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Schwa optionality and the prosodic shape of words and phrases

Abstract: This paper discusses effects of supra-lexical linguistic rhythm on the appearance or absence of optional schwa. Specifically, the roles of rhythmic alternation and prosodic parallelism are studied in three experiments and weighed against each other. In Experiment One, an oral reading study, readers were confronted with either of the two graphemic representations of the alternating adverb <gern(e)> ('happily') in sentential contexts the rhythmic structure of which was systematically varied. The evaluation of the scripted speech productions suggests that readers take the rhythmic environment into account when choosing an allomorph for the prosodically variable target word. Experiment Two is concerned with prosodic determinants for the morphosyntactic alternation in German partitive or possessive constructions. These may be realised as genitive attributes or using a prepositional construction. A forced choice experiment with written material suggests that participants consider the distribution of strong and weak syllables when choosing among the morphosyntactic variants. Experiment Three exploits the prosodic alternation of four adverbs. Analysing the distribution of the variants in a large written corpus attests that the immediate prosodic context affects the choice among the variants. A synopsis of the findings suggests that rhythmic alternation (conceived as the joint effects of stress clash avoidance and stress lapse avoidance) has a stronger impact on the presence or absence of a reduced syllable compared to prosodic parallelism.

Keywords: word prosody, optional schwa, prosodic morphology, German

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1 Introduction

Several words in German are prosodically variable in that they may legally appear either with or without a schwa syllable – with no semantic effect associated with the presence or absence of the syllable headed by the reduced vowel. Schwa optionality is certainly a marginal phenomenon in German morphophonology, most likely because the appearance of schwa is usually morphologically governed, with schwa corresponding to the exponent of e.g. a plural, first person, or agreement morpheme. In spite of schwa's role as inflectional exponent, schwa optionality is attested in all major word classes, as the list in (1) reveals.

- (1) a. Nouns: *die Tür* ~ *die Türe* ('the door')
 b. Verbs (first person sg., pres.): *ich geh* ~ *ich gehe* ('I go')
 c. Predicative adjectives: *fad* ~ *fade* ('dull, tasteless')
 d. Adverbs: *gern* ~ *gerne* ('happily')
 e. Demonstrative pronouns: *dies* ~ *dieses* ('this')
 f. Conjunctions: *eh'* ~ *ehe* ('before')
 g. Preposition: *ohn'* ~ *ohne* ('without')
 h. Numerals: *zu zweit* ~ *zu zweien* ('two by two', 'in sets of two')

A variety of factors are known to impinge on the appearance or absence of optional schwa syllables, among them language change, speaking rate and style (or register), and dialectal influence. That is, not all alternating forms in (1) are equally likely to occur in modern Standard German. For instance, the dated numeral (1h.) of the form *zu NUM-en* has by now been almost fully replaced by the current schwa-less construction *zu NUM-t*. Monosyllabic *ohn'* (1g.) is confined to certain poetic registers, while (1c.) has a dialectal distribution. The appearance of optional schwa (or its orthographic cognate <e>) in genitives *Jahrs* ~ *Jahres* ('year') has been shown to be more likely the higher the frequency of the noun is (Fehring 2011). Still, some alternating forms seem to happily coexist and vary almost freely even within the same historical and dialectal strata.

Aside from factors like usage frequency, speech register, and dialectal distribution, the prosodic-phonological context the variable word is embedded in has been discussed as potentially conditioning the distribution of forms with or without schwa syllable. Studies by Rohdenburg (2014), Schlüter (2005), and Wiese and Speyer (2015) suggest that the prosodic makeup of adjacent words may co-determine the choice among the prosodically varying allomorphs. The claim put forward in these studies is that speakers exploit schwa-optionality to improve the

phrasal rhythm. There are at least two, partly conflicting, ways in which phrasal rhythm may be improved. On the one hand, speakers may, whenever possible, strive for an alternation of stressed (or strong) and unstressed (or weak) syllables, thereby creating a beat that is as regular as possible. This entails that structures involving sequences of adjacent stressed syllables (stress clash) or sequences of unstressed syllables (stress lapses) are disfavoured. On the other hand, the rhythmicity of an utterance may be enhanced by iterating prosodic units of the same type, fostering prosodic parallelism. Accordingly, a prosodic phrase that consists of two words is favoured if the two words exhibit the same prosodic structures (e.g. either two monosyllabic words or two trochees); a sequence of two prosodically different words (e.g. a trochee followed by a monosyllable) would violate the iterative rhythm.

This paper takes a fresh look at the various effects of supra-lexical linguistic rhythm on the appearance or absence of optional schwa. Specifically, the roles of rhythmic alternation on the one hand, and iterative rhythm or prosodic parallelism on the other will be studied in three experiments and weighed against each other. In Experiment One (Section 2.1), an oral reading study, readers were confronted with either of the two graphemic representations of the alternating adverb <gern(e)> ('happily') in sentential contexts that were systematically varied with respect to rhythmic structure. The evaluation of the scripted speech productions suggests that readers take the rhythmic environment into account when reading out the written target word. Experiment Two (Section 2.2) is concerned with prosodic determinants for the morphosyntactic alternation in German partitive or possessive constructions. These may be realised as genitive attributes or using a prepositional construction. A forced choice experiment with written material suggests that participants consider the distribution of strong and weak syllables in the possessum when choosing among the morphosyntactic variants, confirming a rhythmic-prosodic effect. Finally, Experiment Three (Section 2.3) exploits the prosodic alternation of the adverbs *gern* ~ *gerne*, *lang* ~ *lange*, *selbst* ~ *selber*, *meist* ~ *meistens* ('happily, for a long time, self, most of the time'). Analysing the distribution of the variants in a large written corpus attests that the propensity for rhythmic alternation affects the choice among these variants. A synopsis of the endings suggests that rhythmic alternation (conceived as the joint effects of stress clash and stress lapse avoidance) has a stronger effect on the presence or absence of a reduced syllable compared to prosodic parallelism. Before reporting on the experiments in Section 2, the remainder of Section 1 provides relevant background on prosodic structure and linguistic rhythm in German (and beyond).

1.1 (Supra-)lexical prosodic structure and linguistic rhythm

As for word-internal prosody, the core of the German lexicon and morphological system is prosodically constrained in that it displays a strong preference for disyllabic, trochaic forms (for a review, see Domahs, Domahs, and Kauschke 2017, this volume). The trochaic preference dictates e.g. the choice of plural allomorphs (Eisenberg 1991; Wegener 2004; Wiese 2009), and it restricts the productivity of many derivations, such as umlaut in diminutive formation (Fanselow and Féry 2002) or the possibility to form denominal adjectives by suffixation of *-ig*¹ (this derivation is only licit when the suffix is immediately preceded by a syllable carrying stress, thus forming a right-aligned trochee: *ruhig* < *Ruhe*, *tomatig* < *Tomate*, **kürbisig* < *Kürbis*, **mangoig* < *Mango*, **paprikaig* < *Paprika*²). The effect of the trochee in German morphology is probably best seen in hypocoristic truncations with the *i*-suffix (*Ándi* < *Andréas*, *Stúdi* < *Studént*) (cf. Féry 1997; Itô and Mester 1997; Köpcke 2002) in which the trochaic template applies almost exceptionless – in fact, as the examples *Andi* and *Studi* show, this highly productive process may even force the deviance from the stress pattern of the source form to safeguard a trochee. The trochee may thus be understood as an optimal template regulating the shape of words.

Beyond the word, the trochee may lead to rhythmic alternation of strong and weak syllables. In the ideal case, the concatenation of words yields a concatenation of trochees and, consequentially, the perfect alternation of strong and weak beats. A trochaic structure like (2) fulfills pertinent conditions regarding rhythmic alternation, namely the constraints against clustering of strong syllables (**CLASH*) (see Anttila et al. 2010, for various instantiations of this constraint) or against sequences of weak syllables (**LAPSE*) (cf. Shih et al. 2015, for a discussion of different eurhythmy measures). The example in (2) can be considered especially eurhythmical in that the alternation between strong and weak is even reflected in the vowel qualities with diphthongs or long vowels alternating with unstressable reduced vowels.

¹ In the case of stems ending in a syllabic sonorant, a schwa syllable may be skipped, producing dactylic forms like *hibbelig* ('jittery'). This is reminiscent of Kager's notion of the invisibility of schwa syllables to certain phonological processes that are conditioned by stress (Kager 1989), as may be exemplified by German umlaut (Féry 1994).

² A reviewer suggests that hiatus avoidance may be considered a factor in the ungrammaticality of **mangoig* and **paprikaig*. However, cases like *ruhig* [ʁuːɪç] and *böig* [bøːɪç] < *Böe* ('gust', 'squal!') attest the license for hiatus in these contexts.

- (2) *Friede, Freude, Eierkuchen*
 [('fʁi:.də) ('fʁɔɪ.də) ('ʔaɪ.ə) (,ku:.xən)]
 peace, joy, pancake
 'love, peace and harmony'

Apart from the alternating rhythm of strong and weak syllables, (2) constitutes a prime example for iterating rhythm (or prosodic parallelism) with the four trochees building a perfectly parallelistic prosodic structure, i.e. a symmetric set of two pairs of trochees. The prosodic repetitiveness is enhanced by the segmental structure at least for the first pair of trochees (the parallelism is mirrored in the onsets of both the stressed and the unstressed syllable). The alliterating idiomatic expression in (2) suggests that the force of iterating rhythm is most obvious in poetic language where prosodic parallelism is prevalent (concerning, for example, the matching of lines in metered poems, see Menninghaus et al. 2017).

1.2 Rhythmic alternation within and beyond the word

The propensity for rhythmic alternation (i.e. the effect of *CLASH and *LAPSE) is illustrated by cases in which it forces a deviance from patterns that would be expected by mere concatenation of morphs. For instance, the prominence of syllables can be demoted to avoid a clash of neighbouring strong beats. Consider, in this respect, the German word *Nation* [na'tsjo:n] ('nation') with the latinate suffix *-ion* attracting stress on the final syllable. Attaching the equally stress-attracting adjectival suffix *-al* leads to a restructuring of prominences such that the stem-final syllable becomes unstressed and instead the initial syllable receives secondary stress (*national* [,natsjo'na:l]).

In other cases, the force of *CLASH may even impinge on the quality of the underlying vowel. This is the case in the most natural rendition of a compound like *Bauarbeiter* 'builder', made up of the constituents *Bau* [baʊ] 'building' and *Arbeiter* ['ʔa:.baɪ.te] 'worker'. With compound stress on the first constituent, the initial syllable of the second member becomes a reduced syllable and is thus attached to the foot projected by the monosyllabic first member [(('baʊə)(,baɪ.te)]. Importantly, the footing of this compound, arguably driven by *CLASH, runs counter to its morphological structure.³

³ It is certainly possible for *Bauarbeiter* to retain secondary stress on the first syllable of the head noun and, in addition, mark the morphological boundary by a glottal stop

The avoidance of clashes has also been shown to have syntactic effects (cf. especially Schlüter 2005; Speyer 2010, on the syntactic effects of clash avoidance in English). As for German, consider the otherwise unmotivated ordering with the adverbial intensifier *ganz* or *so* that is separated from the adjective or de-adjectival noun it modifies and instead preceding the indefinite pronoun or determiner in noun phrases like (3) (see e.g. Kallulli and Rothmayr 2008 and Gutzmann and Turgay 2015 for syntactic and semantic analyses of similar phenomena). This inversion coexists alongside the canonical ordering with the determiner preceding the intensifying adverb. As noted by Behaghel (1930), the displaced determiner serves as a buffer between two prominent syllables, preventing a clash. Determiner doubling in (4) provides an even more striking case, arguably with the same motivation.⁴

- (3) canonical order ~ determiner inversion
- a. *was ganz Neues ~ ganz was Neues*
‘something quite new’ ~ ‘quite something new’
 - b. *ein ganz junger Mann ~ ganz ein junger Mann*
‘a quite young man’ ~ ‘quite a young man’
- (4) determiner doubling
- a. *ein ganz ein feiner Kerl*
‘a quite a fine chap’
 - b. *ein so ein großer Bub*
‘a such a big boy’

Interestingly, inversion or doubling appears to be illicit in German with di- or trisyllabic intensifiers (*gänzlich*, *dermaßen*) whose unstressed final syllable prevents a stress clash in the first place.

- (5) a. *ein gänzlich feiner Kerl*
a.' **gänzlich ein feiner Kerl*
a." **ein gänzlich ein feiner Kerl*
‘(a) quite (a) fine chap’

[('baʊ)(ʔa:.baɪ.tɐ)]. I would argue, however, that this rendition is only valid under a strong pragmatic pressure to clarify the morphological structure (e.g. in the case of a misunderstanding or correction), and uncommon in running speech.

⁴ Schlüter (2005) notes the same inversion of the indefinite determiner and the adverb *quite* in English and argues that this inversion has a rhythmic motivation.

- b. *ein dermaßen großer Bub*
 b.' **dermaßen ein großer Bub*
 b." **ein dermaßen ein großer Bub*
 '(a) such (a) big boy'

The ungrammaticality of inversion or doubling in (5) casts doubt on purely syntactic accounts of this phenomenon and instead provides further evidence for a rhythmic trigger for these word order options.

As noted above, apart from stress clashes, sequences of unstressed syllables are considered disrhythmic and are thus avoided.⁵ For instance, when the productive suffix *-er* is attached to trochaic place names ending in *-en* [ən] to derive a demonym to the place name, elision of a reduced syllable is common in certain dialects.

The elision of a reduced syllable in these dialects is probably motivated by linguistic rhythm, specifically to avoid sequences of two reduced syllables (*LAPSE). This process seems to have an areal distribution such that it does not affect all place names in the same way, as may be observed when comparing (6) and (7) with (8).⁶

- (6) semi-transparent, with resyllabification of stem-final consonant(s) (mainly East Central German and Bavarian)
- a. *Dresden* [dʁe:s.dən] – *Dresdner* [dʁe:s.dnɐ]
 - b. *Bautzen* [bau.tsən] – *Bautzner* [bau.tsnɐ]
 - c. *München* [mʏn.çən] – *Münchner* [mʏn.çnɐ]
 - d. *Weiden* [vai.dən] – *Weidner* [vai.dnɐ]
- (7) opaque, elision of stem-final consonant (Northern Low Saxon)
- a. *Emden* [ʔɛm.dən] – *Emdner* [ʔɛm.dɐ]
 - b. *Bremen* [brɛ:.mən] – *Bremer* [brɛ:.mɐ]
 - c. *Norden* [nɔɐ.dən] – *Norder* [nɔɐ.dɐ]
 - d. *Apen* [ʔa:.pən] – *Aper* [ʔa:.pɐ]

⁵ The Strict Layer Hypothesis assumed in prosodic phonology (Selkirk 1984) provides a supplementary explanation for the avoidance of lapses: under the assumption that feet in German are trochaic and maximally disyllabic, further unstressed syllables cannot be parsed into feet and thus constitute a violation of the principle EXHAUSTIVITY.

⁶ The examples represent the written norm within the dialectal areas. For certain place names, reduced and full form coexist, e.g. *Uelzen* – *Uelzener* ~ *Uelzer*; *Dülmen* – *Dülmener* ~ *Dülmer*.

- (8) fully transparent, no effect of *LAPSE
- a. *Hagen* [ha:.gən] – *Hagener* [ha:.gə.nə]
 - b. *Siegen* [zi:.gən] – *Siegener* [zi:.gə.nə]
 - c. *Gießen* [gi:.sən] – *Gießener* [gi:.sə.nə]
 - d. *Aachen* [ʔa:.xən] – *Aachener* [ʔa:.xə.nə]

The effect of *LAPSE is especially remarkable when considering dactylic place names like *Tübingen*, *Kaufungen*, *Bevensen*. Mere affixation of the demonymic suffix would lead to three consecutive unstressed syllables, a configuration that is ungrammatical across dialects (**Tübingener*, **Kaufungener*, **Bevensener*). Instead, *LAPSE dictates haplogy in these cases, resulting in elision of stem-final [ən] – as in (7) – to yield *Tübinger*, *Kaufunger*, *Bevenser*.

Vogel et al. (2015) have shown clear effects of *LAPSE on the linearization of constituents in German sentences. Specifically, Vogel et al. (2015) investigated i) the ordering of inherently weak pronominal adverbs in the Middlefield and ii) auxiliary verbs in sentence final verb clusters. Speakers were to repeat sentences with these constructions that were presented in either a rhythmically alternating or a disrhythmic condition, i.e. one in which the placement of the weak pronoun or auxiliary verb leads to three consecutive, unstressed syllables. The results reveal a clear effect of rhythm such that recall errors were significantly more likely in the disrhythmic conditions. In other words, the syntactic representation of the sentences to be recalled was more stable when the corresponding prosodic representation was rhythmically optimal.

The preceding examples attest the importance of rhythmic alternation, more specifically, of the constraints *CLASH and *LAPSE for the phonological representation (and processing) not only of words but also at the phrasal level. The low level constraints fostering an alternating rhythm of strong and weak syllables are complemented by a tendency for iterating rhythm such that patterns that emerge from the distribution of prominences are preferably repeated.

1.3 Prosodic parallelism within and beyond the word

Recently, Wiese and Speyer (2015) suggested that prosodic parallelism is relevant for the occurrence of final schwa in cases like (1) (see Kentner 2015, for discussion). In a nutshell, the idea is as follows: when given the choice, speakers strive for prosodic parallelism; for two words that are prosodic phrase mates, the foot

structures are preferably parallel, i.e. the feet display the same number of syllables and stress pattern. Thus, their argument goes, the appearance or lack of optional schwa is dependent on the foot structure of neighboring words.

Examining a large corpus of written German, Wiese and Speyer (2015) investigated, inter alia, several cases of nouns with apparently freely alternating monosyllabic and disyllabic variants like *Tür* – *Türe* ('door') or *Tags* – *Tages* ('day-GEN') in the context of (preceding) monosyllabic or disyllabic determiners.

- (9) a. ((die)_ε (Tür)_ε)_φ
 b. ((ei.ne)_ε (Tü.re)_ε)_φ

Using chi-square tests on bigram frequencies, they disprove statistical independence of the prosodic shapes of co-occurring determiner and noun. In a follow-up study, Wiese (2016) reports corroborating evidence in corpora of spontaneous spoken language. These results suggest that, when possible, the prosodic structure of the noun preferably mirrors the structure of the determiner, cf. (9). Note that this explanation assumes that function words like determiners project a foot (see Kentner 2015, for discussion).

The effect of prosodic parallelism is not confined to German schwa-zero alternations alone. In fact, there are phenomena that would defy proper analysis without recourse to a constraint on prosodic parallelism; these are cases in which the PARALLELISM constraint appears to have a stronger influence compared to the German schwa-zero alternations, in which parallelism is merely a tendency. Consider Standard Chinese, in which the productivity of N+N compounds and V+Obj combinations is strictly constrained by the number of syllables. As Duanmu (2012) shows, parallel prosodic structures with either two monosyllables (1+1) or two disyllables (2+2) are generally licit for both constructions. However, for N+N compounds, non-parallel structures of the 1+2 type are mostly unacceptable. Similarly, for V+Obj phrases, the imbalanced pattern 2+1 is considered unacceptable (cf. Luo and Zhou 2010; Luo, Duan, and Zhou 2015, for pertinent neuro- and psycholinguistic evidence).

Another case demonstrating the influence of PARALLELISM, again in German morphophonology, is rhyme and ablaut reduplication (Kentner 2017). This type of reduplication has a strict non-identity requirement concerning base and reduplicant, both of which correspond to a prosodic foot (*schickimicki*, **schickischicki* < *schick* 'posh'; *hickhack*, **hackhack* < *hacken* 'to chop, to bicker'). Crucially, nonidentity is confined to the segmental tier. That is, a difference between base and reduplicant concerning the prosodic shape is prohibited (**schischicki*,

**schickischick*; **hickhackle*, **hickehack*), and it is this prohibition that strongly suggests the workings of prosodic parallelism.

Wiese and Speyer's proposal on prosodic parallelism is in line with the observation that equal-sized prosodic constituents are preferred on various levels of prosodic representation and processing. This finding has been codified in several ways: for instance, Ghini (1993) suggests that, in Italian, prosodic structure is built in a fashion that guarantees balanced phonological phrases even if the resulting phrasing is non-isomorphic to syntactic structure. Similarly, Myrberg (2013), examining Stockholm Swedish, suggests that prosodic subconstituents conjoined within an intonational phrase preferably have the same prosodic status. Selkirk (2000) invokes the constraints BINMIN and BINMAX which jointly favor minimally and maximally two prosodic words per phrase. Féry and Kentner (2010) and Kentner and Féry (2013) propose a Similarity condition on prosodic structure such that neighboring constituents at the same level of syntactic embedding be adjusted to exhibit a similar prosodic rendering, irrespective of the constituents' inherent complexity.

Given the abundance of evidence for parallelism, it is not far-fetched to consider it a well-formedness condition on prosodic structure, just like *CLASH and *LAPSE. The exact formulation of this constraint, however, is open to debate (as is the formulation of *CLASH and *LAPSE, cf. discussions in Anttila, Adams, and Speriosu 2010; Shih et al. 2015). Suffice it to say that the PARALLEL constraint requires adjacent prosodic constituents grouped within a higher constituent to exhibit the same prosodic structure.

Having introduced the three rhythmic constraints and their workings in various environments, the following section assesses their relative contribution to word prosodic structure and phrasal rhythm.

2 Three studies on word prosodic structure and phrasal rhythm

The three studies to be presented below were designed to explore the influence of the rhythmic environment on morphophonological (and morphosyntactic) variation in German. Although prosody (or particularly prosodic rhythm) is not explicitly encoded in the written modality (but see Evertz and Primus 2013), all three experiments use written material for this purpose. This is justified by numerous findings which converge to suggest that the use of the written modality (reading and writing) involves recourse to prosodic representations (see, e.g.

Chafe 1988; Breen 2014; and the collection of studies in Kentner and Steinhauer 2017).

The experiments use different linguistic environments and employ different methodologies but all share as crucial factor the distribution of lexically strong or stressed syllables around the morphophonologically or morphosyntactically variable word(s). Experiment One is an oral reading experiment that focuses on the prosodic rendering of the variable prosodic adverb *gem(e)* in different rhythmic contexts. A large-scale online survey (>150 participants), Experiment Two explores rhythmic influences on the choice between possible realisations of possessive or partitive relations. In Experiment Three, we return to prosodically variable adverbs. Employing a corpus analysis, we investigate the usage frequency of prosodically variable adverb-verb sequences to specifically pit effects of rhythmic alternation (avoidance of stress clash and lapse) against those of prosodic parallelism.

2.1 Rhythmic context effects on optional schwa in read speech

The first experiment is concerned with the effects of the rhythmic-prosodic context on the realisation of the prosodically variable adverb *gem(e)* ('happily') in spontaneous (unprepared) oral reading. This adverb has two graphemic representations that correspond to i) a monosyllabic <*gem*> or ii) a trochaic variant <*gerne*>. For the experiment, both graphemic variants were embedded in sentences with systematically varied rhythmic-prosodic structures to ascertain the effect of the rhythmic context on the realisation of schwa on the adverb in scripted speech production.

Previous work suggests that optional schwa syllables are used by speakers to optimise the rhythmicity of phrases and sentences; specifically, it has been argued that a schwa syllable may act as a buffer syllable that prohibits stress clash (Kuijpers and van Donselaar 1998; Rohdenburg 2014; Schlüter 2005). In the case of the variable adverb <*gem(e)*>, the optional schwa syllable may thus prevent a potential clash with a word to the right of it.

The first manipulation of this experiment therefore targets the syllable to the right of the variable word: the noun following the variable adverb in (10) begins in either a stressed (*Himbeeren*) or an unstressed syllable (*Kartoffeln*). In addition, the rhythmic context to the left of the word was manipulated; this manipulation is motivated by the hypothesised propensity for iterating or sequential rhythm that is at the core of prosodic parallelism. The lexical material of the sentences was constructed to yield a trochaic beat with every other syllable bearing

lexical stress. The syllabic structure of the noun directly preceding the target adverb <*gern(e)*> was systematically varied, with either a monosyllable (*Hof*) or a disyllabic trochee (*Garten*). Thus, the first (or only) syllable of the variable adverb falls on either an on-beat or off-beat position of the established trochaic pattern. According to the parallelism hypothesis, the trochaic form of the variable adverb should be preferred when preceded by a trochee while the monosyllabic form should be preferred when preceded by a monosyllabic foot.

- (10) a. *Bodo will in Steffis Garten gerne Himbeeren ernten.*
 b. *Bodo will in Steffis Garten gern Himbeeren ernten.*
 c. *Bodo will in Steffis Hof gerne Himbeeren ernten.*
 d. *Bodo will in Steffis Hof gern Himbeeren ernten.*
 e. *Bodo will in Steffis Garten gerne Kartoffeln ernten.*
 f. *Bodo will in Steffis Garten gern Kartoffeln ernten.*
 g. *Bodo will in Steffis Hof gerne Kartoffeln ernten.*
 h. *Bodo will in Steffis Hof gern Kartoffeln ernten.*
 ‘Bodo would like to harvest {raspberries, potatoes} in Steffi’s {yard, garden}’

2.1.1 Materials, participants, procedure

Twenty-four item sets like (10) were devised. The items were distributed over eight lists such that items and conditions were counterbalanced across the lists with each list containing exactly one condition from each item set. Additionally, each list contained 64 filler items from four unrelated experiments and three practice items not connected to any of the experimental items, yielding a total of 91 items. With the exception of the three initial practice items, the item order was determined by pseudo-randomization (van Casteren and Davis 2006) (for each participant individually) such that items from the same experiment had a minimal distance of two intervening items from other experiments and items from the same experimental condition were separated by at least three fillers.

Twenty-four members (19 female) of the Goethe-University community (Frankfurt, Germany) took part in the experiment. All participants are native speakers of German with normal or corrected-to-normal vision per self report. Initially, participants were not informed about the purpose of the experiment but debriefed after the experiment ended.

The experiment took place in a silent office at Goethe University in single sessions for each participant. Participants were seated in front of a 21.5-inch computer screen and equipped with a microphone head set (Shure) attached to an R-44 digital recorder.

All 91 items of each list were presented in a slide show. Each item was presented on two consecutive screen displays. The first display presented two (irrelevant) context sentences in the upper half and the first two words of the target sentence (in the case of this experiment: subject and modal verb) in the middle of the screen (all text left-aligned). Upon pressing the enter button on the keyboard, the target sentence appeared in full (leaving the rest of the first display intact). Participants were asked to read the first display (i.e. the context) silently before moving on to the second display screen. To ensure spontaneous, unprepared oral reading and minimal look-ahead, participants were instructed to read out the target sentence immediately as it appeared on screen and to do so as fluently as possible. The participants were discouraged from making corrections during or after reading and to move on to the next item after reading by another button press. The productions of the participants were recorded on a digital memory card.

2.1.2 Results

All in all, (24 items x 24 participants =) 576 experimental sentences were recorded. Two student assistants independently evaluated each target sentence. Their task was to determine by ear i) whether the production was a fluent and flawless response to the target sentence and ii) whether the target adverb was realised as monosyllabic *gern* or disyllabic *gerne*.

Seven sentences (1.2%) were scored as non-fluent or otherwise flawed by at least one referee and discarded from further analysis. The judgments concerning the number of syllables were perfectly consistent. Aggregating the 569 valid responses, the adverb was judged to contain a reduced syllable in 260 cases (45.7%) and monosyllabic in 309 cases (54.3%) suggesting a slight preference for the monosyllabic form. All in all, the oral realisation of the adverb corresponded to the graphemic representation in 82% of the cases.

Mixed logistic models (Bates et al. 2013) were applied in the statistical computing environment R (R Core Team 2015) to assess the effects of the graphemic representation ('writtenE'), the rhythmic environment to the left ('RhythmLeft'), and the rhythmic environment to the right ('RhythmRight') on the realisation of the schwa syllable (dependent variable: 'realiseE') in reading. The fixed effects

(or predictor variables) were coded as orthogonal sum contrasts to ensure minimal correlation. Apart from the fixed effects, the models included participant ('speaker') and item as random effects that were adjusted for by participant or by item differences in the effects of the predictor variables. Likelihood ratio tests (carried out by the *anova* function) were used to compare models with different predictor variables and random effect structures in order to determine the model with the best fit for the data. The likelihood ratio test generally prefers simpler or more parsimonious models over more complex ones as long as the inclusion of model parameters does not significantly increase model fit. Consequentially, if the inclusion of a model parameter did not significantly improve model fit, it was culled from the model. Complex models with all three predictor variables, the respective interactions, and complex random effects structures⁷ were tested first and non-significant predictors (as determined by the likelihood ratio tests) were culled in a stepwise fashion. Over and above a highly significant effect of the graphemic representation (readers preferably realise the adverb in line with its graphemic representation), the preceding context significantly affects the realisation of the reduced syllable. As visible in Table 1, trochaic *gerne* appears to be more likely when the preceding word is trochaic; conversely, the monosyllabic variant is preferred after monosyllabic nouns. The coefficients of the best fitting logistic mixed model are tabulated in Table 2.

Tab. 1: Percentages of trochaic realisations of the variable adverb *gern(e)* broken down by graphemic form of stimulus and prosodic form of preceding noun

Percentage of trochaic realisations of adverb		Prosodic form of noun preceding the adverb	
		trochaic	monosyllabic
Graphemic form of the adverb	<gern>	17	10
	<gerne>	80	76

⁷ Several of the more complex models did not converge. Non-converging models were not considered further in the model comparison process.

Tab. 2: Coefficients of the best fitting mixed logistic model with the formula $glmer(real-iseE \sim writtenE + RhythmL + (writtenE | speaker)$, family = binomial). N = 569

	Estimate	Std. Error	z-value	p-value
(Intercept)	-0.06767	0.43364	-0.156	0.8760
writtenE	2.50456	0.33543	7.467	<0.001
RhythmLeft	-0.27643	0.13822	-2.00	0.0455

2.1.3 Discussion

The experiment shows that readers are generally guided by the written form of the prosodically variable word when producing it in spontaneous read speech. Apart from the effect of the graphemic representation, the rhythmic context has a small but significant effect on the realisation of schwa on the critical adverb. This, however, only holds for the manipulation concerning the rhythmic structure to the left of the critical word (RhythmLeft). The other rhythmic effect that was tested in this experiment, the rhythmic context to the right of the critical word, failed to affect the realisation of *gem(e)*. One conceivable explanation is related to the task of spontaneous oral reading: readers may simply not have had the time to sufficiently process the upcoming word to prosodically adjust the target word to it.

The significant effect of RhythmLeft suggests that readers prefer monosyllabic *gem* after a monosyllabic noun while trochaic *gerne* preferentially follows a trochaic noun. This finding, at first sight, corroborates the prediction according to the parallelism hypothesis. However, taking into account the wider prosodic context (with the trochaic beat that was established right from the beginning of the sentence), parallelism as formulated by Wiese and Speyer (2015) may be insufficient to explain the results. Under Wiese and Speyer's account, and under the Strict Layer Hypothesis (SLH) of prosodic phonology (Selkirk 1984), feet cannot straddle word boundaries. This limitation, however, is crucial when evaluating the parallelism effect. Compare, in this respect, the conflicting footings of an example item in (11):

- (11) Conceivable foot structures
 a. trochaic footing ('Abercrombian' feet)
 (*Rosie*) (*will auf*) (*jeden*) (**Fall gem**) (*Ärztin*) (*werden*)

- b. footing according to the Strict Layer Hypothesis
(Rosie) (will) (auf) (jeden) (Fall) (gern) (Ärztin) (werden)
 Rosie wants in any case happily physician become
 ‘In any case, Rosie would like to become a physician.’

(11a.) represents a perfectly iterating prosodic structure – a sequence of six trochees – but blatantly violates the Strict Layer Hypothesis, with the adverb *gern* demoted to the weak position of a trochee (in this position presumably being unaccentable); (11b.), in contrast, abides by the letter of the SLH but the structure fails to represent the trochaic beat that is felt when the sentence is uttered. This is because, according to Wiese and Speyer (2015), even function words project feet (see Kentner 2015, for criticism). If one were to follow Wiese and Speyer (2015), the intended trochaic beat of the experimental items does not correspond to parallel prosodic structures in the first place.

The analysis of the read sentences so far only considered the presence or absence of schwa on the critical adverb but did not involve any assessment of its prosodic prominence. A cursory look at the realisations of the adverb, however, suggests that the monosyllabic adverb often remains entirely unaccented (which would be in line with the representation in (11a.)) and often features a centralised vowel: [gən]. There is independent evidence to the effect that leaving the adverb unaccented (a necessity for the representation in (11a.)) is very common: Kutscher (2014) found that adverbs in German are often prosodically reduced, and thus serve as a trough between prominence peaks, preventing stress clash.

While I acknowledge that this experiment cannot settle the largely theoretical debate among the schools favoring Abercrombian feet (11a.) over those abiding by the SLH (11b.) or vice versa, I point out that the representation (11a.) not only respects *CLASH and *LAPSE; (11a.) also exhibits a sequential rhythm and may thus be in line with a weaker version of PARALLELISM that tolerates violations of the SLH. (11b.), in contrast, only locally fulfills the PARALLELISM constraint (in the bolded part of the sentence) but fails to respect other constraints on rhythmic structure (*CLASH, *LAPSE) in spite of the fact that a natural rendition of the sentence exhibits a perfect alternation of prominences.

2.2 Rhythm and morphosyntactic choice: Morphological genitive vs. prepositional construction

In German, the possessive or partitive relationship may be expressed by (at least) two syntactically distinct constructions:⁸ by morphological case (genitive) or by a prepositional phrase headed by *von* ('of'). The choice between these two is partly governed by register or style with the prepositional construction deemed more colloquial and the genitive more formal. Given that the prepositional construction affords more (function) words than the morphological genitive, the two variants also exhibit a difference concerning their rhythmic patterns.

- (12) a. *Der Wirt der Herberge*
 the owner the.GEN inn.GEN
 b. *Der Wirt von der Herberge*
 the owner of the.DAT inn.DAT
 'the owner of the inn'

As apparent from a comparison of the two syntactic options in (12), the prepositional phrase (12b.) involves, in addition to the determiner, a (usually) unaccented syllable (the preposition *von*) which increases the distance between head noun and attribute. When the latter two are lexical words and new to the discourse context, these referents usually bear an accent. The exact location of the two accents and their distance from each other depends not only on the construction (genitive or prepositional phrase) but also on the prosodic structures of the lexical words involved. The accents are the further apart the more unstressed syllables follow the head noun's stressed syllable, or the more unstressed syllables the attributive noun has preceding its stressed one.

Making use of a systematic manipulation of the prosodic distance between head noun accent and accent on the attribute, the following study aims at testing the hypothesis that the choice between the two syntactic options is attributable to the (implicit) rhythmic structure they engender. A very similar hypothesis has recently been confirmed for the usage of the English *s*-genitive and 'of'-genitive by Shih et al. (2015) who conducted a large-scale analysis using a corpus of spoken American English; in their dataset, however, the effects of rhythm on construction choice, although detectable, were largely dampened by the factor animacy. Here, a more controlled experimental avenue was chosen, i.e. a question-

⁸ In the following, further options will be disregarded, e.g. compounding *Herbergswirt* (lit. 'inn owner') or the preposed genitive, as in *Marias Hund* ('Maria's dog'). The latter construction is confined to animate genitives and mainly used with proper names.

naire study in which the prosodic structures of both the head noun and the attribute were systematically varied while leaving the factor animacy constant. The study will be detailed in the following.

2.2.1 Materials and method

An online questionnaire (Sosci Survey by Leiner 2014) was set up in which participants had to tick their preferred option for the expression of a possessive or partitive relationship in various rhythmic conditions. To this end, 24 items like (13a.–d.) were devised with head noun and attribute separated by a blank. The four conditions of the 24 items were counterbalanced across four blocks in a latin square design such that no head noun and attribute was presented more than once per block. The trials were presented in randomised order, interspersed with 40 filler items from two unrelated experiments. Each item was presented on a single slide together with four options to fill the blank. By ticking the appropriate box, participants had to choose either *der* (i.e. the monosyllabic definite determiner for the genitive attribute) or *einer* (i.e. the disyllabic indefinite determiner for the genitive attribute) or *von der* (i.e. the preposition and following determiner for the prepositional construction). In addition, a fourth option (*aus* ‘from’) was given as an oddball option that invariably leads to an ungrammatical construction. This was included to be able to spot participants who randomly marked one option without proper consideration of the item.

175 students of the Goethe-University community participated in the online questionnaire. Each participant was randomly assigned to one block.

- (13) Insert *der* or *einer* or *von der* or *aus*
- a. *Der Knopf ... Arbeitshose*⁹
 - b. *Die Knöpfe ... Arbeitshose*
 - c. *Der Knopf ... Gesäßtasche*
 - d. *Die Knöpfe ... Gesäßtasche*
‘the button(s) {a., c.: Sg; b., d.: Pl} of the {a., b.: work pants; c., d.: back pocket}’

⁹ All attribute nouns have feminine gender in order to avoid fusion of preposition and determiner, a common process with masculine or neuter attributes (*von dem* > *vom*).

2.2.2 Predictions

The study was originally designed to test the hypothesis that construction choice is co-determined by the propensity for rhythmic alternation. Correspondingly, more short genitives (the monosyllabic determiner *der*) are expected in conditions with greater distance between the accented syllables of head noun and attribute, i.e. when the head noun has non-final stress and the attribute has non-initial stress. Conversely, more prepositional constructions *von der* or disyllabic genitives *einer* are expected in conditions with a short distance between the accented syllables of head noun and attribute. Opposing predictions come about when considering effects of prosodic parallelism. According to the PARALLELISM constraint, structures are preferred that yield an iterating rhythm. Correspondingly, in our case, a trochaic head noun (such as *Knöpfe*) should give rise to a preference for the disyllabic determiner *einer* or the prepositional construction with *von der* (the monosyllabic preposition and monosyllabic determiner are assumed to be grouped into a trochee). A monosyllabic head noun, in turn, should promote the monosyllabic determiner *der*.¹⁰

Tab. 3: Percentages for chosen possessive/partitive construction broken down by stress on head noun and attribute

		Ultima of head noun		Initial of attribute noun	
		unstressed	stressed	unstressed	stressed
Prosodic form of Gen or PP	monosyllabic	59	55	58	56
	trochaic	41	45	42	44
Total		100	100	100	100

¹⁰ The prosodic structure of the attribute was varied in such a way as to make predictions according to prosodic parallelism impossible to test with respect to the attribute noun. The first syllable of the attribute was either a stressed syllable or an unstressable reduced syllable. In the latter case it is unclear what kind of material would be preferred, according to parallelism, between head noun and attribute. What is more, the foot structures of the attributes with initial stress was variable, i.e. some items had initial monosyllabic feet (e.g. (*Haupt*)(*schu.le*)), some presented with trochaic initials (e.g. (*Ei.sen*)(*bahn*)).

2.2.3 Results

Several participants only partly completed the questionnaire, resulting in many missing answers. All in all, 3662 responses or 87% of the expected 4200 (= 175 participants x 24 items) were collected. In 39 of the cases, the oddball option *aus* was chosen, resulting in ungrammatical constructions. The majority (90%) of the remaining 3623 valid responses resulted in a genitive construction (2055 times or 57% of the cases monosyllabic *der*; 1195 times or 33% of the cases disyllabic *einer*). In only 373 or 10% of the cases, the prepositional construction was chosen. One reason for this discrepancy lies in the fact that there were two options to choose from genitives but only one valid prepositional option (not counting the ungrammatical oddball). Moreover, since the task was presented in writing, there is certainly a tendency to choose the formal genitive over the more colloquial prepositional construction.

In order to specifically test the predictions according to the principle of rhythmic alternation (*CLASH, *LAPSE) and PARALLELISM, the responses were grouped by prosodic structure, i.e. the disyllabic trochaic genitive determiner *einer* was collapsed with the likewise trochaic prepositional *von der* and juxtaposed to the monosyllabic genitive determiner *der*.

Table 3 shows the percentages of monosyllabic (*der*) vs. disyllabic responses (*einer* or *von der*) broken down by the prosodic status (stressed or unstressed) of the ultima of the head noun and the initial syllable of the attribute noun. Clearly, participants gave more disyllabic responses when the head noun presented with stress on the ultima and when the attribute had initial stress.

Logistic mixed models (Bates et al. 2013) were applied to assess the effects of the prosodic status of the head noun (stressed or unstressed ultima) as well as of the attribute noun (stressed or unstressed initial syllable) on the choice of monosyllabic or disyllabic responses. The intercepts for participants and items were included as random effects. Again, as in the previous study, predictor variables (which were coded as orthogonal sum contrasts) were culled from the model when their inclusion did not improve model fit.

The results of the best fitting logistic mixed model are tabulated in Table 4. Contrary to predictions, including the effect of stress position on the attribute does not improve model fit. However, the model confirms that the prosodic structure of the head noun significantly affects the choice of the construction. With an unstressed ultima on the head noun, the monosyllabic determiner is clearly preferred over the disyllabic genitive or prepositional construction, most likely because the latter would yield a dirhythmic structure with three or four unaccented

syllables in a row. The results thus support the hypothesis that participants strive for rhythmic alternation when making syntactic decisions.¹¹

There is, however, no indication that participants build prosodically parallel structures. According to prosodic parallelism, as conceived by Wiese and Speyer (2015), participants would have had to prefer a disyllabic trochaic genitive or preposition plus determiner after a trochaic head noun, or, conversely, a monosyllabic genitive after a head noun featuring a stressed ultima. This is clearly not the case.

To conclude, the propensity for rhythmic alternation has a significant impact on construction choice while any effect of prosodic parallelism remains mute.

Tab. 4: Coefficients of the best fitting generalised linear model evaluating the choice of the possessive/partitive construction

	Estimate	Std. Error	z-value	p-value
(Intercept)	-0.33166	0.14641	-2.265	0.0235
UltimaHeadNoun	0.09413	0.03711	2.536	0.0112

2.3 *CLASH, *LAPSE, PARALLELISM – a corpus study

The third study examines a large-scale corpus (DeReKo, cf. Institut für Deutsche Sprache [IDS]) to directly compare the effects of *CLASH, *LAPSE, and PARALLELISM on the morphophonological variation concerning the German adverbs *gern ~ gerne* ('happily'), *lang ~ lange* ('for long'), *selbst ~ selber* ('{my-, your-, her-, him-, our-, them}-{self-, -ves}'), and *meist ~ meistens* ('most of the time'). These adverbs display a (free) alternation concerning the schwa and, consequentially, syllabic structure, i.e. they feature either a monosyllable or a trochee. In the latter case, the final syllable is always a reduced syllable (schwa or [ɐ] in the case of *selber*). Importantly, in contrast to further alternating adverbs, the allomorphs of these adverbs have graphemic cognates both of which are equally acceptable in written Standard German. To the best of my knowledge, there are no more alternating adverbs both variants of which are likewise acceptable in writing.

¹¹ In recent years, a number of online experiments studying eye movements in reading showed comparable results which suggest that the rhythmic/prosodic environment affects syntactic parsing decisions in written sentence comprehension (Breen and Clifton 2013; Kentner 2012; Kentner and Vasishth 2016).

2.3.1 Method and materials

The frequencies of the four variable adverbs were examined in the context of two forms of the verbs *tun* and *machen* ('to do', 'to make') when these follow the variable adverb. This way, four variable adverbs by two verb forms, i.e., eight quadruplets of prosodically different adverb-verb combinations were scrutinised.

Tab. 5: Bigrams scrutinised in corpus experiment and corresponding factors used for the evaluation of the rhythmic effects

Adverb	Verb	*CLASH	*LAPSE	PARALLEL
<i>gern/selbst/meist/lang</i>	<i>tun</i>	×	✓	✓
<i>gerne/selber/meistens/lange</i>	<i>tun</i>	✓	✓	×
<i>gern/selbst/meist/lang</i>	<i>getan</i>	✓	✓	×
<i>gerne/selber/meistens/lange</i>	<i>getan</i>	✓	×	×
<i>gern/selbst/meist/lang</i>	<i>machen</i>	×	✓	×
<i>gerne/selber/meistens/lange</i>	<i>machen</i>	✓	✓	✓
<i>gern/selbst/meist/lang</i>	<i>gemacht</i>	✓	✓	×
<i>gerne/selber/meistens/lange</i>	<i>gemacht</i>	✓	×	×

The prosodic profile of each bigram was coded according to the three rhythmic constraints. This was done in a binary fashion, as displayed in Table 5, where the bigrams are represented as either respecting or violating each of the three constraints respectively.

For each of the four combinations of verb form and adverb, the bigram frequencies within the DeReKo corpus, written section (Institut für Deutsche Sprache [IDS]) were determined. Chi-square tests were applied to test the statistical independence of adverb and verb form. These tests use contingency tables like (14) to compare the expected frequencies according to the null hypothesis (which assumes adverb and verb forms to be statistically independent from each other) to the actual, observed frequencies.

(14)

		Prosodic form of verb	
		Monosyllabic	iambic
Prosodic form of adverb	monosyllabic	<i>gern tun</i>	<i>gern getan</i>
	trochaic	<i>gerne tun</i>	<i>gerne getan</i>

2.3.2 Data analysis and results

For seven of the eight quadruplets of bigrams, the Chi-square tests clearly disprove statistical independence of the prosodic structure of adverb and verb (with p-values < 0.01), supporting the hypothesis that the choice of the prosodic form is conditioned by the prosodic shape of the context. Only in the case of the *meist(ens) machen/gemacht* quadruplet, the test did not yield a significant result. In any case, it has to be determined whether and to what extent each of the three rhythmic constraints under discussion contribute to the prosodic effect. Therefore, for each of the 32 bigrams, the standardised Chi square residuals¹² were calculated as a measure for the degree of deviance from assumed statistical independence of the prosodic form of the adverb and the prosodic form of the verb. Testing the predictions of the three rhythmic constraints against the residuals can inform us about the extent to which each constraint contributes to the frequency distribution of the adverb-verb combinations. In general, a negative residual indicates that a bigram occurs less frequently than the null hypothesis would lead one to expect; conversely, a positive value indicates that the bigram is used more frequently than expected. That is, if the constraints were to affect the prosodic form of the adverb-verb bigrams, structures that violate a given constraint should obtain negative residuals, while bigrams that respect the constraint should engender more positive residuals.

¹² Standardised residuals are calculated as (Observed Frequency – Expected Frequency) / sqrt(Expected Frequency)

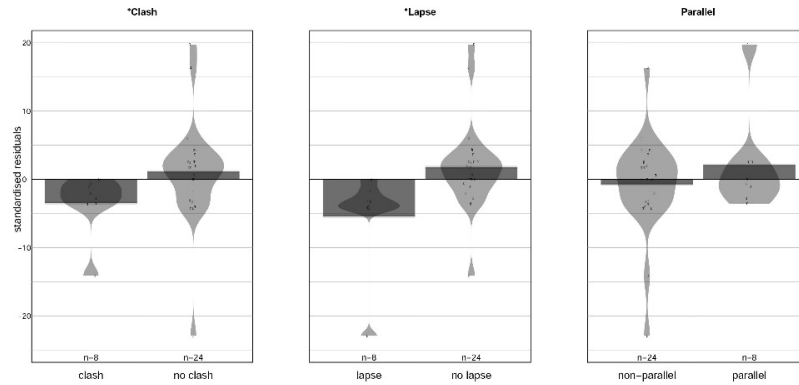


Fig. 1: Standardised Chi square residuals (y-axis) broken down by the two levels of each factor, representing the constraints *CLASH (left panel), *LAPSE (middle panel) and PARALLELISM (right panel), respectively (x-axis). The dots correspond to the individual residuals for each bigram ($n=32$). The bars represent the mean residual, and the shaded area around the dots illustrates the density of the distribution (the wider the shaded area, the denser the clustering of the residuals in that area).

In order to get a first impression about the contribution of the three constraints, the 32 standardised residuals are plotted for each level of the three predictor variables using the `YaRrr` package (Phillips 2017) in the statistical computing environment R (R Core Team 2015). As the plot in Figure 1 shows, bigrams that violate a constraint are, on average, less frequent than expected according to the null hypothesis and hence show more negative residuals (cf. left bars of the three panels) while bigrams respecting the constraints are more frequent than expected. The distribution of residuals thus corroborates the hypothesis that adverb-verb bigrams that respect the rhythmic constraints are favored over those bigrams that violate the relevant constraints. However, the differences between the residuals for the bigrams that violate versus bigrams that obey a given constraint are clearly more pronounced in the case of *CLASH and *LAPSE than in the case of PARALLELISM. This is especially apparent in the residuals for those bigrams that violate *CLASH and *LAPSE: Almost all residuals for bigrams that involve a clash or a lapse are negative, while the residuals for the non-parallel bigrams (left bar in the right panel of Fig. 1) are more evenly distributed with the mean residual close to zero. The distribution of residuals corresponding to the bigrams respecting *CLASH or *LAPSE (right bars in the left and middle panel), while positive on average, spans

both the positive and the negative range (most likely due to the fact that bigrams that obey *CLASH may violate *LAPSE, and vice versa).

Linear models (Bates et al. 2013) were employed to analyse the data. The standardised residuals that were calculated for each of the 32 bigrams (see above) were used as dependent variable. The three constraints (*CLASH, *LAPSE, PARALLELISM) served as binary predictor variables, with each bigram violating or respecting the constraints (cf. Table 3); these predictors were coded as orthogonal contrasts. Including the specific adverb as grouping variable (random effect) did not improve model fit. In Table 6, the output of the model including all three predictor variables is tabulated, with *CLASH and *LAPSE clearly showing significant effects while the effect of PARALLELISM remains non-significant.

A second, simpler model was fit with PARALLELISM discarded as predictor (cf. Table 7). Applying the anova function to compare the simpler model with the full model suggests that discarding PARALLELISM does not deteriorate model fit (Df = 1, p = 0.32).

To summarize, the negative Chi square residuals for bigrams involving a stress clash (e.g. /gern machen/) or a stress lapse (e.g. /gerne getan/) reflect the avoidance of these rhythmically sub-optimal structures when compared to bigrams that obey the respective constraints. No such pattern of avoidance could be observed for bigrams that violate the PARALLELISM constraint (i.e. non-parallel bigrams like /gerne tun/ or /gern machen/). This corpus study thus corroborates the hypothesis that the inclusion or omission of the optional schwa-syllable on the adverb is conditioned by the stress status of the initial syllable of the verb. The overall prosodic shape of the verb, however, i.e. whether it is monosyllabic, trochaic, or iambic, does not appear to affect the inclusion/omission of the schwa syllable on the adverb beyond the effects of *CLASH and *LAPSE.

Tab. 6: Model including all three main effects

	Estimate	Std. Error	t-value	p-value
(Intercept)	-0.02698	1.02653	-0.026	0.979212
*Clash	2.13	0.64902	3.282	0.00277
*Lapse	2.29243	0.64902	3.532	0.00145
Parallelism	0.65506	0.64902	1.009	0.32148

Tab. 7: Model with main effect of PARALLELISM culled

	Estimate	Std. Error	t-value	p-value
(Intercept)	-0.02698	1.02653	-0.026	0.979212
*Clash	1.96624	0.62862	3.128	0.003987
*Lapse	2.45619	0.62862	3.907	0.000514

2.3.3 Discussion

This corpus study yields important insights regarding the morphophonological variation on the adverbs under study. First of all, provided that the written corpus does in fact reflect prosodic preferences, it is clear from the results that supralexical prosodic structure co-determines the presence or absence of a reduced syllable on the variable adverbs. This is in accordance with similar findings by Ingason (2015), Kaufmann (2014), Schlüter (2005), and Vogel et al. (2015) who report rhythmic influences on morphological or morphosyntactic variation. Secondly, this study fails to replicate the findings by Wiese and Speyer (2015) who hold prosodic parallelism accountable for the presence or absence of a reduced syllable. In this study, PARALLELISM does not appear to contribute to the morphophonological variation of the adverbs. The model comparison suggests that the rhythmic influences are reducible to *CLASH and *LAPSE alone. One conceivable reason for the discrepancy between the present results and the findings by Wiese and Speyer (2015) lies in the difference between the structures scrutinised: while this study looked at prosodically variable adverb-verb sequences (e.g. *gern(e) tun*), Wiese and Speyer (2015) studied the variable adverb in other contexts (e.g. the verb-adverb sequence *wär(e) gern(e)*). It remains to be seen why prosodic parallelism explains the variation in one case but not in the other. In this context, it would also be interesting to check to what extent the rhythmic constraints *CLASH and *LAPSE contribute to the variance in Wiese and Speyer's dataset.

Furthermore, this study reveals an interesting finding regarding the relative contributions of *CLASH and *LAPSE, with the latter apparently having a similar, if not stronger, impact on morphophonological choice when compared to *CLASH. Given the greater attention to stress clash and its avoidance in the literature and the comparatively limited consideration of the *LAPSE constraint, this may seem astonishing (entering the terms 'clash' and 'lapse' in the context of the phrase 'linguistic rhythm' produces 493 hits for 'clash' but only 271 for 'lapse' on Google Scholar). What is more, as noted by Julia Schlüter,

[...] many authors [...] concur in the view that stress clashes are perceived as far more objectionable than stress lapses; while the latter are tolerated to a certain extent, the former almost categorically necessitate compensatory measures.

(Schlüter 2005, 20)

Possibly, the somewhat weaker effect of *CLASH on presence or absence of schwa is due to the fact that a stress clash may be alleviated in other ways, e.g. by stress retraction or stress promotion, processes that the writer may subconsciously execute (remember that we are dealing with data from a written corpus). Conversely, it is hardly possible to change a structure violating *LAPSE by altering the assignment of prominences to syllables because the unstressable reduced syllables simply cannot become stressed. A writer abiding by the principle of rhythmic alternation is thus more likely to put morphophonological variation to its rhythmic use in the event of a potential lapse than in the event of a potential clash (see Shih et al. 2015, for a similar point).

In the following, I note several limitations of this study. For one thing, since I examined the variable structures within a written corpus only, it remains unclear whether the results are generalisable to the oral modality. Even more importantly, since only bigrams were studied, with the wider (prosodic) context disregarded, the validity of the results is open to suspicion. It is quite possible that an analysis that considers the phrasal context would lead to different results. However, the approach taken here is in keeping with Wiese and Speyer (2015) who also only considered bigrams, rendering the studies at least methodologically comparable. Finally, the scope of this study is very narrow, narrower by far compared to Wiese and Speyer (2015) who consider schwa-zero variation not only on adverbs but in many more contexts. The results therefore have to be taken with some caution.

3 General discussion and conclusion

Overall, the three studies presented here clearly support the claim that the rhythmic-prosodic context affects morphophonological variation. The first study revealed an effect of the rhythmic pattern (due to the distribution of lexical stresses) on the realisation of the variable adverb *gern(e)* in oral reading. The second study, a forced choice experiment, showed that the variable morphosyntax of the

possessive or partitive relation is susceptible to rhythmic structure. Finally, a corpus study demonstrates the non-independence of the prosodic shapes of variable adverbs in adverb-verb sequences.

As to the relative contribution of the three constraints under discussion (*CLASH, *LAPSE, PARALLELISM) for explaining the variance observed in the three experiments, the findings paint a somewhat mixed picture. The final corpus study quite clearly dismisses the importance of PARALLELISM, while showing that *LAPSE and *CLASH, have a clear impact on the choice of monosyllabic vs. trochaic adverb. Similarly, the experiment on the choice between morphological genitive and prepositional phrase reveals a weak effect of rhythmic alternation but fails to reveal an effect of prosodic parallelism.

The first experiment, however, suggests that prosodic parallelism has a role to play in the realisation of the variable adverb in oral reading. It shows that an iterating rhythm is effectively priming the morphophonological form of the variable adverb that continues the preceding (trochaic) rhythm. However, as highlighted in the discussion of that experiment, the iterating rhythm is only observable through the lens of certain assumptions regarding the foot structure involved, i.e. it is only valid when foot boundaries are allowed to straddle word boundaries (contra the Strict Layer Hypothesis) and when adverbs may be demoted to a prosodically weak position. That is, while there is clear evidence for the joint effects of *CLASH and *LAPSE conditioning the morphophonological structure of words and phrases, effects of prosodic parallelism are relatively minute. This is not to contest the relevance for prosodic parallelism in other contexts. As discussed in the introduction, prosodic parallelism is likely to be a constraining factor in word formation (e.g. reduplication) and it is clearly involved in poetic language. Quite possibly, the role of PARALLELISM is more pronounced in more artistic language use or, more generally in circumstances that are not as strictly constrained by time. Note that for PARALLELISM to become apparent, the linguistic processor needs to consider more material (at least two adjacent feet) than when evaluating local rhythmic well-formedness on a syllable-to-syllable basis.

All in all, the results of the studies presented suggest that phrases and sentences are not built by merely concatenating morphs according to a pre-specified syntactic structure. In addition, word forms may be altered in various ways to suit the supra-lexical rhythmic structure, and the rhythmic structure may reciprocally codetermine morphosyntactic choice.

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