



# The prosody of the verbal prefix *ge-*: historical and experimental evidence

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## Abstract

This study investigates whether prosodic words in West Germanic languages are determined by morphological structure or rhythmic principles, i.e., the trochaic foot. To investigate this question, we looked at the unstressed verbal prefix *ge-* diachronically and synchronically. A corpus study of three Old English, Old Saxon, and Old High German manuscripts showed that *ge-* often attaches to preceding auxiliaries and negation particles but not content words. The findings of the corpus study were verified through a production study in Modern German, measuring the closure duration of [g] as an indication of boundary strength between the prefix and the preceding word. Results showed that closure duration is reduced if the verb follows a monosyllabic auxiliary. Furthermore, we found no indicators that the prefix interacts with preceding content words or negation. Both results taken together support the trochaic foot structure based on rhythmic principles, but only in very restricted contexts.

**Index Terms:** trochaic foot, rhythmic prosodic phrasing, *ge-* prefix, diachronic/synchronic data, West Germanic

## 1. Introduction

Prosodic phrasing is generally assumed to reflect syntactic constituency to some extent [1, 2]. For instance, *Match Theory* [3] assumes that by default each syntactic clause corresponds to an intonational phrase ( $\iota$ ), each syntactic phrase corresponds to a phonological phrase ( $\varphi$ ), and each syntactic word corresponds to a prosodic word ( $\omega$ ). However, there is also ample evidence for nonisomorphism between syntactic and prosodic constituency in the literature [4, 5, 6], especially with function words, which led to the proposal that the matching between syntactic and prosodic constituents only applies to lexical categories and their projections, but not to functional ones [7].

An alternative view proposes that prosodic phrasing in Germanic languages is determined by rhythmic principles driven by the trochaic foot [8, 9, 10]. Specifically, a ‘leftwards’ encliticisation of function words to previous material, regardless of syntactic structure, is proposed. For example, in an experiment measuring speaker latency time in Dutch, [11] showed that the article preceding a noun is prosodically grouped with the preceding verb instead of the following noun with which it forms a syntactic unit. Such findings support the assumption that the rhythmic phrasing of function words can account for the nonisomorphisms found between syntactic and prosodic phrasing.

One question that has received little attention so far is whether morphologically complete words can be prosodically ‘split’ in such a way that the initial part of these words becomes part of the previous prosodic unit. Indications that this might be the case come from prescriptive works concerned with correct pronunciation. In his book on *spoken English*, [12] instructs


his German readers on how to correctly pronounce English sentences. He frequently groups several words into one unit, but there are also instances where the morphological unity of a word is split by a prosodic unit as in *aimə* (*freid* ‘I’m afraid’ [12, p. 74]. In German, [13] provides examples like in (1), where he prosodically groups the unstressed participle prefix *ge-* with the preceding unit, forming trochaic feet (p. 136).

- (1) morph.: Frisch gewagt ist halb gewonnen  
phon.: (Frisch ge) (wagt ist) (halb ge) (wonnen)  
fresh PTCp-dare is half PTCp-win  
fig.: ‘Enthusiastically tried is half won’

[14] conducted a small production experiment on the phrasing of the prefix *ge-* in Modern German, where the prefixed verb was preceded by either monosyllabic or disyllabic object nouns in simple NPs. The disyllabic nouns varied in stress distribution, with stress either on the first or the second syllable. Results showed a significantly shorter closure duration if *ge-* directly followed the stressed syllable, suggesting the formation of a trochaic foot over the last syllable of the object noun and the following prefix.

Evidence for phrasing based on rhythmic principles is also found in early West Germanic (WG) orthography. Word division in early WG manuscripts often does not match the division into morphosyntactic units as found in Modern WG languages. For instance, function words often group together, while compounds are often divided into two words. One possible explanation is that these groupings reflect prosodic units [15, 16], an artefact of the *scriptio continua* in Ancient Greek, where the written text was a representation of the spoken word [17, 18].

The unstressed prefix *ge-* occurs in several medieval WG languages with a number of word categories. Although uniformly written as *ge-* in manuscripts, pronunciation was likely [jə] in Old Saxon (OS) and Old English (OE) and [gə] in Old High German (OHG). The common origin, Proto-Germanic *\*ga/gi*, is assumed to have marked perfectivity and resultativity in preverbal position [19, 20, 21]. In early WG orthography, *ge-* occasionally detaches from the verbal stem and attaches to previous material as shown below in (2) from the OE Parker/Winchester chronicles [22].

- (2)   
... and him wif gefuhton and hie gefliendon ...  
‘.. and fought with them and put them to flight...’  
(Corp. Chris. MS 173, year 917)

The synchronic and diachronic examples discussed above predict the formation of trochaic feet across word boundaries not only for enclitics but also for unstressed prefixes of the following words, especially if the preceding word ends with a stressed

syllable. In contrast, theories of the syntax-prosody interface such as Match Theory would predict the prefix to be firmly associated with the following verb. In addition, these theories would also predict the placement of larger prosodic boundaries after object nouns that might prevent the formation of trochaic feet across word boundaries.

This paper aims to investigate this relationship between morphologically complete words and rhythmic phrasing with focus on the verbal prefix *ge-*. We will first report on three diachronic corpus studies of *ge-* in OS, OE, and OHG in Section 2. Based on the findings and previous research, we then conducted a production experiment on the verbal prefix *ge-* in Modern German, which we report on in Section 3.

## 2. Corpus Studies

### 2.1. Methods

#### 2.1.1. Material

For the corpus studies, one manuscript for each language was chosen:

- Old English (OE):** Manuscript A of the Anglo-Saxon Chronicles (commonly referred to as the ‘Parker chronicle’), which ends in the year 1070.
- Old Saxon (OS):** Manuscript C of the Old Saxon Heliand, which is dated to the 10th century [23].
- Old High German (OHG):** The first book (*liberus primus*) of *De nuptiis Philologiae et Mercurii* (Codex Sangallensis 871). The text is a translation from Latin to German dating to the 11th century [24].

#### 2.1.2. Data Analysis

For the OS data, we first used the HeliPaD [25], a parsed corpus of OS based on Siever’s Edition [26] to extract all occurrences of *ge-* occurring with verbs. No such corpora exist for the OE and OHG data.

All manuscripts were then manually checked for occurrences of *ge-* and the distribution with respect to the previous word and the following verb. There were four possible distributions of *ge-*:

- word *ge-verb***, where *ge-* attaches to the following verb (corresponding to modern word division)
- word-*ge verb***, where *ge-* attaches to the previous word and detaches from the following verb
- word-*ge-verb***, where the verb and the previous word form one unit
- word *ge verb***, where *ge-* stands by itself

In addition, the word category of the preceding word was recorded, especially with regard to whether the preceding word was a function word or a lexical word.

It was sometimes difficult to decide whether a short white space clearly indicated a word division or whether it was simply a widening in the handwriting. These uncertain cases made up only a small percentage (1-2%) and were not included in the results. Cases where a line break occurred between *ge-* and the verbal stem were also not included.

### 2.2. Results: corpus studies

#### 2.2.1. Old Saxon

The total analysed number of instances of *ge-*-preceding verbs in the OS manuscript was 899.

Table 1: *Distribution of ge- in OS in percent, sorted by preceding word type.*

	Distribution	Total	Preceding word type	
			function	lexical
1	<b>word <i>ge-verb</i></b> :	91.8%	27%	73%
2	<b>word-<i>ge verb</i></b> :	3.8%	85.3%	14.7%
3	<b>word-<i>ge-verb</i></b> :	3%	66.7%	33.3%
4	<b>word <i>ge verb</i></b> :	1.4%	46%	54%

In 27 cases the *ge-* prefix was preceded by the negation marker *ne*. In these cases, the following *ge-* was either attached only to the negation marker (distr. 2; 59%) or attached to both, negation and following verb (distr. 3; 33.3%). *ge-* also occurred by itself (7.4%), but never in the expected position (distr. 1) if a negation marker was present. With regard to the auxiliaries (68 cases), *ge-* mostly showed the expected distribution (87%), but also stood by itself in 10% of the cases, and occurred attached to both neighboring elements in one case.

#### 2.2.2. Old English

The total analysed number of instances of *ge-* preceding verbs in the OE manuscript was 385.

Table 2: *Distribution of ge- in OE in percent, sorted by preceding word type and including ET, the Tironian symbol 7, which represents the conjunction ‘and’ in the manuscript.*

	Distribution	Total	Preceding word type	
			function	lexical
1	<b>word <i>ge-verb</i></b> :	55.8%	33.4%	64.6%
2	<b>word-<i>ge verb</i></b> :	10.4%	87.5% (7: 37.5%)	12.5%
3	<b>word-<i>ge-verb</i></b> :	22.6%	88.5% (7: 24.1%)	11.5%
4	<b>word <i>ge verb</i></b> :	11.2%	41.8%	55.8%

Several preceding word categories showed a greater likelihood for *ge-* to attach to. Of the 40 auxiliaries which directly preceded the verb, 13 (32.5%) had *ge-* attached. If sentence-initial adverbs like ‘here’, ‘there’ were followed by *ge-* (29 cases), *ge-* attached in 93.1% of the cases. The negation marker *ne* occurred only once before the verb, but in this case, *ge-* attached as well.

#### 2.2.3. Old High German

The total analysed number of instances of *ge-* preceding verbs in the OHG manuscript was 177.

Table 3: *Distribution of ge- in OHG in percent, sorted by preceding word type.*

	Distribution	Total	Preceding word type	
			function	lexical
1	<b>word <i>ge-verb</i></b> :	92.6%	38.4%	60.4%
2	<b>word-<i>ge verb</i></b> :	0%	0%	0%
3	<b>word-<i>ge-verb</i></b> :	3.9%	86%	14%
4	<b>word <i>ge verb</i></b> :	3.3%	50%	50%

Of the 6 instances in which the negation marker *ne* directly preceded the verb, *ge-* attached in 50% of the cases to the marker as well as the following word (distr. 3). With respect to the auxiliaries (11 cases), most cases had the expected grouping, except for one case where *ge-* stood by itself.

### 2.3. Discussion: corpus studies

The majority of *ge-*-prefixed verbs in OS, OE, and OHG show the orthographic distribution expected based on morpho-

syntactic phrasing (distr. 1). In the marked distributions, a common trend can be observed: when preceded by a function word, *ge-* often attaches to the previous material. Albeit the languages show slight differences in the details, there are common patterns: In all three languages, distribution types 2 and 3 occur most consistently when *ge-* follows the negation particle *ne*. Moreover, preceding auxiliaries seem to trigger non-expected attachments of *ge-* across the three languages: *ge-* is more likely to occur on its own following auxiliaries in OS and OHG, and frequently attaches to preceding auxiliaries in OE.

This behaviour of the prefix *ge-* could be ascribed to the fact that function words like *ne* and the auxiliaries are often monosyllabic and unstressed. The attachment of the prefix would add more prosodic ‘weight’ to the function words, incidentally also forming a complete trochaic foot: (ne.ge). Since lexical words are stressed and form prosodic words, *ge-* is less likely to attach to preceding lexical words. Another aspect is that the negation marker and the auxiliaries are both part of the verbal complex, i.e., they most likely form a larger prosodic unit with the following verb. In contrast, the object nouns are part of a separate prosodic phrase – as a result, a larger boundary can be assumed between the lexical word and the following verb, which is likely to prevent attachment.

With respect to the sentence-initial adverbs in OE, these are topicalized elements where modern transcriptions would assume a prosodic phrase boundary following the adverb (as in ‘In this year, ...’, ‘here, ...’). The expectation would thus be that *ge-* remains with the following verb. One possible explanation for the contradicting results is that the position following the adverb is a typical Wackernagel/second position [27, 28]. As this is beyond the scope of this paper, we leave this for further research.

Summing up, the results of the corpus study show that the prefix attaches to the following verb in a majority of the cases. However, the results also showed that the *ge-* prefixes show alternative attachment patterns if preceded by a function word in the same prosodic unit, where it often seems to form a trochaic foot.

### 3. Production Experiment

The findings of the orthographic distribution of *ge-* in the WG manuscripts and in previous research were used as a basis for a production experiment in Modern German, which, to this day, retains the unstressed verbal prefix *ge-/[gə]*. Our hypotheses were that if the prefix is phrased into trochaic feet, it is more likely to do so a) with material within the same phonological phrase, and b) with material that ends in a degenerated trochaic foot (i.e., a stressed syllable). Differences in phrasing should be visible at the boundary-related interval between the previous word and the prefix [29], especially in the closure duration of [g]: if [g] is phrased with preceding material, the closure duration should decrease. In contrast, the following vowel [ə], which is not part of the boundary interval, should show no difference in duration between the different conditions.

#### 3.1. Methods

##### 3.1.1. Material

The material included lexical and function words, where the prefix followed a) auxiliaries, b) negation particles, or c) object nouns, each with varying stress patterns. For the auxiliaries, we used monosyllabic *bin* (‘be.1SG’) and disyllabic, trochaic *haben* (‘have.1/3PL’). Although *bin*, being a function word,

is usually considered to be unstressed, it is likely that it carries more stress than the following *ge-*, allowing the two elements to form a trochaic foot theoretically. Hence, *bin* is considered to be stressed in the following analysis. For the negation, the modern equivalent of the negative marker would be *nicht*. However, the final [t] would most likely lead to segmentation problems with the following [g] and there is no disyllabic counterpart. We therefore chose two negative indefinites, monosyllabic *nie* (‘never’) and disyllabic, trochaic *nirgends* (‘nowhere’). Thus, in both the auxiliary and the negation condition, *ge-* was either preceded by a monosyllabic degenerate foot or a complete trochaic foot.

For the objects, we used mono-, di-, and trisyllabic object nouns with lexical stress either on the first or the last syllable (the trisyllabic nouns always had secondary stress as well), ending in a sonorant. Table 4 gives an overview:

Table 4: Metrical frames for the object nouns

	Metrical Frame	Example	Translation
a.	(X)	<i>‘Spiel</i>	game
b.	(X –)	<i>‘Garten</i>	garden
c.	(X – x)	<i>Te.le.fon</i>	telephone
d.	(– X)	<i>Ben.zin</i>	fuel
e.	(x – X)	<i>Me.lo.‘die</i>	melody

To enforce the trochaic patterns, each noun was also directly preceded by an adjective with a complete trochaic foot structure.

Given previous findings, we expected the prefix to be more inclined to rhythmically group with the monosyllabic auxiliary and negation indefinite, and object nouns with final stress, and to prefer auxiliaries and negation indefinites over object nouns in general.

##### 3.1.2. Participants

10 Native German speakers from the allemanic speaking area participated in the experiment (∅ age 26.2, 4 males, 6 females). They were all members of the University of Konstanz and received a small payment for their participation.

##### 3.1.3. Procedure

The recordings were made in the soundproof booth of the phonetics laboratory in Konstanz with a condenser microphone (sampling rate 44.1 kHz, 16-Bit, stereo). All target sentences were randomized and interspersed with fillers. Each target sentence was presented on a screen for participants to produce at ‘natural speed’. The procedure took approximately 30 minutes.

##### 3.1.4. Data Analysis

Each sentence was manually annotated in Praat [30] for the closure duration of the prefix-initial [g], the duration of [ə], and the duration of the entire prefix [g]+[ə], following standard segmentation criteria [31]. The duration of each of these intervals was extracted automatically via a Praat script from a total of 642 recordings. Of these, 61 had to be excluded. In a majority of these cases (40), [g] was realised as [j], which can be another pointer towards the prosodic phrasing. For reasons of space, we leave this phenomenon to further research and focus here on the cases that allowed for the measurement of closure duration.

### 3.2. Results: production experiment

We calculated the durations using a linear mixed effects regression model with stress patterns and word category as fixed factors and participants and items as crossed-random factors with the Satterthwaite approximation implemented in the R-library lmerTest [32, 33].

If the prefix followed an auxiliary, the duration of the whole prefix was significantly longer in the unstressed condition ( $p < 0.05$ ). This difference was driven by the closure duration of [g] ( $\beta = 0.0098$ ,  $SE = 0.002647$ ,  $t = 3.692$ ,  $p < 0.01$ ; 3.13%); no difference in duration was found for the prefix's [ə]-vowel (Figure 1).

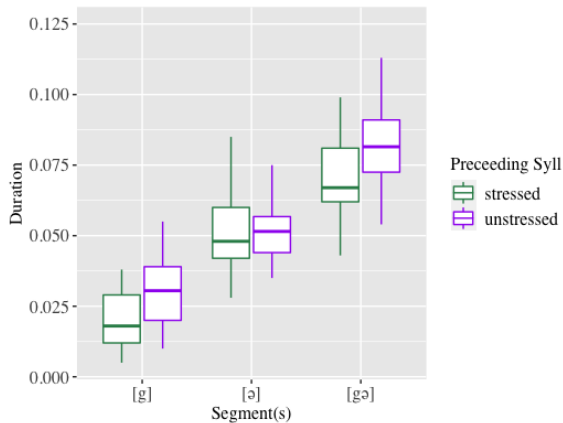


Figure 1: Duration of [g], [ə], and [gə] following auxiliaries, separated by whether the preceding syllable was stressed or unstressed.

No difference in duration in either [g], [ə], or [gə] was found if the prefix followed an object or a negative indefinite.

The comparison of the three categories over both conditions showed a significant difference in the duration of the whole prefix ( $p < 0.001$ ), driven by the closure duration of [g] ( $p < 0.001$ ) for all categories and all conditions. Figure 2 shows the closure duration of [g] in the three categories separated by the stress condition.

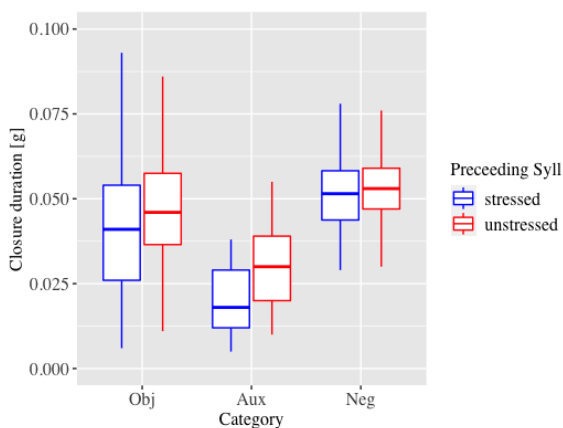


Figure 2: Closure duration of [g] following different types of word categories, separated by whether the preceding syllable was stressed or unstressed.

An analysis of the overall data showed that the closure duration after the object is longer than the duration after the auxiliary ( $\beta$

$= 0.01261$ ,  $SE = 0.00228$ ,  $df = 269$ ,  $t = 5.5$ ,  $p < 0.001$ ; 33%), while the closure duration after the negative indefinites is longer compared to both the auxiliaries ( $\beta = 0.02948$ ,  $SE = 0.00134$ ,  $df = 486$ ,  $t = 21.9$ ,  $p < 0.001$ ; 54%) and the objects ( $\beta = 0.016875$ ,  $SE = 0.002105$ ,  $df = 213$ ,  $t = 8$ ,  $p < 0.001$ ; 31%).

## 4. Discussion and Conclusion

In this paper, we investigated whether the formation of prosodic units is driven by syntactic constituency or based on rhythmic principles, i.e., the trochaic foot. We were particularly interested in whether the rhythmic formation is possible across the boundary of morphosyntactic words. To this end, we studied the verbal prefix *ge-* from a diachronic and a synchronic perspective.

The results of the production experiment confirm some of the assumptions made about the relation between prosodic and syntactic constituency. The prosodic phrase boundary following the object-NP seems to prevent the *ge-* prefix from incorporating prosodically with the previous material. However, these findings are in contrast to previous research [14]. A possible explanation is that in the present experiment the nouns were preceded by a modifying adjective. This addition might have caused the prosodic phrase (encompassing adjective and noun) to have 'enough weight', while the singular nouns in [14] were more prone to group with the following prefix. More research is needed in this direction.

No larger prosodic boundary exists after the auxiliary which forms a phonological phrase with the following verb. Within this domain, the rhythmic reorganisation is possible across word boundaries: in the presence of a degenerated prosodic foot (monosyllabic *bin*), *ge-* seems to be used to 'repair' the foot structure. Such a repair mechanism is not needed after the disyllabic auxiliary *haben*, resulting in a longer closure duration for [g].

Both object and auxiliary results confirm the patterns found in the historical data. In contrast, the results for the negation condition are in stark opposition to the historical findings: prefixes following negation have the longest closure duration overall. One reason for this result might be that in the historical data, the negation marker *ne* was a clitic [34], while, in the current stage of the Jespersen cycle, negation markers form separate prosodic words. In fact, its position suggests a strong prosodic (focus) accent [35] which would also indicate a strong boundary directly following the negation marker [36]. This question is left for further research.

Summing up, both diachronic and synchronic data suggest that the formation of trochaic feet across word boundaries is possible, but that the process most likely occurs within the domain of a prosodic phrase. However, there are also indicators for a 'hierarchical' classification of different types of prosodic phrase boundaries, where weaker boundaries (e.g., after unmarked, non-modified objects) might allow for rephrasing, while larger units form stronger boundaries (e.g., modified objects), and preceding elements in focus form a crisp boundary to the following prefix.

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## 6. References

- [1] E. O. Selkirk, “On derived domains in sentence phonology,” *Phonology Yearbook*, vol. 3, pp. 371–405, May 1986.
- [2] M. Nespor and I. Vogel, *Prosodic Phonology*. Dordrecht: Foris, 1986.
- [3] E. O. Selkirk, “The syntax-phonology interface,” in *The Handbook of Phonological Theory*, J. Goldsmith, J. Riggle, and A. Yu, Eds. Malden, MA: Blackwell, 2011, pp. 435–484.
- [4] S. A. Jun, “The phonetics and phonology of Korean prosody,” Ph.D. dissertation, Ohio State University, Columbus, 1993.
- [5] C.-C. Cheng, *A synchronic phonology of Mandarin Chinese*. The Hague: Mouton, 1973.
- [6] F. Ferreira, “The creation of prosody during sentence production,” *Psychological Review*, vol. 100, no. 2, pp. 233–253, Apr 1993.
- [7] H. Truckenbrodt, “On the Relation between Syntactic Phrases and Phonological Phrases,” *Linguistic Inquiry*, vol. 30, no. 2, pp. 219–255, 1999.
- [8] A. Lahiri and F. Plank, “Phonological phrasing in Germanic: the judgement of history, confirmed through experiment,” *Transactions of the Philological Society*, vol. 108, no. 3, pp. 372–398, Nov 2010.
- [9] D. Abercrombie, “Syllable quantity and enclitics in English,” in *Studies in Phonetics and Linguistics*, 3rd ed., D. Abercrombie, Ed. London: Oxford University Press, 1971, pp. 26–34.
- [10] A. Cutler, “Prosody and the word boundary problem,” in *Signal to syntax: bootstrapping from speech to grammar in early acquisition*, J. L. Morgan and K. Demuth, Eds. Mahwah, NJ: Lawrence Erlbaum, 1996, pp. 87–99.
- [11] L. Wheeldon and A. Lahiri, “Prosodic units in speech production,” *Journal of Memory and Language*, vol. 37, no. 3, pp. 356–381, Oct 1997.
- [12] H. Sweet, *Elementarbuch des gesprochenen Englisch*, 3rd ed. Leipzig: Tauchnitz [u.a.], 1904.
- [13] P. Eisenberg, *Grundriss der deutschen Grammatik: Das Wort*, 3rd ed. Stuttgart; Weimar: Metzler, 2006.
- [14] T. Bögel, “Rhythmic phrasing of prosodic words: a diachronic perspective from Old English, supported by experimental evidence from German,” in *Proceedings of the 50th Annual Meeting of the North Eastern Linguistic Society (NELS 50)*, vol. 1. Amherst: GLSA, 2020, pp. 59–72.
- [15] D. Nübling, *Klitika im Deutschen: Schriftsprache, Umgangssprache, Alemannische Dialekte*. Tübingen: Gunter Narr Verlag, 1992.
- [16] J. Fleischer, “Paleographic cues to prosody? - Accents, word separation, and related phenomena in Old High German manuscripts,” in *Information Structure and Language Change*, R. Hinterhölz and S. Petrova, Eds. Berlin: Mouton de Gruyter, 2009, pp. 161–189.
- [17] E. Frey, “Wortteilung und Silbenstruktur im Althochdeutschen,” Ph.D. dissertation, Universität München, München, 1988.
- [18] M. B. Parkes, *Pause and Effect. An Introduction to the History of Punctuation in the West*. Aldershot: Scolar Press, 1992.
- [19] W. Streitberg, “Perfective und imperfective Actionsart im Germanischen,” *Beiträge zur Geschichte der deutschen Sprache und Literatur*, no. 15 (Jahresband), pp. 70–177, 1891.
- [20] A. van Kemenade and B. Los, “Particles and prefixes in Dutch and English,” in *Yearbook of Morphology*, G. Booij and J. van Marle, Eds. Dordrecht: Springer Netherlands, 2003, pp. 79–118.
- [21] A. Lloyd, *Anatomy of the Verb: The Gothic verb as a model for a Unified Theory of Aspect, Actional Types, and Verbal Velocity*. Amsterdam: John Benjamins, 1979.
- [22] R. Flower and H. Smith, Eds., *The Parker Chronicle and Laws – a Facsimile*. London: Oxford University Press, 1941.
- [23] “British Library: Cotton Caligula A. VII.”
- [24] “St. Gallen, Stiftsbibliothek, Cod. Sang. 871: Juvenal, Satiren mit Glosse.”
- [25] G. Walkden, “Helipad: the Heliand Parsed Database. version 0.9,” 2015.
- [26] E. Sievers, Ed., *Heliand*. Halle: Verlag der Buchhandlung des Waisenhauses, 1878.
- [27] J. Wackernagel, “Über ein Gesetz der indogermanischen Wortstellung,” *Indogermanische Forschung*, no. 1, pp. 333–436, 1892.
- [28] J. Wackernagel, G. Walkden, C. Sevdali, and M. Macleod, *On a law of Indo-European word order*, ser. Classics in Linguistics. Berlin: Language Science Press, 2020, no. 7.
- [29] C. Fougeron and P. A. Keating, “Articulatory strengthening at edges of prosodic domains,” *Journal of the Acoustical Society of America*, vol. 101, pp. 3728–3740, Jun 1997.
- [30] P. Boersma and D. Weenink, “Praat: doing phonetics by computer [computer program],” 2023.
- [31] A. Turk, S. Nakai, and M. Sugahara, *Acoustic segment durations in prosodic research: A practical guide*, ser. Language, Context and Cognition. Mouton de Gruyter, Jul. 2006, pp. 1–28.
- [32] R. Baayen, D. Davidson, and D. Bates, “Mixed-effects modeling with crossed random effects for subjects and items,” *Journal of Memory and Language*, vol. 59, no. 4, pp. 390–412, Nov 2008, special Issue: Emerging Data Analysis.
- [33] A. Kuznetsova, P. Brockhoff, and R. Christensen, “lmerTest package: Tests in linear mixed effects models,” *Journal of Statistical Software*, vol. 82, no. 13, Dec 2017.
- [34] A. Jäger, “Negation in Old High German,” *Zeitschrift für Sprachwissenschaft*, vol. 24, no. 2, pp. 227–262, Nov 2005.
- [35] C. Féry and F. Kügler, “Pitch accent scaling on given, new and focused constituents in German,” *Journal of Phonetics*, vol. 36, no. 4, pp. 680–703, Oct 2008.
- [36] B. Hayes and A. Lahiri, “Bengali intonational phonology,” *Natural Language and Linguistic Theory*, vol. 9, no. 1, pp. 47–96, Feb 1991.