Linking elements in German Origin, Change, Functionalization

Damaris Nübling · Renata Szczepaniak

Abstract Contemporary German is known for its complex system of linking elements. They not only show different degrees of productivity (between unproductive *-es-* and very productive *-s-*), but also exhibit functional diversity, with some of them even allowing plural interpretation, e.g. *-er-* in *Völk+er+kunde* 'ethnology' vs. *Volk+s+kunde* 'folklore'. In this paper, we argue that this is due to the complex historical development from two different sources. The first layer of linking elements, which arose out of Germanic primary suffixes, was reduced to one member, the "older" linking *-e-*, already in Old High German (e.g. in NHG *Tag+e+werk* 'daily task'). The current functional diversity of the linking elements is primarily due to the later evolution out of inflectional endings. The dissociation from the second source has included a gradual change of the assignment rules from lexical (gender, declension class) to prosodic (formal) level. Thus, the current distribution of the most developed linking *-s-* is the most formalized one, as it can be directly deduced from the prosodic form of the first constituent. The development of the second layer of linking elements resembles the process of grammaticalization. However, linking elements form part of word formation and therefore are not the typical result of grammaticalization.

Keywords Linking elements · Compounds · Grammaticalization · Exaptation · Language change

D. Nübling (✉)
Deutsches Institut, Johannes Gutenberg-Universität, Jakob Welder-Weg 18, 55099 Mainz, Germany
e-mail: nuebling@uni-mainz.de

R. Szczepaniak
Institut für Germanistik, Universität Hamburg, Von-Melle-Park 6, 20146 Hamburg, Germany
e-mail: renata.szczepaniak@uni-hamburg.de

1 Introduction

In contemporary German, linking elements occur mainly within noun–noun compounds as in *Held* 'hero' + *Tat* 'act, deed' → *Held+en+tat* 'heroic deed'.[1] Here, they belong to the first constituents of compounds forming the nominal compounding stem (*Held+en+*). Thus, the word-formation component must be seen as the domain of their application and its products as the structural scope of linking elements, i.e. the structural size of constructions which they help to form (Lehmann 1995:143).

In this article, we will turn our attention to the diachronic development of each of the six linking elements in noun–noun compounds. First, we will investigate the origin of German linking elements (Sect. 2). In the pertinent literature, two sources of linking elements are proposed: Demske (1999, 2001) argues that the present-day linking elements originate from inflectional suffixes, which became parts of lexicalized nominal phrases and were subsequently reanalyzed as linking elements in Early New High German (ENHG). Fuhrhop (1996, 1998) considers Germanic primary suffixes (i.e. stem-forming suffixes) as an additional source. Recently, Wegener (2008) has argued for the direct development of all linking elements (except *-(e)s-*) out of former primary suffixes. In Sect. 3, we will investigate the development of each linking element taking into account its historical source as well as the change of assignment rules, the development of non-paradigmatic distribution, functional content, and productivity. We will also argue that individual linking elements differ with regard to their actual state of development. This in turn explains the multifunctional character (functional diversity) of linking elements, the existence of doubtful cases as well as the fact that none of the functions described in the pertinent literature can be assigned to all linking elements. Finally, we will address the question of whether the functionalization, i.e. the development of linguistic material towards linking elements, can be analyzed as a case of grammaticalization, of degrammaticalization, or even of exaptation (Sect. 4).

2 Origin

In the pertinent literature, two sources of German linking elements are considered. The first source is genitive endings in lexicalized noun phrases that underwent the reanalysis towards so-called genitive compounds or improper compounds, e.g. [[*der Brücke-n*] *Zoll*] 'the bridge's toll' > [*der* [*Brücke+n+zoll*]] lit. "the bridgestoll" (Demske 1999, 2001). We will return to this source in Sect. 2.2. The term *improper compounds* ("uneigentliche Komposita") was introduced by Grimm (1826:407) in order to set them apart from so called *proper compounds* ("eigentliche Komposita"), the first constituents of which do not contain any inflectional ending.

---

[1] Additionally, linking elements also occur within certain suffixation as in *Held* 'hero' + *-haft* (adjective suffix) → *held+en+haft* 'heroic', where the first constituent is a noun (*Held+en+*), in compounds with deverbal first constituent (*baden* 'to take a bath' → *Bad+e+mantel* 'bathrobe') and in adverbial compounds. In this study, we will concentrate on the origin, change and functionalization of linking elements in noun–noun compounds and leave other cases for further studies.

Proper compounds were very frequent in Old High German (OHG) and Middle High German (MHG). In OHG, the first constituents of this compound type could contain a linking vowel, e.g. *-a-* as in OHG *tag+a+sterro* 'morning star'. Historically, these linking vowels evolved from Germanic primary suffixes, i.e. stem-forming suffixes making the noun stems, e.g. Germanic *ðag-* ready for inflection (Germanic *ðag-a-z* 'day') or word-formation (Schweikle 2002; Sonderegger 2003). According to Wegener (2008), almost all present-day linking elements, i.e. *-e-*, *-er-*, *-en-* and *-n-* evolved from this source (p. 342). However, she fails to deliver any historical evidence. Her assumption is based exclusively on the observation that in many cases linking elements such as *-er-* in *Kind+er+gesicht* have no plural meaning, neither synchronically nor diachronically. According to her, they could not have developed from the plural suffix in a genitive modifier phrase (pp. 336–337). However, this assumption cannot account for the possibility that *-er-* after being reanalyzed as linking element simply spread to compounds without plural relation between head and modifier. In the following Sect. 2.1, we will concentrate on the question of whether there are reliable arguments for the direct development of OHG primary suffixes towards NHG linking elements.

2.1 Proper compounds: primary suffixes in Old High German as a direct source of contemporary linking elements?
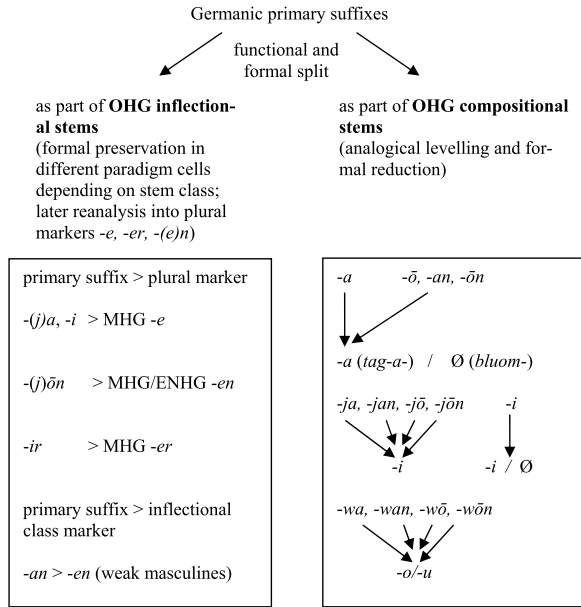
The hypothesis of Wegener (2008) that all linking elements except *-(e)s-* originate directly from primary suffixes implies a formal continuity from Germanic primary suffixes towards NHG linking elements. However, already in the Pre-OHG period the formal development of the former primary suffixes split depending on whether they were kept in inflectional or compounding stems (see Fig. 1). While they preserved their different forms in the inflectional paradigms (and were grammaticalized into plural markers, see Wegener 2005, Nübling 2008, Szczepaniak 2011:55ff.), they underwent analogical levelling and formal reduction in compounds (Brugmann 1906:94ff.; Grimm 1826:410ff.; Gröger 1911:1ff.[2]; Carr 1939).

In OHG, the former formal correspondence between the compositional and inflectional stems did not exist anymore. Already in Pre-OHG, the linking vowel *-an-* (from the type-frequent *a*-stems) spread analogically to *ō-*, *an-* and *ōn*-stems and other (small) stem classes and was subsequently subject to prosodically conditioned reduction. According to Gröger (1911), the linking vowel *-a-* disappeared almost completely after heavy stems,[3] e.g. *bluom-a* 'flower' (*ôn*-stem) in *bluom-garto* 'flower-garden', *bluom-lenti* 'flower-field' (all OHG examples from Gröger 1911). The linking *-a-* occurred in OHG only after light stems such as *tag-a* 'day' in *tag+a+muos*

---

[2]Gröger (1911) provides a study of the OHG compositional vowels based on an exhaustive analysis of OHG manuscripts and glosses.

[3]A stem is considered heavy when it contains a long vowel or diphthong (plus a consonant) or a short vowel plus (at least) two consonants or when it is polysyllabic. Light stem consists of one short vowel plus only one (short) consonant. The stem syllable of heavy stems remains bimoraic (heavy) after the resyllabification of the last stem consonant to the following syllable with the compositional vowel, whereas it contains only one mora, when the stem is light. In OHG, the compositional vowels were preserved especially when providing the second mora for the minimal (bimoraic) foot (see Szczepaniak 2007:104ff., 156–157).

Fig. 1 Functional and formal split of Germanic primary suffixes in OHG

Germanic primary suffixes

functional and formal split

as part of **OHG inflectional stems**
(formal preservation in different paradigm cells depending on stem class; later reanalysis into plural markers *-e, -er, -(e)n*)

as part of **OHG compositional stems**
(analogical levelling and formal reduction)

primary suffix > plural marker

-(j)a, -i > MHG *-e*

-(j)ōn   > MHG/ENHG *-en*

-ir   > MHG *-er*

primary suffix > inflectional class marker

-an > *-en* (weak masculines)

-a   *-ō, -an, -ōn*

-a (*tag-a-*) / Ø (*bluom-*)

-ja, -jan, -jō, -jōn   *-i*

-i   *-i* / Ø

-wa, -wan, -wō, -wōn

-o/-u

'meal'. The linking *-u-* (or *-o-*) of the *wa(n)-* and *wō(n)-*-stems (*scat+o+hūt* 'sunshade', lit. "shadow-hat") and the linking *-i-* of the *i*-stems (*tur+i+wart* 'doorkeeper') underwent a similar prosodically-conditioned reduction. Consequently, the OHG heavy *a-, ō-, i-, u-, s-, n-* and *r*-stems had no linking vowel (or other linking element) at all (for exceptions see Gröger 1911:7ff.). Only the OHG *ja(n)-* and *jō(n)-*-stems and the *īn*-stems preserved the linking *-i-* irrespective of their prosodic structure, e.g. *hemidi* 'shirt' (heavy stem) *hemid+i+lahhan* 'cloth of a shirt' vs. *heri* 'army' (light stem) in *her+i+berga* 'camp, hostel'. Furthermore, it is at least questionable whether the OHG *s*-stems such as (*h*)*rind* 'neat cattle', most of which were heavy, preserved the linker *-ir-*. We will return to this question later in this section.

The quality of the OHG linking vowels shifted. They were subject to many assimilatory processes, such as vowel harmony with the stem vowel of the first constituent as in *spil+o+hūs > spil+i+hūs* 'playhouse, theater' (see Gröger 1911:72ff.; Szczepaniak 2007:104ff.). The formal differentiation of linking vowels was gradually given up. The predominating graphical form <e> in Late OHG writings of Notker (11th century) indicates an advanced qualitative reduction of the former linking vowels into a schwa-like *-e-* (see Gröger 1911:73, 106, 149). This process was completed in MHG.

Thus, there is no historical evidence for the assumption made by Wegener (2008) that there is a straightforward formal development of the linking *-(e)n-* from the primary suffixes *-(j)an* and *-(j)ōn*. Here, analogical levelling led to the formal overlapping with the *a*-stems. In fact, only some instances of the NHG *e*-linker can be traced back to a former primary suffix. Interestingly, this linker is very rare and completely unproductive in NHG: It appears only in fewer than 1 % of all compounds (see Table 3 in Sect. 3) and is restricted to nouns with homophonous plural marker *-e* (for further analysis of the present-day linking elements see Sect. 3). Hence, the linking element

-(e)n- in compounds such as *Blume+n+strauß* cannot be traced back to the primary suffix *-ōn*. Already in OHG, the heavy stem *blouma* lost its analogically-extended linking vowel *-a-*. This also explains why some of the former feminine *ō(n)*-stems, e.g. NHG *Erde* (<OHG *erda*) 'earth', have two compounding stem forms, one of which contains the so-called subtractive linking element as in *Erd+kugel* 'terrestrial globe', the other one being the former genitive singular as in *Erde+n+bürger* 'human being'.

There was also a small group of former *ōn*-stems in OHG containing a linking vowel when used as a compounding stem. According to Gröger (1911:21ff.), those few exceptions were limited to the *ōn*-stems with long consonants such as *sunna* 'sun', *spinna* 'spider', and *wolla* 'wool'. Here, the linking vowel was still apparent in OHG, e.g. *sunn+a+scīm* 'sun-shine'. Additionally, those nouns were first constituents of numerous improper (genitive) compounds, e.g. *sunnūntag* 'sunday', a loan translation of Lat. *dies solis* (Gröger 1911:39). This led to the MHG variants: *sunn(e)tag* (>NHG *Sonn-tag*) and *sunnentag*. Thus, it is important to stress that the linking *-en-* cannot originate from the primary suffix, but only from the genitive singular.

The evidence for a direct development of the NHG linking *-er-* from the primary suffix of the *s*-stems, as proposed by Wegener (2008), is very scarce. According to Gröger (1911:46), the original *s*-stems *(h)rind* 'neat cattle', *kalb* 'calf', *huon* 'chicken', *verh* 'pork', *ei* 'egg' do not contain the primary *ir*-suffix in their compounding form in the OHG records (see Table 1). Instead of the original primary suffix, these nouns appeared in the genitive form (*huoners-, rindro-*), in the analogical genitive form of the *a*-stems (*calpes-*) or as a bare stem (*hrint-*).[4] The absence or avoidance of the linking *-ir* could be accounted for by homonymy with the emerging plural marker *-ir*: Already in OHG, the residues of the former primary suffixes in the inflectional paradigm were reanalyzed as plural suffixes (see Wurzel 1992). Only in MHG, i.e. after the reanalysis of *-ir/-er* as plural suffix, did compositional stems with *-ir/-er* begin to appear. All entries in Table 1 stem from OHG and MHG glosses (Gröger 1911:46). The number of tokens is given in brackets.

The findings presented in Table 1 suggest that all OHG and almost all MHG forms of the former *s*-stems (also with *-ir/-er*) were interpreted as genitive (plural). Thus, the corresponding compounds have to be analyzed as improper compounds, e.g. *rinnirhirte*, *rindirstal*. Only since such improper compounds appeared, first cases of linking *-er-* arose, e.g. *huonerdarm*, *rinderzunge*. This suggests that the linking *-er-* has developed from the genitive plural marker rather than from the primary suffix.

An additional argument for the reanalysis of the genitive phrases as improper compounds comes from the MHG data: Table 2 comprises all MHG *rinder*-compounds found in the MHG corpora accessible in Titus (http://titus.uni-franfurt.de) and in the Middle High German Conceptual Database (http://www.mhdbdb.sbg.ac.at).

---

[4]Originally, the class of *s*-stems consisted of approximately ten members. Practically all of them were heavy stems. It is also known that light *s*-stems changed in OHG into other noun classes (Gröger 1911:48). During the OHG period, this class gained some new members such as OHG *kind* 'child', *gelt* 'income', *wīb* 'woman' (Poitou 2004:85). Interestingly, none of these nouns takes *-er*, but *-es*, when used as the first constituent of a compound.

Table 1 Compositional forms of OHG *s*-stems (Gröger 1911:46)

Language period	Old High German		Middle High German	
Century	10th	11th	12th	13th
s-stem			<u>verhir</u>stal <u>verhir</u>stīga (5) <u>rinder</u>swaige (1) <u>huoner</u>darm (2) <u>chalber</u>scherne (1)	<u>rinnir</u>hirte (1) <u>rindir</u>stal (2) <u>rinder</u>stal (2) <u>rinder</u>zunge (1) <u>huoner</u>darm (1)
Genitive form (of *s*-stems)	<u>rindro</u>stal (1)			
Analogical genitive form of *a*-stems		<u>calpes</u>hūt (1) <u>rindes</u>zunga (1)	<u>rindes</u>zunge (5) <u>kalbes</u>wurz (1)	<u>eies</u>scala (1) <u>rindis</u>zunge (3)
Bare compositional stem		<u>rinth</u>erda (1) <u>rinth</u>irdi (2)	<u>rind</u>blood (2)	<u>rinth</u>erde (1)
				<u>rinders</u>zunge (1) <u>huoners</u>darm (2)

Table 2 includes only compounds and compound-like genitive phrases, i.e. phrases without any determiner or with a determiner or adjective agreeing with the head noun, e.g. MHG *er hât zwei krumbiu rindes horn* 'he has two bent cattle horn'. In such constructions, the MHG noun *rint* exhibits three different compounding forms: *rinder(-)*, *rindes(-)*, and *rint(-)*. While *rint-* appears only in connection with *fleisch* 'meat', the other two forms *rinder(-)* and *rindes(-)* combine with similar or the same second constituents. They are even interchangeable: *rinderhâr* and *rindes har* appear in the same text passage in two different versions of *Alexander*:

(1) *uf dem ruken hat es rindes har* (Lampr., Basl., 551)
(2) *ûf dem goffen habtiz rinderhâr* (Lampr., Vor., 251)
    'It had a cow's hair on its buttocks.'

To sum up, there is no reliable evidence that the linking *-er-* has developed from the primary suffix *-ir* as assumed by Wegener (2008). On the contrary, our findings strongly suggest the development from genitive plural endings used in improper compounds, because (1) first constituents with *-ir/-er* do not occur in OHG texts (and glosses), (2) they appear only in MHG after the reanalysis of *-ir/-er* as a plural suffix, (3) all documented MHG compounds with *-er* exhibit a genitive relation between immediate constituents, and, finally, (4) almost all OHG *s*-stems are heavy, so the prosodically motivated reduction of the original linking material can at least be assumed.

2.2 Improper compounds

In Sect. 2.1, we have shown that the relevance of the Germanic primary suffixes for the development of the German linking elements is restricted to the linking *-e-*. However, not all NHG (even only a few) compounding stem forms with *-e-* can be

Table 2 Compositional stems of MHG *rint*

Graphical form[a]	*rinder*(-)	*rindes*(-)	*rint*(-)
Written in one word	*rinderhâr* (Lampr. Vor., 251) *rindermilch* (Nat. IV, 38 340,2) *rindersuht* (Nat. IIIE, 14 273,15) *rindermist* (Nat. IIIE, 14 273,16) *rinderhût* (three times: Weltchr. 1209; 12273; 28812) *rinderdrec* (Schleg. 1147)	*rindesaugen* (Nat. I, 49c 44,21)	*rintfleisch/ rindtfleisch/rintfleysch* (five times: Buoch 41,2; Eberh. 94,10; Eberh. 99,3; Eberh. 100,7; Kochb. 120,7)
Written separately	*rinder milch* (Eberh. 57,24)	*rindes/is hâr* (Lampr. Basl. 551; Lampr., Str., 290) *rindes bilde* (Ulr., 2, 2687) *rindes horn* (Rud., I. 708) *rindes hût/hiute* (Vel. 319; 362; Ernst 4264) *rindes lebern* (Buoch 29, 2) *rindes knorren* (Trim., 364)	*rint fleisch* (Eberh. 78,1)

[a]All variants occur written in one word with the base noun or separately. Even if the tendency to write in on word is stronger by *rinder*- than by *rindes*, the graphical form cannot be seen as a reliable criterium for separating compounds from free syntactic phrases.

traced back to this source. For instance, nouns denoting animals such as OHG *hunt* 'dog' did not contain a linking vowel because of its prosodic reduction after heavy stems. Interestingly, already in OHG the genitive form *hundes* occurs in many structures that can be analyzed as improper compounds (besides the proper compounds with *hunt+*; see Gröger 1911:40–41). This structure represents the second source of linking elements. However, as Demske (1999:151) argues, the improper compounds occurring in OHG and also in MHG are structurally ambiguous.[5] They can be reanalyzed as complex noun phrases with a prenominal genitive modifier or as genitive compounds, e.g. *hunteszunga* 'dog's tongue':

(3) The structural ambiguity of OHG *hunteszunga* 'dog's tongue'

[[huntes] zunga] complex noun phrase with prenominal modifier *huntes*
[huntes zunga] genitive compound

---

[5]However, there is a small group of compounds with first constituents that are homophonous to the genitive form that do not exhibit a genitive relation. They contain (more or less) affixoidal second constituents, especially *-līh* 'every, belonging to' (with a genitive plural as first constituent: *mannolīh/mannilīh* 'every man', *wortolīh* 'every word').

According to Demske (1999, 2001), the reanalysis of genitive (singular and plural) endings as linking elements took place only in ENHG, which was triggered by the rise of the functional category D: Determiners as well as the prenominal genitives acquired the semantic function of marking the head noun for definiteness. Thus, the former modifying genitive phrases were reanalyzed as first constituents of compounds if the determiner's form was ambiguous and could refer also to the head noun in question:

(4) Reanalysis of a former genitive phrase *der Brücken* 'the bridge's' as first constituent of compound

   [[der$_{Det}$ Brücken$_N$]$_{NP}$ Zoll]$_{NP}$ > [der$_{Det}$ [Brückenzoll]$_N$]$_{NP}$

   [[the$_{Det}$ bridge's$_N$]$_{NP}$ toll]$_{NP}$ > lit. [the$_{Det}$[bridgestoll]$_N$]$_{NP}$ 'the bridge toll'

In (4), the former genitive ending *-n* in (*der*) *Brücken* appears after the reanalysis as a linking element *-n-* in *Brücke+n+zoll*. Generally, the following path of development can be assumed: *inflectional ending > linking element*, where the former inflectional function is lost and a new function is gained. In the next section, we examine the degree of the functional development of every linking element.

The development of linking elements out of the OHG linking vowels is only of marginal relevance for the NHG system of linking elements. The OHG linking vowels were reduced to *schwa* and subsequently dropped in many cases. This led to some variants as e.g. proper *sunnetac/suntac* along with improper *sunnentac* (cf. also OHG *bluom-garto* vs. NHG *Blumengarten* 'flower-garden'). Although only a thorough analysis of the MHG corpus can describe the occurrence and productivity of the "old" linking *-e-*, it seems that it was gradually replaced by the emerging "new" linking elements.

3 Change and functionalization

As mentioned above, the new layer of linking elements arose through the development from inflectional endings to word formation material belonging to the first constituent. With regard to the function of this material, there are many accounts. These, however, only apply to a subset of linking elements or to a limited number of compounds. We will now demonstrate that this functional diversity is due to the degree to which the linking element had lost its old function and gained the new. The functions described in the pertinent literature can be summarized as follows (for a detailed survey see Nübling and Szczepaniak 2008):

(1) *Linking elements as inflectional morphemes* (e.g. Wiese 1996; Donalies 2003): The assumption that linking elements are functionally related to inflectional morphemes is based on the fact that many compounds can be paraphrased with homophonous genitive singular or plural endings, e.g. *-s-* in *Verfall+s+datum* 'expiration date' as *Datum des Verfalls* 'date of expiration'. There are, however, many counterexamples such as *Reiter+s+mann* 'horseman' which cannot be paraphrased by *Mann des Reiters 'horseman's man', *Liebling+s+gericht* 'favorite dish' and not **Gericht des Lieblings* 'dish of the darling', *Freund+es+kreis* 'circle of friends' and not **Kreis des/eines Freundes* 'circle of a/the friend'. How-

ever, Gallmann (1998) argues that linking elements can potentially function as plural, but not as case suffixes, because they belong to non-heads of compounds which only can be specified with regard to (internally licensed) number. Case as an external (syntactic) category can only be assigned to heads of compounds. There are indeed specific cases where linking elements also express plural meaning (see Sect. 3).

(2) *Linking elements as word-formation elements* (e.g. Fuhrhop 1996, 1998, 2000; Aronoff and Fuhrhop 2002): The wide functional range of linking elements related to processes of word-formation includes the structuring of complex compounds, cf. *Hof+mauer* 'courtyard wall' (zero) vs. *Friedhof+s+mauer* 'graveyard wall' (with linking *-s-*), the morphologization of syntactic phrases to compounds, e.g. *Richtung weisend > richtungweisend > richtung+s+weisend* 'trend-setting', and the re-opening of stems with closing suffixes for further word-formation, e.g. *Freundschaft* (with the closing suffix *-schaft*), but *Freundschaft+s+preis* 'special price' (with reopening *-s-*). Generally, linking elements are analysed as final parts of the compounding stem.

(3) *Linking elements as phonologically- or even prosodically-motivated elements* (e.g. Wegener 2003, 2006; Nübling and Szczepaniak 2008, 2009): Linking elements have also been described as means of rhythmic optimization of the first constituent by producing or maintaining a trochaic structure: *Mensch → Mensch+en+hand* 'man's hand', but *Dame → Dame+n+fahrrad* 'ladies' bicycle' (see Fuhrhop 1998, among others). This, however, does not hold for the linking *-s-*. As Wegener (2003, 2006) points out, the occurrence of the linking *-s-* after monosyllabic first constituents increases with decreasing sonority of the final sound: *-s-* appears only in 1.5–4.7 % of monosyllabic first constituents ending in [m, n, l], e.g. *Heil+s+lehre* 'doctrine of salvation', whereas after [p, t, k] the percentage varies between 15 % and 20 % (*Ort+s+tarif* 'local rates'). Wegener's conclusion that the linking *-s* blocks resyllabification or sound fusion refers only to the syllabic structure. Nübling and Szczepaniak (2008, 2011) examined the function of the linking *-s-* on the level of the phonological word and discovered a word-phonological function, which has been developed by this extremely productive linking element: Today, *-s-* appears much more frequently after phonologically marked (e.g. iambic) words, i.e. those that strongly differ from the trochaic word ideal, e.g. *Ver′fall+s+datum* 'expiry date', but *′Notfall+aufnahme* 'emergency hospitalization'.

In order to adequately describe the function(s) of linking elements, we will consider the following criteria: productivity, paradigmaticity, and functionality.

Productivity Only two out of at least six linking elements are productive in the sense that they attach to new stems as first constituents (new word-formations and, mostly, loans): *-s-* and *-(e)n-*. The remaining four "allo"-forms *-es-*, *-er-*, *-(e)ns-*, and *-e-* are limited to a fixed number of first constituents (thus, unproductive). The productivity is reflected in the occurrence of linking elements, as shown by the statistical analysis of Kürschner (2003) and Baayen et al. (2007).[6] Table 3 shows that both productive

---

[6]Kürschner (2003) analyzes 1000 compounds in German newspapers, while Baayen et al. (2007) use the CELEX lexical database for their research.

Table 3 Degrees of productivity of German linking elements and their frequency (K = Kürschner 2003, B = Baayen et al. 2007)

	+/− productive	Linking element	Examples	Frequency
1	Productive	*-s-*	*Abfahrt → Abfahrt+s+zeit* 'departure → departure time'	25 % (K)/17 % (B)
2		*-(e)n-*	*Blume → Blume+n+stängel* 'flower → flower stem' *Schrift → Schrift+en+verzeichnis* 'script → publication list'	11 % (K)/15 % (B)
3	Unproductive	*-es-*	*Kind → Kind+es+wohl* 'child → child's welfare'	4 % (K)/1.5 % (B)
4		*-e-*	*Schwein → Schwein+e+braten* 'pork → roast pork'	1 % (K)/1 % (B)
5		*-er-*	*Kind → Kind+er+wagen* 'child → preambulator'	1 % (K)/0.4 % (B)
6		*-(e)ns-*	*Schmerz → Schmerz+ens+geld* 'pain → compensation for pain' *Name → Name+ns+schild* 'name → name tag'	n.s. (K)/0.2 % (B)

linking elements, *-s-* and *-(e)n-*, are the most frequent ones: *-s-* occurs in 25 % of the cases according to Kürschner (2003) and in 17 % according to Baayen et al. (2007), *-(e)n-* in 11 % and 15 %, respectively. The occurrence rate of the remaining ones ranges between 0.2 % and 4 %, while compounds without any linking element are clearly predominant (58 % and 65 % of the cases, respectively).

The parameter of productivity is very important for our analysis, since it helps to distinguish between fixed stem-forming elements, which are lexicalized (see Sect. 2.1), and productive linking elements, which spread to further (new) first constituents. This spread is also responsible for the rise of new variants with linking elements along with the existing form without the linker, e.g. *Seminar*(*s*)*arbeit* 'term paper'. In contemporary German, there are hundreds of such variants (doubtful cases) between *-s-* and zero. Doubtful cases are defined as frequently occurring Standard German variants which are often subject to investigations at language advisories such as the *Duden-Sprachberatung* but which are fully accepted by grammars (see Klein 2003; Nübling and Szczepaniak 2011). Most of the doubtful cases can be explained by recent language change (coexistence of old and new forms).

Paradigmaticity In addition to the notion of productivity, a distinction must be made between paradigmatic and non-paradigmatic linking elements. Paradigmatic elements are homophonous with an inflectional ending of the noun serving as first constituent, e.g. *Blume-n* 'flower (pl.)' vs. *Blume+n+stängel* 'flower stem'. Paradigmaticity also means that the linking element still retains the same assignment rules as its source, an inflectional element. Here, both the linking and the inflectional elements are equally bound to gender and declension class. Thus, paradigmatic linkers still behave like their predecessors. If there is no formal equivalent in the inflectional

paradigm, the element is non-paradigmatic (i.e. dissociated from its former gender and declension class), e.g. *Arbeit+s+beginn* 'start of work'. As *Arbeit* is a feminine noun, it has no *s*-ending in its inflectional paradigm. Interestingly, the *s*-linker is the only one that can be used productively as a non-paradigmatic element. This means that it shows the highest degree of losing the old function and gaining a new one. We will return to this point later.

Functional content   As former inflectional endings, linking elements have lost their old function to different degrees. Wegener (2008) so far as to differentiate between *-er* as a plural suffix (PL) and as a linking element (LE):

(5)   *Kind+er+chor*   *Kind+er+star*
     child-PL-choir   child+LE+star
     'children's choir'   'child star'

We do not agree with this analysis. We assume that the compound in the left column (*Kind-er-chor*) also contains a linking element which is only associated with plural meaning (see Sect. 3.3). Otherwise, the spread of linking elements to compounds such as those in the right column could not have taken place. Additionally, the psycholinguistic experiments by Koester et al. (2004) show that linking elements are not processed as plural morphemes. Interestingly, compound constituents are significantly shorter than homophonous nouns in isolation, and they display a higher pitch. Nonetheless, there are some plurality effects in German compounds (maybe a kind of secondary remotivation): monosyllabic or polysyllabic final-stressed weak feminines with final consonant such as *Schrift* or *Geburt* do regularly exhibit a plural meaning when occurring with the linker *-en-* which is homophonous with the number marker of these nouns (*Schriftgröße* 'font size' vs. *Schriftenverzeichnis* 'publication list', *Geburtsurkunde* 'birth certificate' vs. *Geburtenrate* 'birth rate'). Many weak feminines with final stress have two compositional stems, e.g. *Schrift+Ø+* vs. *Schrift+en+*, *Geburt+s+* vs. *Geburt+en+*. Unfortunately, such cases are not included in the above mentioned psycholinguistic study of Koester et al. (2004).

We now turn to the synchronic description of the linking elements, starting with the most frequent items. Being aware of the fact that there is no single rule without any counterexample, we will concentrate on the most important tendencies.

3.1 The linking element *-s-*

Undoubtedly, the linking *-s-* is the most developed linking element: In most cases, it occurs non-paradigmatically, above all after feminines where it is, since ENHG, most productive. It regularly appears after the feminine suffixes *-heit/(ig)keit*, *-schaft*, *-ung*, even including two loan suffixes, *-ion* and *-ität*. These cases produce more than 90 % of all non-paradigmatic occurrences of *-s-* (Ortner and Müller-Bollhagen 1991:74). The remaining 10 % of the investigated corpus remarkably often comprise feminines ending in [t]: *Arbeit+s+*, *Heirat+s+*, *Armut+s+*, *Unschuld+s+*, *Andacht+s+*, *Auskunft+s+*, *Zukunft+s+*, *Ohnmacht+s+*, *Geburt+s+*, *Anstalt+s+*, *Geschicht+s+*, *Eifersucht+s+*, *Tobsucht+s+*, *Sehnsucht+s+*, *Ansicht+s+*, *Aus-*

sicht+s+, *Vorsicht+s+*.[7] This behaviour clearly shows that linking elements produce complex codas which consequently are more difficult to pronounce. Paradoxically, it is often assumed that the linking *-s-* leads to greater ease of articulation (cf. Busch and Stenschke 2007:87). This is incorrect.

Furthermore, the above-mentioned examples are complex with regard to their morphological and/or phonological structure. Interestingly, the corresponding simplexes usually are not linked: *Schuld+Ø+gefühl* 'feeling of guilt', *Macht+Ø+gefälle* 'power divide', *Sucht+Ø+verhalten* 'addictive behaviour', *Sicht+Ø+schutz* 'screen'. As pointed out in Nübling and Szczepaniak (2008), it is first of all the phonological complexity that conditions the behaviour of *-s-*: The greater the distance to the word-phonological ideal of a trochee with *schwa* in the second syllable, the more probable the occurrence of *-s-*. This explains why the suffixes carrying main or secondary stress such as *-ion*, *-ität*, *-schaft* and *-heit/-keit* always trigger *-s-*, as well as other types of first constituents such as *Heirat+s+*, *Arbeit+s+* and the *ung*-derivatives deviating from the unmarked trochee, i.e. those that contain full vowels in unstressed syllables. First constituents with unstressed prefixes such as *ge-*, *ver-*, *be-*, *ent-*, which also strongly deviate from the trochaic word ideal, are followed in 85 % of the cases by *-s-* (see Nübling and Szczepaniak 2008). The linking *-s-* is much less frequent (only 36 % of the cases), when the first constituents contain stressed prefixes, such as *un-*, *an-*, *aus-*, *zu-*, which form their own phonological words (pwords). Compounds as first constituents, which also comprise two pwords (e.g., *Eifersucht+s+*, *Tobsucht+s+*, *Sehnsucht+s+*), are linked in 27 % of the cases (according to Kürschner 2003).

The highly productive linking *-s-* frequently attaches to new word formations, many of them containing a loan word as the first constituent. Dozens of doubtful cases confirm its enormous productivity: *Antrag(s?)steller* 'applicant', *Denkmal(s?)pflege* 'preservation of monuments', *Dreieck(s?)tuch* 'triangular bandage' – *Seminar(s?)arbeit* 'term paper', *Respekt(s?)person* 'person of respect', *Subjekt(s?)pronomen* 'subject pronoun'. Sometimes, it could be analyzed as a genitive *-s* (e.g. *Ort+s+mitte* 'village center' as *Mitte des Orts* 'middle of the village') but too many counterexamples, first and foremost all feminine first constituents, rule out the inflectional status. Furthermore, *-s-* can never be interpreted as plural precisely because it does not attach to words which prototypically take an *-s* plural.[8]

Finally, a further feature shows that the linking *-s-* has developed very far from its source: In many cases it serves as a nominalization marker, i.e. in the case of nominalized verbs as first constituents such as *Leben-* 'life/vital', *Essen-* 'meal'. Although forming good pwords, they always take a linking *-s-* which must be interpreted as a marker of the nominal status of the first constituent: *Leben+s+mittel* 'food', *Essen+s+gewohnheit* 'eating habit' (Eisenberg 2006:241). As a rule, trochees with schwa in the second syllable never take linking *-s-*, except in these specific cases.

---

[7]Translation: 'labour, wedding, poverty, innocence, devotion, information, future, blackout, birth, institute, history, jealousy, raving madness, longing, mind, outlook, carefullness.

[8]Words taking *-s* plural are foreign words with word-final vowel, proper names, short words, and onomatopoetic words. As Wegener (2003) points out, there are few counterexamples such as *Leutnant+s+garde* 'lieutenant gard'.

Furthermore, *-s-* even marks the nominal status of (deverbal) second members of synthetic compounds, where the second member still contains a high degree of verbiness and the first constituent of which constitutes their argument, such as agent nouns, *ung*-formations etc. There are many doubtful cases of this type in contemporary German, cf. *Gewicht(+s+)heber* 'weightlifter', *Krieg(+s+)führung* 'warfare', *Schaden(+s+)ersatz* 'indemnity'. Exactly the same nominalizing (or deverbalizing) function seems to hold for head constituents consisting of verbal participles which also produce many doubtful cases: *richtung(+s+)weisend* 'trendsetting', *erfolg(+s+)versprechend* 'promising', *achtung(+s+)gebietend* 'imposing' (see Fuhrhop 1996; Nübling and Szczepaniak 2011).

The productivity of *-s-* is linked to the first constituent's number of syllables: There is a fixed group of about 30–40 monosyllabic stems (masculines and neuters, such as *Ort+s+* 'village', *Amt+s+* 'office', *Glück+s+* 'luck', *Krieg+s+* 'war', *Wirt+s+* 'host', *Staat+s+* 'state') which take *-s-* (therefore, they occupy a different position on the scales in Figs. 2 and 3). The few doubtful cases such as *Schiff(+s+)fahrt* are semantically different: *Schiff+s+fahrt* means 'passage', *Schiff+Ø+fahrt* 'navigation'. Real doubtful cases without semantic difference do not occur, which speaks against productivity. Thus, *-s-* is productive only after polysyllabic words. Here, it occurs both paradigmatically and non-paradigmatically, and in both cases productively (indicated by the arrows on the right-hand side of Fig. 2). As already mentioned above, the final sound of most of these stems are plosives or voiceless fricatives, i.e. the additional linking *-s-* nearly always leads to a deterioration of the word-final syllable by raising the sonority value (for preference laws regarding the syllable structure see Vennemann 1988). In full contrast to the next linking element *-(e)n-*, *-s-* strengthens the right edge of the word and thus marks the borderline between the two constituents.

3.2 The linking element *-(e)n-*

The linking *-(e)n-* is restricted to the weak inflection class shows a completely different behaviour and is divided into two allo-forms. As indicated by the brackets, their distribution is complementary: Nouns ending in *schwa* take *-n-* and those ending in a consonant take the syllabic *-en-*.[9] Both allo-forms produce trochees, either by creating or by maintaining them: *Mensch+en+hand* 'human hand' vs. *Affe+n+hand* 'hand of an ape'. As these examples show, *-(e)n-* is not obligatorily linked with plural meaning although this often happens, e.g. *Mensch+en+menge* 'crowd' and *Affe+n+theater* 'charade'. Historically, *-(e)n-* emerged from the genitive singular or plural of the weak declension class. In most cases, *-(e)n-* is paradigmatic, i.e. it attaches to weak nouns of all three genders.[10] There are, however, a few examples where *-en-* occurs non-paradigmatically, but only in such cases when former weak nouns moved to another class maintaining their original linking element. This is true

---

[9]Only some feminines such as *Hilfe* 'help', *Geschichte* 'history', *Liebe* 'love', *Herberge* 'hostel' create exceptions by taking *-s-*: *Hilf+s+verb* 'auxiliary verb', *Geschicht+s+buch* 'history book', *Liebe+s+beweis* 'proof of love', *Herberg+s+vater* 'hostel warden'.

[10]According to Ortner and Müller-Bollhagen (1991:91), 73 % of the *-(e)n-* elements attach to feminines, 24 % to masculines, and 3 % to neuters.

for *Hahn* 'cock' (as well as for *Storch* 'stork', *Schwan* 'swan') which entered the strong *i*-class by forming the current umlaut plural *Hähne* instead of the previous MHG form, *hanen* 'cocks'. As a first constituent, *Hahn* still preserves the original, now non-paradigmatic *en*-linker: *Hahn+en+kamm* 'cockscomb', *Hahn+en+kampf* 'cockfight' etc. However, the non-paradigmatic *-(e)n-* is not productive, since it does not spread to new first constituents. This is shown by the arrows in Fig. 2: The productivity of *-(e)n-* is linked to paradigmaticity.

There is, however, as already mentioned, one exception where *-en-* rather often has plural reading. It can be added to monosyllabic or polysyllabic final-stressed weak feminines only when the plural interpretation is allowed.[11] If the plural reading is inadequate, another linking element, mostly *-s-* or zero, has to be chosen: *Schrift+en+verzeichnis* 'publication index', but *Schrift+Ø+führer* 'reporter'; *Geburt+en+kontrolle* 'birth control', *Geburt+en+überschuss* 'birth surplus', but *Geburt+s+tag* 'birthday', *Geburt+s+haus* 'birthplace'. Further plural examples are *Rarität+en+handel* 'rarity bargain', *Zeit+en+folge* 'sequence of tenses', *Tat+en+drang* 'zest for action', *Zweipartei+en+staat* 'two parties state',[12] *Priorität+en+katalog* 'checklist of priorities' etc. In our corpus of doubtful cases there is one interesting example which emphasizes this problem, *Unterschrift(+en+? /+s+?)aktion* 'petition, signature collection': As there are many signatures involved, it seems to be more appropriate to choose *Unterschrift+en+aktion*. This is attested by a Google search (17.02.2010): *Unterschrift+en+aktion* clearly dominates with 165,000 (95 %) hits compared to *Unterschrift+s+aktion* with only 8,570 (5 %) hits. Sometimes, (monosyllabic) masculines and neuters also have to be analyzed as plurals, but not as obligatorily as the feminines: *Staat+en+bund* 'confederation' (but *Staat+s+geheimnis* 'state secret'), *Strahl+en+belastung* 'radiation exposure', *Bett+en+zahl* 'accomodation capacity' (but *Bett+Ø+tuch* 'bed sheet'). Until now, it has not been resolved whether the plural interpretation is old (<genitive plural ending) or new (<reanalysis). In any case, this behaviour of the marker *-en-* speaks against an advanced stage of development towards a pure linking element: Linking elements should be free of inflectional information.

All in all, these two linking elements, *-(e)n-* and *-en-* after feminines, which appear to belong together at first sight, have to be separated. Thus, in Fig. 2, *-(e)n-* (gender-independent) and *-en-* (after feminines with final stress) are located on different positions. Once again, the difference becomes evident in Fig. 3 where the arrow shows that *-en-* is always linked to plural.

3.3 The linking element *-er-*

This linking element is always paradigmatic (i.e. bound to gender and declension class of its inflectional source), partly productive and often associated with plural meaning, although there are many counterexamples such as *Hühn+er+ei* 'hen's egg' *Kind+er+auge* 'child eye', *Männ+er+kopf* 'man's head', *Rind+er+braten*

---

[11]There are only very few exceptions like *Frau* 'woman'.

[12]By contrast, other genders and declension classes do not use the plural form despite plural reading: *Dreigang+fahrrad* 'three gears bicycle', *Dreigenus+system* 'three gender system'.

'roast beef'. However, *-er-* is not only often interpreted as a plural but even alternates with other linking elements with singular reading, e.g. *Völk+er+kunde* 'ethnology' vs. *Volk+s+kunde* 'folklore', *Brett+er+verschlag* 'board partition' vs. *Brett+Ø+spiel* 'board game', *Hörn+er+klang* 'sound of bugles' vs. *Horn+Ø+haut* 'horny skin', *Wört+er+buch* 'dictionary' vs. *Wort+Ø+geschichte* 'etymology', *Güt+er+transport* 'carriage of goods' vs. *Gut+s+herr* 'laird'. The most obvious plural cases are those with a kind of pseudosuffix, i.e. nouns already ending in *er* but taking plural umlaut such as *Väteraufbruch* 'organization of single fathers fighting for their parental rights', *Töchterschule* 'girls' school', *Müttergenesungsheim* 'rest centre for mothers'. Strictly speaking, they do not belong to the *er*-plural class—they only look like them—but they show that clear plurals as first constituents are possible.

Ortner and Müller-Bollhagen (1991) point out that first members with linking *-er-* often indicate concrete, countable entities whereas mass nouns are usually unlinked: This holds for *Hörn+er+klang* 'sound of bugles' vs. *Horn+Ø+haut* 'horny skin', and also for *Kräuterfrau* 'herb woman' vs. *Kraut+Ø+salat* 'coleslaw', *Gläs+er+schrank* 'drinks cabinet' vs. *Glas+Ø+schrank* 'glass cupboard' etc.

3.4 The linking element *-e-*

As already pointed out, the linking *-e-* is in most cases a former genitive plural suffix. Only after (historically) short stems such as *Tag* can it be traced back to a primary suffix: *Tag+e+werk* 'daily task', *Tag+e+löhner* 'peon' (see Sect. 2.1). Here, it is completely unproductive (Fuhrhop 1996:541; Kürschner 2003:71f.). Due to their different origin, both *e*-linkers have to be treated separately (see Fig. 2). Furthermore, *-e-* always occurs paradigmatically and continues an old genitive plural suffix if it follows a long stem. It occurs most frequently and even partly productively after monosyllabic nouns denoting animals: *Hund+e+futter* 'dog food', *Pferd+e+schwanz* 'pony tail', *Schwein+e+pest* 'swine fever'. If the plural of the underlying noun is formed with *-e+* umlaut (which does not apply to the above cases) the plural interpretation occurs in most cases: *Läus+e+pulver* 'poison against lice', *Städt+e+planer* 'town planner', *Gäst+e+buch* 'guestbook', *Ärzt+e+kongress* 'doctors' congress'. Thus, a difference has to be made between *-e-* deriving from a primary suffix (*Tag+e+werk* 'daily task'), and *-e-* (+ umlaut if possible) deriving from a plural (*Gäst+e+buch* 'guest book') (see Fig. 2). All in all, this linking element is of minor frequency and relevance.

3.5 The linking element *-es-*

We now turn to syllabic *-es-*. This is not a distributional complement to *-s-* anymore and thus not comparable to the behaviour of *-n-/-en-* or to the behaviour of *-(e)s* as a genitive ending. Therefore, the notation *[*]-(e)s-* is not justified. We now leave the domain of productivity: There is only a fixed number of about 30 nouns (masculines and neuters) that have to be linked with *-es-*: *Freund+es+* 'fiend', *Meer+es+* 'see', *Tod+es+* 'death', *Tag+es+* 'day', *Dank+es+* 'thank' etc. Most of these nouns dispose of different linking elements, depending on the second constituent, e.g. *Kind+es+missbrauch* 'child mistreatment, *Kind+s+kopf* 'silly person', *Kind+er+wagen* 'preambulator', *Kind+Ø+bett* 'puerperium'. Usually, only
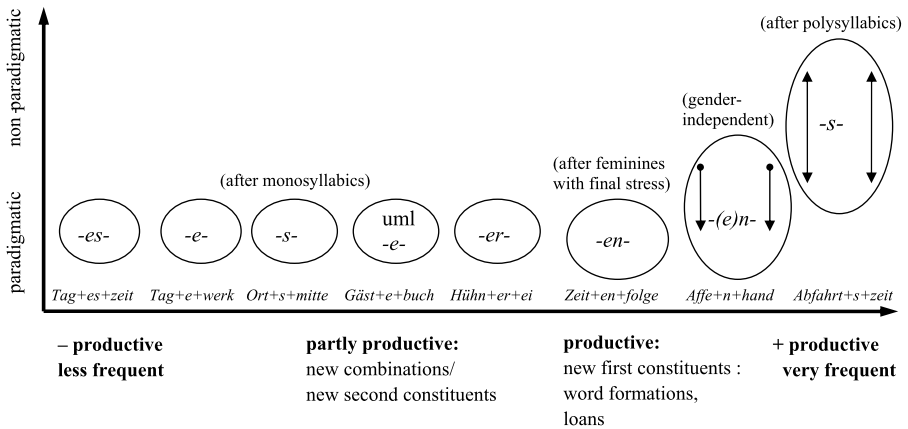
Fig. 2 Different degrees of the development of linking elements: (un)productivity and (non-)para-digmaticity

one of these elements enters new compounds. Here, it is the composition stem form *Kind+er+*: nonsense compounds such as *Kind* 'child' + *Dach* 'roof' would become *Kind+er+dach*. Thus, many of these compounds with linking *-es-* are lexicalized and not productive anymore.[13] Completely lexicalized compounds are: *(um) Haar+es+breite* 'by a hair', *Eis+es+kälte* 'iciness', *Arm+es+länge* 'arm length' (besides *Arm+Ø+länge*), *Grab+es+stille* 'silence of the grave'. Since today *Haar* and *Arm* form their genitive with non-syllabic *-s*, the linking element *-es-* is a kind of non-paradigmatic element.

3.6 The linking element *-(e)ns-*

The most peripheral, unproductive linking element is *-(e)ns-* which attaches to very few nouns, e.g. *Schmerz+ens+geld* 'solatium' (the genitive of *Schmerz* 'pain' is *Schmerz-es*), *Mensch+ens+kinder* 'Jesus! (exclamation)' (the genitive of *Mensch* 'man' is *Mensch-en*). Some nouns changing from the weak into another declension class sometimes take *+ns+*, e.g. *Name+ns+tag* 'name day'. Due to its low relevance, *-(e)ns-* will not be considered here anymore.

3.7 Overview: different degrees of evolution towards linking elements

In the preceding Sects. 3.1 to 3.6, it has been shown that every linking element has its own behaviour, its own grammar and functional load, and its own history. This is summarized in Figs. 2 and 3.

In Fig. 2, linking elements are located on a scale showing their stage of development towards pure linking elements. Fully developed linking elements are highly productive, devoid of inflectional meaning, and they are not restricted to the inflectional

---

[13] There are some very rare exceptions, e.g. *Kind+es+* can be used in new compounds denoting crimes against children such as *Kind+es+entführung* 'child kidnapping' (Becker 1992).
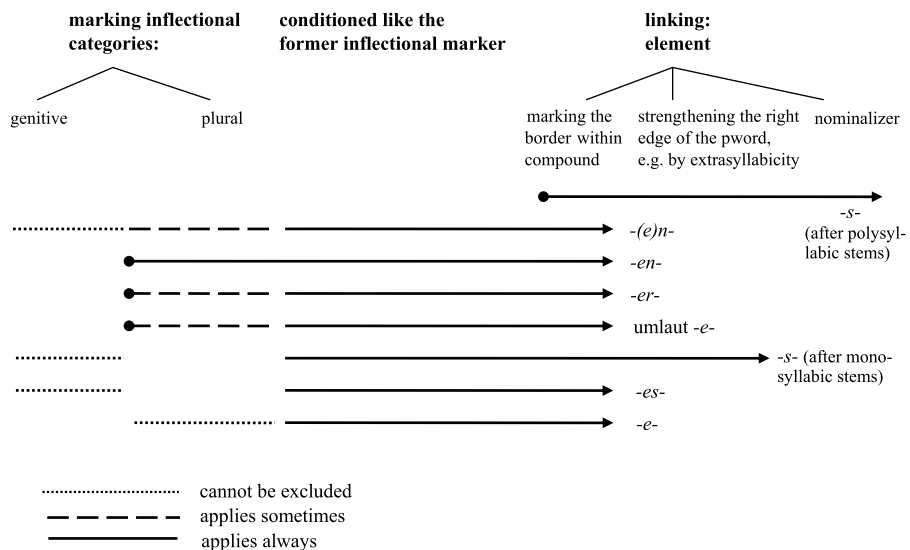
marking inflectional categories:

conditioned like the former inflectional marker

linking: element

genitive   plural

marking the border within compound

strengthening the right edge of the pword, e.g. by extrasyllabicity

nominalizer

-s- (after polysyllabic stems)

-(e)n-

-en-

-er-

umlaut -e-

-s- (after monosyllabic stems)

-es-

-e-

.... cannot be excluded
— — — — — — applies sometimes
—————— applies always

Fig. 3 Different degrees of dissociation between inflectional suffix and linking element

classes and gender of their sources anymore, i.e. they occur both paradigmatically and non-paradigmatically. These criteria are best fulfilled by -s- on the rightmost side in Fig. 2 which in most cases occurs non-paradigmatically, followed by -(e)n- which usually but not always occurs paradigmatically. The linking -en- (after feminines with final stress) still has an additional function of expressing plural meaning (possibly a result of remotivation). It becomes clear that all the remaining linkers are still bound to their former grammar as inflectional suffix, and that they are not productive in the narrow sense anymore: They never attach to new first constituents.

Moreover, Fig. 3 focuses on the conservative behaviour of each linking element inherited from the former inflectional suffix (and refrains from the question of productivity). Every arrow represents the functional spectrum of the corresponding linking element described above. Thus, the evolution of every particular linking element is shown by considering (1) its former function (is it still able to be interpreted as genitive or plural marker?), (2) its distribution (does it still obey the former assignment principles?) and, (3), its function(s) as linking element (does it only mark the border within compounds, does it furthermore strengthen the right edge of the word, or does it even act as nominalizer?). It becomes obvious that only -s- (after polysyllabic stems) has completely detached from the older state as inflectional suffix. It is neither able to mark an inflectional category nor is it conditioned like the former inflectional ending. However, what is most important is the fact that besides marking the border within compounds, it always strengthens the right edge of the pword (*Ankunft+s+zeit* 'arrival time') and it even serves as a nominalizer in cases where it follows obligatorily nominalized infinitives: *Leben+s+mittel* 'food' or first constituents in synthetic compounds: *Krieg+s+führung* 'warfare'.

All the other linkers still follow the old distribution rules, i.e. they are still conditioned like the former inflectional markers, which makes a big difference. Sometimes,

they can even mark inflectional information such as plural or genitive, at least in some cases (indicated by the dotted arrows). The plural interpretation holds for *-en-* (after weak feminines with final stress) and, sometimes, for *-er-* and *umlaut/-e-*. The arrows clearly indicate that these linking element are not as far developed as others. Most linking elements are stuck between both morphological domains, some closer to inflectional markers, others closer to linking elements.

Finally, a look at the precise distribution of the linking elements reveals a further case of language change, the downgrading of the assignment principles. There is a wide range from lexical to prosodic and phonological assignment rules or from idiosyncratic (bound to the lexeme) to formally driven (easily deducible) rules. The exact hierarchy of conditioning levels is the following:

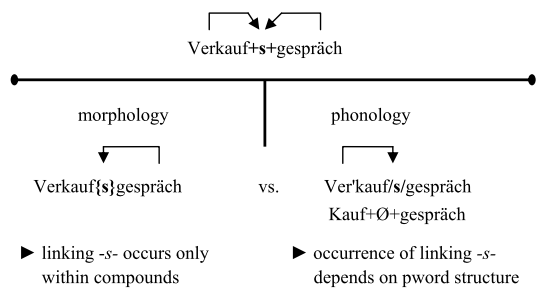lexeme > inflectional class > gender > semantics > morphology > prosody > phonology.

The more formal the conditioning principle, the simpler and the more accessible it is to the speaker. It is easier to deduce a linking element from the prosodic shape of the first constituent than, e.g. from its gender (which does not appear on the surface) or from its inflectional class membership. During language change, the assignment rules often become more formal and thus simpler, they are down-graded (Kürschner 2008; Dammel 2010; Dammel et al. 2010). This can be demonstrated by the English plural suffix *-s* whose three allomorphs today only depend on the final sound of the corresponding word. Looking at Fig. 3, it becomes obvious that the distribution of the most developed linking *-s-* is the most formalized one: It can be directly deduced from the form of the first constituent and therefore has most detached from the former assignment levels, above all from gender and declension class. All in all, the winner of this evolution is *-s-*. The linker *-(e)n-* comes in second place because of its dependence on the prosodic shape of the constituent. However, in contrast to *-s-*, *-(e)n-* is strictly bound to weak nouns (inflectional class). The linkers *-er-*, *-es-* and *-e-* are furthermore bound to gender (all to non-feminines), whereas *-e-*/umlaut is restricted to (strong) feminines.

4 A case of grammaticalization?

Regarding both sources of linking elements, primary suffixes and inflectional endings, their diachronic development comprises two layers. In OHG, the first layer came into existence. After ongoing formal development, it dwindled to the MHG *e*-linker. Already unproductive, this linker had more or less a residual character in MHG. Interestingly, already in MHG, the proper compounding stems with *e*-linkers could be replaced by improper forms (see the beginning of Sect. 2). The ENHG development of linking elements out of inflectional endings can be analyzed as a case of formal renovation.

Both paths of development are not clear cases of grammaticalization, as their target domain is not inflectional morphology, but word-formation. The first path leads from derivational suffixes > primary suffixes (for compounding) > linking vowels. Strictly speaking, this development comprises some semantic bleaching, but it does not leave

Fig. 4 The intermediate status of the linking -*s*- between morphology and phonology

Verkauf+**s**+gespräch

morphology   phonology

Verkauf{**s**}gespräch   vs.   Ver'kauf/**s**/gespräch
Kauf+Ø+gespräch

▶ linking -*s*- occurs only within compounds   ▶ occurrence of linking -*s*- depends on pword structure

the domain of word-formation. More interesting is the rise of the second layer, because this path of development of linking elements includes a movement from inflection into word-formation. Instead of the expected development along the slippery grammaticalization incline towards the complete formal loss of highly grammaticalized inflectional suffixes, a kind of "climbing" the pathway into word formation can be stated. Nevertheless, this development cannot be put on par with degrammaticalization, nor with deinflectionalization (as one type of degrammaticalization, see Norde 2009), since the former inflectional suffix did not aquire a clear derivational function. Note that linking elements are devoid of lexical meaning. "Good" linking elements are highly (phonologically or prosodically) formalized means of compounding. Thus, the most developed German linking -*s*- exhibits an intermediate status between morphology and phonology: As shown in Fig. 4, -*s*- in *Verkauf+s+gespräch* 'sales conversation' is morphologically conditioned by the fact that it only occurs within compounds, i.e. the existence of -*s*- is bound to a further morphological constituent. At the same time, it is prosodically conditioned by the fact that *Ver'kauf* 'sale' has an unstressed prefix and thus is far from being a good pword (i.e. a trochee). Furthermore, the linking -*s*- makes the syllable with the final voiceless fricative more complex.

The development of the new layer of linking elements cannot be seen as a case of exaptation, either: According to Lass (1990, 1997), the concept of exaptation requires that, first, morphological material that lost its original function before gaining a new one has to have been "junk", i.e. useless, empty material. This is not the case with linking elements: It has been shown that they developed directly from inflectional endings, and the best evidence are those (unproductive) linking elements that still behave like inflectional endings, at least partly (see Figs. 2, 3). Even the very productive linking element -*(e)n*- is still bound to its former inflection classes and, partly, to gender.

Second, the adopted function has to be a new function. As shown in the first part of this article, there is an older layer of linking vowels deriving from primary suffixes of proper compounds. We therefore argue that the development from inflectional markers into linking elements is a clear case of reanalysis, which leads to renovation of an already-existing paradigm.

Interestingly, the development from inflectional markers to linking elements includes processes that are involved in grammaticalization (see Lehmann 1985, 1995, 2004):

- *erosion*: All linkers share to some degree the loss of former (inflectional) function. In the case of *-en-* after final-stressed feminines, however, the plural reading could also have been a secondary development (a kind of remotivation). All in all, linking elements are semantically eroded. In the development from the inflectional source, they undergo a continuous formalization of their assignment rules (from morphological to phonological conditioning).
- *condensation*: The structural size of the construction has been reduced from a genitive phrase being a part (and modifying the head) of the noun phrase down to a pure compounding stem within a word-formation product. Thus, the scope of these elements has been strongly reduced.
- *paradigmatization*: The new linking elements (<genitive endings) have joined the pre-existent paradigm of old linking elements (<primary suffixes) (MHG *e/-Ø*).
- *obligatoriness/obligatorification*: The (partially free) formal variation between short and long genitive singular *-s/-es* has been given up on their way towards the two linking elements *-es-* and *-s-*.
- *coalescence*: Linking elements exhibit a higher degree of coalescence than the inflectional endings. Koester et al. (2004) have shown that linking elements also differ prosodically from inflectional endings. Compound constituents are significantly shorter than homophonous simplex nouns, and they display a higher pitch.
- *positional adjustment*: In comparison with the positional variability of ENHG genitive modifiers, which could stay pre- and postnominal, a positional adjustment also can be stated. The reanalysis towards linking elements took place only in the prenominal position.

From a functional perspective, we can observe the development from morphology to phonology in the case of the second layer: Former inflectional suffixes expressing grammatical meaning changed into word-formation elements without grammatical meaning but serving a) to strengthen the right edge of the first constituent (this holds for *-s-*) and b) to guarantee a trochaic structure of the first constituent (this holds for *-(e)n-*). Thus, linking elements indicate the end of the first constituent.

However, linking elements form part of word formation and therefore are not the typical result of grammaticalization. Grammaticalizing elements should end in grammar.

5 Conclusion

The NHG system of linking elements (in noun–noun compounds) is a result of a very complex historical development. Generally, two sources were involved: (1) primary suffixes and (2) inflectional (genitive singular/plural) endings. Both morphologically and prosodically distributed OHG linking vowels have been reduced to MHG *-e/-Ø*. Subsequently, a new layer of linking elements out of inflectional endings led to a formal renovation of the almost obsolete old linking *-e-*. Today, only a few clear cases of the old *e*-linker can be posited (e.g. *Tag+e+buch*).

The functional diversity of the current linking elements is primarily due to the degree of evolution of inflectional endings toward linking elements. The resulting system includes: (1) unproductive, lexically distributed *-es-*, *-s-* (after monosyllabic

nouns), *-e-* and *-(e)ns-*, (2) partly productive *-er-* and *-e-* (+ *umlaut*), which are still associated with plural reading and depend on gender and inflectional class, (3) productive *-en-* after feminines with final stress, where the plural reading could also have been acquired secondarily, (4) productive, but mostly paradigmatic *-(e)n-* (the non-paradigmatic cases are unproductive), and (5) productive, non-paradigmatic *-s-*, which has developed the prosodic function of a pword marker and the morphological function of a nominalizer in synthetic compounds or, more precisely, in compounds containing constituents with a high degree of verbiness.

While the first layer of linking vowels is a clear development within the domain of word-formation, the second, new layer resembles grammaticalization, not only because of the continuant functional erosion, but also because of a scope reduction from a complex nominal phrase (syntactic unit) to a compound (morphological unit). Thus, the most developed linking element *-s-* applies within the word-formation domain as a prosodic means to optimize bad pwords. Its function therefore slipped down from morphology to phonology. In conclusion, most of the present linking elements are the result of a reanalysis leading to formal renovation of the already (i.e. since OHG) existing function.

References

Corpora

Middle High German Conceptual Database. http://www.mhdbdb.sbg.ac.at.
Titus (Thesaurus Indogermanistischer Text- und Sprachmaterialien). http://titus.uni-frankfurt.de.

Primary sources

Buoch = *Daz buoch von guoter spîse*. Digital version based on the digital editions by Thomas Glonig, 1994; 1996; 05.11.2001 (http://www.staff.uni-marburg.de/~gloning/bvgs.htm) and by Alia Atlas (http://cs-people.bu.edu/akatlas/Buch/recipes.html). Digital edition in Middle High German Conceptual Database (= GSP).

Eberh. = *Eberhard von Landshut*: *Kochbuch Meister Eberhards*. Ed by A. Feyl: Das Kochbuch Meister Eberhards. Freiburg i.B. 1963. Digital edition based on the digital edition by Thomas Gloning 1994; 1996; 05.11.2001. Digital edition in Middle High German Conceptual Database (= KME).

Ernst = *Herzog Ernst* (*B*). Ed. by Karl Bartsch. Wien 1869, pp. 13–186. Digital edition in Middle High German Conceptual Database (= ERB).

Kochb. = *Kochbuch aus dem Deutschen Orden*. Ed. by H. Gollub: Aus der Küche der deutschen Ordensritter. *Prussia 31* (1935), 118–124. The digital version based on the digital edition by Thomas Gloning, 7/99. Digital edition in Middle High German Conceptual Database (= KDO).

Lampr. Basl. = *Pfaffe Lamprecht: Basler Alexander*. Ed. by R. M. Werner. Tübingen 1881. Titus entry by S. Heine and D. Reichert. Titus version by Ralf Schlechtweg-Jahn and Jost Gippert, Bayreuth, 20.06.2001/Frankfurt, 19.4.2002/2.3.2003 <http://titus.uni-frankfurt.de/texte/etcs/germ/mhd/a_basler/a_bas.htm>

Lampr. Vor. = *Pfaffe Lamprecht: Basler Alexander*. Ed. by K. Kinzel. Hall 1884. Titus entry by S. Heine und R. Schlechtweg-Jahn. Titus version by Ralf Schlechtweg-Jahn and Jost Gippert, Bayreuth, 12.07.2000 / Frankfurt, 19.4.2002/2.3.2003 <http://titus.uni-frankfurt.de/texte/etcs/germ/mhd/a_vorau/a_vor.htm>

Nat. = *Konrad von Megenburg: Buch der Natur*. Ed. by F. Pfeiffer. Stuttgart 1861. Titus entry by K. Stoyanova. Titus version by Jost Gippert, Frankfurt a/M, 28.2.1998/21.6.1998/30.8.1999/3.10.1999/1.6.2000/2.3.2003 <http://titus.uni-frankfurt.de/texte/etcs/germ/mhd/konrmeg/konrm.htm>

Rud. = *Rudolf von Ems: Alexander*. Ed. by V. Junk. Stuttgart 1928/29. Titus entry by S. Heine und R. Schlechtweg-Jahn. Titus version by Ralf Schlechtweg-Jahn, Bayreuth, 14.06.2000/19.4.2002/ 2.3.2003 <http://titus.uni-frankfurt.de/texte/etcs/germ/mhd/a_rudolf/a_rud.htm>

Schleg. = *Rüdiger der Hünkhover: Der Schlegel*. Ed. by K. Grubmüller: Novellistik des Mittelalters. Märendichtung. Frankfurt/Main. 1996. Digital edition in Middle High German Conceptual Database (= SLG).

Trim. = *Hugo von Trimberg: Der Renner*. Ed. by G. Ehrismann. Tübingen 1908–1912. Digital edition in Middle High German Conceptual Database (= HTR).

Ulr. = *Ulrich von Eschenbach: Alexander*. Ed. by W. Toischer. Tübingen 1888. Titus entry by S. Heine und R. Schlechtweg-Jahn. Titus version by Ralf Schlechtweg-Jahn, Bayreuth, 19.8.1999/ 6.10.1999/1.6.2000/19.4.2002/2.3.2003 < http://titus.uni-frankfurt.de/texte/etcs/germ/mhd/a_ulrich/ a_ulr.htm>

Weltchr. = *Jans Enikel: Weltchronik*. Ed. by P. Strauch, Hannover 1891. Digital edition in Middle High German Conceptual Database by Ulrich Harsch (= JEW).

Secondary references

Aronoff, M., & Fuhrhop, N. (2002). Restricting suffix combinations in German and English: closing suffixes and the monosuffix constraint. *Natural Language & Linguistic Theory*, *20*, 451–490.

Baayen, H. R., Dressler, W. U., Krott, A., & Schreuder, R. (2007). Analogical effects on linking elements in German compounds. *Language and Cognitive Processes*, *22*(1), 25–57.

Becker, T. (1992). Compounding in German. *Rivista di Linguistica*, *4*(1), 5–36.

Brugmann, K. (1906). *Lehre von den Wortformen und ihrem Gebrauch: Vol. 2. Vergleichende Laut-, Stammbildungs- und Flexionslehre nebst Lehre zum Gebrauch der Wortformen der indogermanischen Sprachen*. Strassburg: Karl J. Trübner.

Busch, A., & Stenschke, O. (2007). In *Germanistische Linguistik*. Tübingen: Narr.

Carr, C. T. (1939). *Nominal compounds in Germanic*. London: Milford.

Dammel, A. (2010). *Konjugationsklassenwandel. Prinzipien des Ab-, Um- und Ausbaus verbalflexivischer Allomorphie in germanischen Sprachen*. Berlin: de Gruyter.

Dammel, A., Kürschner, S., & Nübling, D. (2010). Pluralallomorphie in den germanischen Sprachen: Konvergenzen und Divergenzen in Ausdrucksverfahren und Konditionierung. In A. Dammel et al. (Eds.), *Kontrastive germanistische Linguistik. Reihe "Germanistische Linguistik"* (pp. 587–642). Hildesheim: Olms.

Demske, U. (1999). Case compounds in the history of German. In M. Butt & N. Fuhrhop (Eds.), *Variation und Stabilität in der Wortstruktur. Untersuchungen zu Entwicklung, Erwerb und Varietäten des Deutschen und anderer Sprachen* (pp. 150–176). Hildesheim: Olms.

Demske, U. (2001). *Merkmale und Relationen. Diachrone Studie zur Nominalphrase im Deutschen*. Berlin: de Gruyter.

Donalies, E. (2003). *Hochzeitstorte, laskaparasol, elmas küpe, cow's milk, casa de campo, cigarette-filtre, ricasdueñas…*. Was ist eigentlich ein Kompositum? *Deutsche Sprache*, *31*, 76–93.

Eisenberg, P. (2006). *Grundriss der deutschen Grammatik. Das Wort* (Vol. 1). Stuttgart: Metzler.

Fuhrhop, N. (1996). Fugenelemente. In E. Lang & G. Zifonun (Eds.), *Deutsch-typologisch* (pp. 525–550). Berlin: de Gruyter.

Fuhrhop, N. (1998). *Grenzfälle morphologischer Einheiten*. Tübingen: Stauffenburg-Verlag.

Fuhrhop, N. (2000). Zeigen Fugenelemente die Morphologisierung von Komposita an? In R. Thieroff et al. (Eds.), *Deutsche Grammatik in Theorie und Praxis* (pp. 201–213). Tübingen: Niemeyer.

Gallmann, P. (1998). Fugenmorpheme als Nicht-Kasus-Morpheme. In M. Butt & N. Fuhrhop (Eds.), *Variation und Stabilität in der Wortstruktur* (pp. 177–190). Hildesheim: Olms.

Grimm, J. (1826). *Deutsche Grammatik. Zweiter Theil. Drittes Buch*. Göttingen: Dieterich.

Gröger, O. (1911). *Die althochdeutsche und altsächsische Kompositionsfuge mit Verzeichnis der althochdeutschen und altsächsischen Composita*. Zürich: Zürcher & Furrer.

Klein, W. P. (2003). Sprachliche Zweifelsfälle als linguistischer Gegenstand. Zur Einführung in ein vergessenes Thema der Sprachwissenschaft. *Linguistik Online*, *16*(4), 1–26.

Koester, D., et al. (2004). Morphosyntax, prosody, and linking elements: the auditory processing of German nominal compounds. *Journal of Cognitive Neuroscience*, *16*(9), 1647–1668.

Kürschner, S. (2003). *Fugenelemente im Deutschen und Dänischen – eine kontrastive Studie zu einem Grenzfall der Morphologie*. Freiburg (Internet. www.freidok.uni-freiburg.de/volltexte/1256/).

Kürschner, S. (2008). *Deklinationsklassenwandel. Eine diachron-kontrastive Studie zur Entwicklung der Pluralallomorphie im Deutschen, Niederländischen, Schwedischen und Dänischen*. Berlin: de Gruyter.

Lass, R. (1990). How to do things with junk: exaptation in language evolution. *Journal of Linguistics*, *26*, 79–102.

Lass, R. (1997). *Historical linguistics and language change*. Cambridge: Cambridge University Press.

Lehmann, Ch. (1985). Grammaticalization: synchronic variation and diachronic change. *Lingua E Stile*, *20*(3), 303–318.

Lehmann, Ch. (1995). *Thoughts on grammaticalization*. München: Lincom Europa.

Lehmann, Ch. (2004). Theory and method in grammaticalization. *Zeitschrift für germanistische Linguistik*, *32*, 152–187.

Norde, M. (2009). *Degrammaticalization*. Oxford: Oxford University Press.

Nübling, D. (2008). Was tun mit Flexionsklassen? Deklinationsklassen und ihr Wandel im Deutschen und seinen Dialekten. *Zeitschrift für Dialektologie und Linguistik*, *75*(3), 282–330.

Nübling, D., & Szczepaniak, R. (2008). On the way from phonology to morphology. German linking elements and the role of the phonological word. *Morphology*, *18*, 1–25.

Nübling, D., & Szczepaniak, R. (2009). *Religion +s+freiheit, Stabilität+s+pakt* und *Subjekt(+s+) pronomen*: Fugenelemente als Marker phonologischer Wortgrenzen. In P. O. Müller (Ed.), *Studien zur Fremdwortbildung* (pp. 195–222). Hildesheim: Olms.

Nübling, D., & Szczepaniak, R. (2011). *Merkmal(s?)analyse, Seminar(s?)arbeit* und *Essen(s)ausgabe* – Zweifelsfälle der Verfugung als Indikatoren für Sprachwandel. *Zeitschrift für Sprachwissenschaft*, *30*, 45–73.

Ortner, L., & Müller-Bollhagen, E. (1991). *Deutsche Wortbildung. Typen und Tendenzen in der Gegenwartssprache (Vol. 4). Substantivkomposita*. Berlin: de Gruyter.

Poitou, J. (2004). Prototypentheorie und Flexionsmorphologie. *Linguistik Online*, *19*(2), 71–93.

Schweikle, G. (2002). *Germanisch-deutsche Sprachgeschichte im Überblick*. Stuttgart: Metzler.

Sonderegger, S. (2003). *Althochdeutsche Sprache und Literatur. Eine Einführung in das älteste Deutsch. Darstellung und Grammatik*. Berlin: de Gruyter.

Szczepaniak, R. (2007). *Der phonologisch-typologische Wandel des Deutschen von einer Silben- zu einer Wortsprache*. Berlin: de Gruyter.

Szczepaniak, R. (2011). *Grammatikalisierung im Deutschen. Eine Einführung*. Tübingen: Narr.

Vennemann, T. (1988). *Preference laws for syllable structure and the explanation of sound change. With special reference to German, Germanic, Italian, and Latin*. Berlin: de Gruyter.

Wegener, H. (2003). Entstehung und Funktion der Fugenelemente im Deutschen, oder: warum wir keine *Autobahn haben. *Linguistische Berichte*, *196*, 425–458.

Wegener, H. (2005). Grammatikalisierung und De-/Regrammatikalisierung der deutschen Pluralmarker. In T. Leuschner et al. (Eds.), *Grammatikalisierung im Deutschen* (pp. 85–103). Berlin: de Gruyter.

Wegener, H. (2006). Statistical evidence for the role of phonology in the distribution and motivation of the linking element in *-s-* German. In *Pre-proceedings of the international conference on linguistic evidence, empirical, theoretical and computational perspectives*, Tübingen, 2–4 February 2006 (pp. 201–203). Tübingen: SFB 441.

Wegener, H. (2008). The regrammaticalization of linking elements in German. In E. Seoane & M. J. López-Couso (Eds.), *Theoretical and empirical issues in grammaticalization* (pp. 333–354). Amsterdam: Benjamins.

Wiese, R. (1996). *The phonology of German*. Oxford: Clarendon Press.

Wurzel, W. U. (1992). Morphologische Reanalysen in der Geschichte der deutschen Substantivflexion. *Folia Linguistica Historica*, *XIII*(1–2), 279–307.