

# German noun plural reconsidered

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## *Abstract*<sup>1</sup>

In this paper I discuss German noun classes as organized in an inheritance tree which simultaneously satisfies requirements of DATR accounts and of Minimalist Morphology. It is argued that *-s* and *-n* are the only plural suffixes, that the plural ending *-r* is always lexically fixed (which is also the case for other plurals and for the umlauting feature), but that schwa-plurals and unmarked plurals follow from a prosodic constraint, in line with constraint-based proposals. Moreover, the German noun plural system exhibits at least two properties that are problematic for a simple rule- or fact-based analysis: (i) umlaut plural takes precedence over *n*-plural in the feminines, and (ii) many plural forms of nonfeminines vacillate between schwa- and *s*-ending. The latter fact indicates that German is still in the process of adopting *s*-plurals as the default, a situation that can best be described by means of changes in the constraint ranking. Therefore, I sketch an OT analysis that incorporates the morphological facts in the form of constraints with a partially changing order, and which accounts for the two above-mentioned properties. This analysis shows that the plural of feminines is rather robust, even if the plural of nonfeminines is subject to drastic changes.

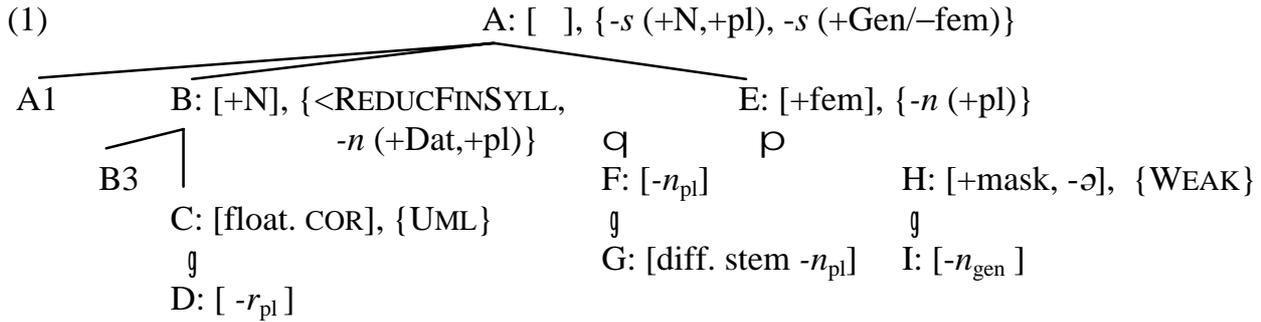
## 1. Introduction

German noun plurals end in *-s*, *-n*, *-ə*, or *-r*, or remain unmarked; in addition, plurals except those with *-s* and *-n* can show umlaut. An ongoing question is how much regularity vs. irregularity is inherent to this system of plural formation. At the one extreme, only *-s* is regarded as regular, and all other plurals as lexically fixed (Clahsen 1999), while at the other extreme, for nearly all plural endings small subclasses determined by gender and phonological shape are found as regular (Mugdan 1977). I will present here an account something in between these two extremes. I will distinguish at least nine classes of nouns: in five of them the plural is regular, while in four of them the plural is lexically fixed. The plural form can be predicted for *-s*, many instances of *-n*, as well as for *-ə* and unmarked, while it is lexically fixed for other instances of *-n* and for *-r*. Following Wiese (1996), I assume that only *-s*, *-n* and *-r* are plural suffixes, while *-ə* is the result of schwa-epenthesis, which is prosodically triggered. For the same prosodic reason, many items are unmarked in the plural. Finally, I regard the appearance of umlaut in the plural as always lexically conditioned.

The whole system of German noun plural can be represented by an inheritance tree with nested regularities:

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<sup>1</sup> The ideas presented here reflect the present state of exchange between several projects of the SFB 282 'Theorie des Lexikons', which is supported by the German Science Foundation (SFB). I am grateful to my collaborators, who have studied the system of German noun plural in concern for the role of prosodic conditions (Richard Wiese, Martin Neef), the computational possibilities of the DATR framework (Jim Kilbury), and the processing aspects in normal and aphasic subjects (Harald Clahsen, Ingrid Sonnenstuhl, Martina Penke). All responsibilities for the conclusions are mine.



Lexical information that defines a nominal class is included in square brackets, while regularities for the respective class of nouns are indicated by braces. A1 and B3 are minor subclasses that will not be discussed before section 4.

Two important properties are inherent to this tree:

- Membership in a nominal class is exclusively determined by the given lexical information; no noun is arbitrarily assigned to a particular class. Note that gender, which is a defining criterium only for class E and H, is not monotonically inherited in the tree.
- The regularities associated with a node are inherited by all subnodes. Thus, inheritance is monotonic for these regularities. (This does not exclude the possibility that some inherited regularities become redundant in view of lexical information.) All items belonging to E, F, G, H, or I have an *n*-plural, while all items belonging to B, C, or D have a reduced final syllable in the plural. (This does not exclude the possibility that most items with an *n*-plural also have a reduced final syllable in the plural, but there are exceptions, see below.)

## 2. The major noun classes

### A is the class of untypical nouns.

Members of this class do not have the lexical feature [+N] for ‘typical noun’. However, they can function as plural nouns in proper syntactic contexts (such as ‘many X’), and in this case they undergo *s*-suffixation.

- (2)      /s/ is the plural suffix in contexts that require plural nouns.  
          *-s* (+N,+pl)

Untypical nouns are

- proper names (such as *Jakob*, *Schmidt*), onomatopoeics (*Kuckuck* ‘cuckoo’, *Wauwau* ‘dog’), acronyms (*GmbH* ‘corporation’, *AG* ‘working group’), truncated forms (*Sozi* from *Sozialist*, *Prof* from *Professor*), quotations (*drei „Frau“ s in einem Absatz* ‘three occurrences of „Frau“ in one paragraph’), and conversions from other categories (*wenns und abers* ‘ifs and buts’), as well as most neologisms introduced in a syntactic context (at least, if they cannot be integrated by analogy to other classes) (Marcus et al. 1995).

It is not yet clear to what extent nonnative nouns can be regarded as ‘untypical’, since many of them have been integrated with an *n*- or *ə*-plural. Moreover, nouns ending in a full vowel are somewhat untypical for German, but many of them have been integrated with an *n*- or *ə*-plural. I will return to this question in section 4.

Most items that can function as plural nouns may in different syntactic contexts also function as singular nouns, and then must be assigned a gender. For instance, proper names and truncated forms referring to females, as well as acronyms relating to feminine nouns, are feminine.

German has only one genitive suffix, namely *-s*, which applies to all nonfeminines, whether typical nouns or not. Therefore, this suffix should be associated with the highest node A of the inheritance tree.

- (3) /s/ is the genitive suffix for [-fem] nouns.  
*-s* (+Gen/-fem)

**B is the class of typical (nonfeminine or umlauting) nouns.**

Members of this class have the feature [+N], and they all are [-fem]. They are constrained prosodically:

- (4) REDUCFINSYLL:  
 All plural forms of typical nouns have a final syllable whose rhyme is reduced to either schwa or a syllabic sonorant (*r*, *l*, or *n*), hence, they end in a ‘reduced syllable’ which cannot be stressed (Neef 1998). In other words, the final syllable of plurals is associated with a mora that lacks any vocalic features but is restricted to [+son].

$$\begin{array}{c} \sigma ] \\ \text{g} \\ \mu \\ \text{g} \\ [+son] \end{array} \quad +\text{pl}/+\text{N}$$

A less restrictive constraint has been formulated by Wiese (1996), who states that all noun plurals (except *s*-plurals) end in a schwa syllable (which lacks a nucleus); this also licenses a final sonorant cluster in feminine plurals, such as /ln/ (*Gabeln* ‘forks’) or /rn/ (*Muttern* ‘nuts’). There are still some exceptions, where the plural does not end in a schwa syllable: feminine nouns ending in a front vowel (such as *Feen* ‘fairies’, *Drogerien* ‘drugstores’),<sup>2</sup> and some weak nouns (such as *Nachbarn* ‘neighbours’, *Ungarn* ‘Hungarians’). A slightly different account is proposed by Golston & Wiese (1996), who decompose the complex requirement of a final schwa syllable into two constraints: NON-FINALITY („Inflected words do not end in a stressed syllable“) and SON]<sub>PL</sub> („Plurals end in a sonorant“). The combination of these two constraints is least restrictive, since only NON-FINALITY is violated by nouns such as *Feen* and *Drogerien*. (5) illustrates the restrictiveness of these constraint variants.

(5)

	Exceptions
REDUCFINSYLL	<i>Gabeln, Muttern, Nachbarn, Feen, Drogerien</i>
Final schwa syllable	<i>Nachbarn, Feen, Drogerien</i>
NON-FINALITY & SON] <sub>PL</sub>	<i>Feen, Drogerien</i>

We may regard any of these requirements as a plural archimorpheme that may, but need not, be specified more narrowly. Under this perspective, the variant proposed by Golston & Wiese is the most attractive one, because the *n*-suffix is just one way to specify SON]<sub>PL</sub>. However, it is unclear why /n/ must be added to feminine nouns that already end in a non-stressed sonorant syllable (*Gabel* ‘fork’, *Mutter* ‘nut’). Since one needs *-n* as a potential plu-

<sup>2</sup> Both *Feen* and *Drogerien* need not be realized with a final schwa syllable: besides [‘fe:ən] and [dro:gə’ri:ən]), also [fe:n] and [dro:gə’ri:n] are possible.

ral suffix in any case (see below) and all exceptions in (5) have an *n*-plural, the most restrictive variant, namely REDUCFINSYLLABLE, is sufficient to characterize the plural in class B.

REDUCFINSYLL triggers the emergence of two subclasses of nouns in B, which, together, constitute a full partition of this class:

- **B1 is the class of nouns with Ø-plural.** Nonfeminine nouns that already end in a reduced syllable can freely instantiate [+pl], in accordance with (4): *Kissen* ‘pillow’, *Schatten* ‘shadow’, *Kabel* ‘cable’, *Enkel* ‘grandchild’, *Lager* ‘camp’, *Adler* ‘eagle’, *Förster* ‘forester’, and all nouns with the structure *Ge\_e* (*Gewinde* ‘winding’, *Geschmeide* ‘juwels’, *Gebirge* ‘mountains’).<sup>3</sup>
- **B2 is the class of nouns with ə-plural.** For [–fem] nouns that end in a consonant, the least expensive operation in order to satisfy REDUCFINSYLL is vowel epenthesis (introduction of a final schwa) in the plural: *Arm-Arme* ‘arms’. Other nouns of this class are: *Schaf* ‘sheep’, *Abend* ‘evening’, *Tausend*, *Reh* ‘roe’, *Korridor*, *Plural*, *Schicksal* ‘fate’, *Bus*, *Status*.

There is another suffix defined at the level of B, namely *-n* for the dative plural (*die Arme - mit den Armen* ‘with the arms’).

- (6) /n/ is the suffix for dative in the plural of typical nouns.  
/n/ (+Dat/+N,+pl)

This suffix does not apply if the noun already ends in *-n* (*mit den Kissen*/\**Kissenen* ‘with the pillows’), maybe because case suffixes are not allowed to add a syllable to a plural form. For the same reason, *n*-dative plural never cooccurs with *n*-plural or *s*-plural (*mit den Augen*/\**Augenen* ‘with the eyes’, *in den Kinos*/\**Kinosen* ‘in the cinemas’). It is for this reason that the *n*-suffix for dative plural becomes relevant only at the level of B.

### C is the class of umlauting nouns.

Members of this class have the floating feature COR(onal) (or [+front]) in the stem (Wiese 1996). This feature is always associated in the plural, as required by UMLAUT:<sup>4</sup>

- (7) MAX(COR) [= UMLAUT]:  
An underlying floating feature COR is associated in the plural.

This constraint is a special instance of the general faithfulness constraint MAX(FEATURE), which requires that underlying floating features have to appear in a derived context.

Class C differs from class B only in the umlaut feature, otherwise the same plural forms appear. Thus, similar to B1 and B2, the two subclasses C1 and C2 arise, constituting a full partition of C:

- **C1.** Nouns that already end in a reduced syllable do not add any additional segment: *Garten-Gärten* ‘gardens’, *Vogel-Vögel* ‘birds’, *Vater-Väter* ‘fathers’, *Mutter-Mütter* ‘mothers’ - in these cases the plural is only characterized by umlaut.

<sup>3</sup> The collective *Ge\_e* nouns that are productively formed from verbs (such as *Gerede* ‘talk’) are singulariatantum.

<sup>4</sup> Nonumlauting nouns such as *Arm* ‘arm’ and *Schaf* ‘sheep’ may still have umlaut in their diminutive forms (*Ärmchen*, *Schäfchen*) because the suffix *-chen* contributes the feature COR. On the other hand, umlauting nouns may have derivational forms without umlaut (e.g. *handlich* ‘handy’ from *Hand-Hände* ‘hands’); I assume that these forms are stored and not productively formed from the noun.





### I is the class of irregular weak nouns.

Members of this class are always [–fem] (mostly masculine, only *Herz* ‘heart’ is a neuter noun), but it cannot be predicted that they are weakly inflected. As a tendency, masculine animates ending in a consonant often belong to this class: *Bär* ‘bear’, *Bauer* ‘farmer’, *Nachbar* ‘neighbour’, *Mensch* ‘human being’, *Herr* ‘gentleman’, as well as nouns ending in *-ent*, *-ant*, *-at*, or *-ot* (*Student*, *Debitant*, *Soldat* ‘soldier’, *Pilot*). These nouns are represented as follows:

$$(13) \quad \begin{array}{l} /h \varepsilon r/ +N \\ | \\ / \dots n/ +feature \end{array}$$

### 3. Interim balance

At this stage it is time to summarize our findings so far. The inheritance tree in (1) simultaneously satisfies some important requirements for morphological systems that have been advocated in the literature, and thus shows some overlap between these accounts.

- In the framework of DATR (Cahill & Gazdar 1999), all facts inherent to a morphological system should be effectively described by associating them with certain nodes of a network (characterizing subclasses of the vocabulary), which preferably constitutes an inheritance tree.<sup>7</sup> (1) is a tree that satisfies this requirement, although it differs from the proposal by Cahill & Gazdar in several respects (see also Kilbury 1999). Recall that some facts are regarded as defining criteria for a certain subclass, while other facts are regarded as regularities for such a class.
- In Minimalist Morphology (MM, Wunderlich & Fabri 1995), the membership in an inflectional subclass should not be arbitrarily assigned, but rather follow from features that can be memorized: either on the basis of a substantial property of the stem itself (such as gender or phonological shape), or on the basis of an additional lexical entry. This requirement is satisfied by the system in (1), where gender and phonological shape are used as predictive features, while all unpredictable plural forms are listed together with the base stem.
- In constraint-based (a-morphous) accounts (Anderson 1992, Neef 1998), affixes have to be replaced by templatic conditions that the inflectional forms of items of a certain class have to meet. This requirement is at least partially satisfied in that only /s/ and /n/ occur as free affixes. All *r*-plurals are lexically fixed in a templatic way; moreover, neither a schwa-affix nor a zero-affix is assumed here.

The regularities of German noun plurals I have discussed above can be summarized as follows:

- (14) Regularities of German noun plurals
- a. Masculines ending in schwa are weakly inflected (and thus also have n-plurals).
  - b. Non-umlauting feminines have an n-plural.
  - c. Nonfeminines ending in a consonant have a ə-plural.
  - d. Nonfeminines ending in a reduced syllable have an unmarked plural.

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<sup>7</sup> It is not yet clear how much emphasis is given to the tree condition. Most examples found in the literature adhere to this condition. See also the concept of Network Morphology, which uses the DATR framework (Corbett & Fraser 1993).

- e. All untypical nouns have an s-plural.
- f. A lexical umlaut feature is associated in the plural (because of MAX(COR)).

I consider these to be hard facts, which can only be overwritten by a lexicalized plural form. As already mentioned above, *Käse* (+masc, ending in ə) is an exception to (14a) in that it lacks any plural form. A few feminines, namely *Finsternis* ‘darkness’, *Bedrängnis* ‘oppression’, *Mühsal* ‘toil’, *Labsal* ‘refreshment’, do not have an *n*-plural, but rather a ə-plural, in analogy to the majority of neuter nouns formed with *-nis* or *-sal* (such as *Hindernis* ‘hindrance’, *Schicksal* ‘fate’). There is a larger number of nonfeminines ending in a consonant that have an *n*-plural (or even an *s*-plural) instead of a ə-plural. And finally, there are also untypical nouns that have a ə-plural rather than an *s*-plural. The classes of nouns for which ə- and *s*-plural compete are considered in the next section. Generally one can say that lexical exceptions to a morphological regularity are expected.

There is another aspect of noun plural formation that is often disregarded, namely the way in which noun-forming suffixes determine plural. Note that German has many productive, as well as some less productive, noun-forming suffixes. Every such suffix determines a subclass in the vocabulary and thus serves to stabilize a certain plural class. A list of German noun-forming suffixes is given in (15). The first column indicates the membership to one of the nominal classes discussed above, and the last column indicates the status as regular vs. lexicalized.

(15) Noun-forming affixes

class	gender	plural	suffixes	status
E	fem	-n	<i>-ung, -heit/-(ig)keit, -schaft, -(at)ion, -(at)ur, -age, -ität, -ik, -(er)ie, -(er)ei, -e</i>	reg
B1	masc	∅	<i>-er, -ler, -ner, -iker</i>	reg
B2	masc	-ə	<i>-är, -eur, -ling, -bold, -at</i>	reg
B2	neuter	-ə	<i>-(i)at, -it, -id, -em, -nis, -sal</i>	reg
D	masc	-r	<i>-tum</i> (pl. <i>-tümer</i> )	lex
F	masc	-n:	<i>-ator</i> (pl. <i>-atoren</i> )	lex
G	masc	-n	<i>-(is)mus</i> (pl. <i>-(is)men</i> )	lex
G	neuter	-n	<i>-um</i> (pl. <i>-en</i> )	lex
I	masc	WEAK	<i>-ant/-ent, -ist</i>	lex

As one can see, there are only 6 irregular (lexicalized) suffixes, compared to 26 regular ones. Moreover, all feminine suffixes are regular, whereas the masculine and the neuter suffixes distribute into the several classes discussed in section 2, except the regularly umlauting class C and the regular weak class H. On the basis of this result, one can see that the noun-forming suffixes do not prevent the loss of these two classes in the German noun plural.

Remarkably, there is no suffix that determines an *s*-plural, a fact that one may regard in two ways. First, it explains why *s*-plurals are comparatively rare, and second, it shows that *s*-plural indeed is restricted to untypical nouns. Morphologically derived nouns are in a way more typical than conversions from other categories. Nothing in this result lets us expect that there is some fuzzy region between the typical and the untypical nouns.

#### 4. The fuzziness of the untypical-typical distinction

As stated above, untypical nouns have an *s*-plural, while typical nouns have a plural form distinct from *-s*. Untypical nouns never add a syllable in the plural (because /s/ can be extra-syllabic in German, see Wiese 1996), while typical nouns often add a syllable. Only typical nouns are subject to specific prosodic conditions in the plural, while untypical nouns are not. Every neologistic noun is per definitionem untypical; therefore, psycholinguistic experiments that test the speakers' reactions to neologisms necessarily have a bias towards untypicality.

However, the distinction between untypical and typical noun is not as straightforward as one may assume. A first observation is that untypical nouns ending in /s/ have *-ə* rather than *-s* in the plural, perhaps in order to avoid identical adjacent segments: *die ixē* 'the x's', *die Felixe*, *die Jonasse*. However, the genitive form of these words always ends in *-s* and never in *-ə*: *des ixēs*, *des Felix(es)*, *des Jonas(es)*. This fact clearly shows that the phonological shape of the base does not play the decisive role; it only becomes important if different endings are possible. We therefore may state the following subclass of B.

##### **B3 is the class of nouns ending in /s/.**

Nouns that end in /s/ and are not marked lexically for *r*- or *n*-plural (such as *Gräser*, *Fässer*, *Schlösser*, *Rhythmus-Rhythmen*, *Atlas-Atlanten*) have a *ə*-plural (regardless of whether they are typical or not): *ixē*, *Jonasse*, *Hindernisse*, *Kekse*, *Kleckse*, *Dropse*, *Klopse*, *Flöße*, *Filze*, *Witze*, *Lose*, *Risse*, *Asse*, *Autobusse*.

There is another class of nouns with which a German child is confronted from the very beginning (and which therefore are not untypical in the sense that the classification is unknown, as for neologisms), namely nouns ending in a vowel, such as *Oma* 'grandmother', *Mama* 'mother', *Opa* 'Grandfather', and *Papa* 'father', though, as a matter of fact, these nouns may first be perceived as proper names. All these nouns (including the feminine ones) pattern with *s*-plural. Otherwise, nouns that end in a full vowel are rare in German, and, therefore, are not typical for this grammatical class. (16) shows an (incomplete) list of nouns ending in a vowel, and their plurals.

(16)

final vowel	gender	plural	examples
a	fem/masc/neut	s	<i>Oma, Opa, Lama;</i>
a	fem	n	<i>Firma-Firmen</i>
o	neut/masc	s	<i>Auto, Büro, Echo, Ghetto, Kino, Kommando, Mooto, Radio, Salto, Torpedo, Trio, Zigarillo</i>
o	neut	n	<i>Konto-Konten, Risiko-Risiken</i>
o	neut	i	<i>Cello-Celli, Porto-Porti</i>
u	masc/neut	s	<i>Akku, Gnu, Guru, Kanu, Tabu, Uhu</i>
au	fem/masc	n	<i>Frau, Modeschau, Sau, Pfau</i>
au	fem/neut	ə	<i>Sau-Säue, Tau</i>
au	masc	s	<i>Stau</i>
ai	fem	n	<i>Malerei, Abtei, Partei</i>
ai	neut	r	<i>Ei</i>
ai	masc/neut	ə	<i>Hai, Blei, Brei</i>
ai	masc	s	<i>Nackedei</i>

e	fem	n	<i>Fee, Allee, Azalee</i>
e	masc	n	<i>See</i>
i	fem	n	<i>Drogerie, Kopie</i>
i	masc	r	<i>Schi-Schier</i>
i	masc/neut	s	<i>Profi, Gummi, Etuú, Taxi, Genie</i>
ü	neut	s	<i>Menü</i>

As one can see from this list, all nouns ending in *a*, *o*, or *u* have an *s*-plural, independently of their status as typical or untypical. (A few nouns ending in *a* or *o* have a truncated stem in the *n*-plural, and some *o*-nouns have borrowed the *i*-plural; none of them preserves the vowel in the plural.) Therefore, one can state the following regular class of nouns:

**A1 is the class of nouns ending in one single back vowel.**

All nouns ending in a single *a*, *o*, or *u* (i.e., in a back, or dorsal, vowel) have an *s*-plural.

In contrast, all feminine nouns ending in *e*, *i*, *ai* or *au* (except umlauting *Sau*) have an *n*-plural. As can be seen from (15) above, *(er)ie* and *(er)ei* are productive noun-forming affixes. However, nouns formed with the productive *i*-suffix, taking truncated stems, (such as *Profi* ‘professional person’, *Studi* ‘student’, *Ersti* ‘freshman’) always have an *s*-plural; these nouns may truly be called ‘untypical’, because they are derived from a truncated stem. Furthermore, all classes of nouns ending in a vowel which are not captured by A1 include items with a lexicalized plural. Therefore, in these instances the noun may be either typical or untypical, a distinction that only weakly correlates with more native vs. more unnative.

There are two nominal classes in which the judgments of the correct plural form often vary. The existence of these two classes is predicted by independent reasons. I call these classes P1 and P2, with ‘P’ for ‘problematic’.

**P1 is a class of problematic nouns because these nouns are unmarked in the plural.** (P1 is coextensive with B1.) Let us assume the constraint MARKPLURAL, which requires plural to be marked on a noun. All items of class B1 above violate MARKPLURAL, hence, there is some pressure to find an alternative plural candidate. Recall that all feminines ending in *r* or *l* have an *n*-plural that does not add a syllable (*Muttern* ‘nuts’, *Gabeln* ‘forks’). Similarly, an *s*-plural added to nonfeminines of this shape would not add a syllable, hence, it would be the least expensive operation in order to satisfy MARKPLURAL. In fact, nouns that already satisfy REDUCFINSYLL are among the items that first get an *s*-plural (*Mädels* ‘girls’, *Enkels* ‘grandchilds’, *Trecker* ‘tractors’) - in terms of both individual and dialectal variation.

**P2 is a class of problematic nouns because these nouns are nonfeminine and end in a C<sup>n</sup>VC syllable with a short vowel and a simple consonantal coda.** (P2 is a subclass of B2.) According to REDUCFINSYLL, these nouns, when typical, should have an *ə*-plural. However, in order to be well-formed prosodically, the respective plural forms must either lengthen the vowel (consider [rad] vs. [re:.dR] ‘wheels’), or allow the final consonant to be ambisyllabic (consider [fæt] vs. [fæt.tə] ‘fats’). This is because stressed penultimates must be strong syllables, constituted as C<sup>n</sup>VV or C<sup>n</sup>VC. For instance, if a word such as *Klub* (+masc) is regarded as a typical noun, its plural must be either [klu:.bə] or [klub.bə], but both are expensive concerning the underlying form /klub/. In contrast, an *-s* in the plural does not alter the weight of any syllable because it can be integrated into the underlying coda, leaving

a monosyllabic [klubs] in this case. Therefore, one expects that the *s*-plural competes with the ə-plural in these cases prosodically.

The option of vowel-lengthening in the plural is very rare in German. In the case of *Tag - Tage* [ta:gə], the singular may be realized with a short vowel, but rather by reduction than as underlying form. More relevant is an ambisyllabic consonant in the plural. German orthography reflects the possibility of an ambisyllabic consonant by double consonant spelling. Words that are spelled with only one final consonant have the *s*-plural: *Tips, Hits, Klubs*.

The most problematic data for the German plural formation are found in the class of [–fem] nouns ending in a stressed VC], which are spelled with a double consonant. (17) lists some items of this class. Note that all root nominals corresponding to a verb have the ə-plural (for instance, *Tritte* ‘treads’, *Schritte* ‘steps’, *Risse* ‘tears’, *Griffe* ‘grips’), which follows from the assumption that these nouns are typical by their relation to a verb.

(17)

	ə-plural	s-plural
neut	<i>Duëlle, Skalpëlle, Kartëlle, Modëlle, Bordëlle, Aquarëlle</i>	<i>Karussëlls</i>
neut	<i>Duëtte, Skelëtte, Fette, Sonëtte, Kabinëtte</i>	<i>Spinëtts, Klosëtts, Brikëtts, Jackëtts, Kotelëtts</i>
neut	<i>Komplôtte Metälle, Kriställe, Krawälle Schiffe, Stoffe Flecke, Lacke</i>	<i>Kompótts Dralls Butts, Kaffs Schecks, Ticks, Hecks, Schocks, Wracks</i>

Remarkably, most nouns ending in the stressed syllable /(C)el/ have an ə-plural, while nouns ending in the stressed syllable /(C)et/ are nearly equally distributed between ə-plural and *s*-plural. Such an equal distribution can be found in many more subclasses. The spelling of the *s*-plural nouns does not indicate that they are untypical in German. Although in some instances with *s*-plural (such as *Karussells*), one might assume that here the *s*-plural is stored, as a general solution this would be contradictory, because it is assumed that the *s*-plural holds for untypical nouns. If a plural form is already stored, the word must be a typical noun.

Only two options seem to be available to describe the nouns that are exemplified in (17) - both are unsatisfying: Either we assume that the ə-plural nouns are [+N] while the *s*-plural nouns are not (which is rather arbitrary because they are spelled like German nouns, and moreover, some of them are masculine rather than neuter), or we assume that the ə-plurals in this class P2 are stored (which is rather unlikely for the low-frequency nouns).

Historically, the *s*-plural was borrowed from French (Paul 1917). At that time, *s*-plurals were simply stored, but later on, *s*-plural nouns could be marked as [+foreign] (or [+untypical]). Many loans (not only those from French) have lost this feature and were fully integrated into the German plural, they even adopted umlaut (such as *Generäle, Märsche, Chöre, Späße, Kanäle, Paläste* - all of these either have a long vowel or a complex coda in the singular), which is true until the 18th or even the beginning of the 19th century. Further *s*-plural nouns were adopted from English and from northern German dialects, and it is often these nouns that end in VC with a short vowel. The feature [+foreign] for *s*-plurals has then been generalized as relating to all kinds of untypical nouns (including those that are clearly nouns and spelled like German words), so the *s*-plural has acquired default status. It is not

yet clear when this happened, and how much the dialects (which were more progressive in the reduction of the former plural system) influenced this process. Probably, many learned registers (which accept *s*-plurals only under restricted conditions, such as French or English origin) have preserved the older plural forms, so the process must have been very slow, maybe it is still ongoing. However, as soon as /s/ was, or is, adopted as a default plural marker, the former regular nouns with  $\text{ə}$ -plural are then confronted with a competing form and shift to irregular ones. Therefore, regarding the high-frequency  $\text{ə}$ -plurals (of the problematic class P2) as lexically stored is more plausible than the first option mentioned above. This leads to the prediction that these  $\text{ə}$ -plural nouns may shift to *s*-plural, depending on frequency, register and style.

However, not only can *Skelette*, *Komplotte* often be replaced by *Skeletts*, *Komplotts*, one also often finds the reverse: *Butte*, *Kompotte* rather than *Butts*, *Kompotts*. This particularly happens when the plural frequency is low (and the plural form is stored only by chance). For instance, for a week-day name such as *Mittwoch* ‘Wednesday’, the plural is very uncommon, but forced by special syntactic contexts (*die vielen Mittwoch\_* ‘the many Wednesdays’). In such a case, *Mittwoche* and *Mittwochs* are nearly equally distributed, and most speakers accept both forms.

In the plural system of (1), which has been discussed to some detail in section 2, it is presumed that for each noun a plural form exists, either by rule or stored. But this assumption need not be true. It may well be the case that the learner has acquired nouns which are only rarely used in the plural or which are used with different plural forms, so there was no chance to acquire a unique plural form. If different plural forms show up, the DATR account would have to assume that these nouns are assigned to more than one plural class, but it is unclear how this account would function when plural data are lacking. The MM account has to assign a unique plural form, too (according to UNIQUENESS, see Wunderlich & Fabri 1995), which can be done either on the basis of inherent properties (such as gender or phonological shape) or on the basis of stored knowledge. Neither of these two accounts is able to predict any vacillation in the selection of plural. Only a constraint-based account can do this: if two constraints lead to different results, but both are attested, these constraints have to be assumed as equally ranked. Such a situation of unranked constraints is not untypical for a change in constraint ranking. Let us assume that such a change takes place in German when the *s*-plural of untypical nouns becomes default plural. The constraint-based account claims that the plural fuzziness we have observed in the problematic plural classes is in fact plural vacillation due to unranked constraints.

## 5. A constraint-based analysis

A constraint-based analysis accounts for selections where an option exists; the option that is selected should be optimal concerning a set of possible candidates and a constraint-ranking. Such an analysis is already motivated by the assumption that prosodic constraints such as REDUCFINSYLL and MAX(COR) play a role in the German noun plural system. Moreover, as pointed out above, MAX(COR) should rank above N-PLURAL, where N-PLURAL corresponds to an affix-based rule for feminines. And finally, uncertainties in the selection of plural forms may best be described by equally ranked constraints.

In a constraint-based analysis, in particular when it attempts to describe a change in a system on the basis of stored knowledge, every derived item that is learned (such as the plural form of nouns) belongs to the input and remains unchanged in the output. If this item massively violates constraints, it can only be the case that the input itself is changed (or

unlearned). No constraint or constraint-ranking can determine the facts that are learned, but if the learned facts violate too many or too high-ranked constraints, the learner may decide to ignore these facts.

It is neither necessary nor possible to restate all the regularities of the German noun plural discussed before in a constraint-based analysis. I will restrict myself to a few instances that are crucial.

The input consists of the lexical entry of a noun together with the feature [+pl]; this means that plural can be freely instantiated. If the lexical entry already offers a plural form, this form is selected; all further suffixation or alteration would be too expensive. But if the lexical entry does not offer a plural form, the proper plural form must be selected from a set of candidates. The candidate set includes the input form, a form with ə-epenthesis (violating DEP(MORA)), and forms with *n*-suffix or *s*-suffix, and, if the lexical entry has an unassociated feature COR, this feature may be associated or not. For a candidate formed with a suffix, the selection conditions of this suffix must be met, so /n/ only applies to masculines ending in schwa and to feminines, whereas /s/ can always apply because it does not require any feature in the base.

Among the constraints for the evaluation of candidates are the following:

- REDUCFINSYLL: A noun plural ends in a reduced syllable. This constraint functions as an output condition for plural forms.
- MAX(COR)<sub>M</sub>: A floating coronal feature in the input is realized in marked categories such as plural. This constraint ensures that umlaut appears if the noun has an underlying but unassociated feature COR.
- S-PLUR: A noun plural ends in *-s*. This constraint forces selection of the candidates generated by the *s*-suffix.
- N-PLUR: A noun plural ends in *-n*. This constraint forces selection of the candidates generated by one of the *n*-suffixes, given that their selection conditions are met. For a noun that never has the chance to undergo *n*-suffixation, this constraint is irrelevant since it cannot be violated. Although in such a case one may consider candidates ending in *-n*, they violate the relatively high-ranked constraint DEP<sub>X</sub> in introducing a segment that is not licensed by a suffix. DEP<sub>X</sub> is not violated if one of the suffixes called upon by the input is applied.
- MARKPLUR: The plural output differs from the singular form. This constraint is only violated if the output is identical to the input entry, which is by default singular.
- NORED(undancy): Plural is marked only once. Since plural can be freely instantiated but must be visible, each plural suffix (*-s* or *-n*) added to a form that already satisfies MARKPLUR leads to a NORED violation. An ə-epenthesis added to an umlauting basic form (as in /hand/ - [hendə]) does not violate NORED because it does not constitute a plural suffix.
- DEP(MORA): A mora in the output corresponds to a mora in the input. This constraint is violated by ə-epenthesis.
- NOAFFIX: Do not add an affix. This constraint must be lower ranked than N-PLURAL and S-PLURAL because it forbids any affixation. However, such an economy constraint is necessary to counterbalance the expressivity constraint MARKPLURAL, and, as we will see in the following, it makes *s*-plural as expensive as ə-plural.

I assume the following constraint ordering for conservative Modern High German:

- (18) {NORED, MAX(COR)<sub>M</sub>} >> {REDUCFINSYLL, N-PLUR} >> {S-PLUR, MARKPLUR}  
>> {DEP(MORA), NOAFFIX}

The first problem I want to consider is the competition between umlaut and *n*-plural in feminine noun plurals, illustrated in (19). Here, the two lowest constraints are neglected because they are not crucial for the result.

(19)		NORED	MAX (COR) <sub>M</sub>	REDUCFIN SYLL	N-PLUR	S-PLUR	MARKPLUR
a.	⇒ Mutter		*!		*	*	*
	⇒ Mütter				*	*	
	Muttern		*!	*		*	
	Müttern	*!		*		*	
	Mütters	*!		*	*		
b.	Hand		*!	*	*	*	*
	⇒ Händ			*!	*	*	
	Hände				*	*	
	Händs	*!			*		
	Händen	*!				*	
c.	Assel				*	*	*!
	⇒ Asseln			*		*	
	Assels			*	*!		

(19a) shows an instance where the base form already satisfies REDUCFINSYLL, and only the COR-feature must be associated; all candidates with *-n* or *-s* are ruled out. Similarly, (19b) shows an instance in which *ə*-epenthesis is optimal. In contrast, nonumlauting feminines turn out optimal with an *n*-plural, as shown in (19c).

The second problem I want to consider concerns plural vacillation, as discussed in the preceding section (*Mittwoche* vs. *Mittwochs*). The speakers' uncertainty about the correct plural form results from the fact that *s*-plural shifts to default status, depending on register and style.

In the conservative system of German, REDUCFINSYLL is very high-ranked; it often requires the introduction of a new mora by epenthesis, leading to a violation of DEP(MORA). As I pointed out before, even most *n*-plurals obey this constraint, and only the feminines ending in a vowel do not violate DEP(MORA). However, *s*-plurals never violate DEP(MORA). When more and more *s*-plurals are accepted, the relative weight of these two constraints may be changed.

(20) illustrates the more conservative judgments, where typical nouns can remain unmarked in the plural (20a) or get an *ə*-plural (20b).

(20)		NORED	MAX (COR) <sub>M</sub>	REDFIN SYLL	N-PLUR	S-PLUR	MARK PLUR	DEP (MORA)	NO AFFIX
a.	⇒ Trecker					*	*		
	Treckers			*!					*
b.	⇒ Spinette					*		*	
	Spinetts			*!					*

Now, let us assume that both MARKPLURAL and S-PLURAL enhance and become equally ranked with REDUCEDFINSYLL and N-PLURAL. Then *s*-plural is preferred for nouns that have an unmarked plural in the previous ranking (21a), while *ə*-plural and *s*-plural become equivalent options (21b). The competition between *ə*-plural and *s*-plural is resolved in favor of the latter only if, in addition, DEP(MORA) also enhances.

(21)		NORED	MAX (COR) <sub>M</sub>	REDFIN SYLL	N-PLUR	S-PLUR	MARK PLUR	DEP (MORA)	NO AFFIX
a.	Trecker ⇒ Treckers			*		*	*!		*
b.	⇒ Skelette ⇒ Skeletts			*		*		*	*

It is interesting to note that such a revised constraint ranking does not affect the umlauting nouns, see (22a) and (22b). Only nonumlauting feminines may be affected, as shown in (22c).

(22)		NORED	MAX (COR) <sub>M</sub>	REDFIN SYLL	N-PLUR	S-PLUR	MARK PLUR	DEP (MORA)	NO AFFIX
a.	Mutter ⇒ Mütter Mütern Müttern Mütters		*!		*	*	*		
b.	Hand Händ ⇒ Hände Händs Händen		*!		*	*	*		
c.	Assel ⇒ Asseln ⇒ Assels			*	*	*	*!		*

However, N-PLURAL was irrelevant in the tableaux (20) and (21); if this constraint is reranked such that it now dominates REDUCFINSYLL (and still dominates S-PLURAL), one arrives at the same outcome as above, see (23a). In the constraint ranking assumed for this tableau, also the enhancement of DEP(MORA) is accounted for, so that *Skeletts* becomes better than *Skelette*, see (23b). This means that the *s*-plural has become effective as default plural for all typical nouns of class B, so that this class is emptied: some items may get a lexicalized plural form, all other items shift to class A.

(23)		NORED	MAX (COR) <sub>M</sub>	N-PLUR	REDFIN SYLL	S-PLUR	MARK PLUR	DEP (MORA)	NO AFFIX
a.	Assel ⇒ Asseln Assels			*!		*	*		*

b.	Skelette				*	*	*!	
	⇒ Skeletts			*				*

The scenario just demonstrated shows that the system of feminines is quite robust in German, because both MAX(COR) and N-PLURAL may stay as high-ranked constraints, even if all members of the problematic classes P1 and P2 shift to *s*-plural (or get a lexicalized plural form). The weakly inflected masculines are subject to an *n*-plural affix, too, but only as long as they stay with a singular form ending in schwa. Some nouns of this class drop this ending however, and thus shift to consonant-final masculines with *s*-plural (*der Jung* - *die Jungs* ‘boys’).

## 6. Conclusions

In section 3, I concluded that the best theoretical account of German noun plurals should make loans from several approaches, such as the DATR account, Minimalist Morphology (MM), and constraint-based theories. In other words, these approaches may converge in the description of a highly complex system as the German noun plural. I have then identified some empirical facts that render this conclusion problematic: first, umlaut plural takes precedence over *n*-plural in the feminines - how can this be captured within an inheritance tree?, and second, many plural forms of nonfeminines vacillate between schwa- and *s*-ending - how can such a situation be described without assuming ambiguity regarding plural exponents? In solving these two problems, I have proposed an OT analysis which, in many respects, is still preliminary. However, some questions concerning the best account must now be answered differently.

- DATR representations, assuming an inheritance network for subclasses in the vocabulary, have the disadvantage that they can only state relations between subnodes and governing nodes, but they cannot incorporate the idea that branches originating from the same governing node are weighed with respect to each other. But exactly this would be necessary to account for the statement that umlaut takes precedence over *n*-plural in the feminines.
- Some important requisites of MM are still preserved in the result at which we arrived: the way in which lexical entries are specified, and the way in which candidates are formed by affixation. Since MM already incorporates the idea of evaluating potential candidates for a paradigm cell, the precedence statement does not pose any problem. However, MM also claims uniqueness for occupying a paradigm cell, and exactly this requirement has become questionable by the second problem. Moreover, it is not compatible with the original premises of MM that plural can be freely instantiated, although conceptually, there is nothing against free instantiation if this is paired with the constraint MARK-PLURAL and a number of devices that realize plural marking.

DATR is a representational device for lexical classes, whereas MM is a generative device for sets of inflectional forms. There is nothing in these frameworks that make them mutually incompatible, although they react to empirical problems in different ways. In contrast, OT is a framework that is less restricted and can, therefore, capture all kinds of problems, including those that are problematic for DATR and MM.

- The advantages of an OT account become obvious in view of the two above-discussed problems: First, it is possible to show how plural allomorphs compete with each other, and second, a more realistic scenario is offered to show how constraint enhancements affect some parts of an overall-system of plural formation without affecting other parts.

One should notice that the OT account proposed here is not a classical one in which affixes are replaced by phonological constraints and every kinds of alternations are regarded as possible candidates. This account still assumes affixes that are sensitive to categorial information (such as feminine gender), hence, it is still morpheme-based.

What is interesting about the German noun plural system is the fact that it shows how an affix-based system may interplay with prosodic constraints. Particularly interesting is that an affix for untypical nouns is able to bleed a large class of typical nouns. My proposal offers scenarios for predictions how further change of the German plural system might proceed. The prediction is that first the unmarked plurals shift to *s*-plurals, and then the (non-umlauting) *ə*-plurals shift to *s*-plurals, unless they are lexically fixed. However, different scenarios are possible.

### **References**

- Cahill, Lynne & Gerald Gazdar (1999) German noun inflection. *Journal of Linguistics*. To appear.
- Clahsen, Harald (1999) Lexical entries and rules of language: A multidisciplinary study of German inflection. *The Behavioral and Brain Sciences*. To appear.
- Corbett, Greville & Norman Fraser (1993) Network Morphology: A DATR account of Russian inflectional morphology. *Journal of Linguistics* 29: 113-142.
- Golston, Chris & Richard Wiese (1996) Zero morphology and constraint interaction: subtraction and epenthesis in German dialects. In *Yearbook of Morphology 1995*, ed. G. Booij & J. van Marle, 143-159. Dordrecht: Kluwer.
- Kilbury, James (1999) German noun plural revisited. Ms. Univ. of Düsseldorf.
- Köpcke, Klaus-Michael (1993) *Schemata bei der Pluralbildung im Deutschen. Versuch einer kognitiven Morphologie*. Tübingen: Narr.
- Marcus, Gary F. et al. (1995) German inflection: the exception that proves the rule. *Cognitive Psychology* 29: 189-256.
- Mugdan, Joachim (1977) *Flexionsmorphologie und Psycholinguistik*. Tübingen: Narr.
- Neef, Martin (1998) Reduced syllable plural in German. In *Models of Inflection*, ed. R. Fabri, A. Ortman & T. Parodi, 244-265. Tübingen: Niemeyer.
- Paul, Hermann (1917) *Deutsche Grammatik*. Band II, Teil III: *Flexionslehre*. Tübingen: Niemeyer.
- Penke, Martina & Marion Krause (1999) Broca's aphasia and German plural formation. Paper submitted to *The Academy of Aphasia*.
- Sonnenstuhl, Ingrid (1999) The mental representation of German noun plurals. In prep. Univ. of Düsseldorf.
- Wiese, Richard (1996) *The phonology of German*. Oxford: Clarendon.
- Wunderlich, Dieter & Ray Fabri (1995) Minimalist Morphology: An approach to inflection. *Zeitschrift für Sprachwissenschaft* 14: 236-294.