Prosodic parallelism explaining morphophonological variation in German

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Abstract

Words in German show several instances of a seemingly optional schwa-zero alternation, both in relation with inflected forms as well as in the final position of stems and simplex words, as in *des Tag(e)s* 'the day, gen. sg.', or *gern(e)* 'gladly'. The present paper proposes that the (non-)appearance of schwa is partially governed by a hitherto unknown prosodic parallelism: the schwa-containing form (a branching trochaic foot) is preferred whenever a neighboring word is of the same trochaic shape; and vice versa: the schwa-less form is found adjacent to another monosyllabic form. In other words, adjacent feet are required to have identical structure, binary branching (bisyllabic) or non-branching (monosyllabic).

Large-scale corpora are used as the main source of evidence for the verification or falsification of the hypothesis. A diverse set of nouns and adverbs involving schwa-zero alternations were studied in appropriate phrasal contexts, both from present-day Standard German and from Early New High German. Based on comprehensive corpus counts, these phrases are tested for the hypothesis of prosodic parallelism. A series of chi square tests and a generalized linear model with mixed effects demonstrate statistically that the prosodic shapes of the target word and its adjacent form are not independent of each other. The focus of the paper is on empirical evidence for *Prosodic Parallelism* as a new type of prosodic constraint. The relevance of this constraint for the persistence of variation over a long period of time is discussed as well.

Keywords: prosody, German, language variation, grammar, morphophonology

1 Introduction – prosodic parallelism[1]

1.1 Overview

Words in present-day German may display a seemingly free schwa-zero alternation, both within

inflectional morphology as well as word-finally. In the case of nouns, schwa-zero alternation exists for stem-final schwa (*Tür(e)* 'door'), for dative singular forms of strong nouns (*Tag(e)* 'day, dat. sg.'), and for genitive singular forms preceding the suffix *-s* for the same noun class, as in *Tag(e)s* 'day, gen. sg.'. Other cases of such alternation are provided by predicative adjectives or adverbs, as in *gern(e)* 'gladly'. As in the noun cases mentioned above, both forms of this adverb may exist in the same register of the language without any semantic or grammatical difference between the two forms. These alternating word forms are often treated as instances of register-dependent variation or as instances of free variation between the presence and the absence of the vowel schwa, but this view ignores the fact that the variation exists even in the standard language.[2] For the alternating genitive noun forms, preferred options have been stated in terms of the number and types of final segments of the noun stems, see section 3 for more discussion. In the orthography of present-day Standard German, the vowel schwa ([ə]) is faithfully represented by the letter <e>. For this reason, we present example forms orthographically, with the understanding that <e> in final syllables represents a possible schwa vowel.

For such schwa-zero alternations, the present paper proposes that the (non-)appearance of schwa is partially governed by a (to the best of our knowledge) hitherto unnoticed prosodic parallelism: the schwa-containing form (a branching trochaic foot) is preferred whenever a neighboring word (preceding or following) is of the same trochaic shape; and vice versa: the schwa-less form is found adjacent to another monosyllabic form. In other words, adjacent feet have identical structure, binary branching (trochaic) or not. The present paper will introduce and defend the parallelism hypothesis by a corpus-based study of the three grammatical phenomena mentioned above.

Put in a wider context, the phenomenon of schwa-zero alternation in German relates to three more general questions: first, how to treat the vowel schwa and its alternations with "zero" in the phonology of German; second, how to analyze the factors responsible for synchronic variation found for this vowel; and thirdly, how to model the course of diachronic variation in historical sound change. For the first question, different answers have been given in the pertinent literature. Schwa is either treated as a vowel (phoneme) to be reduced or deleted under specific circumstances (see (Wurzel, 1981), (Kloeke, 1982)), or as a vowel of epenthesis (see (Giegerich, 1987), (Wiese, 1988, chap. II), (Hall, 1989, p. 810) and later works).[3] The second question

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[2] To present just one example: DUDEN – Deutsches Universalwörterbuch (2001) lists a number of adjectives with a final schwa-zero alternation, such as *bang(e)* 'scared' or *träg(e)* 'dull'. Some, but not all, of them are assigned to a special register. For more examples, see (15).

[3] For final schwa representing a morpheme, Wiese (1988, 159ff.) discusses the possibility that an abstract phonological slot surfaces as schwa by means of feature insertion.

addresses the schwa-zero alternation as a case of either free variation or of complementary distribution, and is discussed for the alternation found in the genitive singular of particular nouns in section 3 below. For the third question, the basic fact to be accounted for is that the schwa-zero variation has existed over a long period of time (see section 5 for evidence), and does not seem to be disappearing, although there is a well-known tendency for schwas derived from (roughly) the Middle High German period to be deleted over time. Finally, we note that the addition of schwa always implies the addition of a syllable, and, furthermore, an unstressed one. This opens the perspective towards a prosodic analysis of the schwa-zero alternation: this alternation is not so much about the absence or presence of a vowel segment, but about the presence or absence of an unstressed syllable.
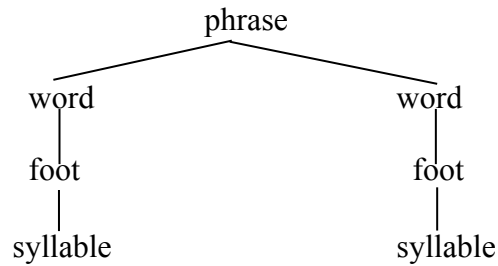
1.2 Prosodic parallelism

We assume that prosodic features and categories are part of the hierarchical prosodic structure as defined by phonological theory (Nespor and Vogel, 1986). Prosodic categories of particular importance for the present analysis are the syllable, the foot, the phonological word, and the phonological phrase. These categories are arranged in a hierarchical order, with the phrase dominating the word, the word dominating the foot, and the foot dominating the syllable. [4] Let us further assume that each mother node may dominate either one or two subordinated nodes, as illustrated in (1). Parallelism then is defined as the identity of two sister nodes in terms of unary or binary branching.

(1)   Prosodic parallelism

a. parallel branching structures in adjacent feet

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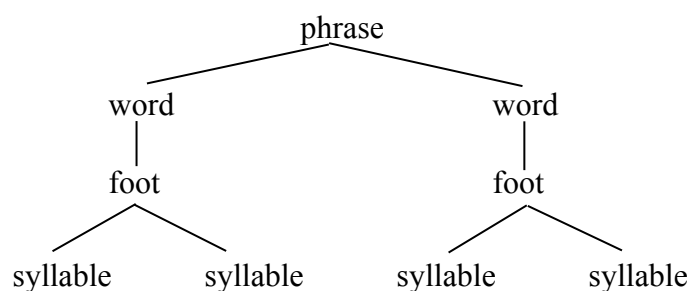
[4] Beyond these basic structures, there are some complications: can categories such as the phrase or the word be recursive (self-embedding, violation of strict layering); are there reasons to assume a clitic group between the word and the phrase, etc.? A possible skipping of units is another issue of debate in the theory of prosodic phonology.

b. parallel non-branching structures in adjacent feet

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                    phrase
          ┌───────────┴───────────┐
        word                     word
          │                        │
        foot                     foot
          │                        │
      syllable                 syllable
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The present proposal claims that parallel structures of the type illustrated here are preferred over non-parallel ones in which one unit branches and the adjacent one does not. Another way of formulating the hypothesis is the following: a form which is invariably (non-)trochaic causes another form in the same dominating category (the phrase) to be (non-)trochaic as well.

Obviously, this parallelism cannot always be obeyed: a monosyllabic foot or word may well be combined with a disyllabic one; as in *sehr langsam* 'very slow'. But whenever there is a choice, parallelism as defined above is the preferred option. In the grammar of German, the optional appearance of schwa in the final syllable of a word provides exactly such a choice. Thus, the parallelism proposed here will be confirmed in the present paper by a series of corpus studies and statistical analyses of the results drawn from the corpora. Prosodic parallelism relies on schwa-zero alternations and exists alongside other factors governing the (non-)appearance of schwa in the four major cases under consideration below. The parallelism also necessarily is of a gradual nature. Given the variety of contexts in which prosodic parallelism appears, we argue that the phenomenon is not confined to a particular morphological construction, such as article-noun combinations in the genitive singular. After having demonstrated the existence of prosodic parallelism, we will discuss its grounding in rhythmic preferences in section 7.

First, we present a brief analysis of stem-final schwa in *Tür(e)* 'door' and *Hirt(e)* 'shepherd' (section 2). Next, the genitive suffix allomorphs *-(e)s* will be studied for a range of nouns in section 3, before various instances of stem-final *-e* in predicative adverbs or adjectives are discussed in section 4. Examples from earlier periods of the German language are presented in section 5, and apparent or real counterexamples to the hypothesis are discussed in section 6. General conclusions for phonological and morphological descriptions and for the interpretation of diachronic variation are drawn in section 7.

For all cases to be studied below, the forms with and without schwa are well-formed in principle. Therefore, categorial judgements on grammaticality will not be adequate in most cases. Instead, preferences and numerical tendencies exist, which can be analyzed statistically. For such

tendencies, large-scale corpora are the main source of evidence for the verification or falsification of the hypothesis. For the present study, the DeReKo corpus was us ed ("Deutsches Referenzkorpus 2011-II ", 2011) for searches performed on Modern High Ge rman, using the Cosmas II interface, and, for Early New High German, the ("Bonner Frühneuhochdeutsch - korpus," 1972). The DeReKo corpus is a collection of present-day written German, consisting mostly (though not exclusively) of newspaper articles from the second half of the 20 [th] century. It contains more than 5,000,000,000 orthographic words and is accessible via a web interface; the present searches were conducted in the period from August to November 2011, using the full set of accessible sub-corpora of written German. The *Bonner Frühneuhochdeutschkorpus* constitutes a digitally available database of Early New High German. The corpus contains 40 documents from ca. 1350 to 1700, covering 10 dialect regions and containing ca. 480.000 lexical items; see (Fisseni, Schmitz, and Schröder, 2007).

2 Stem-final schwa in *Tür(e)* and *Hirt(e)*

As an introductory case, consider the schwa-zero alternation in the noun *Tür(e)* 'door'. German nouns include a few items in which the vowel schwa ([ə]) may or may not appear, without any obvious change in grammatical or lexical-semantic status. Of these nouns, *Tür* is the one with the highest frequency. Other feminine nouns with final schwa-zero alternation are rare; *Müh(e)* 'effort' and *Stirn(e)* 'forehead' are the best additional examples, but with much lower text frequency and a strong preference for one of the forms, namely *Mühe* and *Stirn*. Alongside these feminine nouns, there are some masculine nouns such as *Hirt(e)* 'shepherd` and *Käs(e)* 'cheese'.[5] Here, it is invariantly the form with schwa that appears more often, but as with the feminine examples, the schwa-less variant does occur in present-day Standard German, although more rarely. Even if there are clear preferences for the use of the schwa-less form, both versions are possible in present-day Standard German and do exist, as we will show below. An anonymous reviewer brought another striking pair of compounds to our attention: the highly lexicalized form *Weil(e)* 'while, n.' is usually schwa-final, as is the compound *Langeweile* 'boredom', with two, and thus parallel, schwa-final parts. However, the compound *Kurzweil* 'disport' demonstrates the parallelism with two monosyllabic parts. In these compounds, the two antonymous adjectives and the noun *Weile* conspire in achieving parallelism.

As with any feminine noun in the singular, *Tür(e)* can be preceded by either the definite article

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[5] Many speakers of German consider *Käs* to be a dialectal form, but examples outside of dialectal use are actually easy to find; consider the well-known dish named *Handkäs mit Musik* 'cheese with vinegar and onions'. The compound *Handkäs* itself, containing two monosyllabic stems, incidentally provides another example for the parallelism: non-parallel *Handkäse* is much rarer.

die ('the', nom./acc. sg.) or *der* ('the', gen./dat. sg.), or by the indefinite article *eine* ('a', nom./acc. sg.) or *einer* ('a', gen./dat. sg.). These article-noun combinations are instances of the prosodic structures presented in (1): they are both phonological words, and they together build a phonological phrase. Reduced forms of articles are possible, but articles in German in most cases contain full vowels within one stressed syllable. For this reason, we also consider the articles studied here and in the following to constitute phonological words of their own. The possibility of reduction often exists, but it is not the norm for Standard German. We therefore assume that the written texts studied have an intended reading using non-reduced articles and other function words (for studies of such "intended prosody" in written language see also Bader (1998), Ashby and Clifton 2005).

For these article-noun combinations, we are thus able to make a very specific prediction on the basis of the proposed prosodic parallelism: monosyllabic *Tür* should be preferred with monosyllabic articles *die/der*, while bisyllabic *Türe* should be preferred with bisyllabic articles *eine/einer*. Note that the article forms are invariable, while the following noun may vary. The possible patterns are displayed in table (2), with the sequences predicted to be preferred highlighted in bold.

(2)　　Preferred and non-preferred article-noun sequences for *Tür(e)* 'door'

		Trochaic noun	
		no	yes
Trochaic article	no	**die/der Tür**	die/der Türe
	yes	eine/einer Tür	**eine/einer Türe**

We tested the prediction by a comprehensive search in the DeReKo corpus and by a statistical analysis based on the absolute frequencies found there. Fortunately for our purposes, all plural forms of this noun are *Türen*, so we can be sure to have covered all (correct) article-noun combinations in the singular by searching for *die/der Tür(e)* 'the door, nom., acc./dat./gen. sg.' and *eine/einer Tür(e)* 'a door, nom., acc./dat./gen. sg.'. Table (3) presents, as the first information in the cells, the absolute frequencies of article-noun combinations (percentages in brackets) for this lemma including their sums across rows and columns. This table thus shows that the overall frequency of schwa-less *Tür* is much higher than that of schwa-containing *Türe*, and that this noun also occurs much more often with the schwa-less definite article forms than with the indefinite articles, which contain final schwa. But all combinations are attested in the DeReKo corpus.

(3) Frequencies for *die/der/eine/einer Tür/Türe* 'the/a door' in the DeReKo corpus, depending on two variables

		Schwa in *Tür*		Σ
		no	yes	
Schwa in article	no	79,503 (90.9) 79,421.48	7937 (9.1) 8018.52	87,440
	yes	5143 (89.4) 5224.52	609 (10.59) 527.48	5752
Σ		84,646	8546	93,192

The cells of this table and of most tables to follow contain, first, the absolute frequencies found for the particular condition plus the sums (Σ) across rows or columns, second, the row percentages for these frequencies, and, third, the *expected* counts for the cells given the sums across rows and columns. The deviations between these expected counts and the observed counts (such as the difference between 609 observed cases vs. 527.48 expected cases in the last cell of (3)) are crucial for the statistical test to be performed next.

The question to be asked is whether schwa-less *Tür* and schwa-containing *Türe* divert in a significant way from the distribution expected from the sum frequencies found across rows and columns. These frequencies are not at all similar, as table (3) shows: monosyllabic *Tür* is about 10 times as frequent than bisyllabic *Türe*, and the definite articles are about 15 times as frequent as the indefinite ones. However, all logically possible combinations exist with sufficient frequencies. One appropriate statistical test for testing the question of a systematic association (see (Bortz, 2005, chap. 5), (Backhaus, Erichson, Plinke and Weiber, 2006, chap. 4)) is the chi square test (also known as two-by-two contingency table analysis) testing whether the outcomes of a distribution are independent of each other.[6] For the data in (3) the test reveals (with Pearson's $\chi^2 (1)=14.784$, p>.000121) that the frequency distribution very likely is not a chance distribution: the two variables (article form, noun form) are probably not independent of each other, because the pairings *die/der Tür* und *eine/einer Türe* occur with higher-than-to-be-expected frequencies, with the row and column frequencies as a given.

For one noun at least, we have thus demonstrated that the prosodic parallelism hypothesis has some plausibility; the combinations predicted by the hypothesis are indeed preferred. Of course, this might be a result confined to this lexical item alone, and therefore more relevant cases need to be considered.

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[6] One condition for the adequate use of the chi square test is that the expected frequency in each cell is ≥ 5. With the large corpora used in the present study, this condition is met here as well as in all tests to follow.

With masculine nouns, the test has to be modified slightly. The most frequent of these nouns is *Hirt(e)* 'shepherd'. *Hirt(e)* is a weak noun for which all forms except for the Nom. Sg. are ending in *–en, i.e., Hirten*. As these forms show no variation – the ending is usually pronounced as a syllabic [n] in German – we have to confine ourselves to the nom. sg. In this form, there is no article alternation: both the definite and the indefinite article are monosyllabic (*der Hirt(e) – ein Hirt(e)*). We can, however, replace the definite article by an adjective with strong endings, thus making sure that the adjective occupies the same syntactic position as the article. Adjectives in attributive function – that is, within an NP – cannot be shorter than two syllables, because their inflection invariably adds a schwa syllable. Therefore they constitute a potential test case.

If we confront the forms *der Hirt(e)* 'the shepherd' with *guter Hirt(e)* 'good shepherd', the following patterns are possible (Table (4)), with the ones expected from prosodic parallelism again highlighted in bold.

(4) Preferred and non-preferred modifier-noun sequences for *Hirt(e)* 'shepherd'

		Trochaic noun	
		no	yes
Trochaic article/adjective	no	**der Hirt**	der Hirte
	yes	guter Hirt	**guter Hirte**

The frequency counts based on the DeReKo corpus in Table (5) reveal that, although the form with schwa is preferred across the board, the preference is more salient in the case of the trochaic adjective-noun combination. Thus we can see here the same effect as with *Tür(e)* above.

(5) Frequencies for *Hirt(e)* 'shepherd', depending on two variables

		Schwa in *Hirt(e)*		Σ
		no	yes	
Schwa in article/adjective	no	101 (23.2) 88.43	334 (76.8) 346.57	435
	yes	23 (13.1) 35.57	152 (86.9) 139.43	175
Σ		124	486	610

Although not as many examples as for *Tür(e)* can be found in the DeReKo corpus, the frequencies are sufficient for conducting a chi square test. With Pearson's $\chi^2(1)=7.822$, we arrive at p>.005, which is also a highly significant result, that is, one which is most likely not due to a distribution in which the two variables behave independently of each other. Furthermore, inspection of table (5) shows the predicted combinations to be more frequent than expected

(compare, for example, 101 tokens for *der Hirt* in the first cell to 88.43 expected ones). Again, prosodic parallelism is at work in the selection of alternating noun forms given a particle article form.

3 Schwa in genitive singular nouns

Present-day German displays schwa-zero alternation in the genitive singulars of strong nouns, i.e., in the suffix *-(e)s*. Strong nouns are nouns which take *-(e)s* as a marker for the genitive singular and *-e* or *-er* as a plural marker. They are all of masculine or neuter gender. In its comprehensive description, the Duden grammar (*Duden, die Grammatik*, 2009, chap. 1.5.2.1) summarizes the factors for the two forms *-s* and *-es* and the constraints, identifying lexical-semantic and phonological factors (segmental as well as prosodic) determining the choice of the allomorphs, and suggesting that non-native words tend to show a stronger preference for schwa-less forms. The Duden grammar, among others, states a few cases in which *-es* and *-s* are in strict complementary distribution, as given in (6).[7]

(6)   Allomorph *-es*

    a. after stem-final /s, z, ts/ in stressed syllable:

    Kusses, Hauses, Witzes; Kompromisses, Reflexes; Scherzes, Kommerzes

    'kiss, house, joke; compromise, reflex, gen. sg.'

(7)   Allomorph *-s*

    a. immediately after a full vowel:[8]

    Tempos, Taxis, Kaffees, Büros 'tempo, taxi, coffee, office, gen. sg.'

    b. after a reduced syllable:

    Gartens, Atems, Lehrers, Segels 'garden, breath, teacher, sail, gen. sg.'

    c. after a number of suffixes, including *-chen, -lein, -ling, -tum, -ig*:

    Mädchens, Bächleins, Lehrlings, Reichtums, Königs

    'girl, brook, apprentice, wealth, king, gen. sg.'

    d. after proper nouns:

    Merkels, Berlins, Rheins 'proper names, gen. sg.'

In many other cases, however, there is considerable variation between the two allomorphs, with words showing both forms, and it is of course these words which are in the focus of the present

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[7] In /s/-final syllables which are itself unstressed, suffix *-s* is left out: *(des) Zirkus, Zyklus, Rhythmus* (see (*Duden, die Grammatik*, 2009, p. 196)).

[8] With monosyllabic nouns, *-es* is rare, but possible: *Rehes*, *Strohes*.

study. (Szczepaniak, 2010) presents a corpus-linguistic analysis (also based on the DeReKo corpus), in which she considers vowel quality, sonority of final consonant, and number of final consonants as segmental factors governing the relative frequencies for the genitive ending allomorphs for simplex monosyllabic nouns. In spite of the historical move towards the short allomorphs (-*s*), the overall frequency for simplex nouns with this genitive marker is 37% only. Szczepaniak also demonstrates that increasing morphological complexity (such as with compound nouns) leads to an increase in the number of -*s* allomorphs, although again with a large amount of variation.

A further recent analysis, also corpus-based, by (Fehringer, 2011) focusses on the role of lexicalized entries and patterns derived from the lexical relations between words. Fehringer demonstrates that a number of interacting factors contribute to the choice of the -*(e)s* allomorphs: phonological properties of the final consonant (such as sonority and number of consonants), morphology, and degree of semantic transparency of a compound all result in preferences for one or the other allomorph. But furthermore, such factors are modulated by the frequency of the respective noun, with nouns of either very low or very high frequency often violating the patterns valid otherwise. Therefore, she takes her results as evidence for a "wholesale lexical listing of genitive forms in the lexicon" (p. 90). (Fehringer, 2011, p. 98) also rejects any prosodic explanations for the allomorph distribution: "Nor can the choice of suffix be explained in terms of sentence prosody, as both allomorphs occur within the same prosodic environments." The results of the present paper cast some doubt upon this rejection of a supralexical prosodic influence, as prosodic environments, though not sentence prosody, are argued to exert some influence.

The analysis to follow will be based on monosyllabic strong nouns alone, i.e., nouns with masculine and neuter gender, as feminine nouns never receive -*s* as a marker for genitive singular, and as nouns with a reduced second syllable (*Segel* 'sail', *Ruder* 'rudder') never adopt the -*es* allomorph, as stated above in (6). Within this set of strong nouns, we will present a more comprehensive and advanced statistical analysis.

The basic hypothesis of this paper as applied to genitive forms predicts that a genitive noun should be found in a monosyllabic form with immediately preceding words also being monosyllabic. As with the noun *Tür(e)* studied in section 2, this can be tested with different article-noun combinations: using the highly frequent noun *Tag* 'day' as an introductory example, (8) shows *des Tags* and *eines Tages* to be the expected forms, while the other two combinations are not.

(8)   Preferred and non-preferred article-noun sequences

		Trochaic noun	
		no	yes
Trochaic article	no	**des Tags**	des Tages
	yes	eines Tags	**eines Tages**

A frequency search in the DeReKo database for the phrases in (8) yields the results given in (9), again showing large differences in the token frequencies of the combinations studied here. Yet, all possible combinations occur with a frequency large enough to serve as the basis for a comprehensive analysis.

(9)   Frequency table for *Tag(e)s* in the DeReKo corpus in combination with *des* and *eines*

		Trochaic noun		Σ
		no	yes	
Trochaic article	no	1682 (1.7) 1430.42	96,202 (98.3) 96,453.58	97,884
	yes	273 (0.8) 524.58	35,624 (99.2) 35,372.42	35,897
Σ		1955	131,826	133,781

A statistical analysis for this contingency table again demonstrates that the null hypothesis (the frequencies for the two variables are independent of each other) must be rejected. The chi square test reveals a significant difference (Pearson's $\chi^2(1)=167.34$; $p < 0.0001$), due in particular to the fact that the non-predicted combination *eines Tags* has a much lower frequency than expected on the basis of row and column sums. It is also important to consider the fact that the other non-predicted form (*des Tages*) is often found in postnominal position, as in *im Laufe des Tages, am Ende des Tages*.

This potential pattern of schwa-zero alternation in genitives repeats itself for many other nouns, so that we can pursue the question whether the result found for *Tag* can be generalized. For this analysis, we made use of all monosyllabic masculine and neuter nouns studied by (Szczepaniak, 2010, p. 111/112), with a total number of 162 nouns (91 masculines and 71 neuters). All of these nouns, enumerated in (10), are among those for which both forms are possible in principle.

(10)   Strong nouns with genitive alternation

     a. masculine nouns: Bach, Berg, Brand, Bund, Darm, Dienst, Feind, Fisch, Flug, Freund, Frost, Gang, Geist, Grund, Hang, Hof, Hund, Kampf, Kauf, Kern, Klang, Koch, Kopf, Krieg, Krug, Lärm, Leib, Lohn, Mond, Mord, Müll, Mut, Ort, Pfahl, Plan, Rang, Rat,

Raub, Raum, Ring, Ruf, Rumpf, Saal, Sand, Sarg, Schein, Schirm, Schlag, Schlauch, Sieg, Sinn, Sohn, Spott, Spruch, Staat, Stab, Stahl, Stamm, Stand, Staub, Stein, Stern, Stier, Stock, Stoff, Streit, Strom, Stuhl, Sturm, Tag, Teich, Teil, Text, Tisch, Tod, Traum, Trost, Turm, Wald, Weg, Wein, Wert, Wind, Wirt, Wunsch, Zahn, Zaun, Zoll, Zorn, Zug, Zweck

b. neuter nouns: Amt, Bad, Bein, Bett, Bier, Bild, Blatt, Blech, Blut, Boot, Brett, Brot, Ding, Dorf, Fach, Feld, Fell, Fett, Fleisch, Geld, Gold, Grab, Haar, Haupt, Heer, Heft, Heil, Heim, Hirn, Hoch, Horn, Huhn, Jahr, Kalb, Kind, Kleid, Korn, Land, Laub, Leid, Licht, Lied, Lob, Loch, Mahl, Meer, Moor, Obst, Ohr, Paar, Pferd, Rad, Rind, Rohr, Schaf, Schiff, Schnitt, Schwein, Seil, Spiel, Stück, Tal, Tier, Tuch, Volk, Weib, Werk, Wohl, Wort, Zelt, Ziel

This set of nouns is used here as an independently derived item set, that is, one not selected for present purposes. For all of these, frequencies of all article-noun combinations (*des/eines N-(e)s*) were taken from the DeReKo corpus in a way analogous to the one described above for individual nouns. The corpus contains a total of 1,174,491 relevant article-noun combinations. Thus, even for nouns from the lower frequency range, considerable numbers of article-noun combinations are available. [9] The contingency table for the complete data set, i.e., for all the nouns from (10) combined with articles *des* and *eines*, is given in (11).

(11)   Frequencies of article-noun combinations; all nouns of (10)

		Trochaic noun		$\sum$
		no	yes	
Trochaic article	no	111,708 (10.5) 112,540.53	950,405 (89.5) 949,572.47	1,062,113
	yes	12,740 (11.3) 11,907.47	99,638 (88.7) 100,470.53	112,378
$\sum$		124,448	1,050,043	1,174,491

Inspection of this table shows that differences between observed and expected numbers are small. Furthermore, detailed comparison between expected and observed frequencies in (11) also shows that the deviation from independent distribution is not in the predicted direction. Rather, it is the unpredicted combinations (yes/no, no/yes) which occur with slightly higher frequencies than expected.

Even superficial inspection of the frequencies for some of the nouns used shows that they do not

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[9] Nevertheless, some individual combinations studied have a frequency of zero, most commonly because the respective nouns do not usually occur with the indefinite article, such as *eines Gold(e)s* 'of a gold'.

behave uniformly. As expected, there is considerable variation between nouns, such that some nouns (see *Tag* above) will conform with the hypothesis while others will not. It is plausible that it is this variation between lexemes which causes the significant, but weak overall association in the wrong direction just noted. By a priori consideration, it is likely that some nouns may behave quite differently with respect to the schwa-zero alternation: for some nouns, the form with or without schwa may be lexically specified or occur in fixed idiomatic phrases. According to the results by (Fehringer, 2011, p. 96), frequency of nouns is the most imporant factor: high frequency nouns tend to show more *-es* suffixes than low frequency ones.

Along with this factor of lexical frequency and concomitant lexicalization of one form, the number and/or nature of the final consonant may determine the (non-)appearance of schwa in the genitive form. As an example, consider nouns from (10) with final /ʃ/, such as *Fisch* 'fish', *Tisch* 'table', or *Wunsch* 'wish'. For these, immediately following /s/ as in *Wunschs* may be so rare that prosodic parallelism has no chance for showing an effect. [10] The features of the final consonants influence the schwa-zero alternation in the following way: the suffix *-s* consists of the coronal obstruent /s/, thereby making this consonant less likely to attach to other consonants which are coronal obstruents. The list of such coronal obstruents in final position consists of the following items: /t, d, ʃ/. Stem-final /s/ as in *Gruß* 'greeting' invariably leads to following schwa (presumably because there are no geminates in the phonology of German); such nouns are therefore not included in the list provided by (Szczepaniak, 2010) and given in (10). Similar segmental conditioning exists for heavy final clusters: a noun such as *Dienst* 'service' with three postvocalic consonants is very rarely found with genitive suffix *-s*. While there is again a strong asymmetry in frequencies, the figures also show that the schwa-less forms do not have zero frequency. To summarize, the frequency of lexemes, the number of stem-final consonants and features of articulatory place (coronal obstruents vs. others) are well-known to influence the presence or absence of schwa in genitive nouns, and are not included in the analysis below.

In order to test the parallelism hypothesis against the complete set of genitive singular nouns in an alternative way, a simple linear regression mixed effects model is applied which allows for testing whether items contribute to frequencies independently of other factors; see Baayen et al. (2008) and the R statistical package, (R development core team 2013). The model assumed here used combined frequencies of nouns with and without schwa as the dependent variable, testing whether these frequencies depend on the (non-)trochaic form of the preceding article, with the lexical items listed in (10) as a random effect. This model is formally represented by the formula

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[10] To illustrate the degree of imbalance: In the corpus search, 21 tokens of *des/eines Wunschs* were found, compared to 485 tokens of *des/eines Wunsches*. For *Dienst*, the analogous results are: *Diensts* 25 tokens, *Dienstes* 1730 tokens.

in the topline of (12).[11] Results of the analysis are presented in (12) and demonstrate all factors included (fixed and random) to be highly significant.

(12) Summary of generalized linear mixed model for genitives of strong nouns

Formula: lmer(cbind(Freq_Nom_noschwa, Freq_Nom_schwa) ~ Trochäus_Art + (1+Trochäus_Art| Lexeme)				
Data: data=Freq_Nom, family="binomial")				
	AIC	BIC	logLik	deviance	df.resid
	3184.9	3203.8	-1587.4	3174.9	319
Random effects:				

Groups	Name	Variance	Std.Dev.	Corr
Lexeme	(Intercept)	4.3202	2.0785	
	Trochäus_Artnein	0.4016	0.6338	0.29

Number of obs: 324, groups: Lexeme, 162

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-1.52894	0.16702	-9.154	< 2e-16	***
Trochäus_Artnein	0.32788	0.06125	5.354	8.63e-08	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The fixed-effect factor Trochäus_Artnein, with a highly significant z value and a positive estimate, signifies that the shape of the article is indeed effective in predicting the shape of the noun: trochaic nouns are more frequent with trochaic articles.

In order to demonstrate in detail the influence of lexical frequency and lexicalization on the distribution of schwa in the genitives of strong nouns, we will compare two otherwise similar nouns from (10), namely *Jahr* 'year' and *Stier* 'bull', with different frequencies: *Jahr* 'year' is the noun with the highest type frequency according to the count in the *Leipziger Wortschatzportal* ("Projekt Deutscher Wortschatz," 1998). For lemmas, this data base gives a frequency class based on logarithmic distances from the most frequent word form of German (*der*). While *Jahr* has a value of 5 (meaning that *der* was found to be 5 times as frequent in this corpus of written texts), *Stier* has a value of 14. Thus, the two nouns belong to strongly different frequency classes, while being formally similar in both ending in a long vowel followed by (vocalized) /r/.

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[11] We are grateful to Harald Baayen (Tübingen) and Johannes Knaus (Marburg/Calgary) for their suggestions and help in this analysis.

The analyses of the type familiar to the reader by now for *Jahr* and *Stier* are given in (13) and (14). As before, sequences searched for are those with either the monosyllabic article form or the bisyllabic form, followed by the noun in question.

(13) Frequencies of article-noun combinations for *Jahr* 'year'

		Trochaic noun		Σ
		no	yes	
Trochaic article	no	265 (0.1) 303.07	215,839 (99.9) 215,800.93	216,104
	yes	60 (0.4) 21.93	15,580 (99.6) 15,618.07	15,640
Σ		325	231,419	231,744

(14) Frequencies of article-noun combinations for *Stier* 'bull'

		Trochaic noun		Σ
		no	yes	
Trochaic article	no	239 (68.1) 214.13	112 (31.9) 136.87	351
	yes	52 (41.3) 76.87	74 (58.7) 49.13	126
Σ		291	186	477

Comparing the expected and actual values for the article-noun combinations yields different results for the two nouns: First, the different lexeme frequencies are also reflected in a large difference in overall frequencies of article-noun combinations (231,744 vs. 477). Second, for both counts the chi square test yields a significant result: for the frequencies involving *Jahr*, Pearson's χ^2 (1)=70.946, p < 0.001; for the frequencies involving *Stier*, we find Pearson's χ^2 (1)=28.038, p < 0.001. But crucially, the parallelism hypothesis is confirmed by the results for *Stier* given in (14), while it is disconfirmed by the results for *Jahr* in (13). In the latter case, i.e., for the high frequency noun, corpus frequencies for the parallel phrases *des Jahrs* and *eines Jahres* are actually *below* the expected frequencies. Furthermore, the non-parallel phrase *des Jahres* by far surpasses all other types in frequency (215,839), and provides a good example of a lexicalized phrase not fulfilling the requirement of parallelism. Thus, the high frequency noun violates the prosodic requirement, while the low frequency noun fulfills it. In this situation, the weak but negative result for the comprehensive analysis attempted in (11) is not surprising.

The overall result of the previous discussion of the genitive forms of so-called strong nouns is that a new factor involved in the schwa-zero alternation has been identified through statistical

analysis of corpus data. The Duden grammar (Duden, die Grammatik, 2 009, p. 197/98) also reports corpus-based frequencies for the schwa-zero alternation in genitives of strong nouns. The percentages reported there differ strongly from those reported in the present paper. These differences cannot be judged easily, as it is unclear, first, whether the counts reported are based on nouns in isolation or on nouns preceded by the definite article. Thus, it remains unclear whether possible context effects are considered or not. Secondly, the corpora used in the Duden grammar are not identified.[12]

More generally, the Duden grammar agrees with other literature that the phonological make-up of the lexical item (segmental and prosodic) and the lexical level of the item („Stellung im Wortschatz") are the two factors responsible for the choices in allomorphy. The present study has identified one additional factor for the allomorphy which does not refer to the lexical item itself: the conditioning of the schwa-zero alternation includes the prosody of the phrase it is a part of. Thus, the alternation is not purely lexeme-based.

4 Predicative adverbs

In this section the parallelism effect is explored in a different grammatical domain: can it also be observed for words from a different category, namely for those adverbs or adjectives used as adverbs which show final schwa-zero alternation? Such forms exist, as the examples given in (15) demonstrate. The three examples in (15)a are invariably adverbs, that is, they cannot occur as adjectives, attributive or predicative. In contrast, examples in   (15)b are adjectives which may be used as adverbs or as predicative adjectives. In principle, all of them may be used with or without final schwa, although there are usually preferences for one or the other form in present-day German.

(15)   Adverbs with schwa-zero alternation

>   a. *gern(e), bald(e), heut(e)*[13]

>   'gladly, soon, today'

>   b. *blöd(e), bös(e); lang(e); mild(e); nah(e); still(e)*

>   'dumb, angry, long, mild, close, quiet'

The situation is thus the same as with stem-final schwa in nouns: both forms co-exist in Modern

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[12] See the following information (*Duden, die Grammatik*, 2009, p. 198): "A corpus research (June 2004) found that the ratio of the long form *des Sturmes* 'the storm, gen. sg.' to the short form *des Sturms* is about 1:2, while for the segmentally similar forms *des Lärmes* 'the noise, gen. sg.' compared to *des Lärms*, this ratio is more than 1:10 in favor of the short form." (our translation).

[13] Fleischer et al. (2012) studied the distribution of these three adjectives in different versions of Goethe's *Werther*, and found variation in the use of final schwa across the three items and over time, while Fleischer et al. (2014) analyzed Goethe's use of adverb-final schwa in Goethe's letters across the life-span.

High German (although with sometimes large differences in frequency), but with no obvious difference in grammatical function or lexical meaning. In order to test the prosodic parallelism hypothesis on the basis of adverbs, we again need to find contexts providing a monosyllabic or bisyllabic form adjacent to the variable word. Fortunately for our purposes, it is even possible to provide such an invariable form either preceding or following the alternating adverb/adjective because finite verbs in German are found in the sentential V2 position (with an adverb to follow) and in final position (with an adverb to precede the verb). We begin by looking at simplex or prefixed adverb *gern(e)* 'gladly' in section 4.1, and then proceed to an analysis of a context item to the left of the adjective/adverb in section 4.2. The reverse case is provided by a right-hand verbal context in section 4.3. In section 4.4, we turn towards a case in which two adjacent words (verb plus adverb) may both be used with or without final schwa.

4.1 Simplex and prefixed gern(e)

A first case for the schwa-zero alternation with adverbs is provided by the adverb *gern(e)* 'gladly', for which both forms are rather common in present-day German, as the frequency results in (17) demonstrate. This adverb can be prefixed by the negative prefix *un-*. Considering the absence vs. presence of the prefix in combination with the presence or absence of final schwa, the following two-by-two table (16) is derived. In contrast to other constructions analyzed in the present paper, we are looking here at a single word-internal combination, but native prefixes of the *un*-type are usually considered to constitute a phonological word of their own, adjacent to the phonological word corresponding to the stem; see Wiese (2000) and Hall (1999) for discussion.

(16)   Preferred and non-preferred adverbs

		Schwa in adverb	
		no	yes
Prefix *un-*	no	gern	**gerne**
	yes	**ungern**	ungerne

Table (16) predicts trochaic forms of the adverb to be preferred over both monosyllabic and trisyllabic forms. The corpus-based analysis for these four forms are given in (17). The reason for these predictions are only partially derived from the prosodic parallelism hypothesis: *ungerne* 'not gladly' violates prosodic parallelism and should be dispreferred over *ungern*, while trochaic *gerne* is predicted to be more frequent than *gern* because of the general preference for trochees in German.

(17)   Adverb *gern(e)* with and without prefix

		Trochaic *gern(e)*		Σ
		no	yes	
Prefix *un-*	no	150,784 (30.7) 157,963.02	340,187 (69.3) 333,007.98	490,971
	yes	10,712 (97.6) 3532.98	269 (2.5) 7448.02	10,981
Σ		161,496	340,456	501,952

The frequencies given on the basis of the search in the DeReKo corpus reveal these predictions to be fulfilled: first, *gerne* is more frequent than *gern* in general, demonstrating once again the preference for the trochaic pattern. [14] With the prefix added, the frequency relations are the opposite: *ungern* is found about forty times as often as *ungerne*. Second, the statistical analysis shows the preference for the parallelism; the row and column frequencies are not independent of each other; rather the frequencies in the cells marked as expected in (16) are much above the chance value (Pearson's χ^2 (1)=21988.526, p= 0.000). For this single lexical item, the hypothesis of prosodic parallelism is therefore confirmed once again.

4.2 Left invariable context

In order to study a wider phrasal context, we select *nah(e)* 'near' as an adverb which is both highly frequent and variable with respect to final schwa. As shown in (18), it can be preceded by a number of monosyllabic verbs (see (18)a) or by bisyllabic, trochaic verbs as in (18)b. The five verbs in each group cover a range of verbal paradigmatic dimensions in terms of number, tense, and mood.

(18)   Verbs plus *nah(e)* 'near'

   a. preceding monosyllabic verbs: *bin, war, ist, sind, seid*

                              'am, was, is, are, are'

   b. preceding bisyllabic verbs: *waren, seien, werden, wurde, wurden*

                              'were, would, will, became, sg., became, pl.'

The corpus-based frequencies for these *verb-nah(e)* combinations are given in (19), with frequencies summed over the ten verbs listed in (18).

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[14] This claim is not valid without reservation: there are many adverbs for which the schwa-less form is the dominant one, as for *bald* 'soon', while for others (see *heute* 'today') the schwa-containing forms is the dominant one. But for *gern(e)*, both forms are very frequent, and there does not seem to be a general preference for one of the two on the basis of style, register, or some other obvious factor.

(19) Frequencies for verb plus *nah(e)* combinations

		Trochaic *nah(e)*		Σ
		no	yes	
Trochaic verb	no	1198 (33.2) 1049.5	2416 (66.9) 2564.5	3614
	yes	157 (14.9) 305.5	895 (85.1) 746.5	1052
Σ		1355	3311	4666

Applying the chi square test to these materials yields the following results: χ^2=131,335, p < 0.001, and therefore a highly significant difference. A comparison of the observed and expected frequencies in (19) confirms that the differences are as predicted. Thus, verbs to the left of the adverb *nah(e)* influence the shape of this adverb.

4.3 Adverbs and right-hand context

In (15), the adverbs *bald(e)* and *heut(e)* were listed as adverbs with final schwa-zero alternation. Of these, *bald(e)* is very infrequent with final schwa, but *heut(e)* 'today' provides another test case, but with the relevant context to follow the adverb by combining this adverb with either monosyllabic *früh* 'early' or bisyllabic *morgen* 'morning'. Note that the relevant context is provided here to the right of the adverbs, and not to the left as in previous examples. In table (20), *heut* und *heute* are combined with these two adverbs, and frequencies from the DeReKo data base are reported for all combinations.

(20) Frequencies for adverb combinations *heut(e) früh/morgen* 'today early/morning'

		Trochaic *heut(e)*		Σ
		no	yes	
Trochaic adverb (*früh/morgen*)	no	24 (1.6) 13.85	1444 (98.4) 1454.15	1468
	yes	25 (0.7) 35.15	3699 (99.3) 3688.85	3724
Σ		49	5143	5192

The result of the statistical analysis again provides evidence for the prosodic parallelism: Pearson's χ^2 (1) is 10.457, with p=0.001222. Thus, we have found evidence for the hypothesis for a right-hand context as well as for left-hand contexts. This observation is important because it may be used to argue against a model which assumes a strict left-to-right construction of prosodic structure. In such a model, a left-hand item could determine its right-hand neighbor to display particular prosodic properties, but an influence in the opposite direction would be

impossible.

In order to test the generality of this pattern of bidirectional determination, we draw upon another construction involving the adverb *nah(e)* 'close', in this case with a verb to follow the adverb, i.e., again with a right-hand context. This provides the mirror image to the verb plus *nah(e)* construction studied in the previous section 4.2.

(21)   Adverb (*nah(e)*) plus verb constructions

		Trochaic *nah(e)*		∑
		no	yes	
Trochaic verb	no	1090 (35.4) 1062.52	1989 (64.6) 2016.48	3079
	yes	153 (29.3) 180.48	370 (70.8) 342.52	523
∑		1243	2359	3602

Applying the chi-square test results in χ^2 (1)=7.474 and p >.0063. This once again yields a significant result in the expected direction. Summarizing over the results in (19) and (21), we have thus found an influence of the verb's shape on the adjacent adverb *nah(e)* irrespective of their left-to-right ordering.

4.4 Other verb-adverb combinations

At least one verb-adverb combination allows for both elements to alternate with respect to final schwa; namely that of the past conditional singular form of *sein* 'to be' followed by a variable adverb such as *gern(e)*, see (22). In such a case, there is no cause-effect relation between the two forms; rather, both words show the schwa-zero alternation and have the chance to assimilate to the other in terms of prosodic structure. In this situation, we expect the prosodic parallelism to hold very strongly, and will test this verb-adverb construction accordingly. The corpus-based frequencies are given in (23).

(22)   Auxiliary precding adverb with both words alternating

   wär(e) gern(e)

   'would (1./3. ps. sg.) gladly'

(23)   Frequencies for *wär(e) gern(e)* in the DeReKo corpus

		Trochaic adverb		∑
		no	yes	

Trochaic verb	no	51 80.95 22.01	12 19.05 40.99	63 100
	yes	579 33.28 607.99	1161 66.72 1132.01	1740 100
	Σ	630	1173	1803

Again, a highly significant result is found (Pearson's χ^2 (1)=60.793, p=0.000), and the expected combinations (*wär gern*, *wäre gerne*) turn out to be far more frequent than predicted from their independent frequencies as derived from the sums across rows and columns. The conclusion is that prosodic parallelism does not need a "trigger", an invariable form which causes an adjacent word to display the same structure. Rather, the parallelism relates to a resulting structure irrespective of its cause. This observation of course raises the question what causes the whole construction to consist of either monosyllabic or bisyllabic forms. (23) demonstrates that the doubly bisyllabic construction is far more frequent than its counterpart, and we may assume that this asymmetry reflects the general preference for a syllabic trochee (see discussion below).

5 The historical development of schwa-zero alternations

The variation between forms with and without schwa is observable in German since the process responsible for the variation, the weakening of unstressed syllables (" *Nebensilben- abschwächung*"), began to work (on this process see (Paul, Wiehl and Grosse, 1998, pp. 79–88); (Braune and Reiffenstein, 2004, pp. 60–78)). The weakening of unstressed syllables set in at the end of the Old High German period, roughly in the 10th century, and was gaining momentum in the 11th century (Braune and Reiffenstein, 2004, p. 61). We have to distinguish two 'phases' of this weakening process that are in a feeding relationship. The first phase is attested already at the end of the Old High German (OHG) period, that is, in the 10th/11th century. In this phase unstressed vowels were centralized to a schwa, turning a word such as OHG *gimahala* 'husband' into Middle High German (MHG) *gemahele*. This phase was more or less completed when the MHG textual tradition set in. A second phase might have started soon after the beginning of the first phase, but kept its force throughout the MHG period. In this phase, schwa was subject to apocope and syncope under a number of circumstances that are not yet exhaustively studied. MHG *gemahele* would appear as *gemahel* at the end of the MHG period, and subsequently develop further to Modern High German *Gemahl*.

Whereas phase 1 was completed within a reasonable amount of time, phase 2 actually never came to completion. This observation applies mostly to the apocope of inflectional endings or

other word-final schwas without morphological role. In some cases, the forms with schwa and the forms without schwa are in variation up to the present day, as we have seen above. The fact, however, that this variation remains stable for some 900 years calls for an explanation. The normal outcome should have been that the more conservative forms with schwa and the more modern forms without schwa would compete with each other, while one of the forms, presumably the more modern form without schwa, would eventually win out. This would be considered a normal case of sound change; sound changes tend to be completed in a relative short amount of time, say three generations (on the time span of sound change see (Labov, 1994, 43–112); (Lass, 1997, 281–288); (Janda, 2003)).

This obviously did not happen in the present case, as the schwa-zero alternations have existed for almost one thousand years. Thus, we have to conclude that the presence or absence of schwa is dependent on one or more factors which give continuing support for the existence of the alternation. While we do not want to claim that parallelism is the only factor, we propose the hypothesis that it may be one of the decisive factors keeping the alternation alive across many centuries.

The role of prosodic parallelism in earlier stages of German can be demonstrated by examples from Early New High German (ENHG) sources. Let us begin with feminine stems ending in schwa, such as *Türe* 'door', *Ehre* 'honor' or *Rose* 'rose'. Whereas in Modern German the presence of schwa is all but compulsory in written discourse (with the exceptions of very few variable words such as *Tür(e)*; see section 2), this was not the case in earlier stages of German. The apocope of schwa in words such as *Ehre*, which would be marked without schwa in Modern Standard German, was a normal process in ENHG. So there was variation between the two forms. The variation is not completely free – even in ENHG there are lexical preferences for or against schwa – but it pervades all dialects.

The data to be used here are taken from Bonner Frühneuhochdeutschkorpus (1972). We searched for nominative forms of from a sample of feminine nouns ending in schwa, namely *Ehr(e)* 'honor', *Erd(e)* 'earth', *Höh(e)* 'height', *Lieb(e)* 'love', *Müh(e)* 'hard work', *Ros(e)* 'rose', *Tür(e)* 'door'. These seven nouns were searched for in combination with forms of the definite article as representative for monosyllablic determiner, and forms of the indefinite article, demonstrative pronoun or possessive pronoun as representatives for bisyllabic determiners. Table (24) displays the frequencies for the combinations in this corpus.

(24) Frequencies for feminine stems in combination with article forms

		Trochaic noun		Σ
		no	yes	
Trochaic article	no	105 (44.5) 100.17	131 (55.5) 135.83	236
	yes	27 (36) 31.83	48 (64) 43.17	75
Σ		132	179	311

The results demonstrate that prosodic parallelism might be one of the factors governing the variation, although it is a weak one only in the present data. The differences between the datasets are not high, and the chi square test does not assign significance to the distribution, with Pearson's $\chi^2(1)$=1.68 and p < 0.19494, and a weak tendency in the predicted direction.

A clearer example is provided by the genitive singular ending of the strong nouns, the pattern analyzed in section 3 for Modern Standard German. A search on the *Bonner Frühneuhoch-deutschkorpus* shows that there was schwa-zero variation throughout the ENHG period. In Table (25), the results of the search on article-noun combinations are presented.

(25) Frequencies for strong noun genitives on *-(e)s* in combination with article forms

		Trochaic noun		Σ
		no	yes	
Trochaic article	no	44 (67.7) 38.06	21 (32.3) 26.94	65
	yes	21 (45.7) 26.94	25 (54.2) 19.06	46
Σ		65	46	111

In this search, all lexemes ending in a sonorant or a dorsal obstruent from the lists in (Szczepaniak, 2010, p. 111/2) were included. Not only the definite and indefinite article were taken into account, but also trochaic pronouns such as *dieses* 'this' or *meines* 'my' in order to enlarge the data set. Table (25) confirms the evidence for the relevant variation, and the variation found is as predicted under the parallelism hypothesis. Although the number of tokens is much smaller than what can be found in the DeReKo corpus of present-day German (see details given in section 1.2), the chi-square test results in a value of Pearson's $\chi^2(1)$=5.392, corresponding to p < 0.02023, and thus a significant result: the predicted combinations are significantly more common than would be found if they were independent of each other.

The four periods of ENHG have been conflated in this table in order to increase the numbers (the

size of the *Bonner Frühneuhochdeutschkorpus* is rather limited); no significant change within that period was visible in the data. The dialects fell into three groups: group 1 in which there was actually no variation, but relatively consistently schwa-less forms (we can say that in this dialect area, phase 2 acted as a sound change and came to completion); group 2, in which there is real variation; and group 3, in which there is a strong bias towards the forms with schwa. Group 1 consists of the southeastern dialects Bavarian and East-Swabian and the northwestern Ripuarian dialect area, group 2 comprises the central and southwestern dialects, so to speak (that is: Alemannic, Swabian, Hessian, and East Franconian), whereas group 3 contains the East Central German dialect areas of Thuringia and Upper Saxonia. A quantitative study of the behavior of the different dialect groups cannot be conducted with the present limited set of data.

6 Real and apparent counterexamples

One may well ask whether the prosodic parallelism discussed so far can be found for all lexical items for which a schwa-zero alternation exists. This section will present two cases for which the hypothesis does not seem to hold, and will discuss possible reasons for this. The result will be that one of the counterexamples found may be only apparent, while the other presently constitutes a counterexample for reasons yet to be explored.

6.1 Strong nouns, dative singular

Yet another case of variable schwa is provided by strong nouns in the dative singular. Optionally, these nouns show *-e* as a marker for dative singular forms, but the schwa-less form is taken to be the unmarked form in present-day German, while schwa-containing forms are usually considered very formal or archaic, except for fixed expressions such as *im Schilde führen* 'plan', which is not well-formed with monosyllabic *Schild*.

We will present the results of an analysis analogous to the one performed in section 2 for *Tür(e)*, except that in the present case final schwa has a clear grammatical function within the nominal paradigm. The noun chosen is *Tag* 'day', which is a high frequency noun, for which the dative singular forms may be either *Tag* or *Tage* (the latter being less common and considered to be somewhat archaic). As for monosyllabic or bisyllabic preceding forms, the definite article *dem* and the indefinite article *einem* is chosen. Frequency results for the combination of are given in (26). The overall rarity of *Tage* is reflected in the respective column frequency.

> (26)   Frequencies for *dem/einem Tag(e)* 'the/a day, dat. sg.', DeReKo corpus

	Schwa in *Tag*	Σ

		no	yes	
Schwa in article	no	13,951 (98.1) 14,110.69	270 (1.9) 110.31	14,221
	yes	29797 (99.8) 29,637.31	72 (0.2) 231.69	29,869
Σ		43,748	342	44,090

Again, statistical testing for independence of the two factors by means of the chi square test yields a highly significant result: Pearson's χ^2 (1)=343.905, p=0. In this case, however, the parallel trochaic form *einem Tage* 'a day, dat. sg.' occurs in fact with much *lower* frequency than expected by chance, and vice versa for *dem Tage*.

A possible explanation for this tendency for schwa to work in the opposite direction is provided by the syntactic context of most dative constructions of this type. Dative noun phrases such as *dem Tage* typically occur in connection with a preceding dative preposition, such as *an* 'at' or *mit* 'with'. In such prepositional phrases (at least those with a monosyllabic preposition), the article is tied to the preceding preposition in terms of stress pattern, and not to the following noun. Thus, the prosodic structure of such a phrase is as given in (27)a, with stressed syllables indicated.

(27) Structure of prepositional phrases

a. Prosodic structure   b. Syntactic structure

[[án dem] Táge]   [an [dem Tage]]   'on the day'

The prosodic structure of a prepositional phrase is different from the syntactic structure (see (27)b), which is generally assumed to be a right-branching structure. The prosodic analysis is motivated not only by the stress pattern which relates the unstressed article to the preceding stressed preposition, but also by the facts of article cliticization in such phrases: articles may form a clitic unit with the preceding article, as in *am* (full form *an dem*) or *im* (full form *in dem*), that is, within the initial phrase of (27)a. With this structure for dative article-noun combinations, there is no reason to assume prosodic parallelism between article and noun, because the two items are not part of the same prosodic phrase (as required in stating prosodic parallelism in (1)). Alternatively, the counterexample provided by *Tage* might be related to the fact that this specific form is lexicalized in the particular context provided by *an dem __* . As we have seen for high frequency noun *Jahr* 'year' (section 3), such items may be exceptions to the generalization.

6.2 Adverbial phrases

Another more challenging counterexample is provided by degree adverbs modifying another adverb/adjective, resulting in an adverbial phrase. These constructions provide another suitable

phrasal context for the study of prosodic parallelism with a left-hand context. The examples of degree adverbs to be studied here with following *gern(e)* are given in (28).

(28)   Degree adverbs preceding adverb

            Monosyllabic form: *sehr gern(e)* 'very gladly'

            Bisyllabic trochee: *richtig gern(e)* 'really gladly'

The corpus frequencies of the respective possible combinations are given in   (29) in the way introduced above.

(29)   Degree adverbs and *gern(e)*

		Trochaic *gern(e)*		$\sum$
		no	yes	
Trochaic degree adverb (*sehr/richtig*)	no	2655 (22.8) 2695.72	9013 (77.3) 8972.28	11,668
	yes	80 (47.1) 39.28	90 (52.9) 130.72	170
$\sum$		2735	9103	11,838

The chi square test with Pearson's χ^2 (1)=55.712 (p=0) shows a highly   significant result, but again in the wrong direction: comparison between observed and expected counts shows that it is the frequencies for the non-predicted combinations (*sehr gerne*, *richtig gern*) which are higher than expected. At present, we have no explanation for this result, but just note the existence of such a case. Possibly, the left-hand and/or right-hand phrasal contexts for the phrases considered here play an important role.

7 Discussion

In the present paper, it was possible to study the alternation between schwa and its absence in a large range of cases, because of the fact that present-day Standard German allows for these alternations in a number of grammatical constructions. The complete list of cases studied is given in (30), and we suggest that the number and range of constructions confirm that prosodic parallelism is indeed a valid principle in the German language.

(30)   Constructions analyzed for prosodic parallelism

– stem-final schwa in *die/eine Tür(e)* 'the/a door', *der/guter Hirt(e)* 'the/good shepherd

– genitive singular forms of noun *des/eines Tag(e)s* 'the/a day', *des/eines Jahr(e)s* 'the/a year', *des/eines Stier(e)s* 'the/a bull'

– simplex adverb *gern(e)* 'gladly' vs. prefixed form *ungern(e)* 'not gladly'

– adverb *nah(e)* 'near' with preceding verbs

– adverb *heut(e)* 'today' with following adverb

– adverb *nah(e)* 'near' with following verbs

– verb plus adverb combination: *wär(e) gern(e)* 'would gladly'

– stem-final schwa in nouns from Early New High German

– a set of strong nouns in genitive singular form from Early New High German

– dative singular forms of noun *dem/einem Tag(e)* 'the/a day'

– adverb with preceding degree adverb: *sehr/richtig gern(e)* 'very/really gladly'

Schwa-zero alternations of the type studied here may, at a first look, appear to be instances of free variation: the respective morpheme remains the same with or without the vowel, and no conditions seem to exist which determine one form or the other. However, this characterization is obviously misleading: The existing grammatical descriptions of German reported above already identify a number of determining factors which relate either to some aspect of the respective lemma (segmental structure, frequency, morphology) or to specific registers in which the word forms occur. The present paper has demonstrated that neither free variation nor register-dependent usage provide a sufficient account for the alternation. As for the role of registers, note also that formal or archaic registers do not uniformly lead to more word-final schwas: while genitive and dative singular forms of nouns are more formal and/or archaic with schwa, *Türe* 'door' is considered dialectal.

What has not been considered previously is the possibility that the immediate linguistic (phrasal) context of the items may also be relevant in the choice of the form with or without schwa. The prosodic parallelism hypothesis addresses exactly this possibility, and it has been demonstrated here to be true statistically for a variety of different constructions. The overall picture thus is that the schwa-zero alternation does not constitute a case of free variation, but a situation in which a set of interacting factors leads to the presence or absence of schwa, with prosodic parallelism as one of these factors. A study of these interactions with other factors is beyond the purpose of the present paper.

It is worth noting in this context that the corpora drawn upon in the present study are ones of written, and not spoken, German. The *DeReKo* corpus is a collection of recent newspaper articles, and the *Bonner Frühneuhochdeutschkorpus* is a collection of historical texts, again of course written ones. The preference for obeying prosodic parallelism has thus been demonstrated to hold even for the written language, in contrast to the view that it would hold for the spoken language only. The view that prosody relates exclusively to spoken language is therefore

problematic in the light of these results. Rather, prosody is a necessary and integral part of grammar, whether for spoken or written language (for this view see also (Schlüter, 2005, chap. 3.2)).

The role of prosody in grammar has been demonstrated before by a number of authors in different frameworks. In studies of prosodic morphology (see, e.g., (McCarthy and Prince, 1997), (McCarthy and Prince, 2004)), it has often been stressed that phonology, in particular prosodic phonology, interacts with other parts of grammar, in particular morphology. To present one example, (Schlüter, 2005) has shown that the grammar of English has been shaped considerably by the Principle of Rhythmic Alternation, i.e., the preference for an alternation between stressed and unstressed syllables. For a number of cases, she demonstrates that choices between lexical alternatives (such as monosyllabic *lit* vs. bisyllabic *lighted*) or the marking of infinitives (*(to) come*) are governed throughout the history of English by the preference for a rhythmic alternation between stressed and unstressed syllables. That this principle holds also on levels higher than the word was demonstrated in (Speyer, 2010) for focal accents in historical stages of English and of contemporary German. For the prosodic phonology of Italian, Ghini (1993) notes that there is a preference for phonological phrases to be of equal weight, i.e., to contain equal numbers of phonological words.

As noted in section 2, there is in fact psycholinguistic evidence for the role of prosody in the processing of written language. For reading English sentences, Fodor (1998) argues for a "same-size-sister constraint" in the parsing of ambiguous sentences. For other evidence to this point, see Breen and Clifton (2011) for the role of English word stress in silent reading, or Kentner (2012) on the resolution of syntactic ambiguities through preferred rhythmic (alternating) structures, in reading aloud German sentences.

More directly relevant to the topic of schwa-zero alternation studied here are other schwa-zero alternations found in the grammar of German. A number of proposals argued that schwa is often found in order to fulfill the preference for a bisyllabic trochee in German words; see (Wiese, 2000), (Féry, 1997), (Wiese, 2001), (Wiese, 2009) for discussion on various types of words such as plural nouns, truncations (*i-Bildungen*), adjectival endings and others. One important case is provided by the shape of plural suffixes in German, which add (with the exception of *-s*) a suffix form containing a schwa vowel (*-e*, *-er*, *-en*), except if the noun stem already contains a final schwa vowel, or, more precisely, a final unstressed syllable. In the latter case, the suffix is either *-n* (for feminines, see *Gabel-n* 'forks') or no suffix (for non-feminines, see *Löffel* 'spoons') is found. In spite of all complications involved in German plural formation, the preference for a

bisyllabic trochee at the right edge of plural nouns is undisputed.

The present analyses are not intended to deny this role of rhythmic alternation and the preference for the bisyllabic trochee in the grammar of German. Rather, the role of yet another prosodic principle operating in grammar is explored. Prosodic parallelism provides a constraint on the general trochaic preference: under specific conditions (an adjacent monosyllabic item), the bisyllabic trochee may actually be dispreferred, even though the preference for such a trochee (often implemented by means of a schwa vowel) is a strong one in the grammar of German. If prosodic parallelism may even override the strong general preference for alternating strong and weak syllables, there must be some higher level reason for this priority. This reason may be found in the observation that a preferred rhythm not only consists of alternating strong and weak units, a preference generally interpreted as the avoidance of stress clashes (see Liberman and Prince 1977), but also of the regular repetition of the units associated with rhythm (such as a strong-weak sequence).
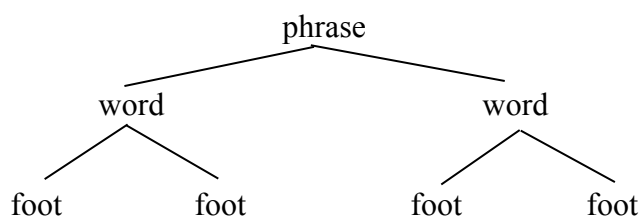
In music and poetic verse, in particular, this repetition of basic units (such as a specific iamb, trochee, etc.) is a more or less strict requirement. Consider a three-beat unit such as the bar in a minuet or waltz: their particular rhythm requires the strict repetition of such a bar. Similarly in verse: a line consisting of a number of poetic feet display an alternation of more or less identical feet such as trochees or iambs.

It is this rhythmic regularity to which prosodic parallelism contributes by providing adjacent identical elements. These elements can be of a different nature (monosyllabic or bisyllabic in the cases under consideration), but they are repeated whenever the phonological part of the grammar allows for this option. The small effect sizes found in some of the analyses above are a reflection of the fact that other parts of the grammar (lexicon, syntax) often prevent strict repetition of the preferred prosodic pattern.

An extension of the present proposal would be to consider prosodic parallelism on other levels than that of feet and syllables (as represented in (1)). Conceivably, adjacent words may also prefer to contain identical numbers of feet, illustrated in (31). This hypothesis cannot be tested with the help of the schwa-zero alternation; instead, other types of material need to be considered. The counterexample noted in section 6 may conceivably find an explanation under such an approach.

(31)   Prosodic parallelism

   a. parallel branching structures within words

```
                    phrase
              /              \
           word             word
          /    \           /    \
       foot    foot     foot    foot
```

   b. parallel non-branching structures within words

```
                  phrase
              /          \
           word         word
            |             |
          foot          foot
```
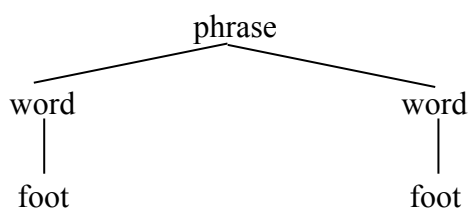
The historical dimension of the present phenomena studied through a brief look into Early New High German in section 5 is another one worth discussing. We have observed that the variation between schwa-less and schwa-containing forms has existed for a long period of time and does not appear to disappear within present-day German. In general, the existence of stable variation over a long period of time is in need of explanation, as variation is usually seen as a mere transitory phase between two stable stages in linguistic change. The existence of prosodic parallelism presents a partial explanation for the observed historical stability of schwa-zero variation: if parallel prosodic structures are preferred, then this preference supports the existence of both variants, as long as a phrasal context exists for these variants. In contrast, if the schwa-zero alternation were to be given up (by preferring either the forms with or without schwa), then parallelism could not be maintained.

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