs to share the same CASE value as the classifier (N1), see (12).

(12)   Lexical entry for *Stück* 'SCL' (preliminary version without Num and Det)

$$
\left[\begin{array}{ll} \text{CAT} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{l} \text{CONC} \left[\text{CASE} \quad \boxed{3} \right] \\ \textit{sort-cl-n} \end{array} \right] \\ \text{COMPS} & \left\langle \text{NP} \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{l} \text{CONC} \left[\text{CASE} \quad \boxed{3} \right] \\ \textit{mass-n} \end{array} \right] \\ \text{IND} & \boxed{1} \end{array} \right] \right\rangle \end{array} \right] \\ \text{CONT} & \left[\begin{array}{ll} \text{IND} & \boxed{1} \\ \text{RELS} & \left\langle \left[\begin{array}{l} \textit{stück} \\ \text{ARG} \quad \boxed{1} \end{array} \right] \right\rangle \end{array} \right] \end{array} \right]
$$

As shown in Figure 1, the hierarchy of nominal HEAD values has been applied here. It is worth noting that, count and mass are typically considered semantic features and are generally not modeled under HEAD. However, it is necessary for *Stück* 'SCL' to choose a complement of type *mass-n* in this case. Without the distinction between count and mass, a nominal headed phrase such as *zwei Stück Vieh* could still be selected by another *Stück* 'SCL', as in (13), which is an undesired outcome.

(13)   * zwei Stück zwei Stück Vieh
        two SCL   two SCL   cattle

4   Adding numerals and determiners

So far it seems that when N1's COMPS is satisfied by N2, it is already a complete NP. But in fact, a classifier, as a count noun, no matter sortal or measure, cannot be directly selected by the verb unless it is preceded by a numeral or a determiner, i.e., (3) and (4). Therefore, numerals or determiners are required. But the syntactic behavior of *ein-* 'one' and other numerals differs when modifiers are involved, and next I will discuss them separately.

4.1   Case 1: when Num is other than *ein-* 'one'

German numerals such as *zwei* 'two' are traditionally treated as adjectives in the *Duden – Die Grammaik* (2022). However in analysis of other classifier languages, numerals are generally treated as a specifier or complement of the head classifier (Bender & Siegel 2005, Ng 1997). This implies that the connection of a numeral to a classifier is specific and restricted. But when a definite article or demonstrative is present, as in (14), two specifiers are required: one for the definite article and one for the numeral. Classifier phrases are not particularly common in German, and there is no supporting evidence or alternative structures in German to justify a double specifier treatment; therefore, this analysis may not be the most suitable for the German data.

(14)   die zwei Scheibe-n   Brot
        the two   slice.MCL-PL bread
        'these two slices of bread'

Furthermore, German numerals other than *ein-* 'one', which means the NUM value of the numeral is always *pl*, can have a flexible position before the noun and can be exchanged in order with a modifier without affecting the truth condition of the phrase, see (15a) and (15b). If I insist on maintaining the double specifier treatment and consider the numeral as a specifier, technically (15b) would not pose a problem because the order of Spr-Mod-Spr is permissible. However, this would also predict phrases like (16), which are not possible in German.

(15)   a. diese zwei trocken-en Scheibe-n   Brot
            these two dry-WK.PL slice.MCL-PL bread
            'these two dry slices of bread'
        b. diese trocken-en zwei Scheibe-n   Brot
            these dry-WK.PL two slice.MCL-PL bread
            'these two dry slices of bread'

(16) a. * schöne das Buch
        nice.WK DET book
        Int: 'the nice book'

    b. * schöne zwei Bücher
        nice.WK two book.PL
        Int: 'two nice books'

Therefore, the flexible order of classifiers w.r.t. modifiers actually indicates a modifier status of classifiers in German. Together with the fact that a numeral may not appear within a classifier phrase (4), repeated as (17), I treat numerals other than *ein-* 'one' as a modifier, i.e., an undeclinable adjective.

(17) a. das   Stück Vieh
        the.NEU SCL   cattle
        'the head of cattle'

    b. die   Scheibe Brot
        the.FEM slice.MCL bread
        'the slice of bread'

Without a definite article or demonstrative, this kind of Mod-flexibility of numerals disappears: numerals can only be placed on the leftmost side of the classifier phrase, comparing (18a) and (18b). In other words, in the absence of a definite determiner, the numeral seems to take over the function of a specifier in the classifier phrase. Just as with every count noun, the classifier phrase is not complete without this specifier, namely the numeral.[11]

(18) a. zwei klein-e   Scheibe-n Brot
        two small-ST.PL slice.MCL-PL bread
        'two small slices of bread'

    b. * klein-e   zwei Scheibe-n Brot
        small-ST.PL two slice.MCL-PL bread
        Int: 'two small slices of bread'

The analysis on numerals other than *ein-* 'one' should fulfill both cases (15) and (18): a numeral is a modifier if there is a specifier within a classifier phrase, and the numeral will be the specifier if no other specifier is present. Therefore I assume that the HEAD value of a number is an underspecified type of *num* as in Figure 2, which has two subtypes, *num-det* (numeral-determiner) and *num-adj* (numeral-adjective).

num-det is at the same time a subtype of *det*. In German the specifier of a classifier can be: *dies-* 'this', *d-* 'the', *mein-* 'my', *zwei* 'two', *ein-* 'one', *jede-* 'every' as in (19). A Hierarchy of HEAD values for determiners is proposed in Figure 3.

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[11]The difference is that in the case of a sortal classifier, there is no bare plural, a specifier is always required. But *Scheibe* 'slice.MCL' allows a bare plural and there would be an optional specifier.
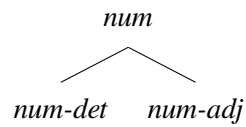
```
                                    num
                                   /    \
                           num-det      num-adj
```

Figure 2: Hierarchy of HEAD values for numerals

(19)　a.　*dem-def-cl-d*
　　　　　dieses Stück Vieh
　　　　　'this head of cattle'

　　　b.　*art-def-cl-d*
　　　　　das Stück Vieh
　　　　　'the head of cattle'

　　　c.　*poss-def-cl-d*
　　　　　unsere 8 Stück Vieh
　　　　　'our 8 heads of cattle'

　　　d.　*num-det*
　　　　　zwei Stück Vieh
　　　　　'two heads of cattle'

　　　e.　*art-ind-cl-d*
　　　　　ein Stück Vieh
　　　　　'a head of cattle'

　　　f.　*jed-ind-cl-d.*
　　　　　jedes Stück Vieh
　　　　　'every head of cattle'

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                                    det
                                   /   \
                               ...      cl-det
                                       /   |    \
                             def-cl-d  num-det  ind-cl-d
                                                /     \
                                        art-ind-cl-d   ...
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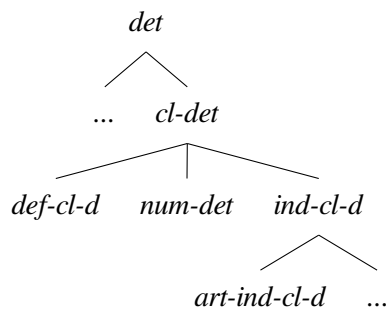
Figure 3: Hierarchy of HEAD values for determiners

Now it is necessary to include the information of a specifier in the entries of a classifier, i.e., a word with HEAD value *cl-n* not only needs to select a *mass-n* as its complement, but must also select a determiner of type *cl-det* to be its specifier. The CONC value of the specifier needs to be shared with its head.

All numerals with [HEAD *num-adj*], whose NUM value is *pl*, cannot co-occur with singular *Stück* 'SCL' or *Scheibe* 'slice.MCL'. Due to the internal agreement of NP, the combination of *ind-cl-d* and *num-adj* in cases such as (20) is ruled out. [NUM *sg*] only appears when the numeral is *ein-* 'one', that is, a *num-det*. Two numerals, no matter whether the combination of *num-det* and *num-adj* or iteration of *num-adj*, are not possible for semantic reasons: there should be only one *card-rel* per *index*.

(20)   * ein / jedes zwei Stück Vieh
      one every two SCL   cattle
      Int: 'a / every two head of cattle'

This underspecified treatment of *num* is further supported by empirical evidence. Both (21a) and (21b) are German expressions for *a theme of this year*, with *dies-* in (21a) being declined as a determiner, and (21b) being declined as an adjective analog to (21c). An underspecified HEAD value of *dies-* to be *det* or *adj* is expected or at least two entries are necessary.
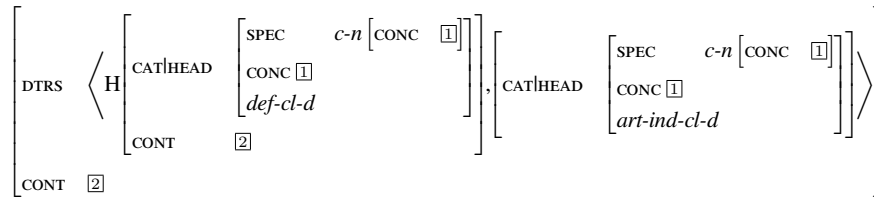
(21)   a. ein Thema dies-es   Jahr-es
        a   theme this.DET-GEN.ST year-GEN
        'a theme of this year'
      b. ein Thema dies-en   Jahr-es
        a   theme this.ADJ-GEN.ST year-GEN
        'a theme of this year'
      c. ein Thema letzt-en   Jahr-es
        a   theme last-GEN.ST year-GEN
        'a topic of last year'

4.2   Case 2: iff Num=1

When the numeral is 1, i.e. *ein-* 'one', it has only the properties of a determiner. Even if there is already a definite determiner, the numeral *ein-* 'one' cannot change places with an adjective and must be fixed in the second position after the definite determiner, see (22). In this case, there exist two determiners tightly tied together and nothing can be inserted between them. Thus I assume a compound structure *compl-det* combining a *def-cl-d* and *art-ind-cl-d*.

(22)   a. diese ein-e   klein-e   Scheibe Brot
         that   one.WK.SG small-WK.SG slice.MCL bread
         'this one small slice of bread'
      b. * diese kleine   eine   Scheibe Brot
         that   small-WK.SG one.WK.SG slice.MCL bread
         'this one small slice of bread'

(23) *compl-det* ⇒

$$
\left[
\begin{array}{l}
\text{DTRS} \quad \left\langle \text{H} \left[
\begin{array}{ll}
\text{CAT|HEAD} & \left[
\begin{array}{ll}
\text{SPEC} & \textit{c-n} \left[\text{CONC} \; \boxed{1} \right] \\
\text{CONC} \; \boxed{1} \\
\textit{def-cl-d}
\end{array}
\right] \\
\text{CONT} & \boxed{2}
\end{array}
\right], \left[
\begin{array}{ll}
\text{CAT|HEAD} & \left[
\begin{array}{ll}
\text{SPEC} & \textit{c-n} \left[\text{CONC} \; \boxed{1} \right] \\
\text{CONC} \; \boxed{1} \\
\textit{art-ind-cl-d}
\end{array}
\right]
\end{array}
\right] \right\rangle \\
\text{CONT} \quad \boxed{2}
\end{array}
\right]
$$

This complex determiner has *def-cl-d* as its head and can be selected by a *c-n* (not only by a *cl-n*), which correctly predicts (24) in German.

(24)   das eine   Buch
       that one.WK.SG buch
       'the one book'

5   Conclusions

This paper provides an HPSG analysis for German numeral classifiers. Based on the semantic differences and morphological behavior, numeral classifiers in German can be categorized into sortal and measure classifiers. Both types of classifiers take N2, the counted NP as their complement, and require a specifier to form a complete classifier phrase. This specifier can be realized by a determiner in the traditional sense but also by a numeral. In plural cases, the numeral can function as a modifier if an additional determiner is present. An underspecified HEAD value of numerals is proposed allowing for the combination of Det-Mod-Num. When the numeral is *ein-* 'one', a *comp-det* is introduced to ensure that nothing can be inserted between these two determiners.

Acknowledgements

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