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Maike Prehn

Vowel quantity and the *fortis - lenis* distinction in North Low Saxon

The goal of this phonological investigation is to establish whether the primary prosodic feature in Low German dialects is tone, quantity, or something else entirely. All in all, we find that Low German employs a combination of vowel quality and vowel quantity, which carries functional load. It is a binary phonological system accounting for the ternary vowel duration found in Low German. I point out a crucial distinction between fortis vs. lenis consonants by means of laryngeal specification vs. underspecification and, hence, structural complexity of the segments. It is this complexity opposition in the coda consonants, which has a profound impact on the vowel duration of a preceding nucleus. We arrive at a phonological surface opposition of monomoraic vs. bimoraic and lax vs. tense in the vowel system, and of laryngeally specified vs. unspecified in the consonant system. Underlyingly, no quantity contrast exists in Low German, all vowels being simply monomoraic. What remains is quality.
With the data and analyses presented in this thesis, Low German falls in the category of languages featuring three phonetic degrees of vowel length that can be traced back to a binary contrast at the surface level.
No ternary quantity system is required.

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Maike Prehn

Vowel quantity and the *fortis - lenis* distinction in North Low Saxon

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and

the *fortis* - *lenis* distinction

in North Low Saxon

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VOWEL QUANTITY AND THE FORTIS - LENIS DISTINCTION IN NORTH LOW SAXON

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ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. D.C. van den Boom

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The initial idea for the project was to develop an analysis of the Central Franconian tone accents. Yet, I found myself much more interested in the Low German overlength phenomena of my Hamburg and Lower Saxony origin. 'Unfortunately', the title of the project was chosen rather generally as *Tone and Intrasegmental Structure in West-Germanic Dialects*, which formally allowed me to divert somewhat from the original plan, and to dive into the (also West-Germanic) matter of Low German dialects - not that my promotor and supervisors would have disapproved of my ambitions. Their support was tremendous, and the result is the present dissertation. Therefore, I would like to thank first and foremost my promotor Paul Boersma, and my supervisors Marc van Oostendorp, Ben Hermans, and Wolfgang Kehrein. So many opinions, so much input, such an incredibly huge amount of support! I'm still wowed – and keep wondering how I actually made my way through all of your suggestions and theories. You made my four PhD years definitely a singularly exciting, memorable, and inspiring time.

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Language is the means of getting an idea from my brain into yours without surgery.

Mark Amidon

I personally believe that we developed language because of our deep inner need to complain.

Jane Wagner

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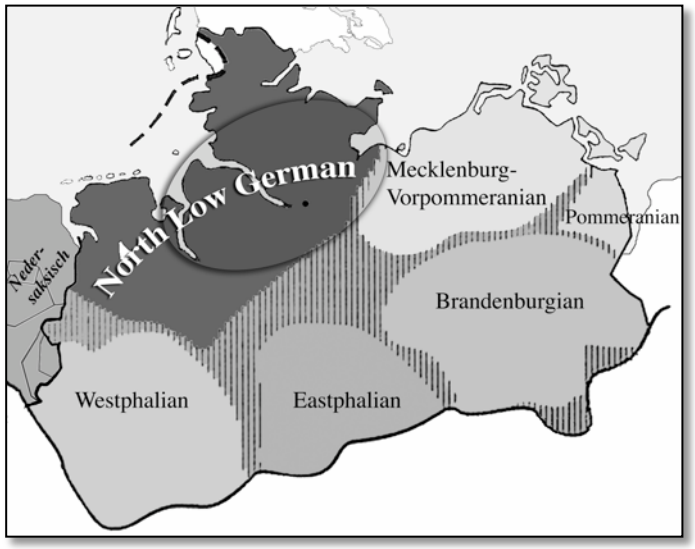
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1. Introduction

The West Germanic language Low German as spoken in northern Germany and the north-eastern part of the Netherlands is defined as a regional minority language in the sense of the European Charter. In Germany, it is generally divided into a western and an eastern variety, each containing again subdivisions into regional variants (i.e. North Low German, Westphalian, Eastphalian for the western part, and Mecklenburg-Vorpommeranian, Brandenburgian, and Pommeranian for the eastern part).[1] The Low German language in the Netherlands is subdivided from north to south into the varieties Gronings, Stellingwerfs, Drents, Twents, Gelders-Overijssels, and Veluws. Figure 1 provides a map of the Low German area with a focus on the German language territory. The hatchings mark transition areas between the dialects.

Figure 1. Map of Low German



I focus in the following on the North Low German area (also: North Low Saxon), and more specifically on its designated 'core-area' as indicated in Figure 1 (see also Figure 5).[2]

A linguistic peculiarity of this area is the assumed presence of a ternary length opposition of short *vs*. long *vs*. overlong in the Low German (LG) vowels.[3] Table 1 exemplifies the alleged distinction with two (near) minimal triples.

[1] Wiesinger (1983a), Lindow et al. (1998).
[2] Termed "Weser-Trave-Raum" by Lindow et al. (1998:19, Abb. 1). The main criterion for this classification is the consistent deletion of schwa in word endings in this area.

Table 1. Low German near minimal triples[4]

short	*long*	*overlong*[5]
(a) /zɪt/ 'sit-1.Sg.Pres.'	(b) /ziːt/ 'side-Nom.Sg.'	(c) /ziːd/ 'silk-Nom.Sg.'
/gɪs/ 'guess-1.Sg.Pres.'	/riːs/ 'rice-Nom.Sg.'	/riːz/ 'giant-Nom.Sg.'
/stɪk/ 'pencil-Nom.Sg.'	/steːk/ 'pierce-1.Sg.Pres.'	/steːg/ 'jetty-Nom.Pl.'

A phonetic difference occurs not only with respect to vowel duration but also in vowel quality, as is demonstrated in the examples. Short vowels are lax (i.e. produced more open), long and overlong vowels are tense (i.e. produced more closed). An additional difference in the tonal contours of the long vowels (*Stoßton*, pushing tone) and the overlong vowels (*Schleifton*, dragging tone) has been postulated and measured on various occasions.[6]

There exists a long-standing discussion on this matter in LG. In phonological analyses, researchers have declared all three of the following phonetic correlates to be *the* primary property of the contrast:

i) a ternary length contrast (e.g. Ternes 1981);
ii) differentiation of two series of short vowels (plus one series of long tense vowels) by means of tenseness / laxness (e.g. Kohler & Tödter 1984; Kohler et al. 1986; Kohler 2001);
iii) tone to distinguish between long vowels and overlong vowels (e.g. Wyland Grundt 1975; Höder 2003; Ternes 2006; Prehn 2007).

The theoretical point of departure is generally the assumption that the deletion of a word-final schwa [ə] (i.e. apocope) and the co-occurring reduction of the word by one syllable triggered two different developments from post-Middle Low German (MLG) to LG, namely vowel lengthening and the lack of vowel lengthening.[7] If the schwa was preceded by an originally intervocalic voiced consonant, a long nuclear vowel (V) in the preceding syllable lengthened to overlong (Table 1 (c) /ziːd/ 'silk-Nom.Sg.' < MLG *side*, /riːz/ 'giant-Nom.Sg.' < MLG *rese*,[8] /steːg/ 'jetty-Nom.Pl.' < MLG *stege*).[9] A number of researchers (e.g. Kohbrok 1901, Bremer 1929, von

[3] The term *Low German* where henceforth occurring in the study is used synonymously to *North Low German* and *North Low Saxon*.
[4] I employ here the notation V for short vowels, V**ː** for long vowels, and the notation VV**ː** for overlong vowels. An artificially lengthened vowel as used for the perception experiment described in chapter 3.1.3 receives an additional half-length sign, i.e. VV˙ (diphthong) or V˙ː (monophthong). Note that the phonological transcription will be revised in the course of the discussion of LG vowel length in section 5.3.3.
[5] The phonologically voiced (or lenis) final obstruents are occasionally not fully devoiced in LG phonetics (see below FN 72 page 59, section 5.3.1.1 page 170). I therefore use rather [z] than [s] in the phonetic transcriptions of this thesis. The underlying voiced (or lenis) status of the respective obstruents is not affected.
[6] See among others Bremer (1929), Bellamy (1968), Höder (2003) in chapter 2.
[7] MLG was spoken approximately between 1300 and 1600 A.D. as a *lingua franca* of the Hanse League.
[8] It may be the case that the nuclear vowel of [riːz] 'giant-Nom.Sg.' has been borrowed from HG (Paul Boersma p.c.).
[9] Note that open syllable lengthening (OSL) occurred in pre-MLG time or in early MLG at the very latest. The additional lengthening of long vowels to overlong vowels occurred on top of OSL. It changed the old

Essen 1957, Ternes 1981) assumed that the extended duration is accompanied by a certain pitch movement that resembles the contour of the originally bisyllabic configuration. If instead of the voiced consonant a voiceless consonant occurred in intervocalic position, the long V maintained its duration and pitch contour and no change emerged (Table 1 (b) /steːk/ 'pierce-1.Sg.Pres.' < MLG *steke*); similarly, short Vs did not change either in this position, independently of whether the intervocalic consonant was voiced or voiceless (Table 1 (a) /zɪt/ 'sit-1.Sg.Pres.' < MLG *sitte*, /gɪs/ 'guess-1.Sg.Pres.' < MLG *gisse*, /stɪk/ 'pencil-Nom.Sg.' < MLG *sticke*; also LG /mʏg/ 'mosquito' < MLG *mugge*).[10] Thus, long vowels differ from the newly developed overlong vowels not only in overall duration, but also in their 'tonal' behavior. The most frequent terms used in the literature for these 'tones' or 'tone accents' are *Stoßton* or 'pushing tone' for the early peaked pitch contour accompanying long vowels (here termed TA1), and *Schleifton* or 'dragging tone'[11] for the pitch contour with a delayed peak accompanying the overlong vowels (here termed TA2), respectively. The contrast is in the majority of cases observable on monosyllables (excluding prefixed items), but also occurs in some bisyllabic words (e.g. /mɑˈtroːz/ 'sailor-Sg.', /kɔmˈbyyːz/ 'caboose-Sg.'). We can say that the opposition is restricted to word-final, stressed syllables.

Moreover, it has been observed for some dialects that schwa after a sonorant consonant equally leaves a trace after apocope or syncope (i.e. deletion of interconsonantal schwa). The effect here is that we find a lengthened sonorant consonant instead of a lengthened nuclear vowel. The prerequisite is that the nuclear vowel was originally short. A durational difference in sonorant consonants occurs between words such as [kan] 'can-3.Sg.' < MLG *kan* and [kanː] 'jug-Sg.' < MLG *kanne*. The latter form probably shows the same pitch contour as the overlong vowel in /ziiːd/ 'silk-Nom.Sg.' < MLG *side* on the sequence of short vowel and long sonorant consonant (Prehn 2010).

The goal of this investigation is to establish whether LG employs vowel quality, vowel quantity or rather tonal accents as a means of expressing lexical or morphological contrasts. The vowel quality differences of tense *vs*. lax have been phonetically analyzed exhaustively and rather unanimously for the regional northern variety of Standard German (Weiss 1976) and local varieties of LG (Kohler & Tödter 1984, Kohler et al. 1986) in the past. This leaves us with the question concerning the presence of vowel quantity differences and tonal differences in LG, and their possible functional load. In order to be able to give a significant phonological account of LG suprasegmentals, I recorded speech material and conducted a perception test with informants from three dialect areas. The dialects under investigation are the local varieties of Kirchwerder (eastern outskirts of

long vowels and the lengthened vowels alike. Short (lax) vowels were not affected because they only occur in (originally) closed syllables (see section 5.1.1.1).

[10] Wiesinger (1983b:1063f.). Note that /ziːt/ 'side-Nom.Sg.' < OSax. *sîda* did not have a schwa in MLG time. Standard German *Egge*, LG [ʔeeːç] 'harrow-Sg.' with overlong V appears to be an exception at first sight. Note, however, that the MLG form is *ēgede* with long V in initial position. It is therefore no exception, but it is compliant to the expected development.

[11] Also: circumflex or circumflected intonation (e.g. Zahrenhusen 1901; Rabeler 1911; Sievers 1914).

Hamburg), Altenwerder (western outskirts of Hamburg), and Alfstedt (close to Bremervörde / Niedersachsen).

I develop the phonological analysis based on the insights of the phonetic investigations, and the grammatical properties of LG (in particular: word stress). Since the durational differences between the long vowels and the supposedly overlong vowels are interrelated with the quality of the following consonant (C), we need to consider the post-vocalic Cs in the analysis as well.[12]

The tests demonstrate that the alleged difference between a second and a third degree of length (i.e. long *vs.* overlong) is indeed present in the phonetic data. The informants employ duration as the main cue for distinguishing between certain minimally different pairs of words. This is true for the production as well as the perception. A tonal phenomenon (i.e. a dragging tone on the overlong vowels) is not consistently produced and perceived. I treat this matter more elaborately in the descriptive part of the study in chapter 3. We could assume at this point of the investigation that the length contrast is phonological.

Yet, another rather prominent opposition needs to be considered as well: the quality contrast between lax vowels and tense vowels. While lax vowels are always short, tense vowels may only be long or overlong. In order to clear the picture, I present in chapter 4 more data, this time focusing on the stress system of LG. Stress has some interesting implications for the specific weight of vowels and succeeding Cs. The stress system shows that short lax Vs and long tense Vs count as identical weight-wise, whereas the tense overlong Vs are heavier. This suggests a phonological relevance of the durational difference.

Chapter 5 contains my synchronic analysis of the LG vowel system. The lax *vs.* tense quality we find in LG vowels distinguishes between the monomoraic short and long vowels. The lax Vs (like all lax vowels in Germanic languages) behave rather special, requiring an additional tense vowel in the nucleus or a consonant in the coda. I argue that, since the tense long and overlong Vs are distinguishable only by means of duration, a binary contrast of moraic weight is sufficient to explain the phonetic facts. The vowel length system can therefore be established as being twofold binary: lax *vs.* tense distinguishes the short and long Vs, whereas monomoraic *vs.* bimoraic distinguishes the long and overlong *Vs.*

The (synchronic) interaction of the overlong vowel length with a following lenis C, and the blocking of overlength in pre-fortis and pre-sonorant context is discussed in chapter 6. I provide an OT analysis of the matter, relating the different behavior with respect to compensatory lengthening to the structural complexity of the segment. While fortis Cs are laryngeally specified and sonorant Cs employ a feature [sonorant voicing], meaning that both categories have a structurally enriched root node, lenis Cs are laryngeally unspecified. They are structurally simplex. It is this status that ultimately allows for the lengthening of a tense long vowel to tense overlong after (diachronic) apocope of schwa in the succeeding syllable.

[12] Socio-linguistic or lexical aspects that are the focus of most of the recent scientific investigations (Appel 1994:16) are not what I am aiming at.

To accommodate LG in a broader linguistic context, I give a typological overview of the languages of the world that show three possibly phonological degrees of length in chapter 7. The outcome of this short venture is that there are at least ten languages that can best be analyzed as being ternary. Although this number is cross-linguistically particularly low, it evinces that a threefold length contrast is by no means impossible.

Chapter 8. contains the conclusion.

Before I start with the descriptive part and the presentation of the data, I would like to give first an overview of the phonological background setting, the dialect area, and the linguistic studies on the length and tone phenomena in LG that have been brought forward until now. Section 2.1 defines the phonological frame that is assumed for the current survey. Section 2.2 contains a brief overview on the three dialect areas investigated here. The relevant literature is presented in section 2.3.

2. Theoretical Basis

2.1. *Phonological background*

Having provided an overview of the research questions regarding LG overlength or pitch phenomena, I turn now to the linguistic background my analyses are based upon. The recordings and perception tests conducted for this survey are designed to fill a gap in the phonetically based research on LG phonology. The study aims at pinpointing whether the investigated LG dialects employ vowel length (binary or ternary), vowel quality (tense *vs.* lax) or distinct tonal contours (TA1 *vs.* TA2) as means of expressing lexical or morphological contrasts.

Since the assumed distinction is typically found in monosyllables (because of the reduction of bisyllables to monosyllables due to apocope), monosyllabic minimal pairs were used for the recordings as well as the later perception test. The pairs contain a non-apocopated item with a long vowel or an apocopated item with long vowel and originally voiceless intervocalic obstruent (defined as *Expected Length Degree 2* and/or TA1), and an apocopated/syncopated item with a supposedly overlong vowel because of an originally voiced intervocalic obstruent (defined as *Expected Length Degree 3* and/or TA2). Also, some recordings with short vowels (defined as *Expected Length Degree 1*) were made to complete the picture. The focus of the study lies, however, with the possible difference between long vowels and overlong vowels.

The phonetics / phonology interface is theoretically most relevant with respect to the phonetic observations. I assume here the viewpoint of Kraehenmann (2003:6f.) and Kingston (2007) that, though we may find no immediate one-to-one relation between both domains, there is at least an indirect connection. Phonetics (production as well as perception) can provide indications on the phonological structure, i.e. the underlying taxonomy of the language. Kingston (2007:435) phrases this as follows.

> "Phonetics interfaces with phonology in three ways. First, phonetics defines distinctive features. Second, phonetics explains many phonological patterns. These two interfaces constitute what has come to be called the 'substantive grounding' of phonology (Archangeli & Pulleyblank 1994). Finally, phonetics implements phonological representations."[13]

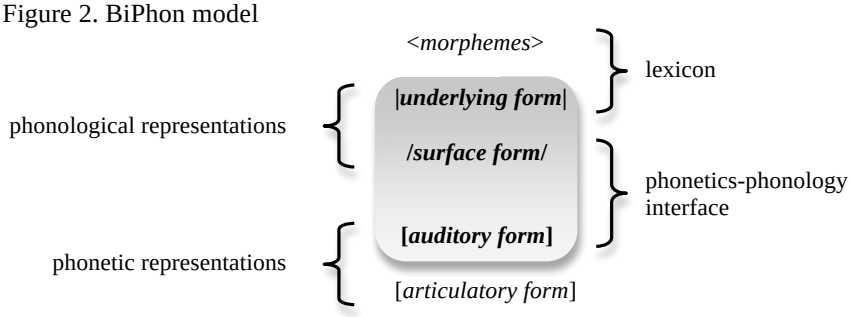
Furthermore, I am working with Boersma's (2007a) bidirectional phonology and phonetics (BiPhon) model to formally express the interrelation of the phonetic and the phonological domain. It employs five levels of representation that are minimally required for describing phonological and phonetic comprehension as well as production.

In the BiPhon model, two levels of phonological representations are assumed, the underlying form and the surface form. While the elements of the underlying form are in the lexicon and determined by a grammar (in the production direction by syntax, morphology; in the comprehension direction by the phonology), the surface form is the phonological surface representation of the utterance. In production, it is

[13] For different views see among many others Ohala (1990), or Hale & Reiss (2000).

computed from the underlying form by the phonological grammar; in comprehension, it is computed from the auditory form by the perception grammar. The phonetic representation consists similarly of two levels, i.e. the auditory form (also: overt form) and the articulatory form. In my analysis, I will be only concerned with the two phonological levels of representation, and the phonetic representation of the auditory form resulting from the phonetics-phonology interface.

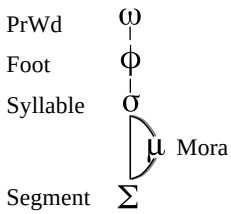
Figure 2. BiPhon model



This formal model has been applied to grammatical analyses (e.g. Apoussidou 2007, Boersma 2007a) using the Optimality Theory (OT) framework (Prince & Smolensky 1993, 2002, 2004; McCarthy & Prince 1995b). The major difference between OT and the earlier rule-based approaches is that the *constraints* of OT are violable while *rules* do not allow for violations. The constraints are hierarchically ranked and evaluate an input form (e.g. an underlying form), adhering to the basic tenet of *minimal violation* (Prince & Smolensky 1993, 2002; McCarthy & Prince 1999). Out of a set of possible output forms (e.g. candidate surface forms) that are generated by a candidate generator (GEN), the winner is determined by the criterion of minimally violating the ranked constraints. The candidate that is (relatively) *optimal* wins. For the constraint ranking, I assume with Tesar & Smolensky (1993) and Topintzi (2005) that the hierarchy is not necessarily total, i.e. constraints may need to be *crucially* unranked with respect to each other, being evaluated in parallel (see chapter 5). Since these constraints are rendered equally important, no variation in the sense of Anttila (1995, 2006) occurs.

Some notes on the internal structure of the words that constitute the outputs of the constraint ranking are in order here. They are subject to the prosodic hierarchy. Segments may be licensed by morae. These units of syllable weight do not stand in a one-to-one relation to the segments. Rather, they can be seen as being represented on a different prosodic tier. The segments are parsed by syllabic structure, as may also be the case with morae. The syllables are grouped into syllable feet, depending on language-specific requirements. The highest prosodic domain used in this thesis is the prosodic word (PrWd), which contains all prosodic properties of a single (isolated) utterance – probably except for morphemic content. The domains of phonological phrase and intonation phrase lie beyond the domain of the PrWd in an utterance. They are not treated specifically in this dissertation. An illustration of the relevant part of the hierarchy follows in Figure 3 below.

Figure 3. The prosodic hierarchy



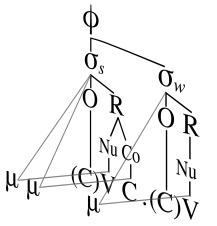
The metrical domain of the foot

> "groups smaller units within a word, such as syllables and morae, into bigger units. Each foot has exactly one head syllable (marked with 's' for 'strong'; 'w' stands for 'weak'), and each prosodic (i.e. content) word has exactly one head foot, no matter how many feet it contains" (Apoussidou 2007:10).

The next lower domain is the syllable. It is divided into *onset* (O) and *rhyme* (R), the latter one being again divided into *nucleus* (Nu) and *coda* (Co). These positions are filled by segments, i.e. *vowels* (V) in the nucleus, and *consonants* (C) in the coda.[14] The syllable may act as a prosodic unit, i.e. carry suprasegmental features such as tone.

I employ here Hyman's (1985) amended Mora Theory with its assumption of morae as units of syllable weight, expressing an indirect notion of length. Crucial to this approach is that onsets are associated to nuclear morae. This avoids descriptive problems with e.g. compensatory lengthening (CL) due to onset deletion.[15] Syllables containing one mora count as light (L); syllables containing two morae count as heavy (H); syllables containing more than two morae count as superheavy (S).

Figure 4. Informal tree structure of foot and syllables



Since the interpretation of morae as purely phonological entities of syllable weight is somewhat more abstract than length-related approaches to morae, one could argue for the postulate of another icon (e.g. *W* for weight) to mark this property. I do, however, not follow this line of reasoning and continue to use the mora as my representation of weight.

[14] Note that sonorant consonants (R) behave differently from obstruents in that they can also occur in nuclear position, e.g. in Limburgian (Paul Boersma p.c.).

[15] Moraic Theory as outlined by Hayes (1989) predicts that the deletion of onsets should not yield CL. The reason is that in this framework onsets are assumed to be non-moraic because they do not contribute to syllable weight. However, this creates a descriptive problem when the loss of an onset does lead to CL as is indeed the case in Samothraki Greek (Kavitskaya 2002:27f.).

The informal tree structure in Figure 4 above illustrates the (possible) individual levels of representation from the foot down to the segmental level.[16]

The segments can be further split up into *features* (see sections 5.1 and 6.1 for the structure of vowels and consonants, respectively). Root nodes (or x-slots) constitute the segmental docking points of the features or feature nodes (Cohn 2003, Kraehenmann 2003) as introduced in the framework of Feature Geometry.

The node I will be mostly concerned with in my analysis is the laryngeal node. It dominates the laryngeal specifications of segments (i.e. voice, spread glottis), distinguishing between voiceless (or fortis) on the one hand, and voiced (or lenis) on the other hand. What I argue for later is that it is the structural complexity of a consonant, i.e. the presence or absence of the laryngeal node (and the Sonorant Voice node, see Rice 1992) that ultimately determines its inherent weight in the investigated LG dialects.

Some information on the language area follows below.

2.2. *The dialect areas*

The area of investigation is the North Low German language region located in the federal states of Niedersachsen, Bremen, Hamburg, and Schleswig-Holstein: The dialects that I am discussing in this survey are the local varieties of the villages of Kirchwerder and Altenwerder (i.e. so-called 'Masch'-dialects of Hamburg)[17], and the dialect of Alfstedt. They lie pivotally within the LG language area that shows consistent schwa deletion in the word endings. The whole North Low German region is termed among others *North Low Saxon* in the literature (e.g. Stellmacher 1983). The area is marked in the map in Figure 5, the lighter shade of grey denoting the 'core area' as defined in the *Niederdeutsche Grammatik* by Lindow et al. (1998).

The term 'dialect' I use in this survey denotes a speech form that is a variety of a superordinate language system. It is regionally restricted and has no normative character.[18] The latter point is, however, equally valid for the LG language as a whole. There exists no defined standard for the LG language system. This is marked by the lack of a (generally accepted) standardized orthographical system. There are some non-obligatory guidelines (e.g. the spelling systems brought forward by Saß 1956, the Loccumer Richtlinien from 1977, or the updated version by Kahl & Thies 2002) that may or may not be adhered to. A measurement of the degree of divergence of the individual dialects from a LG 'standard' is therefore not practicable.[19]

Some diachronic linguistic characteristics of the pivotal North Low Saxon area as compared to Standard German are the lack of the 2nd (High German) sound change, and the loss of final schwa. That does not mean, of course, that synchronic North Low Saxon is by any means linguistically uniform. The LG dialects may vary

[16] Note that it is usually either a moraic representation or the onset/rhyme differentiation that is employed, not both representations in parallel.
[17] Martens (2001).
[18] Appel (1994:5f.).
[19] See Herrgen et al. (2001) for measurements of Standard High German and its local varieties.

from village to village, especially by means of vowel or diphthong qualities. These qualitative differences are of no concern to this study. I therefore do not provide an according qualitative analysis of dialects.[20]

What now follows is some brief general information on the three investigated LG dialect areas. They are indicated on the map in Figure 5 with 'Kw.' for Kirchwerder, 'Aw.' for Altenwerder, and 'Alfs.' for Alfstedt.

2.2.1. *Kirchwerder*

The village of Kirchwerder (Kw.) is one of the four parishes in the Vierlande region south east of the city of Hamburg. It is a rural community with approximately 8,900 inhabitants. Especially the senior citizens (age 65+) are familiar with the local LG variety.

The sociolinguistic aspects of this dialect are currently investigated within the research project 'Hamburgisch: Sprachkontakt und Sprachvariation im städtischen Raum' at the University of Hamburg.[21] Older descriptions of the dialect were provided by Otto von Essen (1958, 1964).

2.2.2. *Altenwerder*

The village of Altenwerder (Aw.) was located at the southwestern periphery of the city of Hamburg. Nowadays, it has no inhabitants any more. The reason is that the extension of the Hamburg Harbor was planned and put into practice from the 1970s on, which means that the approximately 2,000 original inhabitants had to be relocated to neighboring areas near Hamburg. The last residents left around 1980.

This destruction of the community structure may pose a problem with respect to the continuity of the dialect, since all original inhabitants moved to other LG dialect areas, or to areas with a mainly Standard German speaking community. However, the neighboring LG areas some Altenwerder speakers have moved to (Finkenwerder, Moorburg, Neugraben, Neuenfelde, etc.) used to have rather closed LG communities that did not allow for mingling with the Aw. speakers. Thus, it is likely that the Aw. dialect – if spoken at all anymore – has not been influenced much by other LG dialects. Rather, the general 'threat' of Standard German being present in every aspect of life is what may have had an impact on Aw. LG as spoken by the informants.

On the other hand, it could also be reasonable to assume that the dialect was kept as it used to be, trying to keep something from the old home and traditions alive. This is indeed the case with the interviewed informants. This group of Altenwerder speakers have close friendship ties and meet on a regular basis, talking only in the dialect.

All in all, the local variety of Altenwerder can be assumed to be still spoken and preserved. Influences from other speaker communities can naturally not be

[20] Wiesinger (1983a) provides the general isoglosses for the vowel differences. See also Behrens (1954) for some differences with respect to diphthongization, and Martens (2001) for vowel differences within the Hamburg varieties.
[21] Bieberstedt et al. (2008).

excluded. These aspects are investigated also in the context of the project on language contact in the Hamburg region mentioned above.

2.2.3. *Alfstedt*

The last dialect of the study, the local variety of the village of Alfstedt (Alfs.), is spoken some 60 km to the west of Hamburg. The village has less than 900 inhabitants and is basically only reachable by car. There is no direct public transportation or interstate to Alfstedt. This means that the community is as isolated as it can get, bearing in mind the influence of the Standard High German language via national television broadcasting, radio, etc. At least, outside influences from other LG dialects are kept to a minimum. This defines the area as a close to ideal object of investigation in terms of dialect geography.

The Low German language is used actively not only by senior citizens (age 65+) but also by the middle-aged and younger generation (age range 20 to 65). Classes in the local variety are also taught in elementary school.[22]

2.3. *Research history of North Low German*

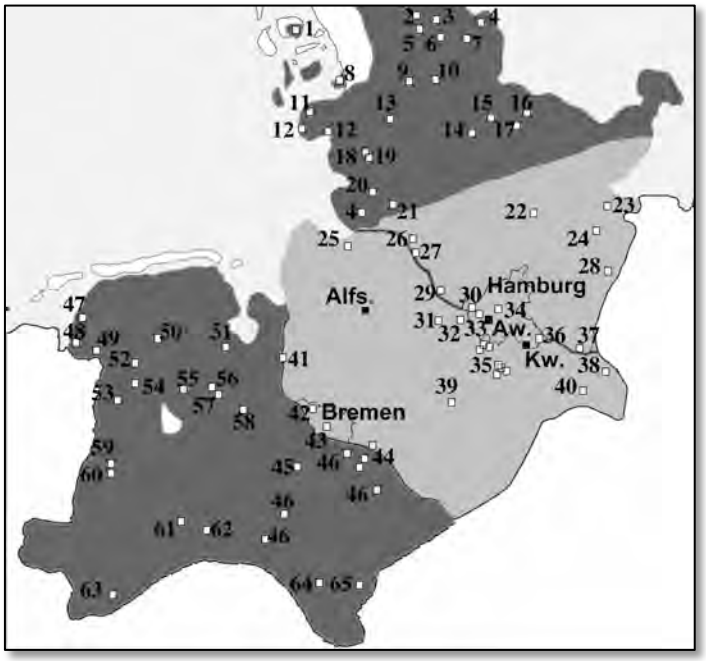
The North Low German dialects that have already been investigated in earlier linguistic studies are marked as white squares in the map of Figure 5.[23] The legend is provided in section (A) of the appendix.

We see that a rather vast linguistic literature exists on the North Low Saxon dialects. The goal of the majority of the works is to provide a synchronic socio-linguistic / statistic survey (Stellmacher 1990), or to develop a pattern of the diachronic sound changes from a reconstructed proto-system, or to give a purely phonetic description of the dialect. Synchronic phonological analyses in generative, metrical, or autosegmental frameworks have been published only after 1968 (Bellamy 1968; Dixon 1968; Chapman 1993; Appel 1994). As far as I know, only the metrical approach brought forward by Chapman (1993) treats the issue of LG vocalic overlength. A synchronic tonal account for the assumed differences in pitch movements is missing up to now, as is an implementation in Optimality Theory.

[22] There is a Low German schoolbook specifically for this region: *Ik bün al hier! Plattdüütsch Lesbook*. Schriftenreihe des Landschaftsverbandes Stade, Vol. 8 (1996).

[23] I do not claim to cover the totality of the North Low German publications. For a detailed overview on the published works within the federal state of Niedersachsen see Appel (1994:14ff.). See also the North Low Saxon google-map at <http://maps.google.com/maps/ms?hl=de&ie=UTF8&msa=0&msid=101985790644615809284.000453664ab42c561dffb&t=p&ll=53.794162,8.371582&spn=2.887865,7.91156&z=7> with references cited in Appel (1994), and in the online-bibliographies of the Institut für niederdeutsche Sprache / Bremen, and of the Digitaler Wenkeratlas / Marburg.

Figure 5. Map of linguistic publications on North Low German varieties



In order to be able to develop an informed analysis, I provide a chronological overview on the discussion of LG vocalic overlength and the corresponding distinct pitch contours (or: tonal accents) in the following sections. Although the list of works is not complete, it covers the most important studies, and gives a (hopefully) adjuvant impression of the spectrum of linguistic theories. Note, however, that it is merely a summary of the literature. I do not intend to discuss all of the approaches reported below in the light of my own analysis right away. It may suffice to say at the moment that virtually all of the surveys connect the synchronic presence of overlength or tonal phenomena in North Low Saxon to the diachronic deletion of schwa in unstressed syllables.

2.3.1. *The early descriptive works until 1938*

The early dialect descriptions are mainly concerned with giving a diachronic account for the development of the synchronic speech sounds. Phonetic details are mentioned more or less in passing. Except for Zahrenhusen (1909) in his survey of the dialect of Horneburg, all of the studies recognize clear differences in the vowel durations.

2.3.1.1 J. Hobbing (1879)

Hobbing describes the articulatory details of the speech sounds in the dialect of Greetsiel (No. 47 of Figure 5), his mother tongue (L1). He recognizes four degrees

of length for the vowels: reduced, short, long, and overlong (Hobbing 1879:9). A disadvantage of his work is that he bases his assumptions not on speech data but on his own speaker intuition. The lack of examples for the reduced length in the text is an additional drawback. We can only speculate that these vowels may be restricted to unstressed positions. The short, long, and overlong are distributed across all vowel qualities, and appear to be in line with the length categories mentioned above in Table 1. Hobbing's transcription of the diphthongs implies furthermore a differentiation between normal diphthongs and configurations with one overlong element. What is not mentioned is a difference in pitch movement.

2.3.1.2 Hugo Kohbrok (1901)

The point of departure for the survey of Kohbrok (1901) is the village of Wesseln near Heide (No. 18 of Figure 5). The author assumes six degrees of length for the local dialect: overshort, short, half-short, half-long, long, and overlong (Kohbrok 1901:22). The individual length degrees are contextually determined, and hence phonetic rather than phonological in nature. The overshort centralized Vs may occur only in unstressed position. Half-short Vs result from half-long or long Vs in certain sentence contexts (not specified by Kohbrok). The author utilizes the notions of *fortis* and *lenis* to describe the contrast between voiceless and voiced obstruents, respectively. In connection to a preceding V, he finds that half-long Vs occur in pre-fortis position, and long Vs in pre-lenis position. The development of the overlong Vs is described as being connected to a certain sound law first introduced for the Rhenish vernacular by Nörrenberg (1884) but not further specified by Kohbrok. The author assumes that the difference between the dialect of Wesseln and the Rhenish dialects is based in the fact that in the latter ones, a combination of dynamic and musical accent is found. It developed on the stem vowel of words that are reduced by the deletion of the final syllable. This tonal effect is not found in the LG dialect of Wesseln (Kohbrok 1901:24). It is only the duration of the deleted final syllable that is transferred to the preceding stem syllable. Kohbrok (1901:24) notes that "this prolongation is so substantial that the monosyllabic word maintains completely the quantity value of the bisyllable".[24]

Overlength developed when an originally voiced C followed after a long V or diphthong. A prerequisite is that deletion of an unstressed schwa took place.

Overlength did not arise if schwa deletion in inter-sonorant position resulted in the syllabification of the final sonorant C (e.g. [riːm̩] 'rhyme-Sg.').[25] The reason is that a bi-syllabic status of the word was maintained, and no lengthening of the nucleus in compensation for the loss of a syllable occurred.

2.3.1.3 H. Zahrenhusen (1909)

Zahrenhusen (1909) investigates the dialect of Horneburg near Stade (No. 31 of Figure 5). He notices a rather expansive diversity in the phonetic inventories of the

[24] My translation. "Diese Verlängerung ist so beträchtlich, dass das jetzt einsilbige Wort vollständig den Quantitätswert des zweisilbigen behält."
[25] See also section 2.3.1.3.

local varieties in the region. For Horneburg, he assumes the presence of four main degrees of vowel quantity: overshort, short, long, and overlong. In addition to these four lengths, the author gives three more middle degrees of half-long, half-short and lengthened short. They are contextually determined and may be regarded as phonetic. The author undertakes no measurements to substantiate his intuitions.

Interestingly, Zahrenhusen (1909:7f.) abstracts away from absolute vowel durations and implements the notion of the mora as a timing unit. Overshort Vs (i.e. short vowels in unstressed position) are non-moraic. Short and long Vs are referred to as being monomoraic and bimoraic, respectively. The overlong Vs and the triphthongs are accordingly assumed to be trimoraic. The status of the overlong segments results from the transfer of the mora from the deleted schwa to the preceding long pre-lenis V (Zahrenhusen 1909:7). A change in the tonal contour to a dragging tone (or 'circumflected intonation' as the author terms it) does not occur in the dialect. This means that the contrast Zahrenhusen describes for the dialect of Horneburg is a fourfold length contrast.

Zahrenhusen notes that apocope in post-fortis position did not result in overlength. The same is true for schwa deletion after the sonorants [l m n r]. Neither syncope in -.RəR# sequences (resulting in the syllabification of the final sonorant C) nor apocope in -.Rə# endings triggered vocalic overlength in the preceding vowel.[26] A full long V of the preceding syllable (i.e. the nucleus of the preceding syllable) remains long in both cases.

With respect to the sonorant Cs, Zahrenhusen finds that [l m n ŋ] (not r since in the relevant cases it has already been reduced) can be lengthened after a preceding short V when apocope or syncope occurred (Zahrenhusen 1909:9, 17). In these cases, it is the R that is assumed to receive the mora of the schwa. The old geminates that were still present in MLG are by comparison all singletons synchronically.

2.3.1.4 Theodor Rabeler (1911)

The dialect area in question is located approximately 25 km to the east of the city of Lüneburg in the district of Bleckede (No. 38 of Figure 5). The phonetic data of this 'Geest' dialect constitutes the main part of the speech material of the article. In addition, the dialects of the bordering villages of the districts of Uelzen and Dannenberg are also included in the analysis.

Rabeler first provides an articulatory phonetic description of the sounds of these LG dialects. He distinguishes between three kinds of syllable accents (Rabeler 1911:159f.) that can apply to syllables containing vowels, diphthongs or creaky vowels in the nucleus:

i) strongly cut accent,
ii) weakly cut accent, and
iii) two-peaked accent.

[26] 'R' denotes in this context any sonorant consonant (rather than syllable rhyme), ' . ' denotes a syllable boundary, ' # ' denotes the end of a word.

i) appears in closed syllables with a strong accented short V. ii) occurs in syllables with a long V preceding a sonorant C or a syllabic obstruent-sonorant cluster. iii) appears only in syllables with overlong V under primary word stress where a schwa of a succeeding syllable was deleted (Rabeler 1911:160). As to Rabeler, a characteristic of the latter phenomenon is a sudden decrease of intensity and pitch (i.e. a rapid fall of the tonal contour) in the final part of the V or in the following sonorant. He tends towards the interpretation that an additional minor increase in intensity follows as a second peak in the succeeding C.

The phonetic measurements he conducted with Marbe's 'Sprachmelodieapparat' yield five phonetic degrees of vowel length in main stressed syllables (Rabeler 1911:165f.). The specific vowel durations, and the accent categories they may occur in follow below.

Rabeler detects

a) short vowels (0.07 sec - 0.1 sec) occurring in words of accent category i),
b) half-long vowels (0.11 sec - 0.18 sec) like the first part of a diphthong in words of accent category ii), or in un-apocopated words of accent category i) ending in lenis C,
c) simple long vowels (0.19 sec - 0.24 sec) in words of accent category ii), including the slightly longer creaky vowels,
d) boosted long vowels (0.31 sec - 0.38 sec) in pre-sonorant position, and
e) overlong vowels (0.39 sec - 0.44 sec) in words of the accent category iii).

The author states that all of those length groups overlap with one another, though a slight gap occurs between group c) and d).

He also finds that heavily stressed Vs in monosyllabic words exhibit either a simple tone contour or a circumflected tone contour (i.e. in boosted long and overlong Vs) (Rabeler 1911:168). The simple tone contour shows a level tone, possibly a high tone H or a mid tone M. The circumflected tone contour of the boosted long Vs exhibits a rising-falling tone movement with a single high peak at about the middle of the vowel. The circumflected tone contour of the overlong Vs differs from this slightly in its movement. The first part (about 0.3 sec) is level or slightly rising, whereas the second part (about 0.1 sec) decreases rapidly in its intensity (or rather: pitch).

Rabeler paints a phonetically detailed picture for the dialect area of Bleckede. His study is the first that provides phonetic measurements. A phonological analysis beyond the diachronic descriptions of sound changes, e.g. in terms of morae as seen for Zahrenhusen (1909) above, is not given.

2.3.1.5 Gesinus Kloeke (1913)

The focus of Kloeke's study lies on the LG dialect of the island of Finkenwerder (No. 33 of Figure 5). It is the westernmost island in the river Elbe and is located in direct adjacency to Altenwerder. The author lists a number of vowel quality differences that exist between the dialects of Finkenwerder and Altenwerder but

does not mention any tonal or quantitative differences between the two dialects (Kloeke 1913:11f.).

Similar to the earlier dialect descriptions we have seen already, the author distinguishes between five degrees of length in the vowels: short, lengthened short, half-long, long and overlong (Kloeke 1913:30). The intermediate durations lengthened short and half-long result from the segmental context the V occurs in (i.e. pre-sonorant short vowel, and pre-fortis long vowels, respectively).

Kloeke explains the overlong duration occurring in vowels and diphthongs as the result of either the contraction of two syllables, or the deletion of an immediately adjacent or post-lenis schwa (Kloeke 1913:31). The liquida [l] does not allow this development.

A dragging tone or circumflected tonal contour is not observed.

2.3.1.6 Heinrich Sievers (1914)

Sievers' study is concerned with the local variety of the area of Stapelholm in the federal state of Schleswig-Holstein (No. 13 of Figure 5). His investigation is based on phonetic observations, and he notes that a differentiation of the vowel length degrees into sub-short, short, half-long, long, and overlong can only have relative meaning (Sievers 1914:29). He abstracts away from these highly structured durational categories, arriving at a ternary distinction of vowel quantity of short, long, and overlong (Sievers 1914:31). He provides no other reason than descriptive ease for his choice.

This level of abstraction is substantially different from the sevenfold classification suggested in Stammerjohann (1914).

Sievers also establishes a connection between the occurrence of overlength and a dragging tone or 'circumflex'. He assumes that the reduction of bisyllabic structure by apocope to a monosyllabic configuration concentrates the duration and the expiratory movement of the bisyllable in the remaining single syllable (Sievers 1914:265). The result is the intonational contour of a bisyllable mapped onto a monosyllabic word.

2.3.1.7 Rudolf Stammerjohann (1914)

The investigation of the dialect of Burg in the Dithmarschen region (No. 21 of Figure 5) is – similar to the survey conducted by Rabeler (1911) – based on the phonetic analyses of speech material recorded with Marbe's 'Sprachmelodieapparat'. Stammerjohann identifies seven so-called 'quantities' by means of the duration measurements: sub-short, short, lengthened short, half-long, long, and lengthened long and overlong. They are grounded in the phonetics and actually denote durational steps rather than prosodic or phonological categories. This is evident from the fact that the allocation of items to the durational degrees is entirely based on the measured duration values of the nuclei and therefore highly context-dependent.

According to the author, Vs are sub-short only in unstressed syllables (transcribed as *ə*). Diachronically short as well as long Vs are generally shortened in this position. The lengthened short degree (i.e. historically short vowels before

fricative) can be interpreted as being allophonic of the short length degree. The durational deviation is, with a range of minimally 10 ms to 20 ms, considerably small here. The half-long degree (i.e. historically long vowels before plosive, and historically short vowels before *l*) represents an allophonic variation of long Vs that unite historically long vowels before fricative, recent diphthongs and triphthongs resulting from the vocalization of post-vocalic *r*, recent pre-nasal diphthongs, and historically long pre-nasal vowels. The lengthened long Vs developed from diachronically long vowels. They occur word-finally in pre-lenis position and before *l*. In (almost) all of the forms given by Stammerjohann, the diachronic form contained a schwa in the second syllable. The mean duration values for this length degree are given as 310 ms to 380 ms. Stammerjohann (1914:78) notes that the overlong degree is in fact also lengthened long. The difference between the two degrees is that the overlong vowels occur in open syllables, resulting in an excess in their duration with mean values of 390 ms to 440 ms (an outlier value occurs at 530 ms).

The author defines a ratio for the individual duration steps of 1 : 2 : 3 : 4 : 5.5 : 7 : 9 (Stammerjohann 1914:78). The values are comparable to the ones obtained by Rabeler (1911) for the dialect of Bleckede.

Stammerjohann (1914:71) detects no circumflected intonation. In the cases where Rabeler (1911) notes circumflected contours (i.e. two-peaked tonal accents for the overlong vowels of the dialect of Bleckede) only single peaked, lengthened overlong syllables occur in Burg. Thus, no difference between the tonal contours of long Vs and lengthened long Vs is observable.

The lengthening of the syllables to overlong configurations corresponds to the findings of the earlier investigations. Not only Vs may bear overlength, but also combinations of short Vs plus sonorant Cs. A prerequisite is in any case the deletion of schwa.

2.3.1.8 Hugo Larsson (1917)

The next work I am treating from the early period of linguistic investigations on the LG dialects is the study of the dialect of Altengamme close to Kirchwerder (No. 36 of Figure 5). Larsson identifies for this variety the duration differences overshort, short, half-long, long, and overlong (Larsson 1917:19). This phonetically based division is in the spirit of the preceding works on LG dialect systems.

The syllables with overlong Vs or diphthongs show a single intensity peak followed by a rapid decrease in intensity. No dragging tone by means of a second syllable peak is detectable.

Larsson distinguishes between final syllabic nasals and final long nasals. Both have developed due to syncope of schwa in the morphological ending (Larsson 1917:18). He palpably transcribes syllabified nasals only in position after long vowels and diphthongs, while transcribing long nasals only after short vowels. Larsson (1917:18) assumes on the basis of the syllable cut theory that sequences of long vowel or diphthong followed by an assimilated nasal are weakly cut and contain two syllable peaks, the second peak lying on the syllabified nasal; short vowels followed by an assimilated nasal are strongly cut with only one syllable

peak, having a long nasal in a single conflated syllable. Therefore, it is really the length of the nuclear vowel that decides on the status of the final nasal. Larsson's examples (given here in his own style of transcription) are [nēm̥] 'to take' < MLG *nemen* and [våiŋ̊] 'to cry' < MLG *weinen* ending in a syllabified nasal,[27] and [zɪŋ̄] 'to sing' < MLG *singen*, [bɪn̄] 'inside' < MLG *binnen* and [hɛm̄] 'to have' < MLG *hebben* with a long final nasal. Cases with apocope after sonorant geminate (e.g. [kanː] 'jug-Sg.' < MLG *kanne*) are not discussed separately but can be assumed to fall into the second category of strongly cut syllables terminating in a long nasal.

Almost all of the studies presented so far base their discussion of the dialects on phonetic observations in combination with historical-linguistic findings and speaker intuitions. It is only Zahrenhusen (1909) and Sievers (1914) who implement more abstract notions beyond absolute duration values in their analyses (i.e. morae and relative length) to express the different length degrees. Only their approaches may be termed in this sense truly phonological. They can be seen as the basis for later phonological analyses working with three distinct degrees of vowel length for LG.

2.3.1.9 Otto Bremer (1929)

The phonetical and historical-linguistic focus of linguistic research continues in the following work. The influential study brought forward by Bremer (1929) is not concerned with a single LG dialect but rather the North Low Saxon variety as a total. His work is based on phonetic observations. The author postulates a prosodic phenomenon *Schleifton* (i.e. dragging tone) for the area from the western to the eastern coast of northern Germany, namely the so-called 'Waterkant' between the mouth of the river Weser and the mouth of the river Oder. Bremer assumes that the same phenomenon also occurs in Standard German (1929:1). He notes that the *Schleifton* results from

> "a transfer of the duration (compensatory lengthening) as well as of the tone of the syncopated or apocopated unstressed *ə* to a preceding sonorant sound (vowel or nasal or liquid). This development occurs if the sonorant is in immediately preceding position, or if a *w*, a formerly voiced *s*, a spirant *g* (or [non-spirant] *b, d, g*) occurs in between the sonorant and the *ə*." (Bremer 1929:1; my translation)[28]

Translated to recent prosodic research, this means that the conflation of two adjacent syllables results in a H(igh) L(ow) tonal contour. The H stems from the nuclear vowel whereas the L is left behind by the deleted schwa. By this, the tonal contour alludes to the original syllable structure. The implicit assumption made by stating the HL contour for words with schwa deletion is such that words that show no schwa

[27] [å] denotes a vowel quality that lies in between [a] and [ɔ] (Larsson 1917:15), presumably [ɑ].

[28] "Es handelt sich um eine Übertragung sowohl der Zeitdauer (Ersatzdehnung) als auch des Tones des aus- und zum Teil auch des abfallenden unbetonten *ə* auf den nächstvorhergehenden tragbaren Sonorlaut (Vokal oder Nasal oder Liquida), wenn dieser unmittelbar vorhergeht, oder wenn ein *w*, ein damals stimmhaftes *s*, ein spirantisches *g* (oder *b, d, g*) dazwischen steht." (Bremer 1929:1). Prior to Bremer (1929), Grimme (1922:54) notes in passing compensatory lengthening as the source of overlength in the dialect of Dithmarschen and for the occurrence of circumflex in the dialect of Stavenhagen in the district of Mecklenburg-Vorpommern.

deletion, bear a single H on the nuclear vowel. Bremer provides examples for the dragging tone but does not distinguish between lexical tone and sentence intonation based tones. He also does not mention the sentence context of the given words.

Bremer essentially finds that not only overlong Vs and diphthongs are able to bear the dragging tone, but also short Vs plus nasals or the liquid /l/. In his approach, these Cs also get lenghtened after apocope, creating in combination with the preceding short V an overlong syllable (Bremer 1929:2).[29] The combination of long V or diphthong plus /l/ also results in a dragging tone if apocope occurs, while a sequence of long V or diphthong plus nasal does not. Bremer makes no explicit reference to the number of assumed length degrees in the vowels. The ones that are mentioned in passing are short, long and overlong.

Having postulated the general presence of the tonal phenomenon, he notes that the specific characteristics differ depending on the syntactic context. Unstressed syllables do not receive the tone. In stressed syllables, the tonal differences are very small to the extent of being barely audible. If anything, the difference of dragging tone *vs.* no dragging tone is best found in utterance-final position. Vowel length is by comparison much more stable. This leads him to the conclusion that it is rather quantity (i.e. overlength as compared to short vowels and long vowels) and not tone that is the crucial prosodic characteristic of North Low Saxon.

2.3.1.10 Otto Furcht (1934)

The dissertation of Furcht (1934) treats the dialect of the village of Estebrügge (No. 32 of Figure 5). The focus of his research lies on the diachronic development of the sounds. A synchronic description of the phonetic details is kept to a minimum and shows a rather low level of abstraction.

He assumes five length degrees: overshort, short, half-short, half-long, long, and overlong Vs (Furcht 1934:13). The half-long duration is the result of shortening of a long V in pre-fortis position. Vocalic overlength occurs if after a succeeding lenis C a schwa is deleted (without creating a syllabic C). A dragging tone as described by Bremer (1929) is not mentioned.

2.3.1.11 Peter Jørgensen (1934)

Jørgensen (1934:53f.) describes briefly the occurrence of overlong vowels in his glossary and grammar of the dialect of Dithmarschen (the area in the vicinity of No. 21 of Figure 5). They developed *synchronically* due to the reduction of the number of syllables in the course of apocope or syncope, if the coda of the stem was not fortis. The stem vowel was compensatorily lengthened only if it was already long. If the stem vowel was short, the succeeding lenis consonant received overlength (Jørgensen 1934:54).

2.3.2. *The works from 1939 to 1967*

While basically all of the studies presented in the section above contain a diachronic analysis of the sound changes in a Neogrammarian fashion, this trend is decreasing

[29] See chapter 0 [kan] ‘can-3.Sg.’ < MLG *kan vs.* [kan:] ‘jug-Sg.’ < MLG *kanne*.

in the works of the period from 1939 to 1967. The focus shifts from the historical linguistic perspective to a synchronic-phonetic one.

2.3.2.1 Ursula Feyer (1939, 1941)

Feyer published two phonetic studies on North Low Saxon dialects; the first one appeared in 1939 on the varieties of the villages of Borgstede (No. 51 of Figure 5) and Aschhauserfelde (No. 57 of Figure 5) in the Frisian Wede and Ammerland, respectively; the second one is her dissertation on the dialect of the village of Baden, district Verden (No. 44 of Figure 5), which was published in 1941.

The author notes that the dialect of Borgstede has apocope and resulting overlength on the stressed syllable before originally voiced Cs. Overlong Vs are also found in the same context after syncope of the morphological endings. If a nasal preceded the lost schwa, the nasal became long, and a preceding V maintained its length.

The dialect of Aschhauserfelde closely resembles these developments. Overlength occurs accordingly in the same cases as in Borgstede (Feyer 1939:45). Specific tonal movements on overlong Vs are not detectable in both dialects.

The local variety of the village of Baden, located at the southern border of the schwa-deleting area of North Low Saxon, is discussed in Feyer (1941). The author assumes three degrees of V duration, i.e. short, long, and overlong, which are phonetically investigated. She compares the values observed for Baden to the ones given by Stammerjohann (1914) for lengthened long and overlong of the dialect of Burg in the Dithmarschen region, and given by Rabeler (1911) for the same length degrees in the dialect of Bleckede. It seems that the overlength of Baden with mean values of 150 – 310 ms cannot compete against the mean values obtained for Burg and Bleckede with 340 ms / 310 – 380 ms, respectively (Feyer 1941:129). This may relate to the fact that the speech material used for Baden is connected speech whereas the recordings for Burg and Bleckede are isolated words. Measurements of some isolated utterances in Baden indeed yielded higher values of 250 – 330 ms in monophthongs, and 320 – 550 ms for the diphthong [aɪː] (Feyer 1941:129). Feyer (1941:130) concludes that a tendency towards a threefold quantity contrast in the dialect of Baden is clearly evident (though she observes a neutralization trend). The local variety shows a ternary split short – long – overlong.

This comes somewhat as a surprise since the dialect of Baden does not necessarily connect overlength to the deletion of a schwa (Feyer 1941:79ff.), e.g. in forms like ‘house-Dat.Sg.’ [huuːzə]. Despite the occurrence of a final schwa we obtain an overlong stem vowel. The overlength in Baden occurs in basically those cases where it occurs in dialects with complete apocope (Feyer 1941:81), disregarding the possible presence of a final schwa. The segmental context is

i) an originally long V, a (OSL) lengthened V, or a diphthong in pre-lenis position,
ii) cases where the schwa of the morphological ending immediately succeeded the vowel (e.g. [khaɪː] ‘cow-Pl.’),
iii) the schwa-preserving adjectives in pre-lenis position,

iv) syncope of post-lenis schwa, but not post-nasal and post-liquid schwa, and (this is exceptional)
v) originally short Vs preceding *-gg*, but no other old geminate (e.g. [bryy:gə] 'bridge-Sg.', [myy:gŋ] 'mosquito-Pl.').

Feyer notes that by means of her measurements "it has been objectively verified what the ear had determined: the quantity of the Baden dialect is lengthened, inspite of the lack of apocope" (Feyer 1941:13; my translation).[30] A two-peaked contour is not realized in Baden. Rather, the pitch movement for the overlong Vs is level, with only a light decrease towards the end, and does therefore not differ from the contour of the long Vs. The neighboring villages of Beppen and Schwarme may, however, employ a dragging tone (Feyer 1941:99f.).

The author finds that the concrete diachronic development of the schwa-endings in Baden is impossible to analyze with a high level of confidence. It might be the case that the dialect had apocope with overlength as a result of it, but re-installed the schwa due to language contact with neighboring dialects and Standard German. Overlength remained (Feyer 1941:83). However, if the schwas were indeed relics, Feyer notes that some other property would need to account for the occurrence of overlong vowels. She deems syllable boundaries the most likely source. Her assumption is here that short Vs are 'clipped', i.e. abruptly or strongly cut-off by a succeeding C. Long Vs are by comparison not cut-off, i.e. they are weakly or smoothly cut.[31] Overlength might then result from an extreme form of weakly cut accent, i.e. a very lose syllable contact (Feyer 1941:84f.). Feyer speculates that schwa-loss might have been implemented in pre-lenis position in LG generally by means of a weakening process due to the length of the weakly cut stem syllable.

We see that Baden is indeed an interesting case of LG overlength without schwa deletion. A phonological investigation of the lengthening process and the synchronic vowel system may be able to provide some insights with respect to the syllable cut theories that have gone through a renaissance after Vennemann (1991). A corresponding analysis is, however, a desideratum.

2.3.2.2 Walther Niekerken (1954)

Niekerken (1954:69) mentions in his study on bilingualism in the North Low Saxon area a 'schleiftonige' (dragging-tonal) overlength on vowels. It emerges whenever a schwa is deleted after a long vowel in hiatus, or after simple voiced C. The prosodic feature is neutralized in unstressed position. It is, however, particularly prominent in sentence-final position.

Besides the vocalic overlength / dragging tone, Niekerken assumes the same phenomenon to occur also in doubled nasals (i.e. in assimilated *nd* or *md* sequences, or original geminates). The result after apocope or syncope is here a long sonorant

[30] "[…] und objektiv ist bestätigt worden, was das Ohr ermittelt hatte: die Quantität der Badener Ma. ist dehnstufig, obwohl die Apokope keineswegs durchgeführt ist." (Feyer 1941:13). The duration of the speech sounds of Baden was measured by means of a Synchron-Kymographion (Feyer 1941:101).
[31] Trubetzkoy's (1938) syllable-cut theory.

that is pronounced with a dragging tone in the majority of cases (Niekerken 1954:70).

2.3.2.3 Otto von Essen (1957-1964)

The phonetician von Essen published three works related to the phenomenon of overlength. The first one appeared in 1957 and contains an analysis of overlong Vs and lengthened Cs in Standard German. Apart from the discussion of the Standard German data, he finds 'overlengthening' of LG long vowels after apocope of a morphological ending. Especially noticeable here is a dragging-tonal movement that is reminiscent of bisyllabic tonal contours (von Essen 1957:243). Von Essen states that the overlength of the vocalic nucleus results from the tonal pattern because the production of this contour requires more effort and, hence, more time.

The total duration of the lengthened long vowels varies notedly. Von Essen interprets this as a development of recent informal speech. He states that overlength is about to vanish from LG dialects (von Essen 1957:243f.).

The second and third studies occurred in 1958 and 1964, respectively. Both investigate the LG dialect of Kirchwerder (Kw.), the former focusing on the vowel system, the latter focusing on recordings of connected speech. Von Essen distinguishes three length degrees of short V, long V, and overlong V. New to the study of 1964 is that the author mentions a qualitative contrast between short Vs and long Vs that adds to the length contrast (von Essen 1964:10). Overlong Vs exhibit no differing quality with regard to the corresponding long vowels.

Von Essen (1958:111) posits vocalic overlength for all cases of final schwa-loss after lenis C, sonorant C or hiatus where the additional length is needed to retain a grammatical contrast. The ternary quantity contrast is only relevant in primary or secondary stressed syllables (von Essen 1964:21). The observation is that the overlong vowels are lexically and grammatically distinctive, which leads von Essen to the conclusion that a ternary quantity distinction exists in the dialect of Kirchwerder. The dragging tone (viz. circumflected tone contour) co-occurring on the overlong vowels arises due to a tonal merger of the tone of the deleted schwa with the tone of the preceding sonorant (von Essen 1958:112). Von Essen states that in LG dialects without complete apocope the very same pitch contour is spread over the whole length of the word, e.g. in [hyːzəɐ̯] 'house-Pl.' (instead of Kw. [hyyːz̥]) and [lyːd̥ə] 'people-Pl.tantum' (instead of Kw. [lyyː] with loss of the final stop) where the final syllable exhibits a low pitch.[32]

The author applies the term overlength not only to overlong Vs and long diphthongs, but also to the combination of diphthong + long nasal as in [beʊn] 'bean-Sg.' *vs.* [beʊnː] 'bean-Pl.', and to the combination of short V + long nasal as in [bɪnː] 'inside' or [panː] 'pan-Sg.' (von Essen 1958:111). After the deletion of a final syllable due to apocope or syncope, it is in these cases that the final nasal lengthens instead of the nuclear vowel or diphthong. Von Essen does not mention a

[32] The dialect of Baden investigated by Feyer (1941) actually appears to be the exception to this pattern. This might relate to it being located at the southern border of the North Low Saxon core area that generally shows complete schwa deletion.

difference between items with apocope (e.g. [panː] ‘pan-Sg.’) and syncope (e.g. [bɪnː] ‘inside’), thereby implying a merger of the cases.

I find the assumption of overlength on sequences of short V + long nasal rather problematic. If such a sequence indeed counted as overlong, one would assume vice versa that a combination of long V + short nasal like [miːn] ‘my-fem.Poss.Pron.’ should also be overlong with a dragging tone (see Chapman 1993). However, no dragging tone is mentioned for these configurations. The matter is left untouched by von Essen.

2.3.2.4 Bruno Hildebrandt (1963)

With the improvement of the technical possibilities, also the analysis of phonetic details improved in the time from 1939 to 1967. This is clearly observable in the detailed phonetic study provided by Hildebrandt (1963) on the connected speech of the dialect of Wewelsfleth in the region of Holstein (No. 26 of Figure 5). On the other hand, no clear theoretical improvements were made in the analysis of the LG dialects. Hildebrandt crucially assumes a ternary length contrast in the vowels (Hildebrandt 1963:23), basing his assumptions mainly on phonetic data. His phonological analysis does not go beyond a purely structuralist approach to determine the phonological status of the speech sounds (i.e. minimal pairs).

Hildebrandt (1963:131) finds that the older informants exhibit a greater difference between long Vs and overlong Vs than the younger informants do. He argues that this must not be interpreted as alluding to the fact that the realization of overlength is increasingly neglected, resulting in a neutralization of the long *vs.* overlong contrast (Hildebrandt 1963:222). However, he finds that overlength is generally not as strictly differentiated from long Vs as long Vs are from short Vs (Hildebrandt 1963:179). The author defines the duration ratio for the three degrees of length as 1 : 1.92 : 2.6 (Hildebrandt 1963:194). There are, however, rather extreme differences in the ratios among the individual speakers.

The author notes that phonetic overlength is not phonemic in words that lost a voiced obstruent after the accented vowel. The primary function of the duration is here an auxiliary one, which means that it constitutes a quantitative variant of the simple length. These sounds should not be classified as belonging to a quantity degree ‘overlong’ (Hildebrandt 1963:109).

This is different for words in which the final schwa was deleted. The pitch contour was preserved and taken over by the root syllable, causing the additional lengthening of the root vowel and the development of dragging tone. Hildebrandt (1963:110f.) states that those overlong forms can have a grammatical function (e.g. Sg. forms as [dax] ‘day-Nom.Sg.’ and [huːs] ‘house-Nom.Sg.’ *vs*. the respective Pl. forms [dooːx] ‘day-Pl.’ and [hyyːs] ‘house-Pl.’) or distinguish between two meanings (e.g. LG [frɛit] ‘to gorge-3.Sg.Pret.’ *vs*. LG [frɛiːt] ‘to court-3.Sg.Pres.’). Hildebrandt emphasizes that the isochronic tendency to maintain the absolute duration of a word despite the loss of a syllable could not have yielded vocalic overlength. The vivid variations in speech tempo and the resulting variations in the duration of words make it appear unlikely that speakers have certain intuitions for concrete word durations (Hildebrandt 1963:111f.).

2.3.2.5 Ove Rogby (1967)

Rogby (1967) treats the LG dialect of the village of Westerhever in Schleswig-Holstein (No. 11 of Figure 5) in his diachronically based study. The main part of the work is concerned with the historical developments of the vowels. The synchronic status is discussed rather briefly.

The author mentions three distinct degrees of vowel length, i.e. short, half-long / long, and overlong (Rogby 1967:21f.). They correspond to the three length categories short : long : overlong given in Table 1 of the introduction. Rogby does not mention the occurrence of a dragging tone or explicit pitch differences. The author provides minimally different sets of words for the length contrast, arguing for its phonological relevance. He assumes that the length difference between long vowels (e.g. /sneː/ 'snow') and overlong vowels (e.g. /sneeː/ 'to cut-3.Sg.Pret.') has developed by means of compensatory lengthening. The stem vowel received more duration after deletion of a vowel in the final syllable (Rogby 1967:22). Another, probably interrelated, option that Rogby considers, is that vowels and diphthongs in pre-fortis position were shortened. This would also produce a length difference with respect to pre-lenis vowels.

In addition to the three length categories, Rogby (1967:23) observes contrastive quality differences of tense *vs.* lax, and rounded *vs.* unrounded in the vowels. He also finds that the quality of the succeeding consonant is interrelated with vowel length. Fortis Cs occur after short vowels, lenis Cs occur after long vowels, and lenis Cs reduced in intensity occur after overlong vowels (Rogby 1967:24). This approach offers the possibility to analyze LG vowel length as a consequence of the three types of final obstruents (i.e. fortis, lenis, and reduced lenis). Rogby, however, does not embark upon this phonological line of reasoning.

His method is taxonomic, distinguishing between phonologically relevant sound differences and purely phonetic differences. It is not so much based on the articulatory and acoustic description of the segments but rather on dialect-internal comparison of sounds. Although his discussion of the contrasts is particularly brief, it may be seen as the first step towards a phonological analysis of the LG length or pitch phenomena.

The common denominator of the works on LG presented above is the effect of schwa deletion on the length of a nuclear V or the length of a final sonorant C. The major commonality between the analyses is the assumption of the principle of isochrony, i.e. the perpetuation of the original (MLG) length of a word. This goal is reached by means of lengthening of a nuclear V from long to overlong in pre-lenis position, lengthening of a final nasal, or syllabification of an assimilated final sonorant C.

2.3.3. *The works from 1968 to 1982*

Wiesinger & Raffin (1982) list in their bibliography of linguistic literature on LG only two phonological works: Bellamy (1968) and Dixon (1968), the latter one not mentioning the phenomenon of overlength and/or dragging tone. The temporal classification had a bearing on my choice for setting the parameters for the third research period from 1968 to 1982. We could assume that with the increasingly detailed phonetic investigations of the LG dialects also phonological methods are now implemented in the analyses. This is, however, only rarely the case, as we will see in due course.

2.3.3.1 Sidney E. Bellamy (1968)

The overview starts with the dissertation of Bellamy (1968) on the LG city dialect of Hamburg; a dialect with complete schwa apocope except for inflected adjectives.[33]

Bellamy provides not only a historical overview on LG, beginning with Early Saxon (500-800 a.D.), but he also gives demographic numbers and cultural-social background information on the synchronic language. Of his 17 informants, the older ones used a more conservative variety of Hamburg LG than the younger ones did. Also, the influence of Standard High German in the former was less, in the lexicon as well as in the phoneme system (e.g. loan phonemes).

The investigation of Bellamy is based on a questionnaire of 226 isolated stimuli plus a (optional) sequence of free speech. He observes a ternary quantity-contrast short, long, overlong in Hamburg Low German vowels and provides according minimally different pairs of words. Bellamy also states that the distinction between short and long vowels is not solely one of quantity but also of quality, whereas long and overlong vowels merely contrast in quantity, i.e. in his notation /ɪ/ *vs.* /iˑ/ *vs.* /iː/ (Bellamy 1968:97, 100f.).[34] In addition to the overlong vowels, he finds long diphthongs. The so-called “overlongs” are therefore iː, yː, eː, øː, uː, eːʊ, aːɪ, oːɪ (Bellamy 1968:95). They are accompanied by a dragging tone that has a high-mid pitch movement. Such a “sing-song-like pitch contour” (Bellamy 1968:119f.) is observed in no other cases.[35]

The phonological analysis relies on the presentation of minimal pairs to demonstrate the LG ternary length distinction, and on feature charts to mark the contrast.[36] He classifies two monophthongal qualities of tense *vs.* lax. The assumed binary features are [obstruent], [consonantal], [vocalic], [voice], [continuant],

[33] Interestingly, a similar exception for schwa deletion is valid for Limburgian. Feminine forms of adjectives (after underlyingly voiceless consonants only) are here the only forms that retain schwa (Paul Boersma p.c.). This phenomenon occurs across a number of Limburgian dialects, e.g. in the city dialect of Roermond: [wɪtə vrɔ́u] ‘white woman’, [dikə vrɔ́u] ‘corpulent woman’. The acute accent denotes TA1 on the respective vowel.

[34] Bellamy transcribes simple length in an amended IPA fashion with a single dot / ˑ /, and overlength with a colon / ː /.

[35] Note that terms such as ‘sing-song-like’ to describe certain pitch movements have been discredited in the past (Paul Boersma p.c.).

[36] The assumption of features may be seen here as occurring in the spirit of the SPE (Sound Pattern of English) by Chomsky & Halle (1968).

[tense], [long], [grave], [diffuse], and [flat]. Interestingly, Bellamy notes in his distinctive feature charts that the short lax vowels are left unspecified with respect to the length feature, the long tense vowels are [-long], and only the overlong tense vowels are [+long] (Bellamy 1968:116). The result is a ternary quantity distribution. This analysis is basically the first approach out of three possible analyses Bellamy suggests. It results in a total of 27 vowel phonemes (including diphthongs), and is preferred over the other two approaches in order to avoid the leap

> "into generative phonology as applied to dialectology and to avoid recourse to morphological criteria in an otherwise strictly phonological analysis" (Bellamy 1968:103).

The second approach relates to Bellamy's observation that overlength may only occur in "monosyllabic morphemes" (Bellamy 1968:101) preceding a final lenis obstruent. It is inherently diachronic and defines overlength as allophonic, being determined by the succeeding, distinctive (voiceless) lenis consonant.

The third approach was introduced first by Keller (1961:343f.). He postulates that the apocopated sequences containing overlength keep synchronically the schwa in the phonology. It is the distinctive property distinguishing the long from the overlong cases. The phoneme inventory is hence reducable by the 'Overlongs'. Bellamy (1968:103) assumes an according rule V → overlong | __O(bstruent)+ə. This means that the presence of schwa and the development of overlength are necessarily intertwined. The schwa deletion is merely phonetic and occurs in all words but the adjectives. It remains unclear how one can have a morphological exception to schwa deletion in inflected adjectives if schwa deletion itself is just a phonetic process.

Inspite of the explanatory appeal of the last approach, Bellamy (1968:103) therefore prefers to avoid generative phonology and "recourse to morphological criteria" and comes to the conclusion that

> "a separate set of over-long vowels must be posited: / i: y: e: o: u: ɑ:ɪ o:ɪ e:ɪ /. (The two "holes" in this pattern, /ɑ:/ and /ɑ:ʊ/ would indicate that these might also occur in a larger corpus than the present one.)"

2.3.3.2 Jan Eilhard Bender (1971)

The study of Dixon (1968) is left aside because the author does not treat the matter of overlength or dragging tone for the investigated variety of Kiel LG.

The following scholar is Bender (1971) with his analyses of the Eastphalian dialect of Hermannsburg and the East Frisian LG dialect of the Großefehn-Moorlager area (No. 50 of Figure 5).

He notes a ternary split in vowel length short : long : overlong for the Eastphalian and East Frisian subjects. The term 'long' seems to represent rather the qualitative notion *tense* than quantitatively long – except for /ɛ:/ /ɔ:/ /œ:/ (Bender 1971:43f., 163). The vowel system of the LG variety is very similar to the Eastphalian vowel system. The main qualitative difference is the presence of short /ɛ/ and the lack of a short */a/ in East Frisian. Interestingly, not in all cases where overlength would be expected does it occur. Examples are [dɔːɣ̊] 'day-Pl.', [ʃruːɣ]

‘screw-Sg.’, but [tu::t] ‘(plastic) bag-Sg.’, [ry::dn̩] ‘to harvest potatoes-Inf.’ (with overlength despite the syllabic status of the final nasal) (Bender 1971:163f.).

According to Bender, it is most likely that the length degrees noted for the investigated dialects are phonetic rather than phonological. They are not mentioned in the vowel systems.

2.3.3.3 Alice Wyland Grundt (1975)

The prosodic phenomenon that had been referred to as ‘overlength’ or ‘dragging tone’ in the scientific literature is analyzed as tonal accents in the study of Wyland Grundt. Just like the title of her article ‘Tonal accents in Low German’ suggests, Wyland Grundt analyses the North Low Saxon dialects not in terms of vowel quantity but in terms of tonal accents. This differs from the studies we have seen so far, where either length or the collective of length and tonal accent were interpreted as carrying functional load. She notes that

> “in Low German and Scandinavian languages the segmental circumstances involve only vowels and diphthongs and [...] it is the redundant tonal transition in centering diphthongs which becomes distinctive when such diphthongs monophthongize.” (Wyland Grundt 1971:160)

Wyland Grundt assumes that the Low German dialects present a variety of intermediate stages in the development towards a tone language. The process of tonogenesis is in progress. The tonal accents developed diachronically by means of a timing change in bisyllabic sequences and the resulting durational weakening of the final vowel. This reduction was compensated for by inserting a schwa-like vowel to the preceding nucleus to create a centering diphthong. The vowel intrinsic pitch changed accordingly, and succeeding monophthongization then phonologized the process (Wyland Grundt 1975:164f.). The author notes that “it is the structure of the diphthong itself, not the environment, which determines the appearance of the tonal accents” (Wyland Grundt 1975:165). With this tool in hand, no reference needs to be made to the deletion of schwa; a property that Wyland Grundt deems necessary in order to account for dialects without apocope but with tonal accents (Wyland Grundt 1975:160f.). She states that tone accent is a secondary development, being triggered by the diphthongization and later monophthongization of old short vowels of open syllables. However, the varieties she brings up do not belong to the North Low German area. Rather, she refers to one East Low German dialect of the Brandenburgian area (i.e. Prenden near Berlin) with *optional* tone accent, and to “a number of the Frisian dialects, spoken on the north coast and in the northern coastal islands of The Netherlands, which have the Stosston in open-syllable lengthened vowels in words without apocope” (Wyland Grundt 1975:161). It needs mentioning, though, that the presence of distinct tonal contours is not at all undisputed for these dialects.

What Wyland Grundt’s approach essentially misses is that the development of a dragging tone or overlong vowel occurred between MLG and recent LG and not in pre-MLG time as suggested. An example is OSax. *wika* > MLG *weke* > LG [ve:k] ‘week’. If the tonal explanation provided by the author was indeed applicable, this

item would need to have a dragging tone or overlength by virtue of the open syllable and reduction of schwa. This is, however, not the case.

All in all, Wyland Grundt provides a particularly different, namely suprasegmental view on the issue of overlength or pitch contours in Low German. In doing so, she argues for phonological structure beyond the syllable – basically a bisyllabic foot.

2.3.3.4 Maike Lohse (1977)

Lohse (1977) provides a purely synchronic description of the phoneme system of Eiderstedt LG (No. 12 of Figure 5). She differentiates two length degrees of long and overlong for lax and tense vowels alike. They are termed "Grundlänge" (basic length) and "Überlänge" (overlength), respectively (Lohse 1977:180). The author makes no references as to the origin of the overlong vowels. Crucial to her is that

> "a vowel needs to be seen as belonging to the basic length if it is arbitrarily producable as indefinitely short without changing the meaning of the word, and without making it incomprehensible. Accordingly, a vowel is to be interpreted as overlong if it is arbitrarily producable as indefinitely long. (Lohse 1977:183; my translation).[37]

These assumptions are based on the observation that the short lax vowels and the long tense vowels show a rather small durational difference.[38] The postulate of three distinct length degrees seems to Lohse therefore inappropriate and uneconomical. The durational ratio between overlong lax vowels and overlong tense vowels is not treated.

2.3.3.5 Elmar Ternes (1981)

In his article on overlength in German dialects, Ternes (1981) refers to two dialect areas with a ternary vowel length distinction. The first area is LG; the second area is Central Franconian, which stretches across Luxembourg, the eastern border region of Belgium, the province of Limburg in the Netherlands, and extends in Germany roughly from the northern Saarland in the south to just north of Krefeld in the north, and to the Westerwald in the east (see Figure 85 of section 7.3.3). The two dialect areas are not adjacent. They are separated from each other by the Westphalian dialect, which exhibits only two different quantities (Ternes 1981:381).

Not only monophthongs participate in the quantity contrast, but also the diphthongs and vowel-sonorant (VR) combinations. The overlength distinction is both morphologically and lexically productive. Ternes observes that the overlong vowels occur in Low German as a result of diachronic compensatory lengthening after schwa-apocope, while the Moselle Franconian dialect shows in exactly those cases a shortened vowel. This is assumed to relate to the intrinsically shorter

[37] "Grundsätzlich läßt sich sagen, daß ein Vokal als der Grundlänge zugehörig anzusehen ist, wenn er sich beliebig und unendlich kurz aussprechen läßt, ohne den Sinn des Wortes zu verändern oder unverständlich zu machen. Entsprechend ist ein Vokal als überlang anzusehen, wenn er sich beliebig und unendlich lang aussprechen läßt."

[38] The notions *short* and *long* stem from the traditional Standard German interpretation of vowel length, analyzing the lax vowel qualities as short and the tense vowel qualities as long. The length degrees do not necessarily display the phonetic reality of LG dialects.

duration of vowels in polysyllables as compared to monosyllables. The absolute duration of the segments decreases with increased number of syllables. This relative shortness is then phonemicized by schwa-apocope (Ternes 1981:384).

Considering the diametrically different development in LG and Franconian, Ternes comes to the conclusion that it is virtually impossible that these two areas have been immediately adjacent geographically (Ternes 1981:385). While this conclusion may be correct for LG and Franconian,[39] it cannot be upheld for another part of the Rhenish dialect area, the so-called Rule B-area of the Westerwald region. We find here basically the same distribution of length as in LG – and this in direct adjacency to the other Franconian dialects with their different distribution.[40]

2.3.4. *The recent works from 1983 to 2008*

We see that in the period from 1968 to 1982 a total of five phonological analyses of LG dialects were brought forward. The most abstract of these is Wyland Grundt (1975) with her prosodic approach to the tonal phenomena she assumes for LG. All other approaches are somewhat more closely geared towards phonetic findings.

Moving on to the most recent research period from 1983 to 2008, the phonological investigations of overlength and dragging tone in LG do not increase much in number. A notable development is that the approaches abstract away more from the phonetics to detect the underlying taxonomy of the language.

2.3.4.1 Maria D.H. Ruscher (1983)

Ruscher (1983) analyzes phonetic data from the LG dialect of the village of Heikendorf near Plön in Schleswig-Holstein (No. 16 of Figure 5) in her M.A. thesis. The aim of her study is to provide a synchronic phonological analysis of the dragging tone phenomenon within the framework of metrical phonology. The research corpus consists of only one single informant, who was raised bilingually Low German and Standard High German. The investigated data consist mainly of isolated utterances and to a minor part of connected speech. This focus of attention is justified because "the Schleifton phenomenon is fully manifested only in stressed positions in the sentence, but tends to disappear in unstressed positions" (Ruscher 1983:6). The author notes that "the data we collected are consistent with the published reports on the North Low Saxon dialect area" (Ruscher 1983:6) – a postulate that is not entirely true, because the study of Tödter (1982) on the dialect of Fintel evinces no phonetic cues on a dragging tone (see section 2.3.4.2 below).

The author assumes that tenseness and laxness of the vowels is distinctive whereas duration is a by-product (Ruscher 1983:12). She nevertheless notes three degrees of vowel length: short, long, and overlong, the latter one being accompanied by a dragging tone. It is characterized by a level pitch contour with a fall occurring over the last third of the vowel (Ruscher 1983:14f.). This phenomenon is not

[39] The LG and Franconian dialect areas are not only not geographically adjacent, but they are also not adjacent *in time*: the Limburgian schwa drop preceded the Saxon schwa drop by more than 400 years (Paul Boersma p.c.).

[40] See Werth (2010) and Köhnlein (2011) for a detailed discussion of the phenomenon in Rule B dialects.

present in all LG dialects. In order to develop a phonological analysis, Ruscher (1983:47) employs a privative approach.

> "Thus, the crucial opposition in North Low Saxon and HP [Heikendorfer Platt; the author] is considered to exist between words with and without Schleifton (paralleling the opposition in Danish between words with and without stød)." (Ruscher 1983:47).

The dragging tone is generally restricted to the final position in a morpheme, e.g. [ˈlei̯iz̥ˌbouk] 'reader' (Ruscher 1983:48). It may occur in monosyllables as well as in polysyllables. Furthermore, the author notes that the association of a pitch feature does not occur if the item receives an additional syllable by inflection (Ruscher 1983:48). There are only very few cases in the Heikendorf dialect that exhibit schwa in the overt form. These are inflected adjective, determiners, and a limited set of non-native formatives with presumably Dutch diminutive endings (Ruscher 1983:67). This is seen as a valid reason to discard a schwa-dependent analysis of overlength and dragging tone.

The analytical path Ruscher (1983:77) takes relies on four phonological tiers of representation for a prosodic word (PrWd): the segmental tier, the syllabic tier, the foot structure, and the tonal tier. The author posits that the "neutral tone pattern in HP words may be described as high (H) plus low (L), where the high tone is associated with the accented syllable and the low tone with the unaccented one" (Ruscher 1983:77). This means that every tone corresponds to a syllable.

The very same HL tonal contour of the bisyllable is found for the dragging tone (Ruscher 1983:79). Ruscher argues, however, that it is not a complex vowel that carries the H and L in dragging tone words. The observation that dragging tone arises only in words ending in a lenis C leads her to the assumption that the coda determines the tonal pattern. Due to a constraint on the rhyme structure, a lenis coda may not associate to the first syllable but is independently syllabified into a second syllable. This means that apparently monosyllabic forms are phonologically bisyllabic. The second syllable in these words is defective because it lacks the rhyme. Its occurrence is interpreted as being language-specific. The bisyllabic tonal contour HL is now enabled to keep its bisyllabicity. The H associates to the vocalic nucleus whereas the L is realized on the final syllabified lenis C. This consonant is "structurally extra-rime material" (Ruscher 1983:86). If a plural marker -n# is attached to the second syllable, the /n/ becomes the syllable nucleus whereas the lenis obstruent constitutes the onset (Ruscher 1983:88).

The author notes that not only regular nasals occur in the dialect of Heikendorf, but also nasals containing dragging tone (Ruscher 1983:99). They develop when a morphological ending -N# or -Ns (where N is representative for any nasal) is added to a stem ending in a nasal, creating a long nasal. The ending becomes syllabic and is therefore able to bear the L. Ruscher assigns basically the same structure to dragging tone words with overlong vowel and dragging tone words with long final nasal.

> "Both contain the marked syllable w:$, i.e. a syllable that lacks the prosodic nodes O[nset] and R[hyme] and instead immediately dominates a mora constituent plus an optionally following voiceless fortis consonant." (Ruscher 1983:103).

Ruscher concludes that the dragging tone is a configuration of two immediately adjacent heterosyllabic morae within the domain of a single foot (Ruscher 1983:104f.). No onset is intervening.

The vocalic overlength in the initial syllable is dependent on isochrony and duration ratios.[41] This means that the syllable foot stretches over a defined time frame, resulting in vowel lengthening as a compensation for the defective second syllable that contains only the lenis C (Ruscher 1983:91). Ruscher implicitly assumes here that plain long vowels are phonologically structured as bisegmental and *mono*moraic (Ruscher 1983:92). For her, the long vowels have the same moraic status as short vowels, which she in fact deems also monomoraic. The overlong vowel results from a rule of vowel copying that inserts a duplicate of the second part of a long vowel VV_{α} as the nucleus V'_{α} to the second syllable. The newly created V'_{α} receives one mora, establishing together with the monomoraic VV_{α} sequence of the initial syllable a bimoraic structure. The ensuing overlong vowel consists of three vowel segments $VV_{\alpha}V'_{\alpha}$ (Ruscher 1983:93).

All in all, Ruscher analyses items with dragging tone or overlength as being structurally different from items without these prosodic properties. Where the former ones are bisyllabic, the latter ones are monosyllabic. Her approach integrates all three sound characteristics of the LG dialect: the dragging tone, the overlength, and their dependence on the quality of the final C. Ruscher (1983:105) finally states that schwa-dependent analyses, though most widely accepted,

> "are hardly justifiable from a synchronic point of view, on the grounds that these segments are nearly non-existent at surface level in present-day Heikendorf Low German."

2.3.4.2 The Kiel research cluster (1982-2001)

The first article of a series of six phonetic publications on the LG dialects in Niedersachsen and Schleswig-Holstein is Tödter (1982). She discusses the local dialect of Fintel in Niedersachsen (No. 39 of Figure 5) on a phonetic basis in the published version of her M.A. thesis. Tödter investigates recordings of five participants that contain carrier sentences with one item of a minimal pair. She assumes – based on the measurements of the mean vowel durations – that in the variety of Fintel only two length degrees exist (Tödter 1982:68). Her explanation for the widespread assumption of a third degree of length is such that a short tense LG vowel was, due to its quality, allotted to the corresponding Standard German quantity degree of tense vowels; i.e. it was interpreted as being long. The presence of a perceptually even longer tense vowel then resulted in the classification as overlong (Tödter 1982:76ff.). Basing her analysis on the measured vowel durations, Tödter (1982:68ff.) assumes instead that the LG short tense vowels are indeed either short (e.g. /kip/ 'pannier-Sg.') or plain long (e.g. /lu(:)s/ 'louse-Sg.'). The longer tense vowels are also interpreted as plain long (e.g. /hy:s/ 'house-Pl.').[42]

[41] Lehiste's (1970a) analysis of Estonian provides the basis for Ruscher's approach.

[42] Although Tödter (1982) uses phonological transcriptions, she does not distinguish between underlyingly voiced or voiceless consonants.

Tödter (1982) observes a notable influence of the quality of the following consonant on the duration of the vowel. Vowels before /k/ are shortest, then vowels before /l/, /m/ and /n/. They are longest before /f/ and /s/. Tödter does not mention, however, whether those voiceless /f/ and /s/ are originally voiceless consonants or just devoiced due to the final position. She implies that all the synchronic codas are the same from an articulatory point of view (Tödter 1982:78). The findings that the vowels are longest before voiceless fricatives are not consistent with earlier research carried out on English syllable nuclei by Peterson & Lehiste (1960). They found that vowels are longest before voiced sounds – a widely accepted and presumably universally valid result. Yet, Tödter's findings are not exactly correct, because she does not take into consideration the diachronic and probably still underlying voiced status of the consonants. Except for her test items /ka:f/ 'calf-Sg.' and /lu:s/ 'louse-Sg.', all examples with final (phonetically) voiceless fricative are apocopated forms that could have overlength. Thus, the findings that the vowels are longest before /f/ and /s/ could easily be a result of this. The more since the non-apocopated form /lu:s/ appears to be less long than both of the apocopated forms /hy:s/ 'house-Pl.' and /inn hu:s/ 'house-Dat.Sg.' (which were said to be within the range of the long vowels) (Tödter 1982:73, Abb. 5).

All in all, the mean vowel durations Tödter (1982:80, Abb. 11) provides with regard to the succeeding consonant appear to be not meaningful. The reason is that the mean duration values of the vowels are pooled across the whole data sample. The categories of long vowels and short vowels are conflated in the analysis. The exact number of short and long items is not controlled for. Additionally, the categories of apocopated and non-apocopated words are not indicated; a rather important detail because all of the investigated items ending in a plosive belong to the category of non-apocopated words, while (almost) all of the items ending in a fricative belong to the category of apocopated (i.e. possibly overlong) words. These shortcomings considerably skew the results.

However, Tödter concludes from the measurements that, although the long vowels are overall heterogeneous and the durational differences are sometimes rather high, all belong to just one class: the long vowels. This means that e.g. /lu:s/ 'louse-Sg.' and /hy:s/ 'house-Pl.' fall into the same category of long vowels. No overlength is present (Tödter 1982:81). Her interpretation of the data is such that she assumes a twofold binary distinction lax *vs.* tense and short *vs.* long (Tödter 1982:82).

A remark I would like to add is that the durational difference between the vowels influenced by apocope and the vowels not influenced by apocope might not be a very pronounced one – yet even from Tödter's data it still seems to be present.

The subsequent article on the dialect of the village of Haßmoor near Kiel (No. 14 of Figure 5) is a collaboration of Tödter and Kohler published in 1984. The variety is analyzed phonetically in basically the same way as the dialect of Fintel was. Five informants participated in the recordings. Neutral carrier sentences in declarative intonation were queried, bearing the item in question in ±final ±focused position.

They were recorded in Standard German and LG to enable a comparison between the two languages.

The result of the measurements is that only two degrees of vowel duration (i.e. short *vs.* long) combined with two degrees of quality (i.e. tense *vs.* lax) are identified (Kohler & Tödter 1984:78, 105f.). While 'house-Nom.Sg.' is found to have a short tense vowel, 'house-Dat.Sg.' is analyzed with long tense vowel.[43] No dragging tone is detectable (Kohler & Tödter 1984:107). However, a slightly significant durational difference of 20 ms (+ 26.32%) is observable between lax /ɪ/ and tense /i/ before plosive with 76 ms and 96 ms, respectively. A similar difference of 17 ms (+ 17.71%) occurs between lax /ʏ/ and tense /y/ before fricative with 96 ms and 113 ms, respectively. At least the first difference value lies above the perceptual threshold of 20% (see section 3.2.1 for a brief discussion of this *just noticeable difference*) and could therefore carry functional load. The authors postulate, however, that these differences between what they term 'short lax' vowels and 'short tense' vowels are much too small to justify a split into two separate quantity degrees short *vs.* long (Kohler & Tödter 1984:79). Also, if one would indeed assume such a split and analyze 'house-Nom.Sg.' or 'louse-Nom.Sg.' as long tense, the attested additional length division in the tense vowels would result in a ternary system of vowel length – a status that the authors argue to be avoidable.[44] Their informal perception tests conducted with manipulated speech material suggest that the lax *vs.* tense quality is more salient than the vowel quantity. Artificially shortened tense 'short' vowels are not identified as short lax vowels (Kohler & Tödter 1984:87f.). Note, however, that this does not necessarily suggest that there is no third degree of quantity in the LG dialect of Haßmoor. The distinction might be enhanced by laxness, adding additional perceptional cues to the speech signal.

Another observation made by the authors is that there are indications for durational triples in the mid vowels. These triples exhibit significant durational differences among each other (Kohler & Tödter 1984:84ff.). An example is [klɔkŋ] 'clock-Pl.' *vs.* [kokŋ] 'cooking' *vs.* [klo:gŋ] 'lament-Pl.'. Also, they find two length degrees in the diphthongs. The old diphthongs /ai/ and /au/ are continuously produced as long, whereas the rather newly created /ɛi/, /ou/ and /œy/ (descending from MLG *ê ō ô*, cf. Table 30 on page 163) are produced as either 'normal' or long depending on the succeeding C. If the consonant is lenis, the diphthong is long; if it is fortis, the diphthong receives normal duration (Kohler & Tödter 1984:84, 87).

Word stress appears to have no systematic influence on the vowel duration. The position within the utterance affects the vowel duration by comparison rather heavily (Kohler & Tödter 1984:107). Stressed vowels in sentence-final position are clearly lengthened as compared to their sentence-medial correspondents (Kohler & Tödter 1984:100, Abb. 12).

The authors interpret the data in such a way that the duration is a means to enhance the qualitative contrast in the mid vowels. An additional durational

[43] Following this analysis, the item /lu:s/ 'louse-Nom.Sg.' discussed by Tödter (1982) should also fall into the short vowel category instead of being considered long.

[44] The durational differences found between /i/ and /i:/, /y/ and /y:/, and /u/ and /u:/ are indeed statistically significant.

differentiation furthers the perception of the opposition. Kohler & Tödter (1984:88) assume that this differentiation is necessary because the qualitative differences tend to be particularly small for the mid vowels. The durational enhancement is irrelevant for the lax *vs*. tense contrast in the closed vowels because they are not conflicting qualitatively with any other vowel quality.

Kohler & Tödter (1984:88) conclude that only the interconnection of quantitative and qualitative differences allows for a consistent production and perception of the ternary duration opposition. The difference between short vowels and long vowels depends on the quality of the following consonant as lenis or fortis. The distinction is therefore defined as twofold binary with two levels of vowel quality (lax *vs.* tense) combined with two levels of length (short *vs.* long) (Kohler & Tödter 1984:106).

The series of phonetic publications on LG dialects continues with the article of Kohler & Tödter & Weinhold (1986a) on the supplementary research conducted on the dialect of Haßmoor. It discusses perception data and some additional production data of the variety, focusing on formant values (F1 / F2) and pitch variations.

The findings are that each of the vowel triples defined in the 1984 study by Kohler & Tödter show one more open (lax) member and two more closed (tense) members (Kohler et al. 1986a:35). The closed lax vowel qualities /ɪ/, / ʏ/, and /ʊ/ are produced more open, resulting in a perceptual transfer into [e], [ø] and [o], respectively. Their actual formant values correspond to the values of the original short tense and long tense member of the mid opening degree (i.e. /e(ː)/, /ø(ː)/ and /o(ː)/).[45] This is also verified in the perception tests (Kohler et al. 1986a:83). Their duration is, however, shorter than the one of the short tense vowels. As a result, a ternary length distinction arises in the vowel system of Haßmoor (Kohler et al. 1986a:35). The authors state that because this distribution is not consistently produced within the data and additionally shows a rather weak functional load, the ternary quantity opposition can be reduced to a binary one (Kohler et al. 1986a:83).

While the duration analysis showed indeed (partly) a ternary length distribution in the vowels, the pitch analysis provides no cues on the presence of a dragging tone (Kohler et al. 1986a:36ff.). Only a very limited number of words was analyzed, namely the two minimal pairs /stiç/ ‘steep track-Sg.’ - /stiːç/ ‘staircase-Sg.’, and /brut/ ‘bride-Sg.’ - /bruːt/ ‘to brew-3.Sg.Pres.’ as produced by two informants. These examples were chosen due to the fact that they are traditionally assumed to exhibit an overlength distinction resulting from earlier schwa-drop. The words are scrutinized in focused-medial position, in unfocused-medial position, in focused-final position, and in unfocused-final position. Besides the general intonational change in the pitch contour, only a difference in the duration of the vowels is detectable.

The authors therefore conclude that both the dragging tone and the ternary length distinction are not a phonetic reality in the dialect (Kohler et al. 1986a:83). Yet, against the background of the three durational steps found in the mid vowels of the

[45] Traditionally interpreted, the short tense vowels of Kohler et al. (1986) would be transcribed as long, while the long tense vowels would be transcribed as overlong.

Haßmoor dialect, the denial of a threefold length distinction must occur as questionable. The presence of a contrast, even if it does not occur frequently in a language, indicates the presence of a distinction in the speaker's minds. It is likely to be of phonological relevance.

Similar results as for Haßmoor are obtained in the study of Kohler et al. (1986b) on the Schleswig-Holstein dialects of Brarupholz in Angeln (No. 7 of Figure 5) and Windbergen in Dithmarschen (No. 20 of Figure 5). The same methods as in the Haßmoor study were applied to conduct data and perform a phonetic analysis.

The authors find that the Brarupholz dialect also exhibits the qualitative merger between the lax closed vowels and the tense mid vowels (Kohler et al. 1986b:128). It is visible in the congruent formant values as well as the results of the perception test. This yields again a ternary length contrast in the mid vowels parallel to the one observed for Haßmoor. A further similarity is that no distinct tonal movements are detectable for the Brarupholz dialect. The dragging tone does not occur.

The results for Windbergen are slightly different when it comes to the vowel qualities. No merger between the lax closed vowels and the tense mid qualities arises. This is due to the fact that the non-closed tense vowels show diphthongization whereas the closed vowels do not. The diphthongs (except for /ai/ and /au/) show here a binary split of short *vs.* long (Kohler et al. 1986b:150). The analysis of the F0 determines no essential differences between the short and (over)long vowels.

As a result, the conclusion drawn for the dialects of Brarupholz and Windbergen is identical to the Haßmoor upshot. Kohler et al. (1986b) assume that neither of the two varieties shows a ternary quantity distinction that is independent of the vowel quality. Distinct pitch differences are not detected and can therefore carry no functional load.

These findings for the three dialects (i.e. Haßmoor, Brarupholz, and Windbergen) as well as for the dialect of Fintel are summarized in Kohler's (1986) and (2001) overviews on the phenomena of overlength and dragging tone in LG. He states that no pitch-related cues for a dragging tone were observable in the investigated LG varieties. The crucial distinction is for him a combination of binary quality (lax *vs.* tense) and binary quantity (short *vs.* long). No minimal triples could be found for [e] [eˑ] [eː], [ø] [øˑ] [øː], [o] [oˑ] [oː] (the short element originating here in a short lax vowel of the closed opening degree) (Kohler 2001:395). Kohler (2001:398f.) notes that a ternary opposition is (if anything) only rudimentarily present nowadays, rendering it irrelevant in speech communication. He generally doubts the possibility to consistently produce and perceive a threefold length difference in human speech without the aid of syntagmatic structure (Kohler 2001:399f.).

I provide a more detailed discussion of Kohler's analysis in section 5.3.2 of the vowel chapter.

2.3.4.3 Carol Chapman (1993)

Ten years after the M.A. thesis by Ruscher (1983) that investigated the dragging tone in the LG dialect of Heikendorf by means of metrical phonology, Chapman (2003) brings forward also a metrical analysis – this time for a ternary length distinction short *vs.* long *vs.* overlong in North Low Saxon dialects.

She relates the additional lengthening of MLG long vowels to overlong configurations to the deletion of schwa in the following syllable (Chapman 1993:134). The observation is again that if an original voiceless fortis C precedes the deleted schwa the stem vowel does not lengthen. The length behaves similar to other known prosodic phenomena such as tone or word stress, being determined also by syllable structure (Chapman 1993:139).

As Chapman (1993:135) points out, not all lengthened LG forms correspond to von Essen 1958's assumption of compensatory lengthening as a means of establishing a grammatical distinction. They can therefore not be readily explained this way. Some words (e.g. [huːs] 'house-Nom.Sg.' *vs.* [hyyːz̥] 'house-Pl.') exhibit umlaut in addition to overlength and thus would not have needed to develop an overlength contrast.[46]

Another approach towards an explanation of the rise of overlength is the adoption of the tone of the deleted final syllable by the stem syllable. In the course of this process, the stem syllable would have had to lengthen. Chapman argues, however, rather for dragging tone to be a by-product of lengthening. She notes that

> "the long/overlong distinction is maintained in unaccented sentence-medial position in North Saxon whereas the Schleifton is not, [which] suggests the greater linguistic importance of the former" (Chapman 1993:136).

However, the traditional generative system of binary distinctive features is not suited to explain the ternary quantity distinction (Chapman 1993:138). It is therefore necessary to employ a different phonological framework. Accordingly, she provides two possible approaches towards a phonological interpretation of the threefold quantity contrast: autosegmental theory and metrical theory.

In an autosegmental approach, quantity is represented on the skeletal tier (x-slots), which can be multiply associated with vowels and vice versa (Chapman 1993:143). This enables an analysis of segmental quantity in a parallel fashion to tone by means of multiple associations of x-slots to segments. Segmentally, the three vowel quantities are identical. They differ only with respect to their associated x-slots (Chapman 1993:143), and their associated morae. It follows that the LG overlong syllables of monosyllabic words are trimoraic. Words maintain constantly their (underlying / suprasegmental) trimoraic status. This is discernible if a suffix is added to them stem, making the word bisyllabic. The initial syllable then loses its third mora to the ultima. As to Chapman (1993:146), this

> "suggests that there exists some higher-level unit, above the syllable, whose length (three morae) remains constant regardless of developments on the segmental level."

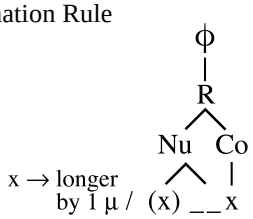
[46] The original notation employed by Chapman (1993) is such that V: indicates a phonetically long, bimoraic vowel, whereas V:. indicates a phontically overlong, trimoraic vowel.

Autosegmental theory does not enable the reference to such a prosodic unit beyond the syllable. The author therefore turns to metrical theory in order to clear the picture. She assumes that overlong syllables constitute the equivalent of two ordinary syllables, containing a strong (s) metrical part and a weak (w) metrical part (see also Prince 1980 on Estonian). In non-overlong words, this structure is spread over two syllables (σ), which together form the so-called syllable foot (ϕ) (Chapman 1993:146). Compensatory lengthening applies basically to maintain the number of morae in one metrical foot if the second syllable rhyme (i.e. nucleus and coda) of a foot is deleted; i.e. $[[bre:]^{\mu\mu}{}_{\sigma}[v\text{ə}]^{\mu}{}_{\sigma}]_{\phi}$ (three morae over two rhymes) becomes $[[bree:f]^{\mu\mu\mu}{}_{\sigma}]_{\phi}$ (three morae over one rhyme) (Chapman 1993:148). The underlying assumption is here that the North Low Saxon metrical foot has to consist of exactly three morae (Chapman 1993:149). The general strong-weak structure of feet determines then that overlong syllables are always stressed. The reason is that these syllables themselves exhaust the foot, i.e. always contain a metrically strong part. The occurrence of the specific tonal contour of dragging tone is now described as falling intonation which occurs since "the intonation pattern is realised over one foot, irrespective of whether it contains one or two syllables" (Chapman 1993:149).

Chapman postulates that lengthening applies only to a certain position in the rhyme, namely the second part of it – the nucleus-final position Nu_2 (Chapman 1993:150f.). A final obstruent is regarded as extrametrical. Chapman (1993:152) assumes that words with more than three morae in one syllable are possible only by means of a word-final long sonorant consonant, if these sounds have developed due to assimilation, e.g. /vo:n:/ 'to live-Inf.' (Chapman 1993:152). The author analyses words like this with a bimoraic V and a bimoraic R. Although she does not specify it in the text, the underlying assumption appears to be here that a (moraic) remnant of the assimilated final syllable is still present synchronically. This remnant would need to be unfooted in order to adhere to the restriction against more than three morae in one foot.

Since the long *vs*. overlong opposition in vowels marks a particular grammatical alternation in LG, Chapman (1993:153) assumes that there has to be a morphological restriction at work. The result of this restriction is that not all monosyllabic words in North Low Saxon exhibit overlength. To formalize this finding, the author comes up with an iterative rule. It determines that a short nuclear vowel gets at first generally lengthened regardless of whether the nucleus is branching. In a second cycle, the newly created branching nucleus gets lengthened again if and only if a morpheme is latched to the right word edge. Accordingly, the synchronic rule is formulated as follows (Chapman 1993:154):

Figure 6. Chapman's synchronic Alternation Rule



The "x" mark here positions on the skeletal tier, which are the equivalent of morae for Chapman (1993:143, 156). Only the Nu_2 position " _ _ " that is created by branching of the nucleus can receive an additional mora and thereby lengthen the nuclear vowel. "In other words, any element in the nucleus lengthens by one mora if it is preceded either by one element or zero" (Chapman 1993:154).

Chapman concludes that the interdependency of tonal phenomena, word stress and quantity indicates that these prosodic properties are all determined by structural requirements and constraints dominating the syllable. They should therefore not so much be treated as an attribute of segments but rather as suprasegmental features (Chapman 1993:155).

I will come back to Chapman's analysis in the course of the vowel analysis in section 5.3.

2.3.4.4 Tim Beeck (1994)

Beeck (1994) discusses the dialect of Windbergen (No. 20 of Figure 5) and gives an overview on the phonological approaches towards vocalic overlength, i.e. (a) apocope related compensatory lengthening, (b) no overlength, c) overlength as a property of the foot rather than the syllable. The author states that the assumption of a third degree of vowel length is not necessary in Windbergen (Beeck 1994:72). The presence of a dragging tone is, however, possible. Its functional load would be rather restricted because it is closely related to the segmental and intonational context (Beeck 1994:112). The dragging tone constitutes a unit of the PrWd phonology and sentence phonology, as Beeck (1994:112) notes. Overlength as well as dragging tone is ultimately regarded as syllable-related means of contrast enhancement (Beeck 1994:113).

2.3.4.5 Steffen Höder (2003)

Höder (2003) assumes in his work on Altenwerder (Aw.) LG a binary quality distinction of lax *vs.* tense vowels. Vowel length is seen as merely allophonic. On top of the quality opposition, a tonal distinction of toneme 1 (unidirectional pitch contour, level or slightly falling) and toneme 2 (complex tone, level and then slightly falling) occurs (Höder 2003:26f.). It is only possible in final syllables exhibiting a (potentially) long vowel (i.e. /aː ɔː/ and /i y u e ø o ɒ/) or a diphthong (including -Vr- and -Vl- combinations). Also, vowel-nasal sequences may carry a tone. The TBU in Altenwerder LG is generally a phonetically long vowel in the final syllable of a PrWd (Höder 2003:27). Short vowels do not participate in the tonal contrast.

The origin of the tone accents in northern Low German dialects is assumed to be apocope (Höder 2003:24).

2.3.4.6 Antje Olthoff (2005)

In her M.A. thesis on the city dialect of Leer (No. 54 of Figure 5), Olthoff (2005) argues for the presence of two contrastive tones (pushing tone TA1 *vs*. dragging tone TA2) on phonetically long *vs.* overlong vowels, exhibiting pitch contours similar to the Scandinavian tonal accents. Additionally, a prosodic property of no-tone is found in the short vowels. Minimal triples demonstrate a distinction between no-tone : TA1 : TA2 that is accompanied by either a durational difference or a qualitative vowel difference between no-tone and TA1 (Olthoff 2005:48f.); e.g. /zɪt/ 'to sit-1.Sg.Pres.' *vs.* /[1]zit/ 'since-temp.' *vs.* /[2]zit/ 'silk-Sg.'.[47]

Not only vowels but also word-final nasals are TBUs in the Leer dialect (Olthoff 2003:49). Olthoff assumes that adjacent nasals merge after syncope of schwa in inter-nasal position. The contracted nasal consonant – and not the preceding vocalic nucleus – receives TA2, e.g. /[1]fʊŋ/ 'to catch-1.Sg.Past' *vs.* /fʊ[2]ŋ/ 'to catch-Pl.Past'. Olthoff argues that such final nasals therefore cannot be regarded as long or interpreted as geminates. They differ from not contracted nasals in terms of tone. Examples of minimal pairs with TA2 on the vocalic nucleus *vs.* TA2 on the final nasal follow below:

Table 2. Leer minimal pairs with TA2

/[2]dɛ̂ɪm/ 'to serve-1.Sg.Pres.'	*vs.*	/dɛɪ[2]n/ 'to serve-Inf.'
/[2]kôm/ 'to come-1.Sg.Pres.'	*vs.*	/ko[2]m/ 'to come-Inf.'

The items to the left underwent the process of apocope. The vocalic nucleus lengthened and received TA2. The resulting single final nasal did not receive a tone in these cases. This is different for the right-hand items of Table 2. The deletion of schwa between two nasals causes here the assignment of tone to the resulting final nasal, whereas the vowel remains unchanged. Olthoff (2003) does not make any assumption with respect to a possible phonological mechanism that is at work in such cases.

2.3.4.7 Elmar Ternes (2006)

Differently from his earlier proposal of 1981, Ternes (2006) assumes the presence of a binary tone accent contrast in North Low Saxon instead of a ternary vowel length opposition. It is a substitute for a third degree of length, arising generally in those languages that have developed a ternary length contrast. In North Low Saxon dialects, compensatory lengthening applied after the occurrence of schwa-apocope and created such a third degree of length. It then developed into the dragging tone (Ternes 2006:93).

[47] Olthoff (2005) marks TA1 and TA2 on the following syllable with superscript [1] and [2], respectively.

The elongated tonal contour of the phonetically overlong LG vowels is termed TA2, whereas the long vowels carry TA1. Ternes (2006:92) observes that these tonal contours are diametrically differently distributed to the tone contours of the so-called Rule-A(2) area of Central Franconian. The tonal developments can be illustrated as follows (Ternes 2006:93).

Table 3. Tonal development in North Low Saxon and Central Franconian

North Low Saxon	originally:	*short*	*long*	*overlong*
		∨	∨	∨
	new:	—	TA1	TA2
Central Franconian Rule A(2)	originally:	*short*	*medium*	*long*
		∨	∨	∨
	new:	—	TA1	TA2

Here it is crucial that the forms that are termed *long* are in both dialects etymologically the same, indicated by the grey shadings in Table 3. While the originally long vowels of North Low Saxon developed TA1, the originally long vowels of Central Franconian developed TA2. The originally overlong cases of North Low Saxon and the originally medium cases of Central Franconian received TA2 and TA1, respectively. The result is such that we find a complementary distribution of the tones in the two areas. TA1 is assigned e.g. to the *Nom.Sg.* cases with long vowel in North Low Saxon but to the *Dat.Sg.* cases with long vowel in Central Franconian. The opposite distribution is true for TA2. It is assigned to the *Dat.Sg.* cases with overlong vowel in North Low Saxon and accordingly to the *Nom.Sg.* cases with medium vowel in Central Franconian. An example is provided in Table 4 (Ternes 2006:92). The originally short vowels of North Low Saxon and Central Franconian did not develop tone.

Table 4. Tonal distribution in North Low Saxon and Central Franconian[48]

		TA1	TA2
(a)	North Low Saxon	[^{1}huːs] ‘house-Nom.Sg.’	[^{2}huuːs] ‘house-Dat.Sg.’
(b)	Trier Franconian	[^{1}huˑs] ‘house-Dat.Sg.’	[^{2}huːs] ‘house-Nom.Sg.’

2.3.4.8 Maike Prehn (2007)

The article of Prehn (2007) discusses the (possibly) tonal phenomena in the LG dialects of Kirchwerder and Altenwerder. She argues on the basis of phonetic pilot measurements that two tone accents (TA1 *vs.* TA2) are the relevant properties in LG, and not vowel duration or moraic structure. The assumption of phonologically

[48] The superscript denotes the respective tonal contour. In accordance with IPA conventions, it is inserted before the syllable that (supposedly) carries the tone.

'overlong' vowels and a resulting ternary quantity distinction is rejected. Instead, Prehn assumes similar to Höder (2003) a dual binary distinction of vowel quality lax *vs.* tense, and of TA1 *vs.* TA2. Vowel length was assumed to be phonetic.

Note that the findings presented in this article are preliminary ones. They will be set into the broader picture of the complete analysis of the focused declarative speech material of the dialects of Kirchwerder, Altenwerder and Alfstedt in section 5.3.

2.3.5. *Conclusion*

The overview on the research history of overlength and dragging tone in LG illustrates that only a comparatively small number of phonological investigations exists for the local varieties. The phonetically based analyses of the 'Kiel research cluster' are inconclusive with respect to the status of a ternary vowel duration opposition in LG dialects. Also, recent research has casted doubts on the correctness of such quantitative approaches. A thorough implementation of phonetic findings into a 'state-of-the-art' phonological framework is, yet, a desideratum not satisfyingly treated in the literature. This trail of thoughts serves as the theoretical starting point for my investigations. I will try to answer a number of research questions raised in the literature in the course this thesis:

- Is it tone, quantity, or something else that is the primary prosodic feature of LG dialects?
- Which of these suprasegmentals has phonemic status, i.e. may be termed *prosodeme*?
- How is the relevant prosodic feature, if there is any, represented phonologically?
- Does it occur in typologically different languages or other dialects? How do researchers deal with it descriptively and phonologically?

I start my analysis rather traditionally in the realm of phonetics. The following chapter is therefore devoted to the collection and phonetic analysis of concrete data of the three LG dialects of Kirchwerder, Altenwerder, and Alfstedt.

3. Descriptive part

The empirical basis of the current survey is the speech data of three North Low Saxon dialects: Kirchwerder (Kw.), Altenwerder (Aw.), and Alfstedt (Alfs.). Most of the recordings were recently conducted by the author, but older recordings from the 1960s and late 1970s (especially Wenker sentences and stretches of free speech) are also considered, though not included in the corpus.[49] A total of 15 informants (two from Kw., seven from Aw., and six from Alfs.) were recorded in the course of the fieldwork. Additionally, 39 speakers participated in a perception test, of whom three as a test group. I introduce the informants and the fieldwork procedures in more detail in the following sections.

The recordings were performed with the portable DAT-recorder Sony TCD-D8 (sampling-rate 44.1 kHz) in conjunction with the omni-directional microphone Sanken COS-11s. They were adjusted for audio noise and transferred in AIFF format to an audio CD.

All of the acoustic analyses as well as the production of the artificial stimuli for the perception task were conducted using the computer program Praat (Boersma & Weenink 2009). At the basis of the phonetic and statistical analysis lies the segmentation and acoustic measurement of the recorded speech data. In order to keep the parameters constant, as many procedures as possible were executed by means of Praat scripts. Only the segmentation of the nuclear vowels and the coda Cs was carried out manually. Formant structures, oscillogram and spectrogram, and auditory impression provided the main references for the division of a token. All duration values and F0 values based on these segmentations are derived from automated measurements. The statistical calculations were then performed with SPSS 16.0.

Having described the technical background, the following sections are devoted to specifying the methodology of the fieldwork and the collection of the data. The test procedures are introduced briefly in section 3.1. Subsequently, I provide in 3.2 to 3.4 a phonetic analysis of the production data of the three LG dialects under investigation. I then move on to the individual results of the Perception Task in section 3.5. A conclusion of the findings of the descriptive chapter follows in 3.6.

What becomes particularly clear in the course of the statistical and phonetic analysis is that pitch movements are neither in Kw., nor in Aw., nor in Alfs. a means of expressing a lexical or morphological distinction in LG minimal pairs. This is true not only for the perception but also for the production. The prosodic entity employed to mark the contrast is vowel duration instead. The quality of the vowel only plays a minor part in that only the mid vowels appear to merge the long duration degree

[49] I am especially indebted to the library of the Institut für Allgemeine und Angewandte Sprachwissenschaften of the University of Hamburg for their generous supply of magnetic tapes. Also, I am much obliged to the Deutsche Sprachatlas in Marburg for their kind support, and for providing me with a wide range of recordings of the Wenker sentences.

with the overlong duration degree.[50] Also, lax vowels may only occur in the short length degree whereas their tense correspondents occur preferably in the long and overlong degree. The findings correspond in this to some extent to the results obtained by Kohler & Tödter (1984), Kohler et al. (1986a), and Kohler (2001). The overlap is, however, not complete.

So, let us turn to the methodological background that is employed to elicit the speech data.

3.1. *Empirical basis*

The main goal of the conducted recordings and perception studies is to pinpoint whether the investigated LG dialects employ vowel length or rather tonal contours as means of expressing lexical and morphological contrasts. The cardinal question is here if diachronically apocopated or syncopated forms, i.e. originally bisyllabic items that developed into monosyllables, have merged synchronically with originally monosyllabic items. Accordingly, monosyllabic minimal pairs were used that contain an item with a long vowel (i.e. the expected length degree 2 or tone accent 1) and an apocopated or syncopated item with a supposedly overlong vowel (i.e. the expected length degree 3 or tone accent 2). This restriction to monosyllables also has the advantage of excluding effects of word length on vowel duration.[51]

3.1.1. *The Participants*

3.1.1.1 Fieldwork

A contact person from the respective community made the first connection with the informants of each village (Kirchwerder, Altenwerder, and Alfstedt). This person was found via the respective local churches of Altenwerder and Kirchwerder, and a personal contact from Alfstedt.

Two combined factors were taken into consideration for the selection of the participants. The informants should be L1 speakers of the local LG variety, and preferably show an active usage of their dialect in everyday life. The vast majority of the subjects interviewed for the study fall into this category (i.e. 35 out of 41 informants = 85.37%).[52] The remaining six informants (i.e. 14.63% of the informants) are L2 speakers of Low German, having learned LG in their later childhood and youth. They nevertheless have active competence in their dialect,

[50] Note that the term ‘overlength’ is merely a descriptive one. It is used as a means to express the presence of a third, i.e. longer, durational degree. Wiesinger (1983b:1063f.) rather employs the labels half-long *vs.* long for the contrast here referred to as long *vs.* overlong.

[51] Interestingly, a supplementary elicitation of eight *bisyllabic* items with informant III.6.Aw indicates that the expected length degree 3 or tone accent 2 may occur also in these cases. I give the single utterances as produced by III.6.Aw in a narrow transcription: [ʃokeˈlɑɑːd̥] ‘chocolate-Sg.’, [tʰakeˈlɑɑːʒ̊] ‘rigging-Sg.’, [kɑbeˈnɑɑːd̥] ‘grilled cutlet-Sg.’, [b̥ɑˈg̊ɑɑːʒ̊] ‘unwanted persons’, [mɑˈtrəouːz̥] ‘sailor-Sg.’, and [kɔmˈbyyːz̥] ‘caboose-Sg.’ *vs.* [kɑˈjyːt] ‘cabin-Sg.’, [grɑˈnɑːt] ‘langoustine-Sg.’. This length distribution is also confirmed for the Leer variety of LG (Antje Olthoff p.c.).

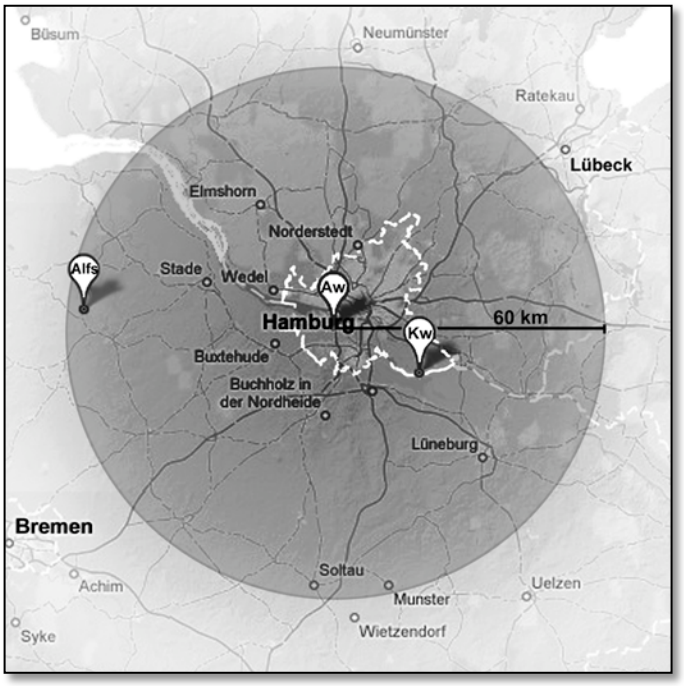
[52] The participants are distributed as follows: two informant from Kw., 17 informants from Aw., and 22 informants from Alfs. The three additional L2 test subjects are not included in the calculations so far, but do not change the overall age range.

using it in every day life. The mean age of the participants of the fieldwork is 61.98 years. Only three informants are clearly younger with an age range from 29 to 45 years. The remainder of the subjects obviously belongs to the older generation of speakers that is here defined by an age range from 46 to 85 years (i.e. the generation of parents and grandparents who may be assumed to be L1 speakers of LG). We thus attain a rather biased age range with a surplus of older speakers.

3.1.1.2 On-line Test

In order to get at a slightly better idea of the perception of LG of the younger generation of speakers (i.e. 19 to 45 years), an on-line test was designed. It was made available on the Internet at <http://www.meertens.knaw.nl/panel/maikefiles/> from July 15th 2008 to January 15th 2009. The target group reached via the medium of the Internet supposedly contains mainly L2 speakers of LG.

Figure 7. Map of the Hamburg region, including demarcations for the villages of Kirchwerder (Kw.), Altenwerder (Aw.), and Alfstedt (Alfs.)



Informants coming from an area within a 60 km radius around the village of Altenwerder were especially encouraged to join the survey. The mutual intelligibility of the LG dialects of the Hamburg region allows for such a large area of investigation. The idea was to keep the dialectal variation between the fieldwork data and the on-line experiment to a minimum by restricting the area roughly to the

region of Hamburg. The area is illustrated in the map in Figure 7. LG speakers from locations further away from Hamburg were, however, also invited to participate.

Thirty-one informants with a mean age of 33.29 years ultimately joined the experiment; 18 of these are male, and 13 female. This basically means that the goal of the test to reach the younger generation of LG speakers was met (only four informants of the older age group are included in the set). These younger subjects of the on-line test show a rather different distribution with respect to usage and proficiency of LG. Here, merely 16 out of 31 informants (51.61%) actively use LG in their every day live. Two informants out of this 'active' group of subjects (i.e. 6.45% of the entire set ≈ 12.5% of the subgroup) are L1 speakers of LG; one participant is a L1 speaker but does not use LG actively; the remaining 13 informants (i.e. 41.94% of the total ≈ 86.67% of the subgroup) are L2 speakers.

Eight of the 31 participants originally come from locations within the designated 60 km radius around the village of Altenwerder (i.e. from Buxtehude, Elmshorn, Itzehoe, Soltau, Stade, Wedel). They constitute *group 1* of the on-line experiment. Out of this group, only two subjects indicate active usage of LG in everyday life.

The other informants come from different areas in the federal lands of Niedersachsen and Bremen, Mecklenburg-Vorpommern, and Nordrhein-Westfalen (i.e. Achim, Aurich, Bassum, Bremen, Celle, Emden, Hermannsburg, Leer, Meppen, Otterndorf, Papenburg, Peine, Visquard, Weener, Wilhelmshaven; Wolgast; Ahaus, Bielefeld, Velen, respectively). They are pooled together into *group 2* of the on-line experiment. A total of 14 subjects from this faction state that they actively use their dialect of LG on a regular basis.

3.1.2. *The Production Data*

One aim of the speech recordings was to obtain data of each of the three LG dialects that could subsequently be manipulated into artificial stimuli for a Perception Test. The location of the recordings was a quiet room in the house of the respective informant or a befriended family, or in the case of Altenwerder also a quiet room in the Altenwerder church. The recordings contain only words uttered in a controlled metalinguistic sentence context, i.e. simple syntactic structure of SVO that contains no indication (morphologically or grammatically) on the item in question. This context-free condition was chosen in anticipation of the listening experiment. The informant's assigned task was in either case to pronounce a list of 11 monosyllabic minimal pairs embedded into 176 Low German sentences, each with its specific intonational contour (declarative, or interrogative). The basic structure of the sentences is given in Table 5.

The list of words was compiled by means of the literature and with the help of the informants. These minimally contrastive items are assumed to differ either in terms of vowel length (long *vs.* overlong), in terms of tonal contours (falling tone accent 1 *vs.* level-falling tone accent 2), or both. To indicate for the speaker the appropriate context in which the carrier sentence might be produced, the LG sentence was preceded by a short, explanatory High German sentence and the intended translation of the LG sentence (e.g. *Der Ober bringt die Weinkarte. - Er hat*

"WEIN" gesagt. – Hee het "WIEN" seggt. 'The waiter fetches the wine list. – He has WINE said.').[53] Each of these carrier sentences contained one member of a potential minimal pair in the varying prosodic conditions (±focused, ±final, declarative, interrogative), i.e. 'He says ...' or 'He has ... said'. The non-focused items were all elicited in postnuclear position. If a minimal pair failed to apply in the dialect, the informants were invited to suggest alternatives. The metalinguistic sentence structure allows for a grammatical production of all the chosen minimal pairs, independent of their morphological status. The words [zɛçt] 'to say-3.Sg.Pres.' and [hɛt] 'to have-3.Sg.Pres.' were chosen to precede or succeed the tokens as to simplify the segmentations of the phonetic string needed for the acoustic analysis. Three training sentences preceded the actual recordings to familiarize the participants with the recording situation. In addition to the sentences, the participants read out a list of isolated words, minimal pairs, minimal rows. The items are listed in the appendix (B). The interrogative cases as well as the non-focused cases were excluded from the perception test and the further analysis due to a general lack of time. Scrutinizing these items is left for future research.

Table 5. Basic LG sentences

	declarative	interrogative
[+focused, +final]	*Hee seggt 'BREF'.* 'He says "LETTER".'	*Seggt hee 'BREF'?* 'Says he "LETTER"?'
[+focused, -final]	*Hee het 'BREF' seggt.* 'He has "LETTER" said.'	*Het hee 'BREF' seggt?* 'Has he "LETTER" said?'
[-focused, +final]	*Hee SEGGT 'Bref'.* 'He SAYS "letter".'	*Seggt HEE 'Bref'?* 'Says HE "letter"?'
[-focused, -final]	*HEE het 'Bref' seggt.* 'HE has "letter" said.'	*Het HEE 'Bref' seggt?* 'Has HE "letter" said?'

The second goal of the recordings was to enable a phonetic analysis of the vowels. Therefore, the preliminary speech recordings for the Perception Test needed to be complemented by further recordings elicited in a Production Task. They as well were carried out at the homes of the informants, and in the case of Alfstedt also in the community hall. The Production Task generally entailed that the subjects were first presented with a list of 20 declarative Standard German sentences, containing at least two words that contrast in terms of tonal contours (i.e. 'pushing tone' *vs.* 'dragging tone') and/or long *vs.* overlong vowel length. The position of the items was either medial or final in the given utterance, and always in sentence focus. The sentences were written on the front of single sheets of paper. On the backside of the

[53] This method proved to be necessary and rather useful since no LG orthographic norm exists. A complete textualization in LG led to discussions with respect to the speaker's intuitions for a correct writing system. To provide nevertheless a 'LG environment', the recordings took place parallel to meetings of LG clubs or groups to which the informants belong, or the informants were encouraged to tell LG anecdotes before the actual recording started.

paper appeared a possible LG translation.[54] The informants were asked to first read silently the front, think of a possible translation, turn the paper around, and compare their translation to the one presented to them on the backside. Finally, they had to read out loud the translation two times. A list of 84 isolated Standard High German words, translated into the respective LG dialect and spoken three times each, completed this recording.

3.1.2.1 Kirchwerder recordings

In the case of Kirchwerder, two similar recording series were conducted on the 21st of August 2006, one with each of the two informants. The locations of the recordings were the homes of the respective participant.

After the two interviews with the informants I.1.Kw and I.2.Kw, one minimal pair was excluded from the preliminary list. This is */haot/ 'skin-Sg.' *vs.* /haːot/ 'to hit-3.Sg.Pres.'.[55] Both speakers produced not */haot/ but [huːt]. As a substitute, /mɛod/ 'courage-Sg.' *vs.* /mɛoːd/ 'fashion-Sg.' was added to the list.[56]

All remaining minimal pairs were confirmed by the informants although informant I.2.Kw got confused by /ɑːl/ 'already' *vs.* /ɑɑːl/ 'all' since he is used to applying Standard German /ʃon/ rather than /ɑːl/, and /alə/ rather than /ɑɑːl/, respectively. Furthermore, he criticized the usage of the word [ʔɛçt] *echt* within the non-focused sentences. He would have preferred [viɐklıç] *wirklich* 'really' instead.

All in all, the reading of the sentence list took about 60 minutes for each Kw. informant. A total of 198 viable tokens were elicited from the two informants.

The Kw. data was not complemented by further recordings due to lack of participants. Because of this, also no Perception Test could be performed for Kw.

3.1.2.2 Altenwerder recordings

The basic test conditions in Aw. were similar – though for this dialect enough speakers were found who participated in the Perception Test and supplementary recordings.

Prior to all the recordings, during a casual meeting with some dialect speakers of Aw., two minimal pairs of the preliminary list were excluded. These are /kɔːt/ 'small cottage-Sg.' *vs.* */kɔɔːt/ 'card-Sg.', and */les/ 'verse-Sg.' *vs.* /leeːz/ 'to read-1.Sg.Pres.'. Both pairs had been verified for Kw. In the case of */kɔɔːt/ the vowel quality is rather [kɔːat], and the lexeme 'verse-Sg.' is simply unfamiliar to the speakers.[57] However, one additional Aw. minimal pair was found. This is /blɔit/ 'to

[54] Again, this method was employed to prevent problems with the individual LG writing intuitions of the informants.

[55] The asterisk ' * ' denotes reconstructed or hypothetical items that were not found in the elicited speech data but were cited in the literature.

[56] The minimal pair */haot/ 'skin-Sg.' *vs.* /haːot/ 'to hit-3.Sg.Pres.' stems from the LG dialect of Leer described in Olthoff (2005). The minimal pair /mɛod/ 'courage-Sg.' *vs.* /mɛoːd/ 'fashion-Sg.' was taken from Höder (2003), as was the better part of the items. My LG informants produced the [ɛ] in [mɛoːd] 'fashion' shorter than the following [o], while in [brɛːiv] 'letter-Pl.' it was the other way around with the [ɛ] being longer than the following [i].

[57] I assumed */kɔɔːt/ 'card-Sg.' to possibly contain TA2 or overlength in case of total assimilation of the vocalized /r/ to the nucleus; */les/ was found in Lübben (1965).

blossom-3.Sg.Pres.' *vs*. /blɔːid/ 'shy-adj.'.[58] To substitute 'verse', /lɛiç/ 'bad-adj.' *vs*. /lɛːig/ 'to tell a lie-1.Sg.Pres.' was added to the list, so that again 11 minimal pairs were obtained.

The first series of recordings of the LG dialect of Altenwerder was then conducted at the Altenwerder church St. Gertrud, in a quiet room behind the sanctuary on the 19th of November 2006. Two female speakers, informant I.1.Aw (age 83) and informant I.2.Aw (age 79), read the corrected list of Low German sentences and the single minimal pairs. They both joined the recording session for the complete period of time. All in all, the recording session took about 80 minutes for both informants. They made some critical remarks on the chosen LG orthography and on the usage of the word *echt* 'really', which seemed inappropriate especially to informant I.2.Aw.[59] She preferred using *wirklich* instead.

Informant I.1.Aw tended to forget the final *sagt* 'say-3.Sg.' in the non-final declarative and interrogative sentences. The first auditive impression is, however, that this did not affect the intonation contour of the preceding part of the sentence. It seems she thought she had already produced this last word of the sentence along with the rest of the utterance.

The impression regarding the production of the focused and non-focused sentence-pattern is that both informants produced the major part of the sentences with the lemma in focused position. Only a limited number of unfocused stimuli were obtained from this recording session. Therefore, the female informant I.3.Aw (age 60) was recorded in a third recording session on February 9th 2007. The appointment was at her house, sometimes interrupted by her husband. Goal of the series of recordings was to collect as many from the still missing intonational variants as possible.

The problem with the data collected in Altenwerder as the basis of the Perception Test is, however, that the first informants did not in all cases use the desired intonation and/or word accentuation. It follows that not the complete set of eight intonation/accentuation variants is available for the supposed overlong stimuli of Aw. Instead of a number of 72, only 70 items are accessible. The missing intonation contours are the -foc.+fin.decl. position of /riiːz/ 'giant-Sg.', and -foc.-fin.decl. position of 'giant-Sg.'. It turned out later that the corpus for the Perception Test had to be restricted to the focused context anyway, abolishing the problem. The recordings were not only used in the fieldwork version of the Perception Test, but also in the on-line version.

The additional speech data, i.e. the declarative 20 sentences plus 84 isolated items, was collected from the Altenwerder speakers III.6.Aw (5th of November 2007), III.7.Aw (9th of November), III.5.Aw and II.5.Aw (14th of November). This Production Task appeared to be the most difficult for informant III.7.Aw since some of the indicated words were unknown to him and in some cases he reanalyzed word forms with an additional final schwa.

[58] Note that /ˀblɔit/ may nowadays be confused with the Standard German adjective *blöd* 'silly, dumb'.
[59] The main problem with textualizing the desired LG sentences was that there is no normative LG orthography. Only some non obligatory guidelines exist (see the spelling systems brought forward by Saß 1956, the Loccumer Richtlinien from 1977, or the updated version by Kahl & Thies 2002).

The complete Aw. recordings provided a total of 466 tokens for the acoustic and statistic analysis.

3.1.2.3 Alfstedt recordings

The third and final collection of LG speech recordings comes from the village of Alfstedt. The first data was recorded with informant I.1.As on the 6th of October 2007 in a quiet room in the house of a befriended family in Holm-Seppensen. Only the rather limited amount of data needed for the manipulations and the resulting Perception Test was recorded. Differently from the informants before, he had already been presented with a Standard German word list containing the relevant stimuli and had been given the assignment to translate the items into Alfstedt Low German two weeks prior to the recordings. He was familiar with the tokens at the time of the recording session and fully informed regarding the aim of the recordings. The recording session took 20 minutes in total with no signs of exhaustion of the informant.

Supplementary recordings were made with the informants II.1.As and III.1.As on the 17th of November 2007, using the Production Task presented to the Aw. informants before. Both informants exhibited some uncertainties in plural marking, vowel quality, and lexicon (e.g. 'deaf', 'bee', 'already'). One additional informant (II.3.As) was recorded in a quiet room in his house in Alfstedt on the 22nd of December 2007. Furthermore, recordings of four informants (II.6.As, III.5.As, III.6.As, and III.7.As) were carried out in a quiet room of the community hall '*De ole Möhl*' in Alfstedt on the 23rd of December 2007. Three of the informants read a short humorous dialogue contrasting the words *al* 'already', *aal'* 'all' and *all'* 'out of stock'. The first informant (III.5.As) read the whole dialogue. The succeeding two informants (III.6.As and III.7.As) took turns in reading.

567 items in total are available for the acoustic and statistic analysis.

After introducing the informants and the settings for the production task, we can now turn to the description of the perception experiment.

3.1.3. *The Perception Tests*

The aim of the Perception Tests is basically twofold. Firstly and mainly, the task is intended to allow for an investigation of whether the pitch contours or the vowel durations are the crucial cues for the LG listeners. Secondly, also the perceptual range of the tone accents and length degrees is scrutinized. The question is up until what kind of pitch movement and/or vowel duration the listeners perceive the individual prosodemes. To suit these needs, a perception test with a repeated measures design in a two-alternatives forced-choice setting (2AFC) is implemented. Only artificial stimuli were used. The reason is to exclude unwanted and uncontrolled phonetic factors. Thus, only the factors vowel duration and F0 remain for the perception test and the analysis.

What is *not* tested is the perceptibility and functional load of the qualitative difference between *lax* and *tense* vowels. No short vowels are included in the experimental set up. That the qualitative difference occurring between short vowels

on the one hand, and long and supposedly overlong vowels on the other hand is indeed of perceptual relevance has been shown earlier by Weiss (1976) for the northern varieties of Standard High German, and by Kohler & Tödter (1984), Kohler et al. (1986 b, c), and Kohler (2001) for Low German. Weiss (1976) found in his perception study that out of his group of seven northern German informants five speakers relied mainly on qualitative differences between lax and tense vowels, and not on vowel duration (Weiss 1976:159f.). Interestingly, they were exactly those informants that where raised in the region of Hamburg and therefore in an allegedly LG context. The other two informants of the group came from southern Niedersachsen, i.e. a Westphalian or Eastphalian speaking area without apocope and the adjunctive ternary duration contrast. They relied in their judgments primarily on vowel duration short *vs.* long. The findings of Weiss (1976) allude to the assumption that for speakers from the LG (Hamburg) area the lax *vs.* tense contrast may carry functional load. This is indeed what the perception study conducted by Kohler & Tödter (1984), Kohler et al. (1986 b, c), and Kohler (2001) confirmed. The manipulations of the durational boundaries between the length categories (i.e. the shortening of tense vowels, and the lengthening of lax vowels) did not result in problems with respect to the discriminability of the vowels (Kohler 2001:396). The LG informants never identify artificially shortened tense 'short' vowels as originally short lax vowels. This suggests that the quality lax-tense is a more salient phonetic cue than the quantity is (Kohler & Tödter 1984:87f.).

The preparations for the Perception Test proceeded as follows. In order to create the stimuli, manipulations of the initial speech recordings of Aw. and Alfs. were implemented using Praat. The reason for using artificial speech items is to exclude unwanted and uncontrolled phonetic factors. Thus, only vowel duration, vowel quality and F0 remain for the Perception Test and the analysis. The preliminarily analyzed speech data from the Kirchwerder informant I.1. served as a model for the pitch manipulations.[60] To bolster the contrast for the informants in the unfamiliar experimental setting, the durational values and F0 contours were moderately exaggerated. The F0 contour as well as the duration of the vocalic nucleus of a minimal pair was changed using a Praat script.[61] An original expected normal long duration (expected length degree 2, ELD 2) with an early peak (tone accent 1, TA1)[62] was altered to an artificial overlong duration (expected length degree 3, ELD 3) and a late peak (tone accent 2, TA2). Other acoustic factors besides vowel duration and F0 had to be excluded as perceptually relevant factors, which is why also the original stimuli with hypothetical dragging tone (i.e. TA2) and overlong vowel duration (ELD 3) were manipulated in a reversed fashion to artificial TA1 tokens with normally long vowel duration (ELD 2). Two experiments were thus

[60] It turned out only in the course of the analyses given in section 3.2 to 3.4 that just informant III.6.Aw produced a stable contrast in F0 contours. If anything, it was found that the originally assumed contour for TA2 with a late peak and an initially rather level phase would constitute her TA1. The originally assumed TA1 with the early peak would then vice versa constitute her TA2.
[61] See section (D) p. 293ff. in the appendix.
[62] See chapter 0, page 3.

obtained; experiment 1 with original ELD 2 / TA1 items, and experiment 2 with original ELD 3 / TA2 items. The manipulations of each item involved nine steps, i.e. three steps of pitch modification (termed 1, 1.5, 2) combined with three steps of duration modification (termed 1, 1.5, 2). This resulted in 3*3 stimuli; e.g. 'river Main' [^{1}maɪ̯n] [$^{1.5}$maɪ̯n] [^{2}maɪ̯n], [^{1}maɪ̯n] [$^{1.5}$maɪ̯n] [^{2}maɪ̯n], [^{1}maːɪ̯n] [$^{1.5}$maːɪ̯n] [^{2}maːɪ̯n].[63] The duration steps are marked as follows in my transcriptions: VV (diphthong) or Vː (monophthong) denotes the regular long ELD 2 (or duration modification step 1), an additional half-length sign VV˙ (diphthong) or Vː˙ (monophthong) marks the artificial ELD in between ELD 2 and ELD 3 (i.e. duration modification step 1.5), and VVː denotes the overlong ELD 3 (or duration modification step 2).[64]

Some stimuli had to be manipulated manually in addition to the automated procedure in Praat. They either sounded unnatural initially, or some noise needed to be erased from the recording. Those stimuli were the item 'all' of non-final declarative sentence context with original pitch 1 manipulated to pitch 2 (1→2), and original duration 1 manipulated to duration 2 (1→2),[65] the item 'giant-Sg.' of non-final declarative sentence context with pitch 1→2 and duration 1→2, and the item 'Vienna' of final declarative sentence context with pitch 1→2 and duration 1→2.

The lengthening parameter was defined generally as 33% per manipulation step with respect to the original vowel duration (i.e. lengthening step 1.5 is equal to 4/3 of the original duration, lengthening step 2 is equal to 5/3 of the original duration). The shortening parameter was by comparison defined generally as 22% per manipulation step with respect to the original vowel duration (i.e. shortening step 1.5 is equal to 7/9 of the original duration, shortening step 1 is equal to 5/9 of the original duration). The Aw. minimal pair 'house-Nom.Sg.' *vs.* 'house-Dat.Sg.' was manipulated with slightly different settings since the vowel of the original Nom.Sg. recording was rather short and needed to be lengthened by 95% per step. The combinations (a) duration 1 / pitch 1, (b) duration 1.5 / pitch 1.5, and (c) duration 2 / pitch 2 are illustrated for this original ELD 2 form in the graphs of Figure 8 below.

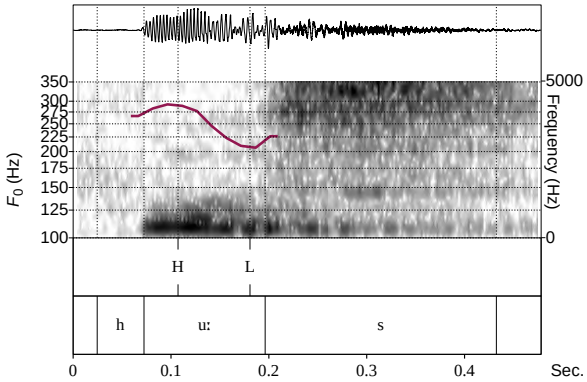
[63] A possible alignment shift of the accent towards a sonorant in the coda (like in *[maɪ̯ˀn]) would have to be studied separately, though.

[64] See FN 4 for the transcription convention employed in this thesis. The notation of duration modification step 1.5 as Vː˙ is preferred here above a notation VV in order to distinguish this artificial length degree from diphthongal transcriptions.

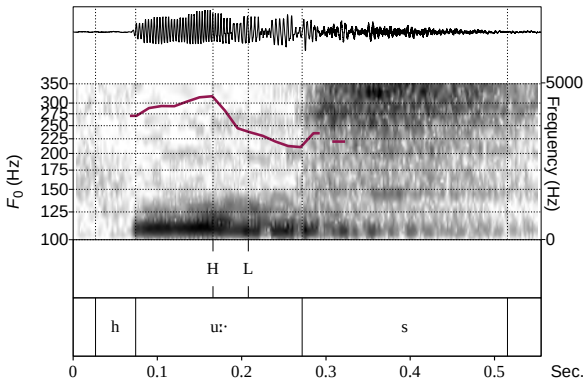
[65] I.e. an item with original ELD 2 was changed into an item with artificial ELD 3.

Figure 8. Manipulations of the original ELD 2 stimulus ‘house-Nom.Sg.’

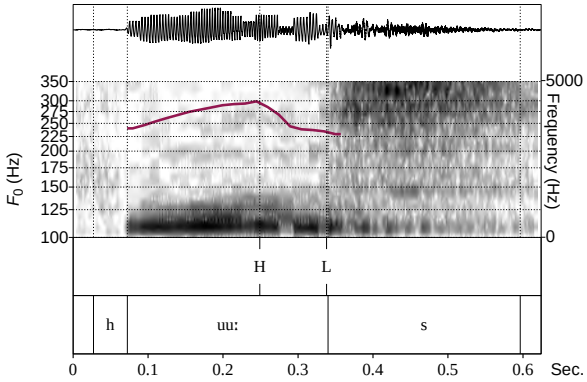
(a) Long duration / early peak



(b) Lengthened duration / middle peak



(c) Overlong duration / late peak



Still, with this rapid increase of vowel duration, some Aw. informants argued during the Perception Test that the vowel would need to be even longer in order to get a

proper Dative form. Thus, for the On-line Perception Test the stimulus 'house-Nom.Sg.' was lengthened by 133% per step (i.e. the factors are 7/3 and 11/3). For experiment 2, the vowel of the original ELD 3 form 'house-Dat.Sg.' was lengthened vice versa to 110% of its original duration in order to get a similar duration as for the 11/3 'house-Nom.Sg.' manipulation of experiment 1. Then, the new 110% duration step 2 form of 'house-Dat.Sg.' was shortened rapidly (i.e. instead of 22% per step rather 33% per step) to create duration step 1.5 and duration step 1 for experiment 2. Additionally, the initial [h] of the 'house-Dat.'-recording had to be changed since it exhibited too much noise and was perceived either as a fricative [f] or a strongly aspirated plosive [t^h] in the pilot test.

The manipulations result in a total of 216 items for experiment 1 and 210 items for experiment 2 (i.e. the nine manipulations per item multiplied with the available set of recorded interrogative and declarative contexts of ELD 2 and ELD 3 words), respectively. This number of items is far too much for a listening task; the more since one needs to repeat each item at least three times in randomized order if a statistically relevant result is sought. The result would be 648 stimuli for experiment 1 and 630 stimuli for experiment 2. Thus, some of the items need to be excluded from the experiment. Restricting the items to the focused declarative forms, and excluding some of the minimal pairs yields 117 items (i.e. 351 stimuli) for the first version of the Pilot test. This number is ultimately further reduced to 81 items (i.e. 243 stimuli)[66] per experiment. By doing so, a timeframe of approximately 35 minutes is achieved for the performance of the Perception Test.

My Perception Test now proceeded as follows. Prior to the experiment, the participants received a note containing general information on the project and the test procedure. The Perception Test was presented to them afterwards on the 13.3" screen of a laptop (Apple MacBook) with the Multiple Forced Choice-experiment tool (MFC) of Praat. An optical mouse was connected to deliver the choices. The experimental set-up was such that the subjects had to listen to certain manipulated randomized speech items (minimal pairs, each item repeated three times in random order) and judge them with respect to their meaning. The experiment had a two-alternative forced-choice (2AFC) setting, i.e. two possible options of word meanings were provided and the participants had to choose one in order to continue with the experiment. If an informant was not familiar with computers and/or the use of a mouse, the interviewer entered the choice indicated by the informant. The actual test was preceded by a short training period of five sentences. The experiment for Altenwerder contained exclusively recordings from this dialect, and the experiment for Alfstedt accordingly only recordings from the Alfstedt variety. This method accounted for the inter-dialectal variation in vowel quality, and ensured that the resulting artificial stimuli appear as more natural to the informants. The tokens were incorporated into a neutral carrier sentence as used for the production task (i.e. 'He says ...' , and 'He has ... said.'). The spoken material was textualized in LG on the screen. If the informant needed to listen to an item again she could repeat it at any

[66] The number of stimuli is calculated as follows: nine items per minimal pair multiplied with nine out of the 11 minimal pairs of the focused declarative intonational contour and multiplied with three repetitions.

time and as often as she wished (250 times at most). The next item followed after choosing for one of the two meaning options, and verifying it by pressing an ok-button. After a certain number of judgments, a break was offered so as not to exhaust the participant too quickly.

3.1.3.1 The pilot test

The method of the planned fieldwork was revisited in a pilot test. This aimed at constructing as economical a test as possible. The evaluation of the pilot test pointed out in what respects the methodology needed to be modified to optimize the actual Perception Task. The test at this point contained besides the forced choices for the stimuli also goodness-of-fit choices, i.e. judgments whether the item was pronounced *well*, *ok* or *poorly*.

The first test person, informant PT1, conducted the experiment in his quiet study, on the 4th of August 2007. He was presented with the larger collection of 351 stimuli in total, stemming from 7 minimal pairs. The experiment took 65 minutes with the first signs of exhaustion appearing after 50 minutes. All in all, it was half an hour too long, which was only doable because the informant had a particularly high level of motivation (a relative of the interviewer). The subject distinguished only once in the very beginning between good and bad for a stimulus. He categorized every stimulus as "good" during the rest of the experiment. It therefore appeared unnecessary to include these categorical judgments into the actual perception experiment.

No overt pattern for choosing the words was identifiable. The stimuli 'straight' *vs*. 'degree' and 'to mow' *vs*. 'river Main' were rather problematic for the subject. This was to a great amount due to the loudness of the loudspeakers. After two blocks of stimuli, the subject was handed headphones, which solved the problem. The number of replays and the time used for the judgment of the stimuli decreased also decidedly afterwards. Were the first two blocks of 54 stimuli took 30 minutes, the remaining 243 stimuli took 35 minutes. The informant complained several times that the decisions were rather difficult to make since the sentence context was not item-specific. Also, he would prefer a direct comparison between two items. All in all, the judgments seemed to be easier and faster for the longest and shortest of the stimuli. The subject claimed that the crucial criterion of the contrast is indeed vowel duration.

The second test person, informant PT2, was presented with an already shortened version of the experiment (i.e. experiment 1). It contained a test phase of five stimuli and the experiment with 243 stimuli in total. This second version of the pilot test was performed on the 20th of August 2007. The stimuli were original ELD 2-words, which were manipulated towards ELD 3-words. The goodness categories were left out of this version, which led to the occurrence of several errors by too fast responses. The informant double-clicked on the buttons instead of clicking only once, which was counted as two delivered judgments. The insertion of an OK-button provided an adequate solution to prevent this experiment-inherent problem. An additional improvement was that each subject was provided with an individual ample timeframe for playing the next tokens. Informant PT2 commented on the

'house-Nom.Sg.' *vs.* 'house-Dat.Sg.' stimuli as being poorly pronounced and hard to perceive. The test took 35 minutes in total.

The third test person, PT3, conducted the Pilot test on the 12th of October 2007. She was also presented with the shortened version (in this case experiment 2) of a test phase with five test-stimuli and the experiment with 243 stimuli. The OK-button had been installed which is why no technically induced errors occurred. However, the informant complained massively throughout the whole test session that she would not perceive a difference between the given stimuli, and, even stronger, that in LG in general no differences between any of the given minimal pairs would exist.

The overall result of the Pilot test is such that the test informants PT1 and PT2 judged in the overwhelming majority of cases according to the duration of the stimulus. Informant PT3 produced no cohesive results, as was already expectable from her statements.

3.1.3.2 Perception Test of Altenwerder

The first part of the actual Perception Task containing five test stimuli and 243 experiment stimuli was conducted on the 24th of September 2007 in the house of an Aw. informant in Sieversen. Five speakers of Altenwerder LG attended the test. Three subjects did the first version of "TA1"-words towards "TA2"-words (Experiment II.), two subjects did the second version of "TA2"-words towards "TA1"-words (Experiment III.).

A second and third test session was conducted on the 11th of October 2007 with two and three native Altenwerder informants, respectively. Both sessions took place in a quiet room at the home of one of the informants. In four more experiment sessions, five additional informants were tested in a quiet room in their respective houses. The fourth to seventh session were held from November 2007 to December 2007.

One informant was excluded from the actual analysis (III.2.Aw) due to deficient data. Some more details of the individual experiment sessions are given in the appendix (D).

3.1.3.3 Perception Test of Alfstedt

Both versions of the Perception Task (Experiment II. And Experiment III.) were used in the first test series in Alfstedt on the 17th of November 2007. Two informants joined this first test. A second test series was conducted on the 22nd and 23rd of December 2007. 12 informants joined the test.

Due to the fact that three of the informants of the initial two sessions need to be excluded from the analysis, a third test series was carried out in Alfstedt. It took place on the 21st and 22nd of June 2008 in the community hall. Eight subjects participated at this occasion.

A total of four informants were ultimately excluded from the statistical analysis due to deficiencies in their data (namely II.10.As, III.3.As, III.6.As, III.9.As).

3.1.3.4 On-line Perception Test

An introductory page explaining the procedure and roughly the goals of the experiment preceded the on-line version of the perception test. It was followed by an anonymized questionnaire for the participant to collect the statistical corner stones.

The set up for on-line experiments generally needs to be shorter than the one for face-to-face experiments in order to keep people from quitting the experiment before it has ended. Thus, for the on-line version the two original experiments of Altenwerder are split up into four shorter experiments of approximately 15 minutes duration (i.e. four item sets: 1. final original TA1/long items; 2. non-final original TA1/long items; 3. final original TA2/overlong items; 4. non-final original TA2/overlong items) in a design with a single between-subjects factor (namely the item set).[67] There is no intermixture of final and non-final stimuli or original TA1/long items and original TA2/overlong items in one experiment. No repetitions of the single stimuli occur (instead of the three repetitions employed in the face-to-face test), bearing in mind the relatively short attention span of on-line participants. Besides the shorter duration of the experiments, some differences in the layout are implemented (pictures are added to the textualization, and the colors are different from the original Perception Test). The participant is randomly assigned one test with the option to voluntarily conduct any or all of the three remaining tests. However, not every participant may be presented with the same set of stimuli. The reason is that not every experiment contains the same number of items,[68] and some informants may conduct only one experiment while others may do more than one experiment.[69] This experimental setup results in a need for a greater number of informants in order to get statistically relevant data. To effectively reach a greater public, on-line user-groups of Low German speakers were invited to join the experiment. 31 informants ultimately participated in the test.

Now that we are familiar with the empirical basis, the participants and the test procedures of the study, we will have a closer look at the production data. The individual descriptions and analyses of the Perception Tests follow thereafter.

3.2. *Kirchwerder: production data and acoustic analysis*

The first impression of the Kw. dialect data is that a possible pitch-related distinction is only barely audible. A preliminary phonetic analysis of the recordings from Kirchwerder informant I.1 was conducted, being limited to two minimal pairs. Such

[67] The two within-subjects factors are the artificial pitch contours of the given stimuli (three levels), and the artificial vowel duration (three levels).

[68] The stimuli for the on-line test are identical to the stimuli used in the face-to-face experiment. The items ‘house-Nom.non-final’ and ‘house-Dat.non-final’ are excluded from both setups because of the poor quality of the respective recordings. The result is a different number of stimuli in the individual on-line experiments. Experiments 1 and 3 that contain the items in final sentence context have 46 stimuli; experiments 2 and 4 that contain the items in non-final sentence context have 37 stimuli.

[69] This could lead to the conclusion that a repeated-measures design is needed here. However, only two informants actually took more than one test, one of these being excluded from the analysis due to his age. In order not to complicate the design too much it was therefore decided to treat the one remaining case as belonging to two informants, allowing for a between-subjects test.

a restriction appeared to be defensible, since the overall auditory impression was basically the same for the complete set of her recordings.[70]

The minimal pairs surveyed below ('house-Nom.Sg.' *vs.* 'house-Dat.Sg.', and 'courage-Sg.' *vs.* 'fashion-Sg.') are both recorded under main focus, in final sentence position, and in declarative sentence-context. The second component of each minimal pair was exposed to apocope or syncope at a certain stage of its diachronic development whereas the first component of the pair was not. All four forms contain a lenis coda consonant in the phonological surface form. The overt form supposedly differs from this representation. While the first member of a given pair is assumed to shows a *fortis* coda consonant, the second member of a pair is assumed to show a *lenis* consonant.[71] This terminology is chosen above 'voiced' *vs.* 'voiceless' because of the usual lack of vocal fold vibration in the so-called 'voiced' plosives in Low German (Haritz 2006).

The recordings were manually segmented in Praat, relying mainly on formant structure, spectrogram, and auditory cues. F0 maxima and minima were determined using the pitch tool ('Move cursor to minimum / maximum pitch' in the editing window). These methods are generally employed for the segmentation of the speech data within this survey.

When we look at the graphs of informant I.1.Kw in Figure 9 (a) to (d), it becomes evident that the tokens without diachronic schwa loss (i.e. (a) and (c)) differ quite obviously from those with diachronic schwa loss (i.e. (b) and (d)). Where 'house-Nom.Sg.' and 'courage-Sg.' show a vowel or diphthong with simple long duration (179 ms, and 261 ms, respectively), 'house-Dat.Sg.' and 'fashion-Sg.' feature a vowel or diphthong with an expanded duration (343 ms, and 344 ms, respectively). In addition to these durational differences, the pitch contours also vary. The graphs (a) and (c) exhibit an overall HL contour. Both, 'house-Nom.Sg.' and 'courage-Sg.' show a rise in the pitch contour that starts in the onset C, even before the transition to the syllable nucleus. The lack of vocal fold vibration in the initial [h] of 'house-Nom.Sg.' causes a slightly later start (and thus a slightly later peak) as compared to the sonorous [m] of 'courage-Sg.'. Overall, the pitch-peak is particularly early aligned on the vocalic segment in (a) and (c) (i.e. after 26.27% and 3.83% of the nucleus, respectively). Table 6 contains a summary of the according data. The F0 maximum lies in the case of 'house-Nom.Sg.' at 229 Hz, and in the case of 'courage-Sg.' somewhat higher at 254 Hz. The peak is in both instances followed by a gentle fall with a succeeding level / slightly rising contour towards the end.

[70] See the LG 176 sentences mentioned in 3.1.2 and given in (B) in the appendix.

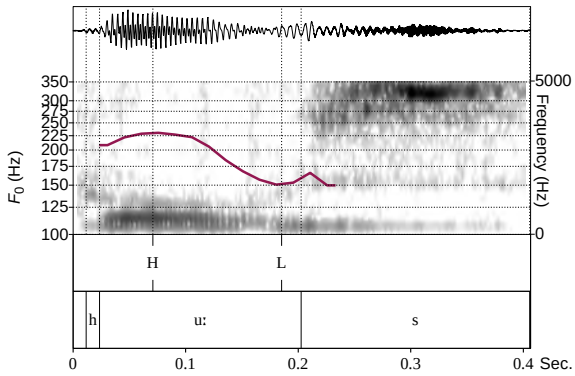
[71] This categorization is validated by speaker judgments. Aw. and Alfs. informants referred to the lenis codas as being 'somewhat different' from the fortis codas. It is not immediately determinable what exactly this difference is. Lenis Cs were variously characterized as being longer or shorter than the fortis correspondent. Detailed scrutiny is definitely in order, though the present study cannot provide one by lack of suitable speech material. A theoretical discussion of fortis *vs.* lenis is given in chapter 6. It will be argued there that LG has a laryngeally unspecified lenis series. The lack of a laryngeal node yields the phonetic variability of lenis Cs, allowing for passive voicing in sonorous context, and for voicelessness in voiceless and word-final context. The traditionally assumed process of final devoicing is made obsolete by this approach (see for example Iverson & Salmons 2003; Jessen & Ringen 2002).

Table 6. Informant I.1.Kw's durations of 'house-Nom.Sg.', 'house-Dat.Sg.', 'courage-Sg.', and 'fashion-Sg.' [72]

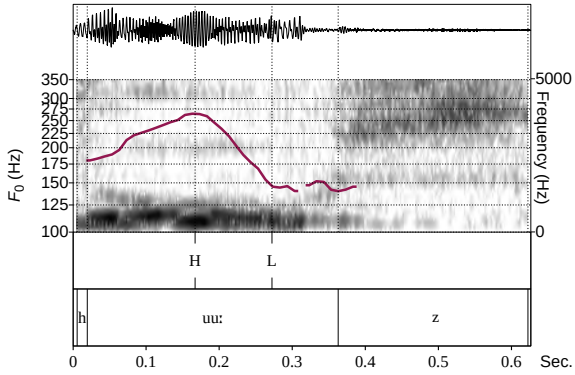
	word pairs, I.1.Kw	V dur.	F0 peak	% of nucleus
(a)	'house-Nom.Sg.' [huːs]	179 ms	47 ms	26.27%
(b)	'house-Dat.Sg.' [huuːz]	343 ms	148 ms	43.15%
(c)	'courage-Sg.' [mɛot]	261 ms	10 ms	3.83%
(d)	'fashion-Sg.' [mɛoːd]	344 ms	114 ms	33.14%

Figure 9. I.1.Kw's long / TA1 *vs.* overlong / TA2 vowels and diphthongs

(a) 'house-Nom.Sg.' [huːs]

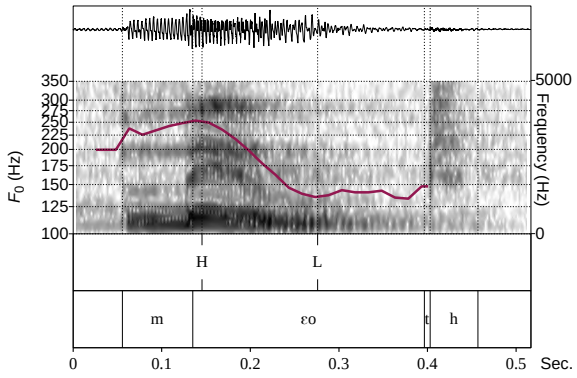


(b) 'house-Dat.Sg.' [huuːz]

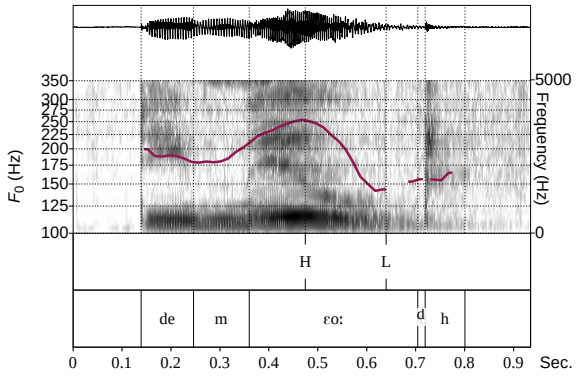


[72] Note that the realization of the lenis coda fricative varies in LG between [z̥] and completely devoiced [s]. The same variability is found also in the other fricatives and in the lenis coda plosives, the latter ones being *unaspirated*. Fortis Cs are invariably produced as voiceless *aspirated*. This indicates the presence of a contrast aspirated *vs*. unaspirated – if not a contrast of voiced *vs*. voiceless.

(c) ‘courage-Sg.’
[mɛot]



(d) ‘fashion-Sg.’
[mɛoːd]



The items ‘house-Dat.Sg.’ and ‘fashion-Sg.’ in the graphs (b) and (d) display a similar HL contour. The rise in the F0 contour equally starts in the onset consonant (again somewhat later in [h] as compared to [m]) but extends in these cases clearly into the succeeding nucleus. As a result, the F0 peak occurs here later on the nucleus (i.e. after 43.15% in ‘house-Dat.Sg.’, and after 33.14% in ‘fashion-Sg.’). The maximum is reached here at 263 Hz for ‘house-Dat.Sg.’, and at 254 Hz for ‘fashion-Sg.’. It is followed by a more pronounced fall of the pitch contour and again a level / slightly rising section. The decrease in the F0 of (b) and (d) is roughly 1.5 times as strong as in (a) and (c).[73]

The two word pairs are definitely minimally contrastive. What is unclear up to now is whether the distinction relies on the vowel duration, or rather on the varying pitch peak alignment. The subsequent sections broach this issue from a phonetic perspective. I firstly investigate the durational values, and then move on to the F0 contours found for the Kw. data set. All further calculations are based on the

[73] F0 decrease: ‘house-Nom.Sg.’ 77.37 Hz *vs.* ‘house-Dat.Sg.’ 112.7 Hz; ‘courage-Sg.’ 114.45 Hz *vs.* ‘fashion-Sg.’ 177.24 Hz.

logarithmic duration values (log10 ms) in order to account for the perceptual distances.[74]

Note that the sample was designed primarily to investigate the vocalic nuclei rather than qualitative distinctions in the codas – a position usually assumed to neutralize voicing distinctions by means of final devoicing. The recordings thus show a lack of diversity with respect to consonant qualities. Furthermore, the data contain too much noise to explicitly measure the assumed acoustic correlates of the overt fortis *vs.* lenis distinction: closure duration, aspiration duration, and voicing during closure. Some preliminary measurements were possible, though. They were executed on a specifically compiled sample with a total of 47 non-minimal items ending in fortis plosives (i.e. 36 tokens) or lenis plosives (i.e. 11 tokens). They are listed in Table 54 of part (E) of the appendix. The items contain either long vowels / TA1 (i.e. 32 * fortis), or overlong vowels / TA2 (i.e. 11 * lenis, 4 * fortis). An independent samples t-test yielded that the two categories of fortis – lenis plosives in the current sample are produced with no significant difference in closure duration (t = 1.368, df = 45, p (2-tailed) = .178). The closure duration of the coda lenis Cs is minimally 7.42% shorter and maximally 49.7% longer than the one of the coda fortis Cs (i.e. the C.I. 95% of the difference lies at 0.9258 to 1.497). The mean duration ratio is 1.1773. The aspiration duration shows an equally non-significant difference between the two groups of plosives (t = .527, df = 45, p (2-tailed) = .601).[75] The aspiration phase is – rather unsurprisingly – found to be generally shorter for the lenis plosives as compared to the fortis plosives of the sample (i.e. it amounts on average up to a mean ratio of 0.884 of the fortis C aspiration; 95% C.I. of the difference from 0.552 to 1.4158). Cues for vocal fold vibration, be it auditory or detectable from the spectrograms, were found for neither fortis nor lenis plosives. More detailed research would, however, be in order.

3.2.1. *Kw. V durations*

For this part of the analysis, univariate ANOVAs with a post hoc test (Bonferroni) and paired samples t-tests were performed on the production data of both Kw. informants with SPSS 16.0. Each ANOVA presented in this thesis is accompanied by a test on the normal distribution of the data by means of Q-Q-plots. The overall result is that the data is normally distributed.

The independent variables were defined as expected length degrees of the vowel duration (*ELD*, three levels), the nature of the coda consonant (*coda C*, two levels), sentence position (*finality*, two levels), and vowel height (*jaw opening*, five levels)[76]. The category ELD is composed of the vowel length degrees short (ELD 1), long (ELD 2), and overlong (ELD 3) as they are to be expected by means of the scientific literature.[77] A list of the factors and the corresponding levels occurs in Table 7. The

[74] Where vowel durations are mentioned, they are calculated back by taking $10^{\log \text{duration}}$.
[75] The aspiration phase is here inclusive of the burst of the plosive.
[76] Three monophthongal and two diphthongal levels.
[77] I.e. ELD 1 = MLG short V (without OSL), ELD 2 = MLG long V without CL (including also long V after OSL), ELD 3 = MLG long and lengthened V with CL.

corresponding mean vowel durations of the Kw. data are given in Table 8 and Figure 10.

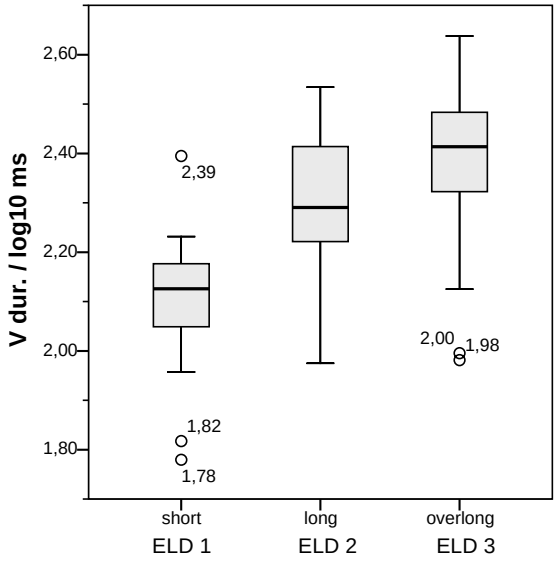
Table 7. Independent variables for the Kw. analysis

factor (fixed)	level
ELD	ELD 1 (short V) ELD 2 (long V) ELD 3 (overlong V)
coda C	obstruent sonorant
finality	non-final final
jaw opening	closed V mid V open V mid-closed diphthong open-closed diphthong

Table 8. Kw. LG vowel durations / ms per ELD

ELD	Mean / ms	Std. Deviation	N
ELD 1	133.041	39.588	21
ELD 2	211.601	62.084	98
ELD 3	257.023	66.913	82

Figure 10. Kw. vowel durations / ms per ELD



The data unambiguously shows that a durational difference exists between each and every of the expected vowel length degrees of the two Kw. informants. Short and long vowels differ on average by 78.56 ms; long vowels and supposedly overlong vowels differ on average by 45.96 ms. We reach a ratio of 1: 1.59 : 1.93 for the mean duration values of ELD 1 through ELD 3. The difference between the short (lax) vowels of ELD 1 and the long (tense) vowels of ELD 2 is undisputed and commonly accepted. What needs further investigation is the possible difference between the long (tense) vowels of ELD 2 and the overlong (tense) vowels of ELD 3. The ANOVA that was conducted on the 180 unpaired items of these two length degrees reports, however, rather skewed results with respect to the influence of the four factors. The ELD (two levels) is found to have no statistically significant effect on the vowel durations (F (1,147) = 2.470, p = .118). The same is valid for the quality of the coda C (F (1,147) = 1.136 p = .288). The two remaining factors *jaw opening* and *finality* are both significant with p < .001 (F (4,147) = 5.676) and p = .013 (F (1,147) = 6.350) respectively.[78] This high level of dependence of the vowel duration on the vowel height and the sentence position of the stimulus is not what we would expect. Additionally, the differing numbers of cells for ELD 2-items and ELD 3-items the ANOVA is based upon (i.e. the lower number of ELD 3 tokens as compared to ELD 2 tokens) can be deemed problematic.

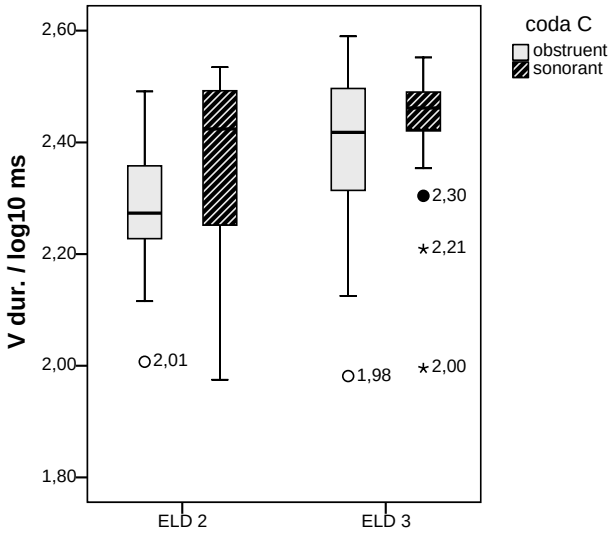
It is therefore necessary to execute a much more sensitive test on the data: a paired samples t-test. In order to calculate the test I reduce the sample to the minimal pairs only (39 paired items, see Table 55 in the appendix).[79] The comparison of the vowel durations of the ELD 2 items with the according ELD 3 items reveals a highly significant difference between the two categories (t = 3.540, df = 38, p (2-tailed) = .001). The mean ELD 2 : ELD 3 ratio is again reported as 1.18.[80] We can now tentatively say that at least the two speakers interviewed for Kw. produce a durational difference for the minimal pairs; i.e. at least some Kw. informants appear to have a lexical distinction by means of vowel duration.

The subsequently performed univariate ANOVA (dependent variable: V dur. difference between ELD 3 and ELD 2) contains three fixed factors (*coda C*, *jaw opening*, and *finality*). We find that none of them reaches statistical significance with respect to the durational difference between ELD 2 and ELD 3. The p-value concerning the quality of the coda consonant (i.e. obstruent *vs.* sonorant) is improved to p = .090 (F (1,26) = 3.098), the sentence position of the item (i.e. non-final *vs.* final) gives p = .731 (F (1,26) = .121), and the jaw opening reaches p = .649

[78] See Table 56 of the appendix.
[79] Minimally different words that were produced by one informant in identical sentence context were paired together (in one case a near minimal pair was chosen: [vi:t] ‘wide’ *vs.* [vii:s] ‘wise’). If one item was produced more than once but failed to have more than one minimally different counterpart, the average was calculated and then paired with the corresponding token. In the event that more than one instance of a minimal pair was available for an informant, the minimally different items were paired according to their chronological occurrence in the recordings (i.e. early during the interview, later in the in the interview etc.). These methods were employed for the reduction of all LG samples.
[80] The C.I. 95% of the difference lies at 1.073 (≈ 7.3%) to 1.294 (≈ 29.4%).

(*F* (4,26) = .624).[81] While the vowel height (i.e. the factor *jaw opening*) has usually an influence on the vowel duration, the duration *difference* is not touched. We would therefore already expect this factor to have no significant influence on the ELD 2 : ELD 3 difference. None of the correlations between the factors turn out to be significant, although *finality*coda C* almost reaches significance level with *p* = .068 (F (1,26) = 3.635). It seems that only *coda C* and the combination of the factors *finality*coda C* have an actual effect on the vowel durations difference. And indeed, if the list of factors is reduced by *jaw opening*, the results of *coda C* (*F* (1, 35) = 5.416, *p* = .025) and *finality*coda C* (*F* 1,35) = 5.416, *p* = .026) increase. The change in the result for *finality* is by comparison irrelevant (*F* (1,35) = .436, *p* = .513). In order to see what these results mean, the logarithmic vowel durations in dependence of the three factors are illustrated in the charts in Figure 11 to Figure 13.

Figure 11. Kw. mean vowel durations depending on the coda C and split up by ELD



[81] See Table 58 of the appendix. The result for *coda C* is improved to being highly significant if the ANOVA contains only this factor (*F* (1,37) = 8.880, *p* = .005). A t-test against zero performed on the duration difference in dependence of *coda C* verifies the outcome of this second ANOVA (*t* = 2.980 , *df* = 37, *p* (2-tailed) = .005).

Figure 12. Kw. mean vowel durations depending on vowel height and split up by ELD

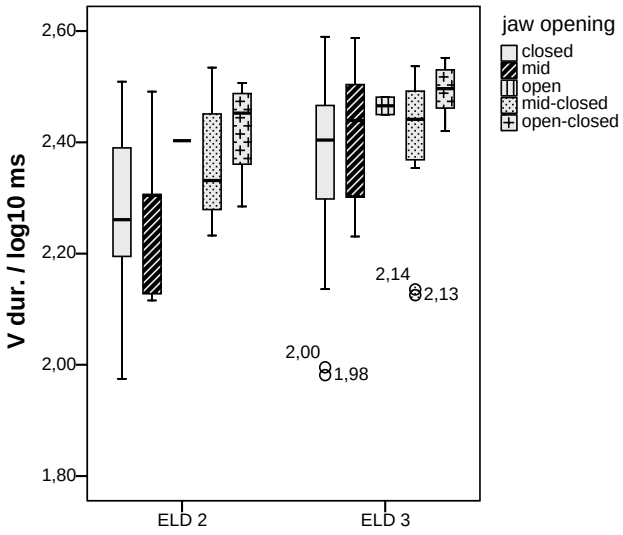
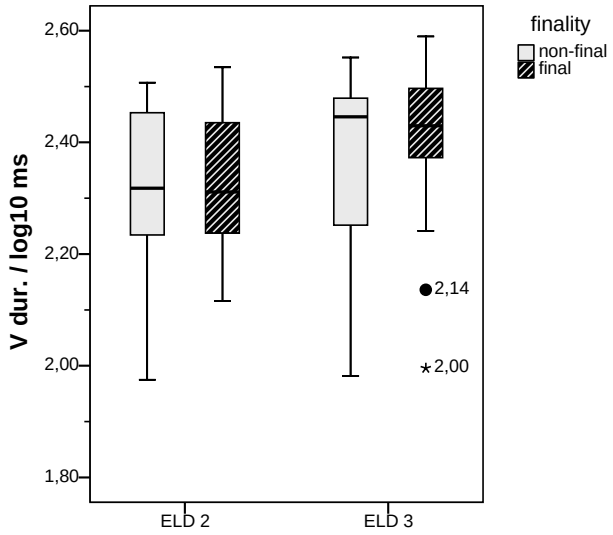


Figure 13. Kw. mean vowel durations depending on sentence position and split up by ELD



The obstruent codas and sonorant codas shown in the box plot of Figure 11 appear to have a differing influence on the duration of the preceding vowel. This is also what we would expect given the calculated influence of *coda C* on the vowel durations. While the durational difference in pre-obstruent context is more or less distinct, the

pre-sonorant context does not result in a similarly clear-cut contrast between ELD 2 and ELD 3.[82] Looking at the obstruent and sonorant cases of the Kw. minimal pairs separately, we obtain a rather different result as in the first t-test. The difference in logarithmic vowel duration between ELD 2 and ELD 3 of pre-obstruent vowels is *p* (2-tailed) < .001 (*t* = 4.349, *df* = 22), while the pre-sonorant context yields no significant difference with *p* (2-tailed) = .798 (*t* = .261, *df* = 15). We find for the pre-obstruent context that ELD 3 vowels are on average 30.88% longer than their ELD 2 counterparts (C.I. 95% of the difference from 1.151 to 1.488; ELD 2 mean duration 189.04 ms, ELD 3 mean duration 247.41 ms). A rather different duration ratio is detectable for the pre-sonorant context. The difference is here close to zero with 1.35% (C.I. 95% of the difference from 0.908 to 1.131; ELD 2 mean duration 252.22 ms, ELD 3 mean duration 255.62 ms). This result is especially interesting because the upper boundary of the pre-sonorant difference does not reach the lower boundary of the pre-obstruent difference. This basically means that for the items with sonorant coda Cs of the Kw. sample no well defined difference between long vowels and overlong vowels can be established. The data strongly suggest that only the items with pre-obstruent vowels show a meaningful difference. In effect, it is rather questionable whether it is still justified to assume overlength for a pre-sonorant V with this rather minuscule difference of 1.35% – especially if we consider the so-called JND (just noticeable difference; also referred to as *Weber fraction*, or *difference limens*).[83] Rosner & Pickering (1994:194) state for this perceptual threshold that a

> "conservative view of all results on duration discrimination is that listeners exposed to real speech can reliably discriminate vowel durations that differ by a factor of 0.2 to 0.25. This value exceeds the Weber fraction for non speech stimuli such as pure tones or noise."

This means that the JND in *natural speec*h lies somewhere around 20 to 25% duration difference.[84] This goal is met by the 30.88% duration difference obtained for the pre-obstruent vowels.

It could be assumed, however, that the coda sonorant receives the overlong status of the ELD 3 vowel, compensating for the 'missing' overlength on the vowel. This is not what we find in the minimal pair data of Kw. Rather, it is the ELD 2 coda R that shows a mean duration that is by 1.1315 longer than the ELD 3 coda R (i.e. 195.652 ms *vs.* 172.909 ms, respectively). The durational difference of the logarithmic sonorant values does not reach significance level (*t* = 1.608, *df* = 15, *p* (2-tailed) = .129)[85]. The according values are given in Table 57 in the appendix. It becomes evident that the final sonorants are not produced longer in order to

[82] This effect of the sonorant Cs was already mentioned by Feyer (1941) and Tödter (1982) in the surveys on the dialects of Baden and Fintel, respectively.
[83] Another possibility is that the sonorous coda C contributes to the length degree as assumed e.g. by Bremer (1929:2), von Essen (1958:111), or Höder (2003). This is, however, not corroborated by the whole of Kw. data. We actually find a longer mean duration of the coda sonorant after an ELD 2 vowel (200.26 ms) as compared to post-ELD 3 vowel (192.92 ms).
[84] Note that Remijsen & Gilley (2008) assume for the JND values of between 7 and 20% that where found for *artificial* sounds and noise.
[85] C.I. 95% of the difference from 0.9605 to 1.333.

compensate for lacking overlength in the preceding vowels. The results indicate that the Kw. minimal pairs ending in a VR sequence do not receive phonetic overlength. Only the instances with obstruent codas exhibit a clear-cut durational difference between ELD 2 and ELD 3.

We move on to Figure 12 and consider now the factor *jaw opening*. What we find is that only the durational difference in the mid vowels reaches significance level (t = 3.608, df = 6, p (2-tailed) = .011)[86]. This is exactly what was assumed in the literature (Kohler 2001). Also, we would expect this very restricted difference by means of the non-significant result for the factor *jaw opening*. We have to note, however, that the number of items with an open vowel is rather under-represented in the sample (only one minimal pair). The result is therefore not entirely conclusive.

Two intriguing details are visible in the third graph in Figure 13 concerning the sentence position of the stimuli. The first is that neither of the two length degrees shows a clear influence of the sentence position on the vowel durations within the single ELDs. The factor *finality* has here no significant effect on non-final and final items. The according significance value of ELD 2 is p = .225 (F (1,26) = 1.547), and for ELD 3 we find p = .177 (F (1,26) = 1.947). This outcome is already pointed out by the lack of relevance of this factor as found above. It is also visible in the mean vowel durations of 214.75 ms (non-final context) *vs.* 211.559 ms (final context) in ELD 2, and 231.953 ms (non-final) *vs.* 263.258 ms (final) in ELD 3. The mean ratios of the final items as compared to the non-final items are, thus, 0.9851 for ELD 2 (C.I. 95% from 0.8063 to 1.2037), and 1.135 for ELD 3 (C.I. 95% from 0.9164 to 1.4057). Interestingly, we see that the non-final sentence position exceeds durationally the final sentence position in ELD 2. The commonly known Gemanic process of utterance-final lengthening seems not to apply here. The independent samples t-test performed on the individual ELDs reports no significant durational difference between the sentence contexts (ELD 2: t = .151, df = 37, p (2-tailed) = .880; ELD 3: t = 1.199, df = 37, p (2-tailed) = .238), though. The second detail that is also visible in the graph is that the durational contrast between ELD 2 and ELD 3 is maintained only in the final sentence contexts. No statistically significant difference is detected by the paired samples t-test for the non-final items (t = 1.695, df = 14, p (2-tailed) = .112; C.I. 95% from 0.9797 to 1.1908). The final items do, however, result in a highly significant difference (t = 3.205, df = 23, p (2-tailed) = .004; C.I. 95% from 1.0806 to 1.433).

With regards to the interaction effects of *finality*coda C* we now obtain the following results.

[86] C.I. 95% of the difference from 1.114 to 1.754.

Table 9. Duration ratios and confidence intervals of ELD 3 *vs.* ELD 2, depending on the sentence position and the coda consonant

*finality*coda C*	ELD 3-ELD 2 ratio	C.I. 95.0%
fin., obstruent	1.404	1.217 - 1.621
nfin., obstruent	1.081	0.857 - 1.363
fin., sonorant	0.922	0.718 - 1.184
nfin., sonorant	1.111	0.898 - 1.375

The table points out that only the vowel durations of the items ending in an obstruent coda effectively differ in relation to the sentence position. We find a more pronounced difference in vowel duration between ELD 2 and ELD 3 in the final sentence position (i.e. 40.4%). This can be assumed to be clearly perceivable with respect to the JND. The non-final context does not yield a meaningful difference (i.e. 8.1%). This result is also suggested by a post hoc test (Bonferroni) performed on the data with the combined factor *finality*coda C*.[87] Only the duration difference between final and non-final pre-obstruent vowels is reported as being significant (*p* (2-tailed) = .006; C.I. 95% of the difference from 1.0944 to 2.0517). These findings readily explain the significant effect of the correlated factors *finality*coda C*. The pre-sonorant vowels are left virtually untouched by the sentence context. It is quite obvious that no stable contrast occurs in the investigated Kw. minimal pairs. It is only detectable in the pre-obstruent vowels. Pre-sonorant vowels appear to be resistant with respect to lengthening processes and exhibit no significant durational difference between ELD 2 and ELD 3 of either sentence context.

Thus, what we have shown so far is that the vowel durations of ELD 2 and ELD 3 for the minimal pairs of the Kw. informants are distinct only in pre-obstruent position of the final sentence context, and at least for the mid vowels. Sonorant codas do not compensate for the lack of phonetic overlength in the preceding nucleus.

3.2.2. *Kw. F0 differences*

Kohler (2001) postulates that the long vowels and the so-called overlong vowels of LG are basically identical with respect to duration and pitch movement. An intriguing issue is that preliminary studies of the dialects of Aw. and Kirchwerder (Höder 2003; Prehn 2007) indicated that the minimal pairs under investigation differed with respect to their F0-contours, though.[88] This is why the following analysis focuses on the F0 contours of the ELD 2 vowels and the ELD 3 vowels or diphthongs.

A Praat script was executed on the complete Kw. corpus of 180 tokens (i.e. of ELD 2, and ELD 3). It firstly determined the F0 peak within the segmented nucleus (absolute and relative locus of the maximum, and F0 value). Secondly, it measured the F0 in semitones (re 100 Hz) at 15 relative points within the segmented nucleus.

[87] I calculated a new variable in SPSS by taking 10**finality+coda C* resulting in four levels of the factor *finality*coda C*: fin. obstruent, non-fin. obstruent, fin. sonorant, and non-fin. sonorant.
[88] See also Olthoff (2005:47ff.) for a tonal description of the dialect of Leer in Ostfriesland.

The pitch values of three ELD 2 items were excluded due to the occurrence of creaky voice and the corresponding deficiencies in the F0 contours of the respective recordings. This resulted in the availability of 38 items for ELD 2 and 39 items for ELD 3 after the reduction of the data to minimal pairs only. The measurements were pooled over the sentence position and the quality of the coda consonant. The mean values for the 15 F0 points were calculated. These data, together with the already obtained mean vowel duration values, were then used to compute mean pitch contours in Praat for a number of contexts.

The contours of the preliminary measurements I have given in the beginning of section 3.2 are characterized by a difference in H alignment depending on the affiliation to of the item to a length category, i.e. an early aligned F0 peak in ELD 2 cases and a late aligned F0 peak in ELD 3 cases. This difference is, however, not reflected in the compilation of the minimal pairs of the Kw. informants. The paired samples t-test run on the F0 data (available for 38 paired items) shows no significant difference with respect to the pitch peak alignment in ELD 2 and ELD 3 items (t = .007, df = 37, p (2-tailed) = .995; C.I. 95% from 0.9085 to 1.0921). The mean pitch peak occurs after 30.55% of the vowel duration in ELD 2, and after 30.58% of the vowel duration in ELD 3. The univariate ANOVA gives an according result.[89] Three factors are again included in the calculation: *coda C* (two levels), *jaw opening* (five levels), and *finality* (two levels). None of them is even close to reaching significance level – not even *finality*. It is reported as having a non-significant influence on the peak locations with p = .562 (F (1,25) = .345). The respective values are summarized in Table 57 and Table 59 in the appendix.

We would expect the factor *finality* to have an effect on the alignment of the H. It is generally found that a low boundary tone (L_i) occurs at the right edge of an utterance in declarative sentence intonations such as the ones scrutinized in the present analysis. This possibly leads to an earlier occurrence of the peak on the vowel in items in final sentence context as compared to non-final items. The latter cases are not immediately influenced by the L_i because it is produced at a greater distance from the non-final token. The situation is sketched in Figure 14.

Figure 14. Final *vs.* non-final sentence position of an intonational unit in declarative intonation.

(a)	**H * L$_i$**	(b)	**H L$_i$**
	{*Hee seggt Ries.*}		{*Hee het Ries seggt.*}
	‘He says giant.’		‘He has giant said.’

The Kw. sample lives only partly up to the expectations. The final *vs.* non-final tokens of the ELD 2 vowels differ with respect to the pitch peak location above chance level (F (1,24) = 5.631, p = .026). The respective Hs occur on average after 41.42% of the vowels (non-final), and after 21.3% of the vowel (final). The F0 peaks of the overlong vowels of ELD 3 show no such effect (F (1,25) = 2.311, p = .141) although the peak locations also differ. The non-final context yields here a

[89] See Table 59 in the appendix.

mean peak after 36.12% of the vowel, the final context after 27.96% of the vowel. These more or less light differences in alignment are also reflected in the mean F0 contours as calculated from the complete Kw. data set.

Figure 15. Kw. mean F0 contours ELD 2, non-final *vs.* final sentence position

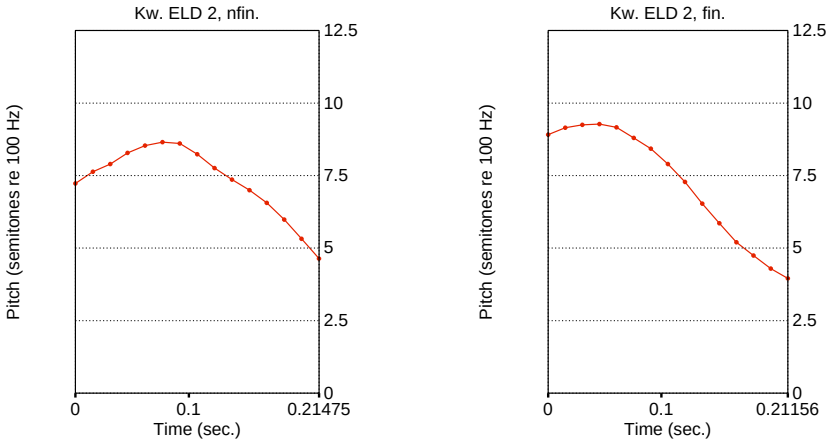
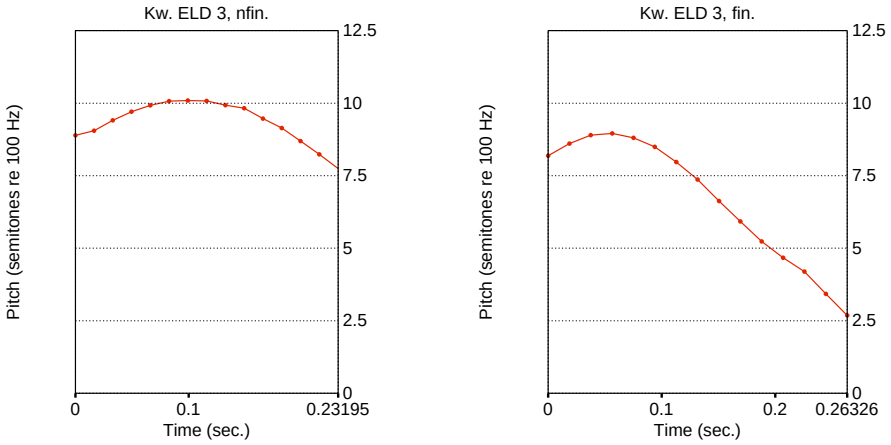


Figure 16. Kw. mean F0 contours ELD 3, non-final *vs.* final sentence position



The ELD 2 contours for the non-final and the final sentence context are given in Figure 15, the respective ELD 3 contours in Figure 16. The F0 values are calculated as logarithmic units in semitones with the reference point of 100 Hz in order to

allow for a comparison of the curves, and to prevent a result biased by gender.[90]

Overall, the two ELD 2 curves in Figure 15 as calculated from the Kw. data differ mainly in the beginning of the vowel. The non-final contour has a lower starting point (7.23 semitones) as compared to the final contour (8.91 semitones). The maximum of the non-final ELD 2 contour is reached at 8.65 semitones. Its pitch decreases succeedingly by 4.02 semitones towards the end of the averaged vowel. The fall in final sentence position is slightly more pronounced (5.3 semitones) while the F0 peak is located at 9.25 semitones.

The mean contour of the utterance-final ELD 3 nucleus in Figure 16 shows only very little difference with respect to its ELD 2 counterpart. It starts at 8.19 semitones, rises gently to 8.96 semitones, and drops distinctly by 6.28 semitones towards the end. The slope is basically identical to the utterance-final ELD 2 curve, differing only in the space available for the fall. If we consider the non-final mean ELD 3 item, we see that it is the odd one out among the set of particularly similar mean pitch contours. It starts at 8.89 semitones, and has its maximum at 10.086 semitones. The fall is less steep as compared to either of the other three contours, with a total decrease of only 2.34 semitones.[91] Yet, no crucial differences in H alignment or the overall falling contour are observable. The earlier findings (Prehn 2007) that a difference in the H alignment on the long *vs.* overlong vowels exists in Kw. cannot be maintained after analyzing the more comprehensive set of data. The upcoming section will now determine whether the finding for Kw. that the most prominent difference lies in the vowel durations is repeated for the Aw. data.

3.3. *Altenwerder: production data and acoustic analysis*

176 intonationally varying sentences and isolated words were recorded for the dialect of Altenwerder. Seven informants with an age range from 44 to 89 years produced the utterances. All of them are native speakers of Altenwerder LG (Aw.). The subjects had lived in Altenwerder until their relocation in the 1970s.

The Aw. sample consists of 466 tokens in total, with 276 items in final sentence position, and 190 items in non-final sentence position. It was found already during the conduction of the recordings that informant III.6.Aw made the difference between the individual vowel length degrees particularly clear by means of exaggerating the durations (*motherese*). She produced a rather huge number of outlier values as compared to the bulk of the Aw. sample. The mean vowel durations of the three expected length degrees (ELD) are given in Table 10, dissected by the main part of Aw. informants (group 1) as compared to III.6.Aw's values (group 2).

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[90] The F0 levels may differ rather strongly for women and men. Rosner & Pickering (1994:216) note that the "average ratios of female-to-male and child-to-male *F0* are 1.687 and 2.000, respectively." Relating the data to a reference point makes homogenized (gender-independent) calculations and comparisons of F0 peaks and F0 ranges possible (Hewlett & Mackenzie Beck 2006:124f.).

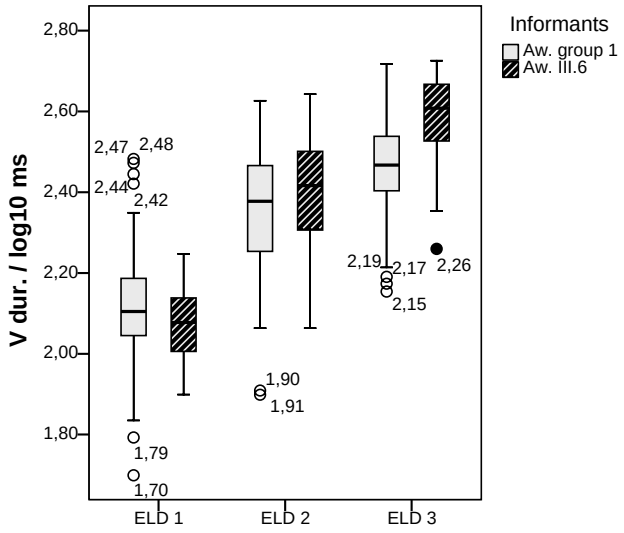
[91] This deviant pitch contour leads then to a highly significant difference between non-final and final mean F0 points in an independent samples t-test (t = 2.996, df = 58, p (2-tailed) = .004; C.I. 95% 0.4552 to 2.2878 semitones). The test is performed on the calculated mean F0 points of the final and non-final ELD 2 and ELD 3 items (i.e. 15 F0 values per context).

Table 10. Aw. LG vowel durations / ms per ELD and dissected by informant group

ELD	Informants	Mean / ms	Std. Deviation	N
ELD 1	Aw. group 1	136.771	50.533	69
	Aw. III.6	119.442	22.690	48
	Total	129.662	42.176	117
ELD 2	Aw. group 1	238.299	70.410	122
	Aw. III.6	258.701	80.458	42
	Total	243.524	73.405	164
ELD 3	Aw. group 1	298.221	72.625	136
	Aw. III.6	395.568	82.537	49
	Total	324.004	86.615	185

Informant III.6.Aw exhibits vowel duration values that differ broadly from the remainder of the Aw. speakers for each of the three expected length degrees. The difference in the means of ELD 1 is -17.33 ms (≈ -12.67%), which means that informant III.6.Aw produces the short vowels on average slightly shorter than the remainder of Aw. informants. The right hand bars of the chart in Figure 17 demonstrate this distribution.

Figure 17. Aw. LG mean vowel durations / ms per informant groups and split up by ELD



The means of ELD 2 differ between the two groups by 20.4 ms (≈ 8.56%) and thus a little less than in the ELD 1 case. This is illustrated in the middle bar chart. Both

groups show a very similar upper boundary, and a slightly higher lower boundary for III.6.Aw as well as a higher mean vowel duration for III.6.Aw. The difference between the means of the last length degree ELD 3 of both informant sets is particularly clear with an additional 97.35 ms (≈ 32.64%) for informant III.6.Aw. It is evident that the vowel durations of ELD 3 produced by III.6.Aw lie well above the values of the remainder of Aw. informants, exceeding the JND threshold.

We can establish a ratio of 1 : 1.74 : 2.18 for the vowel length degrees ELD 1 : ELD 2 : ELD 3 on the basis of the identified mean vowel durations of group 1. The data of informant III.6.Aw reaches a durational ratio of the mean vowel durations of rather extreme 1 : 2.17 : 3.31. This lies well above the ratios established for both, Kw. (see above 1: 1.59 : 1.93) and group 1 of Aw. This clear-cut contrasts in vowel duration across the ELDs for the main part of Aw. participants as compared to informant III.6.Aw makes it necessary to keep the two groups apart in the analysis. I will therefore treat both sets separately in the following sections.

Just like for the Kw. sample, it needs mentioning that the recordings for Aw. focus mainly on the analysis of the vocalic nuclei. The problems for an analysis of the coda Cs are therefore the same as in the previous corpus. Preliminary measurements were performed on the surface fortis and lenis coda plosives of 91 unpaired Aw. items compiled in an own sample (see Table 60 in the appendix). The stimuli belong to ELD 2 (i.e. 7 lenis tokens, 45 fortis tokens) or ELD 3 (i.e. 39 lenis tokens). The independent samples t-test indicates that the informants produce a highly significant difference in closure duration for fortis and lenis plosives (t = 5.480, df = 89, p (2-tailed) < .001). The fortis coda plosives have a mean closure duration of 27.015 ms whereas the lenis coda plosives exhibit a mean closure duration of 50.606 ms. This relates to a ratio for fortis : lenis of 1.873 (C.I. 95% 1.492 to 2.352), i.e. 87.3%. The opposite distribution is valid for the aspiration duration (including the burst of the plosives). Again, a highly significant difference between fortis and lenis is obtained (t = 2.761, df = 89, p (2-tailed) = .007). The aspiration phase of the fortis plosives reaches a mean duration of 155.955 ms while for the lenis plosives it lies at 131.462 ms. The resulting ratio of lenis : fortis is 1.186 (C.I. 95% 1.049 to 1.341), i.e. 18.6%. Thus, the measurements for Aw. suggest that the fortis plosives have a shorter closure duration paired with a longer aspiration phase, while the lenis plosives are characterized by a longer closure duration paired with a shorter aspiration phase. With respect to voicing during closure, no hints on vocal fold vibration in lenis Cs were discernible. This indicates if anything an aspiration opposition in the obstruents rather than a voicing opposition. These results are, of course, not conclusive. Further research needs to be conducted to unambiguously resolve the issue.

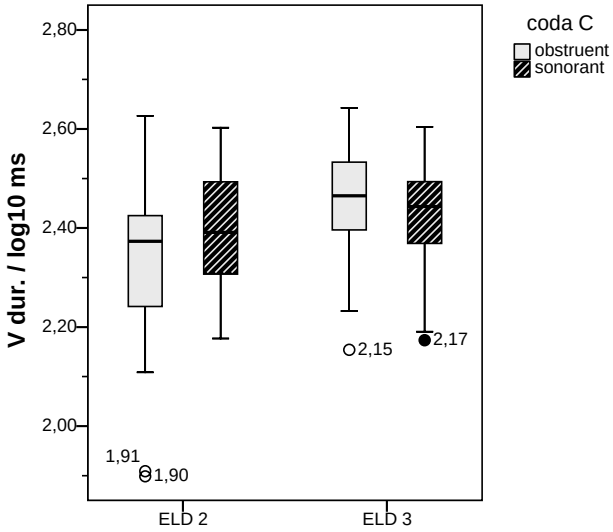
3.3.1. *Aw. V durations, group 1*

The original corpus of the main part of Aw. informants containing 327 items is reduced to 78 minimal pairs in order to perform the t-test and prevent skewed results due to empty cells as first obtained for the Kw. data. The mean vowel durations of the expected length degrees ELD 2 and ELD 3 are 239.81 ms and 308.04 ms

respectively (ratio 1.2475 ≈ 24.75%).[92] The paired samples t-test discloses that the difference between both length categories lies not only above the JND but also well above chance level with *p* (2-tailed) < .001 (*t* = -7.309, *df* = 77). The according values are summarized in Table 62 of the appendix. We find that the Aw. informants produce a distinct durational difference between the long vowels and supposed overlong vowels of the given minimal pairs. It is therefore likely that they employ this difference to distinguish between the items of the two categories.

We now perform a univariate ANOVA on the Aw. group 1 minimal pairs. The three fixed factors are again *coda C* (two levels), *jaw opening* (six levels), and *finality* (two levels). We find that *coda C* (*F* (1,60) = 6.125, *p* = .016) and *jaw opening* (*F* (5,60) = 2.834, *p* = .023) both have a statistically significant effect on the vowel durations. The position of the stimulus in the utterance has, by comparison, no significant influence on the vowel duration (*F* (1,60) = .435, *p* = .512). None of the correlations reach significance level at 5%. The interaction effect of *jaw opening*coda C* misses this goal only barely (*F* (2,60) = 2.974, *p* = .059). It seems, thus, that *jaw opening*, *coda C* and the combination of both factors have an influence on the vowel duration differences of Aw. group 1. If the list of factors is reduced by *finality*, the results for *coda C* (*F* (1, 69) = 7.714, *p* = .007), *jaw opening* (*F* (5,69) = 2.972, *p* = .017), and *jaw opening*coda C* (*F* 2,69) = 3.424, *p* = .038) increase particularly clearly. The quality of the coda consonant (i.e. obstruent or sonorant C) stays the most important factor, though. The corresponding box plots follow below.

Figure 18. Aw. group 1 mean vowel durations depending on the coda C and split up by ELD



[92] C.I. 95% 1.1746 to 1.325.

Figure 19. Aw. group 1 mean vowel durations depending on the vowel height and split up by ELD

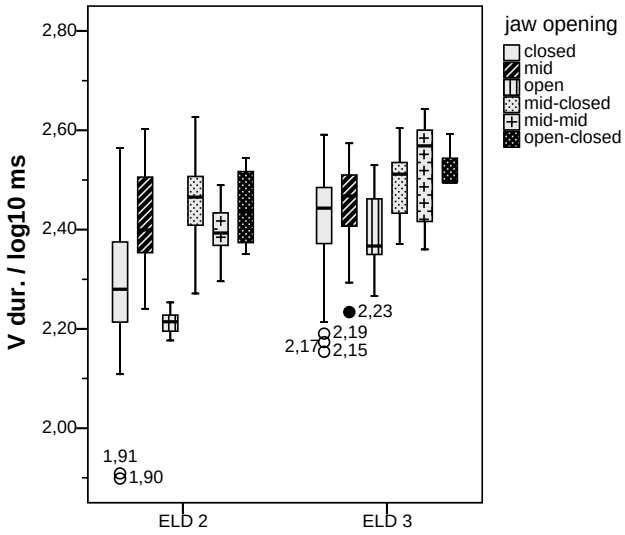
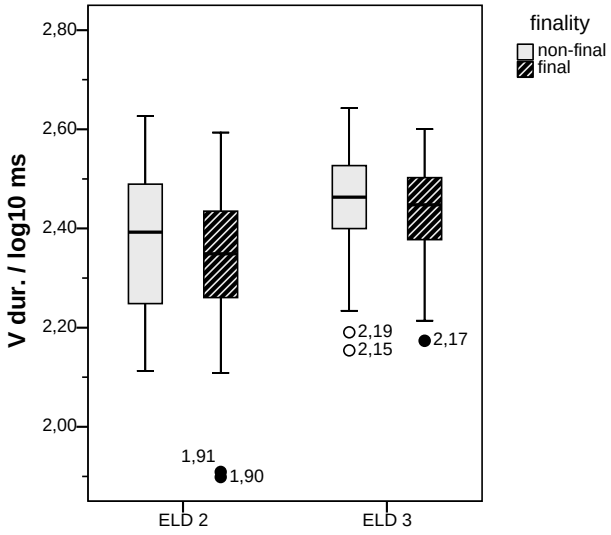


Figure 20. Aw. group 1 mean vowel durations depending on the sentence position and split up by ELD



The graph in Figure 18 seems to reflect basically the same behavior that the Kw. coda Cs exhibit. The mean durations are 218.27 ms and 285.43 ms for the pre-obstruent vowels of ELD 2 and ELD 3 respectively. The according mean durations

of the pre-sonorant vowels are 230.94 ms as opposed to 268.23 ms. We see that the durational difference between ELD 2 and ELD 3 is in the pre-obstruent vowels rather distinct (i.e. by 1.3076 ≈ 30.76%), whereas the pre-sonorant vowel durations differ less for both length degrees (i.e. by 1.1616 ≈ 16.16%).[93] The paired samples t-test shows that the difference in vowel duration between ELD 2 and ELD 3 of pre-obstruent vowels is *p* (2-tailed) < .001 (*t* = 6.609, *df* = 46), while the difference for the pre-sonorant context is *p* (2-tailed) < .001 (*t* = 3.529, *df* = 30). The upper boundary of the pre-sonorant vowel ratio does in the case of Aw. group 1 only slightly exceed the lower boundary of the pre-obstruent vowels. This suggests that vowels preceding a sonorant C do not differ as much between ELD 2 and ELD 3 as the vowels preceding an obstruent. The merger of ELD 2 and ELD 3 for the pre-sonorant vowels found for the Kw. minimal pairs does not occur. But: Although the difference between ELD 2 and ELD 3 pre-sonorant vowels is established as being highly significant, we cannot assume right away that it is at the same time perceptually relevant because it does not quite reach the JND threshold. This perceptual goal is met by the pre-obstruent vowels – and not only by the mean, but also by the lower and upper boundaries (i.e. the C.I.) recovered from the data.

The sonorant coda as the location of the overlength in ELD 3 – or a duration-enhancing element – can be excluded for the Aw. group 1 minimal pairs. The t-test evinces that no significant durational difference exists between ELD 2 and ELD 3 coda Rs (*t* =.004 , *df* = 30, *p* (2-tailed) = .997). This is also visible in the duration values we find for ELD 2 (102.136428 ms) and for ELD 3 (102.136543 ms). They relate to a ratio of 1 (C.I. 95% from 0.872 to 1.148). The sonorant codas receive virtually identical mean durations for the two length categories.

Moving on to Figure 19 and the factor *jaw opening* we obtain a mixed picture with respect to the durational differences. The vowel duration ratios for the overlong degree as compared to the long degree are given in the following table.

Table 11. Mean duration ratios and confidence intervals of Aw. group 1 vocalic nuclei

jaw opening	ELD 3-ELD 2 ratio	C.I. 95.0%
closed	1.323	1.197 - 1.461
mid	1.183	0.966 - 1.448
open	1.497	1.078 - 2.077
mid-closed	1.084	0.988 - 1.189
mid-mid	1.263	0.991 - 1.609
open-closed	1.365	1.180 - 1.578

The closed and open vowels both differ significantly for ELD 2 and ELD 3 (i.e. *t* = 5.710, *df* = 32, *p* (2-tailed) < .001, and *t* = 3.411, *df* = 4, *p* (2-tailed) = .027, respectively) while the difference in the mid vowels of the Aw. group 1 minimal pairs do not reach significance level (*t* = 1.874, *df* = 9, *p* (2-tailed) = .094). The

[93] C.I. 95% for pre-obstruent vowels is 1.205 to 1.419, and for pre-sonorant vowels 1.065 to 1.267.

sample size for the open vowels is, however, particularly small what results in a rather broad confidence interval. The outcome is therefore in this case not entirely conclusive. Overall, the findings obtained for Aw. group 1 monophthongs are the reverse of what we found for the Kw. monophthong data. The diphthongs involving mid vowels show also no significant difference for the long degree and the supposed overlong degree. The mid-closed diphthongs like [ɛi] yield p = .084 (t = 1.831, df = 18), and the mid-mid diphthongs like [ɛo] yield p (2-tailed) = .057 (t = 2.275 , df = 7). The open-closed diphthongs like [ɑi] and [ɑʊ] are by comparison rather distinct for ELD 2 and ELD 3 though the sample size is again very small. They show a significant difference of p (2-tailed) = .012 (t = 9.207, df = 2). The general picture is such, that three out of six contexts differ not a statistically significant level. However, even in these cases a trend is discernible that goes in the direction of a contrast between ELD 2 and ELD 3 items in the minimal pairs of the Aw. group 1 informants.

With regards to the interaction effects of *jaw opening*coda C* we now obtain the following results.

Table 12. Duration ratios of ELD 3 *vs.* ELD 2, depending on the vowel height and the coda consonant

	*jaw opening*coda C*	ELD 3-ELD 2 ratio	C.I. 95.0%
monophthongs	closed, obstruent	1.475	1.330 - 1.635
	closed, sonorant	1.093	0.954 - 1.253
	mid, obstruent	1.309	1.095 - 1.564
	mid, sonorant	0.934	0.711 - 1.227
	open, obstruent	-	
	open, sonorant	1.496	1.212 - 1.848
diphthongs	mid-closed, obstruent	1.066	0.924 - 1.229
	mid-closed, sonorant	1.11	0.939 - 1.312
	mid-mid, obstruent	1.263	1.069 - 1.492
	mid-mid, sonorant	-	
	open-closed, obstruent	-	
	open-closed, sonorant	1.365	1.039 - 1.792

It is evident from the overview that the durations of the items with closed vowels and mid vowels, and ending in an obstruent coda differ particularly clearly form the corresponding sonorant final items. While the former show an ELD 2-ELD 3 difference of 47.5% and 30.9%, the latter do not differ above the JND threshold. The open vowels show a diverging distribution. The pre-sonorant vowel receives here on average a 49.6% longer duration in ELD 3 as compared to ELD 2. A reference value in the obstruent category is lacking. The diphthong data varies with respect to the duration differences of the two length categories. The mid-closed diphthongs like [ɛi] show generally no perceptually relevant duration difference between ELD 2 and ELD 3. The level mid diphthongs like [ɛo] occur in the sample only in pre-obstruent

context. They show a possibly relevant difference of 26.3%. The open-closed vowels such as [ɑi] are represented in the sample only in pre-sonorant position. The result goes basically in the same direction as in the open monophthongs. We find a difference of 36.5% that plainly exceeds the JND. The overall result is that the pre-sonorant nuclei differ to a smaller degree than the pre-obstruent vowels.[94] Only the mid-closed diphthong quality was identified to not show a relevant durational difference between ELD 2 and ELD 3 in either of the coda contexts. This finding is the reason why the factor *jaw opening* turns out significant in the ANOVAs. If the mid-closed diphthong quality is excluded from the scrutiny, the influence of the jaw opening does not reach significance level in the three factorial ANOVA (i.e. the test including the factors *coda C*, *finality*, and *jaw opening*). The p-value decreases to $p = .085$ (F (4,45) = 2.153), and only *coda C* turns out to have a highly significant effect on the vowel duration contrast (F (1,45) = 8.748, $p = .005$). Also, the interaction effect of *jaw opening*coda C* loses its significance by far (F (1,45) = .014, $p = .907$). We may therefore assume that it is in fact only the factor *coda C* (i.e. the quality of the coda consonant) that has a meaningful influence on the vowel duration of the preceding nucleus in the Aw. group 1 data.

The last box plot of Figure 20 illustrates the vowel durations of ELD 2 and ELD 3 in non-final and final sentence position. The result of the Aw. group 1 minimal pairs is similar to what we found for the Kw. data. Neither of the two length degrees shows longer durations in utterance-final position. Instead, the final items are on average slightly shorter as compared to the non-final items (i.e. ELD 2 220.907 ms *vs.* 226.950 ms, C.I. 95% from 0.8559 to 1.107; ELD 3 275.329 ms *vs.* 283.552 ms, C.I. 95% from 0.8791 to 1.0725). The differences turn out not significant in an independent samples t-test (ELD 2: $t = .418$, $df = 76$, p (2-tailed) = .677; ELD 3: $t = .590$, $df = 76$, p (2-tailed) = .557). This is also expressed by the fact that the factor *finality* does not reach statistical significance within the individual ELDs. The according p-value for ELD 2 is $p = .883$ (F (1,60) = .022), and for ELD 3 $p = .529$ (F (1,60) = .400). Final items as produced by the Aw. informants are not durationally enhanced. Another result we obtain is that the general contrast between ELD 2 and ELD 3 is maintained in the two sentence contexts just like in the Kw. cases. We find that the non-final items differ across both length degrees at a highly significant level ($t = 4.319$, $df = 29$, p (2-tailed) < 001; C.I. 95% from 1.1244 to 1.3883). The same goes for the utterance-final items ($t = 5.859$, $df = 47$, p (2-tailed) < .001; C.I. 95% from 1.1556 to 1.3443). This is different from the Kw. recordings

[94] The cases where open vowels are involved seem to be exceptions, though. In fact, the respective minimal pairs (i.e. [ɑ:l] 'already' *vs.* [ɑɑ:l] 'all', and [mɑin] 'river Main' *vs.* [mɑi:n] 'to mow') appear to be somewhat problematic. The monophthong pair was produced rather as an ELD 1 – ELD 3 contrast by informant II.5.Aw, increasing of course the mean difference present in the whole sample. If her data is excluded, the durational difference in the open vowels does not reach significance level any more ($t = 2.578$, $df = 3$, p (2-tailed) = .082). The pair [mɑin] 'river Main' *vs.* [mɑi:n] 'to mow' is a different matter – at least if the influence of the coda C on the duration difference in the nuclei is to be tested. The ELD 3 item is here actually of the syncopated type, i.e. it is not the coda sonorant that interacted with a deleted schwa. This means that in this case there is no reason why the sonorant C should have an influence on the length degree of the nucleus.

where we found a trend to neutralize the ELD 2 - ELD 3 contrast in non-final position.

The data of group 1 of the Aw. informants makes clear that the durations of ELD 2 vowels and ELD 3 vowels are kept distinct in almost all contexts. The pre-obstruent vowels are here the most likely to reach and exceed the perceptual threshold of the JND. The mid-closed diphthongs are an exception. They show a merger between both length degrees. The most relevant and stable factor influencing the vowel duration difference of the Aw. group 1 items turned out to be *coda C*.

3.3.2. *Aw. V durations, informant III.6.Aw*

It is now time to test the data collection of the Aw. informant III.6 for vowel durations. The corpus contains 139 tokens in total that are reduced to 26 minimal pairs for the t-test (they are to be found also in Table 61 in the appendix). The mean vowel durations found in the complete (unpaired) sample of informant III.6.Aw are for ELD 2 of 258.7 ms, and for ELD 3 395.57 ms. This corresponds to an ELD 2-ELD 3 ratio of 1.53, i.e. 52.91%.

If we consider only the paired items, we obtain an even more impressive duration ratio between ELD 2 (mean duration 233.024 ms) and ELD 3 (mean duration 400.498 ms). It becomes now 1.7189, i.e. 71.89% durational divergence of ELD 3 from ELD 2 (C.I. 95% 1.4507 to 2.0366). This difference is established as highly significant by a paired samples t-test (t = 6.577, df = 25, p (2-tailed) < .001). The corresponding values are given in Table 65 of the appendix.

In a next step, the three factorial univariate ANOVA is performed. *Coda C* (two levels), *jaw opening* (five levels), and *finality* (two levels) constitute again the independent variables. We find that none of these have a significant effect on the vowel durations of the long-overlong minimal pairs of informant III.6.Aw. The factor *coda C* is the best among the worst and reaches p = .290 (F (1,13) = 1.218). *Jaw opening* yields p = .907 (F (4,13) = .245), and *finality* results in p = .670 (F (1,13) = .190). None of the correlated factors achieves results above chance level. If anything, the correlation of all three factors *jaw opening*finality*coda C* may have some influence (F (1,13) = 1.145, p = .304). The corresponding box plots follow in Figure 21 to Figure 23 below.

Figure 21. Informant III.6.Aw's mean vowel durations depending on the coda C and split up by ELD

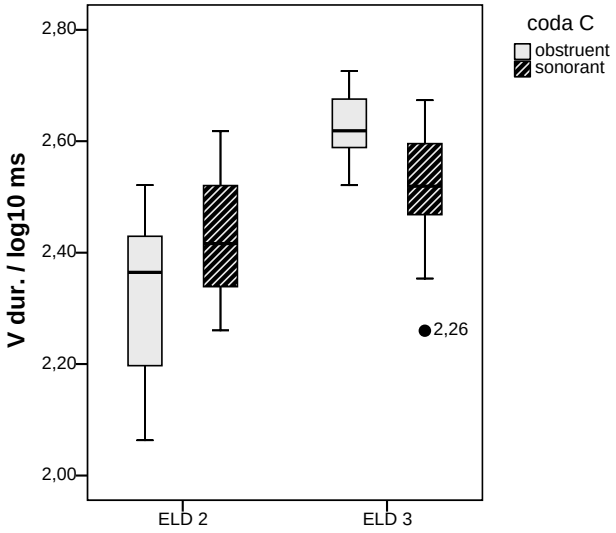


Figure 22. Informant III.6.Aw's mean vowel durations depending on vowel height and split up by ELD

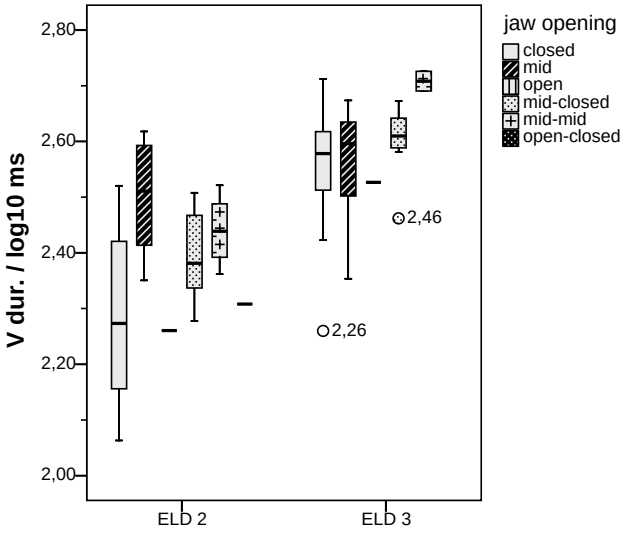
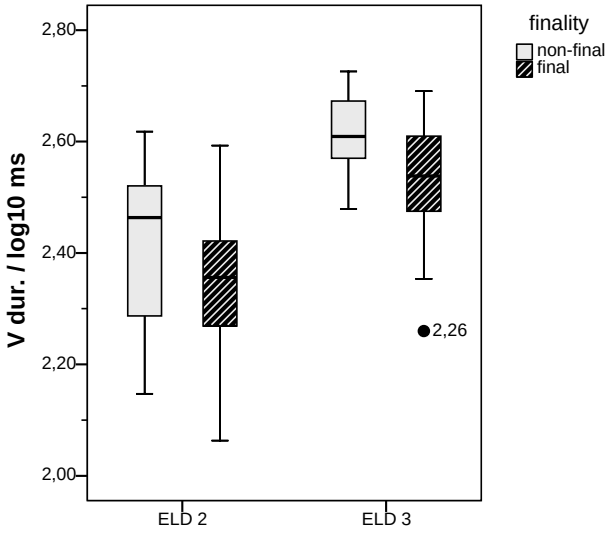


Figure 23. Informant III.6.Aw's mean vowel durations depending on sentence position and split up by ELD



The box plot in Figure 21 depicts the vowel durations in the two coda contexts obstruent C and sonorant C for the minimal pairs. It is evident that the durations of the pre-obstruent vowels differ rather strongly from the pre-sonorant vowels. We find a durational difference between ELD 2 (205.589 ms) and ELD 3 (432.016 ms) in pre-obstruent vowels of remarkable 110.17% (i.e. a mean ratio of 2.1017, C.I. 95% 1.7098 to 2.5835). This difference is highly significant with p (2-tailed) < .001 (t = 7.672, df = 15). The pre-sonorant vocalic nuclei differ to a somewhat lesser extent by 24.6% (i.e. a mean ratio of 1.246, C.I. 95% 1.0568 to 1.4691; mean duration ELD 2 284.774 ms, ELD 3 354.8134 ms) what results in a significant outcome in a paired samples t-test (t = 3.020, df = 9, p (2-tailed) = .014). This means that informant III.6.Aw produces for the items with obstruent codas a larger durational difference between ELD 2 and ELD 3 vowels than in the case of the sonorant coda-items. While the sonorant Cs result for ELD 2 in a generally longer vowel duration than the obstruent Cs, the reverse is true for ELD 3. Here we see that the pre-obstruent vowels receive a longer duration than the pre-sonorant vowels. The quality of the coda C therefore seems to have an impact on the duration of the preceding vowel – different from the result we obtained in the first ANOVA. Our intuition is tested in two more ANOVAs performed separately on the ELD 2 and ELD 3 cases. The result we achieve is that the effect of the coda consonant on the vowel duration in ELD 2 is not significant with p = .204 (F (1,13) = 1.790). The outcome for ELD 3 is rather different, though. We find here a highly significant effect of the coda quality on the vowel duration with p = .001 (F (1,13) = 16.379). This results from the notably higher mean duration of the pre-obstruent vowels as compared to the pre-sonorant vowels in ELD 3. A complete merger with respect to the duration does not occur in the pre-sonorant vowels of the minimal pairs. The

vowels of the VR# sequences differ less across the ELDs than the vowels of the VC# sequences.

The final R does not compensate for this smaller difference between ELD 2 and ELD 3 vowels of minimal pairs ending in VR#. The paired samples t-test demonstrates that no significant difference occurs in the durations of the final sonorants of ELD 2 and ELD 3 (t = -.456, df = 9, p (2-tailed) = .659). The durations of the coda Rs are rather similar with only a slight increase in ELD 3 (i.e. 184.461 ms *vs.* 194.038 ms, mean ratio 1.0519)[95].

The next factor under investigation is the *jaw opening*. The graph in Figure 22 shows that the open vowels and the open-closed diphthongs are under-represented in the minimal pair data of informant III.6.Aw. They are therefore excluded from the analysis. If we look at the remaining vocalic nuclei we find that the mid vowels are the only qualities that differ not at a statistically significant level for ELD 2 (mean vowel duration 343.321 ms) and ELD 3 (mean vowel duration 402.069 ms) (t = 2.754, df = 3, p (2-tailed) = .070). The sample size is here very small, allowing not for a definite judgment, though.

Table 13. Mean duration ratios and confidence intervals of III.6.Aw's vocalic nuclei

jaw opening	ELD 3-ELD 2 ratio	C.I. 95.0%
closed	2.073	1.477 - 2.908
mid	1.171	0.976 - 1.405
open	-	-
mid-closed	1.552	1.340 - 1.799
mid-mid	1.660	1.053 - 2.618
open-closed	-	-

The difference between the two length categories is significant for the closed vowels (t = 4.737, df = 11, p (2-tailed) = .001; mean duration ELD 2 189.802 ms, ELD 3 393.369 ms), as well as the mid-closed diphthongs (t = 7.311, df = 6, p (2-tailed) < .000; mean duration ELD 2 253.980 ms, ELD 3 394.276 ms). Again, the sample size inhibits a conclusion for the mid-mid diphthongs that show a marginally significant difference (t = 14.142, df = 1, p (2-tailed) = .045; mean duration ELD 2 307.6097 ms, ELD 3 510.623 ms). The general result for informant III.6.Aw's data is therefore that for none of the four vocalic qualities a difference between the long and overlong degree can be definitely excluded.

Let us now move on to the variable *finality* for the data of informant III.6.Aw. Again, two main points are scrutinized: the matter of utterance-final lengthening within the individual ELDs, and the question whether the durational difference between ELD 2 and ELD 3 persists in the two sentence contexts. The overall result with regards to final lengthening is that the sentence position has no significant influence on the vowel durations. The graph in Figure 23 indicates, however, that at least within the ELD 3 a relevant difference between non-final items (mean duration

[95] C.I. 95% from 0.8186 to 1.3518.

432.534 ms) and final items (mean duration 348.947 ms) exists. The ratio between the two sentence contexts final *vs.* non-final amounts to 0.8612 (C.I. 95% from 0.7392 to 1.0032). Interestingly, the upper durational boundary of the final items does not reach up to the lower boundary of the non-final items (385.616 ms *vs.* 391.641, respectively). Informant III.6.Aw produces the overlong tokens in final position consistently shorter than the sentence-medial tokens. The independent samples t-test reports a p-value of p (2-tailed) = .055 (t = 2.020, df = 24) that only barely misses significance level. The ANOVA accordingly discloses a significant effect of the sentence position on the vowel duration in ELD 3 (F (1,13) = 7.841, p = .015). The outcome for ELD 2 is not significant for the factor *finality* (F (1.13) = 1.807, p = .202). We again find that the non-final items are produced longer than the final items (mean duration final 229.347 ms, non-final 290.252 ms, C.I. 95% from 0.6061 to 1.0742). No indication for utterance-final lengthening can be found in the data. Rather, it is the non-final sentence context in which the nuclei are produced longer. If we turn now to the second question concerning the duration difference between ELD 2 and ELD 3, we see that the contrast is maintained in the non-final context (t = 4.093, df = 11, p (2-tailed) = .002; C.I. 95% from 1.2639 to 2.1794) as well as in the final context (t = 5.021, df = 13, p (2-tailed) < .001; C.I. 95% from 1.3851 to 2.2653). This is very much the same result we obtained in the investigated data of group 1 of the Aw. informants. What is especially noteworthy for the data of informant III.6.Aw is that the JND is vastly exceeded even by the lower boundaries of the C.I. We may assume that the durational difference as produced by informant III.6.Aw is reliably perceptible and particularly robust.

All in all, what we find for the minimal pairs produced by informant III.6.Aw is that she retains the durational difference between ELD 2 vowels and ELD 3 vowels not only in pre-obstruent but also in pre-sonorant position. The contrast is less pronounced for the latter cases, though. The duration of the word-final R does not compensate for this lower degree of difference. A statistical merger of ELD 2 and ELD 3 occurs only in the mid vowels of informant III.6.Aw. All other vowel qualities are kept distinct. The sentence position is then found to have a partly influence on the vowel duration – though in a rather unexpected way. It is the non-final items of the minimal pair sample that show a clearly longer duration as compared to their final correspondents. Utterance-final lengthening can therefore not be established.

3.3.3. *Aw. F0 differences, group 1*

Höder (2003:23ff.) indicates for the dialect of Aw. that the minimal pairs with long *vs.* overlong vowels differ with respect to their F0-contours. He notes a falling contour for the long vowels by auditive impression, and a complex-falling or level-falling contour for the overlong vowels (2003:26).[96] This can be assumed to manifest in an early peak alignment in the long vowels and a delayed peak in the

[96] See among other figurative descriptions the terms *Stoßton* ‘pushing tone’ and *Schleifton* ‘dragging tone’ (de Vaan 1999:25 FN4; Schmidt 2002:202).

overlong vowels. We will see in the following two sections that these findings can in fact not be maintained.

The same Praat script as for the Kw. analysis was used to measure the F0 in semitones (re 100 Hz) at 15 relative points of each vowel segmentation as well as the total vowel duration, and to compute the mean F0 contours. The graphs in Figure 24 display the mean curves of the ELD 2 items as uttered by the Aw. group 1, i.e. exclusive of informant III.6.Aw. On the left side is the contour of the sample of the non-final sentence position, on the right side is the complementary contour of the final position. The according F0-time-plots of the ELD 3 follow in Figure 25. Note that a calculation of the standard deviation for the mean F0 curves is not adjuvant for two main reasons: the data is pooled across female and male speakers, and variations occurring at the 15 relative points would not be accounted for.

Figure 24. Aw. group 1 mean F0 contours ELD 2, non-final *vs.* final sentence position

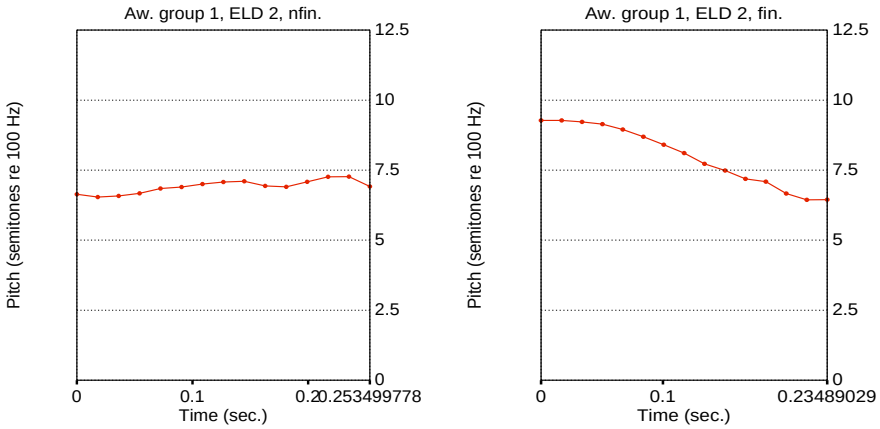
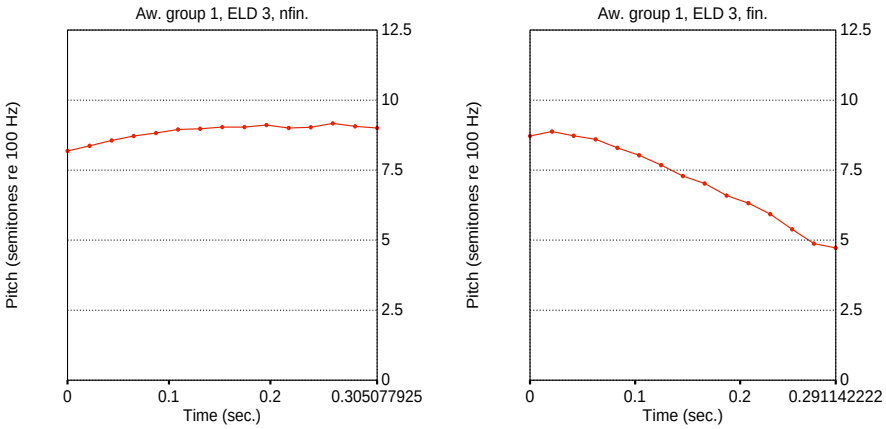


Figure 25. Aw. group 1 mean F0 contours ELD 3, non-final *vs.* final sentence position



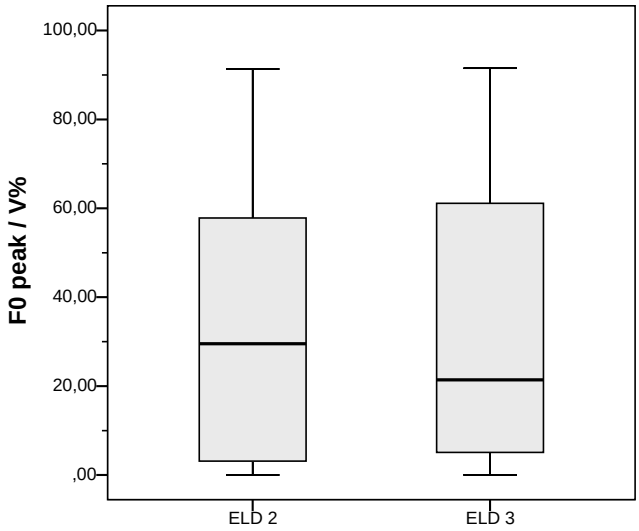
We find for Aw. group 1 that the H occurs in non-final context after 44.28 % of the vowel while the final context yields a clearly earlier peak after 24.97 % of the vowel. The L_i thus appears to have a definite impact on the location of the H in utterance-final stimuli of Aw. group 1. The computed mean F0 contours paint the same picture. The L_i of the final context results in the earlier occurrence of the H as compared to the non-final context without the intonational boundary tone. The same sentence context then yields practically identical curves in long vowels and overlong vowels. We see that neither the contours of the phrase medial position nor the contours of the final position differ substantially among each other. The non-final curves on the left side differ marginally, both contours being of a level-slightly rising shape. The ELD 2 curve shows a very light first peak at 8.39 semitones after approximately 146.77 ms followed by a light dip to 8.17 semitones and a second peak at 8.27 semitones; actually not much of a pitch movement. The ELD 3 curve shows by comparison a light peak of 9.17 semitones at 112.59 ms followed by a plateau. However, the overall pitch movements of the two sentence non-final contours are rather insignificant (0.922 semitones for ELD 2 *vs.* 1.48 semitones for ELD 3). The final curves on the right side are clearly falling. The slope proceeds at a rather equal rate in both cases, the only distinct difference being that for ELD 3 the duration is longer which results in a slightly lower end point of the curve. The contour of ELD 2 falls by 3.101 over a period of 219.66 ms, while the contour of ELD 3 decreases by 5.15 semitones over a period of 287.13 ms.

The further analysis now focuses on the F0-contours of the ELD 2 vowels and the ELD 3 vowels or diphthongs of the minimal pairs. What we are especially interested in is of course the possible contrast in the F0 curve between the ELD 2 vowels and the ELD 3 vowels. The paired samples t-test performed on the minimal pairs of Aw. group 1 identifies no significant difference between the peak locations of ELD 2 and ELD 3 (t = .244, df = 77, p (2-tailed) = .808; C.I. 95% from 0.9251 to 1.05855). Accordingly, the ANOVA establishes the factor *finality* as having a non-significant effect on the duration difference between ELD 3 and ELD 2 (F (1,60) = 2.520, p = .118). The bar charts in Figure 26 provide an illustration of the calculations. It is immediately evident that no clear-cut difference occurs with regards to the H alignment in ELD 2 *vs.* ELD 3. This is exactly what we found for the Kw. minimal pairs.

What we also found for Kw. is that the factor *finality* might have an effect on the peak location *within* the ELDs. And, indeed, this is also what we find for the Aw. group 1 minimal pairs. Similar to the results for the Kw. minimal pairs, the univariate ANOVA identifies the factor *finality* as having a significant effect on the peak location in ELD 2 vowels (F (1,60) = 5.856, p = .019). The vowel height has no significant effect on the peak alignment in the ELD 2 items (F (1,60) = 1.879, p = .111), and neither has the quality of the final consonant (F (1,60) = .194, p = .662). If we look at ELD 3 we find, however, that the sentence position is not significant (F (1,60) = .180, p = .673). Neither of the other two factors, i.e. *jaw opening* or *coda C*, reaches significance level. The former variable has a p-value of p = .887 (F (1,60) = .340), the latter has a p-value of p = .065 (F (1,60) = 3.538). These results point out that the pitch peak alignment on the vowels is basically not

influenced by the three given factors. If anything, it is the sentence position with the L_i in final context that results in a difference in the pitch contour.

Figure 26. Aw. group 1 loci of the F0 peak in % of the vowel, depending on ELD



All in all, the mean non-final and final F0 contours of the ELD 2 and ELD 3 items (complete sample of group 1) do not differ substantially within the same sentence context. The only consistent difference between the two categories is the vowel duration. This means that the postulate of tonal accents for Aw. is not verified by the group 1 data, be it the complete sample or the minimal pairs.

But let us move on to informant III.6.Aw with her motherese pronunciation of Aw. LG. If there is indeed a pitch difference between ELD 2 and ELD 3, we can assume that this data selection pinpoints the contrast.

3.3.4. *Aw. F0 differences, informant III.6.Aw*

What is evident from informant III.6.Aw's complete data is that the pitch peaks between long vowels and overlong vowels do indeed differ by means of alignment. The mean location of the pitch maximum in ELD 2 occurs after 40.85% of the vowel duration whereas in ELD 3 it occurs much earlier after only 22% of the vowel duration. The original assumption that the long vowels would preferably show an early peak as compared to the overlong vowels with a later peak does clearly not hold for informant III.6.Aw's sample. As a matter of fact, it is the other way around with an earlier H in ELD 3 and a later H in ELD 2.

The position of an item in an utterance as produced by informant III.6.Aw does not relate to an alignment difference. The final selection of the sample shows only an insignificantly earlier locus of the maximum after 27.07% of the vowel as compared to 35.33% of the vowel in non-final items. This is true for both the long

vowels and the overlong vowels. We may infer that the declarative L_i has a lesser impact on the pitch contour shapes of informant III.6.Aw than on the ones of Kw. and Aw. group 1. The computed mean F0 contours of ELD 2 and ELD 3 final or non-final contexts in Figure 27 and Figure 28. respectively, reflect this finding.

It appears that the ELD 2 contours are rather level with a smooth fall (-3.48 semitones) in the final sentence context. The non-final cases show an overall pitch movement of maximally 0.63 semitones that can be regarded negligible. Both ELD 3 contours exhibit by comparison a distinct fall, the one of the final context being with 9.2 semitones more pronounced than the non-final one (4.53 semitones).

Figure 27. Aw. informant III.6 mean F0 contours ELD 2, non-final *vs.* final sentence position

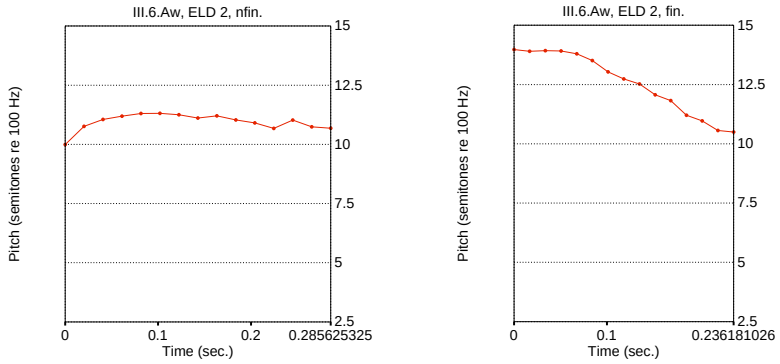
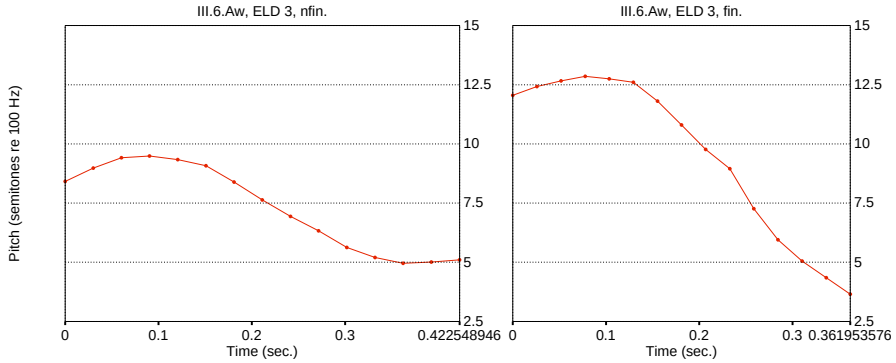


Figure 28. Aw. informant III.6 mean F0 contours ELD 3, non-final *vs.* final sentence position



Despite of the F0 differences we receive for the complete sample of informant III.6.Aw, the results we obtain for the tested minimal pairs are somewhat different. The alignment of the pitch peaks differs here for ELD 2 *vs.* ELD 3 not at a significant level (t = 1.383, df = 25, p (2-tailed) = .179; C.I. 95% from 0.7367 to

1.0517). The rather large scale of the confidence interval and the resulting standard deviation (38.99%) suggests that this result relates to a high amount of variability in the data. This is also true if we restrict the data selection to non-final items (t = 1.180, df = 11, p (2-tailed) = .263; C.I. 95% from 0.5014 to 1.1506) or final items (t = .702, df = 13, p (2-tailed) = .495; C.I. 95% from 0.8072 to 1.0982) only. We see that the variability of the pitch peak location is greatest in non-final position. Accordingly, the univariate ANOVA executed for the minimal pairs shows no significant result for the factor *finality* (F (1,13) = .273, p = .610). The independent variable *jaw opening* does also not yield a significant effect on the F0 peak location (F (1,13) = .289, p = .880), nor does the last factor *coda C* (F (1,13) = .005, p = .945). It is evident that none of the factors has a meaningful influence on the location of the pitch peak in the minimal pairs of informant III.6.Aw.

What we find for informant III.6.Aw's data is that across the length degrees, and the sentence contexts no distinct difference is obtained in the alignment of the H. Only in the complete sample we find that the length degree of the nucleus shows a considerable effect on the location of the pitch peak. Here, she produces a later peak with a level contour in ELD 2, and an early peak with a falling contour in ELD 3. No such difference was identifiable in the reduced sample of the minimal pairs. This is also what we found for the Kw. minimal pairs and the Aw. group 1 minimal pairs. The motherese pronunciation of informant III.6.Aw does not conclusively yield the hypothesized pitch difference between long and overlong vowels. And even if we consider the complete sample of III.6.Aw, the expectations that in long vowels the peak occurs earlier than in overlong vowels is not met.

The implication of the finding is – rather straightforwardly – that there seems to be no tonal contrast (any more) in the minimal pairs of informant III.6.Aw. It might be the case that the light reflexes of pitch peak differences reflect an older, dated version of Low German. I will investigate one more speech sample, i.e. Alfstedt Low German, to find out whether informant III.6.Aw's data is in fact completely speaker-dependent.

3.4. *Alfstedt: production data and acoustic analysis*

A total of eight informants were interviewed for Alfstedt Low German, with an age range from 29 to 72; five of them being native speakers, and three being L2 speakers of the dialect. The recordings were pooled into a sample of 567 items that are suitable for the analysis. Again, only words in declarative intonation were chosen. 346 of the items occurred in medial sentence context, and 221 in final sentence context. Several tokens had to be excluded beforehand during the compilation of the sample since they were produced in continuative intonation, or the informant was overtly unconfident how to appropriately pronounce the stimulus either in terms of vowel quality or in terms of morphology (plural markings). The data was further reduced to 80 minimal pairs in order to execute the paired samples t-test.[97] This aims at determining the possible difference between ELD 2 and ELD 3 in terms of vowel

[97] See the data reduction for the Kw. And Aw. samples.

duration and pitch peak location. A list of the paired items is provided in Table 69 in the appendix.

Analogue to the samples elicited for Kw. and Aw., the Alfs. corpus is first and foremost concerned with the analysis of the vocalic nuclei. Qualitative variations in the coda Cs are only the means to an end, and not the aim of the recordings. The presence of a fortis *vs.* lenis contrast in word-final position can therefore not conclusively be analyzed. A separate sample was compiled, containing 62 un-paired ELD 2 and ELD 3 items ending in a plosive (i.e. 26 fortis ELD 2 tokens, 18 fortis ELD 3 tokens,[98] and 18 lenis ELD 3 tokens). The according word list occurs Table 68 of the appendix. The preliminary findings reported by an independent samples t-test are such that the closure durations for the fortis *vs.* lenis contrast (i.e. 48.766 ms *vs.* 45.117 ms, mean ratio 1.081,) do not differ above chance level (t = .557, df = 60 p (2-tailed) = .580; C.I. 95% from 0.8174 to 1.4292). Similarly, the differences in aspiration durations (inclusive of the burst) do not reach statistical significance for fortis plosives (mean duration 77.061 ms) as compared to lenis plosives (mean duration 79.711 ms) (t = .263, df = 60, p (2-tailed) = .794; C.I. 95% from 0.7475 to 1.2504). The mean ratio for the aspiration duration of fortis *vs.* lenis is here 0.9668. We see that the plosives of the Alfs. sample are not clearly distinguished by either closure duration or aspiration duration. The respective differences amount up to a mean of 8.1% (fortis *vs.* lenis closure duration) and 3.4% (lenis *vs.* fortis aspiration duration). We observe an inversely proportional relation of longer closure duration and shorter aspiration duration in fortis Cs, and shorter closure duration and longer aspiration duration in lenis Cs. The differences do, however, not reach the JND and thus perceptual relevance. The results suggest that the Alfs. informants produce no reliable distinction between final fortis Cs and lenis Cs. This appears to be equally true with respect to voicing during closure. No auditory cues, or visible differences in the spectrograms allude to the presence of vocal fold vibration in lenis coda Cs. Once again, more elaborate scrutiny is needed here to also test other possible phonetic correlates of the fortis *vs.* lenis contrast (i.e. VOT, F0 onset, F1 onset, H1-H2 (first harmonic - second harmonic difference), preceding vowel duration, and following vowel duration).[99]

3.4.1. *Alfs. V durations*

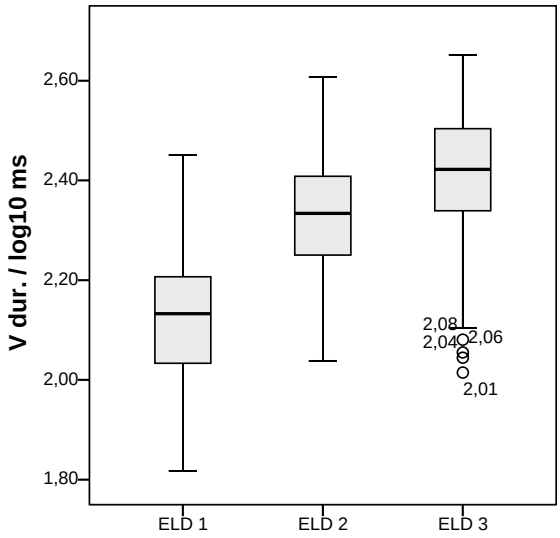
The three expected length degrees ELD 1 to ELD 3 in the complete Alfs. corpus show mean vowel duration of 141.1 ms, 218.67 ms, and 265.77 ms respectively. The data is given in Table 14 and accordingly illustrated in the bar charts of Figure 29. The clearest difference shows up between the short vowels and the long vowels. This is expressed also in the ratio of 1 : 1.55 : 1.88 we arrive at for the three length degrees – values that are rather similar to the ratios calculated for the Kw. data.

[98] We find in these cases phonetic overlength because the fortis coda C is here a suffix and by this invisible metrical constraints. See chapter 6 on the LG fortis and lenis consonants.
[99] Jessen (2001:244).

Table 14. Alfs. LG vowel durations / ms per ELD

ELD	Mean / ms	Std. Deviation	N
ELD 1	141.103	43.198	132
ELD 2	218.671	59.211	197
ELD 3	265.773	69.085	238

Figure 29. Alfs. LG mean vowel durations / ms per ELD



Going into more detail and focusing in the analysis on the 80 minimal pairs, we find that ELD 2 and ELD 3 differ at a highly significant level with respect to the (log10) vowel duration (t = 4.169, df = 79, p (2-tailed) < .001). The mean ratio of the two categories as obtained for the minimal pairs is 1.1409 (C.I. 95% from 1.0713 to 1.215). Both length degrees are therefore found to be distinct for the interviewed informants of Alfs. – even though the mean ratio of the duration difference does not reach the JND threshold.

The subsequently performed univariate ANOVA shows then which factor has a relevant effect on the vowel duration. The dependent variable is here the ELD 3 – ELD 2 duration difference (log10); the three fixed factors are *coda C* (two levels), *jaw opening* (five levels), and *finality* (two levels). The calculations disclose that the coda C has a highly significant effect on the vowel duration difference (F (1,67) = 9.211, p = .003). The jaw opening (F (4,67) = 1.562, p = .195) and the sentence position (i.e. finality) of the stimuli (F (1,67) = .286, p = .595) have by contrast a non-significant influence. This is also true for the interaction effects of the factors. None of them reach significance level. These results of the individual factors are illustrated in the three bar charts of Figure 30 to Figure 32.

Figure 30. Alfs. mean vowel durations depending on the coda C and split up by ELD

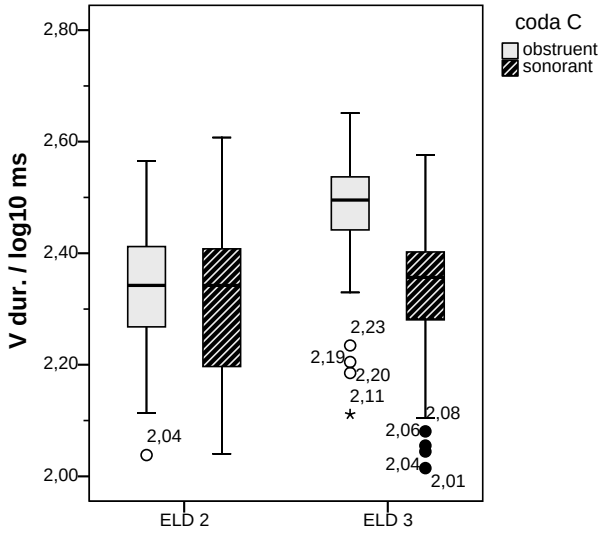


Figure 31. Alfs. mean vowel durations depending on vowel height and split up by ELD

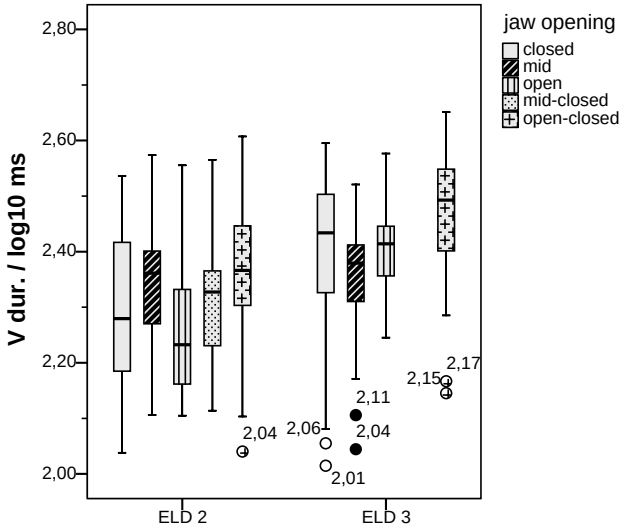
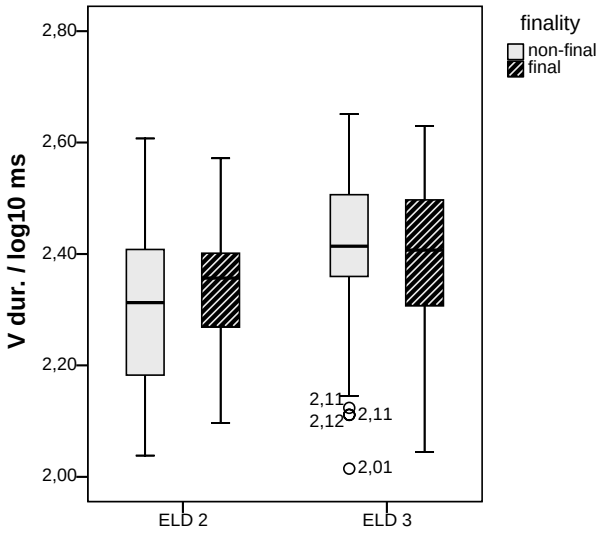


Figure 32. Alfs. mean vowel durations depending on sentence position and split up by ELD



The box plots in Figure 30 indicate a rather clear difference in the logarithmic vowel durations in pre-obstruent position for ELD 2 *vs.* ELD 3. The vowel durations in pre-sonorant position are by comparison rather similar for the length degrees. Two paired sample t-tests performed on the respective selections of the minimal pairs verify this impression. We find that the vowels preceding an obstruent coda differ highly significantly with respect to their logarithmic duration (t = 5.597, df = 27, p (2-tailed) < .001). This is different for the VR sequences. The vowels do here not differ at a significant level between ELD 2 and ELD 3 (t = 1.384, df = 51, p (2-tailed) = .172). We see this already in the mean vowel durations for both length degrees. The vowels in the pre-obstruent context reach a mean duration of 217.587 ms in ELD 2, and 289.446 ms in ELD 3. This corresponds to a mean ratio of 1.3303 (C.I. 95% from 1.1981 to 1.477). The pre-sonorant vowels reach by comparison a mean duration of 216.947 ms in ELD 2, and 227.862 ms in ELD 3. The mean ratio between the two length degrees is here 1.0503 (C.I. 95% from 0.9781 to 1.1278).[100] These values suggest that the Alfs. informants produce a durational merger between ELD 2 and ELD 3 pre-sonorant vowels of the investigated paired items. The pre-obstruent vowels are by comparison kept distinct in both length degrees.

Another possibility would of course be that the 'missing' overlength in the pre-sonorant ELD 3 items is compensated for by a longer duration of the sonorant coda. This is, however, not the case. The paired samples t-test executed on the minimal pairs ending in a sonorant coda C shows no significant differences in the duration

[100] Two univariate ANOVAs performed on the two ELDs separately disclose that the factor *coda C* has no significant effect on the vowel durations in ELD 2 (F (1,67) = 1.264, p = .265), while in ELD 3 it has a highly significant effect (F (1,67) = 19.182, p < .001).

between ELD 2 and ELD 3 (t= .795, df = 44, p (2-tailed) = .431). The duration of the sonorants is found to be only very slightly longer in ELD 3 (177.829 ms) as opposed to ELD 2 (171.171 ms). The mean ratio is here 1.0389 (C.I. 95% from 0.9432 to 1.1444), i.e. a mere 3.89%. This difference is far from being perceptually relevant if we consider the JND of 20-25%. The data indicates that the sonorant coda Cs do not differ durationally in order to compensate for the lack of phonetic overlength in the preceding nuclei. We may therefore conclude that the paired items with VR#-sequences as produced by the Alfs. speakers contain no phonetic overlength.

We now move on to the next factor on the list: *jaw opening*. It was found to have no significant effect on the vowel durations. If we look at the individual vowel qualities we disclose the following. The only vowel qualities that reach significance level with respect to the durational difference are the closed vowels (t = 4.452, df = 34, p (2-tailed) < .001). The durations of all other vocalic qualities, monophthongs and diphthongs alike, do not differ significantly between the ELDs. The mid vowels yield p (2-tailed) = .884 (t = .147, df = 22) with almost no difference between ELD 2 and ELD 3; the open vowels result in p (2-tailed) = .177 (t = 1.570, df = 5) what relates to the small sample size and the rather huge variability; the mid-closed diphthongs yield p (2-tailed) = .351 (t = 1.207, df = 2) again due to the small sample size; the open-closed diphthongs show p (2-tailed) = .204 (t = 1.343, df = 12). The according mean duration ratios and confidence intervals are given in Table 15.

Table 15. Mean duration ratios and confidence intervals of Alfs. vocalic nuclei

jaw opening	ELD 3-ELD 2 ratio	C.I. 95.0%
closed	1.246	1.127 - 1.378
mid	0.993	0.895 - 1.101
open	1.232	0.876 - 1.733
mid-closed	1.284	0.526 - 3.134
open-closed	1.080	0.953 - 1.224

We see here that, despite the non-significant results of the t-tests, the durational differences between ELD 2 and ELD 3 in the open vowels and mid-closed diphthongs reach the perceptual threshold. Both vocalic qualities show, however, a rather broad confidence interval what determines the result of the t-test. The overall result is such that only the closed vowels yield actual evidence for a perceptually relevant difference between long vowels and supposed overlong vowels (i.e. 24.64%). The remainder of the opening degrees does not yield meaningful durational differences. This readily explains why the factor *jaw opening* turns out insignificant. If anything, we find in the Alfs. minimal pairs a contrast in the closed vowels /i, y, u/, and not the mid vowels /e, ø, o / as is the case in the Kw. data.

Let us turn now to the investigation of the vowel durations with respect to the sentence context. Two points are treated, the first one concerning the possible durational enhancement in utterance-final position, the second one concerning the ELD 2 - ELD 3 contrast. The mean durations calculated for ELD 2 are 216.903 ms (non-final) and 217.533 ms (final). The ELD 3 values show a similarly small

difference between the non-final items (247.911 ms) and the final items (247.561 ms). No clear-cut durational difference is visible between the two sentence contexts within the ELDs. This is validated by the independent samples t-test executed on the single length degrees. We find that the durational difference between the final items and the non-final items does never reach significance level. For ELD 2, a p-value of *p* (2-tailed) = .966 (*t* = .043, *df* = 78, C.I. 95% from 0.8776 to 1.1461) is reported. The result for ELD 3 is rather similar with *p* (2-tailed) = .983 (*t* = .022, *df* = 78; C.I. 95% from 0.8765 to 1.1378). Thus, we may assume that final and non-final items produced by the Alfs. informants do not differ duration wise within one ELD. The effect of the factor finality is now tested by means of two univariate ANOVAs performed on the ELD 2 and ELD 3 cases separately. The result for ELD 2 is – as we would already expect – that no significant effect on the vowel duration is found (*F* (1,67) = .815, *p* = .370). This is also true for the overlong vowels. The influence of the factor *finality* does not lie above chance level at 5% (F (1,67) = .242, *p* = .624). This suggests that no utterance-final lengthening is found in the items as produced by the Alfs. informants. The second matter of the duration difference between ELD 2 and ELD 3 is treated with two paired samples t-tests that are run across the paired non-final stimuli and the paired final stimuli. The result is such that the non-final items differ statistically significantly between ELD 2 and ELD 3 (*t* = 2.865, *df* = 45, *p* (2-tailed) = .006). This is also true for the final tokens (*t* = 3.215, *df* = 33, *p* (2-tailed) = .003). The data indicates that the position of a token in the utterance has no impact on the realization of the duration difference between ELD 2 and ELD 3. The contrast is clearly maintained.

Summarizing the findings, the sonorant codas of the Alfs. minimal pairs appear to not allow for phonetic overlength in the preceding vowel. The informants produce overlength only in pre-obstruent vowels. The factors *jaw opening* and *finality* have no actual predictive power with regards to the vowel length difference. Their influence is determined as is being insignificant. All in all, the assumption of three length degrees short : long : overlong is thus far vindicated for the Alfstedt data. What is not clear up to now is whether the data contains differences in the pitch peak alignments that would indicate the presence of a tonal distinction in Alfstedt. This issue is scrutinized in the next section.

3.4.2. *Alfs. F0 differences*

The subsequent analysis is now devoted to investigating the hypothetical presence of distinct F0 contours in the ELD 2 *vs.* ELD 3 vowels. Most of the data that have been studied so far do not allow for the assumption of contrastive tonal movements. Only the Aw. informant III.6. shows some tendencies towards differences in the pitch contours of long and overlong vowels. So, what route does the Alfstedt data take? In order to solve this question the sample of minimal pairs is analyzed with paired samples t-tests to detect a possible difference in peak alignment between ELD 2 and ELD 3. Subsequently, I conduct univariate ANOVAs with the already familiar independent variables *coda C* (two levels), *jaw opening* (five levels), and *finality* (two levels) to establish their relevance; firstly on the peak differences of ELD 3–

ELD 2, secondly on the individual H locations within the two ELDs.

But let us first have a brief look at the complete data of Alfs. The calculated mean pitch contours of this sample are given in Figure 33 and Figure 35. As mentioned in section 3.3.3, a calculation of the standard deviation for the mean F0 curves is not adjuvant since the data is pooled across female and male speakers, and variations occurring at individual points on the vowel would not be accounted for. We see here that the sentence position has a clear impact on the pitch contours of the Alfs. stimuli. This context plays in fact a major role for the specific pinpointing of the H on the vowel. The peak occurs in the non-final items on average after 49.27% of the vowel duration as compared to 9.14% in the final items. This indicates the importance of the influence of the L_i of the declarative intonation on the pitch contour in utterance-final tokens. While the medial sentence position conditions a late occurrence of the H, the final sentence context conditions an early peak since the boundary tone needs to be articulated within the time span of the final token as well. The identical position of ELD 2 and ELD 3 items results then in (almost) identical peak alignments. It is obvious from the graphs that the non-final contours on the left do not substantially differ from each other. Both curves are particularly level with a soft rise towards the end of the vowel. The ELD 2 curve varies by 0.43 semitones at the most, the ELD 3 curve by 0.39 semitones. No crucial difference is found also for the final contours on the right. They exhibit a very distinct fall with a short level phase at the end of the vowel. The mean curve of the long vowels falls by 6.62 semitones. The decline in F0 of the mean overlong curve amounts to 6.59 semitones. Although the contour of ELD 3 starts at a lower F0 (7.11 semitones as compared to 8.15 semitones of ELD 2), the difference in pitch height is insignificant. The slopes proceed at an equal rate, the only difference being here that the longer mean duration of ELD 3 is compensated by a longer short level phase towards the end.

Figure 33. Alfs. mean F0 contours ELD 2, non-final *vs.* final sentence context

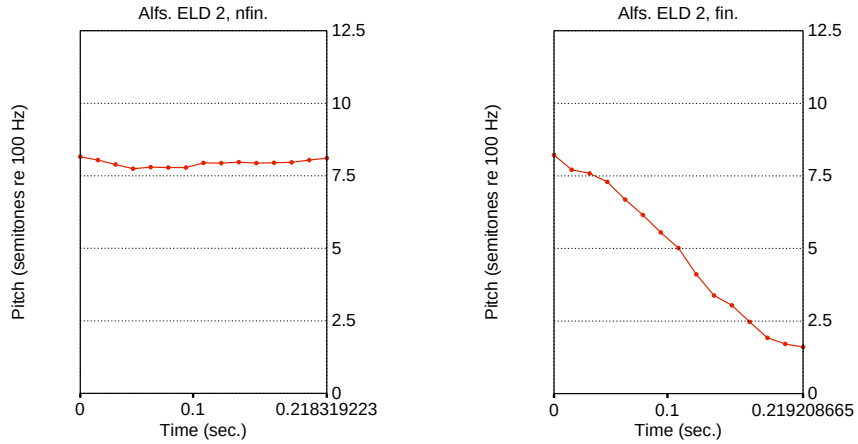
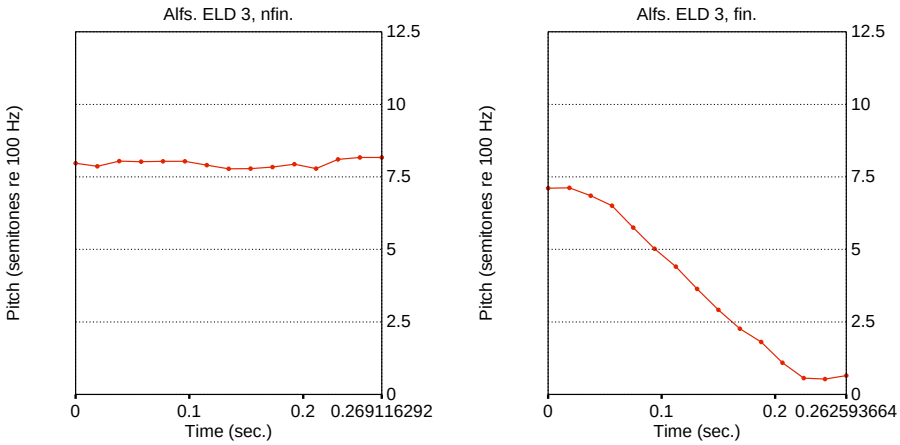
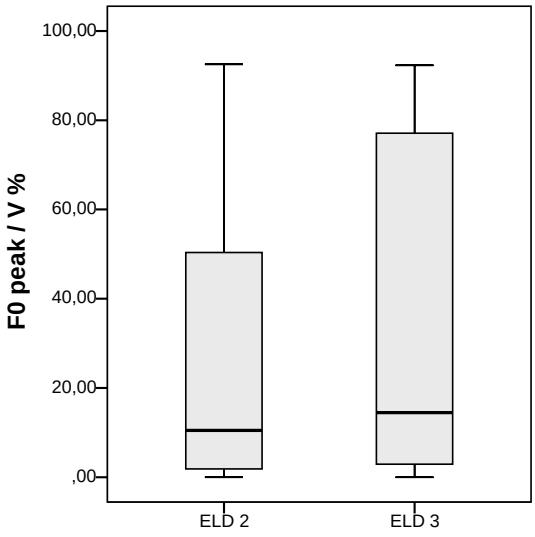


Figure 34. Alfs. mean F0 contours ELD 3, non-final *vs.* final sentence context



The restriction of the analysis to the minimal pairs allows now for the conduction of a paired samples t-test. Performed on all of the 80 (near) minimal pairs, it reveals that the positions of the pitch peaks do not differ significantly for ELD 2 as compared to ELD 3 (t = 1.105, df = 79, p (2-tailed) = .272; C.I. 95% from 0.8996 to 1.0287). This result is illustrated in the bar chart in Figure 35.

Figure 35. Alfs. loci of the F0 peak in % of the vowel, depending on the ELD



But this is of course not all we want to know. What we are also interested in is whether there are significant differences in the pitch peak locations of the two

sentence positions (i.e. non-final *vs.* final) across the ELDs; i.e. are there relevant differences in the peak locations that are independent of the sentence context? The comparison of the non-final items of ELD 2 and ELD 3 suggests the absence of such a contrast with respect to the position of the pitch peak (t = .600, df = 45, p (2-tailed) = .551; C.I. 95% from 0.8673 to 1.0718). The same is true for the comparison of the final tokens across the length degrees (t = -1.261, df = 33, p (2-tailed) = .216; C.I. 95% from 0.8873 to 1.0265). We find no crucial difference with respect to the pitch peak alignment. This is also reflected in the outcome of the univariate ANOVA executed for the dependent variable *F0 peak location ELD 3-2* (i.e. the difference in pitch peak location between ELD 3 and ELD 2 in % of the vowel). It identifies the factor *finality* as having a statistically non-significant effect on the H alignment on the vowels (F (1,67) = 621.019, p = .388).[101] The two further independent variables *jaw opening* and *coda C* have equally no significant effect here (*jaw opening*: F (4, 67) = 699.957, p = .498; *coda C*: F (1,67) = 5.567, p = .935).

The data suggests – at least for the Alfs. paired sample – that between ELD 2 and ELD 3 vowels of the same sentence context no distinct differences in pitch peak alignment exist. Consistent is here only the longer duration of ELD 3 as compared to ELD 2. The hypothesized tonal contours are not at all vindicated by the Alfs. data.

3.5. *The Perception Experiment*

The Perception Test is designed to allow for a decision on the matter of the distinctiveness of tonal contours and/or vocalic overlength in the investigated LG dialects.

The production data shows that only informant III.6.Aw produces – at least partly – the hypothesized tonal contrast. The resulting F0 contours do, however, not quite meet the expectations. Instead of a level TA2 contour and a falling TA1 contour, we find basically the opposite distribution. The original labels for the artificial TA1 and TA2 contours of the Perception Test thus need to be interchanged, assigning to the falling contour the TA2-label, and to the rather level contour the TA1-label.

The monosyllabic minimal pairs tested in the listening experiment all contain vocalic nuclei that have been assumed in the literature to feature a durational division long : overlong. The vocalic qualities are closed and open vowels, and diphthongs (see for the experimental setup sections 3.1.2 to 3.1.3). Bear in mind that the listening experiment tests paired items with three artificial levels of pitch contours (i.e. TA1, TA1.5, TA2), combined with three artificial levels of nucleus duration (i.e. long, lengthened, overlong). Though the production data strongly suggests that an ELD 2 - ELD 3 difference is absent in pre-sonorant position, the corpora for the perception tests contain also items with sonorant coda Cs. Tokens that were originally produced in a non-final sentence context were presented in an accordingly non-final position in the neutral carrier sentence. Originally final tokens were equally given in final position in the carrier sentence.

[101] See Table 72 in the appendix.

The conducted perception data is analyzed in a repeated measures analyses for the individual samples of the pilot test, the Altenwerder test, the Alfstedt test, and the on-line test. The reports follow in the next sections. Since no phonetically short vowels are included in the experimental set up, a test for the perception of the qualitative difference of lax *vs.* tense is automatically omitted.

3.5.1. *The pilot test*

The perception data of the pilot test (experiment I.) contains a total mean of 93 artificial tokens, each assessed three times by the three non-LG informants PT1, PT2, or PT3 (see section 3.1.3.1). The dependent variable in the analysis is *ELD 3 choice* (two levels, i.e. ELD 2/TA1 and ELD 3/TA2) that encodes the length/pitch category chosen by the listeners for a certain item. The independent variables are *finality* (two levels), *coda C* (two levels), *V duration* (three levels), *pitch* (three levels), and *Informant* (here three levels).[102] The two factors *V duration* and *pitch* refer back to the manipulations performed in the speech recordings to obtain the artificial stimuli. The list of independent variables employed in the analysis follows in Table 16.

Table 16. Factors of the repeated measures analysis for the pilot test

factors	levels	reference value
finality	non-final	
	final	✓
coda	sonorant	✓
	obstruent	
Informant	PT1	✓
	PT2	
	PT3	
V duration	long	
	lengthened	✓
	overlong	
pitch	TA1	
	TA1.5	✓
	TA2	

A binary logistic regression was performed on the data set of the pilot test, the results occurring in Table 17.

[102] Hinskens & van Oostendorp (2006).

Table 17. Pilot test results of the multivariate analysis (binary logistic regression). Criterion: *ELD 3 choice*; method: Backward Wald.

					95.0% C.I. for Exp(B)	
predictor	B	df	Sign.	Exp(B)	Lower	Upper
non-final	1.290	1	.000	3.634	2.611	5.058
Informant (PT2)	-1.135	1	.000	.321	.248	.416
coda (obstruent)	-1.104	1	.000	.332	.239	.460
V duration (long)	-.967	1	.000	.380	.300	.482
V duration (overlong)	.940	1	.000	2.559	2.024	3.236
Informant (PT3)	.743	1	.000	2.101	1.652	2.672
Constant	-.191	1	.182	.826		
-2 Log likelihood	895.063					
Nagelkerke R^2	.360					
Model χ^2	262.845	6	.000			

The table is ranked with respect to the effect a variable has on the delivered choices, starting with the highest and ending with the lowest effect. All factors employed in the further analyses are assumed to be categorical.[103] They are either treated as *indicator* (two leveled variables) or *deviation* (three and more leveled variables). This method was chosen in order to obtain specific information on the individual levels of the factors. The indicator variables are here *finality* and *coda*. The responses delivered for the non-final items are therefore compared to the responses for the final items as their reference value. Similarly, the answers given for the items with a coda obstruent are compared to the answers given for items ending in a sonorant C. The deviation variables are *V duration*, *pitch* and *Informant*. The two *V durations* 'long' and 'overlong' (i.e. the according predictors) are compared to their reference value 'lengthened' (i.e. the intermediate artificial value) from which they deviate. Similarly, the two predictors TA1 and TA2 are compared to their intermediate reference value TA1.5. Finally, the two informants PT2 and PT3, constituting individual predictors in the analysis, are compared to PT1 as their reference value because PT1 shows the most evenly distributed answers.

The binary logistic regression shows that the variance in the perception data is to 36% explainable by the remaining six factor groups (R^2 = .360). All of them are reported as being highly significant with $p < .001$.[104] The achieved correct judgments as observed in the data amount to 74% of the judgments predicted by the

[103] *V duration* and *pitch* are not rated as categorical variables in the subsequent binary logistic regressions performed on the LG perception data. It was found to be more relevant to investigate the overall effect of the variable than the effects of the levels on the choices. The reason is that they all point into the same direction: the longer the stimulus the more likely an ELD 3-response is obtained, and vice versa the shorter the stimulus duration is the less likely the ELD 3-word is chosen; *pitch* has basically never an influence on the answers provided by the informants.

[104] This result is also visible in the confidence intervals (C.I.), the lower and upper boundaries lying consistently either above or below 1 for the individual factors.

model. We see in the table that all levels of the factor pitch are absent from the equation. This means that the artificial pitch contours have no effect whatsoever on the choices delivered by the informants. The overall effect of factor *pitch* on the choices is far from reaching significance level (p = .869), i.e. the informants of the pilot test do basically not rely in their judgments on the F0 cues.

What we can also observe in the table is that the non-final sentence position has the most important impact on the choices, followed in the ranking by informant PT2, the nature of the coda C, the long vowel length, the overlong vowel length, and lastly informant PT3. The individual relevance of the factor *Informant*, be it PT2 or PT3, basically expresses how strongly their judgments are biased, i.e. influenced by within subject factors. Informant PT1 is taken here as the reference point for his perception data shows the most even distribution of choices (46.2% ELD 2-item choices, 53.8% ELD 3-item choices). The odds for him are the closest to 1, i.e. $53.8\%/46.2\% = 1.165$.[105] The results for the other two informants are indeed much more biased. Their data as put in relation to PT1 evinces the following. PT2 is 3.115 times more likely to not choose the ELD 3 items but the ELD 2 items as compared to PT1, i.e. the odds ratio for her is $1/.321$ (C.I. 95% .248 to .416).[106] PT3 is quite to the contrary 2.101 times more likely to choose the ELD 3 items than PT1 (C.I. 95% 1.652 to 2.672). The answers provided in the pilot test show fairly clear preferences of the individual speakers for one of the two word-categories.

Apart from these informant related results, we find that the non-final sentence context constitutes the most important factor with regards to the choices. The effect is highly significant (p < .001) as compared to the reference value (i.e. the final context). The odds ratio amounts to Exp(B) = 3.634 (C.I. 95% 2.611 to 5.058), which basically means that the odds for an ELD 3-choice are bigger in non-final context than in final context. Hence, it is more likely that the ELD 3 item is chosen when the stimulus occurs in non-final position in the sentence. This result might be related to the non-final lengthening trend observed in the production data of the dialects that may be reflected in the absolute durations of the respective manipulated stimuli in the perception test, yielding longer absolute durations of the non-final items. We can see that the effect of the artificial length degrees on the choices is highly significant. The participants of the pilot test may as a consequence more easily judge the longer non-final items as ELD 3 words. It might be the case that the non-native pilot test informants do not perceptually compensate for the additional duration.

It is also observable – rather unsurprisingly – that the odds ratio for choosing the ELD 3-word is diametrically opposed for the artificial *long V duration* as compared to the intermediate *lengthened V duration* (Exp(B) = .380; C.I. 95% .300 to .482),

[105] $P/(1-P) = (1/1.8587)/(1-(1/1.8587))$. We see that the *odds* are the ratio of two probabilities, namely the probability of an event occurring and the probability of an event *not* occurring.

[106] Note that the *odds ratio* is a measure of effect size by relating two odds, e.g. the odds for PT2 to choose an ELD 3-item against the odds for PT1 to choose an ELD 3-item. It is calculated as $odds_1/odds_2$, i.e. $(P_1/(1-P_1))/(P_2/(1-P_2))$. If it assumes a value of 1, the odds ratio indicates in this study that both two word-categories (ELD 2-word or ELD 3-word) are equally likely to be chosen for the denoted predictor and its reference value.

and the artificial *overlong V duration* as compared to the intermediate *lengthened V duration* (Exp(B) = 2.559, C.I. 95% 2.024 to 3.236). For items with the *long V duration* it is 2.6316 (i.e. $1/.380$) times more likely that the ELD 2-item is chosen as for the *lengthened* forms. Almost the same odds ratio holds in the opposite direction for the *overlong V duration*. We find here that it is 2.559 times more likely to receive an ELD 3-answer than in the *lengthened* cases. All in all, these values basically mean that the longer the presented stimulus is the more likely it is rated as overlong. Both predictors are basically identical in their importance for the choices.

In addition to the *V duration* and the sentence context, the nature of the word-final C (i.e. the factor *coda*) also affects the judgments. We find that the items with an obstruent coda are 3.0121 times more likely to be rated as ELD 2-words than the items with coda sonorant (Exp(B) = .332, C.I. 95% .239 to .460). This can be attributed to the phonetic fact that vowels in pre-sonorant position may be perceived a being longer in comparison to vowels in pre-obstruent position.

The pilot test clearly suggests the relevance of the vowel length in the perception of the LG stimuli by the non-native informants. All three participants rate the items in the majority of cases according to the *V duration* of the stimulus. The relevance of the indicator variables sentence position (i.e. *non-final*) and coda C (i.e. *obstruent*) may relate to the lack of perceptual compensation for phonetic details by the non-native informants. Apparently, pitch differences play no role in the perception of the LG stimuli by the test subjects.

Let us now move on to the perception tests of the native speakers of LG, starting out with the Altenwerder results.

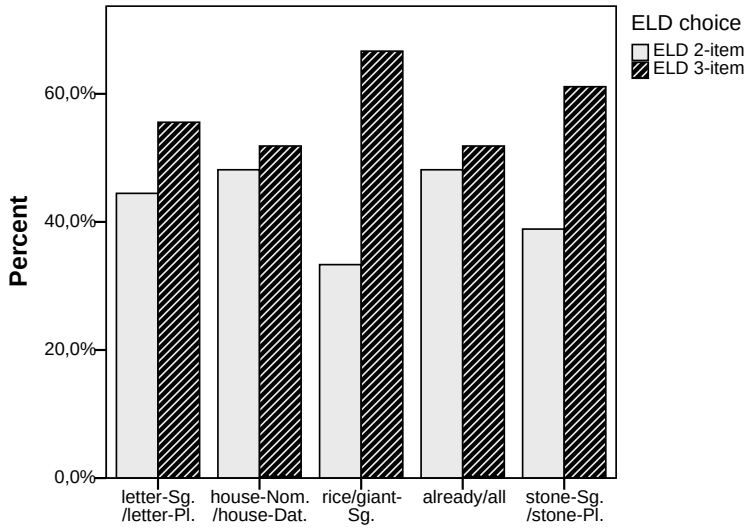
3.5.2. *Altenwerder Perception Test*

The Perception Test consists of two listening experiments that differ only with respect to the origin of the artificial speech items (see section 3.1.4.2). Experiment II. contains such tokens that stem from ELD 2-words (long vowel, hypothetical TA1-contour); experiment III. contains vice versa tokens originating in ELD 3-items (*overlong* vowel, hypothetical TA2-contour). The results for the Aw. informants are given below. Each of the 15 participating informants delivered 243 answers, yielding 3645 responses in total. The independent (categorical) factors employed in the statistical analysis are again the stimuli related variables *finality* (two levels, reference value final), *coda C* (two levels, reference value coda sonorant), *V duration* (three levels, reference value lengthened), *pitch* (three levels, reference value TA1.5), and the participant related variable *Informant* (here 12 levels, resulting from the necessary exclusion of three participants). Informant III.2.Aw is generally excluded from all of the analysis since she made her choices without listening to the individual stimuli during the experiment. This is clearly visible in the distribution of her judgments, with 96.7% allotted to ELD 2-items, and 3.3% allotted to ELD 3-items (i.e. the odds to choose ELD 2 are for her 29.303).[107]

[107] The decision is based on the assumption that at least 33.3% of the stimuli (i.e. the stimuli of either of the distinct categories ELD 2 or ELD 3) should clearly be judged as belonging to their genuine word-

If we look in a first step at the individual minimal pairs we find that the choices are rather evenly distributed except for the 'house-Nom. / house-Dat.' cases. The choices for the ELD 2-category outnumber the choices for the ELD 3-category by 70.9% to 29.1%. This preference for the long word-category was already to be expected since some of the informants stated after the experiment that the stimuli would have had to be longer in order for them to choose the ELD 3-category. In order to present the most realistic picture of the Perception Test, the minimal pair 'house-Nom. / house-Dat.' is nevertheless kept for the analysis. The graph with the minimal pair choices follows in Figure 36.

Figure 36. Aw. word-choices in % of the total per category, split up by word-category

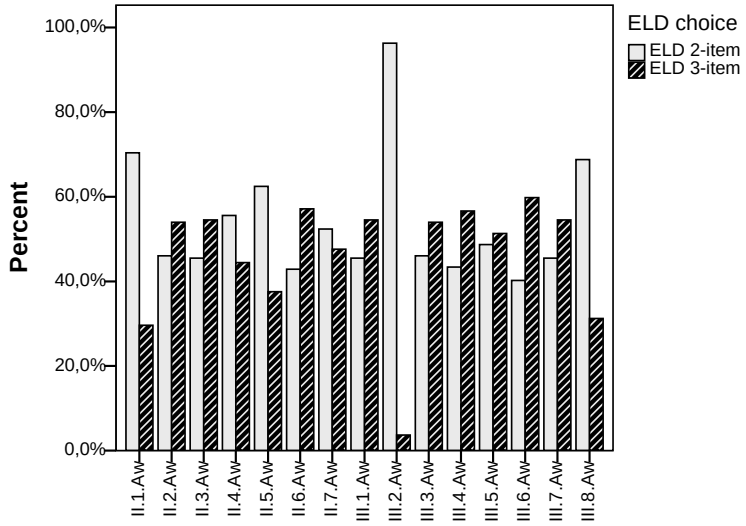


Something that is not visible in the illustration is that 50% of the 14 informants included in the Aw. analysis were overtly alienated by the minimal pair 'already / all'. Five of them (informants II.1.Aw, III.3.Aw, III.4.Aw, III.7.Aw, III.8.Aw) chose almost exclusively for the ELD 3-category, while the other two informants (II.5.Aw, III.5.Aw) chose for the ELD 2-category. This is probably related to the semantic difficulties to incorporate both items 'already' and 'all' into the same neutral carrier sentence. The finding results in the necessity to exclude the minimal pair from the further calculations. A subsequently performed cross-tabs calculation shows that besides informant III.2.Aw, now also informant II.1.Aw and III.8.Aw have to be excluded. Their choices for the ELD 3-category amount to 29.6% and 31.2%, respectively. The overall distribution of responses for ELD 2- and ELD 3-items as made by the Aw. informants is illustrated in the graph in Figure 37.

category. The intermediate level between the two extremes may then be allotted to either of the two categories, yielding 66.7% of the choices. All informants except III.2.Aw met this criterion.

The analysis for the remaining 12 Aw. informants now precedes as follows. I first give an overview of the overall results of the perception test. Then the two experiments are looked at separately from each other. The informants of experiment II. are compared to the values of informant II.7.Aw who shows the most even distribution of word-choices of the this sub-set of informants (52.4% ELD 2 judgments and 47.6% ELD 3 judgments, i.e. odds of 1.101 for ELD 2 choices). For experiment III., the informant III.5.Aw is defined as the reference value (48.7% ELD 2 choices and 51.3% ELD 3 choices, i.e. odds of 0.949 for ELD 2 responses). He also constitutes the reference value for the whole Aw. sample. Additionally, a separate analysis will be run on the perception data of informant III.6.Aw – the 'motherese' informant – in order to determine whether the considerable differences present in her production data are also borne out in her perception of the speech items.

Figure 37. Total number of word choices as delivered by the Aw. informants (exclusive of the minimal pair 'already / all')



We start now with the joint analysis of both Aw. experiments (exclusive of informant II.1.Aw, III.2.Aw, and III.8.Aw). The logistic regression performed on the perception data shows that generally three of the predictor variables have significant influence on the choices. These factors are the sentence position of the stimulus, the *V duration* of the presented stimulus, and the individual *informants*. The significance values are given in Table 73 in the appendix, ranked according to their relevance level. Bar charts for the investigated variables (except for the informants whose overall choices are depicted above) follow thereafter.

The non-final sentence position constitutes the most important factor with respect of the word-choices. This is exactly what we have also seen in the pilot test. The effect is here again highly significant ($p < .001$) as compared to the reference

value (i.e. the final context). The odds ratio lies at Exp(B) = 4.111 (C.I. 95% 3.401 to 4.968) expressing effectively that it is more than four times as likely that the ELD 3-word is chosen when the stimulus occurs in non-final position in the utterance as in final position. This may again relate to the non-final lengthening trend found in the investigated LG dialects (see section 3.3). The manipulation of these items automatically yields longer absolute durations of non-final tokens. Curiously, the LG informants who produced this difference do obviously not compensate for the longer durations in the listening task.

The next independent variables bearing significantly on the choices are the *V durations* with $p < .001$ each. The odds ratio for the long V duration is Exp(B) = .452 (C.I. 95% .397 to .516) indicates – rather unsurprisingly – that with the long V duration it is 2.2124 times as likely that the ELD 2-word is chosen than the ELD 3-word as compared to the reference value of the lengthened V duration. The reverse is true for the overlong V duration that shows an odds ratio of Exp(B) = 2.172 (C.I. 95% 1.902 to 2.479). The comparison with the intermediate vowel length obtains here that for the overlong V duration it is more likely to receive an ELD 3-answer than an ELD 2-answer. We may conclude that the longer the V duration is the more likely it is that the ELD 3-word is chosen by the participants.

The judgments of the individual informants differ only in part statistically significantly from the reference values of informant III.5.Aw. The *p*-values of II.4.Aw, II.5.Aw, and III.6.Aw reach chance level at 5%. The odds ratios of all informants vary from .489 to 1.452. Values of < 1 encode that the odds of the opposite group are bigger, i.e. the likelihood to choose the ELD 3-item is smaller than to choose the ELD 2-item. A value of > 1 accordingly expresses that the odds stand in favor of an ELD 3-choice. Informant III.6.Aw shows a preference for ELD 3-items (Exp(B) = 1.452, C.I. 95% 1.071 to 1.968) while the choices of II.4.Aw and II.5.Aw biased towards the ELD 2-category (with Exp(B) = .689 and Exp(B) = .489, respectively).

The remaining factors *coda C* and *pitch* do not add to the descriptive power of the model. An obstruent consonant results in an insignificant difference ($p = .829$) in the judgments as compared to items with a sonorant coda C. Both coda categories show rather evenly distributed choices across the ELDs. The odds ratio here shows only a light trend to choose the ELD 3-word in the VC cases as compared to the VR cases (Exp(B) = 1.203, C.I. 95% .835 to 1.252).

An even clearer result is obtained for the factor *pitch*. The differences in the F0 contours do not produce significant differences in the judgments of the informants ($p = .551$). Both contours, TA1 and TA2 are almost equally likely to incite ELD 2-choices or ELD 3-choices as compared to TA1.5. The odds ratio of the late peak in TA1 is Exp(B) = .935 (C.I. 95% .822 to 1.064) while for the early peak in TA2 it is Exp(B) = 1.011 (C.I. 95% .889 to 1.150). This demonstrates no clear-cut preference for one of the two word-categories with either of the tonal contours. The listening data of Aw. can thus be assumed to not contain any evidence for the perceptive load of the postulated tonal contours. Neither the artificial TA1 nor the artificial TA2 have an actual influence on the choices delivered by the informants.

If the Aw. perception sample is looked at in general, 68.6% of the answers given by the informants are correct with respect to the model. The calculated variables are able to explain 23.4% of the variance found in the data.[108] We also find a significant difference between the two test series, though the odds ratios for ELD 3-choices in Exp. III. do not differ strongly from Exp. II. (p = .005, Exp(B) = 1.268, C.I. 95% 1.095 to 1.495).

Concentrating on experiment II., we find that four predictors are identified as having a significant impact on the judgments: *V duration*, *finality*, (marginally) *coda C*, and the individual informants (the values occur Table 74 in the appendix). The presence of an obstruent in word-final position here results in increased odds to choose the ELD 2-category. This might be due to the fact that vowels before sonorant Cs are usually perceived longer than before a coda obstruent. The effect is here rather weak, though. 71.3% of the choices are made correctly as compared to the predictions. 32.9% of the data can be predicted by the variables. The factor *pitch* is again established as being insignificant with respect to its effect on the actual choices (p = .267).

The calculations for experiment III show that 66.4% correct choices were made by the informants as compared to the model. The model is, however, able to explain only 15.7% of the data. One variable less than in experiment II. is identified as having significant influence on the choices. The three factors are the position of the stimulus in the sentence, the two *V duration* factors, and the *coda C* (see Table 75 in the appendix). The individual *informants* (p = .622) as well as the differences in *pitch* (p = .735) do not yield significant effects with respect to the judgments. None of the two word-categories is preferred above the other with respect to these factors.

Thinking back to the results of the production data, we found that only informant III.6.Aw showed some cues on distinct pitch contours. The repeated measures analysis performed on her perception data (this time inclusive of the minimal pair ‘already / all’) now evinces the following. Her choices are rather evenly distributed with respect to the word-categories of the individual stimuli. This becomes particularly clear from the bar charts below.

[108] This indicates that a bigger part of variables is left unaccounted for. Since the experimental set-up was carefully controlled for independent variables, it occurs to be more likely that the missing variables are nested on the informants. To these undefined factors might count the speaker-dependent individual degrees of motivation, educational backgrounds, or hearing abilities.

Figure 38. Informant III.6.Aw's word-choices in % of the total per category, split up by word-category

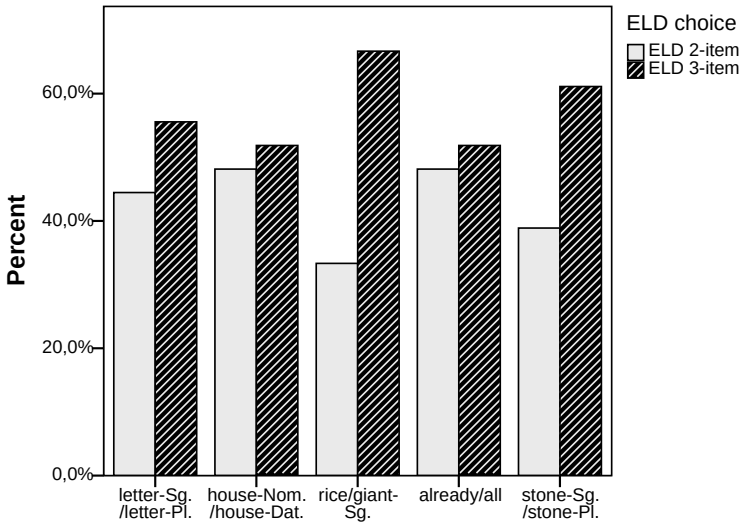


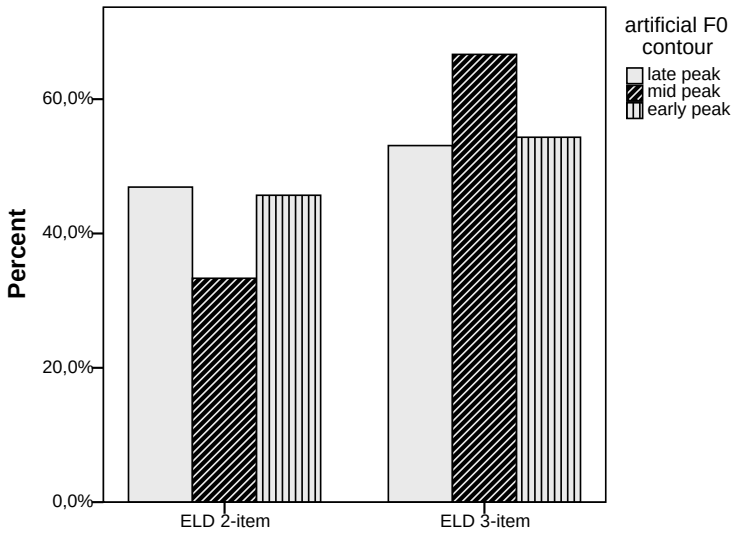
Table 18. Informant III.6.Aw's results of the multivariate analysis (binary logistic regression). Criterion: ELD 3 choice; method: Backward Wald.

					95.0% C.I. for EXP(B)	
predictor	B	df	Sig.	Exp(B)	Lower	Upper
Constant	.330	1	.012	1.391		
V duration (long)	.254	1	.177	1.289	.892	1.862
V duration (overlong)	.200	1	.284	1.222	.847	1.763
-2 Log likelihood	324.432					
Nagelkerke R^2	.034					
Model χ^2	6.151	2	.046			

The logistic regression evinces that 60.1% of the choices delivered by the informant are correct with respect to the model. The model has, however, only a rather low predictive power with only 3.4% of the variance explained by the used variables. The only factors that could be identified as having some bearing on the judgments are the two *V durations*. Both stimuli durations, long and overlong, show the same result. They are more likely to incite ELD 3-responses than ELD 2-responses as compared to the lengthened vowels. The effect does in both cases not reach chance level at 5% (*V duration (long) p* = .177, and *V duration (overlong) p* = .284), though.

Crucially, the pitch contours do not show a significant effect on the word-choices of informant III.6.Aw (p = .149). What does differ in her sample is the amount of mid peak-tokens allotted to the two categories. While all three artificial pitch contours (i.e. TA1, TA1.5, TA2) yield in the complete Aw. sample a rather even distribution of choices across the word-categories, subject III.6.Aw assigns more items with the intermediate pitch contour to the ELD 3 category. Items with early peak (i.e. TA2) and late peak (i.e. TA1) alike are all rather evaluated as ELD 2-word than as ELD 3-word. This is illustrated in the bar charts in Figure 39. The informant appears, thus, not to distinguish the given speech items according to the F0 contours she produced.

Figure 39. III.6.Aw's word-choices in % of the total per category, depending on the artificial F0 contours



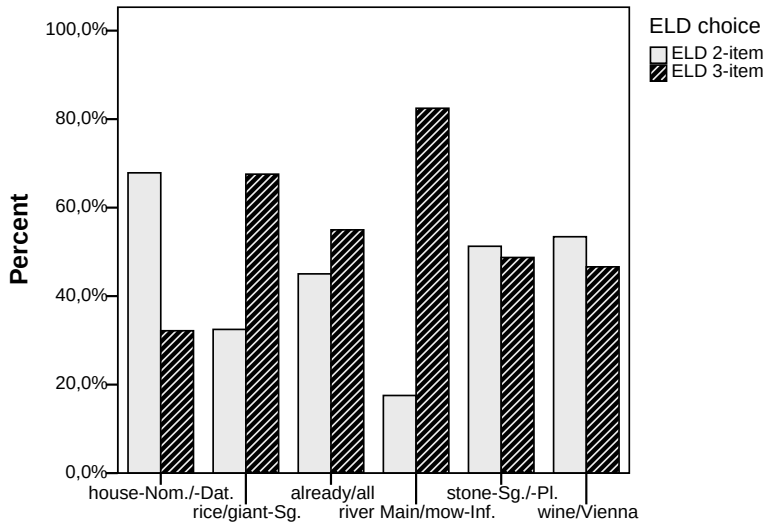
The perception test conducted with the Aw. informants delivers no positive cues for the phonological relevance of F0-contours. The responses are mainly based on the position of the stimulus (what relates to *V duration* due to the lengthening effects found in non-final position), the *V duration*, and the quality of the *coda C*. Additionally, some speaker-dependent variations are found.

3.5.3. *Alfstedt Perception Test*

We continue with the repeated measures analysis of the perception data elicited for the dialect of Alfstedt. The dependent and independent variables that are tested remain the same as in the Aw. analysis, i.e. the ELD 3 choices (two levels) as controlled for the *finality* of the stimulus in the sentence (two levels), the *V duration* and the *pitch* contour (three levels each), the nature of the *coda C* (two levels), and the single *informants* (14 levels). The inspection of the single minimal pairs shows

that seven out of the 21 participants of the Alfs. perception test have to be excluded from the analysis. Their data contains almost no variation in the choices with respect to the minimal pairs, i.e. one word-category was picked consistently for a specific token. The informants are II.5.As, II.6.As, II.10.As, III.3.As, III.5.As, III.6.As, and III.9.As. Additionally, two rather problematic items are identified: 'house-Nom. / house-Dat.', and 'river Main / to mow-Inf.'. 15 participants had severe difficulties with the former pair, 13 informants struggled with the latter pair. This might again relate to the semantic difficulties the informants had with the stimuli. The responses for both are therefore excluded from the sample. The respective graph for the minimal pairs is given in Figure 40 below.

Figure 40. Alfs. word-choices in % of the total per category, dissected by word-category

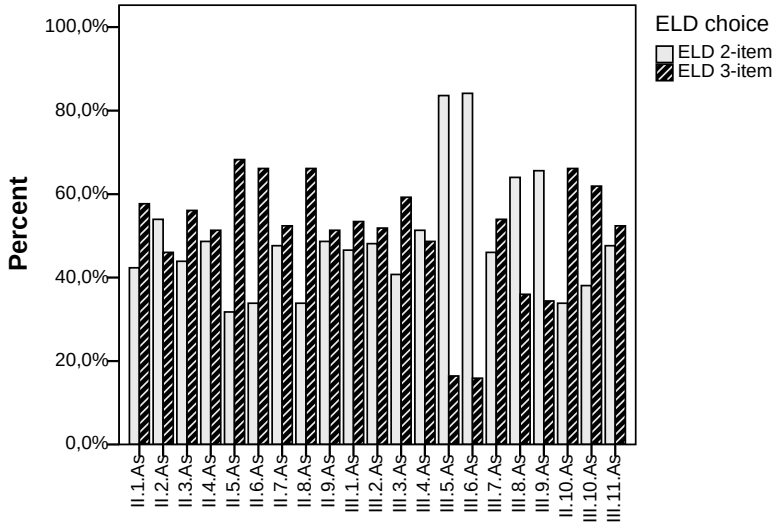


A crosstabs calculation now determines informant II.9.As as delivering the most even choices (48.7% ELD 2-judgments, 51.3% ELD 3-judgments). She is defined as the reference value for the informants. In the separate analysis of experiment III., it is informant III.4.As who is defined as the reference value (51.3% ELD 2-responses, 48.7% ELD 3-responses). The distribution of the choices for each of the participants is illustrated in the bar charts in
Figure 41.

The logistic regression run on the Alfs. data (exclusive of the specified seven informants) defines basically all predictors as having a significant influence on the choices made by the participants. These variables are the individual *informants*, the *V durations*, the nature of the *coda C*, the *finality* of the stimuli, and the *pitch* contours. Significance values and odds of the variables are given in Table 76 in the appendix. The corresponding graphs follow thereafter. The informants with

borderline values constitute automatically the most relevant factors since they deviate the most from their reference value of informant II.9.As. They show *p*-values of < .001. The respective informants are ranked above all other variables.

Figure 41. Total number of word choices as delivered by the Alfs. informants (exclusive of the minimal pairs 'house-Nom. / house-Dat.' and 'river Main / to mow-Inf.')



The most important factor not referring to the participants is *V duration* and *coda C*. Let us have a look at the former first. Both lengths, long and overlong, have a highly significant effect on the informant's judgments ($p < .001$). The odds ratio of the long degree Exp(B) = .591 (C.I. 95% .529 to .662) signifies that the items are 1.692 times as likely to be judged as ELD 2-words than as ELD 3-words as compared to the intermediate lengthened items. Much alike what we have seen in the previous sections, the reverse is true for the overlong items. For them it is 1.562 times as likely to incite an ELD 3-response than an ELD 2-response in comparison to the lengthened vowels (Exp(B) = 1.562, C.I. 95% 1.395 to 1.749). We may again conclude that the longer the stimulus is the more likely it is rated as ELD 3-word.

The variable *coda C* is third in the ranking. The presence of a word-final obstruent has an equally highly significant effect on the responses ($p < .001$). The ELD 3-category is in these cases more likely to be chosen than in the coda sonorant items. This is indicated by the odds ratio of Exp(B) = 1.613 (C.I. 95% 1.350 to 1.927).

The next predictor that has a bearing on the responses of the Alfs. perception test is the position of the stimulus in the utterance. The effect is statistically significant at the 5% level ($p = .001$). The odds ratio expresses also in the Alfs. sample a trend towards the ELD 3-words in the cases with non-final stimuli (Exp(B) = 1.328, C.I.

95% 1.132 to 1.559). This is the same result we obtained also in the pilot test and in the Aw. sample. Up to now, we suggested that the preference for ELD-3 items in medial position might relate to the generally longer duration originally found in the non-final speech items of the investigated LG corpora. Another option is that the contrast between ELD 2 and ELD 3 is perceptually reduced in non-final sentence position, resulting in the biased choices of the informants. This would, however, be in accordance only with the findings of the Kw. production data (see section 3.2.1). All other recordings showed well-defined differences between ELD 2 and ELD 3 for non-final and final sentence context. We may therefore assume also for Alfs. that the preference for ELD 3-words in non-final position is influenced by the actual duration of the items.

Intriguingly, one of the *pitch* factors does have a marginally significant effect on the responses within the Alfs. sample. It is the TA2 contour that has a *p*-value of $p = .011$, while the TA1 contour has no significant influence on the choices with $p = .190$. The odds ratio for TA2 lies at Exp(B) = .865 (C.I. 95% .773 to .967), indicating that it is 1.156 times more likely to choose ELD 2-category if the stimulus has TA2 as compared to TA1.5. Since the odds ratio is more or less close to 1, the bias is rather weak.

All in all, the whole Alfs. sample comprises 60.8% correct responses in comparison to the model. A mere 9.5% of the variance is explainable by the variables in the model. The two test series do not differ significantly from another ($p = .094$, Exp(B) = .878, C.I. 95% .753 to 1.023). The subjects who conducted experiment II. are slightly less likely to choose the ELD 2-category than the participants of experiment III.

Focusing on experiment II., we see that mainly the four factors *finality*, *V duration*, *coda C*, and the *informants* determine the answers. The *informants* are here the least important. Most important for the perception of the stimuli appears to be the sentence position ($p < .001$) with the already familiar and in this case rather pronounced trend to choose the ELD 3-category for non-final items (Exp(B) = 2.374, C.I. 95% 1.881 to 2.996). The artificial pitch contours of the given stimuli appear not to have an effect on the choices. They clearly do not reach significance level at 5% ($p = .266$). Experiment II. produced 66.4% correct choices as compared to the model. 14.7% of the variances in the data are explainable by the employed factors. The respective values are given in Table 77 in the appendix.

If we turn to experiment III. we find that the ranking of the factors differs from experiment II. The factors remain not the same. Individual *informants* (III.8.As, III.10.As.) are ranked above *coda C* and *V duration*, which nevertheless have both a significant effect on the ELD 3-choices ($p < .001$). Less important for the perception of the informants but still significant is the *finality* of the stimulus ($p = .018$). The factor pitch is absent from the ranking. Its overall effect on the judgments lies not above chance level ($p = .129$). If anything, an early peak (TA2) is 1.175 times more likely to result in the association of the stimulus to the ELD 2-category (Exp(B) = .851, C.I. 95% .727 to .996). Overall, we can conclude for experiment III. that the artificial F0 contours do not have a clear distinctive load for the subjects. The informants participating in this test delivered 59.6% correct choices as compared to

the model. A total of 8.2% of the variance occurring in this test series is explainable by the used predictors. The corresponding compilation of values occurs as Table 78 in the appendix.

The perception data of the LG dialect of Alfstedt are characterized by the main influence of the *V duration*. The logistic regression furthermore pointed out the relevance of the coda C, the position of the stimulus in an utterance, and – most intriguingly – some influence of the pitch. The latter factor is, however, clearly the weakest and does not reach significance level in the two test series. The presence of tonal accents and their distinctiveness is therefore not verified by the sample. This is analogue to the results we obtained for the Altenwerder perception data – although the results were more pronounced. We can conclude that the age group of 60+ of both, Altenwerder speakers and Alfstedt speakers, do not rely on pitch but rather on duration in their word-judgments. Since the mean age for both dialect areas lies above 60 years, supplementary tests are in order that focus more on the younger generation of LG speakers. This is why the subsequently analyzed on-line listening experiment was designed.

3.5.4. *On-line Perception Test*

The set-up of the on-line experiment differs from the fieldwork set-up (see section 3.1.2). The two original experiments used for Altenwerder and Alfstedt were split up into four, dividing them into final and non-final item sets. 1479 responses of 31 participants were delivered in total. Five of the informants are of the age group 45+ (i.e. age 49 – 70) resulting in their exclusion from the analysis; 1163 responses remain.

A first logistic regression performed on the data with the predictors *radius* (two levels), and *L1* (two levels) showed that the dialectal point of origin of the informants (encoded by the factor *radius* as coming from a 60 km radius around Altenwerder) does not yield a significant difference. Participants of group 2 coming from places outside the defined radius do not deliver crucially different responses as compared to participants of group 1 coming from places within the radius (p = .983). It does also make no difference with respect to the choices whether or not the subject has LG as L1 or L2 (p = .101). On these grounds, none of the participants would have to be excluded from the tests. [109]

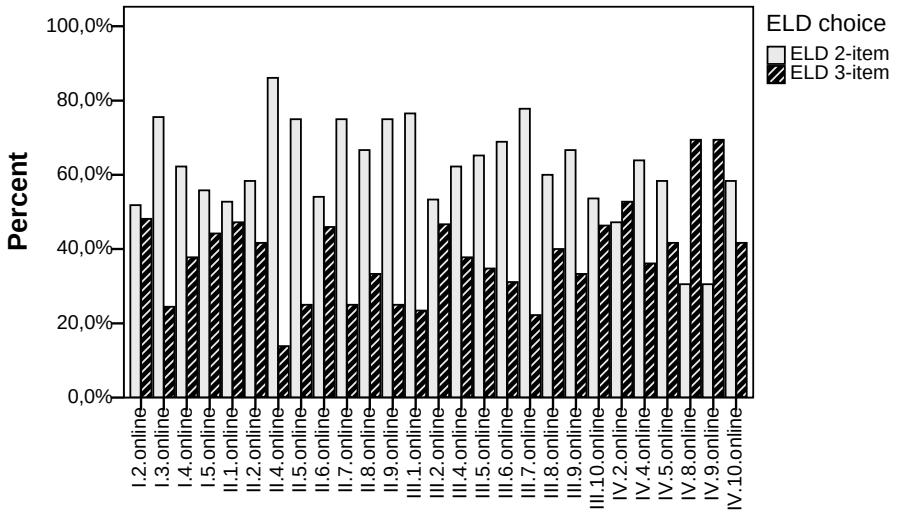
The factors that are used in the further analysis are identical to the former repeated measures analyses of the data of Altenwerder and Alfstedt. The dependent variable is the ELD-category (two levels). The predictors that are tested against the dependent are *finality* of the stimulus (two levels), the *V duration* (three levels), the

[109] The four item sets do naturally not yield completely identical results with respect to the choices of the participants. An ANOVA with a post hoc test (Bonferroni) reveals that item set 4 differs from any of the remaining three item sets on a statistically highly significant level (item set 1: p = .015, C.I. 95% of the difference from .02 to .26; item set 2: p = .000, C.I. 95% of the difference from .07 to .28; item set 3: p = .000, C.I. 95% of the difference from .06 to .25). The item sets 1 through 3 do not differ significantly with p = 1.000, respectively.

pitch (three levels), the nature of the *coda C* (two levels), and the single *informants* (27 levels).

The cross-tabs calculation evinces that informant I.2.online has the most even distribution of choices (51.9% ELD 2-item, 48.1% ELD 3-item). She is therefore taken as reference value in the comparison of the informants. Informant I.2.online is in fact one of the two participants who indicated to have acquired LG as L1, and to use it actively. This defines her also from a purely methodological perspective as the best candidate for the reference value. For the analysis no further informants are excluded – even if their distribution of choices does not meet the $^1/_3$ boundary for one of the word-categories. The reason is that it can be assumed that basically all participants have a rather high degree of motivation (no group dynamics that might 'force' them to join the test). Also, it is unlikely for them to get exhausted or bored by the experiments due to the shortness of the tests. The illustration of the judgments as delivered by the individual informants is given in Figure 42 below. I provide the significance values and odds ratios in Table 79 of the appendix.

Figure 42. Total number of word choices as delivered by the on-line participants



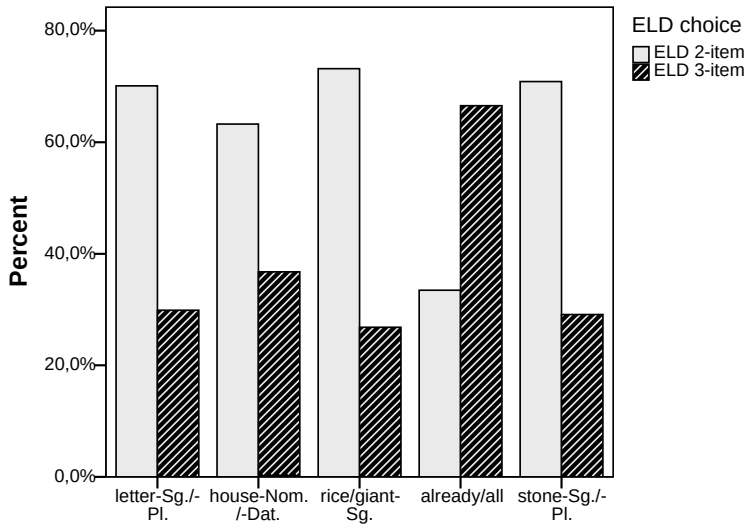
The crosstabs analysis of the answers as delivered for the single minimal pairs shows that the participants have a clear preference for the ELD 2-category (roughly $^2/_3$ of the choices) except for the item 'already / all'. This minimal pair has the opposite response values with $^1/_3$ ELD 2-category, and $^2/_3$ ELD 3-category. An illustration follows in Figure 43.

A logistic regression was performed on the data sample, producing the following results. Individual informants constitute the most important factors with respect to the choices obtained for the word-categories. The informants deviating the most from the reference values of informant I.2.online are calculated as being the most important. The analysis points out three more relevant variables.

The first is the *coda C*, or more precisely the presence of a coda obstruent. It has a highly significant effect on the choices ($p < .001$). If the coda is an obstruent (as compared to being a sonorant) the likelihood that the ELD 2-word is chosen by the participants is 2.2624 times bigger than choosing the ELD 3-word (Exp(B) = .442, C.I. 95% .343 to .570). This is the opposite of what we saw in the Alfs. data. It suggests that the younger LG informants of the on-line test perceive the pre-obstruent vowels as being generally shorter than the pre-sonorant vowels.

The second remaining relevant variable is *finality*. It does not quite reach chance level at 5% ($p = .055$). The trend is clear, however. In the case that an item is presented in non-final sentence context, it is more likely to obtain a choice for an ELD 3-item (Exp(B) = 1.973, C.I. 95% .985 to 3.953). The participants of the on-line test show, thus, the same sensitivity to the longer V durations of the non-final stimuli as the previously investigated groups of speakers.

Figure 43. On-line test word-choices in % of the total per category, dissected by word-category



The third remaining relevant variable is *V duration*. Both the overlong and the long *V duration* have again a highly significant effect on the judgments with $p < .001$ and $p = .002$, respectively. We find that the results of the preceding fieldwork listening experiments are mirrored in the responses of the younger LG speakers of the on-line experiment. The longer the vowel of the stimulus is, the more likely it is that the ELD 3-category is chosen. The overlong *V duration* yields an odds ratio of Exp(B) = 1.424 (C.I. 95% 1.194 to 1.698), while the long *V duration* gives Exp(B) = .746 (C.I. 95% .622 to .894).

The factor *pitch* does not contribute to the word-judgments. Its overall effect is far from reaching statistical significance ($p = .931$). The odds ratios for the two contours of TA1 and TA2 for choosing one word-category above the other equal

almost 1 (TA1 Exp(B) = 1.029, C.I. 95% .861 to 1.229; TA2 Exp(B) = .969, C.I. 95% .811 to 1.159). Obviously, the on-line participants do not rely in their perception on the differences in the artificial pitch contours. This is particularly familiar by now, for the interviews of the Aw. and Alfs. informants produce the same picture.

The overall result of the analysis of the on-line test is such that 67% of the choices are correct with comparison to the calculated model. 15.6% of the variance in the data is explainable by the employed factors.

3.6. *Conclusion*

3.6.1. *Production data*

The sections 3.2., 3.3, and 3.4 are concerned with the evaluation of the phonetic data collected in the villages of Kirchwerder, Altenwerder, and Alfstedt. Isolated sentences and words constitute the respective corpora, all being of declarative intonation. Two main questions were scrutinized. Firstly, are there stable durational contrasts between short vowels, long vowels, and hypothesized *overlong* vowels? Secondly, are distinct pitch contours observable for long vowels (*Stoßton*) as opposed to overlong vowels (*Schleifton*)? Interestingly, we find that all three dialects answer the questions more or less unanimously – informant III.6.Aw with her motherese-biased speech data being a rather exceptional case in some regards. She is especially interesting since her sample is full of phonetic clarifications and enhancements. So, if something like vocalic overlength or tonal contrasts are indeed available in the LG language system, these peculiarities can be presumed to surface in her data.

The focus of the speech recordings clearly was the elicitation of data concerning the vocalic nuclei in LG. The coda consonants were just the means to an end, and not the aim of the corpus compilation. Therefore, the samples are rather restricted with respect to the diversity of consonant qualities. Elaborate analyses on the contrast between fortis consonants and lenis consonants as conducted by Jessen (1998) for Standard High German were therefore not a viable option. Nevertheless, some preliminary analyses were carried out on the coda plosives, measuring the assumed acoustic correlates closure duration and aspiration duration (inclusive of the burst). The results are such that the informants of Kw. and Alfs. are found to not clearly distinguish between fortis codas and lenis codas by means of the acoustic correlates closure duration and aspiration duration (including the burst). Only slight tendencies are discernible. The Aw. informants show by comparison a more pronounced difference for both phonetic correlates. Their fortis codas have a shorter closure phase followed by a longer aspiration phase, while their lenis codas show the opposite distribution. Due to the rather high level of noise in the recordings, reliable measurements of voicing during the closure phase were not possible. The spectrograms and the auditory inspection did not yield a difference between lenis codas and fortis codas by means of vocal fold vibrations. Taking a short leap into phonology, these results indicate that the investigated LG dialects have no voicing

opposition in obstruents. If we nevertheless want to maintain a contrast that is based on phonetic correlates, we may assume a contrast in terms of aspiration instead, where fortis obstruents are aspirated and lenis obstruents are unaspirated.

The findings are, however, not conclusive. Further research on the matter of fortis *vs.* lenis in LG and its possible phonetic correlates (i.e. closure duration, aspiration duration, VOT, closure voicing, F0 onset, F1 onset, H1-H2 (first harmonic - second harmonic difference), preceding vowel duration, and following vowel duration) is definitely in order.

But let us for now move on to the summary of the vowel analysis, starting with the durational scrutiny.

3.6.1.1 V duration contrasts in Kirchwerder, Altenwerder, and Alfstedt

It was found for all (complete) samples that the three expected length degrees of the vowel system ELD 1 : ELD 2 : ELD 3 are kept statistically distinct. The ratios we reach are as follows.

Table 19. V duration ratios of the investigated LG dialects (complete samples)

Corpus	ELD 1	ELD 2	ELD 3
Kw.	1	1.59	1.93
Aw. group 1	1	1.74	2.18
Informant III.6.Aw	1	2.17	3.31
Alfs.	1	1.55	1.88
Mean[110]	1	1.74	2.29

If we consider Lehiste's (1970a:33f.) and Broselow et al.'s (1997:63) findings that in binary length systems in the languages of the world the ratio between short vowels and long vowels is roughly 1 : 2, we see that this upper limit is adhered to rather closely by the LG data (except for informant III.6.Aw). Our data clearly support the assumption made by Remijsen & Gilley (2008:340) that "the ratio between levels of vowel length decreases as we move from a two-level to a three-level system, and this is because the range remains the same."

The quality of the coda consonant has a crucial effect on the duration of the preceding V in all of the minimal pair samples. The ELDs are basically kept distinct in the pre-obstruent cases of the four investigated samples, whereas only the Aw. informants maintain the contrast also in pre-sonorant vowels. Within the Aw. informants, only III.6.Aw produces durational differences between ELD 2 and ELD 3 pre-sonorant vowels that lie above the JND. This restricted occurrence of perceptually relevant duration differences is rather interesting, because the sonorant consonants have been argued in the better part of the literature to allow for overlength in a preceding vowel (see section 2.3). Also, they were suspected to constitute overlong VR (vowel-sonorant) configurations, i.e. a long sonorant in connection with a preceding regularly long vowel. Overall, neither of the argued

[110] Without the outlier values of informant III.6.Aw. we obtain a ratio of 1 : 1.6 : 1.95.

overlong configurations involving a sonorant consonant was corroborated by the data. The VR context shows no statistical difference in vowel duration between the expected long length degree and overlong length degree in the data of all three LG dialects. A durational compensation by means of lengthening of the coda sonorant in comparison to the ELD 2 correspondent does not occur. The sonorant duration is kept relatively constant for ELD 2 and ELD 3. The assumption of overlength in the combinations of V and sonorant coda is thus not warranted by any of the analyzed samples. This is clearly different from the V and obstruent coda configurations.

Table 20. Mean duration ratio of the differences between ELD 2 / ELD 3 vocalic nuclei (paired sample, near-minimal pairs only)

Sample	jaw opening	ELD 3-ELD 2 ratio
Kw.	closed	1.162
	mid	1.398
	open	-
	mid-closed	1.092
	mid-mid	-
	open-closed	1.147
Aw. group 1	closed	1.323
	mid	1.183
	open	1.496
	mid-closed	1.084
	mid-mid	1.263
	open-closed	1.365
Informant III.6.Aw	closed	2.073
	mid	1.171
	open	-
	mid-closed	1.552
	mid-mid	1.660
	open-closed	-
Alfs.	closed	1.246
	mid	0.993
	open	1.232
	mid-closed	1.284
	mid-mid	-
	open-closed	1.080

Earlier investigations of Low German dialects in Niedersachsen and Schleswig-Holstein (Kohler 1986, 2001) revealed a possible ternary duration contrast only for the mid vowels /e, ø, o/. The according tests for the minimal pairs of the Kw. data, Aw. data, and Alfs. data do not corroborate those findings. While the minimal pair sample of Kw. shows distinct length degrees differing above the JND exclusively for

the mid vowels, the Aw. recordings as well as the Alfs. recordings show a durational merger between ELD 2 and ELD 3 of the mid vowels. Instead, it is in these samples that the closed vowels /i, y, u/ are produced with a clearly noticeable durational difference for the length categories long and overlong. Due to the small sample sizes, only a trend towards the distinction is discernible for the open vowel /ɑ/.

The diphthongs show a comparatively mixed picture. None of these vocoid qualities differ at a perceptually relevant level between ELD 2 and ELD 3 in the Kw. minimal pairs. The Alfs. pairs show a difference above the JND only for the mid-closed vowels.[111] The open-closed diphthongs like [ɑi] differ only in the Aw. group 1 minimal pairs – though this finding does not have any actual descriptive power due to the small sample size (*df* = 2). The mid-mid diphthongs (i.e. [ɛo]) differ for both samples of Aw. above the perceptual threshold; for informant III.6.Aw this finding is again compromised by the small number of tokens (*df* = 1). The mid-closed diphthongs such as [ɛi] are produced with a profound durational difference only by informant III.6.Aw. The according measurements for the Alfs. sample are once more biased by the sample size (*df* = 2) and do therefore not lend support for or against the influence of the jaw opening on the durational difference between ELD 2 and ELD 3.

This is a rather varied result. What we may nevertheless conclude is that the contrast long : overlong is a phonetic reality at least for the Low German dialect of Aw. as produced by the informants – even though the contrast is not conclusively verified to cover all vocalic qualities present in the minimal pairs. The durational difference between ELD 2 and ELD 3 is, however, likely to be present also in the other two samples of Kw. and Alfs.[112]

Besides the purely segmental interactions with vowel length, also the position of a word in the utterance can contribute to durational variations. We found for the Kw. data that the vowel durations of ELD 2 and ELD 3 are distinct only in pre-obstruent position of the final sentence context. The contrast does not reach significance in

[111] Note that it is also here where we found a rather huge C.I. resulting partly from the small number of items (i.e. three stimuli).

[112] If we look at the *complete* samples (as compared to the paired samples), we find that the conservative JND of 20 to 25% of durational difference is met and vastly exceeded in basically all monophthongal cases of the investigated speech samples, except in the mid vowels. The according duration ratios are as follows:

Sample	jaw opening	ELD 3-ELD 2 ratio
Kw.	closed	1.3107
	mid	1.2933
	open	-
Aw. group 1	closed	1.4099
	mid	1.0777
	open	1.4194
Informant III.6.Aw	closed	1.8668
	mid	1.13999
	open	1.8463
Alfs.	closed	1.2773
	mid	1.0904
	open	1.4168

utterance-medial position. This influence of the sentence context is not repeated in the samples of Aw. group 1, informant III.6.Aw, and Alfs. Non-final items and final items differ durationally between the two ELDs. A rather unexpected finding is made within the individual length degrees. The well-known Germanic phenomenon of utterance-final lengthening has been thought to possibly enhance durations of sentence-final tokens (Kohler 2002:388). The vowel durations of the stimuli of the four samples where therefore examined with respect to the sentence context they occurred in. Two positions where possible: sentence-medial (post-)focal, and sentence-final (post-)focal. All stimuli were produced in declarative intonation. Intriguingly, it is found for all samples that no significant final lengthening occurs at all. The Kw. data as well as the Alfs. data exhibits a rather slight trend towards vowel lengthening in final position of one of the length degrees (i.e. in ELD 3 in Kw., and in ELD 2 in Alfs.). The corpora of Aw. group 1 and informant III.6.Aw lean towards the opposite direction. The vowel durations of both ELD 2 and ELD 3 indicate rather a process of non-final lengthening (or final shortening). The contrast of long *vs.* overlong is, however, maintained at all times.[113]

3.6.1.2 F0 contours of Kirchwerder, Altenwerder, and Alfstedt

While Kohler (2001) postulates that the long vowels and the overlong vowels of LG are basically identical with respect to pitch movement, other authors assume the presence of a tonal contrast (Höder 2003; Olthoff 2005; Prehn 2007; Ternes 2001, 2006). The postulated pitch contours of the opposition are falling (i.e. TA1 of the long vowels), and level-falling or complex-falling (i.e. TA2 of the overlong vowels). The TA1 would accordingly have an early high tone H; the pitch peak would by contrast align later in TA2 items. The present analysis of the LG dialects of Kirchwerder, Altenwerder, and Alfstedt points rather in the direction of Kohler's findings. The exception is here informant III.6.Aw who appears to produce distinct tonal movements – though these findings are obtained in the complete sample and are not verified by the comparison of the minimal pairs.

First of all, the data is itemized by the sentence position of each stimulus since it is expected that in domain-final position a low boundary tone L_i affects the alignment of the pitch peak on the nuclear vowel. The division of the samples aims at excluding this possible impact and an accordingly biased outcome.

The comparison of the H positions in ELD 2 *vs.* ELD 3 vowels yields no alignment difference for Kw., Aw. group 1, and Alfs. Basically, the non-final contours do not differ among each other, which is also true for the final contours. The expected difference between non-final and final curves manifests in the generally more level appearance of the former as compared to the strictly falling structure of the utterance-final pitch movements. The presence of the L_i is thereby corroborated.

But as I mentioned before, we have one heretic in the production of the pitch

[113] The supplementary query of six bisyllabic items with ELD 3 and two accordingly bisyllabic items with ELD 2 vowels or diphthongs from informant III.6.Aw points towards the presence of the contrast also in polysyllabic words (see FN 3).

contours. Informant III.6.Aw with her motherese pronunciation of LG generates alignment differences of the H for long *vs.* overlong vowels. This is not attributed to the boundary tone, for its presence is equally visible in the utterance-final contours of both length degrees. The difference is such that the pitch peaks occur later in long vowels, and earlier in overlong vowels. The general appearance of the curves is in fact reversed to the assumptions made in the literature. The F0 contours of the long vowels are rather level with little overall movement; the F0 contours of the overlong vowels are by comparison distinctly falling in both final and non-final sentence context. The difference in pitch peak location is, however, found to be not significant in the minimal pairs. We may tentatively assume that some sort of tonal contrast might have been available in the language system and is now being neutralized. None of the other LG samples shows an according contrast. We can, thus, say at this point that no tonal distinction exists for the investigated LG informants. It might be the case that the speech of informant III.6.Aw hints on an older, dated version of Aw. LG, and that distinct pitch contours for ELD 2 *vs.* ELD 3 are *no longer* produced by the other speakers. The perception test carried out for the dialects of Altenwerder and Alfstedt will help to decide on this matter. It will show what the informants do with the phonetic information, i.e. if they are able to perceive tonal contrasts even though they do not produce them (anymore).

In sum, the first obstacle is overcome on our way to establishing whether the LG dialects are contrastive for vowel length, or rather for tonal accents. The opposition that appears to be most likely at this point is in fact the quantitative one. We need to bear in mind, though, that short vowels are preferably produced with a lax quality, whereas long vowels and overlong vowels alike only come in tense quality. A combination of quantitative and qualitative contrast is therefore equally probable for the dialects.

3.6.2. *Perception Test*

Perception data from informants speaking the LG dialects of Altenwerder, and of Alfstedt, as well as from younger adults speaking LG and coming from Niedersachsen, Bremen, Mecklenburg-Vorpommern or northern Nordrhein-Westfalen were elicited in listening experiments. In all samples we find rather high speaker-dependent effects. They may relate to factors such as the motivation of the individual informant, the mood, the ability to cope with the testing situation, the linguistic knowledge, or the hearing abilities. These speaker-dependent variables are not accounted for and left out of the analysis.

Besides the informants, mainly two meaningful factors are obtained: *V duration* and *finality*; the latter one relating to the former one due to the greater vowel duration found in non-final items especially of Altenwerder LG. The differences in vowel duration established in the production analysis for the expected length degrees 2 and 3 (i.e. long vowels and overlong vowels) thus appear to have a functional load for the informants. This is in fact not too surprising since in all but the cases with mid vowels the conservative JND of 20-25% of durational increase is

exceeded in the recordings. The perceptibility of the difference was, thus, particularly likely.

A further perceptual cue for the Aw. informants as well as the participants of the on-line test appears to be the *coda C* (obstruent C *vs.* sonorant C). Words with final obstruent are preferably categorized as ELD 2-item in Aw. (though the trend is only weakly manifested) and as ELD 3-item in Alfs. Sonorant codas do not yield the opposite results, but rather evenly distributed choices for both length categories. For Aw., the results may relate to the perception of *V duration* since vowels in pre-sonorant position are usually perceived longer than in pre-obstruent position. Also, the quality of the manipulated stimulus may have an influence on the choices. The responses are rather inconclusive and for the whole set of Aw. perception data not significant. A full-fletched effect of the coda consonant on the choices is in any case not obtained. Turning to the Alfs. data, the reason for the different classification of vowel-sonorant-items as compared to vowel-obstruent-items is quite probably that – as several informants stated – no clear-cut difference exists between ELD 2 and ELD 3 for words ending in sonorant consonant in this dialect. So, no preference for either of the two length categories was to be expected – which is obviously also corroborated by the data.

The artificial pitch contours never conspicuously constitute relevant predictors for the responses. This is also true for the answers delivered by informant III.6.Aw. She produced in the recordings the only – rather vague – cues for distinct pitch contours for ELD 2-items *vs.* ELD 3-items. The perception data does, however, not indicate a corresponding differentiation between the speech items. It can be concluded that in the LG dialects of Altenwerder and Alfstedt, as well as the LG of younger adults from the LG area, the indicated pitch contours do not at all play a role in the perception and distinction of the given minimal pairs. The assumption of tonal accents (TA1 and TA2) is not vindicated by the data. Rather, it is the vowel duration that allows for a differentiation between ELD 2-items and ELD 3-items. The phonetic overlength seems to be reality not only in the production but also in the perception of the investigated LG informants.

After this rather detailed phonetic investigation, I change the perspective to the phonological analysis of the LG stress pattern. It is especially interesting because of its indications for LG syllable weight and for the representation of segmental weight. In fact, the word stress system may hint on the moraic status of the phonetically overlong vowels of Kirchwerder, Altenwerder, and Alfstedt.

4. Low German stress

The previous chapter dealt extensively with the production and perception data elicited from the LG research area. We now move on to the description of the phonological correlate of phonetic prominence, and investigate the structure of main stressed feet in LG.[114] Compound and phrasal stress is not considered in the analysis, and secondary stress only where necessary. The LG stress system is worth noting since it allows us to draw first conclusions with regards to weight distinctions within the language system.

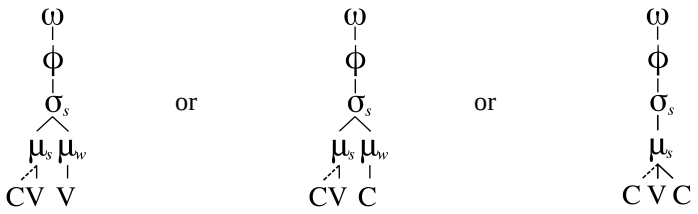
I am assuming here the general violability of the Strict Layer Hypothesis (SLH), i.e. *weak layering*. Thus, each element of the prosodic hierarchy mentioned in section 2.1 and slightly simplified in Figure 44 does not have to be dominated by an element at the immediately following higher level of the hierarchy.[115]

Figure 44.

PrWd	ω
Foot	ϕ
Syllable	σ
Mora	μ
Segment	Σ

An effect of this weak layering is that e.g. syllables do not necessarily have to be footed, and segments may be extrasyllabic. The basic prosodic structure of a PrWd if strictly following the SLH can be exemplified as follows.[116]

Figure 45.



[114] The term 'stress' is used here in the sense of Hayes (1995:8), i.e. as "the linguistic manifestation of rhythmic structure. That is, in stress languages, every utterance has a rhythmic structure which serves as an *organizing framework* for that utterance's phonological and phonetic realization." Possible phonetic correlates of stress are duration, intensity, loudness, pitch or clarity (Apoussidou 2007:10, FN 8).

[115] The prosodic hierarchy has been proposed among others by Selkirk (1984, 1995), Nespor & Vogel (1986), McCarthy & Prince (1995a).

[116] The subscript *s* and *w* mark strong and weak syllables or parts of syllables, respectively. I adopt Hyman's (1985) approach of associating onsets to the (strong) head-mora of the succeeding nucleus. The main argument for such a structure is that onsets are not able to trigger CL (compensatory lengthening) in LG and therefore need to be represented differently from codas (but see Kavitskaya 2002 on onset-CL in Samothraki Greek).

These tree structures are relevant with regard to word stress insofar as the branchingness of the syllable determines the syllable weight and thus the stress assignment. This effectively means that the more morae are attached to a syllable, the more likely it is to attract stress. The syllable weight ultimately points to the weight of vocalic and consonantal segments, i.e. their moraic status.

I argue that the LG primary word stress patterns similar to Dutch and Standard German primary stress. The foot structure is a generalized trochee as defined by Hayes (1991, 1995). The foot is preferably bisyllabic, else bimoraic (i.e. **L**L or **H**).[117] Stress in LG is assigned within the 'three syllable window'. This means that the stressed syllable must be one of the three last syllables in a PrWd. Within this window, stress occurs according to the language-specific stress pattern. The findings for LG are such that superheavy syllables (i.e. syllables with more than two positions) receive stress even in final position. If the final syllable is not heavy at the surface level, trochaic stress is assigned generally to the rightmost non-final heavy syllable or else to the rightmost non-final sequence of two light syllables. Syllables containing a schwa in the nucleus remain unstressed at all times. Stress in loanwords differs from this pattern by means of lexically pre-determined stress markings. To develop this stress system, the subsequent discussion of primary word stress crucially revolves around the following syllable types:

i) non-final stress in CV.CVC.CVC / CVC.CV.CVC / CVC.CVC.CVC,
ii) final stress in CV.CVVC / CV.CVCC,
iii) non-final stress in CV.CəC,
iv) deviant loanword stress.

The structural (metrical) constraints called on within the following analysis refer to the phonological *surface form*. This term applies to "the discrete representation of the phonological surface structure and consists of prosodic elements (feet, syllables, segments) and phonological substance (features, autosegments)" (Boersma 2007a:2). This is basically the output of the grammar and is generated by the interaction of markedness constraints, faithfulness constraints and metrical constraints. The accordingly produced prosodic elements such as feet (i.e. hidden structures that contain one stressed syllable) are required to determine e.g. the stress assignment in a number of languages.[118]

The stress system provides evidence for the specific syllable weight of CVC syllables, CV syllables, CV_1V_1C syllables and CVCC syllables in LG. In the following sections I show that they count as being heavy, light, heavy and heavy, respectively.

[117] With L representing in this connection a light syllable, and H representing a heavy syllable. The head of the foot (i.e. stress) is marked by bold face. Note that the mora is a unit of syllable weight and thus relates to phonological structure. However, it is not necessarily directly reflected on the overt phonetic level (e.g. in the actual duration of a sound).
[118] Apoussidou (2007:14).

4.1. *Polysyllabic stress in LG*

The Low German Grammar by Lindow et al. (1998:30) states that LG stress is generally assigned to the initial syllable of a word. Table 21 shows examples of such stressing.[119] The prominent initial syllable in these cases is a closed syllable with a short lax vowel. The presented pattern is such that rather than stressing a final CVC or CV, the penultimate CVC receives prominence.[120] This is especially interesting since it is not immediately evident why final CVC syllables should be less stress-attracting than non-final CVCs. Both can contain a monomoraic lax vowel with a succeeding, equally monomoraic C. Moraic onsets do not exist in LG, which is why heavy syllables are automatically maximally bimoraic.[121]

Table 21. Word-initial stress in LG

(a)	**CVC**.CV		(b)	**CVC**.CVC	
	'daughter-Sg.'	[ˈdɔxta]		'very'	[ˈbannɪç]
	'altar-Sg.'	[ˈʔaltɑ]		'breathless'	[ˈdampɪç]
	'coffee-Sg.'[122]	[ˈkaffə]		'carnival-Sg.'	[ˈfaslam]
				'work-Sg.'	[ˈʔɔɐbid]
				'bottle-Sg.'	[ˈbʊddəl]

I argue in the following section that the main stress pattern in LG polysyllables is not initial stress, but rather C**V**C.CV.CV(C) *vs.* CVC.C**V**C.CV(C), where the bold face marks the stressed syllable nucleus. The vowel of the closed non-final CVC syllables may only be lax. The open syllables CV may contain either a tense vowel (traditionally interpreted as being *long*)[123] or a diphthong and count indeed as light with respect to syllable weight.

4.1.1. *Non-final stress*

The traditional Dutch and Standard German approaches assign a bimoraic status to open syllables and, thus, to tense (long) vowels. This is based on the observation that

[119] The main part of the data is taken from Lindow (1984) and Niekerken (1935). A broad transcription is added in square brackets. A description of the LG vowel system and the LG consonant system follows in chapters 5 and 6, respectively.

[120] Trisyllabic cases like [ˈsviːˌnegəl] 'hedgehog-Sg.' with initial stress are old compounds. This example consists of *Swin* 'pig' and *Egel* 'hedgehog' documented already in MLG as *swînigel* (Lübben 1965). The syllable boundaries as defined by LG informants seem to indicate that the word is on the verge to lose its compound status in its contemporary form.

[121] I argue below in section 4.1.4 that CVVC syllables with a tense bimoraic vowel do not count as trimoraic (superheavy) in LG. The final C has no mora in these cases.

[122] The discussion of ambisyllabicity in Germanic languages is a long standing one. It is a classical chicken-egg-question. What determines what? Does the lax vowel quality demand ambisyllabic behavior of a succeeding C, or does the ambisyllabicity of the C necessitate laxness of a preceding V? The ambisyllabicity of fortis Cs like [f] in polysyllables such as 'coffee-Sg.' is not *per se* phonetically determined. I rather assume that it is structurally required by the preceding lax V. This structure becomes evident if not a homorganic structural geminate follows the lax vowel, but a hetero-organic cluster, e.g. 'to galumph-Inf.' [klɑˈbastɐn], or 'satchel-Nom.Sg.' [tɔɐˈnʏstɐ].

[123] Note that tense vowels are produced phonetically shorter in pre-stress position than in stressed / post-stress position where they tend to receive long duration.

tense vowels behave generally differently from the lax vowels in not requiring a coda C to close the syllable. They create a branching nucleus by occupying two segmental slots and/or two moraic positions. Yet, is this really true? If we look at the polysyllabic forms in Table 22 (a) to (f), this interpretation becomes shaky. The main stressed syllable is in all of the cases CVC, even if a non-final CV syllable is available.

Table 22. CVC stress in LG[124]

(a)	CV.**CVC**.CV	
	‘porch-Sg.’	[veˈrandɑ]
	‘headmaster-Sg.’	[diˈrɛkta]
	‘calender-Sg.’	[kɑˈlɛnna]
	‘alabaster marble-Sg.’	[rɑˈbalsta]
	‘butterfly-Sg.’	[fiˈlappa]
	‘orange-Sg.’	[ʔoˈraŋʒə]
	‘plight-Sg.’	[beˈdrʊljə]
	‘inconvenience-Sg.’	[mɑˈlɛʃʃə]
(b)	CV.**CVC**.CəC	
	‘mess-Sg.’	[ʃlɑˈmassəl]
	‘potatoe-Sg.’	[kɑˈtʊffəl]
	‘chapter-Sg.’	[kɑˈpɪttəl]
	‘coattail-Sg.’	[ʃlɑˈfɪtçən]
	‘trouble-Sg.’	[mɑˈtɛntən]
	‘rabbit-Sg.’	[kɑˈnɪŋkən]
(c)	CVC.**CVC**.CV[126]	
	‘Valhalla’	[valˈhallɑ]
	‘chinchilla-Sg.’	[tʃɪnˈtʃɪllɑ]
	‘confetti’	[kɔnˈfɛtti]
	‘espresso-Sg.	[ʔɛsˈprɛsso]
	‘female name’	[katˈtɪŋka]
(d)	CVC.**CVC**.CVC[125]	
	‘boat cover-Sg.’	[pɛɐˈzɛnnɪŋ]
	‘slipper-Sg.’	[panˈtʊffəl]
	‘juniper-Sg.’	[mɑxˈxaŋŋəl]
	‘september’	[zɛpˈtɛmba]
	‘inspector-Sg.’	[ʔɪnˈspɛkta]
	‘satchel-Sg.’	[tɔɐˈnʏsta]
(e)	**CVC**.CV.CV	
	‘eskimo’	[ˈʔɛskimoʊ]
	‘tombola-Sg.’	[ˈtɔmbolɑ]
	‘bungalow-Sg.’	[ˈbʊŋgɑloʊ]
(f)	**CVC**.CV.CVC	
	‘albatross-Sg.’	[ˈʔalbɑtrɔs]
	‘alcohol-Sg.’	[ˈʔalkohol]
	‘calcium-Sg.’	[ˈkaltsijʊm]
	‘lexicon-Sg.’	[ˈlɛksikɔn]
	‘nightingale-Sg.’	[ˈnaxtigal]
	‘alcove-Sg.’	[ˈʔalkoβən]

The examples in (a) and (b) show penultimate stress on a CVC syllable. In both cases, stressing the CVC is preferred above stressing an open syllable in initial position or in final position.[127]

[124] CV(C).**CV**.CVC words like [ʒəˈnɛiva] ‘juniper schnapps-Sg.’ and [katˈtaɪka] ‘squirrel-Sg.’ (with overt complete r-vocalization in the ultima) have the structure L(**L**L)<C>. Stressing the diphthong does in these cases not allude to heavy weight. The diphthongs are analyzed in a similar manner as Icelandic short and long diphthongs (Lass 1984). We essentially find phonetically normally long monomoraic diphthongs *vs.* phonetically overlong bimoraic diphthongs (more on the diphthongs in section 5.1.2).

[125] But: ‘darkness’ [ˈdʏstɛɐnɪs]. The suffix *-nis* is invisible to stress assignment like most LG suffixes. Word stress is therefore realized according to the stress pattern of the original adjective [ˈdʏstɛɐ] ‘dusky’ on the initial syllable.

[126] Note that most of these words show stressed CVC syllables only under the assumption of phonological ambisyllabicity (Wofgang Kehrein p.c.).

The tokens of (c) and (d) also exhibit penultimate stress. The decision is here made between the closed initial syllable and the closed penultimate syllable. The final syllable again plays no role with respect to stress assignment. Its status as a CVC syllable or a CV syllable appears to be irrelevant in this connection. Additionally, there appears to be no distinction between closed finals containing a full vowel (e.g. [pɛɐˈzɛnnɪŋ] 'boat cover-Sg.') *vs.* closed finals containing a schwa in the nucleus (e.g. [panˈtʊffəl] 'slipper-Sg.'). They are unstressed in either of the two cases.

The examples given in (e) and (f) bear stress on the rightmost non-final CVC syllable, i.e. the antepenult. The penult is in both word groups CV. The final syllable appears to have no influence on the stress placement like in the examples (a) to (d). Again, the vowel quality of the final syllable is irrelevant with respect to syllable weight.

All items presented in Table 21 and Table 22 have in common that the final syllable is ignored by stress regardless of whether it is (C)V, (C)VC or CəC. Adding inflectional morphemes at the right word edge (e.g. [pɛɐˈzɛnnɪŋs] 'boat cover-Pl.', [kɑˈtʊffəls] 'potatoes-Pl., [ˈfaslams] 'carnival-Pl.') does not yield any difference in stress assignment.

A further similarity between the examples given in Table 22 is that in all cases stress emerges on the non-final CVC syllable independent of the structure of the ultima. If ultima and penultima are CVC as in (d), penultimate stress wins. The generalization is here that the first CVC syllable from the right receives stress to the exclusion of the final syllable (extrametricality). The items given in (a), (b), (e) and (f) additionally show that LG CVC syllables are more likely to attract stress than CV syllables. If the penult is CVC and the antepenult CV, stress occurs on the former; if the penult is CV and the antepenult is CVC, stress surfaces on the latter. The CV syllables, thus, appear to not attract stress, whereas the CVCs do. This leads to the conclusion that non-final (C)VC in LG is heavier than non-final (C)V. We can therefore assume that (C)VC syllables are generally bimoraic, and (C)V syllables are generally monomoraic, if occurring in non-final position within a PrWd. This is crucially different from the traditional approach of a bimoraic status of such open syllables, and, thus, a bimoraic status of the phonetically long tense vowels.

The examples given above demonstrate that LG primary stress – just like Dutch or Standard German primary stress – is introduced from the right edge of the word. So far, we may assume that the domain-final syllable is ignored by stress if it is CV, CəC or CVC. The weight distinction light *vs.* heavy fails to apply in this position.

[127] The items in Table 22 (b) show one peculiarity. All of them have a schwa in the final CVC syllable. One could assume on the basis of such items that schwa never receives stress in LG and that this is the reason for stress to fall on the penult – an observation also made for Standard German (Féry 1996, Wiese 1996), and Dutch (van Oostendorp 1995, besides many others). This could also be valid for the assignment of secondary stress in items like [ˈʔalkoβən] 'alkove-Sg.' of Table 22 (f) that receive secondary stress on the penult instead of the ultima. The behavior of schwa could be expressed in terms of the markedness constraint NON-HEAD(ə): Schwa cannot appear in the head of a foot (Cohn & McCarthy 1998). The constraint, however, does not crucially affect the stress pattern of the polysyllables given in Table 22. Even the cases with a full vowel in the final CVC syllable do not receive utlimate stress. It is therefore not necessary to employ NON-HEAD(ə) for the purposes of this thesis.

All three syllable types are skipped.[128] The presence of a schwa as compared to a full vowel in the nucleus of the final syllable does not yield a difference.

The penult ultimately decides on the stress placement. Stress on the initial syllable is only allowed if the penult is light. Otherwise, stress surfaces on the penultimate syllable. The overall stress pattern appears to be trochaic and sensitive to syllable weight.

There are exceptions to this pattern; namely words ending in superheavy syllables, and loanwords. The analyses of these items follow in section 4.1.4 and section 4.3.

4.1.2. *Constraints on LG word stress*

In this sub-section I develop the ranking of the structural constraints involved in the metrical phenomena of LG. The primary word stress illustrated above is predictable by means of syllable weight of the penult. LG – much like Dutch – is characterized by a strong tendency to avoid stress assignment to the final syllable. The ultima might be thought of as being invisible to stress. This is not entirely true as will become clear in connection with the superheavy final syllables, though (see Table 23 on page 142). The final position is just prosodically *weak*. A way to express this is the constraint schema of WEAKEDGE (P-CAT).[129]

I) WEAKEDGE (P-CAT): The right edge of a P-CAT should be empty (Spaelti 2002:10).

Emptiness in the sense of Spaelti (2002) refers to having the least amount of prosodic structure that is possible in a certain position in a PrWd. The respective position can be described as structurally weak, one effect being a preference of configurations that are equally low on structure.[130] For Spaelti (2002:31), WEAKEDGE enforces extrametrical behavior of word-final constituents (prosodic categories). He postulates the following definition of the right word edge as a prerequisite to formulate WEAKEDGE (Spaelti 2002:10): "Def: the Right Periphery of node *n* is the set of all nodes *m* such that *n* dominates *m*, and there is no node *m*' such that n dominates *m*', and *m* precedes *m*'." Spaelti uses the terms 'right edge' and 'right periphery' synonymously.

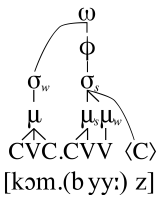
Constraint I) as intended by Spaelti (2002) can be seen as a conflation of a bundle of wellformedness constraints aiming at specific prosodic categories of the prosodic hierarchy, i.e. the foot level, the syllable level, the mora level etc. The target of this constraint family is always the right edge of the PrWd. Spaelti employs a constraint WEAKEDGE (PrWd) to ensure consonant *extrasyllabicity* (not *extrametricality* as he notes) in word-final closed syllables. It is assumed to render a word-final C non-moraic, unsyllabified and unfooted. Only the association to the

[128] See Youssef (2004) on Cairene Arabic.
[129] P-CAT denotes any prosodic category of the prosodic hierarchy mentioned in section 2.1. Spaelti (2002:10) states that "specific constraints can be obtained by providing a specific prosodic category for the argument P-CAT."
[130] See chapter 6.2.2.

PrWd-node remains. I will explain the difference between extrametricality and extrasyllabicity more elaborately below.

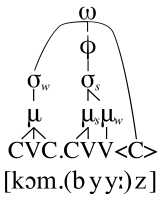
In the context of this thesis, 'Extrametricality' denotes the skipping of the subsequent level in the prosodic hierarchy and associating e.g. segments directly to the syllable instead of associating them to morae. Extrametrical consonants may still be syllabified and footed (also in an extrametrical foot), though they are not moraic. Such a structure is illustrated in Figure 46 [kɔmˈbyyːz] 'caboose-Sg.' of Table 23 (c). We observe that the final [z] is linked to the syllable without being connected to a mora.[131] All other segments are exhaustively parsed by morae. We may therefore say that the final extrametrical ⟨C⟩ is at best 'partially empty' for being non-moraic while at the same time being connected to syllable structure and foot structure. It is not 'empty' in the sense of Spaelti (2002). In effect, WEAKEDGE (PrWd) would be violated by the structure in Figure 46.

Figure 46



'Extrasyllabicity' by comparison means parsing segmental or moraic content neither into the syllable nor into the foot (Hayes 1995:106f.; Watson 2002:92f.). Extrasyllabic consonants are associated directly to the PrWd-node and exist therefore at the very periphery of the PrWd.[132] They are truly 'empty' in the sense of Spaelti (2002). Figure 47 [kɔmˈbyyːz] 'caboose-Sg.' demonstrates such a structure of the final [z]. The preceding (CVV) sequence is properly syllabified and footed. An additional property of the extrasyllabic final <C> is that it does not permit foot extrametricality. This finding is based on the peripherality condition on extrametricality introduced by Hayes (1981) and formulated as follows by Hayes (1995:57): "A constituent may be extrametrical only if it is at a designated edge (left or right) of its domain."

Figure 47



The foot (CVV) in Figure 47 is not located at the right edge of the PrWd and is therefore not peripheral. Considering Hayes' (1981) peripherality condition, the foot

[131] The bracketing denotes the following: ⟨ ⟩ mark extrametrical structure that does not adhere to the prosodic hierarchy, < > mark segmental content that is extrasyllabic, i.e. associates directly to the PrWd-node, ( ) mark footing, [ ] mark the phonetic output. ' .' indicates a syllable boundary.

[132] Another possibility is to assume a degenerate syllable containing the final C (Kager 1995:376).

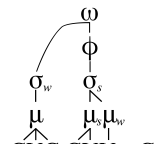
may not be extrametrical.[133] The extrasyllabic final <C> occupies the right word edge, a position that now contains the least possible amount of prosodic structure. The structure in Figure 47 is consequently most harmonic with respect to WEAKEDGE (PrWd). An interesting property further discussed in 6.2.2 is that extrasyllabic final consonants open up the possibility of tense vowel lengthening in the syllable preceding the extrasyllabic segment (Spaelti 2002:9, 15).

Spaelti asserts that the WEAKEDGE-family crucially refers to *prosodic* structure (Spaelti 2002:11). Unparsed elements (e.g. syllables, morae), i.e. elements that are not associated to any prosodic node, are invisible to prosody. A final segment that is not even parsed into the PrWd-node (ω-node) does not structurally belong to the PrWd and hence the prosodic structure. Idsardi (1998:52), referring to the principle of containment introduced by Prince & Smolensky (1993/2002), notes that the

> "idea is that in order to be pronounced, a node or segment must be linked into higher prosodic structure (parsed). Any unparsed material is left unpronounced and then does not appear phonetically."

Such unparsing of a segment is illustrated in Figure 48 where the final [z] remains entirely unassociated to prosodic structure and is therefore excluded from the phonetic realization. It does not constitute the right edge of the PrWd – this position is occupied by the (CVV) sequence, which is exhaustively parsed by prosodic structure. Figure 48 does therefore not satisfy WEAKEDGE (PrWd).[134]

Figure 48



The notion of weak right word edges is intuitively quite appealing for LG, especially when we think of phenomena such as final devoicing, vowel reduction or deletion. Another possibility would be, however, to assume instead of WEAKEDGE (PrWd) the constraint NONFINALITY.

II) NONFINALITY: No head of PrWd is final in PrWd.[135]

This constraint is as Spaelti (2002:10) notes "essentially the statement of an observation".[136] Relevant to my analysis are the different notions of the two

[133] Hayes (1995:107) additionally states that "extrametricality does not chain; i.e., a constituent followed by an extrametrical constituent is not counted as peripheral."
[134] In fact, none of the possible WEAKEDGE constraints referring to the prosodic hierarchy is satisfied by unparsing the final C.
[135] See among many others Prince & Smolensky 1993; Hung 1994; Kager 1995.
[136] He also postulates in his discussion of the dialect of Glarnertüütsch that "NONFINALITY can be seen to be a special case of WEAKEDGE" (Spaelti 2002:10).

constraints. NONFINALITY focuses on the position of stressed feet without making any (direct or indirect) reference towards a possibly different behavior of qualitatively differing final segments or towards the characteristics of word edges. WEAKEDGE (PrWd) defines by comparison the properties of word edges as preferring to be structurally low equipped. With this, the latter constraint refers not only to feet or syllables but also to segments occurring at word edges. Differences in the structure of these segments, be it in the prosodic structure or in the laryngeal structure, are recognized. This means that an extrasyllabic segment is preferred over an extrametrical or exhaustively parsed segment, and that this extrasyllabic segment should contain the least amount of laryngeal structure. I will argue later in chapter 6.2.2 that lenis consonants have indeed less laryngeal structure than fortis consonants and sonorant consonants in LG. Output forms having an extrasyllabic lenis consonant in word-final position are therefore the most harmonic with respect to WEAKEDGE (PrWd). Even stronger, we will see that extrasyllabicity of the final C may be prohibited by fortis Cs and sonorant Cs in section 4.1.4 and in the discussion of LG vowels and consonants in chapters 5 and 6.[137] I will argue that these consonants are inherently moraic and contain laryngeally complex structure, thus not being able to satisfy WEAKEDGE (PrWd) neither on the prosodic level nor on the laryngeal level.

Summing up, the constraint NONFINALITY is, though independently attested for several languages, not best suited to describe LG edge constituents. I therefore stick with Spaelti's (2002) more general concept of weak word edges.

The rather broad scope of WEAKEDGE (PrWd) is somewhat disadvantageous, though. The constraint aims at banishing *all* structures from occurring at the word edge. It so happens, however, that there are words in LG that end in an open CV syllable (e.g. [ˈkaffə] 'coffee-Sg.'). Without a final C, it is not possible to assume an extrasyllabic status of the final segment here because only consonants can occur outside of a syllable. We thus find that the final syllable may be in these cases extrametrical at best. WEAKEDGE (PrWd) is too strong a claim for LG. I therefore rephrase the constraint WEAKEDGE (PrWd) as III) WEAKEDGE (ω,ϕ) (subsequently termed WEAKEDGE).

III) WEAKEDGE (ω, ϕ): The right edge of a PrWd should contain no foot.

This constraint is similar to NONFINALITY; only the notion of weak word edges is added to it. By means of rephrased WEAKEDGE, erecting a metrical foot in word-final position is essentially prohibited. If syllabic content (or a single segment) is parsed, i.e. footed, at the right word edge this constraint is violated. I agree with Youssef's (2004:7) interpretation that the parsing of segmental structure only into the ω-node, as seen in Figure 47, inflicts no violation of WEAKEDGE. This is different from Spaelti (2002:11f.) who assumes that extrasyllabic configurations

[137] LG actually constitutes a kind of language not considered in Hayes' (1995) extensive work on metrical stress patterns in the languages of the world: a language where the quality of the consonant contributes to its specific weight.

cause one violation of WEAKEDGE.[138] The reason why I am diverting from Spaelti's assumption is that it is necessary to associate a segment to the ω-node in order to ensure its phonetic realization; leaving a segment completely unparsed means leaving it unpronounced. Extrametrical, i.e. partially empty segments, as shown in Figure 46, do not satisfy WEAKEDGE because they are parsed not only into the ω-node but also into the ϕ-node or the σ-node. They employ more prosodic structure than extrasyllabic segments.

The final syllable may, however, resist under certain circumstances the pressure to become extrametrical, i.e. it may be footed. The conditions are as follows:

IV) The final syllable is 'superheavy', i.e. ternary at some level of representation (segment).[139]
V) The PrWd is maximally mono-syllabic.

Crucial to my analysis is the following claim.

> Only if one of the conditions in IV) or V) is satisfied, the final C is targeted by WEAKEDGE and strict prosodic layering (Selkirk 1984, 1995; Nespor & Vogel 1986; etc.) may be violated.[140]

The weight condition in IV) relies essentially on the undominated SUPERHEAVY-TO-STRESS PRINCIPLE (SHSP) that is part of GEN:

VI) SUPERHEAVY-TO-STRESS PRINCIPLE (SHSP): Superheavy syllables are stressed (van Oostendorp 2002:212; Gussenhoven 2009:193).[141]

These hypercharacterized syllables are well-known to occur across languages (e.g. Germanic languages, Hungarian, Estonian, Arabic, Hindi, Japanese, Mixe-Zoquean, among many others), and generally stand in domain-final position. The reason for this particularly restricted occurrence is likely to be that it is only this position where extrametrical or extrasyllabic final Cs are possible.

The mono-syllabicity condition in V) is based upon the equally GEN-inherent principle of Non-Exhaustivity:

VII) Non-Exhaustivity: Extrametricality is blocked if it would render the entire stress-domain extrametrical (Hayes 1995:58).[142]

[138] Spaelti (2002:11) asserts that WEAKEDGE is a case of Hierarchical Minimal Violation. Every piece of structure occurring at the right periphery of a PrWd causes a violation of the constraint.
[139] Hagberg (2006:7). I assume that the syllable is not necessarily tri*moraic* at the surface level in order to be 'superheavy'. Rather, its underlying representation contains three (or more) segments in the syllable rhyme. This assumption relates directly to the extrasyllabicity of the final C, i.e. it being not in coda position in the surface representation.
[140] As we will see below, one more condition yields extrasyllabic final Cs. The need for trochaic structure overrides syllable-extrametricality and gives (**L**L)<C> in CV.CəC cases.
[141] This can basically be seen as a sister-constraint to WSP given in XII) below.
[142] This relates back to the assumption that LexWord ≅ PrWd (Prince & Smolensky 1993).

This basically means that the single syllable in mono-syllabic PrWds cannot be left unfooted. What happens is that a final C finds itself relocated to the periphery of the PrWd, outside of the final syllable and the metrical foot. It is not the syllable that occurs at the right word edge but the single C. WEAKEDGE thus remains unviolated also in these cases where the final C associates directly to the ω-node.

WEAKEDGE focuses explicitly on the right margin of every PrWd. It does not operate word-internally. This is demonstrated by the stress assignment to word-internal CVC syllables. Examples are polysyllabic words containing consonant clusters (e.g. LG [zɛpˈtɛmba] 'september', [diˈrɛkta] 'headmaster-Sg.'), and old loanwords containing original lenis geminates (e.g. LG [meˈʃʊggə] 'crazy' < Jiddish *meschuggo*, [ˈbʊddəl] 'bottle-Nom.Sg.' < OFrench *bouteille*).

The constraint family PARSE works contrary to III). It equally refers to the prosodic hierarchy and therefore the SLH (Strict Layer Hypothesis).[143] PARSE is constituted by a number of sub-constraints that demand that every element of P-Cat$_m$ must be dominated by an element of a higher prosodic level P-Cat$_n$. P-Cat$_n$ preferably belongs to the level immediately succeeding P-Cat$_m$ in the prosodic hierarchy. I assume with Spaelti (2002:12) that the ordering of the PARSE-constraints is language-specific, resulting in LG, just like in the Swiss German dialect Glarnertüütsch (Spaelti 2002:13), in high ranked PARSE (μ) and low ranked PARSE (Σ) and PARSE (σ).

VIII) PARSE (σ): All syllables are parsed into feet.
IX) PARSE (μ): All morae are parsed into syllables.
X) PARSE (Σ): All segments are parsed into syllables.

The constraints do not completely adhere to strict layering. On the one hand, segments do not have to be licensed by morae (McCarthy 2008:180); on the other hand, the association of a mora to a segment is not considered to violate PARSE (Σ).

Constraint VIII) keeps syllables from being associated directly to the ω-node rather than being incorporated into feet.

Constraint IX) prevents the occurrence of floating morae in the output form. Candidates that attach morae to the ω-node by skipping the ϕ-level and the σ-level in the prosodic hierarchy are penalized. Every mora of the output that is left unparsed causes one violation of PARSE (μ). This constraint is, however, not immediately relevant to the LG stress system, which is why it is omitted in the according tableaux.

Constraint X) crucially opposes the notion of extrametrical segments. Candidates that attach *segments* (note: not morae) directly to the ω-node by skipping the ϕ-level and the σ-level are dispreferred. For every element of the Σ-level that does not obey PARSE (Σ), one violation mark is inserted.

[143] Prince & Smolensky (1993); McCarthy & Prince (1993); Kager (1999).

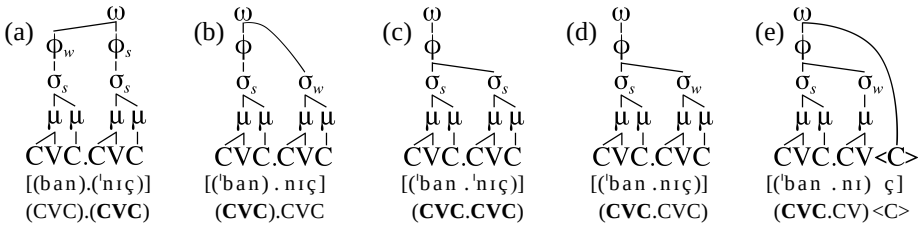
Another opponent of WEAKEDGE in the prosodic system of LG is RIGHTMOST (Prince & Smolensky 1993; Kager 1999:167; Ussishkin 2000:66). This constraint counteracts the urge to leave the final position unfooted and devoid of any structure.

XI) RIGHTMOST: The right edge of the head foot is aligned with the right edge of the PrWd.

It requires that the head foot is rightmost within a PrWd. RIGHTMOST (further on RIGHTM) applies gradiently and receives one violation mark for every syllable that succeeds the head foot to the right. This is true for footed syllables and unfooted syllables alike. Also, one violation is inflicted if extrametrical or extrasyllabic material (i.e. an extra position on the grid) is aligned with the right word edge. The reason is that such elements are unfooted – the head foot is, again, not in the rightmost position. The overall result is such that if RIGHTM >> WEAKEDGE, stress is assigned to the final position or to the penultimate position in a PrWd, depending on the foot structure; a foot (**H**) yields final stress, a foot (**L**L) or (**H**L) naturally yields penultimate stress.

I will argue in the following that the ranking of WEAKEDGE >> RIGHTM applies to LG. CVC.CVC bisyllables such as [ˈbannɪç] ‘very’ or [ˈʔɔʊbid] ‘work-Sg.’ of Table 21 (b) (both forms containing final Cs that are underlyingly lenis) provide evidence for this hierarchy. Both items exhibit penultimate stress instead of equally possible final stress. To prove my point, let us consider the individual candidates in more detail by first assuming no crucial hierarchy of the constraints. The actual ranking is then given in Tableau 1. The structures of the according CVC.CVC candidates are as follows.

Figure 49. CVC.CVC candidates



Candidate (a) is an example for unwanted stress assignment to the final syllable. Its foot structure is (H)(**H**) which means that both CVC syllables are footed while the final one constitutes the head foot. The overt form would be something like [ˌbanˈnɪç]. The ω-node dominates a syllable as well as a foot at the right word edge. This, of course, automatically means that the right word edge is structurally rich. Candidate (a) therefore blatantly violates WEAKEDGE. The structure is at the same time faithful to RIGHTM due to the rightmost head foot. PARSE (Σ) and PARSE (σ) are not violated since all segmental content is licensed by a syllable and all syllables are included in feet. We therefore arrive at a total of one violation.

Tableau 1. [ˈbannıç] ‘very’

CVC.CVC		WEAKEDGE	RIGHTM	PARSE (σ)	PARSE (Σ)
(a)	(CVC).('**CVC**)	***!**			
(b) ☞	('**CVC**).CVC		*	*	
(c)	('**CVC.**'**CVC**)	***!**			
(d)	('**CVC.**CVC)	***!**			
(e)	('**CVC.**CV)<C>		*	*	***!**

Candidate (b) (**H**)H has the desired initial stress. The head foot is at the same time the only foot of the PrWd. It is in penultimate position, which leaves the final syllable unparsed by a foot, satisfying WEAKEDGE. Concurrently, this structure violates of course the counter-constraints RIGHTM for building the foot in penultimate position, and PARSE (σ) for associating the ultima directly to the ω-node. All in all, candidate (b) results in two violations in total. The fact that it is indeed most harmonic with regards to WEAKEDGE is blurred by it being less harmonic with respect to the other constraints.

Moving on to candidate (c), we have a structure (**HH**) that could be ruled out by GEN due to the two heads occurring within a single domain. Alternatively, we can also dispose of this candidate with violable constraints.[144] What we find is a foot that contains two CVC syllables. Both of them are stressed, thereby adhering to a constraint yet to come – the Weight-to-Stress-Principle. The effect is such that only WEAKEDGE is violated. The foot stretches over the whole PrWd, which entails that it is also present in ultimate position at the right word edge. We get what we just saw for candidate (a): too much structural content, and thus a violation of WEAKEDGE. It satisfies all other given constraints. Candidate (c) equals therefore (a) in terms of violations – both produce just one. They are the two most harmonic candidates up to now. They are, alas, not exactly compatible with what we would like to achieve as overt form. Neither of them has stress exclusively in penultimate position.

The next candidate given here is (d) with a structure (**H**L). It has the advantage that it shows the correct stress pattern with stress on the penultimate syllable as in candidate (b). Additionally, it is similar to candidate (c) in building the head foot in rightmost position in the PrWd. The foot consists of two syllables, the penultimate being stressed, the ultimate being unstressed. Even though the final syllable is not the head of the foot, i.e. unstressed, this candidate violates WEAKEDGE just like candidates (a) and (c) do. The foot is located at the right word edge, bringing along too much prosodic structure. The constraints RIGHTM, PARSE (Σ) and PARSE (σ) are by comparison satisfied. This candidate is therefore equally most harmonic with

[144] Candidate c) (**HH**) will be ruled out immediately by the foot form constraint RHTYPE=T to be discussed in a moment.

respect to the given constraint set as candidates (a) and (c) are.

The last candidate is e) with the structure (**H**L)<C>. It has stress in initial position and satisfies WEAKEDGE by associating the final C directly to the ω-node. Note, however, that the final [ç] should be incorporated into syllabic structure since none of the two consonant extrasyllabicity conditions in IV) and V) are fulfilled; i.e. the final syllable is not superheavy and the PrWd is not monosyllabic. The final [ç] should therefore not be allowed to occur outside of both the syllable and the foot at the same time. Considering the constraint set, we observe that RIGHTM, PARSE (Σ) and PARSE (σ) are all violated. Candidate (e) is therefore least harmonic with respect to the given contraint set and is, thus, indeed least likely to be the output form.

Overall, we find that it is clearly impossible to achieve the correct stress pattern and a single winner at the same time if no crucial constraint hierarchy is proposed. Only candidates (b) and (e) are otherwise automatically ruled out due to the two and three violations, respectively. Leaving the four constraints unranked with respect to each other yields the three winners (a), (c) and (d), each of them exhibiting one violation of the given constraints. All rankings except for one generate this result; RIGHTM >> WEAKEDGE gives preference to (a), (c) and (d), as does a dominating PARSE (Σ), a dominating PARSE (σ), or even {WEAKEDGE, RIGHTM} >> {PARSE (Σ), PARSE (σ)}. Only the ranking WEAKEDGE >> {RIGHTM, PARSE (Σ), PARSE (σ)} produces a single output with the correct penultimate stress. This hierarchy gives us only (b) with its (**H**)H structure as the winner. Candidate e) (**H**L)<C> is ruled out by its violation of PARSE (Σ). We see that WEAKEDGE >> RIGHTM is indeed vindicated.

So far, we mainly touched upon wellformedness constraints in the discussion. They only have organizing character within the PrWd and make no reference to syllable weight. The stress assignment in PrWds containing differing syllable types (CVC, CV, CəC, CVCC, CVVC, etc.) cannot be determined by means of these constraints. Some weight constraints need to enter the stage.

One principle we already came across was the SHSP that determines that all superheavy syllables (CVCC, CVVC) automatically receive stress. What has not yet been elucidated is how to treat the other syllable types (CV, CVC) in metrical terms.

What we basically find for LG is that the phonetically long tense Vs of LG open syllables appear to behave light with regard to syllable structure. They are not stress-attracting as CVC syllables are. This stress assignment and the respective foot structure can be attributed to the Weight-to-Stress-Principle (WSP) formulated by Prince (1991).

XII) WSP: Heavy syllables are stressed.

Prince (1991:3f.) points out that ‘stressed’ may refer

> “both to grid-prominence and to foot-position, whichever is at hand. In that case, WSP serves to define a correspondence which holds between notions of salience in three domains: syllable weight (heaviness), foot structure (headship), and grid (prominence).”

It requires any heavy, i.e. bimoraic, syllable to be stress bearing. Trochaic feet that obey WSP are bimoraic (**H**), and bisyllabic (**H**L) and (**L**L). Kager (1999:172) points out that both of the headed structures (**H**H) and (H**H**) violate WSP since not every heavy syllable is stressed. In my analysis, this violation pattern is true not only for footed syllables but also for unfooted syllables. As soon as an H of an utterance does not receive stress, WSP is violated. The violation applies gradiently, inserting one violation mark per unstressed heavy syllable.

Another prediction made by XII) is that if feet of the structure (HH) were allowed, both heavy syllables would be stress-attracting. A foot of the structure (**HH**) with a stress clash would result. However, this is strongly disfavored among the languages of the world.[145] The constraint RHTYPE=T (rhyme type = trochee) now enforces the trochaic foot structure. I assume that it is high ranked in LG, which is vindicated by the LG data and the comparison with other trochaic Germanic languages (Dutch, English, Standard German, etc.).

XIII) RHTYPE=T: Feet are left-headed, i.e. $(\acute{\sigma}\sigma)_{Ft}$ or $(\acute{\mu}\mu)_{\sigma,Ft}$ (Cohn & McCarthy 1998; Kager 1999:172).[146]

It results in stress assignment to the initial (i.e. head) element of a foot, yielding a strong-weak structure at the syllable-level or mora-level. A trochaic structure emerges. Feet containing a single heavy syllable (**H**) are able to satisfy RHTYPE=T due to being bimoraic. The strong head-mora may be the left mora, i.e. $(\acute{\mu}\mu)_{\sigma,Ft}$. The right mora is consequently weak and does not constitute the head of the foot. By comparison, feet of the structure (**HH**) as well as an iambic stress assignment are readily excluded by RHTYPE=T.[147] Also, feet of the type (**L**) are avoided. They constitute bad trochees in the sense that the syllable contains only one mora, which is automatically the head mora. An (**L**) foot is therefore left-headed and right-headed all at the same time – and is consequently not able to satisfy XIII). By this, RHTYPE=T implies that the well-known constraint of FOOT BINARITY (FTBIN) is adhered to.

XIV) FTBIN: a foot is binary at some level of representation (σ, μ) (Prince & Smolensky 1993; Kager 1999:161).

The LG stress pattern demonstrates that the trochee is in fact weight sensitive, i.e. a moraic trochee. Thus, a LG foot might end in a single heavy syllable **H** (i.e. CVC)

[145] *CLASH: No stressed syllables are adjacent (Kager 1999:165). Even stronger, it might be assumed that configurations such as (**HH**) are actually structurally impossible. GEN could never produce them since feet are inherently single-headed; a prerequisite clearly not satisfied by (**HH**). Rather, this foot would dominate two heads. Ruling out (**HH**) is not the only effect of *CLASH. The constraint is also meant to rule out between-foot clashes such as in (L**H**)(**H**L). In general, all configurations are banned that show two adjacent stressed syllables (Paul Boersma, p.c.).

[146] This is a more general formulation of the constraint RH-CONTOUR: A foot must end in a strong-weak contour at the moraic level (Kager 1999:174).

[147] Superheavy syllables are not excluded by RHTYPE=T, because they yield a strong-weak-weak structure at the mora level. The head-mora of the foot occurs in leftmost position, thereby constituting a trochee.

containing ́μμ, or two light syllables **L**L (i.e. CV.CV) (Kager 1995:397f., and 1999:147).

As I will now show, from the assumption that CVC is heavy and CV is light, it must follow that phonetically long tense vowels are really monomoraic. The line of reasoning is similar to the analysis given by van Oostendorp (1995) for Dutch, being based on earlier findings by Smith et al. (1989). Van Oostendorp observes that along the lines of Hayes (1995)'s Metrical Stress Theory, no language exists that exhibits a stress pattern within which only (C)VC syllables attract stress, while CVV syllables do not. The compilation in Table 22 (p. 124) seems to predict exactly this supposedly non-existent system, though. Van Oostendorp (1995:34) avoids this issue and proposes an alternative approach. He suggests for the Dutch vowel system that tense vowels count as light as opposed to diphthongs and long tense vowels of loanwords. They do not automatically attract stress. Instead of CVV rather a representation CV_{tense} is proposed. The contrasting syllable types are therefore not two kinds of heavy syllables, but heavy CVC *vs.* light CV.

A somewhat different account for Dutch syllable weight is presented by Gussenhoven (2009). Although his approach has some appeal in argueing from a primarily phonetic perspective, I will not follow his line of reasoning in my discussion of LG. Gussenhoven (2009) posits that long vowels acquire bimoraic status in stressed position (i.e. in the head of a foot). Their correspondents in unstressed position that are traditionally also assumed to be long maintain their underlying monomoraicity. This approach attempts to explain the fact that tense vowels are realized as phonetically long only under stress; if in unstressed position, they are produced as phonetically short. Gussenhoven (2009:183) compares in his analysis stressed and unstressed tense vowels only with stressed lax vowels. The unstressed lax vowels are excluded from his observations. This analytical gap is rather disadvantageous. It is not quite clear why durational increase should not also be present in stressed *vs.* unstressed lax vowels, and why this durational difference should, then, not be represented in terms of morae.

In fact, Jessen et al. (1995:430) discover for Standard German that the stressed lax vowels [ɪ, ɛ, a, ɔ, ʊ] differ from their unstressed counterparts in vowel duration at a statistically significant level.[148] The durational discrepancy is not as prominent as for tense vowels, though. This is reflected in the fact that almost all tense *vs.* lax pairs are virtually identical with respect to duration in unstressed position.[149] Basically, the lax vowels are less affected by stress. Their durational variance is not as big in head *vs.* non-head position as the duration of the tense vowels is. They are nevertheless shorter in unstressed than in stressed context.

Drawing on these observations from Standard German, it appears reasonable to assume that a similar durational difference exists also for the Dutch head and non-

[148] The measurements of the unstressed vowels were performed on the syllable immediately preceding the main word stress, i.e. in pre-focal position (Jessen et al. 1995:428).

[149] Jessen (1998:147) notes for Standard German: "In position before main stress, which is a position in which vowels are likely to be realized without any level of stress, tense and lax vowels usually still differ significantly in formant structure, but no longer in duration". This is valid for all tense *vs.* lax vowel pairs except for [ɑ, a], which generally exhibit no statistically significant F0 difference. Mooshammer (1999).

head lax vowels. This raises the question as to why the phonetic duration variation between stressed and unstressed *lax* vowels should be trivial, if the equivalent variation between stressed and unstressed *tense* vowels is recognized as being phonologically relevant? In particular if arguing that the "reevaluation of the phonetic facts" (Gussenhoven 2009:182) is crucial to the phonological analysis.[150]

I therefore rather propose a constant, stress-independent moraic status of all LG vowels. The stressing of vowels has only an effect on the phonetic realization, not on the phonological representation. Thus, the occurring differences need not be accounted for in terms of morae. Phonetically short lax vowels are generally monomoraic. Phonetically long tense vowels are equally monomoraic, irrespective of their stress level. This is a direct consequence of the LG weight distribution of CVC as heavy and CV as light.

4.1.3. *OT analysis of non-final stress*

The ranking of the constraints and the resulting foot structures for the crucial examples is illustrated in the following tableaux.

Tableau 2 illustrates the output for CVC.CVC.CVC words like [pɛɐˈzɛnnɪŋ] 'boat cover-Sg.' from Table 22 (d). The occurrence of candidates with a stress clash (**HH**) is prohibited by GEN. RHTYPE=T is therefore not needed in this case and does not occur in the tableau. Output forms containing an extrasyllabic final C are omitted since none of the conditions (superheavy ultima, or mono-syllabic PrWd) is satisfied. WSP is violated by every of the possible candidates since in all cases two heavy syllables of the output are left unstressed. It is therefore irrelevant for the determination of the winner.

Tableau 2. [pɛɐˈzɛnnɪŋ] 'boat cover-Sg.'

	CVC.CVC.CVC	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)	WSP
(a)	('**CVC)**.CVC.CVC		****!**		******	******
(b) ☞	CVC.('**CVC**).CVC		*****		******	******
(c)	(CVC).CVC.('**CVC**)	***!**			*****	******

Candidate (a) is harmonic with respect to WEAKEDGE but violates RIGHTM twice. Two further violations are inflicted by the un-footed penultimate and final syllable. Similar violation marks are inflicted by candidate (b), the only difference being that the H(**H**)H structure yields one violation of RIGHTM. PARSE (σ) is violated twice just as is the case in candidate (a).

[150] An additional detriment of this approach could be seen in the fact that Gussenhoven ignores possible interference of Richness Of The Base. He postulates monomoraic input forms for unstressed tense vowels, and bimoraic input forms for stressed tense vowels, bearing on phonetic data (i.e. the *overt* forms). He is not able to exclude bimoraic input forms from also occurring in unstressed position, or monomoraic input forms from occurring in stressed position.

So far no crucial ranking is necessary because candidate (a) loses automatically against (b) due to having six violation marks as compared to five. It is the comparison between the candidates (b) and c) that alludes to the constraint hierarchy determined in Tableau 1. The finally stressed candidate (c) comprises only four violation marks in total which would elect it as the winner if the constraints where left unranked. It has the footing (H)H(**H**) that violates WEAKEDGE, and PARSE (σ) – and the here irrelevant WSP.

The treatment of the final syllable is the crucial point here. The correct output (b) with penultimate stress results from the ranking of WEAKEDGE >> RIGHTM. It is not possible to identify a more specific ranking by means of the losing candidates. The other constraints hence still remain unranked with respect to each other.

The analysis adds up to the preliminary ranking {SHSP, Non-Exhaustivity} >> RHTYPE=T >> WEAKEDGE >> {RIGHTM, PARSE (Σ), PARSE (σ),WSP}. The winner is candidate (b) with its H(**H**)H foot structure.

It has now been demonstrated that if the penultimate syllable is CVC (i.e. contains lax V plus succeeding non-lenis C), stress falls on it.

This result is equally valid for CVC.CVC.CV cases like [valˈhallɑ] 'Valhalla'. The stress is assigned likewise to the heavy penultimate syllable. If the current constraint ranking is maintained we end up with the correct output form H(**H**)L in (b) of Tableau 3. It satisfies WEAKEDGE, and shows four additional violations among the unranked constraint set, i.e. one violation of RIGHTM due to the penultimate position of the syllable foot, two violations of PARSE (σ), and again one violation of WEAKEDGE.

Tableau 3. [valˈhallɑ] 'Valhalla'

	CVC.CVC.CV	RHTYPE=T	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)	WSP
(a)	('**CVC**).CVC.CV			****!**		******	*****
(b) ☞	CVC.('**CVC**).CV			*****		******	*****
(c)	CVC.('**CVC**.CV)		***!**			*****	*****
(d)	(CVC).CVC.('**CV**)	***!**	*****			*****	******
(e)	(CVC).(CVC.'**CV**)	***!**	*****				******

The losing competitor in (a) has the foot in antepenultimate position (**H**)HL. WEAKEDGE is satisfied, but a fatal violation is caused by RIGHTM. Additionally, PARSE (σ) is violated twice. WSP finally causes one more violation. This excludes (a) as a possible output form.

Candidates (c) through (e) are ruled out either due to the crucial ranking of WEAKEDGE or due to RHTYPE=T. The additional violations of WSP and PARSE (σ) are insubstantial.

The constraint hierarchy {SHSP, Non-Exhaustivity} >> RHTYPE=T >> WEAKEDGE >> {RIGHTM, PARSE (Σ), PARSE (σ),WSP} obtained above is not (yet) altered.

The CV.CVC.CəC[151] structure (e.g. [kɑˈnɪŋkən] ‘rabbit-Sg.’) in Tableau 4 yields penultimate stress parallel to the preceding cases. Overt forms showing final stress are therefore excluded. The given ranking is also valid for CV.CVC.CV cases like [kɑˈlɛnna] ‘calender-Sg.’ in Table 22 (a).

The decision is made here between penultimate stress of L(**H**)L in (b), and antepenultimate stress of (**L**H)L in c), both comprising three violation marks in total. The ranking of RHTYPE=T >> WEAKEDGE >> {RIGHTM, PARSE (Σ), PARSE (σ), WSP} does not determine a single winner, though. This hierarchy causes the exclusion of initially stressed (**L**)HL in (a), and the iambic stress of (L**H**)L in d) by means of RHTYPE=T. Also, it enforces the elimination of word-final footing in LG polysyllables as in L(**H**L) of candidate (e). What the ranking does not produce, however, is a decision between (b) and (c). Both outputs win above the other candidates. In order to achieve the desired winner (b), we need to rank WSP. This is not only necessary to achieve a separate winner here, but it is also in accordance with the LG data. Ranking WSP demonstrates that the obligation to assign stress to heavy syllables rather than light syllables is fairly potent in LG. What is not determinable, though, is whether a crucial ranking regarding WEAKEDGE exists. WSP therefore remains unranked with respect to this constraint for now.

Tableau 4. [kɑˈnɪŋkən] ‘rabbit-Sg.’

	CV.CVC.CəC	RHTYPE=T	WSP	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)
(a)	('**CV**).CVC.CəC	***!**	*		**		**
(b) ☞	CV.('**CVC**).CəC				*		**
(c)	('**CV**.CVC).CəC		***!**		*		*
(d)	(CV.'**CVC**).CəC	***!**			*		*
(e)	CV.('**CVC**.CəC)			***!**			*

The altered ranking is therefore now {SHSP, Non-Exhaustivity} >> RHTYPE=T >> {WSP, WEAKEDGE} >> {RIGHTM, PARSE (Σ), PARSE (σ)}.

We have seen so far that the given constraint hierarchy can account for the stress pattern of words of the type CVC.**CVC**.CV / CVC.**CVC**.CVC as well as of words of the type CV.**CVC**.CəC or CV.**CVC**.CV. The stress assignment in the CVC.CV.CV words like [ˈtɔmbolɑ] ‘tombola-Sg.’ or CVC.CV.CVC words like [ˈnaxtigal] ‘nightingale-Sg.’ given in Table 22 (e) and (f) is addressed next. The desired output

[151] The final CVC syllable is here indeed CəC, which counts as light. This becomes evident only in the LG bisyllables discussed in 4.2.

form has in both cases initial stress on the heavy CVC syllable. Possible secondary stress is ignored here.

Tableau 5. [ˈtɔmbolɑ] ‘tombola-Sg.’

CVC.CV.CV	RHTYPE=T	WSP	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)
(a) ('**CVC**).CV.CV				***!**		***
(b) CVC.('**CV**.CV)		***!**	*			*
(c) ☞ ('**CVC**.CV).CV				*		*
(d) (CVC.'**CV**).CV	***!**	*		*		*

Tableau 5 illustrates the constraint ranking for the CVC.CV.CV cases. We find that candidate (d) (H**L**)L is ruled out due to its iambic foot structure. Candidate (b) fatally violates WSP and WEAKEDGE because the foot is built over the two light syllables (**L**L) at the right word edge to the exclusion of the initial H. This leaves us with candidate (a) with the structure (**H**)LL and candidate (c) with the structure (**H**L)L. We see that the initially stressed form in (c) is more harmonic than (a) with respect to the given constraints. The reason is that the penultimate L is parsed into the head foot in (c), thereby creating only one violation of RIGHTM and one violation of PARSE (σ). Candidate (a) violates by comparison both constraints twice since the penultimate L is not included in the head foot. This means that the foot is one position further away from the right word edge, and a total of two syllables are left unparsed. Thus, candidate (c) wins.

Turning to the CVC.CV.CVC words, the ranking in Tableau 6 gives us the winning candidate (**H**L)H in (c). Its violation of WSP is insubstantial since all other candidates equally show at least one violation of this constraint in CVC.CV.CVC words. RIGHTM and PARSE (σ) each receive one further violation mark, yielding three violations in total. The other candidates except (a) are ruled out by inflicting one fatal violation on RHTYPE=T. This automatically renders the further violations of the unranked constraint set irrelevant. Left over is now only the output form (**H**)LH in (a). It loses against (**H**L)H in (c) by means of RIGHTM and PARSE (σ). Both constraints are violated twice which gives five violations in total.

All in all, the candidates (c) of Tableau 5 and Tableau 6 with the foot structure (**H**L) turn out to be most harmonic for CVC.CV.CV words as well as for CVC.CV.CVC words with respect to the constraint hierarchy. It is only the final syllable, be it heavy or light, that is left unparsed in both cases.

Tableau 6. [ˈnaxtigal] ‘nightingale-Sg.’

	CVC.CV.CVC	RHTYPE=T	WSP	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)
(a)	('**CVC**).CV.CVC		*		**!		**
(b)	CVC.('**CV**).CVC	*!	**		*		**
(c) ☞	('**CVC**.CV).CVC		*		*		*
(d)	(CVC.'**CV**).CVC	*!	**		*		*

The preceding tableaux indicate a clear preference for the extrametrical or extrasyllabic candidates. This is consistent with the usual assumption that final consonant extrasyllabicity yields the rather restricted occurrence of final stress in a number of languages (e.g. Glarnertüütsch, English, Cairene Egyptian Arabic, Latin). Note that this result is a preliminary one. It is only applicable to cases with final lenis C as will be shown in chapter 6. The special status of fortis consonants as moraic eliminates candidates with extrametrical or extrasyllabic final fortis C. This only has consequences for the stress assignment in LG bisyllables of the structure CV.CVC (e.g. [kɑˈjyːt] ‘cabin-Sg.’). The stress pattern of all other cases is unaffected. The rather marked extrasyllabic structure is not crucially needed in the polysyllabic cases discussed so far. An unfooted final syllable does the job just as well.

The LG stress pattern can at the moment be characterized as follows. The final CV, CVC and CəC syllables of LG polysyllables do not receive stress. This is only partly related to syllable weight. Rather, a general tendency towards weakened word edges yields this result. The penultimate syllable decides on the location of the word stress. If the penult is heavy stress surfaces on it; if the penult is light and the antepenult is heavy stress is assigned to the antepenult. The constraint ranking established so far is {SHSP, Non-Exhaustivity} >> RHTYPE=T >> {WSP, WEAKEDGE} >> {RIGHTM, PARSE (Σ), PARSE (σ)}.

4.1.4. *Final stress and superheavies*

Next to final CV, CəC and CVC, a fourth syllable type CVXC complements these basic syllable structures. It is restricted to the final position in a PrWd and is usually referred to as ‘superheavy’. I will demonstrate in the following that, strictly speaking, there are no actual superheavy syllables (S) at the phonological surface level in LG. Final consonant extrasyllabicity renders them heavy instead.

The superheavies are either of the structure CVCC with four segmental positions at the underlying level, or of the structure CVC^{+x} with three underlying segmental positions plus additional weight (a mora) as the synchronic remnant of pre-apocope

status of the syllable.[152] For simplicity reasons, I present the latter items nevertheless as CVVC in the remainder of the stress discussion. According examples are given in Table 23. The items in (d) receive primary word stress per SHSP as mentioned in 4.1.2 above. They constitute together with the overlong items in (a) to (c) an environment that at last allows for final consonant extrasyllabicity at the surface level.

Table 23. Final / superheavy stress in LG

(a)	CV.CV.**CVVC**	
	‘chocolate-Sg.’	[ʃokeˈlɑɑːd]
	‘rigging-Sg.’	[tɑkeˈlɑɑːʒ]
	‘grilled cutlet-Sg.’	[kɑbeˈnɑɑːd]
(b)	CV.**CVVC**	
	‘unwanted persons’	[bɑˈgɑɑːʒ]
	‘sailor-Sg.’	[mɑˈtroːz]
(c)	CVC.**CVVC**	
	‘caboose-Sg.’	[kɔmˈbyyːz]
(d)	CV.**CVCC**	
	‘mud-Sg.’	[moˈrats]
	‘matress-Sg.’	[mɑˈtrats]
(e)	CVC.**CVCC**	
	‘compost’	[kɔmˈpɔst]

Besides this superheavy stress we also find lexical stress assignment to the final syllable. This matter is discussed in section 4.3 below.

The tokens presented in Table 23 (a) to (c) end in CVVC – i.e. syllables featuring a phonetically overlong vowel and a final lenis obstruent. The examples in Table 23 (d) and (e) display a final syllable with a phonetically short lax vowel or a phonetically long tense vowel succeeded by a final consonant cluster. Bear in mind for chapters 5 and 6 that the quality of the final C is essential in determining the moraic status of the preceding vowel. Phonetically overlong, i.e. ELD 3 vowels may only occur where a surface lenis C follows. Surface fortis Cs do not allow for this vowel length.

The constraint ranking for the superheavy cases in Table 23 (c) is given in Tableau 7. If the ranking RHTYPE=T >> {WSP , WEAKEDGE} >> {RIGHTM, PARSE (Σ), PARSE (σ)} is maintained, candidate (d) emerges as the winner. It has the structure H(**H**)<C> with an extrasyllabic final C to satisfy WEAKEDGE. Only three violations occur within the unranked constraint set RIGHTM, PARSE (Σ), and PARSE (σ).

All of the candidates cause a violation of WSP because each of the possible outputs leaves one heavy syllable unstressed.

Candidates (a) through (c) are obviated as possible outputs by the ranking of RHTYPE=T and WEAKEDGE. Where (a) and (b) have a superheavy syllable in foot final position, candidate (c) has a foot that is constructed by a heavy syllable and an

[152] A faithfulness constraint such as MAX-IO: Input segments must have output correpsondents (Kager 1999:67) maintains the underlying segmental positions on the surface level. I assume that a mora can be also present in the underlying form.

extrametrical but footed final C. The output ('**H**).H<C> in (e) loses against H(**H**)<C> in (d) by means of RIGHTM. The reason is that ('**H**).H<C> causes here two violations by building the foot two positions away from the right word edge; i.e. a syllable and the adjoined position come between the foot and the right word edge. H(**H**)<C> violates RIGHTM by comparison just once by means of the extrasyllabic <C>.[153]

Tableau 7. [kɔmˈbyyːz] 'caboose-Sg.'

	CVC.CVVC[154]	RHTYPE=T	WSP	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)
(a)	CVC.('**CVVC**)		*	*!			*
(b)	(CVC.'**CVVC**)	*!	*	*			
(c)	CVC.('**CVV**(**C**))		*	*!		*	*
(d) ☞	CVC.('**CVV**)<C>		*		*	*	*
(e)	('**CVC**).CVV<C>		*		**!	*	*

By way of Tableau 7 we can assume that candidate (d) receives a heavy status of the final syllable since the final <C> is rendered extrasyllabic. Superheavy finals are excluded as possible winners. Their segmental positions are, however, underlyingly present. This is indicated by the fact that if the syllable had had the underlying structure CVC, it would have become light (CV)<C> in the surface form due to final consonant extrasyllabicity. Stress would then indeed not be allowed to surface in final position – as it actually does. Rather, stress would need to surface on the penultimate syllable in order to satisfy the trochaic stress pattern enforced by RHTYPE=T. The respective structure would then be (**H**L)<C>. This is not what we find, though. Apart from the phonetic status as tense overlong vowels, the final stress assignment definitely suggests that these vowels are heavy at the surface level. The overall result is that stress may not surface on an initial light syllable in cases with superheavy final syllable. We can assume that the final syllables are bimoraic. This satisfies the *principle* of Maximal Binarity (MaxBin).

XV) MaxBin: a syllable must be maximally bimoraic.

[153] In fact, the SHSP could be assumed to exclude *a priori* forms containing initial stress such as (e) ('**H**).H<C>. However, as will be shown in the analysis of the consonants in chapter 6, the final syllable counts here not as superheavy but as heavy. The final lenis C is non-moraic. We will see that even if GEN would create extrasyllabic final Cs for all forms and not only final lenis Cs, fortis Cs and sonorant Cs would structurally require to be moraic, hence syllabified.

[154] Note that this marking is simplified. The vowel is in cases such as these not underlyingly long. Rather, an additional weight bearing unit (a moraic morpheme) is latched onto the right edge of the final syllable making the syllable underlyingly bimoraic. See sections 5.3 and 6.2 for the discussion of surface bimoraic vowels in LG.

Bye (2001:163) notes with respect to this tenet that it "is assumed to be hardwired into *Gen*, i.e. trimoraic syllables are universally banned." MaxBin therefore generally disallows the occurrence of superheavy syllables in the surface form.

Moving on to the CV.CV.CVVC cases like [tɑkeˈlɑɑːʒ] 'rigging-Sg.' in Table 23 (a), the ranking produces virtually the same result with final stress as in the CVC.CVVC cases. The most wellformed output is here (LL)(**H**)<C>. The result we obtain for the CV.CVVC cases like [mɑˈtroːz] 'sailor-Sg.' in Table 23 (b) is rather similar with L(**H**)<C>. This outcome is replicated also in the cases in Table 23 (d) with word-final consonant cluster (e.g. [moˈrats] 'mud'). The ranking of these CV.CVCC cases is given in Tableau 8.

Tableau 8. [moˈrats] 'mud'

CV.CVCC	RHTYPE=T	WSP	WEAKEDGE	RIGHTM	PARSE (Σ)	PARSE (σ)
(a) ('**CV**).CVCC	***!**	*		*		*
(b) CV.('**CVCC**)			***!**			*
(c) ('**CV**).CVC<C>	***!**	*		**	*	*
(d) ☞ CV.('**CVC**)<C>				*	*	*
(e) ('**CV**.CVC)<C>		***!**		*	*	

Candidate (d) displays a similar structure as the winner of Tableau 7, the difference being here that the final syllable does not contain an overlong VV but rather a sequence VC. The syllable counts as heavy and receives stress. The final <C> stands in extrasyllabic position which is harmonic with respect to WEAKEDGE.

The footing (**L**)S in (a) fatally violates RhType=T since it does not create a trochee.[155] Apart from one further violation of WSP (it stresses the initial L), it also causes one violation of RIGHTM due to the word-initial location of the head foot. Moreover, PARSE (σ) is violated by leaving the final superheavy CVCC unfooted. The (**L**)S structure is thus excluded as a possible output for words of the CV.CVCC-type. An equally unharmonic output is (c). It is ruled out basically for the same reasons as (a). The difference between the two candidates is that (c) comprises an additional violation of PARSE (Σ). Candidate (b) exhaustively syllabifies and foots the final CVCC syllable. This results in the allocation of a violation mark to WEAKEDGE. It is thereby discarded although it shows only one additional violation of PARSE (σ). This leaves us with the strongest competitor of (d), the initially stressed (e). It has the structure (**L**H)<C> that yields three violations in total. The ranking of WSP, however, ultimately discards this candidate as possible output.

The most wellformed output for a CV.CVCC input is consequently (d) with the structure L(**H**)<C>. Final stress in LG thus automatically arises if a superheavy

[155] (**L**)S denotes a light syllable foot with a following unfooted superheavy syllable.

syllable occurs in final position. Such a syllable can either contain a phonetically overlong vowel or a final consonant cluster.

Tableau 7 and Tableau 8 demonstrate that the visibility of the final syllable for metrics and prosody depends on the segmental content. The final syllable receives primary word stress if it is the rightmost heavy syllable in the output. Thus, rather than stressing an initial syllable, WEAKEDGE is violated and stress is placed on the final heavy. This is only possible in words with invariantly heavy final CVVC and CVCC. It is in these cases that the weight of the initial syllable is irrelevant. As soon as two light syllables (e.g. [ˈʔoːmɑː] ‘grandmother-Sg.’, [ˈbraoɛʁ] ‘brother-Sg.’) are available, stress surfaces word-initially. The respective foot structure is then (**L**L).

4.1.5. *General stress pattern*

It needs mentioning that the analyzed data is rather limited and, thus, is not entirely conclusive.

We have seen above, however, that the penultimate syllable decides on the definitive stress placement. If the penult is heavy (i.e. CVC) stress stays there; if the penult is light (i.e. CV) and the antepenult is heavy (i.e. CVC) stress is assigned to the antepenult.

Final stress in LG results from a superheavy syllable. Its final constituent is rendered extrasyllabic. The syllable remains heavy in the output and is therefore able to attract the primary word stress.

4.2. *Stress in LG bisyllables*

The constraint ranking developed so far for the stress pattern of LG polysyllables is challenged by a part of the LG bisyllables. This group of words appears to assign stress deviantly – namely to the ultima, without having a superheavy final syllable. Even phonetically short or long full vowels in closed final syllable receive primary word stress in these cases if the penult is light (note in comparison the CVC.CVC structures with penultimate stress like [ˈfaslam] ‘carnival-Nom.Sg.’ in Table 21 (b). Respective examples of LG bisyllables of the structure CV.CVC with unexpected final stress are given in Table 24 (b). They deviate from the LG stress pattern developed so far. The CV.CVC items with regular stress on the penult are given in Table 24 (a).

Table 24. Bisyllabic stress in LG

(a)	**CV**.CVC		(b)	CV.**CVC**	
	‘spoon-Sg.’	[ˈlɛɪpəl]		‘cabin-Sg.’	[kɑˈjyːt]
	‘mop-Sg.’	[ˈfɔidəl]		‘chapel-Sg.’	[kɑˈpɛl]
	‘time-Pl.’	[ˈtiːdən]		‘langoustine-Sg.’	[ɡrɑˈnɑːt]
	‘outside’	[ˈbuːtən]		‘capon-Sg.’	[kɑˈpuːn]
	‘tobacco-Sg.’	[ˈtoːbak]		‘pleasure-Sg.’	[pleˈziːʁ]
	‘peewit-Sg.’	[ˈkiːvɪt]			
	‘therefore’	[ˈdɑːrʏm]			

Especially interesting are here the examples in (a) [ˈtoːbak] ‘tobacco-Sg.’, [ˈkiːvɪt] ‘peewit-Sg.’ and [ˈdɑːrʏm] ‘therefore’ where we find a full vowel in the ultima and stress surfaces in the light penult. Given the words in Table 24 (a), we would clearly expect the same stress assignment to the penult also in the cases in (b). The ranking WEAKEDGE >> RIGHTM should not allow for a footing as in (b). In fact, it should rather support initially stressed *[ˈkɑːjyːt] with a foot structure (**L**L)<C> parallel to Table 24 (a).[156] Yet, WEAKEDGE does not meet these expectations and stress surfaces on the final syllable. This behavior is rather unexpected, the more so because there is no clear-cut difference between the CVC syllables in Table 24 (a) and the CVC syllables in Table 24 (b). The words of Table 24 (b) are Romance loanwords that were probably introduced into the language with a final schwa and regular penultimate stress, whereas the examples in Table 24 (a) are either no loans (e.g. [ˈdɑːrʏm]) or apocopated Romance loanwords (e.g. [ˈtoːbak]).[157]

Looking more closely at the CV.CVC bisyllables in Table 24 (b), we find that following the loss of the final schwa-syllable the word stress in these items lies on the final CVC syllable, irrespective of whether the nucleus contains a phonetically short or long (or overlong) full vowel. This comes as a surprise for it appears that WEAKEDGE renders neither the final syllable nor the final segment extrametrical here. I will show in the following section that the current constraint ranking, though efficient in explaining all of the other LG data, is not yet able to fully cope with the bisyllables. In order to be able to account for the metrical irregularity we need to consider a pattern of lexical stress present in loanwords.[158] The OT analyses of the bisyllabic data in Table 24 (a) and (b) are given below.

4.2.1. *OT analysis of bisyllabic stress*

I first give a brief OT analysis of the bisyllabic words of Table 24 (a) above (e.g. [ˈkiːvɪt] ‘peewit-Sg.’). Note that the items of Table 24 (a) with a schwa in the nucleus of the ultima can be treated identically to the CV.CVC items showing a full vowel in the nucleus of the ultima.

The forms in Table 24 (a) with a full lax vowel in the ultima require the crucial ranking of WEAKEDGE >> PARSE (σ) >> RIGHTM. This results basically from the underlyingly moraic status of fortis Cs as will be discussed in more detail in section 6.2.3. Outputs like CV.(**CVC**) that leave the initial syllable unfooted lose thereby from (CV.CV)<C> forms. This change in the constraint hierarchy has in fact no influence on the results obtained so far. The accordingly adjusted ranking follows in Tableau 9.

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[156] Having a glance at LG monosyllables, high ranked WEAKEDGE would have the capacity to discard outputs with primary word stress, i.e. all LG monosyllables, right away.

[157] [kɑˈjyːt] ‘cabin-Sg.’ < French *cahute* ‘hut-Sg.’; [kɑˈpɛl] ‘chapel-Sg.’ < Middle Latin *capella*; [ɡroˈnɑːt] ‘grenade-Sg.’ < Italian *granata* from Latin *mālum grānātum* ‘pomegranate’; [kɑˈpuːn] ‘capon-Sg.’ < French *chapon*; [pleˈziːɐ] ‘pleasure-Sg.’ < French *plaisir*; [ˈtoːbak] ‘tobacco-Sg.’ < Spanish *tabáco* with stress shift to the penult. I am not aware of any CV.**CVC** cases in LG such as in Table 24 (c) that do not fall into the category of loanwords.

[158] With respect to lexical or grammatical word-level stress, I assume with Kohler (2008:258) that it is “a place marker in the phonology of words […]. It is an abstract phonological specification of a *position* (a syllable) in a word; it has no physical attributes by itself.”

Tableau 9. [ˈkiːvɪt] ‘peewit-Sg.’

	CV.CVC	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a)	(ˈ**CV**)**.**CVC	***!**	*		*	*	
(b)	(ˈ**CV**.CV(**C**))			***!**			*
(c)	(ˈ**CV**.CVC)		***!**	*			
(d) ☞	(ˈ**CV**.CV)<C>					*	*
(e)	CV.(ˈ**CVC**)			***!**	*		

We find that bisyllables with a light penult and ending in a CVC-syllable enforce penultimate stress and final consonant extrasyllabicity. Interestingly, the loanword ‘tobacco-Sg.’ displays a stress shift from the penultimate syllable in the original item *tabáco* to the penult in the LG word [ˈtoːbak] as a result of the constraint hierarchy. I assume that due to the relatively high frequency of the word (it occurs in the language not only as an individual lexeme but also in collocations) its stress pattern has been adjusted to the LG norm.

Tableau 10. [ˈfaslam] ‘carnival-Sg.’

	CVC.CVC	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a) ☞	(ˈ**CVC**)**.**CVC		*		*	*	
(b)	(ˈ**CVC**.CVC)		*	***!**	*		
(c)	CVC.(ˈ**CVC**)		*	***!**	*		

Bisyllables with a heavy penult like [ˈdɔxta] ‘daughter-Sg.’, [ˈbannɪç] ‘very’ or [ˈfaslam] ‘carnival-Sg.’ given in Table 21 above do not require extrasyllabicity. The initial syllable is able to manifest the trochaic stress pattern all by itself. The result for a CVC.CVC structure is briefly illustrated in Tableau 10, superseding Tableau 1. The merited winner is (**H**)H in (a). The output form for CVC.CV [ˈdɔxta] ‘daughter-Sg.’ is (**H**)L.

Let us turn now to CV.CVC forms featuring ultimate stress such as [kɑˈjyːt] ‘cabin-Sg.’ of Table 24 (b). Their bisyllabic stress pattern is obviously not in line with the assumption of a structure-free right edge of the PrWd. The words have primary word stress in final position, i.e. the head foot is final in the PrWd. The location of the primary stress has not changed with respect to the donor languages.

Tableau 11 evaluates the according inputs using the established set of constraints.[159] We palpably arrive at the wrong output form here, which is not exactly surprising since the constraint ranking generates the correct output for the bisyllables with penultimate stress. The most wellformed output in Tableau 11 is accordingly candidate (e). It causes only two violations in total; one of RIGHTM for not parsing the final C into the foot, and one of PARSE (Σ) for not parsing the final C into a syllable. RHTYPE=T and WEAKEDGE are left untouched. The desired output would be, however, candidate (b). It yields a fatal violation of WEAKEDGE by comprising the head foot (**H**) at the right edge of the PrWd. One further violation is inflicted by low ranked PARSE (σ).

Tableau 11. [kɑˈjyːt] ‘cabin-Sg.’

CV.CVC	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a) ('**CV**).CVC	***!**	*		*	*	
(b) 💣 CV.('**CVC**)			***!**	*		
(c) ('**CV**.CVC)		***!**	*			
(d) (CV.'**CVC**)	***!**		*			
(e) ☹ ('**CV**.CV)<C>					*	*

Footing the L as in candidate (a) does not adhere to the requirement for trochaic feet. RHTYPE=T is fatally violated. Additionally, WSP is violated once. Lastly, RIGHTM and PARSE (σ) are equally not satisfied by this candidate. Not a particularly wellformed candidate with respect to the given constraints, we must say.

An equally unharmonic output is (c). It has the structure (**L**H) and is discarded by means of WSP and WEAKEDGE. Low ranked RIGHTM, PARSE (Σ) and PARSE (σ) are left unviolated.

Candidate (d) has iambic stress assignment which excludes this output right away. Its (L**H**) structure is again most wellformed with regards to RIGHTM, PARSE (Σ) and PARSE (σ). The violation of RHTYPE=T is fatal, though. Otherwise it would have been ruled out by violating WEAKEDGE.

What we in fact get here with the winner in (e) is the same result as for the CV.CVC forms of Table 24 (a); stress on the penult. There is no way to rearrange the yet unranked constraints to achieve the final word stress here, while not simultaneously confounding all the tableaux developed above. So, what can we do? We need to consider the possibility of lexically stressed items in LG; items that unlike the [ˈtoːbak]-type have not been adjusted for the LG metrics. This is done in the subsequent section.

[159] The notation ‘☹’ marks the desired but not achieved winner of a tableau. The symbol ‘💣’ denotes a winning candidate that is not desired as an output form.

All in all, we have established the following weight distributions of LG syllable shapes.

Table 25. Syllable weight in LG

	non-final	final
light	CV, CəC	CV, CəC, CVC
heavy	CVC	CVVC, CVCC

The weight is determined – at least partly – by the syllable's position within the PrWd and the segmental context. CV- and CəC-syllables are invariantly light. CVC is mostly counted as being heavy, if not standing in final position in a polysyllabic word. The constraint ranking developed in the sections above is formulated again in XVI).

XVI) {SHSP, Non-Exhaustivity} >>
RHTYPE=T >>
{WSP, WEAKEDGE} >>
PARSE (σ) >>
{RIGHTM, PARSE (Σ)}

4.3. *Loanword stress*

The LG lexicon contains a substantial number of loanwords. Some of them behave along the lines of the LG stress pattern, as we can see in the examples in Table 22 (a) to f) above. Stress is assigned here to the rightmost heavy syllable exclusive of the final syllable. There is, however, a subset of loans that in some respects constitute exceptions to this stress pattern, just like the cases in Table 24 (b). Their word stress is not (completely) predictable by means of the given constraint ranking.[160] I therefore argue that they contain lexically assigned stress that surfaces due to a high ranked faithfulness constraint. By comparison, the lack of lexical stress in the input forms of native LG words leaves the faithfulness constraint untouched.

The list in Table 26 contains in addition to Table 24 (b) examples of loanwords that were borrowed into LG with such a deviant stress pattern. The most apparent characteristic of the forms in Table 26 (a) to (d) is that a supposedly light CV syllable is stressed rather than a heavy CVC syllable. If all three syllables of a trisyllabic word are light, stress may occur optionally on any of these. This peculiarity is demonstrated by (e), (f) and (g) in Table 26. The loanwords of (e) with the structure CV.CV.C(C)V pattern according to the CV.CV.CVC(C) words presented in (d). They receive antepenult stress. The CV.CV.CV cases of Table 26 (f) and g) by contrast bear penultimate stress and final stress, respectively. Table 26 (b) and (c) exhibit penultimate stress. Yet, the syllable weight established for LG

[160] Note that no cases of **CV(C)**.CVC.CV(C) occur. This indicates that loans are not entirely free in their stress patterns since a heavy penult may not be ignored by stress.

cannot account for this assignment. The stress-bearing penultimate syllable here is light CV whereas the unstressed antepenult is heavy CVC. It is inexplicable by means of post-lexical stress assignment why CVC should behave as *heavy* in originally LG words (and older loanwords), and at the same time also behave as *light* in more recent loanwords. No crucial ranking of the so far unranked RIGHTM, PARSE (Σ), and PARSE (σ) could achieve this result. It appears, thus, to be necessary to assume the presence of lexical stress in loanwords.[161] The stress is lexically predetermined, being present already in the input form. Its presence or absence in the CV.CV.C(C)V cases in Table 26 (e) is immaterial since the output form does not differ from the stress assignment developed in 4.1.1 and 4.1.3. The words receive the expected initial word stress. A tableau for these cases (e.g. initially [ˈdoːmino] 'domino-Sg.') would not yield additional insight into the stress system. It is therefore omitted in the further discussion of loanword stress in LG.

Table 26. Trisyllabic stress in LG

(a)	CVC.CVC.**CV**	
	'industry-Sg.'	[ʔɪndʊsˈtriː]
(b)	CVC.**CV**.CV	
	'albino-Sg.'	[ʔalˈbiːno]
	'angora'	[ʔaŋˈgoːrɑ]
	'sombrero-Sg.'	[zɔmˈbreːro]
	'embargo-Sg.'	[ʔɛmˈbɑːgo]
(c)	CVC.**CV**.CVC	
	'spectacle-Sg.'	[spɛkˈtɑːkəl]
	'to calk-Inf.'	[kalˈfoːtɐn]
(d)	**CV**.CV.CVC(C)	
	'tulip-Sg.'	[ˈtoʊlipant]
	'charlatan-Sg.'	[ˈʃɑːlɑtɑn]
(e)	**CV**.CV.C(C)V	
	'domino-Sg.'	[ˈdoːmino]
	'Canada'	[ˈkɑːnɑdɑ]
	'flower bird-Sg.'	[ˈkoːlibri]
	'alibi-Sg.'	[ˈʔɑːlibi]
(f)	CV.**CV**.CV	
	'arena-Sg.'	[ʔɑˈreːnɑ]
	'Sahara'	[zɑˈhɑːrɑ]
	'valuta-Sg.'	[vɑˈloʊtɑ]
	'tornado-Sg.'	[tɔɐˈnɑːdo]
	'koala-Sg.'	[koˈʔɑːlɑ]
	'judoka-Sg.'	[ʒuˈdoʊkɑ]
	'bikini-Sg.'	[biˈkiːni]
(g)	CV.CV.**CV**	
	'melody-Sg.'	[meloʊˈdiː]
	'umbrella-Sg.'	[pɑrɑˈplyː]

4.3.1. *OT analysis of the lexical stress*

The loanwords of the structure CVC.CVC.CV such as [ʔɪndʊsˈtriː] 'industry-Sg.' in Table 26 (a) comprise final stress although they have the same overall HHL structure as the words of Table 22 (c) (e.g. [zɛpˈtɛmba] 'september'). Considering

[161] Another solution would be to postulate a bimoraic status of tense vowels in loanwords as suggested by Astrid Kraehenmann (p.c.). This is, however, neither phonetically nor phonologically justifiable. The actually occurring qualitative assimilations of the loanword vowels to the LG vowel inventory implicates also a quantitative assimilation. The borrowed long tense Vs should therefore pattern with the LG long tense Vs as monomoraic.

the constraint ranking obtained above, we receive a form H(**H**)L with penult stress rather than the final stress required in this case. Similarly, the loans in Table 26 (b), (c), and (f) contain a stressed L in penultimate position. The LG word stress pattern also appears to be inapplicable in these cases. This is evident from the following Tableau 12 for CVC.C(C)V.CV cases like [zɔmˈbreːro] 'sombrero-Sg.' taken from Table 26 (b).

Tableau 12. [zɔmˈbreːro] 'sombrero-Sg.'

CVC.CV.CV	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a) ('**CVC**).CV.CV				****!**	******	
(b) 💣 (**CVC**.CV).CV				*****	*****	
(c) ☒ CVC.('**CV**.CV)		***!**	*****	*****		

The constraint ranking yields winner in (b) with stress in initial position and the foot structure (**H**L)L. This is not the desired output form, however. The form in (c) is in fact supposed to win since stress in [zɔmˈbreːro] 'sombrero-Sg.' surfaces on the penultimate syllable.

What we can assume now is an altered ranking for (recent) loanwords. This would entail that the constraint ranking varies within the same language depending on the loanword-status of a given word; an approach that has crucially been proposed by Itô & Mester (1995, 1999) in their core-periphery model of the lexicon. Within this model, the lexicon is basically viewed as comprising multiple layers or *strata*. The theory essentially predicts the existence of cophonologies with a different ranking of faithfulness constraints applying to every stratum. The wellformedness constraints are ordered in a fixed hierarchy and maintain their relative ranking. However, this postulate of re-ranking faithfulness constraints opposes the traditional OT approach, which crucially claims the invariance of a constraint ranking in a given language.[162] I assume the OT treatment of grammar in the following analysis. The adaption of loanwords to the borrowing language – the main argument in favor of a stratal approach – can be explained by means of (child) perception and auditory cues. Peperkamp et al. (2008:160) crucially note that

[162] An altered proposal in the framework of Correspondence Theory (McCarthy & Prince 1995b) is the 'strata-indexed faithfulness' (Itô & Mester 1999) or 'split faithfulness' (Lee 2003:89) account. Instead of the re-ranking of one and the same IO-faithfulness constraint in dependence of the stratum, rather a specified, i.e. indexed, faithfulness constraint referring to each vocabulary sub-lexicon is proposed. In effect, the assumption of different cophonologies for each stratum is unnecessary. A single phonology is sufficient to describe the language-internal variation by means of "a unique set of ranked structural constraints, with stratally indexed faithfulness constraints interleaved at different points" (Itô & Mester 1999:76). The postulate implicitly made by this approach is that the native stratum is left unmarked while loanwords may be underlyingly marked twice: firstly for the stratum in order to determine which of the faithfulness constraints is applicable; secondly for the lexical stress. This is – at least for LG – an unnecessary complication.

"loanword adaptions reflect the average result of perceptual assimilation as found in most speakers".[163]

Returning now to the deviant stress pattern observable in the loanwords of Table 24 (b) and Table 26, I assume the surfacing of lexically pre-determined stress.[164] Apoussidou (2007:11) describes lexical stress as "not (fully) predictable by the grammar". A sequence of segments is marked for stress already in the input form. The foot structure and syllable structure is then assigned by the grammar, i.e. the constraint ranking. The faithfulness constraint that is arguably responsible for the emergence of the lexical stress in the surface form and the overt form is IDENT-STRESS I-O (further on ID-STR). It determines that a stressed sequence of the input must be retained in the output (i.e. phonological surface form or phonetic overt form).

XVII) IDENT-STRESS I-O: A syllable that is stressed in the underlying form is also stressed in the surface form.[165]

The loanword cases that have not yet been adapted to the LG stress system are most faithful to underlyingly present stress. None of the metrical constraints interfere and evoke a differing stress assignment. ID-STR crucially outranks the wellformedness constraints, yielding ID-STR >> RHTYPE=T >> {WSP, WEAKEDGE} >> PARSE (σ) >> {RIGHTM, PARSE (Σ)}.[166] The result is that stress marks in the underlying form are kept and projected to the surface form and subsequently to the overt form. The position of the stress within the PrWd is irrelevant. Relating to the examples in Table 26, this means that the deviant stress of the loan words arises from lexical stress markings in the underlying form, which gives penultimate stress in words such as e.g. [zɔmˈbreːro] 'sombrero-Sg.' or [kɑˈjyːt] 'cabin-Sg.'. The according ranking of the CVC.CV.CV cases in Table 26 (b) is illustrated in Tableau 13.

Tableau 13. [zɔmˈbreːro] 'sombrero-Sg.'

CVC.'**CV**.CV	ID-STR	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a) ('**CVC**).CV.CV	***!**				**	**	
(b) ☞ CVC.('**CV**.CV)			*	*	*		
(c) ('**CVC**.CV).CV	***!**				*	*	
(d) (CVC.'**CV**).CV		***!**	*		*	*	

[163] For experimental data see Peperkamp et al. (2008), for a detailed analysis see Boersma (2007a), Boersma & Hamann (2008).
[164] Inkelas & Orgun & Zoll (1997:410): "prespecification is the most constrained while simultaneously the only descriptively adequate way of handling lexical exceptionality to static patterns and alternations."
[165] See the faithfulness to stress constraints in Apoussidou (2007:22).
[166] This solution must not be interpreted as ultimate. See the alternative approach suggested by van Oostendorp (1997).

The winner is naturally candidate (b) with the foot structure H(**L**L). Most importantly, it is faithful to ID-STR, i.e. keeps the stress markings of the input also in the output of the overt form. It violates WSP and WEAKEDGE each ones. Output (b) is at the same time harmonic with regards to RHTYPE=T, which determines that it outranks the iambic candidate (H**L**)L in d). The two crucially ranked constraints ID-STR and RHTYPE=T choose (b) also above the initially stressed candidates (a) and (c). Both competitors contain a stress shift from the penultimate to the antepenultimate syllable. They thereby fatally violate ID-STR, which excludes (a) (**H**)LL and c) (**H**L)H as possible phonological surface structures. Without the crucial ranking of ID-STR, candidate (c) would of course win the tableau. It is faithful to RHTYPE=T and WSP. The three subsequent violations of WEAKEDGE, RIGHTM and PARSE (σ) are minimal compared to the other candidates.

A similar tableau with the individual stress marks in the input is valid for each of the polysyllabic cases in Table 26 as well as for the bisyllabic cases like [kɑˈjyːt] ‘cabin-Sg.’ in Table 24 (b). The result is always the same: the stress in the output matches the stress in the input. Tableau 14 demonstrates this again by means of the bisyllabic CV.CVC form [kɑˈjyːt] ‘cabin-Sg.’.

Tableau 14. [kɑˈjyːt] ‘cabin-Sg.’

	CV.'**CVC**	ID-STR	RHTYPE=T	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)
(a)	('**CV**).CVC	***!**		*		**	**	
(b) ☞	CV.('**CVC**)				*	*		
(c)	('**CV**.CVC)	***!**		*	*			
(d)	('**CV**.CV)<C>	***!**					*	*

The winner in (b) is the finally stressed L(**H**). Without lexically pre-determined stress on the ultima, WEAKEDGE would rule out this candidate and choose (d) (**L**L)<C> as the winner.[167]

The constraint ID-STR is left untouched by forms that do not have lexically pre-determined stress. This guarantees that the grammatical stress pattern developed in the preceding sections is maintained. Only forms that have entered the lexicon and contain an underlying marking for stress will attain an effect of ID-STR.

[167] For loanwords ending in an open syllable such as [ʔɪndʊsˈtriː] ‘industry-Sg.’ this means that we obtain a final monomoraic foot. This is a structure that is usually deemed defective. Another possibility would be to assume – similar to van Oostendorp (1995) – the presence of ‘truly long’ (i.e. bimoraic) vowels in loans, thus differentiating between loan phonemes and native phonemes. The final open syllable of the ‘industry’-type loans would as a result be counted as heavy.

4.4. *Conclusions on LG stress*

We have seen in the previous sections that the pattern of LG primary word stress can be described by means of a fixed set of faithfulness and wellformedness constraints. The ranking developed for LG is given in XVIII).

XVIII) {SHSP, Non-Exhaustivity, MaxBin} >>
ID-STR >>
RHTYPE=T >>
{WSP, WEAKEDGE} >>
PARSE (σ) >>
{RIGHTM, PARSE (Σ)}

This constraint hierarchy determines that the grammatical stress is assigned trochaically by means of syllable weight. CV syllables generally count as light. This means that the respective phonetically long vowels are monomoraic. Word-internal CVC syllables count as heavy. In polysyllables, their weight in word-final position basically depends on the segmental context. The superheavy syllables that may occur in final position in PrWds retain a heavy syllable status. Crucial is here the extrasyllabic position of the final consonant. The weight of the phonetically overlong tense vowels can be defined as bimoraic, yielding a heavy status of the CVV<C> sequence.

The stress assignment is such that if the penultimate syllable is (C)VC, stress goes there; if the respective penultimate syllable is (C)V the stress moves further to the left to the antepenult. The antepenult might then be either a (C)VC syllable or a (C)V syllable. Word-final stress occurs either in mono- and bisyllables that comprise a light initial syllable and a heavy final syllable, or in cases with final superheavy syllable. The preferred foot structure is a moraic trochee. All in all, the major part of the LG stress assignment is predictable by means of syllable weight in this way.

A subset of LG PrWds shows stress assignment that is insensitive to syllable weight. This is induced by the high ranked faithfulness constraint ID-STR. The constraint is triggered only by lexical marking for stress in input forms. I argue that loanwords like [zɔmˈbreːro] ‘sombrero-Sg.’, [biˈkiːni] ‘bikini-Sg.’ or [kɑˈjyːt] ‘cabin-Sg.’ comprise an underlying specification for stress on the penultimate syllable. Thus, ID-STR steps in, yielding overt forms that correspond to the underlying form with respect to primary word stress.

5. Low German vowels

The previous chapters provided phonetic data of LG as well as a brief analysis of the stress system. We found that both phonetically short vowels and phonetically long vowels count as light. The LG stress pattern does not yet allow for a clear-cut phonological interpretation of the data, though. Let us therefore turn our attention to the LG vowels to determine how the durational differences witnessed in the vocalic system can be analyzed phonologically.

The analysis of LG vowel length has been a matter of quite some debate over the past 100 years, as has been pointed out in chapter 2.3 above. Three main approaches have been brought forward, attempting to explain the issue on phonological grounds:

i) a tonal contrast of TA1 (pushing tone) *vs.* TA2 (dragging tone);
ii) the assumption of a ternary contrast in vowel length of short *vs.* long *vs.* overlong, or short *vs.* half-long *vs.* long; and
iii) a twofold binary contrast of vowel length (short *vs.* long and overlong) and vowel quality (lax *vs.* tense).

This chapter evaluates these three positions for the vowel system of LG. We will see that the account in iii) is preferable, being supported best by the phonetic facts presented in section 3.2 to 3.6. However, this approach has to be adjusted in the light of the stress analysis provided in chapter 4. Instead of a vowel length opposition short *vs.* long and overlong, we arrive at a contrast of short and long *vs.* overlong. The vocalic facts are closely interrelated with the issue of coda consonants. What I will argue later on is that a quantitative approach in terms of Mora Theory is possible to explain the LG data. The key are the laryngeal features of the consonants (a matter that will be discussed in more detail in chapter 6). They enable us to account for the special status of lenis obstruents – the only consonants that allow for phonetic overlength of a preceding vocalic nucleus.

With respect to these nuclei, we found in the Perception Test no cue to the existence of distinctive tonal contours in the speech of the investigated LG informants of Altenwerder and Alfstedt. The same is true for the perception sample obtained from the on-line listening experiment. Also, the production data of the three dialects of Kirchwerder, Altenwerder, and Alfstedt were inconclusive with respect to the possible presence of distinct pitch contours. Only one informant (III.6.Aw) produced some cues for a difference. While this must not necessarily mean that the contrast is expressed in a different way, I assume that due to the existing interface between phonetics and phonology (see section 2.1) it is rather likely that the opposition is expressed not in terms of tones.[168]

We crucially observed that it was mainly the vowel duration that had a noticeable effect on the perception of the stimuli by the informants. Three rather distinct

[168] Kehrein (p.c.) notes that it is indeed impossible for tones to play a role in the phonological system of LG if the informants neither produce nor perceive specific tonal contours.

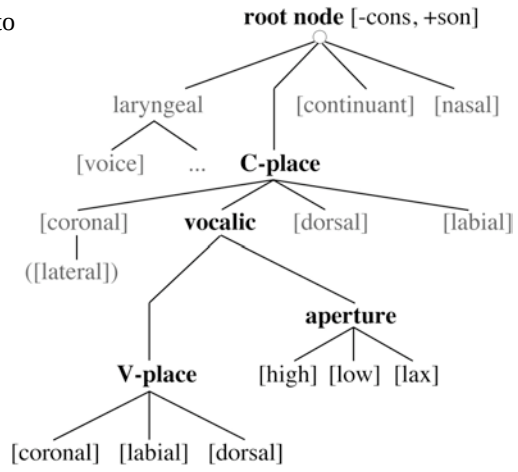
durational degrees of short : long : overlong were witnessed in the production data. A neutralization between phonetically long and overlong vowels occurs mainly in the mid vowels. Their durational differences between ELD 2 and ELD 3 is somewhat weaker than for closed vowels and open vowels (except for the Kw. data). This was discernible from the minimal pairs as well as the complete samples of the LG informants. The complete samples showed that closed vowels as well as open vowels exhibit a more pronounced durational difference between the two length categories ELD 2 *vs.* ELD 3, with the conservative JND of 20 - 25% being met at all times. The results give us reason to presume that for the informants the synchronic LG contrast is not a matter of pitch contours (and thus tonal accents) but rather of durational difference.

Before diving into the analysis of the LG vowel phonemes, I give a brief overview on the vowel qualities and the matter of vowel length in the language. The phonological analyses of the vowel system follow thereafter.

5.1. *Vowel quality*

Although inherently inseparable from segmental length, I will try to focus on the quality of the LG vowels first before continuing with the matter of vowel quantity. I assume the following autosegmental structure of vowels (Clements & Hume 1995; van Oostendorp 1995):

Figure 50. Autosegmental approach to vocalic structure



Van Oostendorp (1995:10) postulates "that the class nodes labeled ′C-Place′, ′V-Place′, ′Laryngeal′, ′vocalic′ and ′Aperture′ are structural non-terminals; they cannot occur in a representation unless they dominate some feature." The major class features are specified directly on the root node (segmental node). The class nodes V-place and aperture determine the place of articulation within the oral cavity and the manner of articulation (e.g. *tense* or *lax*), respectively. These two parameters define the actual quality of the vowel.

5.1.1. *LG monophthongs*

The general LG vowel pattern is given in Figure 51. Note that local varieties may differ in the actual realization of these phonemes, especially by means of diphthongization.[169] We have 14 qualitatively differing monophthongs in the system, plus the schwa-vowel. It has been pointed out in the discussion on LG stress that schwa is a defective vowel in the sense that it is structurally empty. Its vocalic node does not branch. The schwa may therefore be interpreted as lacking a vocalic node in the sense of van Oostendorp (1995), which results in the rather deviant behavior of this vocoid.

Figure 51. The LG vowel system

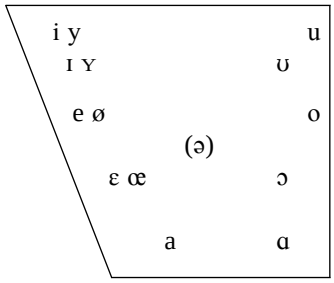


Table 27: Vocalic system of LG[170]

	/lax/ [*short V*]	/tense/ [*long V*]	[*overlong V*]
closed	[lɪçt] ‘to lie-3.Sg.’	[riːs] ‘rice-Sg.’	[riiːz] ‘giant-Sg.’
	[lʏt] ‘little’	[fyːɐ] ‘fire-Sg.’	[lyyːd] ‘people-Pl.tantum’
	[mʊt] ‘must-3.Sg.’	[huːs] ‘house-Sg.’	[druuːv] ‘grape-Sg.’
mid[171]	[brɛt] ‘plank-Sg.’	[deːk] ‘blanket-Sg.’	[ʔeeːç] ‘harrow-Sg.’[172]
	[zœs] ‘six’	[zøːn] ‘son-Sg.’	[bløøːd] ‘leaf-Pl.’
	[vɔs] ‘fox-Sg.’	[loːt] ‘to let-3.Sg.’	[dooːv] ‘deaf-adj.f.’
open	[dax] ‘day-Sg.’	[ʔɑːl] ‘all’	[mɑːɪn] ‘to mow-Inf.’

The vowels are divided into two basic categories: lax vowels and tense vowels:[173] lax vowels are phonetically short, tense vowels are either phonetically long or phonetically overlong.[174] Table 27 exemplifies the vowel set of LG.

[169] Lauf (1988).
[170] The transcription given in square brackets is a generalized moderately broad phonetic transcription. It denotes e.g. the voicing difference found for the final coronal fricative in ‘rice-Sg.’ *vs.* ‘giant-Sg.’. Where the former is unanimously produced without any vocal fold vibrations, the latter shows variance in its realization. It varies from slightly devoiced [z̥] to completely devoiced [s].
[171] Note that overlong mid vowels are diphthongized in some varieties of LG (e.g. Kw., Aw., Finkenwerder, Alfs., Diekhusen, Bardenfleth, Osterbruch, Horneburg), hence Aw. LG [ʔeːɪç] ‘harrow-Sg.’, [bløːɪd] ‘leave-Pl.’, [doːʊv] ‘deaf-f.’. Furthermore, no monophthongal overlong realization of the open degree is available across the LG dialects.
[172] From MLG *ēgede*.

The diachronic development of the LG lax and tense vowel phonemes is summarized in Table 28 below by means of the dialect of Wesseln / Dithmarschen (Kohbrok 1901, cited in Wiesinger 1983b:1064):[175]

Table 28. Diachronic development of LG vowels

LAX VOWELS		TENSE VOWELS	
LG	MLG	LG	MLG
ɪ	< i, (î)$_{CSS}$,[176] (e)$_{N+C}$	iː(ː)	< î
ʏ	< y, (ŷ)$_{CSS}$, (ö)$_{l+C}$	yː(ː)	< ŷ
ʊ	< u, (û)$_{CSS}$, (o)$_{l+C}$	uː(ː)	< û
ɛ	< e, ë, (ê$_2$,ê$_4$, ê$_1$)$_{CSS}$	eː(ː)	< ē$_1$, ē$_2$
œ	< ö, (ô$_2$, ô$_1$)$_{CSS}$	øː(ː)	< ȫ$_1$, ȫ$_2$
ɔ	< o, (ô$_2$, ô$_1$)$_{CSS}$, [(a)$_{l + dental}$]	oː(ː)	< ō$_1$, ō$_2$, ā, â (ā, â)$_{analog. Umlaut}$
a	< a, (â)$_{CSS}$, (i, e, ë, a)$_{r + dental}$	ɑː(ː)	< (a)$_{r + labial/velar}$

We see here that MLG long vowels in closed syllables were shortened via a process of closed syllable shortening (CSS). The lengthened vowels in Table 28 result from a process of open syllable lengthening (OSL) in pre-MLG time. This development does not occur anymore at later language stages.

The synchronic presence of a lax *vs.* tense difference has been briefly outlined in chapter 3 above. This topic has been subject to a variety of phonetical studies although to my knowledge only one study is concerned with the contrast in LG.[177] But what determines this opposition phonologically? I give an overview on the phonetic findings and the possible phonological interpretations of the lax *vs.* tense contrast in the succeeding section.

5.1.1.1 LG lax and tense

The lax and tense vowels differ phonetically most notably in terms of F1, F2, and intrinsic duration. Other phonetic and articulatory correlates of lax vowels as compared to their tense correspondents were found to be a gestural overlap in CV

[173] See van Oostendorp (1995) for a discussion of the terms and alternative labels such as [±peripheral], [open$_i$], and [±ATR] or [±RTR].

[174] This is quite similar to the respective vowels of the Nilo-Saharan language Dinka (Remijsen & Manyang 2009).

[175] Circumflex (^) marks Pre-MLG long Vs, macron (¯) marks MLG lengthened short *Vs.* The sound changes within the set of mid vowels are denoted as follows (Wiesinger 1983a:821, 1983b:1045, 1071f.): MLG ê$_1$ [æː] < *i*-Umlaut of WGerm *â*; MLG ē$_1$ [iə] < WGerm *i* / *e*; MLG ê$_2$ [ɛː] < WGerm *ai* / *ê$_2$*; MLG ē$_2$ [eə] < WGerm *ë*; MLG ê$_3$ [ei] < WGerm *ei*; MLG ê$_4$ [eː] < WGerm *eo* / *ê$_2$*; MLG ô$_1$ [øː] < WGerm *ô*; MLG ȫ$_1$ < Umlaut of *ō$_1$*; MLG ô$_2$ [œː] < WGerm *au*; MLG ȫ$_2$ < Umlaut of *ō$_2$*; MLG ô$_1$ [oː] < WGerm *ô*; MLG ō$_1$ [oː] < OSax *o*; MLG ô$_2$ [ɔː] < WGerm *au*; MLG ō$_2$ [oː] < OSax *u*; MLG e [e] < primary Umlaut of WGerm *a*; MLG ë [ɛ] < WGerm ë / secondary Umlaut of *a*.

[176] CSS: Closed Syllable Shortening.

[177] I.e. Spiekermann (2002, 2004) for Low German. For rather recent research on Standard German see among others Kroos et al. (1997), Hoole & Mooshammer (2002), Pape & Mooshammer (2006).

and VC sequences, increased tongue and jaw movement, relative stability with respect to temporal manipulations (i.e. speech rate differences), an early aligned intensity peak, and a lower number of intensity peaks and acceleration peaks (Hoole & Mooshammer 2002; Spiekermann 2004). Also, the nature of a succeeding C was and is subject to phonetic scrutiny in order to clarify the lax *vs.* tense vowel distinction. Dutch and English word forms show for example a difference in the F0 peaks in dependence on the quality of the nucleus. Ladd (2004:125) notes that "the peak accompanying a long [i.e. tense] vowel is late in the vowel, but accompanying a short [i.e. lax] vowel is late in the following consonant."[178] This suggests that a syllable boundary following after the F0-peak is introduced right after the vowel in the former case, and within the consonant in the latter case. A distribution of V_{lax}C.C *vs.* V_{tense}.C is the result.

It is a rather complex bundle of phonetic properties that defines the lax *vs.* tense contrast. The perceptual relevance of the qualitative difference between the two vocalic categories was confirmed for the northern (i.e. Hamburg) varieties of Standard High German by Weiss (1976), and for Low German by Kohler & Tödter (1984) and Kohler (2001). With these experimental findings, it appears reasonable to assume a phonological relevance of the opposition tense *vs.* lax.

It has been mentioned above in chapter 4 that the LG lax vowels, like Dutch and Standard German lax vowels, require a coda C to close the syllable. They never occur in open syllables. This behavior has been variously expressed in the literature by means of a prosodic syllable-cut correlation (e.g. Trubetzkoy 1939, Spiekermann 2004), a mono-positional representation of lax vowels in a obligatorily bi-positional nucleus (van der Hulst 1985:57), or the 'Compulsory Coda Principle' (Barry et al. 1999), the OT constraints CONNECT(Ñ, lax) (van Oostendorp 1995:4) and LAX+C (Gussenhoven 2009).[179]

All of these approaches have in common that they crucially refer to the vocalic aperture feature [lax] of vowels. Vowels with a specification for [lax] have properties that vowels lacking this feature do not have.[180] Van Oostendorp (1995:34) accordingly defines that "*a syllable Σ is bimoraic* iff *the head of Σ dominates a feature [lax]* (= CONNECT($\sigma_{\mu\mu}$, lax) in a moraic theory of syllable structure […]." This entails that a succeeding intervocalic C is rendered ambisyllabic, i.e. becomes a 'virtual' geminate that occupies the (moraic) coda position of a preceding syllable and at the same time the onset position of a succeeding syllable (van der Hulst 1984, 1985). The phonetic indications for the syllable boundaries mentioned above appear to lend some support for these assumptions.

The effect is the same in all theoretic frameworks. The lax vowel may not occur in an open syllable and is not affected by (synchronic) lengthening processes. Only

[178] Caspers & van Heuven (1993).
[179] Becker (2002) and Cohn (2003).
[180] This is also in line with the phonetically based explanation suggested by Hoole & Mooshammer (2002). They postulate that "lax vowels are characterized by *pulsatile* force input, tense vowels by *distributed* force input." (Hoole & Mooshammer 2002:150). The more centralized positions of the lax vowels result from the active support of a higher consonant-to-vowel movement amplitude. The short vowel duration as well as the intrinsic pitch are then interpreted as an enhancement of "the pulsatile nature of the acceleration signal."

tense vowels may lengthen and may acquire a second mora. In order to express this in OT terms I adopt the constraint LAX+C given by Gussenhoven (2009), slightly amending it to XIX).[181]

XIX) LAX+X: a lax vowel requires a subsequent *segment* in the same syllable.

This constraint can be illustrated as follows (Gussenhoven 2009:185).

Figure 52. LAX+X syllable structure



The difference to the constraint LAX+C assumed by Gussenhoven (2009) is that LAX+X is more general. It is not specified what segment needs to close the syllable since it may be [+cons] as well as [-cons]. This means that even a vocalic segment is able to satisfy LAX+X. It takes into account the occurrence of lax-tense diphthongs in LG mentioned in section 5.1.2 below. However, it also opens up the possibility of lax-lax configurations, i.e. lengthening of the short lax vowel to a bisegmental long lax vowel; a rather undesirable result because we generally do not find long lax vowels in LG. The OCP (Obligatory Contour Principle) offers a straightforward possibility to exclude these configurations. It crucially disallows two adjacent identical segments within the same PrWd, i.e. segments containing certain matching features – in this case [lax].[182]

XX) OCP: No identical adjacent elements.

A bisegmental representation would therefore need to change into a monosegmental representation. And now the circle becomes full. LAX+X is violated by having a bimoraic though monosegmental lax V in the nucleus. Another segment would still need to follow in the same syllable. This renders the whole lengthening process pointless. The effect of the interaction of both constraints on the lax vowels is visible in the following tableau. Note that the given output forms are not the overt forms for the metrical constraints developed in chapter 4 still have to be applied.

[181] I prefer this constraint concept above CONNECT($\sigma\mu\mu$, lax) because it refers to the branchingness of the syllable in a different way than the connect constraint does. It enables the necessary exclusion of a syllable branching into two lax constituents in LG, and allows for the occurrence of monomoraic CVC_{lenis} sequences (see section 6.2.2).
[182] See Fukazawa (1999) for a detailed discussion of the OCP on features.

Tableau 15. [bʊddəl] ‘bottle-Sg.’

CVCCəC lax	OCP	LAX+X
(a) ☞ CV$^{\mu}$C$^{\mu}$.Cə$^{\mu}$C$^{\mu}$ lax		
(b) CV$^{\mu}$.Cə$^{\mu}$C$^{\mu}$ lax		***!**
(c) CV$^{\mu}$V$^{\mu}$.Cə$^{\mu}$C$^{\mu}$ lax lax	***!**	
(d) CV$^{\mu\mu}$.Cə$^{\mu}$C$^{\mu}$ lax		***!**

The respective invalid structures of (c) and (d) follow in Figure 53. Only (a) meets both criteria by creating an ambisyllabic geminate C.

Figure 53. Invalid lax nuclei



OCP ! LAX+X !

It is evident that only consonants or tense vowels may follow a lax nuclear vowel. Whether or not a coda consonant receives a mora depends on its quality and the position of the syllable in the PrWd (i.e. morpheme-finality). Since LAX+X is never violated, i.e. lax vowels never occur in open syllables, we can assume that it is undominated in LG.

The behavior of the LG tense vowels is generally different from the lax vowels. They are left unspecified for the feature [lax], which allows them to occur in open syllables. They indicate no need for a coda C.[183] Even stronger, one needs to assume that the tense vowels cannot have a following tautosyllabic C or ambisyllabic C word internally – not even in the case of consonant clusters (Wolfgang Kehrein p.c.).[184] They exhaust the syllable. This property in conjunction with the constraint of FOOT BINARITY (FTBIN) mentioned in XIV) in chapter 4 has often been taken as evidence for a phonologically long, i.e. bimoraic or heavy, representation of tense vowels. The system of LG primary word stress has shown, however, that phonetically long tense vowels count as light with respect to syllable weight just like the lax vowels do. If we want to express this in terms of OT, the currently employed

[183] See LG ‘hedgehog-Sg.’ [ˈsviːˌnegəl].
[184] E.g. *ʔalˈkoːββən ‘alcove-Sg.’, or *ʔalˈbɑːtrɔs ‘id.’. The word-final position, and hence monosyllables, are a different matter. A final C may be rendered extrasyllabic if it is lenis, or may require parsing if it is fortis or sonorant (see section 6.2).

constraint set is not yet sufficient. It would be possible to achieve bimoraic output forms by Richness of the Base (ROTB) in contexts where phonetic overlength is not applicable. An underlyingly bimoraic vowel could be kept bimoraic. I therefore argue for a constraint that generally excludes vowels with more than one mora at the surface level.[185]

XXI) *$V_{\mu\mu}$: No bimoraic vowels.

An effect of this constraint is that monomoraic CV_{tense} syllables emerge. Examples are [mɑ.ˈtroːs] ‘sailor-Nom.Sg.’ and [mɑ.ˈtrats] ‘mattress-Sg.’ where the initial open syllable fails to attract stress (i.e. remains light) inspite of the general bias against final stress in LG (see section 4.1.4). This monomoraic status is kept in the LG output form by means of the faithfulness constraint DEP-μ.

XXII) DEP-μ: Every mora of S_2 has a correspondent in S_1.

This constraint essentially determines that for every mora present in the output form a corresponding mora must be already present in the input form. The insertion of an additional mora as a repair mechanism (e.g. by means of FTBIN) is therefore disallowed. Mora deletion is, however, not penalized. The – rather infrequently occurring – monosyllables ending in a monophthong (e.g. [roː] ‘raw’) are consequently counted as monomoraic.

All in all, the vocalic aperture node with its feature [lax] appears to have a crucial influence on the syllable structure of the according nucleus. We will see later in the discussion of the consonants that another (namely consonantal laryngeal) node has a similarly important impact on the metrical structure of fortis and lenis consonants. The features of segments can, thus, be assumed to determine the metrical representation.

5.1.2. *LG diphthongs*

In addition to the 14 monophthongs, we generally find five synchronic diphthong qualities in LG. They developed from the MLG long mid vowels. All of these diphthongs have qua articulation a closing or level jaw movement. The differences between ELD 2 and ELD 3 pointed out for the monophthongs are also valid for the diphthongs, dividing them into two categories: normal long diphthongs and overlong diphthongs. Table 29 gives some minimal pairs.

[185] See van Oostendorp (1995) on Dutch vowel length. Note that this constraint is only relevant in the case of phonetically long tense vowels. They are required to be able to be bimoraic in the case of phonetic overlength, resulting in a lower ranking of *$V_{\mu\mu}$ as compared to LAX+X and OCP.

Table 29: Diphthongs of Aw. LG

[*long*]		[*overlong*]	
[brɛif]	‘letter-Sg.’	[brɛːiv]	‘letter-Pl.’
[ʃɔin]	‘beautiful’	[mɔːid]	‘tired’
[brɛot]	‘bread-Sg.’	[brɛoːt]	‘to brew-3.Sg.Pres.’
[main]	‘river Main’	[maːin]	‘to mow-Inf.’
[haot]	‘skin-Nom.Sg.’	[klaːot]	‘to steal-3.Sg.Pres.’

The MLG origins of the synchronic diphthongs are given in Table 30 (Wiesinger 1983b:1064).

Table 30. Diachronic development of LG diphthongs

DIPHTHONGS	
LG	MLG
ɛ(ː)i	< $\hat{e}_2$, $\hat{e}_4$, $\hat{e}_1$
ɔ(ː)i	< $\hat{o}_2$, $\hat{o}_1$, (öy)
ɔ(ː)u [186]	< $\bar{o}_2$, $\bar{o}_1$, [(a)$_{l + dental}$]
ɑ(ː)i	< ei, ($\hat{e}_1$)$_{hiatus}$, (öy)
ɑ(ː)o	< ou

These genuine diphthongs are complemented by synchronically derived diphthongs of underlying Vr-combinations. The original /r/ vocalizes to a full-fledged [a] in post-vocalic, syllable- or word-final position. The result is that, in conjunction with the preceding V, opening diphthongs like [ia, ua, oa, ea] emerge in the overt form.

5.2. *Vowel length*

Coming back to vowel length and moraicity and the issue of the LG ternary vowel durations, it was already mentioned above that the matter is inseparable from the vowel quality. Not all qualities may occur in all durational degrees. The lax vowels are inherently shorter than their tense correspondents, as has been pointed out in section 4.1.2; be it under main stress or in unstressed position. They occur only in the ELD 1 as defined in chapter 3, i.e. as short vowels. The tense vowels by comparison occur preferably in ELD 2 and ELD 3, i.e. as long vowels and phonetically overlong vowels. Only if the vowel quality is left aside do we reach a three-way length system for the LG vowels of (lax) short V : (tense) long V : (tense) overlong V. The near-merger between ELD 2 and ELD 3 of the mid tense vowels is regarded as an example of an ongoing process of contrast neutralization. The length difference is, however weak, still present in the production data. Neutralization is, thus, not yet achieved.

[186] Instead, we find ɛ(ː)o in Aw. LG.

The analyses of the LG recordings from the villages of Kirchwerder, Altenwerder, and Alfstedt are corroborated by the data obtained in the listening experiments. There we find that the informants distinguish between ELD 2-items and ELD 3-items mainly on the basis of vowel duration. Lengthening of an item in utterance-final position cannot be held liable for enhancing the phonetic difference between the two length degrees.[187] The recordings of Kw. and Alfs. exhibit a particularly weak trend towards this process. The speakers from Aw. produced the vowels of domain-final ELD 2 and ELD 3 items even with a slightly shorter duration than vowels of corresponding domain-medial items. This is a rather curious finding for a Germanic language. Does this already indicate the factual presence of overlength in LG as spoken by the informants investigated?

If we follow the footsteps of Remijsen & Gilley 2008's analysis of Luanyjang Dinka, the absence of final lengthening in a ternary system would be no surprise. The authors assume that a ternary quantity contrast is the absolute and upper limit for length contrasts, defined and constrained by the phonetic space available for duration distinctions. As a result, final lengthening would be virtually impossible in the longest degree – and consequently in the other length degrees if the quantity contrast is supposed to be maintained.

Apart from pre-pausal lengthening, another – phonological rather than phonetic – lengthening process has been mentioned already earlier in this study. This is compensatory lengthening (CL). I briefly introduce this issue and the trouble it causes in the mora-theoretic framework in the next section.

5.2.1. *CVCV Compensatory Lengthening*

In the past, the diachronic loss of a final vocalic segment (schwa) and resulting compensatory lengthening of the preceding nucleus has been assumed to be *the* source of overlength in the North Low Saxon dialects.[188] This is reason enough to have a closer look at this process and its theoretical implications.[189]

First of all: what does CL entail? What does it actually do? Kavitskaya (2002:xi) formulates it as follows:

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[187] Duration is perceived logarithmically (Allan & Gibbon 1991). This means that you perceive a duration factor of e.g. 1.5 always as equally salient, i.e. the difference between 100 ms and 150 ms feels the same as the difference between 200 ms and 300 ms (Paul Boersma p.c.). An effect is, as Lunden (2006:7) notes, "that increases in duration are less noticeable when added to already long durations." Hence, if the same perceptual difference between long and overlong vowels in final position is to be maintained, more absolute duration must be added to the duration of the overlong segments. This means that the *absolute* duration difference between long vowels and overlong vowels in final position would be expected to be bigger than in non-final position.

[188] Other approaches regard the lengthening as a by-product of the transfer of the tonal properties of the deleted final syllable to the nucleus (von Essen 1957; Hildebrandt 1963). To my knowledge it was only Kohler (2001) who came up with an explanation different from both approaches, assuming the phonetical pre-lenis lengthening of vowels to constitute the origin of the vowel length differences. This interpretation is utilized also in the CVCV CL description by Kavitskaya (2002).

[189] The assumption that the LG third degree of vowel length developed not by means of CL but rather as an instance of OSL (Emilie Caratini p.c.) is not justified. Firstly, also vowels lengthened by OSL undergo additional lengthening to ELD 3 (e.g. [doo:x] 'day-Pl.'); secondly, the process of OSL cannot be restricted to VC_{lenis} alone, which would automatically lead to the occurrence of lengthening also in VC_{fortis}-cases.

> "The term *compensatory lengthening* (CL) refers to a set of phonological phenomena wherein the disappearance of one element of a representation is accompanied by a corresponding lengthening of another element."

This process may be diachronic or synchronic, and refers to the deletion of a segment or a syllable. The lengthening is optional rather than obligatory, i.e. deletion does not automatically result in lengthening. Kavitskaya basically distinguishes two types of CL. The first one is a process with vowel lengthening resulting from the deletion of a neighboring (generally tautosyllabic) consonant (Kavitskaya 2002:37); this is termed CVC CL by Kavitskaya. An example is the West Saxon vowel lengthening after *g*-loss (Kavitskaya 2002:77), or the Germanic vowel lengthening due to deletion of a subsequent nasal (Hayes 1989:291; also Kavitskaya 2002:63).

Figure 54. (a) West Saxon CVC CL after g-loss

*fri**g**njan	>	*frignan, fr**iː**nan*	'to ask'
*the**g**naz	>	*-θegn, -θ**eː**ni*	'young man, thane'

(b) Gothic CVC CL after n-loss

*θa**ŋ**xta	>	*θaːxta*	'thought'

The deletion of the syllable-final *g* in (a) and *ŋ* in (b) leaves behind a position or mora that is not parsed by segmental content. It is subsequently filled by the preceding vowel, accordingly lengthening the nucleus (Hayes 1989). Numerous languages and language families employ(ed) this phenomenon, among which are Turkish, Kabardian, Ngajan, Ancient Greek, Komi, Latin, Lithuanian, Germanic, Bantu, Persian, West Saxon, Ket, Teheran Farsi, Hebrew, Indo-Aryan, Romanesco Italian, Samothraki Greek,[190] and Onondaga (see Topintzi 2006, Kavitskaya 2002 and references cited therein).

The second type of CL entails a conservational process that is triggered by the loss of a final V and that ultimately yields a durational increase in the preceding nucleus; it is referred to as CVCV CL (Kavitskaya 2002:35). This kind of lengthening is also what is assumed for LG. An example for this process is found besides other languages (e.g. Dinka, Lama, Bantu, Baasaar, Runyoro-Rutooro, Korean, Hungarian, Estonian, Saami, (Late Common) Slavic, and Germanic) in the Romance language Friulian (Kavitskaya 2002:104, citing Hualde 1990; Prieto 1992).

Figure 55. Friulian CV_1CV_2 CL

*káz**u**	>	*kaːs*	'case'
*lóv**u**	>	*loːf*	'wolf'
*rúd**u**	>	*ruːt*	'pure'
*mɛ́l**e**	>	*miːl*	'honey'

[190] Different from the other languages, Samothraki Greek is a case of CL by onset deletion.

Hayes (1989:286) provides an analysis in terms of Mora Theory. To account for the loss of the final vowel and the resulting changes in nucleus duration, he employs the mechanism of so-called *Parasitic Delinking*. This entails that "[s]yllable structure is deleted when the syllable contains no overt nuclear segment" (Hayes 1989:268). The process is termed 'double flop' by Hayes (1989:267). After apocope and the resulting deletion of the final syllable, the originally associated head mora becomes entirely free, allowing a new association. Crucial is here that also the original onset consonant of the second syllable loses its association. The mora is now allowed to dock onto the preceding syllable without violating the universal ban of crossing association lines. It becomes the second non-head mora of the nucleus. The final C is re-syllabified under the first syllable, constituting the new coda position. The process is illustrated in Figure 56 below.

Figure 56. Parasitic Delinking and subsequent lengthening of the V_1



Interestingly, we find a similar limitation on CL for Friulian as for LG. The lengthening of a V_1 is allowed across the board only if the consonant preceding the V_2 is voiced.[191] What is different from the LG cases is that the deletion of the final vowel in Friulian is not restricted to schwa but to non-open vowels (Kavitskaya 2002:104). Intervening sonorant Cs show a split pattern with respect to lengthening. CL applies only in pre-lateral context, i.e. the most sonorous sonorant Cs.[192] /r/ and nasals do not participate in the lengthening process. While vowels before /r/ are always long, pre-nasal vowels are always short.[193] The examples in Figure 57 illustrate this observation (Prieto 1992:212, 216ff.). The first column contains items with a segmental context allowing for CL; the second column on the right shows items that do not adhere to the CL prerequisites of Friulian. It is visible that a vowel length contrast occurs only in pre-lateral position in (a). It is established by means of CL.

[191] A complication with the system arises due to the fact that Friulian is a voicing language, i.e. has a laryngeally specified voiced series [voice], whereas the voiceless consonants are left laryngeally unspecified. This is opposite to LG, which employs rather a laryngeally specified spread glottis series [s.g.] that is accompanied by unspecified voiced consonants. This issue will be briefly treated in the following chapter in the discussion of the consonant system.

[192] See the phonetically grounded sonority scale provided by Parker (2002:236): low vowels > mid vowels > high vowels > glides > laterals, ɻ > flaps > trills > nasals > /h/ > voiced fricatives > voiced stops > voiceless fricatives > voiceless stops, affricates.

[193] Kavitskaya (2002:114f.) relates the occurrence of long vowels in pre-rhotic position to two combined processes: to diachronic simplification of rhotic geminates, and to the generally longer trasition phases from vowels to rhotics that were phonologized after deletion of a non-closed final V. The short vowels in pre-nasal position have been argued in the literature to not have lengthened, because occurring durational enhancement was interpreted as a co-occurring property of nasalization (Kavitskaya 2002:115).

Figure 57. Pre-sonorant vowel length in Friulian

(a)	**pilu*	>	***péːl***	'hair'	**kastɛllu*	>	*caʃcɛ́l*	'castle'
	**mɛle*	>	***míːl***	'honey'	**mille*	>	***míl***	'thousand'
(b)	**mare*	>	***máːr***	'sea'	**turre*	>	***tóːr***	'tower'
	**kore*	>	***kúːr***	'heart'	**kurro*	>	***kóːr***	'I run'
(c)	**kane*	>	***cáŋ***	'dog'	**annu*	>	***áŋ***	'year'
	**priːmu*	>	***príŋ***	'first'	**somnu*	>	***sómp***	'dream'

The vowel length contrast is neutralized in (b) and (c), with always long vowels (i.e. /l/) patterns together with the voiced obstruents, while the other part of the sonorants patterns with the voiceless consonants in neutralizing the vowel length contrast in Friulian. But let us have a look at some examples from LG in Figure 58 (a) and (b).

Figure 58. Low German CVCV CL

(a)	MLG *rîde*	>	LG *ried*	[riiːd]	'to ride-1.Sg.Pres.'
	MLG *hûse*	>	LG *Huus*	[huuːz]	'house-Dat.Sg.'
	MLG *ēgede*	>	LG *Eeg*	[ʔeeːç]	'harrow-Sg.'
	MLG *sāge*	>	LG *Saag*	[zooːg]	'saw-Sg.'
(b)	MLG *dûne*	>	LG *Duun*	[duːn]	'down feather'
	MLG *mîne*	>	LG *min*	[miːn]	'my-Poss.Pron.'
	MLG *dêle*	>	LG *Deel*	[deːl]	'part-Pl.'

Phonetic overlength (i.e. ELD 3) occurs basically if a schwa is deleted at a morpheme boundary, or in interconsonantal post-lenis position.[194] Kavitskaya notes that the specific lengthening processes that interact with consonant quality cannot be accounted for by Mora Theory – i.e. exactly the approach that has been advanced by Hayes (1989) to provide a phonological analysis of CL; it suffers from three major weaknesses:

i) Hayes' (1989) Mora Theory predicts that only the deletion of a weight bearing segment can trigger CL. As an effect, CL because of vowel deletion should *always* be an option.
ii) Also, every (usually non-weight-bearing) consonant should behave uniformly, i.e. its quality should not matter. This is definitely not the case

[194] The TA2 of the Franconian Rule B occurs roughly in those cases were we find phonetic overlength in LG (see section 7.3.4.2). The distribution is, however, not exactly parallel. If it was, the ELD 3 would be expected in LG in cases with originally long closed vowels or diphthongs in pre-lenis position after schwa-apocope, and in all originally long mid and open vowel or diphthong qualities. Vowels that became long *after* OSL applied would not receive ELD 3 but rather retain their status as ELD 2. This is, however, not the case in LG. Instead of this rather complex allocation, a more simplistic distribution occurs in LG. The phonetically overlong vowels or diphthongs are theoretically possible across all tense vowel qualities in pre-lenis position after post-OSL apocope, and in all tense vowel qualities after post-OSL syncope. Lax vowels are by definition not affected by this (or any other) lengthening process.

in either Slavic, Romance, or LG, where a voiceless C appears to block CL (Kavitskaya 2002:29, 111f., 119f.).

iii) Lastly, it is unclear why the mora of the deleted segment should link to the V_1 instead of associating to the C_2 (Fox 2000:100ff.).[195]

Mora Theory undergenerates in these respects. It is not able to explain the influence of the consonant quality on the lengthening process. Kavitskaya (2002) now crucially assumes that the lengthening in the given cases of so-called CVCV CL can be accounted for by means of a listener oriented approach. The durational increase is not at all compensatory in nature. She notes that

> "in certain contexts, intrinsic phonetic properties of the speech signal can be misparsed and reinterpreted, yielding phonologization […]. CL as a historical process does not in fact involve any transfer of length or weight. Rather, intrinsic phonetic vowel durations […] are reinterpreted as phonologically significant upon a change in the conditioning environment or syllable structure." (Kavitskaya 2002:10f.)

This is, however, a matter of dispute for LG. Lengthening before sonorant Cs would also be expected within this phonetic model. Note that Kavitskaya (2002:5102) points out

> "that vowel lengthening correlated with glides, liquids, nasals and fricatives in certain environments can be viewed as perceptually-based phonetic change, since vowels are usually longer in these environments."

We found in chapter 3 for LG that vowels in pre-sonorant position, though phonetically slightly longer than pre-obstruent vowels, do not generally receive phonetic overlength – be it apocope-related or context-related lengthening. Those vowels remain normally long.[196] No lengthening applies here. Thus, it seems that there is more to the sonorant Cs than the phonetic perspectives of Kavitskaya (2002) and Kohler (2001) are able to explain. The intrinsic durations of the vowels can definitely not account for the differences between ELD 2 and ELD 3 vowels.

Since it is virtually impossible to express the lengthening phenomenon in LG on the basis of the vowel-deletion process alone, we need to consider the originally intervocalic C as a factor in the lengthening equation. We come back to this point in chapter 6.

Having set the corner stones of LG vowel duration, I move on to the possible phonological analyses of the matter. The following sections now provide some solutions with respect to the issue of how to properly treat the three steps of LG

[195] In addition to these shortcomings, a fourth flaw is mentioned in the literature. It entails that no gradual change as assumed by Timberlake (1983) is possible if CL entails Parasitic Delinking (Hayes 1989) – the complete deletion of a segment is prerequisite for CL to apply.

[196] The only exception was the 'motherese' informant III.6.Aw who produced a durational contrast between ELD 2 and ELD 3 for pre-obstruent vowels and pre-sonorant vowels. It might be the case that ELD 3 has been present in the pre-sonorant cases historically (Wolfgang Kehrein p.c.).

vowel duration. I seek to incorporate not only the phonetic facts established in chapter 3, but also the findings of the word-stress analyses of chapter 4.

5.3. *The LG vowel system: triple* vs. *twin quantity*

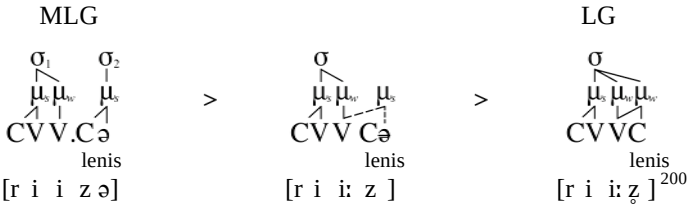
This section focuses on the possible phonological representation of vowel length in LG. I argue that a twofold binary approach comparable to the one proposed by Kohler (1986, 2001) is indeed applicable to the LG vowel system. Yet, the original version has to be amended in a number of ways; especially with respect to the reasoning behind the analysis. I argue that there is sufficient evidence – also in the data presented by Kohler (2001) – for a third length degree in the LG vowels.[197] The phonological representation is, however, best characterized by means of a two-fold binary system that employs not only a lax *vs.* tense distinction, but also a weight distinction of light *vs.* heavy.[198]

I do not yet give an analysis in terms of OT for the matter of LG vocalic overlength is irrevocably intertwined with the quality of the post-nuclear consonant that is discussed in chapter 6. This chapter is therefore constrained to the discussion of possible and – hopefully – meaningful approaches to explain the phonetic data scrutinized in chapter 3. The OT analysis follows only in the next chapter parallel to the considerations on the fortis *vs.* lenis issue.

5.3.1. *An 'overlength' account for LG*

The data I have presented in chapter 3 indicate the relevance of durational differences between the long tense vowels and the so-called overlong tense vowels of LG.[199] Remember that Hayes' (1989) phonological analysis for the development of this difference in terms of Moraic Theory employs the mechanism of *Parasitic Delinking* (see 5.2.1 above). The structures in Figure 59 visualize this process by means of LG 'giant-Nom.Sg.'.

Figure 59. Trimoraic analysis LG 'giant-Nom.Sg.':



[197] See section 2.3 for the available diachronic approaches to explain the *phonetic* occurrence of ELD 3 in LG (e.g. CL, phonetic lengthening in pre-lenis position, the urge to maintain the originally bisyllabic tonal contour).

[198] See chapter 4 for a discussion of lax *vs*. tense in relation to LG syllable weight.

[199] Note that similar proposals existed for the dialects of the Rhineland Accentuation area. They have been shown to be phonologically tonal (e.g. Gussenhoven 2000), although some researchers disagree (Kehrein 2009; Köhnlein 2011); see the various references discussed in Schmidt (1986).

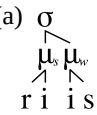
[200] The final obstruent of the LG form remains lenis synchronically not only in the underlying form but also in the surface represenation (see sections 3.2 and 3.6). Note that the transcriptions of the MLG and pre-LG forms are hypothetical. The pre-LG form may have had a stronger voicing on the final /z/ or a

Chapman (1993) in her metrical approach to LG overlength assumes a rather similar structure. The difference is here that overlength is not interpreted as a segmental property but rather as a feature of the syllable. Chapman argues that the MLG trimoraic foot structure with its intonational contour (i.e. dragging tone) was preserved in LG, being reduced from a bisyllabic configuration to a mono-syllabic configuration (Chapman 1993:148). This readily explains why syllables with overlength are always stressed; each foot needs to dominate one stressed syllable – and since the foot is exhausted by the presence of the overlong trimoraic syllable, stress is automatically assigned thereon. It is the branching nucleus (i.e. the bisegmental VV), and more precisely its second part, that receives the mora of the deleted final schwa.[201] This process could be motivated in terms of OT by a high-ranked faithfulness constraint MAX IO (μ).

XXIII) MAX IO (μ): Every mora of S_1 has a correspondent in S_2 (McCarthy & Prince 1995; Kager 1999).

MAX IO (μ) crucially prevents morae of the input form from being deleted in the output form. All morae are preserved. In any case, the development from MLG to LG – be it in terms of Hayes (1989) or Chapman (1993) – leads to the lexical distinction in Figure 60 (a) and the surface quantity contrast shown in (b).

Figure 60. (a)



‘rice-Nom.Sg.’



‘giant-Nom.Sg.’

(b) /rɪs/ ‘rip-Nom.Sg.’
/riːs/ ‘rice-Nom.Sg.’
/riiːz/ ‘giant-Nom.Sg.’
=
short, long, overlong

A possibly co-occurring pitch contour with a delayed peak on the overlong vowels and diphthongs (i.e. the so-called *Schleifton* or dragging tone) is regarded as purely phonetic and thus phonologically irrelevant (Chapman 1993:136; Winter 1979:197).

5.3.1.1 Problems with overlength

As neatly as the overlength account incorporates the three levels of vowel duration of the investigated LG dialects into a phonological system, it does have some shortcomings.

First of all, the spreading of a free mora, i.e. a unit of phonological weight (Kim 2002:193; Blevins 1995:208), is usually not blocked by a preceding voiceless C. Yet, this is what we find in LG. According to Cohn (2003:70), the mora serves “as the connection or link between prosodic and segmental structure.” The so-called root nodes cover the segmental aspects of timing whereas morae are argued to cover the prosodic ones (i.e. weight). However, there does not necessarily exist a direct one-to-one mapping between the two of them (Cohn 2003:73). Thus, it is expected that

short pause before the /z/, hinting at the lost final schwa and the old syllable structure with /z/ in the onset of the second syllable.

[201] See section 2.3.4.3.

the free mora following the voiceless, formerly inter-vocalic C would move further to the left where it would dock onto the preceding vowel of the nucleus. This mora linking, however, does not occur for voiceless Cs. An example of this is the following pair that is minimally different to the examples given in Figure 60 above:

Figure 61.

(a)	ELD 3	LG *Saag* [zoo:g]	'saw-Sg.'	< MLG *sage*	*vs.*
(b)	ELD 2	LG *Saak* [zo:k]	'thing-Sg.'	< MLG *sake*	

In Figure 61 (b), MLG voiceless [-k-] appears to have blocked the third mora from associating to the preceding vowel, while in 6 (a) MLG [-g-] did not; it allowed for the creation of a phonetically overlong (ELD 3) vowel. Hayes' (1989) as well as Chapman's (1993) approach to LG overlength does not cover this difference. Hayes wants to exclude possible interaction between apocopated schwa and its preceding consonant, which is why he crucially assumes that the consonants are not connected to morae but to syllables. This effectively renders his theory incapable of explaining the difference.

Considering Chapman's (1993) approach we find that although she mentions the pre-lenis position of a vowel as one condition for the occurrence of overlength in LG, she fails at explaining the reason behind this observation. Her metrical account does not distinguish between lenis coda consonants and fortis coda consonants. She assumes that not the segments but rather the positions on the metrical grid are relevant for the lengthening processes (Chapman 1993:150). Her analysis is concerned only with the surface lenis obstruents, and the sonorant consonants. The former are regarded as extrametrical, i.e. as being located outside of the prosodic structure and prohibiting quadri-moraic configurations; the latter are assumed to be part of the nucleus. The blocking-issue of the fortis coda Cs as demonstrated in Figure 61 is neglected as being a purely phonetic matter. No further reference is made as to the structure of the fortis obstruents or their influence on a preceding vowel.[202]

Another deficit of Chapman (1993) is the restriction of her overlength analysis to morphological complex forms like [huu:z] 'house-Dat.'. Words such as [zii:d] 'silk-Sg.' that are morphologically simple cannot be derived by Chapman's rules.[203] Instead, she assumes that overlength in these cases "must be specified in the lexical representation of the lexeme" (Chapman 1993:153, FN 43). It is unclear why the diachronic deletion of a morphemic schwa should require a Synchronic Alternation Rule (Chapman 1993:154), whereas the diachronic deletion of a *non*-morphemic schwa would result in lexical specification.

It is these analytical shortcomings that let Chapman's (1993) approach appear rather questionable.

[202] Chapman (1993:131) asserts that some durational deviations in *long* vowels are results of the phonetic context. Long vowels in pre-lenis position are produced longer than long vowels in pre-fortis position. For Chapman (1993: 131), "the difference in vowel length serves as an important clue for identifying the character of the following sound".

[203] See section 2.3.4.3.

Something we need to bear in mind when dwelling on the matter of LG vowel length are the indications of the LG stress pattern as shown in chapter 4. The analysis in section 4.1.1 shows that tense vowels do not *per se* count as heavy (i.e. bimoraic or long) and therefore do not automatically receive stress (e.g. [ˈʔalkoβən] 'alcove-Sg.'). This finding already led us to the conclusion that non-final (C)VC syllables in LG are heavier than non-final (C)V syllables. We can assume that (C)VC syllables are generally bimoraic, and (C)V syllables are generally monomoraic, if occurring in non-final position within a PrWd. This obviously means that the V is monomoraic in both syllable types, independent of the lax or tense vowel quality.[204] Only the phonetically overlong tense vowels count as heavy and attract stress by means of the SUPERHEAVY-TO-STRESS PRINCIPLE (SHSP, see section 4.1.2, paragraph VI). That this principle is in effect is evident from words of the structure CV.CV.CVVC with a final syllable containing an overlong vocalic nucleus (e.g. [tɑkeˈlɑɑːʃ] 'rigging-Sg.'). Although the initial CV.CV sequence could be properly footed with stress assignment to the antepenultimate syllable, it is indeed the final CVVC syllable that receives stress.

We arrive at two kinds of light vowels (phonetically short lax V, phonetically long tense V), and one kind of heavy vowel (phonetically overlong tense V). This weight distribution does not call for phonological overlength in the quantity system. It rather looks like a binary opposition of short *vs.* long. Apparently, no trimoraic configuration is needed.

But the problems with overlength do not stop here. No genuine minimal-triples are available since the vowel quality changes between lax and tense for ELD 1 *vs.* ELD 2 and ELD 3. This qualitative factor has been shown to be perceptually relevant by Kohler & Tödter (1984), Kohler et al. (1986 b, c), and Kohler (2001) for LG, and by Weiss (1976) for the northern German regiolect of Standard High German (see 3.1.3). The importance of this aspect can also be inferred by the fact that the contrast between ELD 1 *vs.* ELD 2 is obviously not a matter of phonological weight. Both count as light with respect to word stress. The split between the phonetically short lax vowels and phonetically long tense vowels requires therefore an alternative explanation that a purely length-based account cannot provide.[205] We will get to this point in due course.

The assumption of a phonologically overlong, i.e. trimoraic, syllable gives rise to a further issue as it violates the presumably universal *principle* of Maximal Binarity (MaxBin) that was given in XV). It does not allow more than two morae within one syllable,[206] prohibiting effectively the occurrence of superheavy syllables in the output form.

We see that the phonological overlength approach for LG vowel quantity is rather problem-prone. Although the analysis by Chapman (1993) might be upgradable in terms of consonant quality, the remaining descriptive and theoretic

[204] A bimoraic status of the phonetically short lax vowels is clearly undesirable from a analytical point of view. If the lax V were able to build a foot on its own, why would it require a coda to close the syllable?
[205] See van Oostendorp (1995:28ff.) for his analysis of Dutch vowels.
[206] This could also be expressed in terms of high ranked **Mora Crowding* (*μμμ) (Prince & Smolensky 1993/2002:50, 2004:248f.).

issues are left untouched. We are in need of a different proposal for a LG vowel system.

5.3.2. *The binary approach: Kohler*

Aware of the problems with vowel quality, Kohler (2001) puts forward a binary analysis of the LG quantity system. Although he leaves open a relation to present phonological theories of weight, his conclusions for northern LG basically reflect the findings of Wodarz (1979) and Weiss (1976) for the northern German variety of Standard German. His analysis is based on phonetic scrutiny of four LG dialects, one being located within the defined 60 km radius around Altenwerder in Niedersachsen (i.e. Fintel), and three outside of this radius in Schleswig-Holstein (i.e. Windbergen, Brarupholz, and Haßmoor).

The geography defines naturally the dialect of Fintel to be most relevant with respect to the currently investigated varieties of Kirchwerder, Altenwerder, and Alfstedt. The Fintel study analyses ELD 1, ELD 2 and ELD 3 items that were elicited under declarative sentence intonation, and in sentence-medial, *pre*-focal position (Tödter 1982:66).[207] A second focus on the items of interest as described by Kohler (2001) for this study is not mentioned in Tödter (1982) and remains dubious. If the choice of sentence focus with the main stress occurring after the item of interest is indeed as described in Tödter (1982), a problem arises. The token is then likely to have been produced in an unstressed way (Willkommen 1999:82). This effect has been pointed out by Jessen et al. (1995). Durational differences between tense ELD 2 and ELD 3 vowels on the one hand, and between tense ELD 2 and lax ELD 1 vowels on the other hand are expected to rapidly decrease in pre-focal context. We would, thus, predict only two length degrees to emerge: short *vs.* long. And this is exactly what Tödter (1982) finds.

Kohler (2001:392) notes that the same elicitation method as for Fintel was implemented for the recordings of the Windbergen, Brarupholz, and Haßmoor dialects. However, we find in the descriptions of the respective studies (Kohler et al. 1984) that only for Haßmoor a bi-focal realization (i.e. stress on the item and the penultimate word) was intended, while for Brarupholz and Windbergen the sentence focus lies only on the respective item. The outcomes are now that two length degrees are obtained for the diphthongs, and three phonetic length degrees are witnessed at least for the mid vowels of Haßmoor and Brarupholz (the open vowels are missing in the surveys). This parallels my recent findings for Kirchwerder, Altenwerder and Alfstedt. The only unexpected finding for the stressed sentence position is that the closed ELD 2 vowels merge durationally with the closed ELD 1 vowels, yielding a binary split. This result diverges fundamentally from the very clearly defined differences between the short *vs.* long length categories in the recent data of Kirchwerder (duration ratio 1.59), Altenwerder (duration ratio 1.74, and 2.17), and

[207] Tödter (1982:66) specifically notes that she instructed the informants to stress the penultimate word of her carrier sentence *Dat / de … schall / schütt groot ween.* 'This / these … shall big be.'. This method was supposed to divert the interest from the stimulus and ensure a comparable sentence intonation across all of the recordings.

Alfstedt (duration ratio 1.55). Yet, the data presented in the Schleswig-Holstein studies from the 1980s is not entirely conclusive because the open vowel quality is missing from the samples. The overall impression is therefore that a ternary contrast is a valid option for the dialects of Schleswig-Holstein since two length degrees occur only for the closed vowels.

Kohler's (2001) conclusion is different, though. Minimal triples for a possible ternary opposition are not available, which is why Kohler deduces that "eine dreistufige Opposition ist heute nur so rudimentär ausgeprägt, daß sie für die sprachliche Kommunikation keine Bedeutung hat [...]" (transl.: a three-step opposition of length is of rudimentary status nowadays, and has, thus, no relevance in verbal communication) (Kohler 2001:398f.). A distinct F0 contour on the ELD 3 vowels, viz. a dragging tone, was also not observable in his data (Kohler 2001:397). Kohler therefore assumes a binary rather than a ternary quantity distinction for all four investigated LG dialects of Niedersachsen and Schleswig-Holstein. Instead of the traditionally assumed phonetically long status of the tense ELD 2 vowels, he rather labels them as short, noting that durational differences between short lax vowels and long tense vowels do not reach the JND (Kohler 2001:394). Accordingly, the tense ELD 3 vowels are labeled as long. No analysis is provided for the two occurring length degrees (short *vs.* long?) in the diphthongs. This length opposition poses an analytical problem in a binary system supposedly contrasting only short vowels *vs.* long vowels and diphthongs. What to do with the longer diphthongs? This problem adds to the point made in section 2.3.4.2 that Kohler's denial of a threefold length distinction must occur as questionable against the background of the three durational steps found in the mid vowels of the Haßmoor dialect. The presence of a contrast, even if it does not occur frequently in a language, indicates the presence of a distinction in the speaker's minds. It is likely to be of phonological relevance.

In addition to the analytical problems, a methodological issue arises for the post-vocalic coda Cs. Instead of comparing the durations of lax *vs.* tense vowels in identical pre-consonantal context (i.e. only vowels in pre-obstruent context among each other and only vowels in pre-sonorant context among each other) the vowel durations were looked at across all consonant contexts (i.e. lax pre-plosive *vs.* tense pre-fricative *vs.* tense pre-sonorant, and so on). This is particularly disadvantageous because phonetic effects of the succeeding C on the nucleus are not controlled for and may very well skew the results. Such influence is clearly visible in the data analyzed in chapter 3 above. We have seen there that a pre-obstruent vowel receives remarkably different (i.e. longer) duration values in ELD 3 in all investigated dialects than a pre-sonorant vowel does. This or similar effects are left untouched by Kohler (2001).

Having made his point for a binary length distinction, Kohler (2001) turns to a diachronic explanation of the quantity contrast. He argues that the source of this opposition is not a matter of CL. Based on the observation that vowels preceding voiced obstruents are in general phonetically longer than vowels preceding voiceless obstruents (Chapman 1993; see also FN 202 above), Kohler (2001:398) states that a difference in vowel length was already present in LG before schwa loss. This

phonetic length contrast in the preceding nucleus was then phonologized by apocope and the following desonorization of the final originally voiced obstruent. His examples of schwa loss yield:

Figure 62. (a) different vowel length:

ELD 3	LG *ried* [riiːd] ‘to ride-1.Sg.Pres.’	< MLG *rîde*	*vs.*
ELD 2	LG *riet* [riːt] ‘to rip-1.Sg.Pres.’	< MLG *rite*	

(b) no effects on vowel length:

ELD 2	LG *bliem* [bliːmm̩] ‘to stay-Inf.’	< MLG *blîven*

The examples in (a) demonstrate the expected development to a phonetically overlong vowel *vs.* long vowel, whereas (b) is assumed to constitute a counterexample without overlength despite schwa loss after a preceding voiced obstruent. Kohler contends that CL could not have operated in LG since no congruent results emerge with respect to vowel duration in items showing an intervocalic voiced obstruent diachronically. The synchronic result of the originally contextually determined vowel duration differences is then a binary phonological contrast of both, vowel quality and vowel length, rather than a ternary quantity distinction:

Figure 63.

/rɪt/ ‘to ride-1.3.Sg.Past’	with a lax V
/rit/ ‘to rip-1.Sg.Pres.’	with a tense V
/riːd/ ‘to ride-1.Sg.Pres.’	with a tense V:

The findings of the LG dialects of Fintel, Brarupholz, Haßmoor, and Windbergen are indeed such that no clear-cut durational difference can be established between the lax V of ELD 1 and the tense V of ELD 2 (Kohler 2001:390). However, due to the methodological weaknesses of the data, the analysis appears as not entirely convincing.

An additional complication for the analysis of Kohler is that he implies a monosyllabic syllable structure for his counterexample in Figure 62 (b) MLG [bliːvən]. Although schwa is indeed absent in the synchronic LG form, more detailed speech data show that the second syllable is maintained by syllabifying the final nasal into the nucleus position.[208] The voiced onset of the final syllable assimilates to the syllabic nasal, yielding a development to LG [bliːbm̩] and even further to LG *bliem* [bliːmm̩].[209] The respective structure is illustrated in Figure 64 (a) below.[210] The phonetically long tense vowel of the initial syllable does not require a coda C.

[208] Prehn (2010) finds in her investigation of word-final long nasals in LG that the long nasals do not show distinct F0 contours in 97.92% of the 96 investigated items. The long nasals of syncopated forms exhibit delayed intensity peaks and sonority peaks as compared to their apocopated correspondents. This points into the direction of a bisyllabic representation of words ending in a nasal geminate that developed by means of syncope. See Kohbrok (1901:24), who points out that it is syllabification of final sonorant consonants after syncope that prevents the development of overlength.

[209] See Zahrenhusen (1909:8) on the lack of overlength before syllabified coda consonants.

[210] I employ here Hyman’s (1985) approach of associating onsets to the head-mora of the succeeding nucleus.

The syllable is open. The first part of the nasal configuration therefore constitutes the onset of the following syllable. The nucleus of this final syllable is the second part of the nasal configuration.

Figure 64. (a) LG [bliːmm̩] ‘to stay’ (b) LG [kann̩] ‘jug-Pl.’



A phonological geminate including a final syllabic part can be assumed in cases containing a phonetically short lax V in the nucleus of the initial syllable like in [kann̩] ‘jug-Pl.’ in Figure 64 (b).[211] This nucleus needs a coda to close the syllable. The short lax [a] of LG [kann̩] ‘jug-Pl.’ thus requires the following [n] to occupy a position within the initial syllable, i.e. in the coda. Syncope of schwa places the final nasal in the nucleus of the second syllable. In order to also have an onset, an ambisyllabic nasal is created. It builds at the same time the coda of the initial syllable and the onset of the final syllable (more on final sonorant consonants in section 6.2.4).[212] It is apparent that the word LG [bliːmm̩] given in Figure 64 (a) indeed stays bisyllabic. It does not qualify for a change in vowel duration (or pitch contour) since the syllable structure stays intact. Kohler, however, employs *bliem* as a counterexample against CL-effects based on schwa loss since it is a monosyllable in his view. Basing his arguments on this example effectively weakens his argument.

Another point that requires some attention is the across-the-board conjunction between apocope and overlength implicitly assumed by Kohler. This relation is not applicable to LG. In fact, only (post-)MLG apocope seems to have triggered CL. Apocope that occurred in pre-MLG time did not yield CL. This is illustrated by OSax. *sîda* > MLG *sît* > LG [ziːt] ‘side’. We see here that a word that was already apocopated in MLG times does not show phonetic overlength in synchronic LG. The OSax. form satisfies the basic requirements of comprising a long vocalic nucleus, a final vowel, and an intervocalic lenis C, but no CL applies. We may conclude that this process occurred later, in the language stage between MLG and LG, and not as a general development.

What Kohler (2001) also leaves open is the stress system of LG and its implications for syllable – and hence vowel – weight. Although he brings forward an analysis of LG vowel quantity, he gives no account of the representations of this quantity in terms of morae, x-slots, or the like.

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[211] [kanː] ‘jug-Sg.’ is by comparison monosyllabic. Its final geminate nasal is monomoraic and bi-positional, i.e. occupies two segmental slots on the grid (Prehn 2010:202).

[212] An alternative possibility is a mono-syllable with a phonological non-syllabic nasal geminate. This is rather problematic since [mm̩] of LG *blie-m* developed from two independent segments [bm̩] which in some LG dialects (e.g. Kirchwerder) are still distinct from each other. Furthermore, it does not reflect the phonetic reality particularly well.

Nevertheless, his quantity account paints a correct picture of the LG vowels. It distinguishes vowel quality and vowel quantity at the same time. This approach is inherently different from the proposals made for Standard German and Dutch that relate contrasts in the vowel system either to quantity or to quality, i.e. tense *vs.* lax (van Oostendorp 1995). Kohler's postulates may now be used to build a phonologically more refined analysis that also considers the LG stress system, the factual presence of phonetic overlength, and the vowel-consonant interaction regarding syllable weight (i.e. mora association and extrametricality).

5.3.3. *The binary approach: upgraded*

While Kohler's (2001) assumptions with respect to the distribution of length on the LG vowels may be correct, his line of reasoning is not entirely conclusive. I will try to bridge the gaps with my synchronic analysis in the upcoming section.

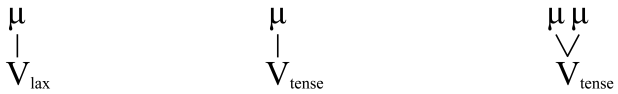
The starting point is the stress system of LG as discussed in chapter 4. We have seen there that the language utilizes a trochaic stress pattern that is to a large extent dependent on syllable weight. Lax ELD 1 vowels count inherently as monomoraic in LG. They cannot occur in open syllables and require a succeeding consonantal coda. This (C)V_{lax}C configuration then constitutes a heavy syllable that is able to attract stress in polysyllabic words. The phonetically long tense vowels are equally rendered monomoraic. The lack of the feature [lax] does, however, allow for the absence of a coda position, yielding light CV_{tense} syllables that do not attract primary word stress if a CVC syllable is available.[213]

The specific weight of the phonetically overlong tense vowels was not established so far. What the stress analysis showed is that the LG syllable weight of final syllables can be ranked as follows: CV_{tense} < {CV_{lax}C, CV_{tense}C} < CVV_{tense}C. The closed CVVC syllables as in [kɔmˈbyyːz] 'caboose-Sg.' show an ELD 3 vowel or diphthong and appear to count as underlyingly superheavy. They have undergone the same diachronic development (i.e. lengthening after apocope or syncope and reduction of the PrWd by one syllable) as synchronic monosyllabic items containing ELD 3 vowels like [riiːz] 'giant-Sg.' have. The interference of a lenis C is crucial in these cases. Without it, we end up with an ELD 2 vowel, i.e. a plain long tense vowel or diphthong as in [kɑˈjyːt] 'cabin-Sg.'. This is independent of whether the resulting PrWd is mono- or polysyllabic. It is therefore reasonable to assume that the CVVC monosyllables behave identically to the final CVVC syllables in polysyllabic words. Being a superheavy syllable is here obviously interlinked with the ELD 3 status and the consonant quality. But where is the weight located? Is it the phonetically overlong vowel that holds and retains more than one mora, or does the lenis coda attribute to the syllable weight? Thinking back to the stress analysis in section 4.1.2, we can assume that the coda Cs of CVVC syllables are rendered extrasyllabic by virtue of WEAKEDGE. The constraint determines that the right edge of a PrWd should not contain a foot. This leaves the vowel as the location of syllable weight. If we now consider the assumed LG restriction to maximally bimoraic syllables (i.e. MaxBin) while bearing in mind that CVV<C> is

[213] Kehrein (p.c.) rather assumes that it is the feature [tense] that prohibits coda Cs.

still stress-attracting (i.e. heavy), we arrive at a bimoraic status of the nucleus (see sections 4.1.4 and 4.4). A trimoraic representation of the vowel is neither necessary nor desirable. Ternarity is not needed to distinguish the phonetically long monomoraic vowels from the phonetically overlong vowels. Two morae are sufficient to express phonetic overlength in LG. The absence of true minimal triples due to the perceptually relevant vowel quality differences (lax *vs.* tense) renders the presence of trimoraic vowels even more unlikely. Thus, we can presume a weight contrast of monomoraic (short) lax vowels *vs.* monomoraic (long) tense vowels *vs.* bimoraic (overlong) tense vowels.

Figure 65. LG monophthong weight at the surface level



We see that Kohler (2001) analyses correctly the distribution of phonological length in LG monophthongs. The short lax vowels and long tense vowels fall together under the category of monomoraic vowels, while the overlong tense vowels count as bimoraic at the phonological surface level.

Assuming a phonological difference between long and overlong vowels in terms of one mora *vs.* two morae violates *Vμμ given in XXI) above, though. The constraint decisively levels out any weight distinctions between long tense vowels and overlong tense vowels. The reason why a bimoraic output form is still able to emerge in the phonetically overlong cases is that a moraic (allo)morpheme – the originally stem-final schwa (e.g. the original feminine marker, the plural or infinitive marker, and so on) – is included in the input form.[214] The schwa was lost historically along with the final syllable, and yielded vowel lengthening if occurring after a preceding voiced consonant. Overlength is, thus, the result of a monomoraic root vowel being enriched with the mora of a (allo)morpheme. *Vμμ needs to be ranked below a constraint that preserves this morphemic content present in the input form. REALIZE MORPHEME (RM) is just what we are looking for.[215]

XXIV) REALIZE MORPHEME: For every (allo)morpheme in the input, some phonological element should be present in the output.

Tableau 16 exemplifies the ranking for cases like [rii:z] ‘giant-Sg.’ that involve a moraic (allo)morpheme.

[214] I use the term ‘(allo)morpheme’ in the sense of Hammarström (1976:47) for “a set of allomorphs that are similar in regard to their segments”. i.e. in the context of this thesis for all LG schwa-endings.
[215] See van Oostendorp (2005:118), Trommer (2008) for a discussion of the constraint, and Boersma (1998:189) for a functional account of the matter. See Kurisu (2001) for a different approach, requiring phonological distinctivity between paradigmatically related forms instead of the realization of underlying phonological material (Trommer 2008:167, FN3).

Tableau 16. [riiːz] ‘giant-Sg.’

[C V^{μ} C] $^{\mu}$	RM	*$V_{\mu\mu}$
(a) ☞ C $V^{\mu\mu}$ C		*
(b) C V^{μ} C	*!	

We may now obtain by RM >> *$V_{\mu\mu}$ a bimoraic form whenever a moraic (allo)morpheme occurs – a generalization that is not valid for LG because only voiced obstruents allow this process. This issue will be treated in the following chapter. Let us stick to the analysis at hand for the moment.

Morpheme preservation yields not only minimal pairs like the inflected forms [huːs] ‘house-Nom.Sg.’ *vs.* overlong [huuːz] ‘house-Dat.Sg.’, but also a lexical contrasts such as [riːs] ‘rice-Sg.’ *vs.* [riiːz] ‘giant-Sg.’.[216] The according Pl. or Dat. forms of ‘giant’ do not exhibit overlength as they are constructed with final *-s#*, *-n#*, or *-t#* respectively. The assumption is such that in some declensions (e.g. the strong *a*-stems and *i*-stems) the Nom./Akk.Sg. shows an empty morpheme – a so-called zero-morpheme or Ø-morpheme.[217] This is an ‘invisible’ affix, which basically means that it consists of an empty string of phonological segments. Conversely, the Nom.Sg. morpheme in other noun classes (e.g. the weak *n*-stems) is filled with a mora, which yields overlength if a voiced obstruent preceding a historically apocopated schwa is involved.[218] An abbreviated overview of the LG noun classes where a moraic (allo)morpheme occurs is added in appendix (F) (Lasch 1974:191-203).

An example for phonetic overlength of a zero-morpheme in the Nom.Sg. *vs.* a moraic (allo)morpheme in the Dat.Sg. is the neuter a-stem *Huus*. The Ø-morpheme is underlyingly attached to the root of the Nom.Sg. form [h u_{tense} z] ^{Ø}] ‘house-

[216] The presence of a final /z/ in ‘house’ is evidenced by dialects not comprising complete schwa-apocope (e.g. the village of Baden of the district of Verden, Feyer 1941), yielding the Dat.Sg. [huuːzə] and the Nom.Pl. [hyyːzər]. In ‘giant-Nom.Sg.’ it is evidenced by the plural form [riiːzən] ‘giant-Nom.Pl.’.

[217] The terminology ‘strong nouns’ and ‘weak nouns’ was introduced first by Jacob Grimm (1822). The so-called ‘strong nouns’ are those nouns that developed historically from Proto-Germanic word classes employing a thematic vowel (also ‘extension vowel’) to form the word stem in conjunction with the word base. In German, these inflectional classes show identical word forms in the nominative and accusative. The genitive ending is *-s*. The ‘weak nouns’ by comparison had no thematic vowel diachronically, i.e. they are *a*thematic. These nouns show the ending *-en* in the accusative. See appendix (F) on page 330 for an abbreviated overview of the LG noun-classes.

[218] Grimme (1922:54) “Das starke Nomen zeigt im Nominativ und Akkusativ keine Endung, abgesehen von einigen *-ja*-Stämmen, die in A [i.e. **A**ssinghausen / Sauerland] *e*-Auslaut haben [...]. Das schwache Nomen zeigt in AB [i.e. Assinghausen, and Ost**b**evern / Niedersachsen] normalerweise als Nominativendung ein *e*. In DS [i.e. Heide / **D**ithmarschen, and **S**tavenhagen / Mecklenburg-Vorpommern] ist dieses *e* zwar äußerlich verschwunden; es äußert aber seine Nachwirkung a) bei Stämmen, die einfach konsonantisch auslauten in Überdehnung (D) bzw. Zirkumflektierung des gedehnten Stammvokals (S), b) bei Stämmen, die auf *mm*, *nn* oder *nd*, *ɒɒ* (*ŋg*), *ll* oder *ld* auslauten, in Entwicklung von zirkumflektierten *m*, *n*, *ɒ*, *l* (S).“ „An Endungen findet sich [für den Plural]: 1. In der starken Flexion: a) *e*, das in DS zwar geschwunden, doch durch Überdehnung (D) bzw. Zirumflektierung (S) von vorhergehender Länge oder *m*, *n*, *ɒ*, *l* kompensiert ist [...].“

Nom.Sg.' in Figure 66 (a). The mora (μ) of the morpheme of the Dat.Sg. on the other hand is underlyingly associated to the root as shown in Figure 66 (b) [[h u_{tense} z] $^{\mu}$] 'house-Dat.Sg.'.

Figure 66. Structure of 'house' in LG

(a) [C V^{μ}_{tense} C] $^{\emptyset}$] 'house-Nom.Sg.'

(b) [[C V^{μ}_{tense} C] $^{\mu}$] 'house-Dat.Sg.'

The established weight properties of the LG vowels require an adjustment of the phonological transcription. We found that short lax vowels and long tense vowels are both monomoraic, while the overlong tense vowels are bimoraic. The long vowels are sufficiently characterized by their tense quality. The addition of the diachritic length mark ' ː ' would even confuse the picture, indicating a phonological heavier status of the phonetically long vowels as compared to the short vowels. We therefore arrive at a revised phonological transcription for the LG long tense vowels, e.g. /huz/ 'house-Nom.Sg.' and /ris/ 'rice' without the length sign. The phonological transcription of the LG overlong vowels consequently requires only one length mark to distinguish them from the simple long vowels. I choose a notation with a single V and the phonetic length sign, e.g. /huːz/ 'house-Dat.Sg.' and /riːz/ 'giant-Sg.'.

Now that we have settled the weight distributions in the vowels, let us have a brief look at the diphthong cases. Kohler's (2001) findings are that two durational degrees apply to all diphthong qualities except for the open-closed /ɑi/ and /ɑʊ/. My own results for Kirchwerder, Altenwerder and Alfstedt differ from this outcome (see Table 20 in section 3.6.1.1). It was found that none of the diphthongs in the Kw. minimal pairs reach the JND for their durational differences between ELD 2 and ELD 3. The Aw. group 1 shows a relevant contrast for the mid-mid and open-closed qualities. The mid-closed diphthongs do not reach the JND. All diphthong qualities present in the data of III.6.Aw differ durationally well above the JND. Finally, we see for Alfs. that only the open-closed diphthongs show no relevant difference. Taking the Aw. data as the point of departure we can assume that the durational difference between ELD 2 and ELD 3 is present in all diphthong qualities. Thus, the genuine LG diphthongs (i.e. to the exclusion of 'fake' diphthongs formed by V+r) can be divided into two categories: normal diphthongs and long diphthongs. In traditional analysis, this leads to a bimoraic representation of the first and a trimoraic representation of the latter.

Phonetic overlength of the diphthongs would then be represented differently from the phonetic overlength of the monophthongs in terms of mora association. This is rather undesirable. The alternative assumption of a monomoraic status of the normal diphthongs is, however, unusual; especially if we consider that the general finding in the languages of the world is such that falling diphthongs are heavy and, thus, stress-attracting. Yet, this distribution appears not to hold for LG. Similar typological evidence for the monomoraicity of such falling diphthongs comes from

Icelandic. In this North-Germanic language, a condition applies to vowels and diphthongs alike, requiring them to be short before long Cs and clusters, and long before singleton Cs and in open syllables. The short diphthongs are duration-wise equivalent to short vowels, whereas the long diphthongs are equivalent to long vowels, i.e. comprise twice the length of a short vowel or diphthong (Lass 1984:112). This applies in a slightly amended form also to the LG diphthongs. The normal diphthongs are produced only slightly longer than the long monophthongs. The same is true for the overlong monophthongs and the long diphthongs. Overall, it appears to be justified to assume a mora-wise similar analysis for the LG data as for the Icelandic data. We arrive at phonetically long monomoraic diphthongs *vs.* phonetically overlong bimoraic diphthongs.

A different approach proposed by Heijmans & Gussenhoven (1998) and Heijmans (2003) for the south-eastern Low Franconian dialect of Weert is that the contrast in the diphthongs relies on the segmental structure. They assume that the 'normal' diphthongs do not consist of two vocalic parts, but rather feature a sonorous consonantal second component. This consonant is inherently shorter than the preceding vowel. The result is a (C)VC(C) structure of the respective syllable and an overall shorter duration as compared to the overlong diphthongs. Following this assumption, the left-hand column in Table 29 would contain those 'diphthongoids' with /j/ and /β/ instead of [i] and [ʊ, o]. The moraic structure of this configuration is such that the lax first part receives one mora and the second, i.e. consonantal, portion would also bear a mora. The overlong diphthongs transcribed in the right-hand column of Table 29 have by comparison the structure (C)VV(C). They, too, receive two morae – one on the first vowel and one on the second vowel. However, the diphthongoid approach is rather problematic. An immediate consequence of this analysis is that the dialect of Weert shows segmentally different forms at the underlying level for directly related forms, e.g. /stæjn/ 'stone-Sg.' versus /stɛin/ 'stone-Pl.'. Transferred to LG, the same would be expected in cases like */rajzn/ [ˈraɪzn̩] 'to travel' versus /rɑːiz/ [rɑːiz] 'journey-Sg.'. The diachronically apocopated 'journey-Sg.' has bimoraic (overlong) VV whereas the non-apocopated 'to travel' would have bimoraic VC. An explanation for this is rather hard to come by. An even more serious disadvantage of the diphthongoid account is that the phonetic data of LG lend no support for the consonantal status of the second part of the long diphthongs. Both segments appear to be equally vocalic.

I therefore analyze the normal and the long diphthongs as being monomoraic and bimoraic, respectively. Only the latter are inherently stress-attracting in LG. A difference with respect to the Icelandic short diphthongs is that the LG normal diphthongs may occur in open syllables just like the long tense vowels. This is exemplified by [ˈslɔidaɐ] 'centrifuge-Sg.' that comprises the foot structure (**L**L)<C>. The according weight distributions of the LG diphthongs are given below.

Figure 67. LG diphthong weight



normal diphthong long diphthong

LG monosyllables having a diphthong in the nucleus and a consonant cluster in word-final position lend support for this two-fold weight distinction. Only examples with a normally long diphthong preceding a cluster are available: e.g. [bɛist] 'cow-Sg.', [mɛist] 'mostly', [fɛist] 'party-Sg.', [gɛist] 'ghost-Sg.', [dɛinst] 'service-Sg.', [gə-døɪns] 'stuff'; examples of synchronically diphthongized cases are [kɔult] 'cold', [bɔump] 'tree-Sg.' and [ʔɔuvt] 'fruit'.[219] These diphthongs behave like long tense vowels, being able to occur not only in closed syllables but also in open syllables (e.g. L(**L**L)<C> [ʒəˈnɛiva] 'juniper schnapps-Sg.', [kɑˈtaɪka] 'squirrel-Sg.'). The long diphthongs may by comparison precede at most one (non-suffix) lenis consonant (e.g. [brɛːiv] 'letter-Pl.', [mɛoːd] 'fashion'). Following consonant clusters are not possible. This indicates that the long diphthongs occupy more space within a syllable than normal diphthongs, i.e. they are heavier.

The moraic status of the LG vowels is – at least for the ELD 1 *vs.* ELD 2 cases – in accordance with the system established by van Oostendorp (1995) for Dutch. The distinguishing property is here the presence or absence of the feature [lax]. The LG system as a whole is, however, not sufficiently describable by means of this feature. The existence of the phonetically overlong tense vowels of ELD 3, as well as the two length degrees of the diphthongs require a quantitative addendum to the system. What researchers have strived to achieve for Standard German and Dutch, namely the limitation to only one phonological property in the phonological descriptions (i.e. quantity *or* quality, not both), is inapplicable to LG. We need the feature [lax] as well as the binary length split in order to properly describe the language.[220]

The two quantitative approaches introduced above are complemented by a tonal approach. It needs mentioning, though, that the length accounts are more in line with the analysis of the LG data given in chapter 3.

5.3.4. *The no-length account: a tonal development*

The third approach introduced here aims not at the durational differences but rather at the assumed differences in the pitch contours (i.e. TA1 *vs.* TA2). These have been recurrently described in the older studies on LG (Bremer 1929; von Essen 1958, 1964; etc.); some cues of them were found also in the production data recorded from informant III.6.Aw, and indicated as such in the study of Ruscher (1983:43). Bear in

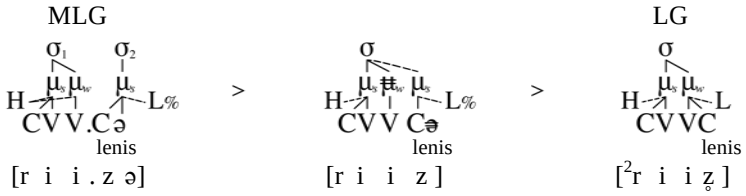
[219] That the latter example can in fact not be analyzed by means of extrametrical coronal obstruents as suggested among others by van Oostendorp (1995) is shown below in section 6.2.5.2.

[220] Note that this is also the case for some Brabant Dutch dialects including the city dialect of Tilburg (van Oostendorp 1995:76ff.). The length contrast short *vs.* long occurs here in the lax vowels, though. Along the lines of my own analysis, low ranking of the OCP and the resulting possibility of two adjacent identical (lax) segmental positions could provide a possible explanation for this phenomenon.

mind that there is no evidence for the factual presence of differing pitch contours in the speech samples of Kw., Aw. group 1, and Alfs. Assuming a non-arbitrary relation between phonetics and phonology, the tonal account remains therefore only speculative.

The recognizable variances in pitch movement in part of informant III.6.Aw's data (see section 3.3.4) could in principle be accounted for by analyzing the according lexical or grammatical contrast in terms of tones. This is in line with Ruscher's (1983), Höder's (2003), and Ternes' (2001, 2006) assumptions. Within this approach, the three durational levels in the vowel system are regarded as phonetic, leaving only two phonological length degrees, namely short and long. The increased duration of the phonetically overlong vowels results from the greater articulatory expense and effort that is necessary to produce an HL contour within the limited frame of one syllable. Figure 68 shows the prominence related analysis of the diachronic development of LG 'giant-Nom.Sg.'.

Figure 68. Prominence related analysis Aw. 'giant-Nom.Sg.'



The crucial phonological features are the tones H and L, not the mora. We can assume that a MLG syllable under main stress had an intonational high tone H, whereas an unstressed syllable or a syllable under secondary stress received an intonational low tone L%. In the development from MLG to LG, the metrical contours were phonologized by schwa loss and the devoicing of final voiced consonants, and became tone accents (Prehn 2007, analogously to Boersma 2006 for Franconian). Underlyingly voiceless coda consonants in words like MLG [ri:s] 'rice-Nom.Sg.' were not able to license tone.

In a first step, the schwa of the unstressed final syllable was deleted, leaving behind its intonational boundary-tone L% along with its tone bearing unit (TBU), the mora.[221] The second syllable was lost, and the final _z]$_{\omega}$ adopted the head mora along with the prominence features of the apocopated schwa. The constraint ALIGN

[221] It might as well have been the case that the head mora of the schwa got lost along with the vocoid. There is no definite way to actually prove that the non-head mora of the nucleus was preserved, rather than deleting it in favor of the head mora of the schwa (that subsequently became the non-head mora of the nucleus). The latter might, however, be the more likely option for it keeps a property of the lost (allo)morpheme in order to maintain a contrast. Additionally, non-head morae are the more probable candidates for deletion as compared to head morae. Anyway, this is besides the point since the analysis here relies on the tonal properties instead of the syllable weight – and the lack of the feature [spread glottis] in -z]$_{\omega}$ would be sufficient to license a tone without being moraic (see with respect to voiced Cs Bradshaw 1999; Yip 2002; Boersma 2006).

TONE TO STRESSED VOCALIC MORA in XXV) was violated at this intermediate stage, so that the tone had to spread further to the left in the direction of stress.

XXV) ALIGN TONE TO VOCALIC 'μ: a tone has to be aligned to a vocalic mora and has to have main stress.

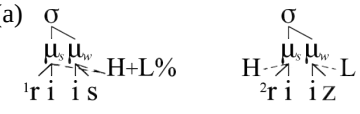
The weak (non-head mora) of the nucleus was deleted in favor of the maintained strong mora of the schwa. In a second step towards LG, final devoicing of the (passively voiced) -z > -z̥ applied. This devoiced -z̥ was not able to bear a tone. Therefore, the HL contour had to be realized solely on the nucleus. The original length of the nucleus was extended to accommodate both tones. The consequences were HL pitch contours combined with phonetically overlong vowels, i.e. the vowels influenced by schwa loss and final devoicing. These tonal movements are referred to as TA2.

Neither the duration nor the pitch contour changed on the long vowels without schwa loss. The assigned tone is referred to as TA1. The overt tonal contour in these cases remained HL, which should have effectively led to a merger with the newly developed TA2 words. Yet, this did not happen. The reason is that at an earlier stage of the language – before the deletion of schwa – prominence tones were assigned to the head mora of each syllable. One H tone was associated with the stressed syllable in the case of the original monosyllables, since there was only one head mora. Nevertheless, an intonational boundary-tone L% was aligned with the right edge of the word. In the case of the bisyllables, however, each of the two head morae received an intonational tone. The stressed position had a H, while the unstressed position (second syllable) had a L%. Schwa loss then led to the removal of the second syllable. This triggered the association of the L% to the preceding voiced obstruent, and the alteration of intonational to phonemic tones. The L then moved further to the left towards the stressed long vowel where it associated with its right edge. This is how a tonal contour HL was established on the new monosyllables. Expansion of the pitch contour of the long vowel resulted in an increase of the vowel's duration. Phonologically, however, the bimoraic structure stayed intact since both tones were able to associate with one of the two morae of the nucleus.

The original monosyllables by comparison kept their single H tone. The distinction between the two word categories remained since the boundary-tone stayed put. Hence, the contrast of TA1 *vs.* TA2 is one of a single H + L% versus a contour HL + L%.

The contrast can be analyzed in terms of tone as displayed in Figure 69 (a). The list in (b) contains the resulting dual binary distinction of short lax vowel with no tone, long tense vowel with TA1, and long tense vowel with TA2.

Figure 69. (a)



'rice-Nom.Sg.' 'giant-Nom.Sg.'

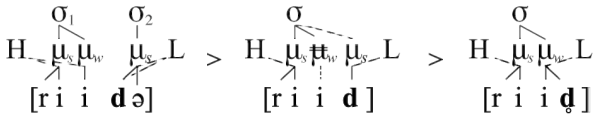
(b) /rɪs/ 'rip-Nom.Sg.'
/[1]ri:z/ 'rice-Nom.Sg.'
/[2]ri:z/ 'giant-Nom.Sg.
=
Ø tone, TA1, TA2

While the H in ‘rice-Nom.Sg.’ is associated to both vocalic morae, the H in ‘giant-Nom.Sg.’ is linked to the first mora and the L to the second mora of the nucleus. The difference between the two items would probably be a single F0 peak in ‘rice-Nom.Sg.’ and a F0 minimum only after the final segment *vs*. an extended high-low F0 movement on the nucleus of ‘giant-Nom.Sg.’.

The assumption of tones is in line with the well-known phenomenon of blocking of low tone spreading by voiceless consonants:

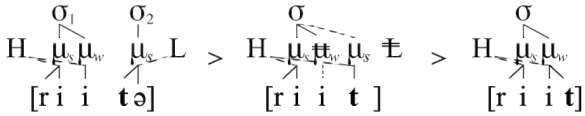
Figure 70. MLG *rîde vs. rîte*

(a)



MLG *rîde* ‘to ride-1.Sg.Pres.’ LG *ried* [TA2]

(b)



MLG *rîte* ‘to rip-1.Sg.Pres.’ LG *riet* [TA1]

MLG [-t-] is not able to license a tone since it lacks the vocal fold vibration by virtue of the feature [spread glottis] (s.g.). Thus, the L cannot dock onto it, nor spread through it to the preceding stressed syllable. The result is that the pitch contour stays H+L%, i.e. Accent 1.

An advantage of this tonal approach is that MaxBin is not violated since a ternary quantity distinction is no longer needed. The binary distinction of tense *vs.* lax, and the binary distinction between TA1 and TA2 renders this issue irrelevant.

The tonal contrast of the Hamburg area would mark

XXVI) (a) a grammatical contrast as in ‘house-Nom.Sg.’ [^{1}huːs]
vs. ‘house-Dat.Sg.’ [^{2}huuːz̥]

(b) a lexical contrast as in ‘bread-Nom.Sg.’ [^{1}brɛot]
vs. 'to brew-3.Sg.Pres.' [^{2}brɛoːt].

The occurrence of the tone accents is limited to Vː, V_1V_2 , and combinations of V+r and V+l in the final syllable (Höder 2003). Due to the complete r-vocalization (in a slightly milder form known from Standard German), the latter cases could also be regarded as diphthongs, as has been pointed out above.

The restriction of TA1 and TA2 to word-final positions is consistent with Zhang's (2000) phonetically based findings with respect to tonal melody mapping. He emphasizes that tones generally favor closeness to the left edge of a prosodic word “for the ease of processing, but contour tones can only occur on the final syllable

because of its extended duration" (Zhang 2000:608).[222] Although in LG TA1 is theoretically defensible on non-final syllables, there is no contrast in this position, since TA2 occurs in word-final position only. The two LG tone accents are not contrastive on short – i.e. monomoraic – vowels, or in unstressed position.

Unfortunately, the assumption of a tonal contrast is not borne out by the speech data of Kirchwerder, Altenwerder group 1, and Alfstedt, as was pointed out earlier. It is only the *motherese* informant III.6.Aw who exhibits phonetic cues on the presence of differing pitch contours in ELD 2 as opposed to ELD 3. Yet, these indications are mere trends and do not reach significance. We have seen in chapter 3 that there is basically no reason to assume the presence of a tonal contrast TA1 *vs.* TA2 on the grounds of F0 variances or the perception of such differences in the synchronic LG of the investigated informants. This weakens the tonal account we just developed. Considering the phonetics to be (at least partly) an indication for phonological structure, the quantity account appears to be the more likely analysis for the LG data of Kirchwerder, Altenwerder, and Alfstedt.

5.4. *Conclusions on LG vowels*

It is evident from the discussion that a binary analysis of the vocalic overlength observed in the LG dialects of Kirchwerder, Altenwerder, and Alfstedt is best suited to describe the phonetic data. What we find is a combination of a quality contrast lax *vs.* tense with a quantity contrast short (i.e. monomoraic) *vs.* long (i.e. bimoraic). This surface contrast is, at least with respect to the weight distinction, not reflected in the underlying form. At this level of representation, all vowels are rendered monomoraic. The second mora of the phonetically overlong vowels is assigned at the surface level by means of the moraic (allo)morpheme.

We now move on the analysis of the LG consonant system, the employed laryngeal features and the discussion of the arguably present fortis *vs.* lenis contrast that determines the occurrence of the phonetically overlong vowels.

[222] The argument is, however, somewhat weakened for LG by the fact that no utterance-final lengthening was found for the investigated varieties of Aw. and Alfs. Only the Kw. data displayed cues for this process.

6. The Low German fortis - lenis distinction

We now turn to the consonant system of LG. Interestingly, the well known fortis *vs*. lenis contrast present in the southern-most part of the West Germanic language continuum, in the Swiss German dialects (Kraehenmann 2003:98ff.), can be argued to exist also within the consonant system of LG. The LG underlyingly fortis consonants appear to block diachronic CVCV compensatory lengthening (CL) as described by Mora Theory (Hayes 1989).[223] Kohler (1984:165) notes that utterance-final surface lenis and fortis consonants are completely leveled in the overt form in Low German. The only difference would here be the durations of the preceding vowels (i.e. ELD 2 *vs.* ELD 3). He finds that

> "The explanation usually given for these data – compensatory lengthening in connection with the elimination of the following /ə/ […] – is wrong because it cannot even account for the differentiation [between an ELD 2 *vs.* ELD 3 minimal-pair]. The distinction in vowel duration is tied to an original [±fortis] contrast in the following consonant and to the structures 'vowel+fortis consonant' versus 'vowel+morpheme boundary+fortis consonant' (as in *Brut* [brut] 'bride' – *bru-t* [bru:t] '(he) brews'), the latter preserving final vowel length." (Kohler 1984:165)[224]

Although the interference of consonant quality with CL phenomena has been regarded as counterevidence to Mora Theory (Kavitskaya 2002) or CL in general (Kohler 1984, 2001), the contrast of fortis *vs.* lenis can readily account for the blocking. What I aim at showing is that the fortis C_2s in diachronic $C_1V_1C_2V_2$ sequences behave as geminate consonants mora-wise and, thus, *structurally*. They are complex with respect to autosegmental structure and they are inherently moraic – two aspects that have not been treated in this thesis up to now. By this they prevent CL of a preceding long V: to overlong VV:. The only consonants that effectively allow for lengthening of a preceding V are those LG C_2's that are lenis (i.e. laryngeally unspecified either for spread glottis (s.g.) or sonorant voicing (SV) in terms of feature theory).[225] I argue that they are structurally simplex and inherently non-moraic, obtaining no mora by means of DEP-μ >> WEIGHT-BY-POSITION.[226] My assumption is that this weight distinction in LG consonants depends on the segmental complexity of the consonants.

Thus, what my approach essentially predicts is that the lack of the laryngeal specification in lenis Cs and the corresponding non-moraicity allows for an interaction between a preceding vowel and a following vowel, permitting phonetic

[223] For the terminology of the levels of representation see chapter 0 and Boersma (2007a).
[224] Note that Kohler transcribes the LG tense overlong vowels as long and the LG tense long vowels as short.
[225] A major difference between CL in the language systems of LG and e.g. Dinka mentioned below in section 7.2 is the interaction of vowel length in original C_1VC_2-ə sequences with the C_2 in LG. Dinka does not show such an interaction; the intervocalic consonant has no influence on the lengthening process.
[226] As far as I can see, we cannot relate the moraicity of a LG utterance-final consonant in monosyllables to the sonority scale as suggested among others by Zec (1988). Rather, we have two consonantal categories that are moraic across the board (i.e. fortis Cs and sonorant Cs). The third category of lenis Cs – sonoritywise in between sonorant Cs and fortis Cs – is not moraic.

overlength to evolve. By contrast, the presence of a laryngeal feature [spread glottis] in LG fortis consonants and the feature [Sonorant Voicing] in LG sonorant consonants prohibits the development of overlong preceding vowels. This results from the structural complexity of both segment types. Thereby, sonorant Cs pattern together with fortis obstruents (i.e. the laryngeally specified member of the consonantal opposition) in LG, although they do not build a natural class in any theory of phonology. This issue will be treated in an OT setting in sections 6.2.2 to 6.2.4.

Before diving into the matter, I provide a brief overview on the LG consonant system. The lenis *vs*. fortis discussion starts thereafter.

6.1. *The LG consonant system*

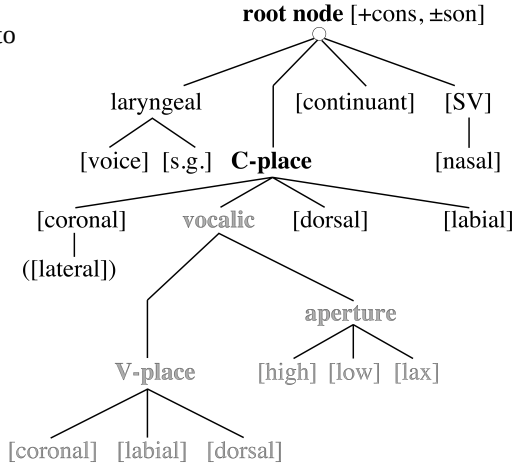
If we abstract away from the individual dialects and the phonetic variations, we reach a system of 22 consonantal qualities for LG. They are given in the following chart where the left member of a consonantal pair is voiceless and the right member voiced.

Table 31. LG consonant qualities[227]

	bilabial	labiodental	alveolar	postalveolar	palatal	velar	glottal
plosive	p b		t d			k g	(ʔ)
nasal	m		n			ŋ	
trill			r				
fricative		f v	s z	ʃ (ʒ)	ç j	(x)	h
lateral approximant			l				

Features such as [s.g.] of the fortis Cs are assigned at the underlying level. A feature tree for the consonantal segments is provided in Figure 71.

Figure 71. Autosegmental approach to consonantal structure



[227] The parenthesized segments have arguably no phoneme status in LG.

In the course of this study we have come across a number of minimally different pairs of words. At the overt level, they differ most notably in terms of the duration of the vocalic nucleus. A possible 'voicing' difference in the coda at the underlying level or surface level is (almost) completely neutralized in the investigated LG dialects with regards to the acoustic correlates closure duration and aspiration duration (see sections 3.2, 3.3, and 3.4). Similarly, Haritz (2006) found for the LG dialect of the city of Aurich (Ostfriesland) that the voiced coda obstruents are produced with almost no vocal fold vibration and a general lack of aspiration. But obviously a difference persists. We have seen in section 3.3 that the Aw. informants distinguish consistently between voiceless codas (shorter closure duration, longer aspiration duration) and voiced codas (longer closure duration, shorter aspiration duration) in the sample. Examples are 'courage' [mɛot^{h}] *vs.* 'fashion-Sg.' [mɛoːt] or [mɛoːd̥].[228] This suggests the validity of the contrast, the more so because the utterance-final position is usually assumed to be subject to final devoicing in German, i.e. complete contrast neutralization between voiceless and voiced segments (see chapter 3). The terms 'voiced' *vs.* 'voiceless' appear to be rather inappropriate to describe the opposition, though. They describe a phonetic difference between presence *vs.* absence of vocal fold vibration that is not realized as such in LG. I therefore employ the terms *fortis* and *lenis* instead. This captures best the notion of bundles of phonetic features that determine the consonantal contrast. I provide a discussion of this terminology in section 6.2.

The following table contains a list of the minimal pairs most frequently used in this study, and the according representations of the coda Cs at the different phonological levels.[229]

Table 32. Representations of the coda Cs in the LG minimal pairs

		underlying level	surface level	overt form
(a)	/huz/ 'house-Nom.Sg.'	z	z	s
	/huuz/ 'house-Dat.Sg.'	z	z	s / z̥
(b)	/mɛod/ 'courage'	d	t	t^{h}
	/mɛoːd/ 'fashion'	d	d	t / d̥
(c)	/ris/ 'rice'	s	s	s
	/riiz/ 'giant-Sg.'	z	z	s / z̥
(d)	/zid/ 'side-Sg.'	d	t	t^{h}
	/ziid/ 'silk-Sg.'	d	d	t / d̥
(e)	/brɛod/ 'bread-Sg.'	d	t	t^{h}
	/brɛoːt/ 'to brew-3.Sg.Pres.'	t	t	t^{h}

[228] Two informants of Alfstedt LG reported independently from each other that the distinction – if any – between LG 'rice-Sg.' /ris/ and 'giant-Sg.' /riːs/ is the duration of the final /s/. The fricative in 'rice-Sg.' would be shorter than the one in 'giant-Sg'. Rather, both subjects, while demonstrating the difference, produced the latter lexeme with an amount of vocal fold vibration unusual for the word-final position.

[229] The lenis coda Cs may be variously realized by the LG speakers as devoiced obstruents, voiceless unaspirated obstruents, or full-fletched voiceless aspirated obstruents.

What we need to consider here is a possible change of the underlying representation of the lenis Cs, e.g. in the course of so-called final devoicing. Similar to Jessen & Ringen (2002) for Standard German, I assume for LG that this contrast neutralization is in fact a matter of the variable phonetic realization of lenis Cs. It occurs in the overt form (i.e. the phonetic form) rather than at the phonological surface level or the underlying level. The lenis coda Cs become fortified only phonetically due to their final position. No final devoicing in the classical sense is required.[230] This detail is in accordance with the findings that we obtain a difference between lenis Cs and fortis Cs in utterance-final position (though this difference may be rather small, see chapter 3). The original, laryngeally unspecified lenis structure is still in place, also surfacing in the phonetic implementation.

Basically two of the given cases appear to be problematic at first sight: (d) and (e). In (d) we find an ELD 2 form [ziːt] 'side-Sg.' < OSax. *sîda* that was apocopated diachronically, and that has at the same time an underlying lenis coda. CL to ELD 3 would therefore be expected. As was mentioned in chapter 5 above, however, 'side-Sg.' has *pre*-MLG apocope, i.e. contained at the time of CL no final vocalic segment anymore that could yield lengthening of the nucleus.

Forms such as (e) [brɛoːt] 'to brew-3.Sg.Pres.' or [mɑːit] 'to mow-3.Sg.Pres.' are instances of ELD 3 in seemingly pre-fortis position. Hence, no CL should apply. It has been pointed out by Kohler (1984:165) that the forms are morphologically complex, though. They have developed diachronically by means of syncope of the schwa. An intervening lenis C merged completely with the preceding nucleus (e.g. MLG *bru**w**-et* > [brɛoːt]) or was deleted (e.g. MLG *mei**d**-et*, *mei**g**-et*, *mei**h**-et*, *mei-et* > [mɑːit]).[231] We find [[brɛoː] -t] and [[mɑːi] -t] with the final -t being a metrically invisible suffix. Van Oostendorp (2002:223) notes "that the final coronals [in polymorphemic words] are always in the adjoined position", i.e. in the appendix of a PrWd in Dutch. This structure may also be assumed for Standard German and Low German.[232] Consonantal inflection lies indeed beyond metrical structure and does not add to the syllable weight. Stem final consonants may do so, however.

This structural difference in LG consonants is also indicated by another process that occurs in vowels preceding voiced obstruents. We find not only CL from long to phonetically overlong in this segmental context in LG. In cases of syncope in the morphological endings, voiced consonants appear also to allow for feature spreading from the following to the preceding coda while voiceless consonants do not. Complete assimilation is the result; e.g. MLG *liggen* > [lɪŋŋ] 'to lie-Inf.', but no MLG *weken* > *[vɛŋŋ] 'week-Pl.'. The question now is what motivates the blocking *vs.* spreading? Obviously, it is something consonant-inherent that enables or disables the processes described. Different classes of consonants act differently. It is therefore necessary to make reference to the consonantal structure and hence the phonological features. In order to do so, we first need to get some background information with regards to lenis *vs*. fortis.

[230] See Lombardi (1999) for a [voice] approach to Standard German and an OT account of final devoicing.
[231] It is possible that the intervocalic lenis C of MLG *bru**w**-et* is merely epenthetic (Paul Boersma p.c.).
[232] Booij (1995:26ff.); Wiese (1996:47f.).

6.2. *Lenis* vs. *fortis and [SV]*

The contrast between *lenis* (or lax) consonants and *fortis* (or tense) consonants has been used in the literature rather frequently over the years. It is employed to describe the phonetic manifestation of a privative contrast of [s.g.] *vs.* nothing in languages such as German (Kohler 1984; Jessen & Ringen 2002). This has the particular advantage of covering the variation in the phonetic implementations of the laryngeally unspecified consonants present in the data. Where vocal fold vibration is virtually absent from the lenis consonants, as is the case in languages such as Standard German and LG, the term 'voiced obstruents' could be rather misleading. Jansen (2004:60) notes that in fact the

> "two term distinction between fortis and lenis stops is based on phonetic features other than voicing, such as segmental duration, release burst characteristics and formant perturbations."

Jessen (2001:244) distinguishes two basic phonetic correlates for lenis and fortis stops, respectively: closure voicing and aspiration duration. Additionally, no fewer than six non-basic phonetic correlates shared by both entities are identified: F0 onset, F1 onset, H1-H2 (first harmonic - second harmonic difference), closure duration, preceding vowel duration, and following vowel duration.

The brief experimental phonetic study of Aurich LG conducted by Haritz (2006) shows (weak) proof for differences in one investigated basic phonetic correlate (i.e. aspiration duration), and two non-basic phonetic correlates (i.e. preceding vowel duration and closure duration) as defined by Jessen (2001). Tests regarding the remaining basic phonetic correlate of closure voicing, as well as the non-basic correlates F0 onset, F1 onset, H1-H2, and following vowel duration are left aside. Haritz' data set is altogether rather limited with only four investigated words in ±focused context, produced by 6 speakers. A high amount of speaker-dependent variation occurs in the corpus. In effect, her results are statistically not significant. The attested phonetic tendencies of basic and non-basic correlates persist, though. They are confirmed by the preliminary analysis of the Altenwerder recordings. The data demonstrate that at least with respect to the analyzed variables of aspiration duration and closure duration of the word-final plosives, the consonants remain distinct, disregarding the traditionally assumed process of final devoicing (see chapter 3). Thus, a distinction between voiceless Cs and voiced Cs is maintained. A result that can best be expressed by a fortis *vs.* lenis distinction for a rather large amount of phonetic variation is encoded by these terms.

Fortis *vs.* lenis can be abstracted away and applied to LG phonology in basically three ways. The distinction could be implemented as

(a) a binary contrast, representing the laryngeal specifications [s.g.] *vs.* [voice], respectively,
(b) a binary contrast with fortis *vs.* lenis as two independent categories strong *vs*. weak, involving a single distinction of moraic *vs*. non-moraic, and
(c) fortis *vs.* lenis as labels of a privative contrast of [s.g.] *vs*. nothing, or nothing *vs.* [voice] (see Shiraishi 2006, Botma 2004 for voiceless = marked, voiced = unmarked).

The predictions made if option (a) is correct are the following:
Both categories of fortis and lenis are laryngeally specified. This predicts that they are equally strong. Assimilation processes could therefore be expected to be equally frequent for both categories. This is not the case, however.

Additionally, the binary representation postulates the occurrence of vocal fold vibration in [voice] obstruents. A final devoicing constraint is needed to ensure that no voicing occurs in coda position.

These predictions are rather problematic. Phonetically, no vocal fold vibration is present in the voiced obstruents of LG. Furthermore it is unclear why a segment that is laryngeally specified should exhibit such a widespread phonetic variability as the voiced obstruents do.

If option (b) is correct, the predictions are somewhat different. There are two categories present in the obstruent system: a strong category, and a weak category. In order to express the opposition, we need to assume some property, e.g. mora association. Fortis Cs are moraic (strong, marked), whereas lenis Cs are non-moraic (weak, unmarked). This moraic marking of a strong-weak distribution allows for an explanation as to why lenis has a much wider range of phonetic implementation, from fully voiced to unvoiced or unaspirated. In effect, no final devoicing is needed for LG – it might just be a phonetic variant of the lenis C that occurs in final position.

However, moraicity alone is not sufficient to explain assimilatory effects in the consonants. If we consider that the non-moraic lenis Cs are assimilated but not the moraic fortis Cs, we are led to the conclusion that assimilation is dependent on the moraic status of a segment. Moraic segments appear to be stable whilst non-moraic segments are prone to assimilation. Yet, words like MLG *blîven* > LG [bliːmm̩] with progressive and regressive assimilation in the onset and the coda of the second syllable are inexplicable by this account of 'moraic assimilation'. Onsets are generally non-moraic and should therefore be weak, not causing assimilation of other segments. Nevertheless, the onset of the second syllable in the example still produces progressive assimilation of the following nasal. A similar prediction is made for cases like [slɔː.pn̩] 'to sleep-Inf.'. Here, the onset of the second syllable is non-moraic, too. The question arises as to why no assimilation to the succeeding moraic nasal occurs if it is indeed only the lack of a mora that determines the weakness of a segment?

Finally, (c) predicts that only one category (i.e. *fortis*) is laryngeally specified. Jessen & Ringen (2002) suggest within this line of reasoning that it is the monovalent feature [s.g.] that is distinctive for the consonants in Germanic languages.[233] This opposition occurs in so-called contextual voicing languages like English, Korean, or Standard German, and can also be postulated for the Low German dialects of North Low Saxon. I basically assume a laryngeal specification of [s.g.] in fortis obstruents. This means that in terms of van Oostendorp (1995), these

[233] Most importantly employed to explain final devoicing. There is no need to postulate a process of final devoicing since only intervocalic obstruents receive passive voicing. Final obstruents are either specified for [s.g.], i.e. inherently voiceless, or unspecified, i.e. not marked for any laryngeal features at all, including voicing.

consonants hold a laryngeal node. It is the lenis obstruents that are left laryngeally unspecified. The distinctiveness of a unary feature [s.g.] captures best the existing phonetic differences in final obstruents _T# (laryngeally specified) *vs.* _D# (laryngeally unspecified). Also, the unstable behavior of lenis Cs with regards to assimilation can be adequately expressed. The laryngeally specified category can be assumed to be phonologically stronger (i.e. marked) and more resistant with regards to assimilation, deletion etc.

Interestingly, the same is valid for a third class of consonants – the sonorant Cs. We can assume that voicing is redundant in these consonants because they are – just like vowels – inherently voiced segments. Itô et al. (1995) state that sonorant Cs do therefore not license the feature [voice] but remain laryngeally unspecified. An approach brought forward by Rice (1993) is that they possess a privative feature [sonorant voice] (SV) instead. Assuming sonorant Cs to be specified by an own feature has a crucial advantage. Mielke (2008:166) notes that

> "This feature allows for straightforward analyses of voicing-sensitive phonological patterns, which ignore voiced sonorants. The proposal of this feature recognizes phonetic differences between sonorant voicing and obstruent voicing, namely that the former involve spontaneous voicing and the latter do not and therefore predicts (correctly) that phonological patterns may exploit this distinction."

Such a distinction between [voice] and [SV] is not what we find in LG, though. Rather, the voicing in sonorant Cs is here opposed to the passive voicing in the unspecified lenis Cs. Looking at the featural specifications, we find that fortis Cs and sonorant Cs group together by means of structural complexity. Both consonant categories show specifications that are missing in lenis Cs. It seems reasonable to assume that the differences in the treatment of CL and assimilatory processes by lenis Cs as opposed to fortis Cs and sonorant Cs refer to these structural dissimilarities.

6.2.1. *A matter of segmental complexity*

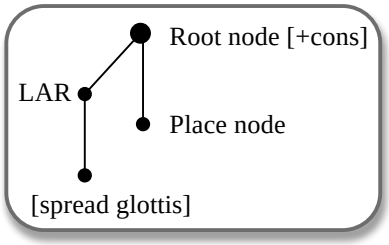
Inspite of the fact that the extra in structure of sonorous segments (i.e. the additional feature [SV]) seems to be in line with Rice's (1992) and Rice & Avery's (1993) assumption that the more sonorous a segment is, the more structure it has, we cannot directly relate sonority and structural complexity in LG. In fact, the behaviour of the LG fortis obstruents would rather relate to the Government Phonology model proposed by Harris (1990), stating quite to the contrary that the least sonorous segments contain the most structure (i.e. the most elements), hence not allowing phonetic overlength in a preceding vocalic nucleus. We have already seen in chapter 3, however, that both classes of sonorant consonants and fortis obstruents group together in LG in blocking overlength.

Neither of the two approaches linking sonorancy with structural complexity seems to be fitting snugly for the LG codas. The overall picture is that there is no linear correspondence between the two entities in LG. The sonorant Cs march to a different drummer – the feature [SV] as compared to laryngeal [s.g.] of the obstruent Cs. Rather, it appears to be most suitable here to somehow relate structural

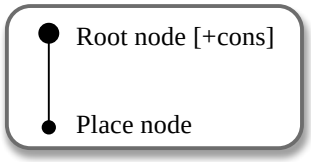
complexity and consonantal weight. Both consonantal classes, sonorant Cs and fortis Cs, have in common that they have a branching root node. Thus, some sort of specification is added to the root node: either it dominates [SV] or it dominates a laryngeal node LAR that in turn dominates [s.g.]. Neither [s.g.] nor [voice] is contrastive in sonorant Cs, so no laryngeal node is needed. The structures of LG fortis obstruents and sonorant Cs are given in Figure 72 (a) and (c), respectively. The structure of LG lenis Cs is illustrated in Figure 72 (b).

Figure 72.

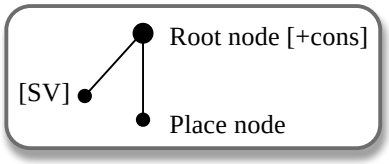
(a) fortis obstruents



(b) lenis obstruents



(c) sonorants consonants



The structural complexity of the fortis Cs and sonorant Cs as compared to the simplex lenis Cs has basically two immediate consequences. It determines the necessity for moraic licensing, and it creates configurations that are resistant with respect to assimilatory processes. I treat licensing by a mora and the resulting weight distinction in LG consonants next, arguing for the underlying moraicity of fortis Cs and sonorant Cs in LG. The effects of complexity on feature assimilation will be discussed thereafter.

6.2.1.1 Moraic licensing and consonantal weight

The postulate made by classical Mora Theory (Hayes 1989) with regards to consonant weight is fairly different from my structural complexity approach. It is usually assumed that singleton Cs are represented as non-moraic (i.e. weightless), geminates as monomoraic and syllabic geminates as bimoraic, independent of their featural specifications. As an effect of this representation of the Cs, a large set of monomoraic monosyllabic (C)VC words would arise in LG. The stress pattern demonstrates that not only lax Vs but also tense Vs are monomoraic in LG (see chapter 4). If the succeeding C was generally a singleton in the traditional sense, i.e. non-moraic, the syllable would receive only one mora in total. It would therefore

count as light. This is unexpected, because it has been shown that (C)VC forms do indeed count as heavy in LG with regards to stress.[234]

A way out is that the coda C receives a mora of its own. The principle of *Weight-by-Position* (WBP) allows for such general moraicity of the C without requiring the phonological ambisyllabic structure of a 'real' geminate or the phonetic long duration. It assigns an additional mora to *every* coda consonant, rendering (C)VC syllables bi-moraic, i.e. heavy and stress-attracting.

XXVII) WBP: Coda consonants are moraic (Hayes 1989; Kager 1999:147).

What is not captured by this positional mora licensing is the fact that in the LG data a phonetic distinction between lenis and fortis consonants in coda position is maintained in the overt form – although the contrast tends to be more and more neutralized (see chapter 3). With XXVII) alone, both consonant qualities would be equally moraic. In order to avoid this inappropriate phonological leveling, lenis and fortis coda Cs must therefore not be lumped together as is the case in traditional Mora Theory. The richer structure of the fortis Cs and sonorant Cs can be argued to relate to the underlying weight of the segments by making licensing by a mora necessary. These consonants are inherently moraic, which defines them as geminates in terms of Mora Theory.[235] They constitute literally *strong* configurations that occupy much space within a Prosodic Word (PrWd). A preceding V is accordingly shortened. In Alemannic, fortis consonants even receive geminate status on the basis of their duration (Kraehenmann 2001, 2003; Kraehenmann & Lahiri 2008) to the extent that

> "the underlying contrast between stops in Swiss German dialects is based purely on quantity and […] that the duration of the stop closure is its sole reliable phonetic reflex" (Kraehenmann 2001:109).[236]

Contrary to the strong fortis Cs, the lenis Cs are underlyingly non-moraic. They can be assumed to avoid bearing weight due to their lack of structure, i.e. laryngeal specification. They try to occupy as little space as possible, providing a preceding V with a greater amount of space within the foot. Lenis obstruents are singleton Cs by default.

This underlying weight distribution is kept intact by ranking DEP-μ >> WBP. The ranking entails that the sonority of a segment is not directly linked to its syllable weight. Remembering the stress system established in chapter 4, the weight distinction $\{C_{lenis} < C_{fortis}, R\}$ can be assumed.[237] This is in accordance with the LG syllable weight given in section 4.4 and repeated in Table 33. WBP is only required

[234] We will see in due course that there is an exception to this pattern. Some monosyllabic forms are monomoraic in LG. Their occurrence is rather restricted, though. Only forms with a tense vowel, no moraic (allo)morpheme, and a final lenis C may retain monomoraicity in the surface form.
[235] See for an analysis of Korean fortis and aspirated consonants Choi & Jun (1998).
[236] Phonetic representations of fortis other than duration are "more extensive movements as well as greater peak and average velocities of the articulators producing the stricture" (Kohler 1984:154) and "laryngeal tensing" (Kohler 1984:160).
[237] R represents any sonorant consonant.

for lenis Cs in syllable-final position if otherwise a violation of FTBIN would ensue. I will come back to the OT analysis in due course.

Table 33. Syllable weight in LG[238]

	final
light	CV, C**ə**C, CV**C**
heavy	CVV$\mathbf{C}_{\mathbf{lenis}}$, CV$\mathbf{C}_{\mathbf{fortis}}\mathbf{C}_{\mathbf{fortis}}$, CV**R**$\mathbf{C}_{\mathbf{fortis}}$

The Romance language Friulian mentioned in section 5.2.1 exemplifies that this LG pattern of consonantal complexity is by no means a universal one.[239] In fact, it appears not to apply to Friulian at all. We can deduce this from the fact that compensatory lengthening (CL) applies in Friulian only in the *specified* [voice] and lateral environment (see Figure 55, page 165), while the unspecified voiceless obstruents, nasals and trills do not allow CL of a preceding vowel.[240] Some examples for the lack of CL after the deletion of a non-low final vowel follow in Figure 73.

Figure 73. No CL in Friulian $C_1V_1C_2V_2$

*ka**s**u > *kas* ‘bodice’
*mu**t**u > *mut* ‘mute’
*fi**n**e > *fin* ‘end’
*ca**n**e > *can* ‘dog’

We find that those segments that are most complex in LG, thereby blocking lengthening in a preceding nucleus, behave contrarily in Friulian. In this Romance language, the specified and, thus, most complex members of the consonantal opposition allow CL, while the unspecified consonants do not. I give the according patterns of Friulian and LG in Table 34 below, marking the specified features by shading.

Table 34. Diachronic CL pattern of Friulian *vs.* LG

	CL	no CL
(a) Friulian	[voice], [lateral]	voiceless, trill, nasal
(b) Low German	lenis	[s.g.], SV

[238] Note that $CVVC_{fortis}$ and CVVR syllables would count as superheavy. In LG, they occur – if at all – only in inflected forms. The final consonant is then a morpheme and is located in the adjoined position in a PrWd (e.g. /brɛoː**t**/ ‘to brew-3.Sg.Pres.’; see section 6.1, page 190).
[239] Hualde 1990; Prieto 1992; Kavitskaya 2002.
[240] Vowels before trills are always long in Friulian (Kavitskaya 2002:110; Prieto 1992:217f.).

What I tentatively suggest here is that [SV] does not add to the structural complexity of a segment in Friulian. Rather, the feature [lateral] enriches the feature [coronal], creating structural complexity. The language shows in any case a clear preference for CL in vowels preceding the most *sonorous* member of a consonantal category. Thus, vowel lengthening in Friulian appears to be a matter of sonority rather than complexity. The sonority hierarchy seems indeed to apply in Friulian in the sense of Rice (1992) and Rice & Avery (1993). [241]

6.2.1.2 Assimilation

Let us now turn to the assimilatory effects that occur in lenis Cs but not (or to a much lesser degree) in fortis Cs and sonorant Cs.

We have seen that fortis Cs and sonorant Cs are complex segments with respect to their featural representation. The LG data suggests that they are particularly stable when it comes to assimilatory processes. They rather spread their own features than assimilating to surrounding segments. Examples are MLG *holten* 'wooden' > LG [hɔltn̩], *lāten* 'to let-Inf.' > [lo:tn̩], *māken* 'to make-Inf.' > [mo:kŋ], *bīten* 'to bit-Inf.' > [bi:tn̩], *vāten* 'to grab-Inf.' > [fattn̩], *balke* 'balk-Sg.' > [balk], *māten* 'extent-Pl.' > [mɑ:tn̩], *koken* 'cake-Sg.' > [koʊkŋ], *lēpel* 'spoon-Sg.' > [leˈ:pl̩], *wassen* 'to grow-Inf.' > [vassn̩], *derschen* 'to flail-Inf.' > [dœʃʃn̩], *slāpen* 'to sleep-Inf.' > [slo:pn̩], *snacken* 'to talk-Inf.' > [snakkŋ]. Even though the place specifications may be identical for the obstruent and the following nasal (e.g. [coronal] as in [lo:tn̩] or [vassn̩]) no complete assimilation occurs.[242] Also, the presence or absence of [cont] in the consonant is irrelevant. We may conclude that the fortis Cs constitute the marked members of the lenis *vs*. fortis contrast.[243]

The LG lenis Cs behave diametrically different. They display rather broad phonetic variation and an overall tendency to assimilate to surrounding fortis Cs and sonorant Cs. This is explainable by their lack of a branching root node, which allows them to adopt spread features. Examples of progressive assimilation processes are MLG *finden* 'to find' > LG [fɪnn̩], *kinder* 'children' > [kɪnnəɐ] where the assimilating segments are both specified for [coronal] at the level of the place node. Progressive as well as regressive assimilation is found in MLG *blîven* 'to stay-Inf.' > LG [bli:mm̩], *lēven* 'life-Sg.' > [le:mm̩], *seggen* 'to say-Inf.' > [zɛŋŋ].[244] These words exemplify cases with differing place specifications (i.e. [labial] and [coronal], and [velar] and [coronal]). Not only continuant obstruents (i.e. consonants specified for [cont]) but also plosives (i.e. consonants lacking [cont]) assimilate.[245]

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[241] The contrary distribution of CL in Friulian as compared to LG might be explainable by re-ranking the constraints REALIZE MORPHEME, DEP-μ and MAX IO (μ). This is, however, merely a suggestion. Unfortunately, a comprehensive approach can not be provided here due to lack of space. It is left for future research.

[242] Very little exceptions exist to this pattern, e.g. *Winter* 'winter' > [vɪnnəɐ].

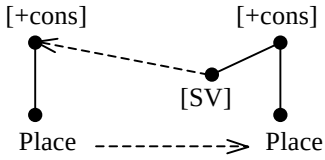
[243] Shiraishi (2006:45).

[244] For Kohler's (2001:388) assumption that MLG *blîven* 'to stay-Inf.' contradicts the theory of CL see section 5.3.3.

[245] This is inherently different from the process of voicing assimilation described for languages like Terena and Navajo (Grijzenhout 2001).

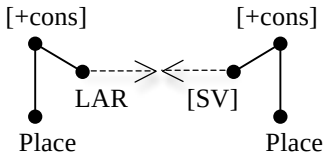
All in all, the assimilation processes in LG are most probably related to the presence or absence of a laryngeal node in the obstruents. If an obstruent consonant is not laryngeally specified (i.e. lenis), [SV] of the sonorant consonant and place features of the lenis obstruent may spread. This spreading process may work from left to right (e.g. *nd* > *nn* in [kɪnnəʁ]) or from right to left (e.g. *gn* > *ŋŋ* [zɛŋŋ]). Figure 74 demonstrates the assimilation for cases like *lēven* 'life-Sg.' > [leːmm̩].

Figure 74. Assimilation between lenis C and sonorant C



If a consonant is laryngeally specified (i.e. fortis) in contrast, both [SV] as well as the place features of the fortis obstruent are inhibited from spreading, and no assimilation occurs. My assumption is that the fortis segment is equally complex as the [SV] segment due to its laryngeal specification. Both consonants hinder each other from spreading their content to the other segment. This is illustrated in Figure 75.[246]

Figure 75. Lack of assimilation between fortis C and sonorant C



We see that phonological complexity can be employed to explain certain behavioral peculiarities of fortis Cs. After having established the structural differences between the two obstruent categories of lenis and fortis, we can move on to a detailed OT analysis of the matter. Starting point are the lenis Cs and the occurring CL in preceding vowels.

6.2.2. *Lenis consonants in OT*

Avery & Idsardi (2001:50) term the English voiced obstruents as phonologically inert and characterize them as lacking consistent phonetic cues. The authors state (in the tradition of Iverson & Salmons 1995) that these "are the properties we take to be the hallmarks of the unmarked member of a contrastive pair" (Avery & Idsardi 2001:50). Crucially, 'inertness' and the 'lacking consistent phonetic cues' are also

[246] The place feature [dorsal] e.g. in [snakkŋ] 'to talk-Inf.' appears to be an exception to this pattern, spreading to the final nasal and resulting in *kn* > *k!*.

properties of the LG lenis obstruents, making 'unmarked' a suitable notion for these consonants.

The lenis Cs, unlike the fortis Cs, evade weight assignment. I assume that lenis Cs are structurally small, having no feature specifications attached. They occupy as little structural space as possible in the PrWd. The result is that the nuclear V is equipped with a greater amount of space within the foot. This behavior may also be reflected in the general avoidance of voiced geminates in LG.[247] Only very few instances occur, e.g. the (ambisyllabic) loan words [bʊddəl] 'bottle-Sg.' or [meʃʊggə] 'crazy'. Lenis Cs can be characterized as inherently non-moraic and, hence, singleton Cs in terms of Mora Theory. As such, they effectively allow lengthening of a preceding V of the same syllable.

Spaelti (2002:10) and Ham (2001:49) in their works on the Swiss German dialects Glarnertüütsch and Bernese, respectively, account for singleton coda Cs of monosyllables in terms of an extrasyllabic position. Remember that this position is located at the periphery of the PrWd, and its segmental content is not parsed into a syllable or foot (see section 4.1.2). Extrasyllabic consonants are associated directly to the ω-node. Instead of the final obstruent, the nuclear V is thereby located at the right edge of the PrWd. The effect is that this V may lengthen in Swiss German. The vowel lengthening process depends here on the requirement of FTBIN for a bimoraic status of the foot. Yet, lengthening processes in word-final position are restricted in the Swiss German dialects. Final lengthening create a conflict with WEAKEDGE, i.e. the avoidance of structure and, thus, mora-assignment at the right edge of prosodic words.

Translated to the LG prosodic structure, the difference between synchronic fortis and lenis Cs in monosyllables can also be expressed by extrasyllabicity of the lenis Cs. The constraint WEAKEDGE that has been employed in chapter 4 to account for the stress assignment in LG also enforces extrasyllabicity of coda consonants in monosyllabic PrWds. It eliminates all candidates that comprise associations of the lenis coda other than directly to the PrWd node, i.e. it penalizes all kinds of structure in word-final position. Candidates with a lenis coda C associated to the second mora of the nucleus via mora-branching are equally disfavored. The lenis C is rendered extrasyllabic (see section 4.1.4). Spaelti (2002:11) concludes that the extrasyllabic segment needs to be associated to the PrWd node since this position "contains the least amount of structure, and is therefore the most harmonic with respect to WEAKEDGE". I argue that it is especially the weak, simplex lenis obstruents that are allowed and even required in this position because they are laryngeally unspecified. Thus, by making them extrasyllabic, the least amount of segmental and prosodic structure is aligned with the right word edge.[248] These obstruents become structurally simplex on two levels of representation: the segmental level and the prosodic level.

[247] Also expressed in the OT constraint NOVOIGEM (NO-DD): No voiced obstruent geminates (Itô & Mester 2004).

[248] The result of this extrasyllabic structure is indeed not an identical configuration of onsets and lenis codas (Ben Hermans p.c.). Bear in mind that I assume with Hyman (1985) that onsets are connected to the head-mora of the nucleus rather than to the syllable node.

This relates directly to the occurrence of phonetically overlong bimoraic vowels in LG. The lack of structural content in the final lenis Cs leaves an additional mora to the nucleus if an underlying moraic (allo)morpheme is involved (i.e. the remnants of an apocopated final schwa, see section 5.3.4). Different from Swiss German, FTBIN is not accountable for this lengthening of the vowel in LG. Rather, the extrasyllabic lenis Cs allows the vowel to occupy more space – space that comes in the shape of the free moraic (allo)morpheme ($^{\mu}$]) that attaches to the nucleus. An association to the final C is impossible due to the avoidance of structure in lenis Cs and in word-final position.[249] The phonetic result is then an *overlong* V by means of CL. These processes are demonstrated in the following OT analysis.

Tableau 17 contains the constraints that have been mentioned in connection to vocalic overlength so far in this survey. They are repeated in XXVIII) below.

XXVIII) MaxBin: a syllable must be maximally bimoraic.
WEAKEDGE (ω, φ): The right edge of a PrWd should contain no foot.
DEP-μ: Every mora of S_2 has a correspondent in S_1.
FTBIN: a foot is binary at some level of representation (σ, μ).
RM: For every (allo)morpheme in the input, some phonological element should be present in the output.
*$V_{\mu\mu}$: No bimoraic vowels.

The following rankings were already determined:

i) MaxBin >> WEAKEDGE etc. (see section 4.1.4)
ii) DEP-μ >> FTBIN (see section 5.1.1)
iii) RM >> *$V_{\mu\mu}$ (see section 5.3.3)

*$V_{\mu\mu}$ and DEP-μ are not yet ranked with respect to each other, and neither are MaxBin and RM. A necessary addition to the ranking is WEAKEDGE >> *$V_{\mu\mu}$ in order to exclude the association of the moraic (allo)morpheme to the final lenis C. Avoidance of bimoraic vowels could otherwise result in the creation of a moraic lenis coda.

Something else we need to consider when discussing lenis Cs is the assumption that the contrast neutralization between LG lenis Cs and fortis Cs in final position relates to the variable phonetic realization of the lenis Cs. The original, laryngeally unspecified lenis structure remains, surfacing in the phonetic implementation. The constraint in XXIX) expresses this by prohibiting outputs with an altered voicing specification.[250] Thus, input forms with a lenis coda cannot be changed underlyingly. IDENT (LAR) is generally unviolated in LG, which is why it is left out in the subsequent OT tableaux.

[249] This behavior is expressed in terms of constraint IX) PARSE (μ): All morae are parsed into syllables (see section 4.1.2).
[250] We may assume that the preservation of the structure also entails that the moraic status of a segment is maintained (i.e. lenis Cs remain non-moraic, fortis Cs remain moraic).

XXIX) IDENT (LAR): Consonants should be faithful to the underlying laryngeal specification (Kager 1999:14; Lombardi 1999:270).

With these constraints at hand, we obtain the subsequent Tableau 17 for cases with moraic (allo)morpheme in combination with a lenis coda C (denoted in the tableaux as D) and a tense nucleus.[251]

Tableau 17. [huu:z] 'house-Dat.Sg.'[252]

[[C V^{μ} D]$_{\sigma}$ $^{\mathbf{\mu}}$]$_{\phi}$ [253]	MaxBin	RM	WEAKEDGE	*Vμμ	DEP-μ	FTBIN
(a) [[CV$^{\mu}$D$^{\mathbf{\mu}}$]$_{\sigma}$]$_{\phi}$			***!**			
(b) ☞ [[CV$^{\mu\mathbf{\mu}}$]$_{\sigma}$]$_{\phi}$<D>				*		
(c) [[CV$^{\mu\mu\mathbf{\mu}}$]$_{\sigma}$]$_{\phi}$<D>	***!**			*	*	
(d) [[CV$^{\mu\mu}$D$^{\mathbf{\mu}}$]$_{\sigma}$]$_{\phi}$	***!**		*	*	*	
(e) [[CV$^{\mu}$]$_{\sigma}$ D$^{\mathbf{\mu}}$]$_{\phi}$			***!**			
(f) [[CV$^{\mu}$]$_{\sigma}$]$_{\phi}$<D>		***!**				*

RM and FTBIN are satisfied by all of the given candidates except for (f)[254]. The most important constraint is WEAKEDGE. It alludes to the prosodic structure and is violated whenever the right edge of the PrWd contains a foot (see section 4.1.2). Note that extrasyllabic moraic Cs are *per se* excluded due to the particularly weak status of the prosodic word adjunct (van Oostendorp 2002).

From this tableau, only the ranking WEAKEDGE >> *Vμμ is determinable. An independent ranking argument for none of the other constraints can be established.

If we look at the bimoraic candidates (a) and (e), we see that they produce only one – though fatal – violation of WEAKEDGE. Both output forms contain footed material at the right word edge. Not syllabifying the coda does not diminish the

[251] Remember that the development of bimoraic *lax* nuclei is prohibited by means of LAX+X and the OCP (see section 5.1.1).

[252] The notation is such that [ ]σ marks syllabic content, [ ]ϕ marks footed content, and < > marks extrasyllabic content being associated directly to the PrWd-node. [V$^{\mu}$D]σ denotes in a simplifying manner mora sharing between V and D, and a monomoraic V followed by a non-moraic D in the same syllable. Further differentiation is not required for the present analysis.

[253] I imply here that vowels are inherently moraic configurations. Furthermore, I assume in a cyclic manner that the input form in the subsequently discussed cases is the output of the stress system, i.e. the prosodic structure is already in place.

[254] A form [[CV$^{\mathbf{\mu}}$]$_{\sigma}$]$_{\phi}$<D> with the moraic (allo)morpheme replacing the mora of the nucleus can be excluded by means of RHTYPE =T.

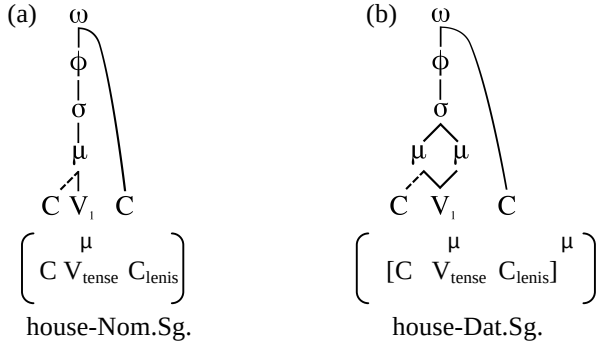
violation in (e). Both forms are excluded although they are faithful to all remaining constraints.

Candidates (b), (c) and (f) have by comparison an extrasyllabic C, i.e. the right word edge is structurally low equipped. They are most faithful to WEAKEDGE. The form in (f) results due to its monomoraic structure and the lack of the moraic (allo)morpheme in a fatal violation of RM and an additional violation of FTBIN. The occurrence of a bimoraic vowel in (b) and a trimoraic vowel in (c) results in the insertion of one violation mark to $*V_{\mu\mu}$. The latter candidate is additionally unfaithful to the principle of MaxBin that rules it out. Also, it creates a violation of DEP-μ for adding a third mora. What is valid for (c) goes also for (d) to the addition of a violation mark on WEAKEDGE.

We see that ultimately candidate (b) $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<D> wins due to the ranking of WEAKEDGE >> $*V_{\mu\mu}$. The output violates the given ranking the least. It contains a bimoraic vowel and an extrasyllabic lenis C. This output satisfies also the requirement of RHTYPE=T for a trochaic foot structure as discussed in section 4.1.2.

WEAKEDGE is only triggered in the cases with lenis coda Cs. It is crucially ranked above FTBIN and is outranked by the (undominated) RM and MaxBin.[255] The structures of synchronic monosyllables ending in lenis C are given in Figure 76 (a) and (b).

Figure 76.



These representations show not only the syllable level but also the dominating Prosodic Hierarchy at the foot level (ϕ) and the PrWd level (ω). The form in Figure 76 (a) represents cases like *Huus* 'house-NomSg.' with a tense V in the nucleus and no μ] latched to the right edge of the word. Forms with a lax vowel like *Dag* 'day-Sg.' or *Rad* 'bicycle-Sg.' are treated differently because of the requirements for a segment to close the syllable in these cases (see section 5.1.1.1 and the discussion below). Figure 76 (b) is representative for words such as *inn Huus* 'house-Dat.Sg.' where a moraic (allo)morpheme yields a phonetically tense overlong nucleus. The occurrence of this mora-(allo)morpheme creates the crucial distinction for the contrast. It is exemplified by *Huus* 'house-Nom.Sg.' and *inn Huus* 'house-Dat.Sg.'

[255] Note that a crucial ranking of RM >> WEAKEDGE is not determinable. Both constraints may as wel be unranked with respect to each other.

presented in Figure 66 and recapitulated here in Figure 77. The root for both the Nom. and the Dat. are otherwise identical synchronically.

Figure 77. Structure of 'house' in LG

(a) [C V^{μ} C] 'house-Nom.Sg.'
tense

(b) [[C V^{μ} C] $^{\mu}$] 'house-Dat.Sg.'
tense

The underlying lenis coda Cs become fortified only on the overt level due their final position as mentioned above. This detail is in accordance with the finding that a difference between lenis Cs and fortis Cs in utterance-final position is sustained (though this difference may be rather small, see chapter 3). The original, laryngeally unspecified lenis structure is upheld, also surfacing in the phonetic implementation. Phonetically, the form e.g. *Huus* 'house-Nom.Sg.' had a fortified lenis C on the overt level already in MLG time (due to 1st 'final devoicing'). The C thus lacked the phonetic properties to enhance the duration of the preceding V.[256] Phonologically, the PrWd comprises no underlying moraic (allo)morpheme, to the effect that no vowel lengthening occurs. If we consider the corresponding monomoraic input form $[[CV^{\mu}D]_{\sigma}]_{\phi}$, it seems that the present constraint ranking {MaxBin, RM} >> WEAKEDGE >> {*$V_{\mu\mu}$, DEP-μ} >> FTBIN is also suited to achieve the correct output with an extrasyllabic lenis C in these cases.[257] There is no specific morphemic content present in the input, which is why RM is left unviolated. No ranking argument can be provided for this constraint, leaving it unranked with respect to MaxBin. The co-dominating MaxBin is equally not violated by any of the given output forms. DEP-μ, too, appears to be of no actual relevance here.

Taking into account the LG stress system with the ranking MaxBin >> RHTYPE=T >> WEAKEDGE, we see in Tableau 18, however, that the desired output form (c) $[[CV^{\mu}]_{\sigma}]_{\phi}$<D> is at odds with the finding that feet of the type (**L**) are generally avoided because they constitute bad trochees (see section 4.1.2). They crucially violate RHTYPE=T, i.e. the requirement for trochaic feet in LG. Candidate (c) is therefore outranked by candidate (d) $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<D>. This form is in fact identical to the output of Tableau 17 that includes a moraic (allo)morpheme. We always obtain a lengthened bimoraic V. Such a structural merger between the two forms is clearly wrong.

[256] Listeners or learners interpret the phonetic properties individually, i.e. independently from one another. They reanalyze individually the data and create their own phonological system. It is inherently independent from the system the preceding generation of speakers (or any speaker in general) have in their minds. If in a language an originally long V before phonetically voiceless C is contrasted with a new longer V before lenis C, the first might get shortened while the latter gets even more lengthened in order to enhance the contrast.

[257] Note that input forms with bimoraic vowels at the *surface* level are excluded because *$V_{\mu\mu}$ applies already underlyingly.

Tableau 18. [huːz] ‘house-Nom.Sg.’

[[C V$^{\mu}$ D]$_{\sigma}$]$_{\phi}$	MaxBin	RM	RHTYPE =T	WEAKEDGE	*V$_{\mu\mu}$	DEP-μ	FTBIN
(a) [[CV$^{\mu}$D]$_{\sigma}$]$_{\phi}$			*!	*			*
(b) [[CV$^{\mu}$D$^{\mu}$]$_{\sigma}$]$_{\phi}$				*!		*	
(c) ☹ [[CV$^{\mu}$]$_{\sigma}$]$_{\phi}$<D>			*!				*
(d) 💣 [[CV$^{\mu\mu}$]$_{\sigma}$]$_{\phi}$<D>					*	*	

In order to achieve a winner that differs from the representation of the phonetically overlong vowels in Tableau 17, we need to re-rank one of the so far unranked constraints. The ranking of neither MaxBin nor RM generates a different result. This leaves DEP-μ as the ranking option. Assuming it to dominate RHTYPE=T gives the correct result here. The amended Tableau 19 produces now the winning output in (c) with a monomoraic foot and the extrasyllabic lenis C latched to the right word edge.

Tableau 19. [huːz] ‘house-Nom.Sg.’

[[C V$^{\mu}$ D]$_{\sigma}$]$_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	WEAKEDGE	*V$_{\mu\mu}$	FTBIN
(a) [[CV$^{\mu}$D]$_{\sigma}$]$_{\phi}$				*	*!		*
(b) [[CV$^{\mu}$D$^{\mu}$]$_{\sigma}$]$_{\phi}$			*!		*		
(c) ☞ [[CV$^{\mu}$]$_{\sigma}$]$_{\phi}$<D>				*			*
(d) [[CV$^{\mu\mu}$]$_{\sigma}$]$_{\phi}$<D>			*!			*	

Besides a violation mark inserted for the lack of trochaic structure, output (c) violates only low ranked FTBIN and is faithful to all remaining constraints. Candidate (d) satisfies by comparison FTBIN but is fatally unfaithful to DEP-μ and also violates *V$_{\mu\mu}$. This results from the mora insertion to the vowel. It produces an output form with a bimoraic vowel, one mora not corresponding to a mora of the input form. The outputs given in (a) and (b) fatally violate WEAKEDGE by having footed content at the right word edge. The moraic status of the lenis coda does not play a crucial role in this decision. The lack of an additional mora yields a violation of RHTYPE=T and FTBIN in (a), while the insertion of an additional mora produces a violation of DEP-μ in (b).

Tableau 19 demonstrates the possibility of monomoraic feet in LG. The winning candidate contains a light foot since the insertion of a mora as a ‘repair-mechanism’

– as would be required by FTBIN – is dispreferred.[258] Output forms such as this are restricted to the forms comprising a tense vowel, no moraic (allo)morpheme, and a final lenis C. In monosyllables with a lax vowel in the nucleus and a succeeding lenis C (e.g. [pad] 'path-Sg.', [rad] 'bicycle-Sg.'), the consonant is forced into the coda position due to dominating LAX+X and OCP. However, as to my knowledge, these forms are particularly rare, and seem to be broadly restricted to the open lax vowel [a].[259] All in all, the rareness of forms containing a short lax vowel followed by a lenis C in coda position might be seen as an indication of the general preference for prosodically invisible final lenis Cs in LG. WEAKEDGE determines that these consonants are preferably placed in the adjoined position. Overall, we can say that words ending in lenis consonants behave rather special, allowing on the one hand for the development of bimoraic vowels, and on the other hand for the occurrence of monomoraic feet. As a consequence, we can say that the phonetic overlength detected in the recordings of the three LG dialect areas Kirchwerder, Altenwerder and Alfstedt is analyzable as being not underlyingly present in the vowels. This means that LG does not necessarily have an underlying length contrast. With the additonal mora of the moraic (allo)morpheme and the constraint ranking at hand, we reach, however, a surface length contrast between monomoraic and bimoraic vowels.

This is not only valid for monosyllables but also for bisyllables such as [mɑˈtroːz] 'sailor-Sg.' and [kɔmˈbyyːz] 'caboose-Sg.' (see section 4.1.4, Tableau 7).[260] Including the ranking RHTYPE=T >> {WSP, WEAKEDGE} >> PARSE (σ) >> {RIGHTM, PARSE (Σ)} developed for the LG stress system into the current constraint hierarchy, Tableau 20 emerges.

Tableau 20. [kɔmˈbyːz] 'caboose-Sg.'

	$[CV^{\mu}R^{\mu}]_{\sigma}[[CV^{\mu}D]_{\sigma}{}^{\boldsymbol{\mu}}]_{\phi}$	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	$*V_{\mu\mu}$	FTBIN
(a)	$[CV^{\mu}R^{\mu}]_{\sigma}[[CV^{\mu}D^{\boldsymbol{\mu}}]_{\sigma}]_{\phi}$	*	*!	*				
(b)	$[CV^{\mu}R^{\mu}]_{\sigma}[[CV^{\mu\boldsymbol{\mu}}D]_{\sigma}]_{\phi}$	*	*!	*			*	
(c) ☞	$[CV^{\mu}R^{\mu}]_{\sigma}[[CV^{\mu\boldsymbol{\mu}}]_{\sigma}]_{\phi}$<D>	*		*	*	*	*	

[258] This ranking is crucially different from the ranking presented by Spaelti (2002:16) for the Swiss German dialect of Glarnertüütsch. In this language variety, FTBIN is ranked high in the constraint hierarchy. This yields a lengthening effect in the nucleus from a monomoraic to a bimoraic vowel. This is valid for all coda Cs.

[259] This appears to be the case at least for Leer LG (Antje Olthoff p.c.). The form [ʔɛb] 'tide' is actually one of the rare cases containing a lenis geminate diachronically.

[260] Similar to the monosyllable 'giant-Nom.Sg.', these two forms contain a moraic (allo)morpheme in the Nom.Sg.

I give here only the three candidates that are most faithful with respect to the discussed trochaic foot structure. MaxBin, RM, RHTYPE=T and DEP-μ are left out in order to keep the tableau to a reasonable size. None of the three candidates violates them. Note that no crucial ranking of the bundle RIGHTM, PARSE (Σ) in relation to *$V_{\mu\mu}$ and FTBIN can be determined. Leaving them here unranked with respect to *$V_{\mu\mu}$ is just an intuitive decision. The constraint PARSE (σ) becomes only relevant in words with more than one syllable. I therefore omit it in the tableaux on monosyllabic forms.

The evaluation of the input form demonstrates that the final syllable is indeed heavy – not superheavy. It maintains this status due to RM, to which the presented candidates are all faithful. What obviates the H(**H**) candidates (a) and (b) as possible outputs in comparison to H(**H**)<C> in c) is the ranking of WEAKEDGE. Even though (c) shows overall the most violations on the given constraints, being wellformed with respect to WEAKEDGE is the key to success here. The constraint hierarchy that has been established up to now can be summarized as follows.

XXX) {MaxBin, RM} >>[261]
DEP-μ >>
RHTYPE=T >>
{WSP, WEAKEDGE} >>
PARSE (σ) >>
{(RIGHTM, PARSE (Σ),) *$V_{\mu\mu}$} >>
FTBIN

Let us now turn to the treatment of the complementary class of fortis Cs to see in how far this ranking produces here the correct results.

6.2.3. *Fortis consonants in OT*

I have argued above in section 6.2.1 that fortis consonants are underlyingly moraic by virtue of their structural complexity. Their weight bearing status is indicated especially by the LG stress system where words like [maˈtrats] ‘mattress-Sg.’ or [moˈrats] ‘mud’ receive final stress (see section 4.1.4). The lax nuclear vowel bears one mora, which in itself is not enough to be stress-attracting. Instead of building a foot (**L**L)<C> as could be expected if the penultimate [t] was not weight bearing, the foot is constructed as L(**H**)<C>. It follows that fortis coda Cs must be moraic in order to motivate the stress assignment to CVC syllables. I assume that this mora is underlyingly present and not assigned by positional weight constraints such as WbP. The according markedness constraint expressing this mora assignment is FORTIS-μ.[262]

[261] Note that the ranking of RM to RHTYPE=T and to DEP-μ is not fixed. RM can be unranked with respect to the latter two constraints without causing a difference in the outputs.
[262] Another possibility would be to assume a MAX constraint that maintains moraic status of fortis Cs (Wolfgang Kehrein p.c.).

XXXI) FORTIS-μ: Laryngeally specified obstruents have a mora.[263]

In more general terms, it applies to the underlying level of laryngeally specified segments and defines them as geminates in the view of Mora Theory. In fact, without this prerequisite, we obtain a possible output $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<T> in a tableau based on the constraint ranking in XXX) (the fortis consonants are denoted as T in the tableaux). This form shows a lengthened vocalic nucleus. No possible ranking would generate a favorable result like $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$ without lengthening of the V as the phonetics tell us. This is rather undesirable. FORTIS-μ now determines directly the association of a mora to the fortis consonant. This definition correctly predicts that fortis Cs behave as true geminates word medially (but nevertheless syllable-finally), employing an ambisyllabic structure.[264]

Tableau 21. [de:k] 'blanket-Nom.Sg.'

$[\,[\,C\,V^{\mu}\,T^{\mu}\,]_{\sigma}\,\mathbf{^{\mu}}\,]_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	FORTIS-μ	WEAK EDGE	RIGHTM	PARSE (Σ)	*Vμμ	FTBIN
(a) $[[CV^{\mu}\mathbf{^{\mu}}T]_{\sigma}]_{\phi}$					*(!)	*(!)			*	
(b) ☞ $[[CV^{\mu}T\mathbf{^{\mu}}]_{\sigma}]_{\phi}$						*				
(c) $[[CV^{\mu\mu}T\mathbf{^{\mu}}]_{\sigma}]_{\phi}$	*!					*			*	
(d) $[[CV^{\mu\mu}\mathbf{^{\mu}}]_{\sigma}]_{\phi}$<T>	*!				*		*	*	*	
(e) $[[CV^{\mu}\mathbf{^{\mu}}]_{\sigma}]_{\phi}$<T>					*		*(!)	*(!)	*(!)	
(f) $[[CV\mathbf{^{\mu}}]_{\sigma}]_{\phi}$<T>				*!	*		*	*		*
(g) $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$		*!				*				

Above, I give in Tableau 21 an OT analysis of those forms with a moraic (allo)morpheme that contain a final fortis C. WSP is obviated because it is left unviolated in monosyllables. FORTIS-μ must not be ranked below WEAKEDGE because with such a hierarchy of WEAKEDGE >> FORTIS-μ the output form $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<T> we wanted to exclude would still win. Leaving it unranked with

[263] It is a complement to *FINAL-C-μ: the final consonant is weightless (Kager 1999:268). High ranked *MORAIC ONSET: no moraic onsets. keeps FORTIS-μ from inserting a mora to the onset position in LG.

[264] Unfortunately, I was not able to find CVC.CVC forms ending in a fortis C. All cases that seemed to be fitting phonetically (e.g. [ˈbannıç] 'very') turned out to have a final lenis C.

respect to WEAKEDGE then produces the desired result.[265] Candidate (b) with the bimoraic structure $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$ outranks all other output forms.

Candidates (a) through (f) embed the moraic (allo)morpheme in their structure. MaxBin then excludes the trimoraic candidates (c) and (d) that are mora-wise most faithful to the input form. The output in (f) is ruled out second by fatally violating RHTYPE=T. It contains only one mora in total what does not allow the creation of a wellformed trochee. Only candidate (g) does not maintain the moraic (allo)morpheme. This produces a fatal violation of RM, excluding (g) as possible output.[266]

I assume here for candidate (a) that branching of the second mora between the V and the coda C is insufficient to satisfy FORTIS-μ. It is therefore unfaithful not only with respect to WEAKEDGE but also with respect to FORTIS-μ, excluding it as possible output.

Candidates (b) through (g) each insert one violation mark to the unranked WEAKEDGE, FORTIS-μ combination. The first two output forms do not satisfy WEAKEDGE due to the presence of foot structure at the right word edge. The latter three output forms then violate FORTIS-μ because they assign no mora to the (extrasyllabic) final C. What finally discards the remaining candidate (e) is $*V_{\mu\mu}$ or RIGHTM, PARSE (Σ).

The result is that, different from the monosyllabic *lenis* forms, the monosyllabic *fortis* forms retain a moraic (allo)morpheme not on the vowel but on the coda C. The evaluation of a trimoraic monosyllabic input form comprising a final fortis consonant results in a bimoraic output. Fortis words appear to be able to maintain a coda by keeping its prosodic structure.

This is not only true for cases including a moraic (allo)morpheme, but also in forms where we find a zero-morpheme, i.e. no additional moraic (allo)morpheme is present in the input. The following Tableau 22 illustrates this point for words like [ri:s] ‘rice’. Similar to the [de:k] ‘blanket-Nom.Sg.’ case, the winning candidate is the bimoraic (b). It ultimately outranks the structure $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<T> in (d) by means of RIGHTM, PARSE (Σ), $*V_{\mu\mu}$ similar to what we have seen above. A palpable difference between the two tableaux of the fortis forms is the impact of high ranked MaxBin and RM. The outcome is in both cases always a structure $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$.

[265] My interpretation of the dashed line in the tableau is such that I assume the possibility of crucially unranked, i.e. equally ranked constraints. No complete constraint hierarchy is required. Although a ranking FORTIS-μ >> WEAKEDGE would produce more clear-cut results here, the polysyllabic form in Tableau 23 shows that the two constraints need to be left unranked.

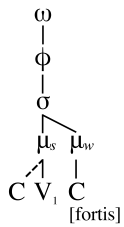
[266] If one would like to generally prevent the moraic (allo)morpheme from ‘overwriting’ the morae of the input form, the constraint MAX IO (μ) given in XXIII) could be invoked.

Tableau 22. [ri:s] ‘rice’

[[C V^{μ} T^{μ}]$_{\sigma}$]$_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	FORTIS-μ	WEAK EDGE	RIGHTM	PARSE (Σ)	*Vμμ	FTBIN
(a) [[CV$^{\mu\mu}$T]$_{\sigma}$]$_{\phi}$					***(!)**	***(!)**			*	
(b) ☞ [[CV$^{\mu}$T$^{\mu}$]$_{\sigma}$]$_{\phi}$						*				
(c) [[CV$^{\mu\mu}$T$^{\mu}$]$_{\sigma}$]$_{\phi}$	***!**		*			*			*	
(d) [[CV$^{\mu\mu\mu}$]$_{\sigma}$]$_{\phi}$<T>	***!**		*		*		*	*	*	
(e) [[CV$^{\mu\mu}$]$_{\sigma}$]$_{\phi}$<T>					*		***(!)**	***(!)**	***(!)**	
(f) [[CV$^{\mu}$]$_{\sigma}$]$_{\phi}$<T>				***!**	*		*	*		*

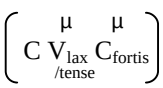
It is apparent that fortis Cs in fact constitute literally *strong* moraic configurations that need to be parsed and thereby occupy space within a PrWd. The effect is that a preceding V is confined to having a single mora. The structure of an according monosyllable is given in Figure 78 below. It is equally valid for underlying forms with or without a moraic (allo)morpheme.

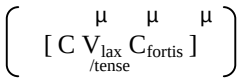
Figure 78.



surface form:

underlying forms:





The constraint ranking produces a somewhat different result in bisyllabic items. I provide a brief evaluation of forms such as [ˈkiːvɪt] ‘peewit-Sg.’ with a foot structure (**L**L)<C> in Tableau 23. The two candidates (a) and (b) are the closest competitors as determined in the simplified Tableau 9 in section 4.2.1. MaxBin, RM, RHTYPE=T

and DEP-μ are again left out in order to keep the tableau to a reasonable size. They are not violated by either of the two candidates.

Tableau 23. [ˈkiːvɪt] ‘peewit-Sg.’

	$[[CV^{\mu}]_{\sigma}[DV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$	FORTIS-μ	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	$*V_{\mu\mu}$	FTBIN
(a) ☞	$[[CV^{\mu}]_{\sigma}[DV^{\mu}]_{\sigma}]_{\phi}$<T>	*				*	*		
(b)	$[CV^{\mu}]_{\sigma}[[DV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$			*	*!				

With the newly established constraint FORTIS-μ and its requirement for moraic fortis Cs we see that we need to leave FORTIS-μ crucially unranked with respect to WEAKEDGE. Assuming a hierarchy of FORTIS-μ >> WEAKEDGE results in the incorrect winner in (b) with stress on the ultima. The opposite ranking of WEAKEDGE >> FORTIS-μ has already been excluded for LG by Tableau 21 above, where the wrong candidate $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<T> with a bimoraic vowel preceding an extrasyllabic fortis C would win against the desired candidate $[[CV^{\mu}T^{\boldsymbol{\mu}}]_{\sigma}]_{\phi}$ with a monomoraic vowel preceding a syllabified and footed moraic fortis C. Additionally, ranking PARSE (σ) >> RIGHTM is a necessary means to decide between (**L**L)<C> in (a) and L(**H**) in (b). Leaving it unranked, candidate (b) would win because it produces overall fewer violations of the constraints. This is, however, not in accordance with the stress found in these forms. Thus, in order to reach a wellformed foot structure and at the same time comply with the observations made for LG, the final fortis C needs to be allotted to the adjoined position. A solution that is only possible if we assume that parsing a syllable is indeed more important than parsing a segment or erecting a foot at the right word edge.

All in all, the result is such that the final fortis C loses its mora and is forced to occupy the extrametrical position only in bisyllables. In monosyllables, its underlying moraic status is kept also in the surface form.

6.2.4. *Sonorant consonants in OT*

The sonorants I discuss in the succeeding section show the same behavior as the fortis Cs. They, too, are mora-bearing in the final position of monosyllables but placed into the appendix in bisyllables.

I have argued above that sonorant Cs and fortis Cs group together in LG with respect to structural complexity. Where fortis Cs are laryngeally specified as [s.g.], the sonorant Cs receive a feature [SV] that enriches the root node.[267] The assumption

[267] [SV] might be also present in obstruent Cs in some languages (Rice 1993). This is not the case in LG since no allophonic alternation exists between sonorants and lenis obstruents.

of such a complexity connection appears to be justified by the phonetic data presented in chapter 3. It strongly suggests that sonorant consonants do not allow distinct lengthening of a preceding vowel. Rather, the vowel retains its durational status as phonetically short or long. Its underlying monomoraicity is preserved at the surface level. This is reminiscent of the fortis Cs that induce equally no lengthening in a preceding vocalic nucleus. Yet, both consonantal categories do not build a natural class.

Leaving aside the complexity by means of featural specifications, another possibility to explain the rich structure of sonorant Cs is to refer to their particularly high sonority level. This could enforce mora assignment and, thus, more structure of the sonorant C. This mora association would predict parsing of the segment by means of high ranked PARSE (μ) (see section 4.1.2).

Either way, what we obtain are sonorant Cs that are underlyingly endowed with a mora. The respective constraint is formulated in XXXII).

XXXII) SONORANT-μ: sonorant consonants have a mora.

It is the complement to FORTIS-μ and determines mora association to sonorant consonants. Since no further ranking arguments are so far provided, I assume that SONORANT-μ (SON-μ) enters the constraint hierarchy just where FORTIS-μ is positioned. The resulting tableau for forms like [mi:n] '(coal-)mine-Sg.' ending in a sonorant C and containing a moraic (allo)morpheme is given below as Tableau 24. The sonorant Cs are labeled as R. I, again, assume here only output forms that incorporate the moraic (allo)morpheme into their structure.

Tableau 24. [mi:n] '(coal-)mine-Nom.Sg.'

[[C V$^{\mu}$ R$^{\mu}$]$_{\sigma}$ **$^{\mu}$**]$_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	SON-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*Vμμ	FTBIN
(a) [[CV$^{\mu\mu}$**$^{\mu}$**R]$_{\sigma}$]$_{\phi}$					*(!)	*(!)			*	
(b) ☞ [[CV$^{\mu}$R**$^{\mu}$**]$_{\sigma}$]$_{\phi}$						*				
(c) [[CV$^{\mu\mu}$R**$^{\mu}$**]$_{\sigma}$]$_{\phi}$	*!					*			*	
(d) [[CV$^{\mu\mu\mu}$]$_{\sigma}$]$_{\phi}$<R>	*!				*		*	*	*	
(e) [[CV$^{\mu\mu}$]$_{\sigma}$]$_{\phi}$<R>					*		*(!)	*(!)	*(!)	
(f) [[CV**$^{\mu}$**]$_{\sigma}$]$_{\phi}$<R>				*!	*		*	*		*

Since the ranking and the effect of the constraints are virtually identical to the corresponding Tableau 21 for the fortis forms with moraic (allo)morpheme, the outcome is here naturally the same. Candidate (b) with its structure $[[CV^{\mu}R^{\boldsymbol{\mu}}]_{\sigma}]_{\phi}$ wins. It becomes evident that we may not assume a ranking of SON-μ >> WEAKEDGE. The reason is that instead of the desired form (b) $[[CV^{\mu}R^{\boldsymbol{\mu}}]_{\sigma}]_{\phi}$, the overlong candidate (e) $[[CV^{\mu\boldsymbol{\mu}}]_{\sigma}]_{\phi}$<R> would prevail, then.

MaxBin rules out the trimoraic forms in (c) and (d). It is then the demand for a trochaic foot structure that excludes the second candidate f) since it contains only one mora. The combination of not associating a separate mora to the sonorant C, and building the foot at the right word edge rules candidate (a) out. The decision for (b) is made by $*V_{\mu\mu}$ and/or RIGHTM, PARSE (Σ). The preference for monomoraic vowels in LG ultimately discards the direct opponent of (b), candidate (e) with the structure $[[CV^{\mu\boldsymbol{\mu}}]_{\sigma}]_{\phi}$ <R> as a possible output.

The result for the zero-morphemic forms ending in a sonorant C is virtually the same, the difference being the nature of the consonantal mora. While we find that the mora of the final sonorant C in the cases like [mi:n] '(coal-)mine-Nom.Sg.' is the moraic (allo)morpheme, the mora in zero-morphemic items is the underlyingly present mora of the sonorant C. The prosodic structure of words like [zø:n] 'son-Sg.' that have bimoraic inputs is maintained most faithfully in the output. Neither footing nor syllabification of the segments change. The winner of the respective Tableau 25 is again (b) $[[CV^{\mu}R^{\mu}]_{\sigma}]_{\phi}$ just like in Tableau 24. The absence of the moraic (allo)morpheme does not provoke a different outcome.

Tableau 25. [zø:n] 'son-Nom.Sg.'

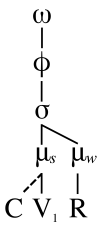
$[\,[\,C\,V^{\mu}\,R^{\mu}\,]_{\sigma}\,]_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	SON-μ	WEAK EDGE	RIGHTM	PARSE (Σ)	$*V_{\mu\mu}$	FTBIN
(a) $[[CV^{\mu\mu}R]_{\sigma}]_{\phi}$					***(!)**	***(!)**			*	
(b) ☞ $[[CV^{\mu}R^{\mu}]_{\sigma}]_{\phi}$						*				
(c) $[[CV^{\mu\mu}R^{\mu}]_{\sigma}]_{\phi}$	***!**		*			*			*	
(d) $[[CV^{\mu\mu\mu}]_{\sigma}]_{\phi}$<R>	***!**		*		*		*	*	*	
(e) $[[CV^{\mu\mu}]_{\sigma}]_{\phi}$<R>					*		***(!)**	***(!)**	***(!)**	
(f) $[[CV^{\mu}]_{\sigma}]_{\phi}$<R>				***!**	*		*	*		*

This mora-association creates a merger between synchronic forms such as '(coal-)mine-Sg.' with a moraic (allo)morpheme and 'my-Poss.Pron.' without a

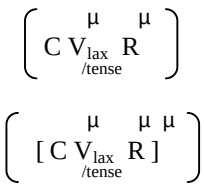
moraic (allo)morpheme. Both forms receive an identical surface structure. This corresponds to the finding that no phonetic difference exists in LG between the two word categories with respect to vowel duration or the duration of the coda sonorant. The according bimoraic structure of a monosyllable ending in a sonorant C is illustrated below.

Figure 79.

surface form:



underlying forms:



Though the raking of SON-μ >> WEAKEDGE has been shown to not apply, it still might be the case that we find a ranking of WEAKEDGE >> SON-μ. This would not affect the results of Tableau 24 and Tableau 25. However, that SONORANT-μ (SON-μ) is indeed unranked with respect to WEAKEDGE becomes evident if we consider bisyllabic forms like [ˈfaslam] ‘carnival-Sg.’ discussed in section 4. We found in the course of the discussion of the stress system that the final sonorant in bisyllables is allotted to the adjoined position in order to create a (**L**L)<C> structure. Tableau 26, a constraint-wise upgraded version of Tableau 10 (see section 4.2.1), illustrates this point.

In the tableau, I again give the two candidates that are the closest competitors. Candidate (a) shows the footing L(H) whereas candidate (b) has the structure (**L**L)<C>. Output forms with a trimoraic final syllable are left out because they are excluded by MaxBin anyway.

Tableau 26. [ˈfaslam] ‘carnival-Sg.’

$[[CV^{\mu}T^{\mu}]_{\sigma}[TV^{\mu}R^{\mu}]_{\sigma}]_{\phi}$	FORTIS-μ	SON-μ	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	$*V_{\mu\mu}$	FTBIN
(a) $[CV^{\mu}T^{\mu}]_{\sigma}[[TV^{\mu}R^{\mu}]_{\sigma}]_{\phi}$			*(!)	*(!)	*				
(b) ☞ $[[CV^{\mu}T^{\mu}]_{\sigma}[TV^{\mu}]_{\sigma}]_{\phi}$<R>		*				*	*		

The exhaustive footing of the segmental and syllabic content at the right word edge in candidate (a) in conjunction with WSP results in two violations of the unranked constraint set SON-μ, WSP, WEAKEDGE. The output in (b) violates these constraints at the same time only once by leaving the final sonorant C mora less. In doing so, the structure (**L**L)<C> outranks (**L**H) and emerges as the winner.

This result is equally valid for forms containing a schwa-syllable in the ultima like [ˈlɛɪpəl] 'spoon-Sg.'. They, too, enforce stress assignment to the penultimate syllable. Bear in mind that I assume contrary to Féry (1996) for Standard German that schwa is moraic in LG.[268]

The constraint ranking we have developed by now follows in XXXIII).

XXXIII) {MaxBin, RM} >>
DEP-μ >>
RHTYPE=T >>
{FORTIS-μ, SON-μ, WSP, WEAKEDGE} >>
PARSE (σ) >>
{RIGHTM, PARSE (Σ), *$V_{\mu\mu}$} >>
FTBIN

The ranking determines that, differently from the result we obtained in the monosyllables, utterance-final sonorants in *bisyllables* can indeed occur in the extrasyllabic appendix position. It is then, and only then, that they not retain their moraic status. This observation is virtually identical to the result of the fortis Cs.

What did not receive further attention so far is the question how consonant clusters are treated in LG. I discuss these cases in the following section.

6.2.5. *Cluster*

The discussion of the single final Cs showed that lenis Cs are always extrametrical. Fortis Cs and sonorant Cs are by comparison parsed in monosyllables but extrametrical in bisyllables. This extrametricality of fortis Cs occurs also in fortis consonant clusters or sonorant-fortis clusters. An exception are clusters of the type lenis-fortis as we will see in a minute. The fortis Cs of these combinations maintain their moraic status, and are fully parsed.

6.2.5.1 Fortis-fortis

The location of the final fortis C of a fortis-fortis cluster in the adjoined position becomes evident if we again take into account the LG stress system. We established a preference for splitting up a word-final cluster into a syllabified and an extrasyllabic constituent in LG bisyllables. Tableau 27, the amended version of Tableau 8 (see section 4.1.4), depicts this point by means of [moˈrats] 'mud'. Trimoraic syllables are again left out of the tableau.

[268] An explanation including weight assignment to a final schwa by means of WbP is inapplicable. Not only apocope but also syncope triggered the CL process. A nuclear, interconsonantal schwa therefore also needs to be moraic.

We see that both bisyllabic outputs equally violate FORTIS-μ by not associating a separate mora to the final consonant. The decision between the two forms depends on WEAKEDGE. It chooses the extrasyllabic candidate (b) for comprising no foot at the right word edge. The winner stays (b) irrespective of where the subsequent constraint bundle of RIGHTM and PARSE (Σ) is then ranked in relation to *$V_{\mu\mu}$ and FTBIN. No specific hierarchy is determinable.

Tableau 27. [moˈrats] ‘mud’

$[\ CV^{\mu}\ ]_{\sigma}\ [\ [\ RV^{\mu}T^{\mu}T^{\mu}\ ]_{\sigma}]_{\phi}$	FORTIS-μ	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	*$V_{\mu\mu}$	FTBIN
(a) $[CV^{\mu}]_{\sigma}\ [[RV^{\mu}T^{\mu}T]_{\sigma}]_{\phi}$	*		*!	*				
(b) ☞ $[CV^{\mu}]_{\sigma}\ [[RV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$<T>	*			*	*	*		

What is valid in the LG bisyllabic cases is also true for the monosyllabic words ending in a fortis cluster. Note that the nuclear vowel is in both cases lax, requiring the penult C to be syllabified. Outputs with both consonants in extrasyllabic position are obviated. The respective OT analysis is provided in Tableau 28 below.

Tableau 28. [rʊst] ‘quiet-Sg.’

$[\ [\ C\ V^{\mu}\ T^{\mu}\ T^{\mu}\ ]_{\sigma}]_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	FORTIS-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*$V_{\mu\mu}$	FTBIN
(a) $[[CV^{\mu}T^{\mu}T]_{\sigma}]_{\phi}$					*(!)	*(!)				
(b) ☞ $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$<T>					*!		*	*		
(c) $[[CV^{\mu\mu}T^{\mu}]_{\sigma}]_{\phi}$<T>	*!				*		*	*	*	
(d) $[[CV^{\mu}T^{\mu}T^{\mu}]_{\sigma}]_{\phi}$	*!					*				
(e) $[[CV^{\mu\mu}TT]_{\sigma}]_{\phi}$					**(!)	*(!)			*	
(f) $[[CV^{\mu\mu}T]_{\sigma}]_{\phi}$<T>					**!		*	*	*	
(g) $[[CV^{\mu}T]_{\sigma}]_{\phi}$<T>				*!	**		*	*		*

The candidates in (e) through (g) palpably show here two violations of the constraint FORTIS-μ. This relates to the fact that both of the fortis consonants present in the input form are required to be moraic. For every fortis C that receives no mora, a violation mark is inserted. However, being most faithful to the input form by maintaining the mora of both fortis Cs does not result in winning the tableau. We see that candidate (d) is discarded by MaxBin.

The ranking produces the structure $[[CV^{\mu}T^{\mu}]_{\sigma}]_{\phi}$<T> in (b) as the winner. The decision is again made by WEAKEDGE since the immediately competing form $[[CV^{\mu}T^{\mu}T]_{\sigma}]_{\phi}$ in (a) shows one violation of FORTIS-μ just like (b) does. If not for the ranking WEAKEDGE >> {RIGHTM, PARSE (Σ)}, the fully parsed (a) would win.

6.2.5.2 Lenis-fortis

Comparing the findings of the fortis clusters to lenis-fortis clusters, we observe a different result. The outcome for the monosyllables ending in a lenis-fortis cluster complies in fact with the findings for the monosyllables ending in a single fortis C as has been indicated above. This becomes evident by applying the constraint ranking to CVDT forms like [ʔo:vt] ‘fruit-Pl.tantum’. The respective tableau is given as Tableau 29 below. I omit forms with mora insertion, i.e. more than the two input morae, since they would be excluded by MaxBin anyway.

Tableau 29. [ʔo:vt] ‘fruit-Pl.tantum’

$[\,[\,C\,V^{\mu}\,DT^{\mu}\,]_{\sigma}]_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE=T	FORTIS-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*Vμμ	FTBIN
(a) ☞ $[[CV^{\mu}DT^{\mu}]_{\sigma}]_{\phi}$						*				
(b) $[[CV^{\mu}D^{\mu}]_{\sigma}]_{\phi}$<T>					*		*!	*		
(c) $[[CV^{\mu\mu}DT]_{\sigma}]_{\phi}$					*	*!			*	
(d) $[[CV^{\mu\mu}D]_{\sigma}]_{\phi}$<T>					*		*!	*	*	
(e) $[[CV^{\mu}D]_{\sigma}]_{\phi}$<T>				*!	*		*	*		*

The winner that is achieved here is candidate (a) with the exhaustively parsed bimoraic structure $[[CV^{\mu}DT^{\mu}]_{\sigma}]_{\phi}$. It is in fact overall most harmonic with respect to the given constraints. Only one violation occurs on WEAKEDGE.

The closest competitor to (a) is the extrasyllabic output in (b). It is excluded by the structural constraint bundle RIGHTM, PARSE (Σ) due to the construction of the foot in non-final position.

Apart from the finding that the final fortis C is parsed in lenis-fortis clusters, we see that the penultimate lenis C is prohibited from occupying an extrasyllabic position. In a manner of speaking, it is barred by the succeeding fortis C from leaving its syllabified status.

6.2.5.3 Sonorant-fortis

The result for the sonorant-fortis clusters reduplicates the findings obtained for the fortis-fortis cases above. Some examples of words ending in such a consonant cluster are [stʊmp] ‘blunt’, [stʊŋk] ‘quarrel; trouble’, [bʊnt] ‘colourful’, [flʊnʃ] ‘pouting mouth’, [baŋk] ‘bank-Sg.’, [kraŋk] ‘sick’, [dans] ‘dance-Sg.’, and [vʊnsk] ‘wish-Sg.’.

Tableau 30 evaluates the input of the CVRD item [dans] ‘dance-Sg.’. The winning candidate is (**H**)<C> in (b). The sonorant C is here exhaustively footed while the final fortis C occurs in the adjoined position. This output outranks the monomoraic form in (e) by means of RHTYPE=T. The candidates (a), (c) and (d) are then discarded by the constraint conjunction of FORTIS-μ, SON-μ WSP, WEAKEDGE.

The outcome is therefore that the sonorant-fortis clusters behave by and large identical to fortis-fortis clusters with respect to the prosodic structure. The initial member of a cluster is parsed, the final member of a cluster is allotted to the extrasyllabic position in the appendix.

Tableau 30. [dans] ‘dance-Sg.’

[[C V^{μ} R^{μ} T^{μ} $]_{\sigma}]_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	FORTIS-μ	SON-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*$V_{\mu\mu}$	FTBIN
(a) $[[CV^{\mu}R^{\mu}T]_{\sigma}]_{\phi}$					*		*!				
(b) ☞ $[[CV^{\mu}R^{\mu}]_{\sigma}]_{\phi}$<T>					*			*	*		
(c) $[[CV^{\mu\mu}RT]_{\sigma}]_{\phi}$					*	*(!)	*(!)			*	
(d) $[[CV^{\mu\mu}R]_{\sigma}]_{\phi}$<T>					*	*!		*	*	*	
(e) $[[CV^{\mu}R]_{\sigma}]_{\phi}$<T>				*!	*	*		*	*		*

6.2.5.4 Sonorant-lenis

The last type of consonant cluster that I treat is the sequence of sonorant C and lenis C. Examples for these configurations are [ˈhambɔɐ̯ç] ‘Hamburg-name’, [ʃɪld] ‘(traffic) sign-Sg.’, [gɛld] ‘money’, [vald] ‘forest-Sg.’, [vɪnd] ‘wind-Sg.’, [rʊnd] ‘round’, [pʊnd] ‘pound-Sg.’, [band] ‘ribbon-Sg.’, or [mɑːnd] ‘month-Sg., moon-Sg.’. The respective evaluation follows in Tableau 31.

Tableau 31. [pʊnd] ‘pound-Sg.’

[[C V^{μ} R^{μ} D]$_{\sigma}$]$_{\phi}$	MaxBin	RM	DEP-μ	RHTYPE =T	SON-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*$V_{\mu\mu}$	FTBIN
(a) [[CV$^{\mu}$R$^{\mu}$D]$_{\sigma}$]$_{\phi}$						*!				
(b) ☞ [[CV$^{\mu}$R$^{\mu}$]$_{\sigma}$]$_{\phi}$<D>							*	*		
(c) [[CV$^{\mu\mu}$RD]$_{\sigma}$]$_{\phi}$					*(!)	*(!)			*	
(d) [[CV$^{\mu\mu}$R]$_{\sigma}$]$_{\phi}$<D>					*!		*	*	*	
(e) [[CV$^{\mu}$R]$_{\sigma}$]$_{\phi}$<D>				*!	*		*	*		*

What is observable here is that, again, the winner (b) of the tableau is such that the last part of the cluster is adjoined to the foot. We obtain the structure [[CV$^{\mu}$R$^{\mu}$]$_{\sigma}$]$_{\phi}$<D> with a monomoraic vowel succeeded by a moraic sonorant consonant. The lenis C as the final member of the cluster is extrasyllabic. All other candidates competing with (b) are ruled out in virtually the same way as in the cluster-cases discussed above.

The monomoraic, i.e. light, syllable structure of [[CV$^{\mu}$R]$_{\sigma}$]$_{\phi}$<D> in (e) fatally violates RHTYPE=T. Bimoraic [[CV$^{\mu\mu}$R]$_{\sigma}$]$_{\phi}$<D> of candidate (d) assigns no separate mora to the sonorant C. The result is that a fatal violation mark is inserted for SON-μ. The exhaustively footed candidates (a) [[CV$^{\mu}$R$^{\mu}$D]$_{\sigma}$]$_{\phi}$ and (c) [[CV$^{\mu\mu}$RD]$_{\sigma}$]$_{\phi}$ are then ruled out by WEAKEDGE and SON-μ, WEAKEDGE, respectively.

Any candidates containing a trimoraic syllable would militate against MaxBin to the effect of exclusion as a possible output.

All in all, what is discernible for the consonant clusters of LG is that it is always the final member of the sequence (occurring in final position in the PrWd) that is extrasyllabic. The actual quality of the consonant, be it fortis or lenis, is irrelevant in this respect. Note that monomorphemic PrWds with a cluster ending in a sonorant do not occur in LG. Given the behavior of the clusters shown above, it appears reasonable to assume that if such clusters were found in LG the final sonorant C would also occur in the adjoined position.

6.3. *Conclusions on LG consonants*

We have seen that the LG language system employs two phonological degrees of vowel length whilst showing evidence for three phonetic levels of vowel duration short – long – overlong. The assumption of bimoraic phonetic overlength is justified by means of syllable weight. LG syllables of the structure CV (where V encodes a phonetically long tense vowel) count as light in utterance non-final position. Non-

final CVC syllables, utterance-final CVC syllables not ending in a lenis C, and utterance-final CVVC syllables ending in a lenis C count as heavy and do attract primary word stress.

The 'voicing' difference in obstruent consonants was assumed to be a matter of fortis-lenis contrast. This is phonetically justified especially by the lack of vocal fold vibration in the voiced consonants in general, and the differences in closure duration and aspiration duration between the plosives. Also, the behavior of the fortis Cs with respect to CL differs from the one of the lenis Cs. Where the former simply do not show any lengthening effect on a preceding tense vowel after the loss of a succeeding schwa, the lenis Cs allow this process. A preceding tense vowel becomes phonetically overlong.

These findings bring forth three conclusions:

i) Phonetically long tense vowels, as phonetically short lax vowels, are monomoraic in LG. Accordingly, phonetically overlong tense vowels are bimoraic.

ii) Lenis coda Cs are non-moraic and laryngeally unspecified, i.e. they do not contain a laryngeal node, to the extent that they are extrametrical. This allows a preceding vowel to take over the mora of a moraic (allo)morpheme and lengthen as a consequence. Besides this lengthening, also the literal *weakness* of the lenis Cs is expressed by their position outside of the Prosodic Hierarchy. They are prone to assimilatory processes.

iii) Fortis consonants and sonorant consonants group together in LG. They are inherently monomoraic and thus syllabified under the syllable foot, though not for identical reasons.
I argue that fortis Cs require a mora due to their literally *strong* status. They have a laryngeal node, enriching the root node, which necessitates licensing by a mora. Sonorant consonants in comparison receive a mora not because of their laryngeal specification – which they do not have – but because of their high sonority and their enriched root node by means of a [SV]. Both consonant groups behave consequently as phonological geminates. Their moraic status is lost only in utterance-final position of *bisyllables* or the final position of a cluster by virtue of WEAKEDGE. Constituting the only coda position of *monosyllables*, they retain their mora in order to build a wellformed foot by satisfying FTBIN.

I hope to have demonstrated that the underlying weight distinction in LG consonants depends on the segmental complexity of the consonants, where complex = moraic, and simplex = non-moraic. This relates to the representation of the segments within a PrWd where only complex segments can be licensed by a mora if occurring in the coda position. Not only do we find two degrees of vowel length, but also two degrees of consonantal length since D and T differ in moraic structure. Contrary to vowel length, which is derived by means of the moraic (allo)morpheme on the

surface level, the length contrast in obstruents is underlyingly present. Sonorant consonants, on the other hand, do not show a contrast: they are all inherently moraic.

The overall picture we obtain when looking at monosyllables ending in single consonants or clusters is such that

iv) word-final lenis Cs are *always* extrasyllabic,
v) word-final single fortis Cs of monosyllables are exhaustively parsed,
vi) word-final single fortis Cs of bisyllables are extrasyllabic,
vii) word-final fortis Cs of lenis-fortis clusters are exhaustively parsed,
viii) word-final fortis Cs of fortis clusters are extrasyllabic,[269]
ix) word-final single sonorant Cs of monosyllables are exhaustively parsed,
x) word-final single sonorant Cs of bisyllables are extrasyllabic.

The constraint ranking, including the relevant structural constraints developed in chapter 4, can now be summarized as follows:

XXXIV) {SHSP, Non-Exhaustivity, MaxBin, RM} >>
{IDENT-STRESS I-O, DEP-μ} >>
{RHTYPE=T, LAX+X, OCP} >>
{FORTIS-μ, SON-μ, WSP, WEAKEDGE} >>
PARSE (σ) >>
{RIGHTM, PARSE (Σ), *$V_{μμ}$} >>
FTBIN

The data and analyses presented up to now deal first and foremost with the LG language. All in all, the data clearly point into the direction of a third level of vowel duration. This is valid for both perception and production – a fact that appears to make the language a typological outsider, especially if we consider Kohler (2001:399f.).

> "Taking into account suprasegmental confounders on the production level, it is quite doubtful whether a ternary paradigmatic duration opposition in the vowel system can consistently be produced and identified without syntagmatic support in human language."[270]

His assumption would imply that threefold duration contrasts may only occur within specific syntactic confinements. Accurate perception of three durational steps would be exceedingly difficult without such context. Interestingly, we saw for LG that the informants were able to contrastively produce and perceive ELD 2 *vs*. ELD 3 items on the basis of vowel duration alone (see section 3.5), thereby contradicting Kohler (2001:399f.). No syntactic information was provided in the experiments.

[269] Van Oostendorp (2002).
[270] My translation. "Es ist darüber hinaus zweifelhaft, ob eine dreifache paradigmatische Daueropposition im Vokalismus ohne syntagmatische Unterstützung in der menschlichen Sprache konsistent produziert und identifiziert werden kann in Anbetracht der suprasegmentalen Störvariablen auf Äußerungsebene."

The question arises if LG is indeed an exception to the assumption above or if there are other examples of languages with ternary duration contrasts across the world. Furthermore, one wonders how such a threefold vowel duration opposition may be treated phonologically? The following chapter aims at shedding some light on these questions.

7. Vocalic overlength in the languages of the world

The LG data presented in the previous chapters demonstrate rather explicitly the presence of a third level of vowel duration in production and perception. Phonologically, there is reason to assume a binary representation of vowel length at the surface level. In order to put LG into a broader typological perspective, I provide here an overview of languages exhibiting three durational degrees of vowel length. We will se that the LG analysis is in fact one of many analytical possibilities to phonologically account for the phonetic facts.

The terminology used here is such that 'duration' denotes a purely phonetic property, i.e. measurable *absolute* time units of segments. 'Overlong' as compared to 'short' and 'long' is then used as a mere description of the phonetic realization available in the given language. 'Quantity' and 'length' by comparison denote equivalently *relative* time units as manifestation of an independent variable (i.e. duration) within the phonology (Laver 1994:436). *Phonology* here basically refers to the phonological surface representation as defined in chapters 2 and 4 with reference to Boersma (2007a:2). I assume that this level of representation contains (besides other properties) quantitative or syllable weight information. This content is not necessarily present in the underlying form, i.e. that level of representation that is part of the lexicon. The surface form is by comparison the output of the grammar and is generated by the interaction of markedness constraints, faithfulness constraints and metrical constraints.

The main question the typological excursion is now circling around is whether or not the phonology may contain a representation of ternary quantity in terms or three morae. Although ternary length systems are not exactly common and have been assumed to be particularly unstable (Schmidt 2002), there are several languages that have been found to display an according contrast. The respective languages cited in the literature (besides North Low Saxon) are Pai, Seri, Mayo, Wichita, Seneca, Sarcee, Central Siberian Yupik, Hopi, Mixe, (Luanyjang and Agar) Dinka, Scottish Gaelic, Estonian, Standard High German, and the Low and Central Franconian dialects.[271] This particularly low frequency of languages with three overt degrees of length, and the recurring evasion of such a system by establishing subsidiary prosodic categories (e.g. tone, vowel quality) is the main focus of a 2007 article by McRobbie-Utasi. She essentially finds that systems retaining three degrees of vowel duration employ additional prosodic features (F0, intensity, duration ratios, etc.) to corroborate the contrast (McRobbie-Utasi 2007:195f.).[272] "The implications of these

[271] Interestingly, a ternary length contrast has been claimed also for Proto-Indo-European (Antonsen 2002:254ff., and references therein). Another language with an alleged ternary vowel length contrast is the Austronesian language Rotuman (e.g. Churchward 1940, Blevins 1994, Hale 2011), though no conclusive phonological analysis is available as to this point.

[272] Rather peculiarly, McRobbie-Utasi (2007) employs the term *quantity* only in cases "when the relevance of other prosodic factors (in addition to duration) need to be considered in the manifestation of contrast" (McRobbie-Utasi 2007:169). This basically means that quantity is seen as the collective of several prosodic features; namely duration, F0, intensity, duration ratio, etc.

tendencies clearly point to instability as being characteristic of a system with three-way length distinction" (McRobbie-Utasi 2007:196). She further notes that

> "it has been observed that languages with this type of contrastive system [i.e. a ternary length system] […] undergo significant changes in their prosody in the direction of re-establishing binary distinctions" (McRobbie-Utasi 2007:167).

We will have a closer look at these claims in the course of this typological excursion. What we will see is that the phonological toolbox that is employed to analyze ternary contrasts is rather expansive – in fact so expansive that it might predict the occurrence of languages featuring even more than three length degrees.

I start out with a flying visit to the indigenous languages of the Americas. What we will see is that most of the supposedly ternary duration systems might need to be analyzed by means of a ternary quantity system. The phonetic data are, however, not entirely conclusive.[273]

The subsequently discussed Nilo-Saharan language Luanyjang Dinka is by comparison rather well documented and, thus, well analyzable by means of elaborate phonetic data. The three durational levels within the vowel system may represent indeed a ternary moraic contrast as described by Remijsen & Gilley (2008).

The Eurasian languages broached in the final section of this chapter are indeed not covered by a ternary quantity interpretation. Each one of the four cases in point (i.e. Scottish Gaelic, Estonian, Standard High German, and Central Franconian) once again contain overlength – if at all – just as an overt phonetic realization. The underlying contrast in the language systems is inevitably binary.

7.1. *Languages in the Americas: Pai, Seri, Mayo, Wichita, Seneca, Sarcee, Hopi, Mixe*

The subsequently discussed languages fall rather short on phonetic as well as phonological investigations. However, they are assumed to employ a threefold length distinction of some kind within their vowel systems.

The languages, Seri,[274] Mayo, Mixe, Wichita, Seneca, Sarcee, Central Siberian Yupik, and Hopi, do all comprise an overt ternary duration opposition. Pai is here the odd one out, not showing such a clear-cut threefold contrast in the overt form.

7.1.1. *Pai*

Pai is a branch of the Yuman language family in Arizona. There have been a number of publications stating that various Pai languages have three degrees of vowel duration that are likely to be phonological (Redden 1966 on Hualpai; Joël 1966 on Paipai; Kendall 1976 on Yavapai; Shaterian 1976, 1983 on Yavapai).

I pick out Yavapai for a brief illustration.[275] Besides auditive studies, it has been subject to experimental phonetic surveys (Munro 1990; Thomas 1992), making it an

[273] The transcriptions provided in this section and the following sections are adopted from the respective references.

[274] Thanks to Wolfgang Kehrein for pointing this language out to me.

opportune candidate for a closer inspection. Thomas (1992) investigates recordings of isolated items and connected speech with minimal triples and near minimal triples for short vowels, long vowels, and extra-long vowels put into neutral carrier sentences. An example of such a three-way contrast (based on Shaterian 1976, and Munro 1990) is given in Table 35. Thomas (1992) elicits basically data of two informants. A drawback of her sample set is that the words under investigation are rather heterogenous syllable-wise: they contain one to four syllables. To exclude the possibility of word length effects on the vowel duration it would have been better to focus on words of identical syllable number. Especially since it has been assumed that the number of syllables is inversely proportional to the absolute vowel durations of the syllables (i.e. the more syllables, the less vowel duration per syllable).[276]

Table 35. Ternary vowel duration in Yavapai

V duration	item	
short	[ʔaha]	'water'
long	[ʔahaˑ]	'be bitter'
overlong	[ʔahaː]	'cottonwood'

Thomas (1992:90) states that the Yavapai vowel inventory contains five qualities /a, e, i, o, u/, which occur in three contrastive length degrees. This difference emerges only in stressed syllables, which basically means in word-final position since Yavapai has a system of word-final stress. The C succeeding the nucleus in a CVC syllable seems to have no influence on the durational contrast. Unfortunately, the contrast is not as well established as Thomas puts it. Thomas' third degree of vowel length is not consistently produced longer for every vowel quality than vowels of the second, i.e. long, degree (Thomas 1992:96). The phonetic data shows that only for /i/ a statistically highly significant difference between the duration of the long vowels and the overlong vowels can be found in both isolated items and connected speech. The vowels /a, e, u/ do generally differ – if at all – at a marginally significant level with respect to the duration of long vowels and overlong vowels (Thomas 1992:97ff.). The absolute durational difference is rather low. The first subject produces a significant difference for /o/ in connected speech if the data is adjusted for word length effects (mono-syllables and bi-syllables investigated separately). The second subject shows a marginally significant difference for /a/ in connected speech.

All in all, only /i/ does have a clear difference between the supposed short, long, and extra-long vowel length throughout the elicited Yavapai data, and independent of any word length effects.

Neutralization effects between the long vowels and the overlong vowels occur more often and more prominently in isolated items, i.e. as a result of utterance-final lengthening in prepausal position (Thomas 1992:104). Thomas (1992:104) notes that

[275] The language is virtually on the verge of extinction (Thomas 1992).
[276] See especially Pike (1945). Also Bertrán (1999) and the references cited therein.

> "Prepausal lengthening has applied to all three length categories in isolation because any one length category is longer in isolation than it is in context. However, the extra-long length category seems to have reached its maximum duration and cannot stretch in duration as much as the long length category."

The overall result of the statistical analysis is such that for the complete set of data (as pooled across *all* vowel qualities and both speakers) the difference between long vowels and extra-long vowels amounts up to a mere 2% in isolated utterances, and 8% in connected speech (Thomas 1992:109). Other factors like pitch, vowel quality, or lexical category do not add to the durational contrast. Thomas (1992:116) even notes that it is reasonable to ask whether the durational difference is sufficient to assume it to be the distinguishing factor between words with long and extra-long vowels. Nevertheless, she concludes on the basis of the marginally significant difference between long vowels and extra-long vowels with $p < .02$ (Thomas 1992:115) that "a strong case for positing three distinctive vowel lengths can be made."

This is a conclusion I cannot share. Especially since the upper durational margin of +8% for extra-long vowels in connected speech lies much below the conservative JND (just noticeable difference) threshold of 20 to 25% noted by Rosner & Pickering (1994:194) for natural speech. It is indeed rather questionable whether the durational difference between Yavapai long and supposedly extra-long vowels is reliably perceptible. A perception test would here be in order to clear the picture.

As for the Yavapai production data, it appears to be the case that phonologically only two distinct vowel quantity categories *short vs. long* are justifiable – at least for the mid and open vowels. The items [ʔahaˑ] 'be bitter' and [ʔahaː] 'cottonwood' of Table 35 would then belong to the same quantitative category (homophony), a position that is also held by other researchers (e.g. Langdon 1976; Munro 1990). An actual threefold duration difference is found for /i/, unconditioned by either morphology or syllable structure. This alludes to a possible ternary representation of the closed vowels in the phonology. A restriction of the threefold-length constrast to one vowel quality only must remain, however, rather suspicious. Nevertheless, the ternary length account is not invalidated for Yavapai.

7.1.2. *Seri*

Seri is a language isolate spoken at the northwestern coast of Sonora in Mexico. Its vowel system contains the four qualities /i, e, o, a/, with *e* representing the more open allophones [ɛ] and [æ].

Seri has a rather complex morphological system that is closely interrelated with the structure and length of the nuclei. Vowel length also interacts in a balancing manner with consonant length (Moser & Moser 1965). Phonetically, we clearly find a third – if not a fourth – degree of vocalic duration within a single syllable (Marlett 1988:251ff.). Moser & Moser (1965:65) note that

> "Vowels occur in sequences of two identical or diverse vowels [i.e. V_1V_1 or V_1V_2], in sequences of three identical or diverse vowels or combinations of these [i.e. $V_1V_1V_1$, $V_1V_1V_2$, $V_1V_2V_2$, $V_1V_2V_1$, or $V_1V_2V_3$], and in sequences of four, which are combinations of identical and diverse vowels.
>
> Sequences of two and three identical vowels are phonemically in contrast with single vowels and with each other and are structurally analogous to sequences of diverse vowels."

Marlett (2008:5) notes that the extra-long nuclei may also consist of a combination of short vowel and long vowel. These combinations are usually characterized by comprising a more closed jaw opening for the shorter constituent, as compared to a more open realization of the longer constituent (Marlett 2005:71). In qualitatively identical sequences obviously only the durational factor is present.

The occurrence of four adjacent vowels in Seri is more restricted than the occurrence of the other vowel sequences; they are only allowed in syllable-medial and syllable-final positions. Short, long and extra-long vocalic configurations may by comparison also occur syllable-initially (Moser & Moser 1965:66). This basically means that we obtain an overt contrast of short *vs.* long *vs.* extra-long vocalic nuclei within a syllable. Examples with sequences of identical vowels are given in Table 36 (Moser & Moser 1965:65; Marlett 2003).

Table 36. Ternary vowel duration in Seri[277]

[short V]		[long V]		[extra-long V]	
ʔíttoox	'my eyes'	*ʔítoŋ*	'my speech'	*ʔíitiŋ*	'my efforts'
ʔéppeŋ	'white tail deer'	*kéetiŋ*	'to build up side of basket for extra load'	*kéeetiŋ*	'to lie (rep.)'
hapéxem	'one who is feared'	*hapéexem*	'one who is respected'	*k^{w}éeexam*	'those who groan'
kóʔʔa	'to have'	*kóotso*	'to hiss (tpl.)'	*kóooWk^{w}iŋ*	'to bark (rep.)'
káttool	'to be wild'	*káatiŋ*	'to use'	*káaatiŋ*	'to talk excessively'

The length opposition between short *vs.* long *vs.* extra-long is only possible in stressed position (Marlett (1988:253).[278] The extra-long vowels may be assumed to be trimoraic (Marlett 2003). Marlett et al. (2005:119) point out that the extra-long vowels result from the juxtaposition of (allo)morphemes containing identical vowel qualities. This third durational degree is therefore morphologically determined and not independently possible. The extra-long degree is not underlying but emerges in the surface form. Examples of verb stems containing such extra-long sequences as

[277] The acute accent on vowels marks the primary word stress. *W* denotes a voiceless spirantized [w].

[278] The stress assignment of Seri results from the construction of moraic trochees at the right edge of a root, but is at the same time quantity sensitive, i.e. influenced by syllable weight. Heavy or super-heavy final syllables attract stress. A final consonant counts as extrametrical for it does not add to the weight of a syllable (Marlett 2008:9).

provided in Marlett (1981:220ff.) are subject to a number of morpho-phonological processes.

Table 37. Seri verb stems (Sg. subject / Sg. action) with extra-long vocalic nucleus

/-aːa/	‘call’
/-aiːχ/	‘leave’
/-aːix/	‘sway’
/-iiːn/	‘go’
/-keːe-χ/	‘cut hair of’
/-saːit-χ/	‘gather together with stick’
/-siiːx/	‘move’

Marlett (1981:95) therefore concludes that the respective vowel sequences are analyzable as structurally bi-vocalic clusters of short V and long V:. All in all, the overt phonetic representation of short *vs.* long *vs.* extra-long vowels is always traced back to an phonological opposition of monomoraic *vs.* bimoraic; i.e. there appears to be no *phonological* ternarity of the vowel segments in Seri.

7.1.3. *Mayo*

Three types of overt vowel length are also documented within the Southern Uto-Aztecan family in Mayo and Yaqui, two closely related languages spoken in the Mexican provinces of Sonora and Sinaloa (Burnham 1988; Hagberg 2006). I focus here on Mayo. Besides a category of ‘no-length’ (i.e. short vowels), the two categories ‘underived length’ (i.e. long vowels) and ‘derived length’ (i.e. half-long vowels) occur in the language. Vowel length is basically predictable from the context, being interrelated with stress and pitch phenomena. The pitch peak (H) – the most salient phonetic correspondent of Mayo stress (Burnham 1988:39) – is assigned differently to phonologically long vowels and derived (i.e. overt) long vowels. Examples are given in Table 38 below (Burnham 1988:45; Hagberg 1988, 2006:151, 153).

Table 38. Ternary vowel duration in Mayo

no-length [short V]		derived length [half-long V]		underived length [long V]	
ka-	‘no-’	*ká˙*	‘no’		
ne-	‘me-’	*né˙*	‘me’		
wé-ye	‘go-Pres.’	*wé˙*	‘go’		
yá-wa	‘make-Pres.’	*yá˙*	‘make’		
yóka	‘paint’	*yó˙-ko*	‘tomorrow’	*yóóko*	‘jaguar’
nátemae	‘ask’	*wá˙-te*	‘others’	*wááte*	‘remember’
téku	‘squirrel’			*tééka*	‘sky’

The short vowels and the underived long vowels occur only in non-final positions, and the derived long vowels only in final positions.

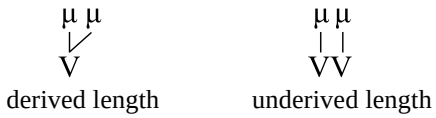
The short vowels of the 'no-length' category as well as the long vowels of the 'underived length' are interpreted as being underlying, while the derived (half-long) type of vowel length is the result of a lengthening process of a short vowel. Besides the lengthening, different pitch contours occur on the phonologically long vowels and derived (i.e. overtly) long vowels. The underlyingly long vowels show an early aligned H (denoted by a double accent mark), whereas the derived (half-)long vowels exhibit a late peak on the vowel (denoted by a single accent mark) (Hagberg 2006:161).

Hagberg (2006:153f.) claims that the lengthening relates to mora insertion. It can happen if a word has either only one underlying mora, or an underlyingly moraic coda C is rendered extrametrical (Hagberg 2006:156). The difference in pitch contours could then be expressed by means of H assignment to the morae of the nucleus. The association of the H to the first part (or mora) of the vowel in underived long forms does not apply to the items with derived length. As to Hagberg, the late pitch peak rather indicates an association to the second part (or mora) of the nucleus.[279] To be more precise, the stress associates to the leftmost mora of the nuleus in underived forms, and to the rightmost mora in derived forms. These pitch differences might be interpreted as some sort of stress autosegments as Hagberg (2006) postulates.

Another possibility would be to assume in a stratal fashion two levels of stress assignment. The first would be the level of the lexicon where stress is assigned by default to the initial mora of an underlyingly bimoraic vowel. The derived long vowel, being underlyingly monomoraic but at the surface level bimoraic, then receives post-lexical stress on the second mora of the nucleus.

What is also thinkable is that both types of long vowels differ by means of moraic structure. While the derived forms would be monosegmental with two mora associations, the underived forms comprise two segmental slots associated with two morae. An illustration of this option is given in Figure 80.

Figure 80. Derived and underived long vowels in Mayo



derived length underived length

We see that there are at least three options to analyze the ternary vowel duration phonologically. The overt three types of vowel duration of Mayo do, thus, not constitute a phonological ternary length contrast. The major distinguishing factor is the variation in pitch (and hence stress) alignment.

[279] Hagberg (2006:164) states indeed that "the acoustic pattern of the pitch of Mayo utterances indicates that Mayo's autosegmental stress ends up linking to a mora rather than to a syllable."

7.1.4. *Mixe*

In our search for a vowel system with three phonological degrees of length we move on to the Mexican province Oaxaca. Here we find the language Mixe that belongs to the Mixe-Zoque language family. It can be split up into three to four rather distinct main varieties (Jany 2006:1). One of them is Coatlán Mixe, which has been identified as a language with a ternary contrast in vowel length (Hoogshagen 1959). Other Mixe varieties with a similar three-fold length distribution are Camotlán Mixe and San José El Paraíso Mixe (Hoogshagen 1959:111, and van Haitsma 1976, respectively). Minimal triples are available that differ only by means of vowel duration *short vs. long vs. extra-long*. Some examples are given below (Hoogshagen 1959; van Haitsma 1976).

Table 39. Minimal triple of Mixe vowel length[280]

[short V]		[long V]		[extra-long V]	
poʃ	'a guava'	*poːʃ*	'a spider'	*poːːʃ*	'a knot'
pet	'a climb'	*peːt*	'a broom'	*peːːt*	'Peter'
ʔoy	'although'	*ʔoːy*	'he went'	*ʔoːːy*	'very'

This opposition occurs independently of sentence position only in stressed syllables (Hoogshagen 1959:114). Pitch contours appear to play no role here for the long and extra-long vowels show the same overall pitch movement.

The syllables of Coatlán Mixe obligatorily have onsets, either a single C or a cluster. This is why the third degree of vowel duration cannot be reanalyzed as heterosyllabic V:.V (see Scottish Gaelic below in section 7.3.1) (Hoogshagen 1959:115). There is, however, a possibility to analyze the phonetic facts in a binary manner. Hoogshagen (1959:115) assumes that

> "phonetic [V:] = phonemic (V·h). This interpretation is based on complementary distribution and phonetic similarity: V may be accompanied by [h], V· may not be accompanied by [h] but by a third mora of length; [h] and a third mora of length are phonetically similar in that they are vocoid in quality (voiceless and voiced respectively). This interpretation of [V:] as (V·h) makes it possible to analyze the third mora of length as an allophone of a phoneme present elsewhere in the pattern".

Hoogshagen's preliminary comparison with Totontepec Mixe indicates indeed that the extra long vowels of Coatlán result from CL after the loss of a final glottal segment. This segment is assumed to be still present in Totontepec overt [^{V}ːʔ] sequences. The glottal segment in Coatlán by contrast would then be present in the phonological surface representation, but would not be realized in the phonetic overt form. This means that we end up with a phonological system of binary vowel quantity short *vs.* long.

[280] The transcription used in Hoogshagen (1959) and accordingly Fox (2000:43) is rather ' : ' for the extra long duration, and ' · ' for the long duration.

As a synchronic analysis this diachronically inspired approach is rather abstract and not entirely satisfactory – especially, since the phonetics appear to tell us that there are three degrees in vowel duration present in the language. The glottal segment remains a phantom. The synchronic data therefore rather allude to a ternary surface representation. For now, it remains unclear how a learner should be able to reanalyze the glottal segment (or any segment at all) without direct or indirect evidence for its existence. Further research is needed to clarify the phonetic picture and determine the status of the assumed glottal segment.

What we have seen so far from the indigenous languages of the Americas are several instances of overt ternary duration contrasts (though its occurrence is rather restricted for Yavapai).[281] Almost all of the according languages might need to be analyzed in a ternary fashion. So far, one of the phonological analyses provides compelling and sound argumentations for a binary surface representation – the pitch alignment analysis of Mayo. Only one of the remaining languages of this chapter (i.e. Hopi) appears to definitely call for a binary analysis as well as we will see in due course.

7.1.5. *Wichita*

Wichita is a moribund North Caddoan language that is fluently spoken by only one remaining speaker. Nine additional persons are believed to be able to speak the language, though less proficiently. None of the speakers is monolingual. Naturally, no dialectal variation is discernible any more (Rood 2001). Wichita used to be spoken in central and south-central Oklahoma, southern Kansas, and northern Texas.

The language has a vowel system consisting of only three phonological vowel qualities /i, e, a/. Phonological /i/ basically covers the phonetic range between front closed and front close-mid unrounded vowels, /e/ represents the phonetic open-mid unrounded vowels, and /a/ incorporates the open back unrounded vowels. A sequence of any short V plus the labial approximant /w/ yields long [oː].

In his 1975 article, Rood postulates a ternary durational contrast of short *vs.* long *vs.* overlong for the Wichita vowel system. Examples are given in Table 40 (Rood 2001).

Long vowels are assumed to be twice as long as short vowels, while the overlong vowels are 2.5 to 3 times as long as the short vowels (Rood 2001:581).

Besides the overt duration contrast there exists an independently distributed binary tonal contrast of H and L. The occurrence of the respective tones is completely unpredictable as Rood (2001:581) notes. Thus, no connection between quantity and tonal contour can be established.

[281] The Algonquian languages Malecite and Passamaquoddy are left out of the discussion since it appears that only Hayes (1995:216) assumes here an overt ternary duration contrast depending on certain phonological rules. LeSourd (1989) in his comprehensive description of the languages makes no reference as to this point.

Table 40. Ternary vowel duration in Wichita[282]

[short V]		[long V]		[overlong V]	
tiʔi	'this'	*tiˑsaˑs*	'medicince'	*-ʔiːs*	'see'
wickhéʔes	'funny'	*heˑcʔi*	'be fat'	*reːhi*	'buy; choose'
		heˑha	'be a creek'		
nahehárih	'creek'	*náˑʔih*	'his'	*náːʔih*	'his child'
hárah	'there'	*haɾíˑh*	'that one'	*haːrih*	'in that place'
kammac	'grind corn'	*cammaˑci*	'hoe, cultivate'		

Rood (1975:318) finds that the overlong Vs may occur without any apparent restriction in any syllable. There might, however, be some interaction with stress and vowel quality, and stress and tone, respectively. The pattern of primary word stress decides that stress falls on long vowels (and thus also overlong vowels) if no H syllable is available (Rood 2001:582). No reference is made as to the possible duration degrees of secondary stressed syllables and unstressed syllables.

Considering vowel quality again, one can observe that not every of the three vowel phonemes occur equally frequently in each of the three durational degrees. While short /e/ is rather rare, this quality is very common in the long and especially in the overlong degree. For /a/ we basically find the opposite distribution. It is very common in the short and the long degree, whereas cases of overlength occur but in a few words. /i/ occurs equally frequently in either of the three durational degrees. All in all, certain vowel qualities appear to have clear preferences for certain durational categories.

Rood (2001) takes only the two degrees short and long to be definitely phonological, i.e. present in the phonological surface level of the language. He assumes that overlong vowels are most likely to be derived from V:CV sequences that syncopated the intervocalic C synchronically. The long vowel and the succeeding short vowel then merge into a phonetically overlong configuration. This is indicated by related languages that retain e.g. intervocalic /h/ and /j/ where Wichita shows deletion thereof (Rood 2001:584).

Rood's approach essentially merges synchrony and diachrony for there appears to be no independent evidence for the actual presence of the assumed underlying /h/ and /j/ in Wichita.[283] This diachronically inspired analysis that refers to consonantal positions not present in the synchronic language appears rather stipulative. As far as the auditory analyses can tell, there are three degrees of vowel duration that might as well be synchronically interpreted as a phonological ternary vowel length contrast. Indeed, Rood (2001:584f.) also notes that "it is necessary to preserve the contrast between long and overlong" until further research has been conducted. Otherwise, length differences occurring in certain root pairs may not be accounted for. The

[282] Note that Rood's transcription of long vowels involves the IPA symbol for half-length ' ˑ ' , and overlength is noted accordingly with ' ː '.
[283] See the analysis of Mixe above.

possibility of a ternary representation in the phonology is, thus, not at all obliterated. Given Rood's (2001) diachronic analysis, a phonological representation of bisegmental $V_{\mu\mu}V_{\mu}$ rather than $V_{\mu\mu\mu}$ might be expected.

Rood (1975:318) mentions two further Amerindian languages assumed to show phonetic overlength: Seneca and Sarcee. Let us consider them briefly for a moment.

7.1.6. *Seneca*

Seneca is the westernmost language of the (northern) Iroquoian language family and was originally domiciled in New York State. The total number of fluent speakers is approximately 100, which places Seneca together with Wichita and Sarcee in the league of severely endangered languages.

In the synchronic vowel system of Seneca, we come across a matrix of five phonemic qualities /i, e, æ, a, o/. They may occur in a durational opposition of short *vs.* long *vs.* overlong. The latter case is a merger of a sequence of V_1: and V_1 , with both long vowel and short vowel being qualitatively identical (Chafe 1959:493; Rood 1975:318). Some examples of the three vowel durations as noted by Chafe (1959) follow in Table 41.

Table 41. Ternary vowel duration in Seneca[284]

[short V]		[long V]		[overlong V]	
ʔote:khaʔ	'it burns'	*ʔoʔkáat*	'it passed by'	*kaka:aʔ*	'story'
-noʔsɛ-	'to be uncle to'	*ʔoʔké:ʔɛ:ʔ*	'it's gray'	*ʔoʔké:ɛʔ*	'ashes'
ʔóiwaʔ	'thing, cause'	*waɛʔ*	'he said it'	*wa:ɛʔ*	'he put it in'

The vowel merger is assumed to have occurred in connection to the (diachronic) loss of an intervocalic Proto-Northern-Iroquoian **h* or **r*. This is rather reminiscent of what we just saw for Wichita. Overlong vowel configurations are possible only in the penultimate or ultimate syllable of a PrWd. Chafe (1959) specifically transcribes a sequence of two vowels V:V rather than a single overlong V:: . This is justified by the fact that in sequences of qualitatively non-identical vowels no assimilation occurs. They end up with V_1:V_2 as for example in **wɛnókahɛ:thaʔ* > *wɛnóka:ɛthaʔ* 'they make holes',[285] or **hoka:ro:t* > *hoka:ot* 'he is telling stoRiese.[286]

[284] Not only single and multiple stresses are possible in a Seneca PrWd, but also no stress at all. An acute accent above the according vowel denotes the H.

[285] With length metathesis occurring in VV: sequences (Chafe 1959:493).

[286] Tonal interaction does not occur since high pitch is solely used to mark word stress rather than being employed as a paradigmatic property (Melinger 2002:288). No other phonetic feature is used to distinguish between stressed and unstressed syllables, which is why Seneca is termed a 'nonstress accent language'. In a nutshell, stress is banned from occurring in word-final position as well as on penultimate syllables that have been lengthened via a process of Even Penultimate Lengthening (Melinger 2002:293). Main stress is allowed, then, under the following conditions. It exclusively falls on (underlyingly) even-numbered closed syllables, or on even-numbered open syllables immediately being succeeded by a non-peripheral closed syllable. This also entails the possibility of having more than one stress assigned to a PrWd. In the event of having no non-final closed syllable at hand, no stress at all is assigned (Melinger 2002:290).

Only one overlong vocalic sequence is generally tolerated in a PrWd. Chafe (1959:493) notes, however, that there might be dialectal divergence to this point. He gives the example of **wahariwáste꞉rist* 'he noticed it', which underwent first r-loss to **wahaiwáste꞉ist*, and then h-loss that yielded **wa꞉iwáste꞉ist*. This outcome was adjusted to *waiwáste꞉ist* (with only one V_1꞉V_2), or remained *wa꞉iwáste꞉ist* (with two V_1꞉V_2 sequences).

All in all, the overlong configurations in Seneca are represented in the phonology by binary vowel clusters V꞉V rather than just one single vocalic segment V꞉꞉. They emerge where diachronically a syllable was lost. Occurring in a single syllable, however, the adjacent vocalic segments establish a ternary duration contrast in the overt form – similar to the analyses we obtained for Seri and Wichita. In terms of morae and surface representations, we might indeed end up with a trimoraic syllable, though not a trimoraic segment.

7.1.7. *Sarcee*

The Athapaskan language Sarcee is an endangered language (approximately 50 speakers) that is spoken in the region of Calgary. The language system contains four vowel phonemes /i, a, u, o/, which can occur in three degrees of vowel duration. Additionally, we find a tonal contrast of three level tones H(igh), M(id), and L(ow), and the so-called 'inflected tones' or contour tones that are combinations of the former (Cook 1971:165). The short and overlong length degrees coincide only with the level tones, while the long vowels may bear either a level tone or a contour tone. This basically means that the level tones occur across all three durational degrees.[287] Concrete phonetic descriptions are, unfortunately, not provided in the material, obviating a comparison with other languages employing additional prosodic features such as tones to support a durational contrast (e.g. Estonian). Examples are given in Table 42 (Cook 1971, 1975).

Table 42. Ternary vowel duration in the Sarcee level tone items[288]

[short V]		[long V]		[overlong V]	
tsáɬ	'circular ornament'	*gá˙ɬ*	'awl'	*tázá˙^{a}yīsʔī*	'he is in mourning'
dīcáh	'I will go'	*-tsì˙*	'to put pickets around'	*dí˙^{i}kʔàz*	'it is red'

Summarizing findings by Cook (1971), Rood notes that the overlong vowels in Sarcee emanate from morphophonemic processes and widespread interaction with tones (Rood 1975:318). The same is valid for the long vowels with contour tones.

[287] As to Cook (1971:166), the "phonetic difference between the long and the overlong is conditioned by tone: if the two vowels have different level tones, the result will be a long vowel with an inflected tone; if the two vowels have the same level tone, the result will be an overlong vowel with that level tone." However, this assumption of a purely tonal contrast is not fitting for the cases with long level toned vowel *vs.* overlong level toned vowel.

[288] The acute accent ' ˊ ' marks here a high tone, the macron ' ¯ ' denotes a mid tone, and the grave accent ' ˋ 'marks a low tone. The diacritic ' ˙ ' denotes a long vowel, and an additional superscript vowel marks overlength. Note that only the items in the first row comprise identical tones.

Both incidents, long contour vowel and overlong level vowel, result effectively from the co-occurrence and subsequent contraction of a sequence of two qualitatively identical vowels with level tones; they are vowel sequences (termed 'geminate vowels' by Cook 1971:167). The long contour vowel is constituted by two adjacent short vowels with different level tones (e.g. áà > â:), while the overlong level vowel relates to a sequence of two completely identical vowels (e.g. áá > áá:). This sequencing behavior is illustrated by them being spread across (allo)morpheme boundaries (Cook 1971:166). They never occur morpheme-internally.[289]

While the tonal contrast holds for the vowel sequences, we may not conclude right away that the tones can be assumed the primary feature of the Sarcee vowel system (McRobbie-Utasi 2007:188). The synchronic duration degrees are, still, the only contrastive properties in level-tone items of the same register (i.e. H, M, or L). Yet, as Cook (1971) describes the overt contrast, an underlying ternary contrast of mono-segmental V *vs*. V: *vs*. V:: is rather unlikely. The vowel quantities may be reducible to just two underlying phonological degrees: short vowels, and long vowels, each enriched with one level tone. The overlong vowels would then result from V_1V_1: or V_1:V_1 in the phonology (see Seri). This means that we, again, find a ternary length contrast in the surface representation. Similar to the findings above, the three morae occur, however, not within a single segment but in bisegmental sequences.

7.1.8. *Central Siberian Yupik*

Another Amerindian language that has been argued to exhibit three distinctive degrees of vowel length is Central Siberian Yupik. It belongs to the Eskimo-Aleut language family and is spoken along the coast of the Chukchi Peninsula, on St. Lawrence Island, and in two Alaskan villages (Savoonga and Gambell). The language can be subdivided into several daughter languages and dialects.

The stress system is generally iambic, i.e. in the case of a bisyllabic foot, the foot-final syllable is stressed. All feet in non-final position within a PrWd receive stress. Now, this stress system relates to a synchronic change in the vowel system: a process of Iambic Lengthening (Leer 1985:136). It entails that non-final short stressed vowels of open LL syllables are lengthened to become heavy and be able to create an L**H** iamb. Additionally, underlyingly long vowels of open syllables are lengthened to overlong vowels (Hayes 1995:241). Hayes (1995:269) interprets this process as a general strategy for avoiding contrast neutralization. The result is an overt three-way split of the vowel length into short *vs.* long *vs.* overlong. According examples are given in Table 43 (Krauss 1985a):

[289] The only exception to this pattern is the synchronically mono-morphemic personal pronoun *āâ* 'we' with a mid tone + contour tone that probably developed from two juxtaposed morphemes (Cook 1971:166).

Table 43. Ternary vowel duration in Central Siberian Yupik[290]

underlyingly short V				underlyingly long V	
[short V]		[long V]		[overlong V]	
qayátgun	'by way of kayaks'	*qayáákun*	'by way of a kayak'	*qáyaá꞉kun*	'by way of his kayak'
		qayááni	'his own kayak'	*qayáá꞉ni*	'in his (another's) kayak'
aŋyáq	'boat'	*angyááni*	'his own boat'		
mallú	'cadaver'	*náállu*	'a mother also'		

A distinct falling pitch movement accompanies the overlong vowels. A relation to vowel quality is not mentioned. The pitch change is basically the phonetic manifestation of the phonological entity 'foot' (Leer 1985:136). The opposition between the three duration degrees is not present in the underlying representation, though. It arises only in the surface form and is conditioned by the syllable structure (i.e. lengthened long V and overlong V are only possible in open syllables). The result is then the phonological representation of V_{μ} *vs.* $V_{\mu\mu}$ *vs.* $V_{\mu\mu\mu}$.[291]

Krauss (1985b:47) states for the Alaskan varieties as well as for the east Russian variety of Central Siberian Yupik that nowadays "there is widespread loss of that distinction, between lengthened short vowels and lengthened long (overlong) vowels in open syllables." The avoidance of contrast neutralization between lengthened underlyingly short Vs and lengthened underlyingly long Vs appears to be, thus, on the verge of disappearance.

7.1.9. *Hopi*

The last language in our overview of the languages of the Americas is the Uto-Aztecan language Hopi (Whorf 1937, 1946). Whorf (1937:267) notes with reference to Uto-Aztecan vowel length that

> "Perhaps it would be better to use the symbolism **ă*, **a*, **a꞉*, and the terminology "reduced mora or ultra-short," "full mora or short (or medium)," "two-mora or long." In Hopi we have precisely this odd three-length system."

The three lengths may occur only in stressed position. An illustration of the contrast by means of a minimal triple is given below.[292]

[290] Word stress is marked with an acute accent above the vowel.

[291] See the Muskogean pitch accent languages Choctaw and Chickasaw. They undergo basically the same process of Iambic Lengthening that converts feet of the type L**L** into L**H** (e.g. Choctaw *salitihatok* > *saliːtihaːtok* 'I was dirty', *okčalilih* > *okčaliːlih* 'I woke him up'). This yields via avoidance of contrast neutralization a possible overt contrast of vowels in stressed open syllables of two *vs.* three morae (Hayes 1995:211), i.e. long *vs.* overlong. Unerlyingly, the contrast is short *vs.* long.

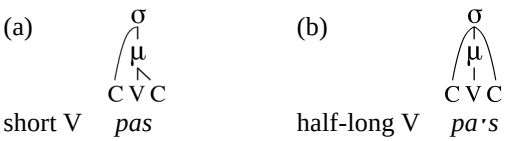
[292] I diverge from the notations by Whorf (1937, 1947) by employing IPA for the transcription.

Table 44. Ternary vowel duration in Hopi

underlyingly short				underlyingly long	
[short V]		[half-long V]		[long V]	
pas	'very'	*paˑs*	'field'	*paːs*	'calm'

This observation is essentially repeated in his 1946 article (Whorf 1946:159). The shortest length degree is here defined as being 'clipped', i.e. abruptly cut-off by a following consonant.[293] The medial length is described as half-long without clipping, and the character of the long degree is not further specified. This syllable structure-related view is essentially what Trubetzkoy stated (1938:196) in his *Silbenschnitt-korrelation* (syllable cut) with regards to the overt ternary contrast of Hopi. Mora sharing might be one way to represent the difference between short (i.e. 'clipped') and half-long vowels. This is shown in the structures in Figure 81.[294]

Figure 81. Syllable cut in Hopi



The production of the short V in (a) is abruptly cut off by the succeeding C, while the half-long V in (b) occupies the syllable nucleus alone and is therefore produced longer.[295] The long vowels are then represented with a bimoraic V and an equally extrametical C. We arrive at a two-fold binary opposition of 'strongly cut' (short Vs) *vs.* 'weakly cut' (half-long Vs and long Vs), and monomoraic *vs.* bimoraic.

The claim of a ternary vowel duration contrast is based on very scarce material and has never actually been validated, though. The vowel system contains the six qualities /i, e, ø, a, o, u/, of which the /ø/ is produced as a less rounded [ø̜] and the /u/ is phonetically rather [ɯ]. The suggested Hopi contrast of short *vs.* half-long *vs.* long vowels only occurs in so called pausal forms, i.e. in items like the object noun phrases (occurring usually in utterance-medial position) that are dislocated and realized in utterance-final position (Jeanne 1978:63). A final vowel is deleted in these forms. This process yields lengthening of a preceding short vowel in a compensatory fashion, and is accompanied by a change to a falling pitch contour (Jeanne 1978:63f.). This finding essentially results in an alternative approach of the Hopi quantity system. It appears to be the case that originally long vowels and short vowels differ from the lengthened short vowels by means of their pitch contour. The transcriptions in Table 45 illustrate this point.

[293] See the syllable-cut approaches (abrupt ≈ short V *vs.* smooth ≈ long V) for vowels in Germanic languages.
[294] Anderson (1985:103). Note that Trubetzkoy (1938) does not explicitely provide structures.
[295] Another possibility to (a) would of course be an ambisyllabic final C that occupies both the coda position of the first syllable and the onset position of a (possibily empty) second syllable.

Table 45. Pitch contrast in Hopi

[short V]	[half-long V]	[long V]
pas 'very'	*pasa* > *pâ·s* 'field'	*paːs* 'calm'

Jeanne (1978:64) notes "tentatively that the [deleted final] vowel is present in underlying representation", i.e. in Boersma's (2007a) phonological surface representation. A possibility is here to assume – somewhat similar to Mayo – that the lengthened (half-long) vowel consists of two morae just like the original long vowel does. A clear difference would be, however, that the second mora stems from the deleted final vowel and is associated to a low tone L. The first mora is inherited from the original short status of the vowel and is associated to a high tone H. This creates then the described falling pitch contour HL on the lengthened vowels. Unfortunately, Jeanne makes no actual reference to the tonal contour of the originally long vowels. What is clear is that the pitch does not change in these cases and by this differs from the one of the lengthened vowels. It seems reasonable to assume that it is a single H, i.e. a level high tone.

The result is a binary surface representation of Hopi vowel length, i.e. *short vs. long*, the short category containing the short and the lengthened vowels; it is then combined with a binary tonal contrast of (supposed) HL *vs.* H.

We, thus, end up with two possible twofold binary approaches for Hopi vowel length; the first one being related to the syllable structure and the phenomenon of syllable cut, the second one depending on tonal contours. We do not obtain a phonologically ternary quantity system.

As an intermediate result, we can say at the moment that all but two of the indigenous American languages presented in this chapter are most likely to employ three distinct degrees of vowel duration (Pai, Seri, Wichita, Seneca, Sarcee, Central Siberian Yupik, and Mixe). Mayo and Hopi were identified to show sound arguments for a binary representation of a (possible) ternary duration contrast.

The quantity systems of three of the languages, i.e. Wichita, Seneca, and Mixe, have been analyzed in the past as being binary by means of employing an invisible, inaudible, but phonologically present consonantal segment (Rood 1975; Chafe 1959; Hoogshagen 1959). While this might be justified diachronically and from a purely structuralist perspective, it seems not to be vindicated by the synchronic language data. The analyses are therefore not entirely convincing and do not exclude a three-way length distinction right away. What might be a viable option is to assume vowel sequencing as in Seri or Sarcee. So far, however, none of the investigated languages gives water-proof evidence against a surface phonological representation of ternary vowel length /VV:/.

However, the overall available perception data with respect to the three durational degrees for each of the presented languages is rather scanty – if at all present. Further research is here definitely necessary in order to test the functional load of the vowel durations, and to smooth out all remaining analytical problems.

We will now see what (and if) other languages from across the world can add to the findings attained from the languages in the Americas.

7.2. *African languages: Dinka*[296]

Our typological excursion leads us now from the Americas to Africa and the Western Nilotic language Dinka. This is a tone language spoken mainly in Southern Sudan, and more specifically along the tributaries of the White Nile. Several rather distinct dialects exist that differ by means of tones, vowel articulation, and possibly vowel quantity. What all of them have in common is that inflected stems are mainly monosyllabic. They differ from their uninflected, equally monosyllabic, counterparts by marking grammatical information in terms of segmental and/or prosodic alternations (Remijsen & Manyang 2009:113).

I focus here primarily on the dialect Luanyjang Dinka discussed in the studies by Remijsen & Gilley (2008) and Remijsen & Manyang (2009). This variety comprises a set of four tones (low, high, rising, falling), two voice qualities (breathy *vs.* modal/creaky), seven vowel qualities /i, e, ɛ, a, ɔ, o, u/, and again a ternary vowel duration contrast short *vs.* long *vs.* overlong.[297] An example of the contrast is given in Table 46.

Table 46. Ternary vowel duration in Dinka

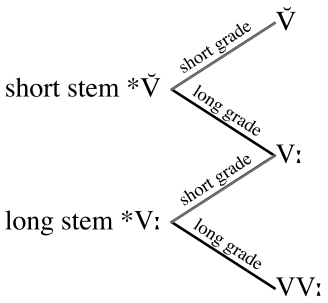
[short V]		[long V]		[overlong V]	
[-tét]	'to pick-2.Sg.Pres.'	[-tèːt]	'to pick-3.Sg.Pres.'	[-tèeːt]	'to divulge-3.Sg.Pres.'
		[-téːt]	'to divulge-2.Sg.Pres.'		

This length opposition developed due to CVCV CL of originally short vowels and originally long vowels after the loss of an inflectional suffix. In the course of events, short vowels of phonologically short stems became long, and long vowels of phonologically long stems became overlong (Kavitskaya 2002; Remijsen & Gilley 2008:322, based on Andersen 1987). The distribution of the so-called *long grade* of a long stem (resulting from CL) is restricted to morphologically complex or marked forms, e.g. plural forms. They differ from their morphologically simplex or unmarked counterparts, e.g. singular forms, by means of one to two length degrees. Overall, the alternations in vowel length given in Table 46 can be summarized in the following schema.

[296] The Bantu language Kikamba (Roberts-Kohno 1995, 2005) with its supposed quadruple vowel length contrast of *short* : *half-long* : *long* : *very long* is left out of the overview. The four durational degrees are (convincingly) analyzable as a phonological binary contrast of *short* : *long*.

[297] Arbitrarily termed short : half-long : long by Remijsen & Gilley (2008). This notation appears to be phonetically more appropriate since the mean maximum vowel duration of the longest degree as taken from their complete data set only barely reaches 170 ms (Remijsen & Gilley 2008:332). By comparison, the mean vowel duration of Q3 in Estonian as reported by Lehiste (2003:50) amounts to 435 ms, and the vowel duration of ELD 3 in the investigated LG data (complete samples) as seen in chapter 3 averages out at 254.85 ms (Kw.), 298.22 ms (Aw. group 1), 395.57 ms (informant III.6.Aw), and 265.77 ms (Alfs.).

Figure 82. Luanyjang Dinka grade alternations[298]



The grade alternation is in the majority of cases accompanied by a change in the tonal contour, as can be seen in the examples above. There is a limited number of words available that differ within a paradigm only by means of quantity. These cases indicate in particular that vowel quantity can act independently of other prosodic properties. In most cases, however, various combinations of the factors quantity, tone, vowel height, voice quality, differing coda Cs, and occurrence of a semivowel in onset position are employed (Remijsen & Gilley 2008:324).

Remijsen & Gilley (2008:335) point out that in terms of vowel quality the long grade of the short stem patterns together with both grades of the long stems. The two long vowel lengths, i.e. the long grade of the short stem and the short grade of the long stems, are close to being completely identical with respect to vowel duration and vowel quality. They cannot clearly be teased apart (Remijsen & Gilley 2008:338). The short grade of the short stems, i.e. short V, shows by comparison considerably centralized vowel qualities (except for /ɔ/). This is attributed to the short duration and the resulting "articulatory undershoot" (Remijsen & Gilley 2008:335). The lax quality is therefore not interpreted as phonological.

The mean durational differences within the Luanyjang vowel system as identified by Remijsen & Gilley (2008:339) are 31.89% for short *vs.* long, and 57.39% for long *vs.* overlong, if the long degree is taken as the basic value, i.e. the short degree reaches 68.11% of the duration of the long degree, and the overlong degree reaches 157.39% of the duration of the long degree. The authors note that "the differences in vowel duration that are involved in the Luanyjang Dinka phonemic length distinction should be distinguishable by the human auditory system—they are well above the JND range of 7-20 percent" (Remijsen & Gilley 2008:339). Note that the JND mentioned here refers *not* to natural speech sounds (see the conservative JND of 20 to 25% noted by Rosner & Pickering 1994:194) but rather to sounds in general, i.e. synthetic speech and non-speech stimuli as e.g. described in Lehiste (1970a:11ff.). A desiderate of Remijsen & Gilley's analysis is that they do not provide a perception study to verify their assumption of perceptual relevance.

[298] As an alternative to the three durational degrees, an approach of two durational degrees plus stress / no-stress was brought forward by Gilley (2003). However, her proposal is based on a phonetic absurdity: a stressed syllable receives only half the duration and a more centralized vowel than an unstressed syllable. This is contrary to current findings on the realization of stress (Gussenhoven 2004).

The conclusion drawn on the basis of their data is such that the three durational degrees of the Dinka vowel system represent an according ternary quantity contrast. The authors express this by means of morae. Short vowels have one mora, both versions of long vowels have two morae, and overlong vowels ultimately have three morae in the phonological surface representation. The vowel quality lax or tense does not (yet) play a part in the distinction. The ratio between stressed short and long vowels is on average 2:1 as noted by Lehiste (1970a:34) for languages with a binary vowel quantity system. Now, looking at the rather close-packed quantity space of Dinka, ratios of only 3:2 can be found (Remijsen & Gilley 2008:340). The durational range between the average of the lowest quantity degree and the highest quantity degree of a binary *vs.* a ternary system is, however, basically the same. The authors infer from this "that the phonetic space for vowel length distinctions is constant. As a result, any increase in categories on the continuum will lead to crowding of the phonetic space" (Remijsen & Gilley 2008:340). They conclude that the ternary quantity contrast is, as a matter of fact, the upper limit, defined and constrained by the phonetic space available for duration distinctions.[299]

We now have indeed one language with a three-way duration opposition that appears to require an analysis with a *phonological* ternary contrast of vowel quantity. What has not yet been sufficiently investigated for Dinka, though, is the influence of the coda C on the duration of the preceding vowel. It is generally assumed that Luanyjang Dinka comprises a voicing opposition in onset stops but not in codas.[300] Remijsen & Gilley (2008:334) found that the duration of a coda stop is longer if succeeding a short V, shorter if succeeding a long V, and correspondingly shortest after an overlong V. This effect "cannot be explained in terms of the three-level vowel length hypothesis" as they note (Remijsen & Gilley 2008:341). A possible interpretation would here be that the language comprises some sort of isochrony with respect to syllable length. After all, the progressive decrease in duration might hint on a relevant contrast for the coda stops. Though of course highly speculative, one wonders whether there could be a fortis *vs.* lenis distinction that has its finger in the vowel quantity pie.[301]

7.3. *Eurasian languages: Scottish Gaelic, Estonian, Franconian and German(?)*

The languages discussed so far are on the rather poorly investigated end of the research scale. This is definitely not true for the now following Eurasian languages.

[299] What Remijsen & Gilley (2008) omit from their discussion is that the 'phonetic space' in e.g. Estonian is comparably broader. While Luanyjan Dinka shows a range of the mean vowel duration from about 72 ms (short V) to about 170 ms (overlong V), Estonian comprises a durational range from approximately 106 ms (Q1) to 435 ms (Q3) (Lehiste 2003:50). Crucial seems to be here that Luanyjang does not employ additional prosodic features to underpin the length distinction.

[300] The phoneme inventory of Luanyjang Dinka lacks fricatives (Remijsen & Manyang 2009:114).

[301] Kehrein (p.c.) notes that a possibility to check the influence of the coda stops on the vowel length differences would be to have a look at the vowel length differences in open syllables. If the contrast fails to apply in this context, the coda stops are likely to trigger the difference. Otherwise, the fortisness cannot be the source of the length contrast.

All of the given languages facilitate some sort of quantitative processes in connection to the loss of a final segment or syllable. We start this section with Scottish Gaelic, moving then to the most famous language when it comes to ternary length contrasts: Estonian. Standard German and the German and Dutch varieties of the Central Franconian dialect continuum finally conclude the overview.

7.3.1. *Scottish Gaelic*

Ternes (1989:102ff.) analyzes the Scottish Gaelic dialect of Applecross as having phonetically three distinct vowel quantities short, half-long, and long in monosyllables. He assumes that each of these three durations is phonological, assigning one, two and three morae, respectively. The synchronic contrast is illustrated by two (near) minimal triples in Table 47 (Ternes 1989:102).

Table 47. Ternary vowel duration in Scottish Gaelic, dialect of Applecross

[short V]		[half-long V]		[long V]	
ʃĭń	‘we-stressed Pron.’	ʃĭˑń	‘venison’	ʃĭːń	‘to sing’
tuł	‘to go’	uˑł	‘apple’	suːł	‘eye’

The short vowels originate diachronically from short vowels, and the long vowels stem from long vowels. Ternes (1989) notes, based on his auditory impression, that the duration of the long vowels corresponds to a half-long vowel plus a short vowel. Crucial is the half-long series. It is a merger of a hiatus of two short vowels V_1-V_2. Such mergers also occurred with a preceding long vowel and a short V_2 of the same quality, resulting in a long V. If the vowel quality differed, however, hiatus was maintained.

The threefold vowel length opposition is only present in monosyllables. As soon as monosyllabic words with a trimoraic long vowel are suffixed for example with the plural marker /-ən/, the long vowel of the stem is ‘shortened’ to half-long, i.e. bimoraic (Ternes 1989:109f.).

Smith (2004) finds the ternary vowel length contrast rather dubious and seeks to reanalyze the syllable structure of Applecross Gaelic along the lines of Leurbost and Islay Gaelic. He comes to the conclusion that instead of the three distinctive vowel quantities rather a binary contrast combined with binary differences in syllable structure can be assumed. The insertion of a syllable boundary is what is needed. Smith arrives at the following (four-way) system of vowel quantity.

Figure 83.
(a) V short vowel
(b) V.V short vowel plus hiatus
(c) Vː long vowel
(d) Vː.V long vowel plus hiatus

The ‘ . ’ indicates in (b) and (d) the syllable boundary. The splitting into V.V and Vː.V might indeed appear justifiable if we consider that these are the diachronic

hiatus cases. This is also vindicated by the (synchronic) intuitions of the speakers. The original hiatus words are basically perceived as bisyllabic. Along the lines of Smith (2004) it is therefore unnecessary to postulate phonologically trimoraic vowels for synchronic Applecross by relying on the historical syllable status.[302]

7.3.2. *Estonian*

The probably most prominent and notorious representative of languages with an assumed ternary quantity distinction in the vowel system is the Uralic language Estonian.[303] It has been the subject of a rather huge amount of linguistic studies over the years. The common ground established by now is that it has three overt degrees of vowel duration as well as consonant duration *short* : *long* : *overlong*.[304] Examples for this contrast in the vowel system follow in Table 48.

Table 48. Ternary vowel length in Estonian

[short V] Q1		[long V] Q2		[overlong V] Q3	
koti	'to roam around-Imp!Sg.'	*kooti*	'code-Gen.Sg.'	*koo͡ti*	'code-Part.Sg.'
sada	'hundred-Nom.Sg.'	*saada*	'send-2.Sg.Imp!'	*saa͡da*	'get-Inf.'

Lehiste (2003:49) notes accordingly that the "existence of three contrastive quantities is, however, a phonetic fact, regardless of how the phonetic data are interpreted." The three duration degrees are commonly termed 'Q1' for short duration, 'Q2' for long duration, and 'Q3' for the extra-long or 'overlong' duration. These terms may refer to segments and syllables alike.[305]

It has been shown that the vowel duration itself is not the primarily distinguishing factor between Q<3 (i.e. Q1 and Q2) and Q3 vowels, but rather the duration *ratio* within a sequence of two syllables and the according F0 contours (Eek 1980; Lehiste 1997, 2003; Lippus et al. 2007). Lehiste (2003:62) finds that the "phonetic correlates of overlength are not completely stable". The length contrast is aided by additional auditory properties. Besides the durational ratio between two syllables, there exists a meaningful correlation between syllable quantity and the respective pitch contour. Where Q1 and Q2 of Estonian bisyllables have a fall in the F0 contour between the end of the first and the beginning of the second syllable, Q3 shows a rather early fall already within the first syllable and a low level-falling pitch in a succeeding syllable. The F0 differences between Q<3 and Q3 in single syllables are insufficient to distinguish between the respective length degrees, though.

[302] See the syllable-based re-analysis of Roberts-Kohno (1995, 2005) for the supposed phonological quadruple vowel length contrast of *short* : *half-long* : *long* : *very long* to a phonologically binary contrast of *short* : *long* in the Bantu language Kikamba.

[303] Saami as a representative of a language with an overt ternary length contrast in the consonant system is here left out of the picture.

[304] The studies by Lehiste (1960, 1965, 1966, 1968, 1970a, 1970b, 1977, 1980, 1985, 1997, 1998, 2003) have contributed a major part to arriving at this point.

[305] If a syllable contains only Q1 segment, it 'is in Q1'; if a syllable contains only Q2 segments, or Q2 and Q1 segments, it 'is in Q2'; finally, if a syllable contains a Q3 segments, it automatically 'is in Q3' (Lehiste 2003:49f.).

Perceptual studies demonstrate that the pitch movement – just like the durational ratio – is significant only in sequences containing more than one syllable. Then it becomes an important cue for the discrimination between Q1 and Q2 on the one hand, and Q3 on the other hand (Lehiste 2003:53, 61; Lippus et al. 2007:1051f.). Lehiste suggests that the presence of a pitch contour is "a necessary condition for the perception of the [three way length] difference, and that durational patterns alone do not provide a sufficient amount of information" (Lehiste 2003:62). The two degrees of short and long are distinguishable by means of duration alone.

Diachronically, the intricate vowel duration system came about due to the loss of an unstressed short vowel of an open syllable. Q3 is the result of this process that is usually assumed to be a form of CL (Lehiste 2003:48).[306] Synchronic Q3 still behaves bisyllabic in the sense that it exhausts the foot and displays a condensed version of the bisyllabic pitch contour of Q<3 syllables (Lehiste 2003:64). Kehrein (p.c.) notes that the difference in pitch contours between Q3 and Q<3 could be seen as a direct result of foot structure. We could therefore say that it is duration and pitch that provide cues to perceive a contrast in foot structure.[307]

It is especially the bisyllabic behavior of Q3 that has inspired the various phonological analyses. There are mainly two possible approaches for a phonological analysis of the phonetic facts that have been proposed over the years.

XXXV) (a) The ternary durational opposition of the system is explained by means of the metrical stress system. The defining characteristic of (phonetic) Q3 is its ability to occupy a whole foot, while Q<3 cannot do so (Prince 1980; Elenbaas / Kager 1999).

(b) Alternatively, a binary quantity contrast with additional prosodic features on the syllable level or the foot level is supposed, avoiding a trimoraic and quadrimoraic syllable by assuming special structural configurations such as a degenerate syllable, a free mora or mora-sharing (e.g. Bye 1997; Eek & Meister 1997).[308]

[306] If a single C_2 preceded the lost short V_2, the preceding nucleus was lengthened (*laulgmahan* > *laːulma* 'to sing'). If a consonant cluster preceded the lost short V_2, the first member of the cluster was lengthened (**jalkg* > *jalːk* 'foot'). A geminate preceding the short V_2, however, prevented the lengthening process (**tüttärät* > *tütːrät* 'daughters'). There are differing approaches available, though. Ehala (2003) assumes instead of CL of Q2 after syncope and apocope rather a *shortening* (weakening) of original Q3 to Q2. This process would have occurred in open syllables and independently of the quality of the succeeding C. The two contrasting pitch patterns of Q1 and Q2 *vs.* Q3 are unaccounted for.

[307] The Q3 pitch contour is to be expected if a Q3-syllable forms a foot of its own. It hosts the complete contour of a foot. Q1- and Q2-syllables constitute a part of a foot and, thus, do not carry the entire pitch contour.

[308] A third approach was brought forward by Ehala (2003) on the basis of his Q3-shortening hypothesis. It is basically a combination of the two approaches: instead of the binary quantity contrast, a binary syllable weight contrast of light *vs.* heavy is proposed, where all Q<3 syllables invariantly count as light while Q3 are heavy. In a fourth approach, Pöchtrager (2006) argues within the framework of Government Phonology that Q3 cannot be a property of the syllable, simply because there are no syllables and feet at all. He reinterprets the sequence of alleged Q3-vowel and Q3-consonant in e.g. [koːttːi] 'flail-Part.Sg.' as Q2-Q2, referring to the duration measurements that corroborate his theory (see also Ojamaa 1976) and to the fact that [koːttːi]-forms are always morphologically complex. He concludes that

Let us have a brief look at the approach in (a). Prince (1980) states that a Q3 syllable alone exhausts the metrical foot by having at the same time a strong (*s*) and a weak (*w*) constituent. This is not true for either Q1 or Q2 syllables. They need a Q1 or Q2 syllable to follow within the same foot. The result is a contrast between monosyllabic feet and bisyllabic feet. This distribution is depicted in Figure 84.

Figure 84. Estonian metrical feet[309]



Monosyllables comprise at least one Q3 segment in order to satisfy the foot requirements.[310] The effect is that a ternary quantity opposition in monosyllabic words is impossible. Only Q1 and Q3 segments may occur in this domain-final position. Perception studies confirm this restriction. The Estonian subjects tested were not able to distinguish between Q2 and Q3 segments on the basis of a monosyllable. Q1 was, however, easily identified (Ehala 2003:52, drawing on data from Eek & Meister 1997). Phonologically, a trimoraic representation is not necessary by means of the metrical approach because the length distinction is realized at the foot level and not the syllable level. A binary representation is sufficient to express the difference.

7.3.3. *Low and Central Franconian*

Let us now turn to the local German and Dutch varieties of the Rhineland region. Here, we do find some peculiar durational and F0 patterns that where up until the early 1980s interpreted as quantity phenomena by some researchers (e.g. Hardt 1843, Laven 1858, Baldes 1895, Menzerath 1928/1929, Dittmaier 1934, Ternes 1981).

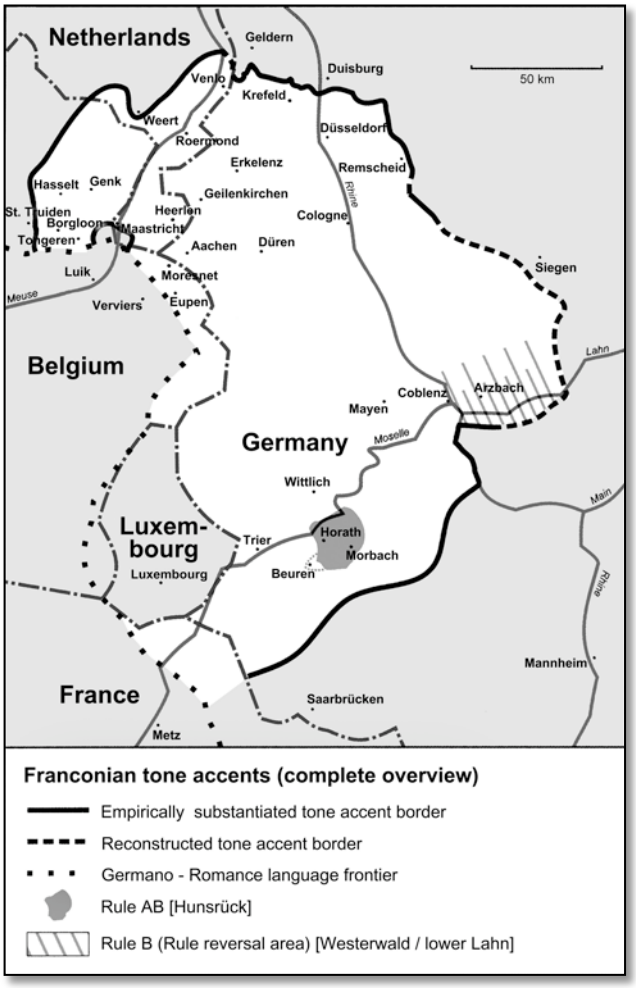
This dialect area extends roughly from the northern Saarland in the south to just north of Krefeld and Venlo in the north, and from the Westerwald in the east to the Romance language border in the west, including also the eastern border region of Belgium and the provinces of Limburg in the Netherlands and Belgium.[311] The map in Figure 85 outlines the respective area.

[309] Bye (1997:78) rather assumes that the third mora of a Q3-syllable may be either freestanding {|σμμ| μ} or parsed into another syllable {|σμμσμ|}.

[310] Note that clitics such as *ma* 'I-Pers.Pron' and *sa* 'you-Pers.Pron.' are exceptions to this (otherwise obligatory) foot pattern. According to Pöchtrager (2006:155) they do "not qualify as domains of their own", though.

[311] Note that the dialects of Luxembourg lost the tonal accents in the past (Gilles 1999, 2002; Wiesinger 1970). They are therefore excluded from the map.

Figure 85. Map of the Low and Central Franconian tone accent area[312]



Franconian is certainly one of the most extensively studied German varieties, the earliest linguistic approaches dating back to Neogrammarian time.[313] The area can be generally divided into four subareas:

i) Rule A, constituting the main part of the continuum,
ii) Rule A2, an area running along the northern border of the tone accent territory, including most of Limburgs and ending slightly south of Remscheid,
iii) Rule AB, being located in the Hunsrück region, and

[312] Adapted from Schmidt & Künzel (2006:139).
[313] For an extensive overview on the German research history from the beginning until 1986 see Schmidt (1986:50ff.).

iv) Rule B, extending over the Westerwald region at the eastern border of the tone accent area.

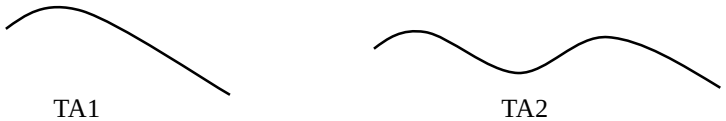
All of the dialects are characterized by the presence of an apparent three-way vowel duration contrast of short *vs.* long *vs.* overlong.

Table 49. Ternary length in Central Franconian[314]

[short V]	[long V]	[overlong V]
klat 'smooth'	*kla:t* 'to endue-3.Sg.Pres.'	*klaa:t* 'dress-Sg.'
halt 'to resound-3.Sg.Pres.'	*ha:lt* 'to maintain sth.-2.Pl.Pres.	*haa:lt* 'to heal-3.Sg.Pres.'

This contrast goes along with tonal differences between short vowels and long vowels or VR sequences on the one hand, and overlong vowels or VR sequences on the other hand. While short vowels can bear only tone accent 1 (TA1), long vowels and VR sequences are able to carry either TA1 or tone accent 2 (TA2). The overlong vowels receive invariably tone accent 2 (TA2). The respective prototypical pitch contours occurring in phrase-final position are as follows.

Table 50. Prototypical declarative contours of TA1 and TA2 in monosyllables[315]



TA1 TA2

The contours may vary in dependence on intonational boundary tones present in the declarative, continuant, or interrogative sentence context. Extended duration, i.e. the phonetic overlength (Schmidt 2002:204; Gussenhoven & Aarts 1999), is attributed to a more complex F0 movement in TA2. Overall, the prototypical declarative contours of the two tonal accents as produced in monosyllables in phrase final position are a rather steep fall for TA1 as compared to a falling-rising-falling pitch in TA2.

A prerequisite for the occurrence of a tonal accent contrast is in any case a long nucleus consisting either of a bimoraic vowel (V:), a diphthong (V_1V_2), or a short vowel succeeded by a sonorant consonant (VR). Two examples of the contrast are given below.[316]

[314] City dialect of Trier (Ternes 1980:382; Werth 2011:124).
[315] Schmidt (2002:204).
[316] The tonal accents are transcribed with superscript 1 and 2 respectively. I employ here the conventions of the IPA, marking the tone accent at the beginning of the syllable that is actually carrying it.

Table 51. Rule A minimal pairs[317]

	TA1	TA2
(a)	[^{1}dɔʊf] 'pigeon-Nom.Sg.'	[^{2}dɔːʊf] 'baptism-Nom.Sg.'
(b)	[^{1}haos] 'house-Dat.Sg.'	[^{2}haːos] 'house-Nom.Sg.'

Despite the experimental phonetic studies carried out by Heike (1962, 1964) and Jongen (1967, 1969ab, 1972ab) it was until the early 1980s believed by some researchers that the primary characteristic of these dialects is the ternary split in vowel duration of short *vs.* long *vs.* overlong. The occurring pitch movements, prominence and intensity phenomena were accordingly assumed to be accompanying phonetic properties.[318] This quantitative view was convincingly invalidated with the release of Hermans' M.A. thesis (1982) and Schmidt's (1986) seminal dissertation on the Central Franconian tone accents.[319] The primarily distinguishing features have been established to be the two tonal accents since then, i.e. TA1 and TA2.[320] Current phonological approaches treat these tone accents in a privative fashion. The lexical tone is TA2, which contrasts with 'nothing', i.e. TA1. No ternary length contrast is needed.

There are basically two diachronic sources of TA1 in Rule A. Firstly, the Middle High German (MHG) long open and mid Vs and diphthongs and their umlaut products receive TA1 automatically. This assignment is usually referred to as *spontaneous*. Secondly, the MHG long closed Vs and diphthongs, their umlaut products, long Vs of Open Syllable Lengthening (OSL), and VR also receive TA1 in Rule A – if a sequence of voiced C and retained or apocopated schwa succeeds them. This assignment is referred to as *combinatory*. All remaining cases with long nucleus obtain TA2 in Rule A. While spontaneous TA1 is identically distributed in Rule A2 as compared to Rule A, the distribution of the combinatory TA1 shows a significant difference between the two areas. In Rule A2, the long closed Vs, closing diphthongs and OSL lengthened Vs receive combinatory TA1 only if a voiced C and *apocopated* schwa follows. If the schwa is maintained, we find TA2 (de Vaan 1999:26; Köhnlein 2011:220ff.).

That an account incorporating the tonal characteristics (see Kehrein's (2008; 2009) mora accents, Köhnleins's (2011) tone accents, Werth's (2010) tones) is likely

[317] Dialect of Mayen (Schmidt 1986).

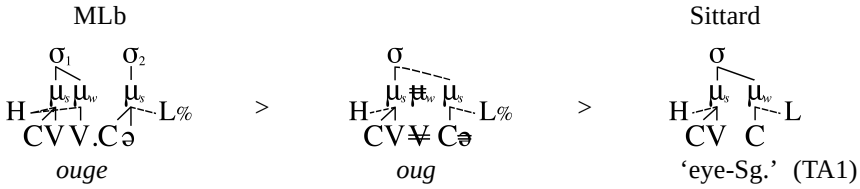
[318] For phonetic approaches see among others e.g. Hardt (1843), Diedrichs (1886), Frings (1913), Graß (1920), Menzerath (1928/1929), Palgen (1931), Bruch (1954); a three-way contrast as a phonological notion is introduced by Ternes (1981).

[319] An exception is Chapman (1993:137) who still assumes a ternary quantity contrast, referring back to Ternes (1981). She is quite obviously not familiar with Schmidt's (1986) work.

[320] Various terms have been employed in the literature to denote both prosodemes, occasionally confusing the two. They are basically as follows: TA1 = acute, circumflex(!), correption, *Kürzungsakzent* 'shortening accent', *Doppelton* 'double tone', *eingipflig* 'single peaked', *Stoßton* or *Stoottoon* 'pushing tone', *stark* or *scharf geschnitten* 'strongly or sharply cut', *Schärfung* 'sharpening'; TA2 = circumflex, grave, extension, overlong, *zweigipflig* 'double peaked', *Schwebelaut* 'leviating sound', *Schleifton* or *sleeptoon* 'dragging tone', *Dehnton* 'drawling tone', *Trägheitsakzent* 'sluggish accent', *schwach* or *sanft geschnitten* 'weakly or smoothly cut' (de Vaan 1999:25 FN4; Schmidt 2002:202).

to be preferable above the quantitative one becomes evident if we constrain our view to the development of vowel length only. Instead of a diachronic lengthening process in connection to schwa deletion and a succeeding voiced obstruent like in LG, we find *shortening* in deleted cases and no change in items without schwa deletion in the dialects of the Rule A2 area. This Low Franconian process appears as particularly counterintuitive, especially since the shortening would be conditioned by the presence of a voiced word-final obstruent (and the loss of schwa). Usually, it is exactly these sounds and these contexts that yield lengthening processes in preceding vowels (Kohler 2001:397). The tonal account does not suffer from this problem and may indeed be able to explain the shortening. I provide here one possible diachronic explanation.[321] Its basis is that the Middle Limburgian (MLb) final schwa of a bi-syllable holds a low tone L, while the bi-moraic head-syllable σ_1 has a high tone H. Deleting the schwa does not do away with the mora and the L of σ_2. It seeks to remain incorporated in the PrWd and associates to a preceding voiced C, which links as a coda to σ_1. We attain a TA1 contour of H*L in the mono-syllable. The weak mora of σ_1 is deleted in favor of the strong mora of the second syllable. A binary configuration in adherence to MaxBin is preferred above a ternary one. This tonal based change is illustrated below by means of MLb *ouge* 'eye-Sg.' in the city dialect of Sittard.[322]

Figure 86. Diachronic tone of Sittard (Rule A2)



The resulting mono-syllable contains one mora on the V and one mora on the coda C. The tonal development of TA1 therefore effectively results in the shortening of the originally long vowel of the nucleus. Looking at the TA2 items, voiceless Cs as compared to voiced Cs are inherently unable to bear the L of the schwa-syllable.[323] The prosodic content of the σ_2 cannot associate and is therefore deleted along with the final schwa. The vowel of the σ_1 remains long with a tonal contour of H*H for TA2. We find an almost completely opposite system to LG with shortened Vs in connection to apocope and a preceding voiced C.

Interestingly, Rule B also seems to turn the lexical distribution we find in Rule A upside down. The cases in Table 51 (a) receive TA2 and overlength for 'pigeon-Nom.Sg.' and TA1 and normal length for 'baptism-Nom.Sg.', the cases in (b) accordingly receive TA2 and overlength for 'house-Dat.Sg.' and TA1 and normal

[321] Boersma (2007b), Prehn (2009). Note that this is an HL alignment account, which neither Schmidt (1986) nor de Vaan (1999) give.
[322] Hanssen (2005).
[323] See Boersma (2007b).

length for 'house-Nom.Sg.'.[324] Another intriguing detail is that a part of the TA2-items of Rule B with their elongated pitch contours occur basically in the same environment where we find phonetic overlength in LG – i.e. after schwa-loss in post-lenis position. Besides other factors, schwa loss was also accompanied by the lengthening of a preceding nucleus in Rule B. Schmidt (2002:219, 229f.) relates these similarities between LG and Rule B to a diachronic pre-tonemic language stage that was valid for both areas, and in fact even for the whole of the North and West Germanic languages including also parts of the Balto-Slavic region. He states that allophonic durational differences that were accompanied by some minor tonal features were characteristic of this period. The synchronic prosodic phenomena ultimately developed from these due to macroprosodic changes in syllable structure, i.e. apocope (West Germanic languages) or morphophonological integration of the final syllable, i.e. clitics, into the PrWd (North Germanic languages).[325] The former process yields the two differing patterns of tone accents in Low and Central Franconian (Rule A(2) *vs*. Rule B), and a quantity contrast in LG.

7.3.4. *Standard High German*

A language that is also being cited in connection with overlength is Standard High German (McRobbie-Utasi 2007).[326] The assumption of overlong vowels for this supraregional language system is rather far-fetched and cannot be upheld, as has been shown already several years ago in experimental phonetic studies (Hanhardt et al. 1965; Wodarz 1979).

The phenomenon of overlong vowels is attributed to compensatory lengthening processes. Long main stressed vowels of open syllables are assumed to lengthen to overlong after apocope or syncope of a succeeding vowel (Wodarz 1979:29). The resulting contrast in the vowel system might be interpreted as three length degrees if leaving aside the qualitative differences (tense *vs.* lax). Examples are given below von Essen 1957:241; Hanhardt et al. 1965:214; Pilch 1966:258).

Table 52. Ternary vowel duration in Standard German?

[short lax V]		[long tense V]		[overlong tense V]	
List	'cunning-Sg.'	*liest*	'to read-3.Sg.Pres.'	*liehst*	'to loan-2.Sg.Pret.'
Bütte	'vat-Sg.'	*Blüte*	'blossom-Sg.'	*blühte*	'to bloom-3.Sg.Pret.
satt	'full'	*Saat*	'seed-Sg.'	*saht*	'to see-2.Pl.Pret.'

Wodarz (1979:28) summarizes earlier research findings that state an according vowel length contrast of [ɪ] ≠ [iː] ≠ [iiː], [ʏ] ≠ [yː] ≠ [yyː], [ʊ] ≠ [uː] ≠ [uuː], [ɛ] ≠ [ɛː] ≠ [ɛɛː], [ɔ] ≠ [oː] ≠ [ooː], and [a] ≠ [aː] ≠ [aaː] for Standard German. The vowels [eː]

[324] The perception and production of the 'reversed' tonal accents of Rule B, and possible phonological analyses thereof in synchronic and diachronic perspective, are currently investigated in the two rather different dissertations by Werth (2010) and Köhnlein (2011).
[325] For alternative diachronic approaches see Gussenhoven (2000), Boersma (2006), or Kortlandt (2007).
[326] Also, the Upper Saxon dialect of the city of Leipzig is referred to as showing overlong vowels (Zimmermann 1998).

and [øː] do not exhibit the postulated ternary length-distinction. Wodarz (1979:283ff.) finds that in fact neither the measurements of vowel duration, nor the structure of the formant frequencies, nor the structure of the F0 points to a phenomenon of overlength in Standard German. Similarly, Hanhardt et al. (1965:216f.) state that

> "there is no systematic pattern of any kind in the hypothesized contrast between long and overlong in German vowels. One is as likely to find greater length in the vowel of the allegedly long member of the pair as in that of the overlong".

Crucially, earlier auditory and experimental phonetic observations of overlong vowels in Standard German (e.g. Martens & Martens 1965; Mueller 1956; von Essen 1957; Pilch 1966; etc.) are falsified for every possible direct phonetic correlate.

Even stronger, Wodarz (1979:284f.) states that also speakers of the northern German dialect continuum show no general tendencies that point towards a ternary length distinction. He had, however, only one single informant coming from the relevant region (i.e. Ahrensburg near the city of Hamburg). A different study carried out by Kohler and Tödter (1984) verified by comparison a transfer of durational contrasts of LG to the standard language for speakers of LG varieties of Schleswig-Holstein. What we can conclude is basically that there is no such thing as overlength in nation wide Standard German. Different languages (Low German) or local dialects (Rhineland area) might influence the regional varieties, though. This is not only reflected in the production but also in the perception of Standard German vowels.

Weiss (1976:159f.) found in his perception study on Standard German vowel quality and duration that out of his group of seven originally northern German informants five speakers relied mainly on qualitative differences between lax and tense vowels, and not on vowel duration (be it short, long or overlong). Interestingly, all of these informants where raised in the region of Hamburg and therefore in an allegedly LG context. The other two informants of the group stemmed from southern Niedersachsen, i.e. an Eastphalian speaking area. They relied in their judgments primarily on vowel duration short *vs.* long. The additional 13 subjects that participated in Weiss' test exhibited a split pattern. The two informants coming from the city of Berlin basically resembled the test results of the Hamburg speakers. Their choices where clearly determined by the vowel quality. The subjects that where raised in southern and/or eastern German areas patterned together with the southern Niedersachsen informants. Their choices unequivocally relied on duration as the crucial phonetic cue in vowel discrimination (Weiss 1976:160).

The most straightforward conclusion to be drawn is that perceptual cues needed in LG are transferred to the standard language in northern Germany. Those cues are likely not to be as important in the rest of the German language area (except for maybe Berlin). The question now is, what kind of linguistic characteristic could it be that induces a qualitative distinction lax *vs.* tense rather than a quantitative one short *vs.* long in northern Germany? I will come back to that in only a moment in the discussion of the LG vowel system.

The overall result for the Standard German vowel system is that we have a binary opposition in either qualitative terms (lax *vs.* tense), or quantitative terms (short *vs.* long).[327] A ternary length contrast is not detectable. Weiss (1976:218) concludes that "one cannot generally say duration is a more important perceptual criterion than vowel quality and vice versa." Furthermore,

> "clear-cut parameters cannot be stated with any degree of validity, since the significance of duration and quality varies not only from person to person, depending on production and dialect, but also varies according to the vowels themselves." (Weiss 1976:223)

The matter is still far from being settled, both positions, quantity *vs.* quality, having their advocates.[328] Be that as it may, the contrast present in the Standard German vowel system can be assumed to be binary; either qualitatively, or quantitatively. The postulate of a ternary contrast of vowel length is out of the picture.

7.4. *A typological conclusion*

The discussion showed that one language that had been assumed in the literature to comprise a ternary length contrast yields no convincing evidence for a third degree of vowel duration at all (i.e. Standard High German). The phonetic studies of this language do not deliver conclusive evidence for a phonologically ternary length contrast. Ternarity – overt as well as phonological – may therefore be assumed to be out of the picture in this case. A second language for which such a contrast is rather questionable is Yavapai, the opposition being restricted to the closed vowel /i/ only. Although the confined occurrence of the distinction is a rather unusual asymmetry in the vowel system, there is up to now no way of generally excluding a ternary contrast for Yavapai.

For the remaining twelve languages (plus LG), a number of phonological tools have been employed in order to account for the three-fold durational contrasts in the overt forms, some of them being based upon additional prosodic features corroborating the duration contrast. I give a summary in form of a small catalogue in Table 53.

We see that a ternary length contrast is assumed at the phonological surface level for several languages in addition to Yavapai. Except for Dinka, where a true ternary quantity contrast is found, length has been reanalyzed by means of a variety of phonological tools: morphological structure, pitch peak alignment, phonological Cs standing in between the overt V:V sequences, a phonological V:V sequence (bi-segmental rather than mono-segmental), metrical processes applying to the phonological surface (Iambic Lengthening), syllable cut, tonal or tone accent

[327] Weiss (1976:13, FN11) acknowledges the possibility of phonetically overlong vowels in Standard German in cases of compensatory lengthening. However, he specifically notes that only two degrees of length, i.e. short *vs.* long, are in fact distinctive.

[328] The so-called syllable-cut theory is noteworthy in this context. It relates the vowel qualities lax and tense prosodically to the presence or absence of a coda C. Only long, i.e. tense, vowels may occur in the nucleus of open syllables while lax vowels are confined to closed syllables (Trubetzkoy 1938; Auer et al. 2002).

differences, compensatory processes due to C deletion, a combination of quality and quantity, syllable structure, and foot structure.

Table 53. The phonological toolbox for overt ternarity

Language	*Phonological tools*
Seri	Juxtaposition of morphemes containing identical vowel qualities yields extra-long vowels: $V_1]V_1$: > VV:
Mayo	Lengthening of CV in final position in a PrWd results in an intermediate, half-long V duration. A phonological contrast derived long *vs.* underived long (i.e. underlyingly mono- *vs.* bimoraic) is maintained by means of differences in pitch peak alignment. Three possible tools are employed: 1. Stress autosegments, 2. Lexical and post-lexical stress assignment, 3. Monosegmental *vs.* bisegmental surface representation.
Mixe	The phonetically overlong [VV:] derives from a phonological surface form /V:h/.
Wichita	1. Overlong vowels are mergers of long V and short V of bisyllabic V:CV sequences that deleted the intervocalic C synchronically. The contrast occurs in the overt form. 2. Ternary length contrast of V *vs.* V: *vs.* V:V in the phonology.
Seneca	Diachronic deletion of intervocalic **h* and **r* result in the merger of the two remaining vowels to V:V that contrast at the phonological surface level with V and V: .
Sarcee	The overlong vowels stretch across morpheme boundaries and may be represented as V_1V_1: < $V_1]V_1$: or V_1:V_1 < V_1:]V_1 in the phonological surface form.
Central Siberian Yupik (+Choctaw, Chickasaw)	The metrical process of Iambic Lengthening of LL > L**H** in conjunction with the avoidance of contrast neutralization produces the overt opposition of short *vs.* long *vs.* overlong vowels.
Hopi	1. The syllable structure and the phenomenon of syllable cut determines a binary contrast and a distinction between short Vs and half-long *Vs.* 2. Tonal contours distinguish between the half-long (HL) and the long (H) length degree.
Dinka	A ternary vowel length contrast in the phonological surface form: V *vs.* V: *vs.* VV:.
Scottish Gaelic	The (perceptually verified) reanalysis of the syllable structure yields a phonological four-way contrast with monosyllabic short V, monosyllabic long V:, a heterosyllabic sequence of two short Vs (hiatus), and a heterosyllabic sequence of long V: and short V (hiatus).

Language	*Phonological tools*
Estonian	Vowel length depends on foot structure. An overlong Q3 vowel behaves bisyllabic in exhausting the foot. Phonologically, no ternary contrast exists since the Q3 can be analyzed as binary by means of e.g. a degenerate syllable, a free mora or mora-sharing.
Low and Central Franconian	The threefold length contrast in the overt form is dependent on two distinctive tonal accents, one being phonetically longer than the other.
North Low Saxon	The overt three-way duration contrast is traced back to a binary length contrast at the surface level combined with a binary quality contrast.

Although the main goal of phonology is to be restrictive in order to give a meaningful explanation of facts, we see here that we can indeed be restrictive in about eleven different ways. Yet, only five out of the thirteen approaches presented in this study (i.e. the phonetically grounded accounts for Mayo, Hopi, Scottish Gaelic, Low and Central Franconian, and North Low Saxon) provide so far a solid analytical alternative to the ternary length contrast at the phonological surface level in the respective languages.

For the remaining languages we can say with Sherlock Holmes: when you have eliminated the impossible, whatever remains, however improbable, must be the truth. Surface ternarity, though rather rare cross-linguistically, is for now in some languages a necessary means to account for the overt ternary duration contrasts. This is true for those languages that show up to now no verifyable evidence for a phonological tool other than length. Further research is here clearly required and may reveal quite different phonetic data and phonological analyses. One thing that the typology indicates already at this point is that there are certain limitations to phonological contrasts, constraining the length oppositions to a maximum of three degrees.

The phonetically based approach of Remijsen & Gilley (2008) provides another answer as to why phonological ternary systems are rare. They assume an upper boundary for the available duration of segments. Within this limited scale and with reference to auditorily recognizable contrasts, a language may establish its length oppositions. In order to make a contrast most salient, fewer length categories (preferably two) have to be arranged on the scale. Accommodating three length categories then results in a rather crowded durational space. The individual categories are perceptually not as distinct as in the case of a binary length contrast. This can be taken as the main reason to either phonetically enhance the contrast (e.g. by means of differing pitch contours in Estonian), or introduce a distinctive opposition of another prosodic feature (e.g. in Mayo, Sarcee, Central Franconian, North Low Saxon).

8. Vowel quantity and the fortis-lenis distinction in North Low Saxon

This dissertation covers the phonetic description of the issue of vocalic overlength in the three North Low Saxon dialects of Kirchwerder, Altenwerder and Alfstedt, and entails an overview on the linguistic literature on Low German dialects, a brief stress analysis, the phonological analyses of the vowel and consonant data, and a typological overview on languages featuring ternary length phenomena in the vowel system. The crucial findings for Low German phonetics (see chapter 3) and phonology (see chapters 4, 5 and 6) are briefly summarized below.

8.1. *Low German Phonetics*

The phonetic analysis provided in chapter 3 treats the production and perception of items with supposed overlong vocalic nucleus by Low German informants.

Two main questions were scrutinized with respect to the speech recordings of the three Low German dialects of Altenwerder, Kirchwerder and Alfstedt. The first question was whether there are stable durational contrasts between short vowels, long vowels, and hypothesized *overlong* vowels. The second question was whether distinct pitch contours are observable for long vowels (*Stoßton* or pushing tone) as opposed to overlong vowels (*Schleifton* or dragging tone). With regards to the traditionally assumed dragging tone, only one Altenweder informant (i.e. the *motherese* speaker III.6.Aw) was identified as showing some minor cues in F0 variation within the given minimal pairs, i.e. between items with long vowel *vs*. supposed overlong vowel. No other Low German informant showed similar peculiarities.

It was found for all (complete) samples that the three expected length degrees (ELD) of the vowel system short (ELD 1) : long (ELD 2) : overlong (ELD 3) are kept statistically distinct. We observe mean ratios of 1 : 1.74 : 2.29 in the complete samples.

The quality of the coda consonant has a crucial effect on the duration of the preceding vowel in all of the minimal pair samples. The expected length degrees are kept distinct in the pre-obstruent cases of the four investigated samples, whereas only the Altenwerder informants maintain the durational difference also in pre-sonorant vowels. I assume that this contrast preservation in Altenwerder is phonetic rather than phonological. It was also found for the three Low German dialects that neither the vowel durations nor the sonorant consonant durations differ significantly in items with vowel-sonorant consonant sequences of the long length degree and the expected overlong length degree. The assumption of overlength in the combinations of vowel and sonorant coda is not warranted by any of the analyzed samples.

Besides the purely segmental interactions with vowel length, also the position of a word in the utterance can contribute to durational variations. We found for the samples of Altenwerder group 1, informant III.6.Aw, and Alfstedt that non-final items and final items differ durationally between expected long degree and expected overlong degree. A rather unexpected finding is made within the individual length

degrees. The well-known Germanic phenomenon of utterance-final lengthening was assumed to possibly enhance durations of segments in sentence-final tokens (Kohler 2002:388). Intriguingly, it is found for all four speech samples (i.e. Kirchwerder, Altenwerder group 1, informant III.6.Aw, and Alfstedt) that no statistically significant final lengthening occurs at all. The Kirchwerder data as well as the Alfstedt data exhibits only a very slight trend towards vowel lengthening in final position of one of the length degrees (i.e. in the overlong degree in Kirchwerder, and in the long degree in Alfstedt). The corpora of Altenwerder group 1 and informant III.6.Aw lean towards the opposite direction. In these two samples, the vowel durations of both expected long degree and expected overlong degree indicate a process of non-final lengthening (or final shortening), instead. The contrast of long *vs*. overlong in the monosyllables is, however, maintained at all times.

Turning to the perception study, fieldwork data from informants speaking the LG dialects of Altenwerder, and of Alfstedt, as well as on-line data from younger adults speaking LG and coming from Niedersachsen, Bremen, Mecklenburg-Vorpommern or northern Nordrhein-Westfalen were elicited in listening experiments (forced-choice setting, stimuli being manipulated with respect to vowel length and F0). In all samples we find rather high speaker-dependent effects. Two meaningful factors are obtained in the fieldwork tests and the on-line test: *vowel duration* and *finality*, the latter relating to the former due to the greater vowel length found in non-final items especially of Altenwerder Low German. The differences in vowel duration established in the production analysis for the expected length degrees long and overlong appear to have a functional load for the informants. This is in fact not too surprising since in all but the cases with mid vowels the conservative JND (just noticeable difference) of 20-25% of durational increase is exceeded in the recordings. The perceptibility of the difference was, thus, particularly likely.

A further perceptual cue for the Altenwerder informants as well as the participants of the on-line test appears to be the *coda consonant* (obstruent consonant *vs.* sonorant consonant). Words with final obstruent are preferably categorized as long degree-item in Altenwerder (though the trend is only weakly manifested) and as overlong degree-item in Alfstedt.[329] By comparison, sonorant codas yield rather evenly distributed choices for both length categories.

The artificial F0 contours never conspicuously constitute relevant predictors for the responses. This is also true for the answers delivered by informant III.6.Aw. Her perception data do not indicate a differentiation between the speech items by means of the varying pitch contours.

We can conclude that in the investigated Low German dialects the indicated pitch contours do not at all play a role in the perception and distinction of the given minimal pairs. The assumption of tonal accents (TA1 and TA2) is not vindicated by the data. Instead, it is indeed the vowel duration, which allows for a differentiation between phonetically long and overlong speech items. Therefore, the data conducted

[329] Bear in mind that the speech data used in the perception tests always contains only one kind of obstruent, i.e. either fortis obstruents in experiment 1 or lenis obstruents in experiment 2. Only the vowel is manipulated qua duration and F0 contour.

for the current study pinpoint the presence of overlong vowels and diphthongs as a phonetic reality in Low German.

8.2. *Low German Phonology*

I complemented the phonetic findings of three durational categories in the vowel system by an analysis of the Low German stress pattern in chapter 4. The result is such that the quality of the vowel, being tense or lax, is of no relevance for the syllable weight. Both vowel qualities count the same. This is detectable by the grammatical stress that is assigned trochaically by means of syllable weight. Consonant-vowel (i.e. CV) syllables generally count as light. Word-internal CVC syllables count as heavy. Their weight in word-final position depends in polysyllables basically on the syllabic context. The 'superheavy' syllables count as heavy. Crucial is here the extrasyllabic position of the final consonant. The weight of the phonetically overlong tense vowels can be defined as bimoraic, yielding a heavy status of the CVV<C> sequence.

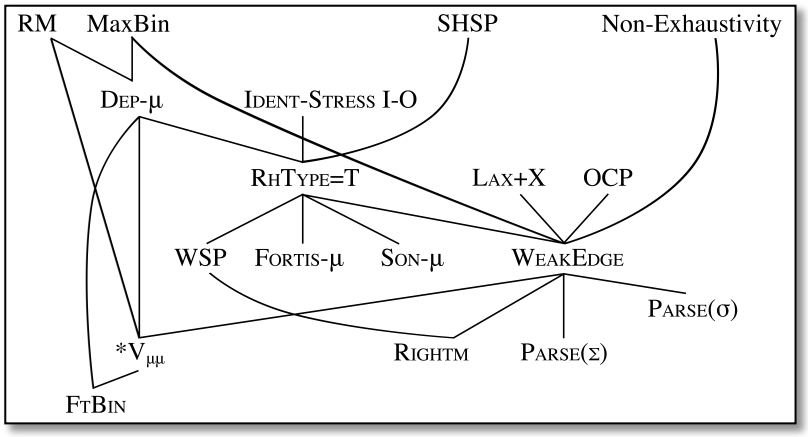
The stress system already indicates a surface weight distinction in Low German vowels. While phonetically short lax vowels and phonetically long tense vowels are light, the phonetically overlong tense vowels count as heavy. We reach a binary weight contrast that can be expressed in terms of morae as monomoraic *vs*. bimoraic (see chapter 5). On top of this opposition, we find a quality contrast lax *vs*. tense that distinguishes the short and long vowels. The *underlying* weight of the Low German vowels is, however, generally monomoraic. Lax vowels may not become bimoraic by virtue of the OCP (Obligatory Contour Principle) in conjunction with the inherent requirement to not occur in open syllables. The second mora in the overlong vowels is assigned at the surface level by means of the moraic (allo)morpheme. We therefore do not find an underlying quantity contrast in the investigated Low German dialects of Kirchwerder, Altenwerder and Alfstedt, and probably North Low Saxon in general. The language system comprises two surface phonological degrees of vowel length whilst showing evidence for three phonetic (i.e. overt) steps of vowel duration short – long – overlong.

It is the presence of a moraic (allo)morpheme that supplies the structural material to effectively perform the lengthening of the vowel. The emergence of the surface binary quantity opposition is determined by the structural properties of the consonant following within the same syllable (see chapter 6). The fortis consonants and sonorant consonants do not allow the association of the moraic (allo)morpheme to the preceding nucleus, thus inhibiting the development of phonetic overlength. Only the lenis consonants enable the spreading of the moraic (allo)morpheme and the resulting vowel lengthening. These observations relate to the structural complexity of the consonantal segments. Both fortis consonants and sonorant consonants have a structurally enriched root node; the former by means of a laryngeal specification, the latter by means of the [SV] (sonorant voice) node. This can be seen as the reason why they are inherently moraic, and why they are able to block the association of a moraic (allo)morpheme to the preceding vowel. The lenis consonants are by comparison structurally poor. They do not require a mora and do

not lengthen the preceding vowel by themselves. Rather, they *enable* the lengthening process.

I have expressed this behavior by means of a constraint hierarchy, assuming that some constraints need to be crucially unranked. This does not produce variation as in the partial rankings of Anttila (1995, 2006), because the unranked constraints are of equal importance. As an effect, they are evaluated in parallel. An overview of the constraint hierarchy is provided in Figure 87.

Figure 87. Hasse diagram of the Low German constraint ranking



I add only two new constraints to the total set of constraints: FORTIS-μ and SON-μ. They do not dominate any constraints in the ranking. If they were ranked high in the hierarchy, the result would be that fortis consonants and sonorant consonants could never be left unparsed. These segments would always require a mora, and hence necessitate being syllabified and footed. A possible effect would be the violation of the principle of MaxBin, e.g. in items ending in consonant clusters.

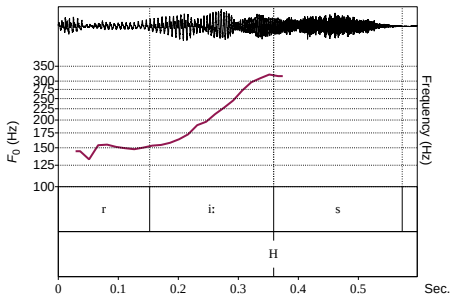
An additional effect of the ranking is the possibility of monomoraic feet in Low German. Forms like /kat/ ‘cat-Sg.’ with a phonetically short lax vowel and a following fortis coda consonant are bimoraic, whereas forms like /huz/ ‘house-Nom.Sg.’ with a phonetically long tense vowel followed by a lenis consonant a monomoraic. This means in these cases that the former items are heavy while the latter items are light. This may appear somewhat counter-intuitive from a purely phonetic point of view. It has, however, been demonstrated by the stress analysis that we do not find a difference in weight between short lax and long tense vowels inspite of the occurring durational discrepancies. While phonetics can be assumed to permit some conclusions for phonology, the connection between the different levels of representation is rather indirect. We do not find a one-to-one relation.

8.3. *Outlook*

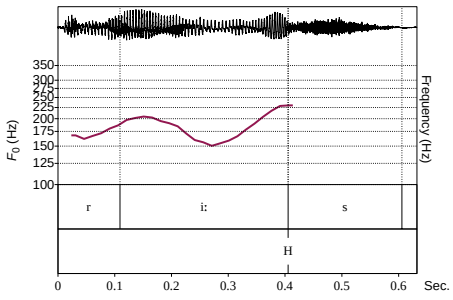
This dissertation is restricted to the investigation of monosyllabic forms in sentence focus and under declarative intonation. The elicited corpus contains, however, more data. Monosyllables in unfocused position under declarative intonation, and in focused and unfocused position under interrogative sentence intonation have not been analyzed so far. Especially the latter context has not been described in the scientific literature up to now. In order to establish a conclusive picture of the prosodic system of Low German, it is indispensible to investigate also the question intonation.

Intriguingly, a preliminary inspection of four minimal pairs produced by informant I.3.Aw in focused-final interrogative sentence context show indeed differences in the F0 contours.

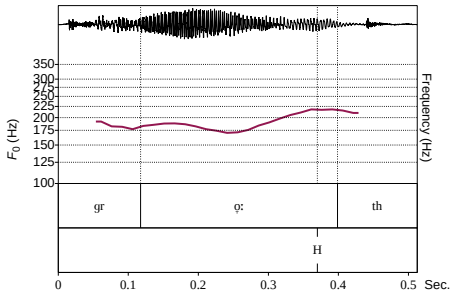
Figure 88. Focused-final interrogative contours of informant I.3.Aw



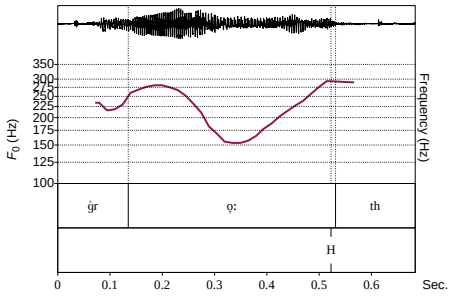
ELD 2 [ri:s] ‘rice’



ELD 3 [rii:s] ‘giant-Nom.Sg.’



ELD 2 [gro̩:t] ‘degree-Nom.Sg.’



ELD 3 [gro̩o̩:t] ‘just; straight’

The items with a long vowel (ELD 2) appear to have a rising L*H% contour on the rhyme, while the items with an overlong vowel (ELD 3) appear to have a falling-rising HL*H% contour on the rhyme. It is unclear, whether this behavior is merely a speaker-dependent variation or representative of an overall pattern. Alas, I have to leave this matter for future research.

8.4. *Closing remarks*

> "We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time." (T.S. Elliot)

The first and foremost goal of this investigation was to establish whether it is tone, quantity, or something else that is the primary prosodic feature in Low German dialects. All in all, I have shown that Low German employs a combination of vowel quality and vowel quantity, which carries functional load. It is a binary phonological system accounting for the given phonetic facts of the ternary vowel duration in Low German. Pitch plays no role with respect to the perception of lexical or morphological contrasts in the investigated Low German dialects (at least under declarative sentence intonation and in focused position). Thus, considering the question which of these suprasegmentals has phonemic status in Low German, i.e. may be termed *prosodeme*, we were able to conclude that tone accent does not qualify as having *prosodeme*-status. In order to decide between quality and quantity, then, we had to consider the different levels of representation (Apoussidou 2007, Boersma 2007a) and possible contextual influences on vowel duration.

I pointed out a crucial distinction between fortis *vs*. lenis consonants by means of laryngeal specification *vs*. underspecification and, hence, structural complexity of the segments. It is this complexity opposition in the coda consonants, which has a profound impact on the vowel duration of a preceding nucleus. As a diachronic rule of thumb, we find no overlength after apocope of final schwa if the coda is structurally *complex* (i.e. fortis or sonorant). Only if the coda is structurally *simplex* (i.e. lenis), a preceding long vowel lengthens to overlong after apocope. This qualitative contrast ultimately allows for a binary explanation of phonetic overlength in Low German (Kohler 2001). In effect, we arrive at a phonological surface opposition of monomoraic *vs*. bimoraic and lax *vs*. tense in the vowel system, and of laryngeally specified *vs*. unspecified in the consonant system. Therefore, both quality and quantity are established as *prosodemes* in Low German.

Underlyingly, no quantity contrast exists in Low German, all vowels being simply monomoraic. What remains is quality.

With the data and analyses presented in this thesis, Low German falls in the category of languages featuring three phonetic degrees of vowel length that can be traced back to a binary contrast at the surface level (e.g. Mayo, Mixe, Central Franconian). No ternary quantity system is required.

9. Klinker kwantiteit en de fortis-lenis distinctie in het Nederduits

Deze dissertatie bevat niet alleen een fonetische beschrijving van vocale overlengte in de drie noordelijke Nederduitse (ook wel: Nedersaksische) dialecten van Kirchwerder, Altenwerder en Alfstedt, maar het bevat ook een overzicht van de taalkundige literatuur over Nederduitse dialecten (ND-dialecten). Bovendien geeft het een analyse van de klemtoon, fonologische analyses van de klinker- en medeklinkerdata en een typologisch overzicht van talen met drievoudige lengteverschijnselen in het klinkersysteem. De bevindingen voor de Nederduitse fonetiek (zie hoofdstuk 3) en fonologie (zie hoofdstukken 4, 5 en 6) zijn hieronder samengevat.

9.1. *Nederduitse Fonetik*

Met betrekking tot de geluidsopnamen van de drie Nederduitse dialecten van Altenwerder, Kirchwerder en Alfstedt zijn twee kernvragen nader onderzocht. De eerste vraag was of er stabiele lengtecontrasten zijn tussen korte, lange, en hypothetisch-gepostuleerde *overlange* klinkers. De tweede vraag was of er aparte tooncontouren waar te nemen zijn op lange klinkers (stoottoon), die zich onderscheiden van de tooncontouren op overlange klinkers (sleeptoon). Wat betreft de sleeptoon die traditioneel wordt aangenomen, liet slechts één informant (de *motherese* spreker III.6.Aw.) een paar kleine gevallen van F0-variatie in bepaalde uitingen zien. Geen enkele andere informant vertoonde dergelijke eigenaardigheden.

In alle (complete) datasamples bleven de drie gradaties van lengte binnen het klinkersysteem kort (expected length degree 1) : lang (expected length degree 2) : overlang (expected length degree 3) statistisch van elkaar te onderscheiden. Gemiddelde ratio's van 1 : 1.74 : 2.29 kunnen worden waargenomen in de volledige samples.

De kwaliteit van de codaconsonant heeft een cruciaal effect op de duur van de voorafgaande V (vocaal of klinker) in alle minimale sample-paren. De expected length degrees (ELDs) worden van elkaar onderscheiden in de gevallen voor een obstruent in de vier onderzochte samples en alleen de Altenwerder informanten behouden ook het contrast in de pre-sonorante vocalen. Verder verschillen de duur van de klinkers noch de duur van de sonorante medeklinkers significant in klinker-sonorant sequenties (VR) van ELD 2 en ELD 3 items. De aanname dat er overlengte gevonden wordt in de combinatie van V met sonorante coda (R), wordt niet per se ondersteund door de geanalyseerde samples.

Behalve de puur segmentele interactie met klinkerlengte kan de positie van een woord in een uiting ook bijdragen aan variatie in lengte. Voor de samples van Altenwerder groep 1, informant III.6.Aw, en Alfstedt vonden we dat niet-finale items verschillen in duur van finale items tussen ELD 2 and ELD 3. Een nogal onverwacht resultaat kwam naar voren in de individuele gradaties van lengte. Er werd altijd aangenomen dat het bekende verschijnsel van zinsfinale rekking in Germaanse talen de duur van segmenten in zinsfinale tekens kon bevorderen (zie Kohler 2002:388).

Een zeer interessant resultaat is dat in de vier samples helemaal geen finale rekking plaatsvindt. Zowel de Kirchwerderdata als de Alfstedtdata vertonen alleen een heel lichte neiging tot het verlengen van de klinker in de finale positie van één van de lengtegradaties (d.w.z. in ELD 3 in Kirchwerder, en in ELD 2 in Alfstedt). De corpora van de Altenwerder groep 1 en informant III.6.Aw leunen zelfs in de tegenovergestelde richting. De duur van de vocalen van zowel ELD 2 als ELD 3 wijzen juist op een proces van niet-finale rekking (of zelfs finale reductie). Het contrast tussen lang *vs*. overlang in de monosyllaben blijft echter altijd behouden.

Als we vervolgens naar het perceptieonderzoek kijken, zien we twee belangrijke resultaten in het veldwerk en de on-line tests: V-*lengte* en V-*finaliteit:* de relatie tussen deze twee verschijnselen uit zich in de grotere klinkerlengte in niet-finale items, die voornamelijk geattesteerd is in Altenwerder Nederduits. De verschillen in klinkerduur die zijn geobserveerd in de productieanalyse van de verwachte lengtegradaties 2 en 3 (lange vocalen en overlange vocalen), lijken een functionele betekenis te hebben voor de informanten. Dit is niet erg verrassend gezien het feit dat in alle gevallen, met uitzondering van de instanties met middenklinkers, de conservatieve JND (kust noticeable difference) van 20-25% tijdsduurstijging in de opnames wordt overschreden. Het is derhalve zeer aannemelijk dat het verschil duidelijk waarneembaar is.

Een ander perceptueel signaal voor zowel de Altenwerder informanten als de participanten van de on-line tests leek de *coda-C* (consonant of medeklinker) te zijn (obstruent *vs.* sonorant). Woorden met een finale obstruent worden bij voorkeur gecategoriseerd als een ELD 2-item in Altenwerder (hoewel deze trend zich slechts licht manifesteert) en als een ELD 3-item in Alfstedt. Sonorante codas leveren niet het tegenovergestelde resultaat op, maar juist gelijkverdeelde keuzes voor beide lengtecategorieën.

De kunstmatige pitchcountouren vormen nooit opvallend relevante voorspellers voor de respons van de informanten. Dit geldt ook voor de antwoorden van informant III.6.Aw. Haar perceptiedata laten geen differentiatie tussen de spraakitems zien wat betreft de variërende pitchcountouren.

De conclusie is dat in zowel de ND-dialecten van Altenwerder en Alfstedt, als in het Nederduits van de adolescenten uit het ND-gebied, de aangegeven pitchcountouren helemaal geen rol spelen in de perceptie en distinctie van de gegeven minimale paren. De aanname dat toonaccenten (TA1 en TA2) aanwezig zijn, wordt niet ondersteund door de data. Het is daarentegen de V-lengte die de differentiatie tussen fonetisch lange en overlange spraakitems toestaat. De opnames die voor dit onderzoek zijn uitgevoerd laten zien dat overlange vocalen en diftongen een fonetische realiteit vormen, in tegenstelling tot wat tot op heden werd aangenomen (zie hoofdstuk 3).

9.2. *Nederduitse Fonologie*

De fonetische bevindingen van de drie tijdscategorieën worden aangevuld met een analyse van het LG-klemtoonpatroon in hoofdstuk 4. De resultaten geven aan dat de kwaliteit van V -*tense* (gespannen) of *lax* (ongespannen)- niet relevant is voor het

gewicht van de syllabe. Voor beide kwaliteiten geldt hetzelfde. Dit is te zien aan de grammaticale klemtoon die trocheïsch wordt toegekend op basis van het gewicht van de syllabe. CV-lettergrepen zijn doorgaans licht. Woordinterne CVC-syllaben daarentegen, zijn zwaar. Hoe zwaar een lettergreep is in woordfinale positie, is afhankelijk van de syllabische structuur. De onderliggende 'superzware' syllaben die voor kunnen komen in de finale positie in prosodische woorden behouden hun gewicht aan de fonologische oppervlakte. Hierbij is de extrasyllabische positie van de laatste medeklinker in een woord cruciaal. Het gewicht van de fonetisch overlange tense vocalen kan dan gedefinieerd worden als bimoraïsch, wat de zware status oplevert van de CVV<C> sequentie.

Het klemtoonsysteem laat al een gewichtsverschil zien aan de oppervlakte in LG-vocalen. Terwijl fonetisch korte lax klinkers en fonetisch lange tense klinkers licht zijn, zijn de fonetisch overlange tense klinkers juist zwaar. Hiermee bereiken we een binair contrast in gewicht dat uitgedrukt kan worden als mono- *vs.* bimoraïsch. Hierbovenop vinden we het kwaliteitsverschil lax versus tense dat de korte en de lange klinkers van elkaar onderscheidt. Het *onderliggende* gewicht van de LG klinkers is echter over het algemeen monomoraïsch. De tweede mora in de overlange klinkers wordt toegekend aan de oppervlakte door middel van een moraïsch (allo)morfeem. Daarom vinden we geen onderliggend kwantiteitsverschil in de onderzochte LG-dialecten van Kirchwerder, Altenwerder en Alfstedt, en waarschijnlijk in heel het noordelijke Nedersaksische gebied. Het taalsysteem bevat twee fonologische oppervlakteniveaus voor klinkerlengte terwijl het aanwijzingen geeft in de richting van drie fonetische (d.w.z. overte) stappen in de duur van een klinker; kort – lang – overlang.

Het is de aanwezigheid van een moraïsch morfeem dat het structurele materiaal aanlevert dat op effectieve wijze de klinkerrekking kan uitvoeren. Het verschijnen aan de oppervlakte van de binaire kwantiteitsoppositie wordt bepaald door de structurele eigenschappen van de consonant die volgt in dezelfde syllabe. De fortis consonanten en de sonorante consonanten laten de ontwikkeling van fonetische overlengte niet toe. Alleen de lenis (stemhebbende) Cs maken rekking mogelijk. Deze observaties zijn gerelateerd aan de structurele complexiteit van de consonantsegmenten. Zowel fortis (stemloze) Cs als sonorante Cs hebben een structureel verrijkte wortelknoop, de eerstgenoemde door middel van een laryngeale specificatie en de laatstgenoemde door middel van de [SV]-node (sonorant voice). Dit is de reden dat ze allebei inherent moraïsch zijn en dat ze de koppeling van een moraïsch morfeem aan de voorgaande V kunnen blokkeren. De lenis Cs zijn in vergelijking structuurarm. Zij vereisen geen mora en hebben zelf niet de macht om een voorgaande V te verlengen. Zij kunnen dit proces daarentegen wel faciliteren.

Ik heb dit gedrag uitgedrukt in een verzameling *constraints* (beperkingen) in de hiërarchie. Hierbij neem ik aan dat sommige constraints ongeordend dienen te zijn. Dit leidt niet tot de variatie die voorkomt bij de gedeeltelijke ordening van Anttila (1995, 2006), omdat de ongeordende constraints dezelfde waarde hebben. Als gevolg worden ze parallel geëvalueerd. Hieronder staat een overzicht van de constraints en hun hiërarchie:

XXXVI) {SHSP, Non-Exhaustivity, MaxBin, RM} >>
{IDENT-STRESS I-O, DEP-μ} >>
{RHTYPE=T, LAX+X, OCP} >>
{FORTIS-μ, SON-μ, WSP, WEAKEDGE} >>
PARSE (σ) >>
{RIGHTM, PARSE (Σ), *$V_{\mu\mu}$} >>
FTBIN

Ik voeg slechts twee nieuwe constraints toe aan de totale set uit de literatuur: FORTIS-μ and SON-μ. Deze domineren geen enkele constraint in de rangschikking. Als ze hoog in de hiërarchie stonden, zouden fortis medeklinkers en sonorante medeklinkers nooit ongeparseerd kunnen blijven. Deze segmenten zouden dan altijd een mora vereisen en vervolgens syllabificatie moeten ondergaan en tot een voet gemaakt moeten worden. Een mogelijk effect is de schending van MaxBin, bijvoorbeeld in items die eindigen in consonantclusters.

Een bijkomend effect van de rangschikking is dat er een bestaansmogelijkheid wordt gecreëerd voor monomoraïsche voeten in LG. Vormen zoals /kat/ met een fonetisch korte lax klinker en een daaropvolgende fortis coda medeklinker zijn bimoraïsch, terwijl vormen als /huz/ met een fonetisch lange tense klinker gevolgd door een lenis medeklinker monomoraïsch zijn. In deze gevallen betekent dat dat de eerstgenoemde items zwaar en de laatstgenoemde items licht zijn. Dit lijkt misschien wat tegenintuïtief vanuit een puur fonetisch perspectief. De klemtoonanalyse heeft echter gedemonstreerd dat we geen gewichtsverschil vinden tussen de korte lax klinkers en de lange tense klinkers, ongeacht de discrepanties in tijdsduur. Hoewel de fonetiek een aantal conclusies toelaat voor fonologie, is de connectie tussen de verschillende representatieniveaus tamelijk indirect: we vinden geen één-op-één-relatie.

Ik heb laten zien dat het voorgestelde fonologische systeem de fonetische feiten van LG verklaart. Er wordt een cruciaal onderscheid gemaakt tussen fortis en lenis consonanten door een laryngeale specificatie en vervolgens door de structurele complexiteit van de segmenten. Uiteindelijk staat dit een binaire verklaring toe van fonetische overlengte in het Nederduitse (Kohler 2001).

Hiermee valt Nederduits in die categorie van talen die drie verschillende fonetische lengtegradaties hebben die teruggevoerd kunnen worden tot een binair contrast op het oppervlakteniveau (bijv. Mayo, Mixe, Centraal Frankisch). *Onderliggend* bestaat er geen kwantiteitscontrast in het Nederduitse omdat alle klinkers gewoon mono-moraïsch zijn.

Er is geen drieledig kwantiteitssysteem nodig.

References

Aertsen, Henk & Hannay, Mike & Lyall, Rod (eds.) (2004). *Words in their places: a festschrift for J. Lachlan Mackenzie*. Amsterdam: Vrije Universiteit.

Akinlabi, Akinbiyi (ed.) (1995). *Theoretical Approaches to African Linguistics*. Trenton, NJ: Africa World Press.

Allan, L.G. & Gibbon, J. (1991). Human bisection at the geometric mean. In: Learning and Motivation 22, 39-58.

Andersen, Torben (1987). The phonemic system of Agar Dinka. In: Journal of African Languages and Linguistics 9, 1-27.

Anderson, Stephen R. (1985). *Phonology in the twentieth century. Theories of Rules and Theories of Representations*. Chicago: University of Chicago Press.

Antonsen, Elmer H. (2002). *Runes and Germanic Linguistics*. Berlin / New York: Mouton de Gruyter.

Anttila, Arto (1995). *Deriving variation from grammar. A study of Finnish genitives*. Stanford University, 28 May 1995. ROA 63. Available at: <http://roa.rutgers.edu/files/63-0000/63-0000-ANTTILA-0-0.PDF> (09 September 2009).

Anttila, Arto (2006). Variation and Opacity. In: Natural Language and Linguistic Theory, Vol. 24(4), 893-944. Also available as ROA 827.

Apoussidou, Diana (2007). *The learnability of metrical phonology*. LOT Dissertation Series 148. PhD dissertation. Amsterdam: University of Amsterdam.

Appel, Heinz-Wilfried (1994). *Die antaktischen Konsonanten in niedersächsischen Dialekten. Ein Beitrag zur synchronen Phonologie des Neuniederdeutschen*. Neumünster: Wachholtz.

Archangeli, Diana & Pulleyblank, Douglas (1994). *Grounded Phonology*. Cambridge, Mass.: MIT Press.

Aronoff, Mark & Oehrle, Richard (eds.) (1984). *Language Sound Structures*. Cambridge: MIT Press.

Auer, Peter & Gilles, Peter & Spiekermann, Helmut (eds.) (2002). *Silbenschnitt und Tonakzente*. (Linguistische Arbeiten. 463). Tübingen: Niemeyer.

Baldes, Heinrich (1895). *Die Birkenfelder Mundart: I. Die Lautlehre, A. Der Vokalismus*. Beilage zum Osterprogramm des Gymnasiums zu Birkenfeld. Birkenfeld: Hoestermann.

Barry, William J. (1984). Kontrastive Vokaluntersuchung: Dithmarschen – Angeln. Eine Pilotstudie. In: Kohler, Klaus. J. & Barry, William J. (eds.) (1984). 134-191.

Barry, William & Klein, Cordula & Köser, Stephanie (1999). *Speech Production Evidence for Ambisyllabicity in German*. In: Phonus 4, pp. 87-102. Univ. Saarland: Inst. für Phonetik.

Becker, Thomas (2002): Silbenschnitt und Silbenstruktur in der deutschen Standardsprache der Gegenwart. In: Auer, Peter & Gilles, Peter & Spiekermann, Helmut (eds.), 87-101.

Beeck, Tim (1994). Die Mundart von Windbergen in Dithmarschen. Phonemquantität vor dem Hintergrund der funktionalen Satzperspektive. Unpubl. M.A. thesis. Hamburg: University of Hamburg.

Behrens, Hans (1954). Beobachtungen zur Geschichte der niederdeutschen Diphthongierung. In: Niederdeutsches Jahrbuch 77, 84-110.

Bellamy, Sidney E. (1968). *Hamburg Low German: Current status and phonology*. PhD dissertation. Austin / Texas: University of Texas.

Bender, Jan Eilhard (1971). *Die getrennte Entwicklung gleichen niederdeutschen Sprachgutes in Deutschland und Nebraska*. PhD dissertation. University of Nebraska.

Bermúdez-Otero, Ricardo (2001). *Underlyingly Nonmoraic Coda Consonants, Faithfulness, and Sympathy*. Unpubl. MS. University of Manchester, January 2001. Available at: <http://www.bermudez-otero.com/DEP-mora.pdf> (13 August 2009).

Bertinetto, Pier Marco & Loporcaro, Michele (eds.) (1991). *Certamen Phonologicum II*. Torino: Rosenberg & Selier.

Bertrán, Antonio Pamies (1999). Prosodic Typology: On the Dychotomy between *Stress-timed* and *Syllable-timed* Languages. In: Journal of Theoretical and Experimental Linguistics, Vol. 2, 103-131.

Besch, Werner & Knoop, Ulrich & Putschke, Wolfgang & Wiegand, Herbert Ernst (eds.) (1983). *Dialektologie. Ein Handbuch zur deutschen und allgemeinen Dialektforschung, Zweiter Halbband* (HSK 1.2). Berlin / New York: de Gruyter.

Bieberstedt, Andreas & Ruge, Jürgen & Schröder, Ingrid (2008). Hamburgisch – Sprachkontakt und Sprachvariation im städtischen Raum. Eine Projektskizze. In: Niederdeutsches Jahrbuch 131, 159-183.

Blevins, Juliette (1994). The Bimoraic Foot in Rotuman Phonology and Morphology. In: Oceanic Linguistics 33.2, 491–516. Honululu: University of Hawai'i Press.

Blevins, Juliette (1995). The Syllable in Phonological Theory. In: Goldsmith, John A. (ed.). 206-244.

Boersma, Paul (1998). *Functional Phonology*. PhD dissertation. Amsterdam: University of Amsterdam.

Boersma, Paul (2006). *The history of the Franconian tone contrast*. 7 April 2006. <http://www.fon.hum.uva.nl/paul/> (8 April 2006).

Boersma, Paul (2007a). *Cue constraints and their interactions in phonological perception and production*. Available at: ROA 944, <http://roa.rutgers.edu/view.php3?roa=944> (11 November 2007).

Boersma, Paul (2007b). *Two reanalyses in Franconian tonogenesis*. Talk presented at the Workshop Segments and Tone, 7.-8. June 2007, Meertens Instituut / UvA, Amsterdam. Abstract Available at: <http://www.meertens.knaw.nl/pdf/variatielinguistiek/tone/ boersma. pdf> (28 July 2009).

Boersma, Paul & Hamann, Silke (2008). *Loanword adaptation as first-language phonological perception*. Available at: ROA 975, <http://roa.rutgers.edu/view.php3> (28 January 2009).

Boersma, Paul & Weenink, David (2009). *Praat: doing phonetics by computer*. (Version 5.1.04). [Computer program Available at: <http://www.fon.hum.nl/praat/download_mac. html> (21 April 2009)].

Bolinger, D. (ed.) (1972). *Intonation*. Harmondsworth: Penguin.

Booij, Geert (1995). *The Phonology of Dutch*. Oxford: Oxford University Press.

Booij, Geert & Weijer , Jeroen van de (eds.) (1997). *Phonology in Progress - Progress in Phonology*. The Hague: Holland Academic Graphics

Botma, Bert (2004). *Phonological Aspects of Nasality: an Element-Based Dependency Approach*. LOT Dissertation Series 90. PhD dissertation. Amsterdam: University of Amsterdam.

Bradshaw, Mary (1999). *A crosslinguistic study of consonant-tone interaction*. <http://linguistics.osu.edu/research/publications/dissertations/> (15 April 2009).

Bräunlich, Margret & Neubert, Baldur & Rues, Beate (eds.) (2001). *Gesprochene Sprache – transdisziplinär. Festschrift zum 65. Geburtstag von Gottfried Meinhold*. Frankfurt, Main: Peter Lang.

Bremer, Otto (1929). Der Schleifton im Nordniedersächsischen. In: Niederdeutsches Jahrbuch 53, 1-32.

Broselow, Ellen & Su-I Chen & Marie Huffman (1997). *Syllable weight: Convergence of phonology and phonetics*. Phonology 14.1, 47-83.

Bruch, Robert (1954). *Grundlegung einer Geschichte des Luxemburgischen. Teil 3: Das Luxemburgische im westfränkischen Kreis*. Luxemburg: P. Linden.

Burnham, Jeff (1988). Mayo suprasegmentals: synchronic and diachronic considerations. In: Shipley, William (ed.) (1988). 37-52.

Burton-Roberts, Noel & Carr, Philip & Docherty, Gerard (eds.) (2000). *Phonological Knowledge: Conceptual and Empirical Issues*. Oxford: Oxford University Press.

Bye, Patrik (1997). Representing 'overlength' - Against trimoraic syllables. In: Booij, Geert & Weijer , Jeroen van de (eds.). 61-101.

Bye, Patrik (2001). *Virtual Phonology: Rule Sandwiching and Mutliple Opacity in North Saami*. PhD dissertation. Tromsø: University of Tromsø.

Bye, Patrick & Lorentz, Ove & Rice, Curt (eds.) (1996). *Papers from the 2nd Workshop on Comparative Germanic Phonology 1996*. Nordlyd. Tromsø University Working Papers on Language and Linguistics, No. 24.

Caspers, Johanneke & Heuven, Vincent J. van (1993). Effects of Timing Pressure on the Phonetic Realization of the Dutch Accent-Lending Pitch Rise and Fall. In: Phonetica 50, 161-171.

Chafe, Wallace L. (1959). Internal Reconstruction in Seneca. In: Language, Vol. 35.3, 477-495.

Chapman, Carol (1993). Überlänge in North Saxon Low German: Evidence for the metrical foot. An approach to vowel length based on the theory of metrical phonology. In: Zeitschrift für Dialektologie und Linguistik 60:2, 129-157.

Chomsky, Noam & Halle, Morris (1968). *The Sound Pattern of English*. New York: Harper & Row.

Churchward, C.M. (1940). *Rotuman Grammar and Dictionary*. Sydney: Methodist Church of Australasia.

Clements, George N. & Hume, Elizabeth V. (1995). The Internal Organisation of Speech Sounds. In: Goldsmith, John A. (ed.). 245-306.

Cohn, Abigail C. (2003). Phonological Structure and Phonetic Duration: The Role of the Mora. In: Working Papers of the Cornell Phonetics Laboratory 15, 69-100. Ithaca, N.Y.: Cornell University.

Cohn, Abigail C. & McCarthy, John J. (1998). Alignment and Parallelism in Indonesian Phonology. In: Working Papers of the Cornell Phonetics Laboratory 12, 53-137.

Cole, Jennifer & Hualde, José I. (eds.) (2007). Laboratory Phonology 9. Berlin / New York: Mouton de Gruyter.

Cook, Eung-Do (1971). Vowels and tone in Sarcee. In: Language, Vol. 47, 164-179.

Cook, Eung-Do (1975). The Verb «be» in Sarcee. Available at: <http://celia.cnrs.fr/FichExt/Am/A_03_04.pdf> (15 June 2009).

Cordes, Gerhard & Möhn, Dieter (eds.) (1983). Handbuch zur niederdeutschen Sprach- und Literaturwissenschaft. Berlin: Erich Schmidt.

DeMallie, Raymond J. (ed.) (2001). *Handbook of North American Indians. The Plains*. Vol. 13.1. Washington D.C.: Smithonian Institution.

Diedrichs, August (1886). *Unsere Selbst- und Schmelzlaute (auch die englischen) in neuem Lichte. Oder Dehnung und Brechung als solche und letztere als Verrätherin alltäglicher, vorzeitlicher und vorgeschichtlicher Wortwandlungen*. Straßburg.

Dittmaier, Heinz (1934). Die rheinische Schärfung. In: Teuthonista 10, 155-171.

Dixon, Jennifer R. Cory (1968). *Die plattdeutsche Sprechweise zweier Gewährsleute, ein Verlgeich.* State exam. thesis. University of Kiel: Kiel.

Eek, Arvo (1980). Further information on the perception of Estonian quantity. In: Estonian Papers in Phonetics 1979, 31-57.

Eek, Arvo & Meister, Einar (1997). Simple Perception Experiments on Estonian Word Prosody: Foot Structure *vs.* Segmental Quantity. In: Lehiste, Ilse & Ross, Jaan (eds.). 71-99.

Ehala, Martin (2003). Estonian Quantity: Implications for Moraic Theory. In: Nelson, Diane & Manninen, Satu (eds.). 51-80.

Elenbaas, Nine & Kager, Réne (1999). Ternary rhythm and the lapse constraint. In: Phonology 16, 273-329.

Essen, Otto v. (1957). Überlange Vokale und gedehnte Konsonanten des Hochdeutschen. In: Zeitschrift für Phonetik und allgemeine Sprachwissenschaft, Vol. 10, 239-244. Berlin: Akademie-Verlag.

Essen, Otto v. (1958). *Die Vokale der niederdeutschen Mundart von Kirchwerder*. In: Ammer, Karl et al. (Ed.): Zeitschrift für Phonetik und Allgemeine Sprachwissenschaft, Vol. 11 (1958), 105-118.

Essen, Otto v. (1964). *Kirchwerder bei Hamburg*. Lautbibliothek der deutschen Mundarten; 33 / 34, incl. audiotape. Göttingen: Vandenhoeck & Ruprecht.

Ezawa, Kennozuke & Rensch, Karl H. & Bethge, Wolfgang (eds.) (1979). *Sprache und Sprechen. Festschrift für E. Zwirner zum 80. Geburtstag*. Tübingen: Niemeyer.

Fanselow, Gisbert & Féry, Caroline (eds.) (2002). *Resolving Conflicts in Grammars: Optimality Theory in Syntax, Morphology, and Phonology*. Linguistische Berichte Sonderheft 11. Hamburg: Buske

Féry, Caroline (1996). German Foot and Word Stress in OT. In: Bye, Patrick & Lorentz, Ove & Rice, Curt (eds.). 63-96.

Féry, Caroline & Vijver, Ruben van de (eds.) (2003). *The Syllable in Optimality Theory*. Cambridge: Cambridge University Press.

Feyer, Ursula (1939). *Deutsche Mundarten: Nordniedersächsisch aus Oldenburg (Friesische Wede und Ammerland). Auf Grund von Schallplatten*. Leipzig: Harrassowitz.

Feyer, Ursula (1941). *Die Mundart des Dorfes Baden (Kreis Verden) grammatisch und phonetisch dargestellt, mit einer quantitativen Analyse der Vokale*. PhD disseration. University of Berlin. Gräfenhainichen: A. Heine.

Fikkert, Paula & Jacobs, Haike (eds.) (2003). *Development in Prosodic Systems*. Berlin / New York: Mouton de Gruyter.

Flier, Michael S. (ed.) (1983). *American Contributions to the ninth International Congress of Slavists, Kiev, September 1983, Vol. 1: Linguistics*. Columbus / Ohio: Slavica.

Fournier, Rachel (2008). *Perception of the tone contrast in East Limburgian dialects*. PhD dissertation. Nijmegen: Radboud Universiteit.

Fournier, Rachel & Verhoeven, Jo & Swerts, Marc & Gussenhoven, Carlos (2006). Perceiving word prosodic contrasts as afunction of sentence prosody in two Dutch Limburgian dialects. In: Journal of Phonetics 34, 29-48.

Fox, Anthony (2000). *Prosodic Features and Prosodic Structure. The Phonology of Suprasegmentals*. New York: Oxford University Press.

Frings, Theodor (1913). *Studien zur Dialektgeographie des Niederrheins zwischen Düsseldorf und Aachen*. Deutsche Dialektgeographie 5. Marburg.

Fukazawa, Haruka (1999). *Theoretical Implications of OCP Effects on Features in Optimality Theory*. PhD dissertation. College Park: University of Maryland. Available at: ROA 307, <http://roa.rutgers.edu/view.php3?roa=307> (8 October 2008).

Furcht, Otto (1934). *Die Mundart des Alten Landes (bei Hamburg)*. PhD dissertation. Hamburg: University of Hamburg.

Gilles, Peter (1999). *Dialektausgleich im Letzebuergeschen. Zur phonetisch-phonologischen Fokussierung einer Nationalsprache*. Tübingen: Niemeyer.

Gilles, Peter (2002). Einflüsse der Rheinischen Akzentuierung auf die segmentelle Ebene. Evidenz aus dem Luxemburgischen. In: Peter Auer, Peter Gilles & Helmut Spiekermann (eds.): Silbenschnitt und Tonakzente. Tübingen: Niemeyer (Linguistische Arbeiten. 463), 265-282.

Gilley, Leoma (2003). The feature of stress in Nilotic. In: Anyanwu, R.-J. (ed.): Frankfurter Afrikanistische Blätter, Vol. 15, 99-120.

Goeman, Ton & Taeldeman, Johan & Rem, Margit (eds.) (2006). *Taalvariatie en Corpuslinguïstiek*. Taal en Tongval 58.1. Amsterdam: Meertens Instituut.

Goldsmith, John A. (ed.) (1995). *The Handbook of Phonological Theory*. Cambridge, Mass.: Blackwell.

Goldsmith, John A. (ed.) (1999). *Phonological Theory: The Essential Readings*. Malden, Mass.: Blackwell.

Graß, Joseph (1920). *Experimentalphnetische Untersuchungen über Vokaldauer. Vorgenommen an einer ripuarischen Dorfmundart*. PhD dissertation. Hamburg: University of Hamburg.

Grijzenhout, Janet (2001). Representing nasality in consonants. In: Hall, Tracy (ed.) (2001). 177-210.

Grimm, Jacob (1822). *Deutsche Grammatik, Erster Teil*. Göttingen: Dieterichsche Buchhandlung.

Grimme, Hubert (1922). *Plattdeutsche Mundarten*. Berlin: de Gruyter.

Gussenhoven, Carlos (2000). On the origin and development of the Central Franconian tone contrast. In: Lahiri, Aditi (ed.) (2000). 215-260.

Gussenhoven, Carlos (2004). *The phonology of tone and intonantion*. Cambridge: Cambridge University Press.

Gussenhoven, Carlos (2007). A vowel height split explained: Compensatory listening and speaker control. In: Cole, Jennifer & Hualde, José I. (eds.). 145-172.

Gussenhoven, Carlos (2009). Vowel duration, syllable quantity and stress in Dutch. In: Hanson, Kristin & Inkelas, Sharon (eds.). 181-198. Available at: <http://www.ru.nl/contents/pages/314295/vowelkiparsky.pdf> (23 July 2009).

Gussenhoven, Carlos & Aarts, Flor (1999). The dialect of Maastricht. In: Journal of the International Phonetic Association, 29 (2), 155-166.

Hagberg, Lawrence R. (1988). Stress and Length in Mayo. In: Shipley, William (ed.) (1988). 361-376.

Hagberg, Lawrence R. (2006). An Autosegmental Theory of Stress. SIL e-books 3. SIL international.

Haitsma, Julia Dieterman van & Haitsma, Willard van (1976). *A Hierarchical Sketch of Mixe as spoken in San José El Paraíso*. Summer Institute of Linguistics Publications in Linguistics and Related Fields 44. Norman: Summer Institute of Linguistics of the University of Oklahoma. Available at: <http://ethnologue.com/show_work.asp?id=16762> (04 March 2009).

Hale, Mark (2011). Aspects of Rotuman Phonetics – Implications for Rotuman Phonology. Talk presented at the 19th Manchester Phonology Meeting, 19.-21. May 2011, University of Manchester.

Hale, Mark & Reiss, Charles (2000). Language as cognition. In: Burton-Roberts, Noel et al. (eds.), 161-184.

Hall, Tracy (ed.) (2001). *Distinctive Feature Theory*. Berlin, New York: de Gruyter.

Ham, William H. (2001). *Phonetic and Phonological Aspects of Geminate Timing*. New York / London: Routledge.

Hammarström, Göran (1976). *Linguistic units and items 1*. Berlin / Heidelberg / New York: Springer.

Hanhardt, Arthur M. & Obrecht, Dean H. & Babcock, William R. & Delack, John B. (1965). A Spectrographic Investigation of of the Structural Stats of *Ueberlaenge* in German Vowels. In: Language and Speech, Vol. 8, 214-218. Teddington: Kingston Press Service.

Hanson, Kristin & Inkelas, Sharon (eds.) (2009). *The nature of the word. Essays in Honor of Paul Kiparsky*. Cambridge, Mass.: MIT Press.

Hanssen, Judith E.G. (2005). *Tone and intonation in the dialect of Sittard*. Unpubl. M.A. thesis. Radboud Universiteit: Nijmegen.

Hardt, Mathias (1843). Vocalismus der Sauer-Mundart. In: *Programm des Könglich-Großherzoglichen Progymnasiums zu Echternach, herausgegebn beim Schulzse des Schuljahres 1842-43*. Trier. 1-29.

Harris, John (1990). Segmental Complexity and Phonological Government. In: Phonology 7, 255-300.

Hayes, Bruce (1981). A Metrical Theory of Stress Rules. PhD dissertation. Cambridge, Mass.: MIT.

Hayes, Bruce (1989). Compensatory lengthening in moraic phonology. In: Linguistic Inquiry 20, 253-306.

Hayes, Bruce (1991). *Metrical stress theory: principles and case studies*. Ms., UCLA.

Hayes, Bruce (1995). *Metrical Stress Theory. Principles and case studies*. Chicago / London: University of Chicago Press.

Heike, Georg (1962). Suprasegmentale Merkmale der Stadtkölner Mundart. Ein Beitrag zur "Rheinischen Schärfung". In: Phonetica 8, 147-165.

Heike, Georg (1964). *Zur Phonologie der Stadtkölner Mundart. Eine experimentelle Untersuchung der akustischen Unterscheidungsmerkmale*. Deutsche Dialektgeographie 57. Marburg: Elwert.

Heijmans, Linda (2003). The relationship between tone and vowel length in two neighboring Dutch Limburgian dialects. In: Fikkert, Paula & Jacobs, Haike (eds.). 7-45.

Heijmans, Linda & Gussenhoven, Carlos (1998). The Dutch dialect of Weert. In: Journal of the International Phonetic Association (JIPA) 28, 107-112.

Hendrickx, Jacques (1978). *Morfofonologische variantie in substantieven en adjectieven van het Weerts*. M.A. thesis. Amsterdam: Universiteit van Amsterdam.

Hermans, Ben (1982). *Het toon-aksent in het dialect van Maasbracht*. Unpubl. M.A. thesis. Amsterdam: Universiteit van Amsterdam.

Herrgen, Joachim & Lameli, Alfred & Rabanus, Stefan & Schmidt, Jürgen Erich (2001). *Dialektalität als phonetische Distanz. Ein Verfahren zur Messung standarddivergenter Sprehformen*. On-line publication. Available at: <http://www.uni.marburg.de/fb09/dsa/publikationen/dialektalitaetsmessung> (21 July 2008).

Hewlett, Nigel & Mackenzie Beck, Janet (2006). *An introduction to the science of phonetics*. New York / London: Routledge.

Hildebrandt, Bruno (1963). *Experimentalphonetische Untersuchungen zur Bestimmung und Wertung der 'durativen Funktion' akzentuierter Vokale im Nordniedersächsischen*. PhD dssertation. Hamburg: University of Hamburg.

Hinskens, Frans & Oostendorp, Marc van (2007). De palatalisering en velarisering van coronale masaal-plosief clusters in GTR. Talige, dialectgeografische en onderzoekseffecten. In: Goeman, Ton & Taeldeman, Johan & Rem, Margit (eds.) (2006). 103-122.

Hobbing, Johann (1879). *Über die Mundart von Greetsiel in Ostfriesland. Ein laut-physiologischer Versuch. I. Einleitung. Über die einzelnen Sprachlaute*. Nienburg: J. Hoffmann.

Höder, Steffen (2003). *Das Lautsystem des Altenwerder Platt. Eine phonetisch-phonologische Bestandsaufnahme*. Unpubl. term paper. Institut für Germanistik I, University of Hamburg.

Holst, Jan Hendrik (2001). *Lettische Grammatik*. Hamburg: Buske.

Honma, Takeru & Okazaki, Masao & Tabata, Toshiyuki & Tanaka, Shin-ichi (eds.) (2003). *A New Century of Phonology and Phonological Theory. A Festschrift for Professor Shosuke Haraguchi on the Occasion of His Sixtieth Birthday*. Tokyo: Kaitakusha.

Hoogshagen, Searle (1959). Three Contrastive Vowel Lengths in Mixe. In: Zeitschrift für Phonetik und Allgemeine Sprachwissenschaft Vol. 12 (1959), 111-115.

Hoole, Philip & Mooshammer, Christine (2002). Articulatory analysis of the German vowel system. In: Auer et al. (eds.), 129-152.

Hualde, José I. (1990). Compensatory lengthening in Friulian. In: Probus Vol. 2, 31-46.

Hulst, Harry van der (1985). Ambisyllabicity in Dutch. In: Bennis, Hans & Beukema, Frits (eds.): Linguistics in the Netherlands 1985, AVT Publications 1, 57-66. Amsterdam: John Benjamins.

Hung, Henrietta (1994). *The Rhythmic and Prosodic Organization of Edge Constituents*. PhD dissertation. Waltham, Mass.: Brandeis University.

Hyman, Larry (1985). *A Theory of Phonological Weight*. Dordrecht: Foris.

Idsardi, William J. (1998). Tiberian Hebrew Spirantization and Phonological Derivations. In: Linguistic Inquiry 29, 37-73. Available at: <http://www.ling.umd.edu/~idsardi/papers/1998li.pdf> (14 November 2010).

Inkelas, Sharon & Orgun, Orhan & Zoll, Cheryl (1997). The Implications of Lexical Exceptions for the Nature of Grammar. In: Roca, I. (ed.). 393-418.

Itô, Junko & Mester, Armin (1995). The Core-Periphery Structure of te Lexicon and Constraints on Reranking. In: Beckman, J. & Urbanczyk, S. & Walsh, L.: University of Massachusetts Occasional Papers in Linguistics UMOP 18, 181-209. Amherst, Mass.: GLSA.

Itô, Junko & Mester, Armin (1999). The structure of the phonological lexicon. In: Tsujimura, Natsuko (ed.). 62-100.

Itô, Junko & Mester, Armin (2003). Weak Layering and Word Binarity. In: Honma, Takeru et al. (eds.). 26-65.

Itô, Junko & Mester, Armin (2004). The Phonological Lexicon. In: McCarthy, John J. (ed.) (2004), 552-568.

Itô, Junko & Mester, Armin & Padgett, Jay (1995). Licensing and Underspecification in Optimality Theory. In: Linguistic Inquiry 26.4, 571-614.

Iverson, Gregory K. & Salmons, Joseph C. (1995). Aspiration and laryngeal representation in Germanic. In: Phonology 12, 369-396.

Iverson, Gregory K. & Salmons, Joseph C. (2003). Laryngeal enhancement in early Germanic. In: Phonology 20, 43-74.

Jany, Carmen (2006). Vowel Length and Phonation Contrast in Chuxnabán Mixe. In: Harper, Lea (ed.): Santa Barbara Papers in Linguistics 18, Proceedings from the 9th Workshop on American Indigenous Languages. University of California: Santa Barbara. Available at: <http://www.linguistics.ucsb.edu/research/papers_vol18.htm> (25 February 2009).

Jeanne, LaVerne Masayesva (1978). *Aspects of Hopi Grammar*. PhD dissertation. Massachusetts: Massachusetts Institute of Technology.

Jessen, Michael (1998). *Phonetics and Phonology of tense and lax obstruents in German*. Amsterdam / Philadelphia: John Benjamins.

Jessen, Michael & Marasek, K. & Schneider, K. & Claßen, K. (1995). Acoustic correlates of word stress and the tense/lax opposition in the vowel system of German. In: Proceedings of the XIIIth International Congress of Phonetic Sciences 13 (4), 428-431.

Jessen, Michael & Ringen, Catherine (2002). Laryngeal features in German. In: Phonology, Vol. 19, 189-218.

Joël, Judith (1966). *Paipai Phonology and Morphology*. PhD dissertation. Los Angeles: Univerity of California.

Jørgensen, Peter (1934). *Die Dithmarsische Mundart von Klaus Groths «Quickborn». Lautlehre, Formenlehre und Glossar*. Kopenhagen: Levin & Munksgaard.

Jongen, René (1967). Het fonologisch karakter van de Moresnetse sleep- en stoottoon. In: Taal en Tongval 19, 141-152.

Jongen, René (1969a). Intonation de phrase, accent de phrase, accent de mot et accentuation rhénan. In: Lingua 23, 315-326.

Jongen, René (1969b). Die Signalisation von Wort- und satzprosodischen Merkmalen (Intonation und Rheinische Akzentuierung). In: Haver, J. van (ed.): Handelingen van het XXVIIe Vlaams Filologencongres, Brussel, 8-10 April 1969. Zellik.

Jongen, René (1972a). *Phonologie der Moresneter Mundart. Eine Beschreibung der segmentalen und prosodischen Wortformdiakrise*. Assen: Van Gorcum & Comp.

Jongen, René (1972b). *Rheinische Akzentuierung und Sonstige Prosodische Erscheinungen*. Bonn: Ludwig Röhrscheid Verlag.

Kager, René (1993). Alternatives to the Iambic-Trochaic Law. In: Natural Language and Linguistic Theory 11, 381-432.

Kager, René (1995). The Metrical Theory of Word Stress. In: Goldsmith, John A. (ed.). 367-402.

Kager, René (1997). Rhythmic vowel deletion in Optimality Theory. In: Roca, Iggy (ed.). 463-499.

Kager, René (1999). *Optimality Theory*. Cambridge: Cambridge University Press.

Kahl, Heinrich & Thies, Heinrich (2002). *Der neue Saß. Plattdeutsches Wörterbuch*. Hamburg: Wachholtz.

Katerbow, Matthias & Werth, Alexander (eds.) (2010). *Beiträge zur modernen Regionalsprachenforschung*. Hildesheim: GL.

Kavitskaya, Darya (2002). *Compensatory Lengthening. Phonetics, Phonology, Diachrony*. New York / London: Routledge.

Keller, Rudolf (1961). *German Dialects. Phonology and Morphology.* Manchester: Manchester University Press.

Kehrein, Wolfgang (2008). *The birth of tonal accent(s)*. Talk presented at the Tonakzent Workshop, Marburg, 14. March 2008. Available at <http://home.medewerker.uva.nl/w.kehrein/page2.html> (24 September 2009).

Kehrein, Wolfgang (2009). *There's no tone in Cologne: against tone segment interactions in Franconian*. Unpubl. ms. Amsterdam: University of Amsterdam.

Kendall, Martha B. (1976). *Selected Problems in Yavapai Syntax: The Verde Valley Dialect.* New York: Garland.

Kim, Young-Seok (2002). On non-moraic geminates. In: Studies in Phonetics, Phonology and Morphology 8:2, 187-201.

Kingston, John (2007). The phonetics-phonology interface. In: Lacy, Paul de (ed.), 435-465.

Kingston, John & Diehl, Randy L. (1994). Phonetic Knowledge. In: Language, Vol. 70.3, 419-454.

Kiparsky, Paul (2008). *Compensatory Lengthening*. Available at: <http://www.stanford.edu/~kiparsky/Papers/newyork.syll.pdf> (06 October 2008).

Kloeke, Gesinus. (1913). *Der Vokalismus der Mundart von Finkenwärder bei Hamburg*. 11. Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten, Vol. 30 (1912). Hamburg: Lucas Gräfe & Sillem.

Köhnlein, Björn (2011). *Rule Reversal Revisited. Synchrony and diachrony of tone and prosodic structure in the Franconian dialect of Arzbach*. LOT Dissertation Series 274. PhD dissertation. Leiden: University of Leiden.

Kohbrok, Hugo (1901). *Der Lautstand des ȳm-Gebietes in Dithmarschen*. Darmstadt: G. Otto's Hofbuchdruckerei.

Kohler, Klaus J. (1984). Phonetic Explanation in Phonology: The Feature Fortis/Lenis. In: Phonetica 41, 150-174.

Kohler, Klaus J. (1986). Überlänge und Schleifton im Niederdeutschen. Zusammenfassung der Ergebnisse aus vier Dialektuntersuchungen. In: Kohler, Klaus J. et al. (eds.). 5-17.

Kohler, Klaus J. (2001). Überlänge im Niederdeutschen? In: Peters, Robert et al. (eds.). 385-402.

Kohler, Klaus. J. & Barry, William J. (eds.) (1982). Phonetische Forschung in der Niederdeutschen Dialektologie, AIPUK Vol. 17. Kiel: Univers. Kiel.

Kohler, Klaus. J. & Barry, William J. (eds.) (1984). Phonetische Forschung in der Niederdeutschen Dialektologie, AIPUK Vol. 21. Kiel: Univers. Kiel.

Kohler, Klaus J. & Tödter, Regina (1984). Experimentalphonetische Untersuchungen zur ‘Überlänge’ im Nieder- und Hochdeutschen Schleswig-Holsteins. In: Kohler, Klaus. J. & Barry, William J. (eds.). 61-131.

Kohler, Klaus J. & Tödter, Regina & Weinhold, Michael (eds.) (1986a). Phonetische Forschung in der Niederdeutschen Dialektologie, AIPUK Vol. 23. Kiel: University of Kiel.

Kohler, Klaus J. & Tödter, Regina & Weinhold, Michael (1986b). Ergänzende Untersuchungen zur 'Überlänge' in der Mundart von Haßmoor (Kreis Rendsburg-Eckernförde). In: Kohler, Klaus J. et al. (eds.). 19-116.

Kohler, Klaus J. & Tödter, Regina & Weinhold, Michael (1986c). Untersuchungen zur 'Überlänge' in den Mundarten von Brarupholz (Kreis Schleswig-Flensburg) und Windbergen (Kreis Dithmarschen). In: Kohler, Klaus J. et al. (eds.). 117-177.

Kortlandt, Frederik (2007). The Origin of the Franconian Tone Accents. In: Amsterdamer Beiträge zur älteren Germanistik 63, 1-3.

Kraehenmann, Astrid (2001). Swiss German stops: geminates all over the word. In: Phonology 18, 109-145.

Kraehenmann, Astrid (2003). *Quantity and Prosodic Asymmetries in Alemannic. Synchronic and Diachronic Perspectives*. Berlin / New York: Mouton de Gruyter.

Kraehenmann, Astrid & Lahiri, Aditi (2008). Duration differences in the articulation and acoustics of Swiss German word-initial geminate and singleton stops. In: Journal of the Acoustical Society of America, Vol. 123.6, June 2008, 4446-4455.

Krauss, Michael (ed.) (1985a). *Yupik Eskimo Prosodic Systems. Descriptive and Comparative Studies*. Alaska Native Language Center Research Papers 7, 1985. Fairbanks: University of Alaska.

Krauss, Michael (1985b). Supplementary Notes on Central Siberian Yupik Prosody. In: Krauss, Michael (ed.): *Yupik Eskimo Prosodic Systems. Descriptive and Comparative Studies*. Alaska Native Language Center Research Papers 7, 1985. Fairbanks: University of Alaska. 47-50.

Kroos, Christian & Hoole, Philip & Kühnert, Barbara & Tillmann, Hans G. (1997). Phonetic evidence for the phonological status of the tense-lax disitinction in German. In: Forschungsberichte des Instituts für Phonetik und Sprachliche Kommunikation der University of München (FIPKM) 35, 17-25.

Krull, Diana (1999). Foot isochrony in Estonian. In: *Proceedings of the XIVth ICPhS, August 2-7, San Francisco*. Berkeley, CA: University of California. 1063-1066.

Kurisu, Kazutaka (2001). *The Phonology of Morpheme Realization*. PhD dissertation. Santa Cruz: University of California. Available at: ROA 490, <http://roa.rutgers.edu/files/490-0102/490-0102-KURISU-0-0.pdf> (10 August 2009).

Lacy, Paul de (2006). *Markedness. Reduction and Preservation in Phonology*. Cambridge: Cambridge University Press.

Lacy, Paul de (ed.) (2007). *The Cambridge Handbook of Phonology*. Cambridge: Cambridge University Press.

Ladd, D.R. (2004). Segmental anchoring of pitch movements: autosegmental phonology or speech production? In: Quené, Hugo & Heuven, Vincent van (eds.). 123-132.

Lahiri, Aditi (ed.) (2000). *Analogy, levelling, markedness: Principles of change in phonology and morphology*. Berlin, New York: Mouton de Gruyter.

Langdon, Margaret (1976). The Proto-Yuman Vowel System. In: Langdon, Margaret & Silver, Shirley (eds.). 129-148.

Langdon, Margaret & Silver, Shirley (eds.) (1976). *Hokan Studies*. The Hague: Mouton.

Larsson, Hugo (1917). *Lautstand der Mundart der Gemeinde Altengamme (in den Vierlanden bei Hamburg)*. 1 Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten, Vol. 34 (1916). Hamburg: Meissner.

Lasch, Agathe (1974[2]). *Mittelniederdeutsche Grammatik*. Tübingen: Niemeyer.

Lass, Roger (1984). *Phonology. An introduction to basic concepts*. Cambridge: Cambridge University Press.

Lauf, Raphaela (1988). Veränderungen im Langvokalsystem nordniedersächsischer Ortsdialekte zwischen 1879 und 1986. In: Niederdeutsches Jahrbuch 111, 103-114.

Laven, Philipp (1858). *Gedichte in Trierischer Mundart*. Trier: Lintz.

Laver, John (1994). *Principles of Phonetics*. Cambridge: Cambridge University Press.

Lee, Juhee (2003). Lexical stratification in constraint-based grammars. In: Casillas, G. & Reimers, P. (eds.): Essex Graduate Student Papers in Language & Linguistics, Vol. 5, 76-94. Essex: Department of Language and Linguistics, University of Essex.

Leer, Jeff (1985). Evolution of Prosody in the Yupik Languages. In: Krauss, Michael (ed.). 135-157.

Lehiste, Ilse (1960). Segmental and Syllabic Quantity in Estonian. In: American Studies in Uralic Linguistics. Bloomington: Indiana University Publications. 21-82.

Lehiste, Ilse (1965). The function of quantity in Finnish and Estonian. In: Language 41.3, 447-456.

Lehiste, Ilse (1966). *Consonant Quantity and Phonological Units in Estonian*. Bloomington: Indiana University.

Lehiste, Ilse (1968). Vowel quantity in word and utterance in Estonian. In: *Congressus secundus internationalis finno-ugristarum, Helsinki 1965*. Helsinki: Societas Finno-Ugrica. 293-303.

Lehiste, Ilse (1970a). *Suprasegmentals*. Cambridge, Mass. / London: MIT Press.

Lehiste, Ilse (1970b). Diphthongs versus vowel sequences in Estonian. In: Hála, Bohuslav & Romportl, Milan & Janota, Přemysl (eds.): Proceedings of the Sixth international Congress of the Phonetic Sciences, Prague 1967. Prague: Academia. 539-545.

Lehiste, Ilse (1977). Variability in the Production of Suprasegmental Patterns. In: Sinor, Dennis (ed.). 131-139.

Lehiste, Ilse (1980). Estonian linguistics: State of the art. In: General linguistics 20.4, 149-164.

Lehiste, Ilse (1985). An Estonian Word Game and the Phonematic Status of Long Vowels. In: Linguistic Inquiry 16, 490-492.

Lehiste, Ilse (1997). The Structure of Trisyllabic Words. In: Lehiste, Ilse & Ross, Jaan (eds.). 149-164.

Lehiste, Ilse (1998). Partitive or Illative. In: Linguistica Uralica 34.3, 162-171.

Lehiste, Ilse (2003). Prosodic change in progress: from quantity language to accent language. In: Fikkert, Paula & Jacobs, Haike (eds.). 47-65.

Lehiste, Ilse & Ross, Jaan (eds.): *Estonian Prosody: Papers from a Symposium*. *Proceedings of the International Symposium on Estonian Prosody, Tallinn, Estonia, October 29-30 1996*. Tallinn: Institute of Estonian Language.

LeSourd, Philip S. (1989). *Accent and syllable structure in Passamaquoddy*. PhD dissertation. Cambridge, Massachusetts: MIT press.

Lindow, Wolfgang (1984). *Plattdeutsches Wörterbuch*. Leer: Verlag Schuster.

Lindow, Wolfgang & Möhn, Dieter & Niebaum, Hermann & Stellmacher, Dieter & Taubken, Hans & Wirrer, Jan (1998): *Niederdeutsche Grammatik*. Leer: Verlag Schuster.

Lippus, Pärtel & Pajusalu, Karl & Allik, Jüri (2007). The Tonal Component in Perception of the Estonian Quantity. In: Trouvain, Jürgen & Barry, William J. (eds.): Proceedings of the 16th International Congress of Phonetic Sciences, 6-10 August 2007, Saarbrücken. Saarbücken: University of des Saarlandes. 1049-1052.

Lohse, Maike (1977). Das Phonologische System des Plattdeutschen im westlichen Eiderstedt. In: Nordfriesisches Jahrbuch, Vol. 13, 179-185.

Lombardi, Linda (1999). Positional Faithfulness and Voicing Assimiliation in Optimality Theory. In: Natural Language & Linguistic Theory, Vol. 17.2 (1999), 267-302.

Lorentz, Ove (1996). Length and Correspondence in Scandinavian. In: Nordlyd 24, 1996. Pp. 111-128.

Lübben, August (1965). *Mittelniederdeutsches Handwörterbuch*. Darmstadt: Wissenschaftliche Buchgesellschaft.

Lunden, S.L. Anya (2006). *Weight, final lengthening and stress: A phonetic and phonological case study of Norwegian*. PhD dissertation. Santa Cruz: University of California.

Marlett, Stephen A. (1981). *The Structure of Seri*. PhD dissertation. San Diego: University of California.

Marlett, Stephen A. (1988). The syllable structure of Seri. In: International Journal of American Linguistics, Vol. 54.3, 245-278.

Marlett, Stephen A. (2003). *Surface contrast without phonemic contrast: theoretical and practical implications.* Talk presented at the Society for the Study of the Indigenous Languages of the Americas. Atlanta. Available at: <http://lengamer.org/admin/language_folders/seri/user_uploaded_files/links/File/BibliografiaElectronicaSeri.htm> (15 June 2009).

Marlett, Stephen A. (2005). A Typological Overview of the Seri Language. In: Linguistic Discovery, Vol. 3.1, 54-73.

Marlett, Stephen A. (2008). Stress, Extrametricality and the Minimal Word in Seri. In: Linguistic Discovery, Vol. 6.1, 1-14.

Marlett, Stephen A. & Herrera, F. Xavier Moreno & Astorga, Genaro G. Herrera (2005). Seri. Illustrations of the IPA. In: Journal of the International Phonetic Association, Vol. 35.1, 117-121.

Martens, Peter (2001). Niederdeutsche Dialekt-Varianten in Hamburg. In: Peters, Robert et al. (eds.). 487-503.

Martens, Carl & Martens, Peter (1965[2]). *Phonetik der deutschen Sprache*. München: Hueber.

McCarthy, John J. & Prince, Alan S. (1993). Prosodic Morphology: constraint interaction and satisfaction. *Technical Report* 3, Rutgers University Center of Cognitive Science.

McCarthy, John J. (ed.) (2004). *Optimality Theory in Phonology*.

McCarthy, John J. & Prince, Alan S. (1995a). Prosodic Morphology. In: Goldsmith, John A. (ed.). 318-366.

McCarthy, John J. & Prince, Alan S. (1995b). Faithfulness and Reduplicative Identity. In: Beckman, J. & Urbanczyk, S. & Walsh, L. (eds.): University of Massachusetts Occasional Papers in Linguistics UMOP 18, 249-384. Amherst, Mass.: GLSA.

McCarthy, John J. & Prince, Alan S. (1999). Generalized Alignment. In: Goldsmith, John A. (ed.). 102-136.

McGarrity, Laura W. (2003). *Constraints on Patterns of Primary and Secondary Stress*. PhD dissertation. Bloomington: Indiana University.

McRobbie-Utasi, Zita (2007). The instability of systems with ternary length distinctions. The Skolt Saami evidence. In: Toivonen, Ida & Nelson, Diane (eds.). 167-206.

Melinger, Alissa (2002). Foot structure and accent in Seneca. In: International Journal of American Linguistics, Vol. 68.3, 287-315.

Menzerath, Paul (1928/1929). Deutsche Vokalquantität und Dialektgeographie. In: Teuthonista 5, 208-212.

Mielke, Jeff (2008). *The Emergence of Distinctive Features*. Oxford / New York: Oxford Universiy Press.

Mooshammer, Christine (1999). Effects of stress and tenseness on the production of CVC syllables in German. In: Proceedings of the XIVth International Congress of Phonetic Sciences (ICPhS), 409-412.

Moser, Edward W. & Moser, Mary B. (1965). Consonant-vowel balance in Seri (Hokan) syllables. In: Linguistics, Vol. 16, 50-67.

Mueller, Hugo (1956). Hinweis für einen deutschen Phonologiekurs. In: Deutschunterricht für Ausländer, Vol. 6, 166-171. München: Hueber.

Munro, Pamela (1990). *The Phonetics of Vowel Length in Tolkapaya Yavapai*. Ms. Los Angeles: University of California.

Nespor, Marina & Vogel, Irene (1986). *Prosodic Phonology*. Dordrecht: Foris.

Niekerken, Walther (1935). *Das Feld und seine Bestellung im Niederdeutschen. Dargestellt auf Grund der Mundart der Ortschaften Tötensen, Leversen, Westerhof, Asendorf, Brackel, Marxen und Schmalenfelde, sämtlich belegen im Kreise Harburg, Reg.-Bez. Lüneburg*. Hamburg: Wachholtz.

Niekerken, Walther (1954). Zu den Problemen der Zweisprachigkeit im niederdeutschen Raum (mit besondere Berücksichtigung des Nordniedersächsischen). In: Niederdeutsches Jahrbuch 76 (1953), 64-76.

Nörrenberg, Konstatin (1884). Ein niederrheinisches accentgesetz. In: PBB 9, 402-412.

Ohala, John J. (1990). There is no interface between phonetics and phonology. A personal view. In: Journal of Phonetics 18, 153-171.

Ojamaa, Koit (1976). *Temporal Aspects of Phonological Quantity in Estonian*. PhD dissertation. University of Conneticut.

Olthoff, Antje (2005). *Das Niederdeutsche in Leer (Ostfriesland): phonologische Beschreibung, orthographische Darstellung und Exemplifizierung anhand einer*

Übersetzung aus 'Der kleine Prinz' von Antoine de Saint-Exupéry. Unpubl. M.A. thesis. Hamburg: University of Hamburg.

Oostendorp, Marc van (1995). *Vowel Quality and Syllable Projection*. PhD dissertation. Tilburg: Katholieke Universiteit Brabant.

Oostendorp, Marc van (1997). Lexicale variatie in optimaliteitstheorie. In: Nederlandse Taalkunde 2, 133-154.

Oostendorp, Marc van (2002). The Phonological and Morphological Status of the Prosodic Word Adjunct. In: Fanselow, Gisbert & Féry, Caroline (eds.). 209-235.

Oostendorp, Marc van (2005). Expressing Inflection Tonally. In: Catalan Journal of Linguistics 4, 107-126.

Osgood, Cornelius (ed.) (1946). *Linguistic Structure of Native America*. Viking Fund Publication in Anthropology No. 6. New York: Viking Fund.

Palgen, Helene (1931). *Kurze Lautlehre der Mundart von Echternach*. Luxemburg.

Pape, Daniel & Mooshammer, Christine (2006). Intrinsic F0 differences for German tense and lax vowels. In: Proceedings of the 7th International Seminar on Speech Production in Ubatuba, Brazil, December 13th to 15th, 2006. 271-278.

Parker, Stephen G. (2002). Quantifying the Sonority Hierarchy. PhD dissertation. Amherst: University of Massachusetts.

Peperkamp, Sharon & Vendelin, Inga & Nakamura, Kimihiro (2008). On the perceptual origin of loanword adaption: experimental evidence from Japanese. In: Phonology, Vol. 25.1, 129-164.

Peters, Robert & Pütz, Horst P. & Weber, Ulrich (eds.) (2001). *Vulpis Adolatio. Festschrift für Hubertus Menke zum 60. Geburtstag*. Heidelberg: Winter.

Peterson, Gordon E. & Lehiste, Ilse (1960). Duration of syllable nuclei in English. In: Journal of the Acoustical Society of America 32, 693-703.

Pike, Kenneth Lee (1972; 1945). The Intonation of American English. In: Bolinger, D., 53-83.

Pilch, Herbert (1966). Das Lautsystem der hochdeutschen Umgangssprache. In: Zeitschrift für Mundartforschung, Vol. 33, 247-266. Wiesbaden: Steiner.

Pöchtrager, Markus Alexander (2006). *The Structure of Length*. PhD dissertation. Wien: University of Wien.

Prehn, Maike (2007). Schwa loss and its results in LG. Tone or Overlength? In: Los, Bettelou & Koppen, Marjo van (eds.): Linguistics in the Netherlands 2007, AVT Publications 24, 187-198. Amsterdam: John Benjamins.

Prehn, Maike (2009). Swimming against the current: CVCV compensatory *shortening*. A case study of Weert Franconian. Poster presented at the 17th Manchester Phonology Meeting, 29th May 2009, University of Manchester.

Prehn, Maike (2010). *Die langen finalen Nasale im Nordniedersächsischen. Ihre Phonetik und phonologische Repräsentation*. In: Katerbow, Matthias & Werth, Alexander (eds.), 187-207.

Prieto, Pilar (1992). Compensatory lengthening by vowel and consonant loss in early Friulian. In: Catalan Working Papers in Linguistics (CWPL) 1992, 205-244. Barcelona: Free University of Barcelona.

Prince, Alan S. (1980). A metrical theory for Estonian quantity. In: Linguistic Inquiry 11:3.511-562.

Prince, Alan S. (1991). Quantitative consequences of rhythmic organization. In: Chicago Linguistic Society 26.2, 355-398.

Prince, Alan S. & Smolensky, Paul (1993/2002). *Optimality Theory: Constraint Interaction in Generative Grammar*. Available at: ROA 537, <http://roa.rutgers.edu/view.php3> (09 February 2009).

Prince, Alan S. & Smolensky, Paul (2004). *Optimality Theory. Constraint Interaction in Generative Grammar*. Oxford & Cambridge, Mass.: Blackwell.

Quené, Hugo & Heuven, Vincent van (eds.) (2004). *On speech and language: studies for Sieb G. Nooteboom*. LOT occasional series 2. Utrecht.

Rabeler, Theodor (1911). *Niederdeutscher Lautstand im Kreis Bleckede*. In: Zeitschrift f. deutsche Philologie, Vol 43, 141-202 / 320-377.

Redden, James E. (1966). Walapai I: Phonology. In: International Journal of American Linguistics 32, 1-16.

Redden, James E. (ed.) (1992). *Occasional Papers in Linguistics Number 17; Papers from the 1992 Hokan-Penutian Languages Conference and the J.P. Harrington Conference, Held at the University of California, Santa Barbara, and the Museum of Natural History, Santa Barbara, June 24-27, 1992*. Carbondale, Illinois: Department of Linguistics Southern Illinois University.

Remijsen, Bert & Gilley, Leoma (2008). Why are three-level vowel systems rare? Insights from Dinka (Luanyjang dialect). In: Journal of Phonetics 36.2, 318-344.

Remijsen, Bert & Manyang, Caguro Adong (2009). Luanyjang Dinka (Illustrations of the IPA). In: Journal of the International Phonetic Association 39.1, 113-124.

Rice, Keren D (1992). On deriving sonority: a structural account of sonority relationships. In: Phonology 9, 61-99.

Rice, Keren D. (1993). A reexamination of the feature [sonorant]: the status of 'sonorant obstruents'. In: Language, Vol 69 (1993), 308-344.

Rice, Keren D. & Avery, Peter (1993). Segmental complexity and the structure of inventories. In: Toronto Working Papers in Linguistics, Vol 12.2, 131-153.

Roberts-Kohno, Rosalind Ruth (1995). Vowel coalescence and hiatus in KiKamba. In: Akinlabi, Akinbiyi (ed.). 313-327.

Roberts-Kohno, Rosalind Ruth (2005). *Aspects of Kikamaba Phonology: Syllabification and the Tone-Syntax Interface*. ILCAA Language Monograph Series 2. Tokyo: Tokyo Institute of Foreign Studies.

Roca, Iggy (ed.) (1997). *Derivations and Constraints in Phonology*. Oxford: Oxford University Press.

Rogby, Ove (1967). *Niederdeutsch auf friesischem Substrat. Die Mundart von Westerhever in Eiderstedt (Schleswig-Holstein). Die starktonigen Vokale und die Diphthonge*. Uppsala: Almqvist & Wiksells.

Rood, David S. (1975). The implications of Wichita phonology. In: Language 51.2, 315-337.

Rood, David S. (2001). Sketch of Wichita, a Caddoan language. In: DeMallie, Raymond J. (ed.). 580-608.

Rosner, Brian S. & Pickering, John B. (1994). *Vowel Perception and Production*. Oxford Psychology Series 23. Oxford: Oxford University Press.

Ruscher, Maria D.H. (1983). On the phenomenon of Schleifton in the dialect of Heikendorf. M.A. thesis. Simon Fraser University.

Saß, Johannes (1956). *Kleines plattdeutsches Wörterbuch. Nebst Regeln für die Plattdeutsche Rechtschreibung*. Hamburg: Wacholtz.

Schmidt, Jürgen Erich (1986). *Die Mittelfränkischen Tonakzente*. Stuttgart: Steiner.

Schmidt, Jürgen Erich (2002). Die sprachhistorische Genese der mittelfränkischen Tonakzente. In: Auer, Peter et al. (eds.). 201-233.

Schmidt, Jürgen Erich & Künzel, Hermann J. (2006). Das Rätsel löst sich: Phonetik und sprachhistorische Genese der Tonakzente im Regelumkehrgebiet (Regel B). In: Vaan, Michiel de (ed.). 135-163.

Selkirk, Elisabeth O. (1984). On the major class features and syllable theory. In: Aronoff, Mark & Oehrle, Richard (eds.). 107-136.

Shaterian, Alan (1976). Yavapai [+sonorant] segments. In: Langdon, Margaret & Silver, Shirley (eds.). 87-94.

Shaterian, Alan (1983). *Yavapai Phonology and Dictionary*. PhD Dissertation. Berkeley: University of California.

Shipley, William (ed.) (1988). *In Honor of Mary Haas. From the Haas Festival Conference on Native American Linguistics*. Berlin / Amsterdam / New York: Mouton de Gruyter.

Shiraishi, Hidetoshi (2006). *Topics in Nivkh Phonology*. Groningen Dissertations in Linguistics 61. PhD dissertation. Groningen: Rijksuniversiteit.

Sievers, Heinrich (1914). *Die Mundart der Stapelholmer*. (Teildruck). Marburg. 1-96. Continued as MS, 219-509.

Sinor, Dennis (ed.) (1977). *Studies in Finno-Ugric Linguistics in Honor of Alo Raun*. Indiana University Uralic and Altaic Series, Vol. 131. Bloomington: Indiana University.

Smith, Norval & Bolognesi, Roberto & Leeuw, Frank van der & Rutten, Jean & Wit, Heleen de (1989). Apropos of the Dutch vowel system 21 years on. In: Bennis, Hans & Kemenade, Ans van (eds.): Linguistics in the Netherlands 1989, AVT Publications 6, 133-142. Dordrecht: Foris.

Smith, Norval (2004). Vowel length in Applecross Gaelic. In: Aertsen, Henk & Hannay, Mike & Lyall, Rod (eds.). 293-298.

Spiekermann, Helmut (2004): Silbenschnitt im Niederdeutschen. In: Niederdeutsches Jahrbuch 127, 123-140.

Stammerjohann, Rudolf (1914). *Die Mundart von Burg in Dithmarschen mit besonderer Berücksichtigung der Quantitätsverhältnisse*. In: Zeitschrift f. deutsche Mundarten, 54-131 / 193-225 / 289-311.

Stellmacher, Dieter (1983). Phonologie und Morphologie. In: Cordes, Gerhard & Möhn, Dieter (eds.). 238-278.

Stellmacher, Dieter (1990). *Niederdeutsche Sprache – Eine Einführung*. Frankfurt, Main: Peter Lang.

Ternes, Elmar (1981). Über Herkunft und Verbreitung der Überlänge in deutschen Dialekten. In: Phonologica 1980. Akten der Vierten Internationalen Phonologie-Tagung, Wien 29. Juni - 2. Juli 1980. Innsbrucker Beiträge zur Sprachwissenschaft, Vol. 36, 379-386.

Ternes, Elmar (2001). Ansätze einer Phonemtypologie deutscher Dialekte. In: Bräunlich, Margret et al. (eds.). 171-182.

Ternes, Elmar (2006). Tone Reversal in Franconian and Elsewhere. In: North-Western European Language Evolution (= NOWELE) 47, 91-109.

Tesar, Bruce & Smolensky, Paul (1993). *The learnability of Optimality Theory: an algorithm and some basic complexity results*. MS. Department of Computer Science & Institute of Cognitive Science, University of Colorado at Boulder. Available at: ROA 2, <http://roa.rutgers.edu/files/2-0000/2-0000-TESAR-0-0.PDF>, (19 December 2009).

Thomas, Kimberly Diane (1992). Vowel Length in Yavapai Revisited. In: Redden, James E. (ed.), 90-131.

Timberlake, Alan (1983). Compensatory lengthening in Slavic, 2: Phonetic reconstruction. In: Flier, M.S. (ed.) (1983), 293-319.

Tödter, Regina (1982). Phonetische Untersuchungen zur Vokaldauer in einem niederdeutschen Dialekt. In: Kohler, Klaus. J. & Barry, William J. (eds.), 49-93.

Topintzi, Nina (2005). Putting 'commas' at the right place: A note on crucial non-ranking in OT. In: UCL Working Papers in Linguistics 17, 83-108.

Topintzi, Nina (2006). A (not so) paradoxical instance of compensatory lengthening: Samothraki Greek and theoretical implications. In: Journal of Greek Linguistics, Vol. 7 , 71-119.

Trommer, Jochen (2008). Multiple-Feature Mutation and 'Realize Morpheme'. In: Linguistische Arbeitsberichte 87, 'Varieties of Competition', 163-182.

Trubetzkoy, Nikolaj S. (1938). *Grundzüge der Phonologie*. Travaux du Cercle Linguistique de Prague 7. Prag.

Tsujimura, Natsuko (1999). *The Handbook of Japanese Linguistics*. Malden, Mass.: Blackwell.

Vaan, Michiel de (1999): Towards an Explanation of the Franconian Tone Accents. In: Amsterdamer Beiträge zur älteren Germanistik 51, 23-44.

Vaan, Michiel de (ed.) (2006). *Germanic Tone Accents. Proceedings of the First International Workshop on Franconian Tone Accents, Leiden, 13-14 June 2003*. Stuttgart: Steiner.

Vago, Robert M. (1989). Empty consonants in the moraic phonology of Hungarian. Acta Linguistica Hungarica 39. 293-316.

Vennemann, Theo (1991). Syllable structure and syllable cut prosodies in Modern Standard German. In: Bertinetto, Pier Marco et al. (eds.), 211-244.

Verhoeven, Jo (1992). Fonetische Kenmerken van Sleep- en Stoottoon in het Dialect van Weert. In: Taal en Tongval 44.2, 140-155.

Verhoeven, Jo (ed.) (2002). *Phonetic work in progress*. Antwerpen: Universiteit Antwerpen.

Verhoeven, Jo (2002). The phonetics of tonal contrasts in Weert revisited. In: Verhoeven, Jo (ed.). 191-197.

Watson, Janet C.E. (2002). *The Phonology and Morphology of Arabic*. Oxford: Oxford Univerity Press.

Weiss, Rudolf (1976). *The Perception of Vowel Length and Quality in German: An Experimental-Phonetic Investigation*. Hamburg: Buske.

Werth, Alexander (2010). Die Mittelfränkischen Töne. Perzeptionsphonologische Grundlagen der Prosodie. PhD dissertation. Marburg: Deutscher Sprachatlas.

Whorf, Benjamin Lee. (1937). The origin of Aztec TL. In: American Anthropologist, Vol. 39, 265-274.

Whorf, Benjamin Lee (1946). The Hopi language, Toreva dialect. In: Osgood, C. (ed.). 159-183.

Wiese, Richard (1996). *The Phonology of German*. Oxford: Oxford University Press.

Wiesinger, Peter (1970). *Phonetisch-phonologische Untersuchungen zur Vokalentwicklung in den deutschen Dialekten.* Bd. 1: Die Langvokale im Hochdeutschen. Bd. 2: Die Diphthonge im Hochdeutschen. Berlin: de Gruyter.

Wiesinger, Peter (1983a). Die Einteilung der deutschen Dialekte. In: Besch, Werner et al. (eds.). 807-900.

Wiesinger, Peter (1983b). Phonologische Vokalsysteme deutscher Dialekte. Ein synchonischer und diachronischer Überblick. In: Besch, Werner et al. (eds.). 1042-1076.

Wiesinger, Peter & Raffin, Elisabeth (1982). *Bibliographie zur Grammatik der deutschen Dialekte. Laut-, Formen-, Wortbildungs- und Satzlehre 1800 bis 1980*. Bern, Frankfurt a.M.: Peter Lang.

Willkommen, Dirk (1999). *Nordstrander Platt: Phonologie des Nordstrander Platt; Niederdeutsch in multilingualer Region.* Neumünster: Wachholtz.

Winter, Werner (1979). Zur 'Überlänge' im Deutschen. In: Ezawa, Ket al. (eds.). 197-200.

Wodarz, Hans W. (1979). *Phonetische Untersuchungen zum Problem der Überlänge*. Hamburg: Buske.

Wyland Grundt, Alice (1975). Tonal Accents in Low German. In: Cogen, Cathy & Henry Thompson & Graham Thurgood & Kenneth Whistler & James Wright (eds.): Proceedings of the first annual meeting of the Berkeley Linguistics Society, February 15-17 1975. 160-169.

Yip, Moira (2002). *Tone*. Cambridge: Cambridge University Press.

Youssef, Islam (2004). *An Optimality-Theoretic Approach to Extrasyllabicity in Superheavy Syllables. A typology of Cairene Arabic, English, and Kelkar's Hindi*. Available at: <http: //www.hum.uit.no/a/youssef/Research_files/superheavy-youssef.pdf> (03 September 2008).

Zahrenhusen, Hinrich J.D. (1909). *Lautstand der Mundart von Horneburg (Hannover). I. Teil: Vokalismus*. Hannover: Geibel.

Zec, Draga (1988). Sonority constraints in prosodic structure. PhD dissertation. Palo Alto, CA: Stanford University.

Zec, Draga (2003). Prosodic Weight. In: Féry, Caroline & Vijver, Ruben van de (eds.). 123-143.

Zhang, Jie (2000). The Phonetic Basis for Tonal Melody Mapping. In: Billerey, Roger & Lillehaugen, Brook Danielle (eds.): Proceedings of the 19th West Coast Conference on Formal Linguistics, 603-616. Somerville, Mass.: Cascadilla Press.

Zimmermann, Gerhard (1998). Die "singende" Sprechmelodie im Deutschen. Der metaphorische Gebrauch des Verbums "singen" vor dem Hintergrund sprachwissenschaftlicher Befunde. In: ZGL 26, 1-16. Berlin / New York: de Gruyter.

Appendix

(A) Legend to Figure 5.
Map of linguistic publications on North Low German varieties

Alfs. : Alfstedt
Aw. : Altenwerder
Höder, Steffen (2003). *Das Lautsystem des Altenwerder Platt. Eine phonetisch-phonologische Bestandsaufnahme*. University of Hamburg: Institut für Germanistik I. (Unpublished term paper).
Prehn, Maike (2007). Schwa loss and its results in Low German. Tone or Overlength? In: Linguistics in the Netherlands 2007, 187-198.
Kw. : Kirchwerder
Essen, Otto von (1958). Die Vokale der niederdeutschen Mundart von Kirchwerder. In: Zeitschrift für Phonetik, allgemeine Sprachwissenschaft und Kommunikationsforschung 11, 105-118.
Essen, Otto von (1964). *Kirchwerder bei Hamburg*. Lautbibliothek der deutschen Mundarteb; 33/34, incl. audio tape. Göttingen: Vandenhoeck & Ruprecht.
Prehn, Maike (2007). Schwa loss and its results in Low German. Tone or Overlength? In: Linguistics in the Netherlands 2007, 187-198.

1.Föhr
Bremer, Otto (1887). Föhringer Platt. In: Jahrbuch des Vereins für niederdeutsche Sprachforschung, Vol. 12 (1886), 123-129.
2. Flensburg
Dyhr, Mogens; Zint, Ingeborg (1985). Vorüberlegungen zu einem Projekt 'Sprachvariation in Flensburg'. In: Kopenhagener Beiträge zur Germanistischen Linguistik 23, 91-104.
Wasserzieher, Ernst (1829). Flensburger Deutsch. In: Zeitschrift für deutschen Unterricht 6, 563-567.
3. Husby
Bock, Karl Nielsen (1933). *Niederdeutsch auf dänischem Substrat. Studien zur Dialektgeographie Südostschleswigs*. (DDG 34). Marburg: Elwert.
4. Gelting (Angeln), Averlak (Dithmarschen)
Barry, William J. (1984). Kontrastive Vokaluntersuchung. Dithmarschen - Angeln. Eine Pilotstudie. In: Phonetische Forschungen in der niederdeutschen Dialektologie. Kohler, Klaus. J. & Tödter, Regina & Weinhold, Michael (eds.). University of Kiel: Institut für Phonetik. 133-148.
5. Munkwolstrup
Hermannsen, L. (1929). Über die Mundart meines Heimatdorfes. In: Die Heimat 39, 217-220.
6. Satrup
Friedrichsen, P. (1872). Sprachverhältnisse zu Satrup in Angeln zum Schlusse des vorigen und im Anfang dieses Jahrhunderts. In: Zeitschrift der Gesellschaft für die Geschichte der Herzogthümer Schleswig, Holstein und Lauenburg 2, 388-391.
7. Brarupholz
Kohler, Klaus J.; Tödter, Regina; Weinhold, Michael (1986). Untersuchungen zur 'Überlänge' in den Mundarten von Brarupholz (Kreis Schleswig-Flensburg) und Windbergen (Kreis Dithmarschen). In: Phonetische Forschungen in der niederdeutschen Dialektologie. Kohler, Klaus. J. & Tödter, Regina & Weinhold, Michael (eds.). University of Kiel: Institut für Phonetik. 117-177.
8. Nordstrand
Willkommen, Dirk (1999). *Nordstrander Platt. Phonologie des Nordstrander Platt; Niederdeutsch in multilingualer Region*. Neumünster: Wachholtz.
9. Herzogtum Schleswig
Bock, Karl N. (1948). *Mittelniederdeutsch und heutiges Plattdeutsch im ehemaligen dänischen Herzogtum Schleswig. Studien zur Beleuchtung des Sprachwechsels in Angeln und Mittelschleswig*. Kopenhagen: Munksgaard.

10. Schleswig

Diercks, Willy (1994). *Niederdeutsch in der Stadt Schleswig. Zu Attitüden und zur Sprachverwendung*. (ZDL Beihefte 86). Wiesbaden: Steiner.

Jørgensen, Peter (1954). *Zum Schleswiger Niederdeutsch. Kritik und Forschung*. Kopenhagen: Munksgaard.

Laur, Wolfgang (1975). Der Infinitiv mit "und" statt "zu" im Schleswigschen. In: Muttersprache 85, 299-309.

Mensing, Otto (1938). Das Plattdeutsche in Schleswig. In: Nordelbingen 14, 15-23

11. Westerhever (Eiderstedt)

Lohse, Maike (1977). Das phonologische System des Plattdeutschen im westlichen Eiderstedt. In: Nordfriesisches Jahrbuch, Vol. 13, 179-185.

Rogby, Ove (1967). *Niederdeutsch auf friesischem Substrat. Die Mundart von Westerhever in Eiderstedt (Schleswig-Holstein). Die starktonigen Vokale und die Diphthonge*. Uppsala: Almqvist & Wiksell.

12. St. Peter (Eiderstedt), Vollerwiek (Eiderstedt)

Lohse, Maike (1977). Das phonologische System des Plattdeutschen im westlichen Eiderstedt. In: Nordfriesisches Jahrbuch, Vol. 13, 179-185.

13. Stapelholm

Sievers, Heinrich (1913). *Die Mundart der Stapelholmer*. PhD diss. Marburg.

14. Haßmoor

Kohler, Klaus J. & Tödter, Regina & Weinhold, Michael (1986b). Ergänzende Untersuchungen zur 'Überlänge' in der Mundart von Haßmoor (Kreis Rendsburg-Eckernförde). In: Phonetische Forschung in der Niederdeutschen Dialektologie (AIPUK 23). Kohler, Klaus. J. & Tödter, Regina & Weinhold, Michael (ed.). 19-116. University of Kiel: Institut für Phonetik.

15. Schinkel

Potthast-Hubold (1979). *Dialekt und Einheitssprache im Niederdeutschen. Untersuchungen am Beispiel Schinkel*. Leer. Schuster.

16. Heikendorf

Ruscher, Maria D.H (1983). *On the Phenomenon of Schleifton in the dialect of Heikendorf*. Simon Fraser University, M.A. thesis.

17. Kiel

Dixon, Jennifer R. Cory (1968). *Die plattdeutsche Sprechweise zweier Gewährsleute, ein Verlgeich.* State exam. thesis, Kiel.

Mörcke, Karen (1971). *North Saxon influence in the phonology of Standard German as spoken in Kiel*. M.A. thesis. Simon Fraser University.

Kamp, Klaus & Lindow, Wolfgang (1967). *Das Plattdeutsche in Schleswig-HolsteIn: Eine Erhebung des Statistischen Landesamtes Schleswig-Holstein:* Neumünster: Wachholtz.

18. Wesseln

Kohbrok, Hugo (1901). *Der Lautstand des žym-Gebiets im Dithmarschen*. PhD diss. Kiel, Darmstadt.

19. Heide

Jørgensen, Peter (1928/29). Formenlehre der dithmarsischen Mundart (mit Berücksichtigung der Sprache Klaus Groths). In: Teuthonista 5, 2-38.

Jørgensen, Peter (1934*). Die Dithmarsische Mundart von Klaus Groths "Quickborn". Lautlehre, Formenlehre und Glossar.* Kopenhagen: Levin & Munksgaard.

20. Windbergen

Beeck, Tim (1994). *Die Mundart von Windbergen in Dithmarschen. Phonemquantität vor dem Hintergrund der funktionalen Satzperspektive*. Unpubl. M.A. thesis. University of Hamburg.

Kohler, Klaus J.; Tödter, Regina; Weinhold, Michael (1986c). Untersuchungen zur 'Überlänge' in den Mundarten von Brarupholz (Kreis Schleswig-Flensburg) und Windbergen (Kreis Dithmarschen). In: Phonetische Forschungen in der niederdeutschen Dialektologie (AIPUK 23). Kohler, Klaus. J. & Tödter, Regina & Weinhold, Michael (eds.). 117-177. University of Kiel: Institut für Phonetik.

21. Burg (Dithmarschen)

Stammerjohann, Rudolf (1914). Die Mundart von Burg in Dithmarschen mit besonderer Berücksichtigung der Quantitätsverhältnisse. In: Zeitschrift für deutsche Mundarten 9, 54-96, 97-131, 193-225, 289-311. Waisenhaus.

22. Fahrenkrug

Jellinghaus, Hermann (1888). Mundart des Dorfes Fahrenkrug in Holstein: In: Niederdeutsches Jahrbuch 14, 53-58.

23. Hemmelsdorf
Pühn, Hans-Joachim (1956). *Ostholsteinische Mundarten zwischen Trave und Schwentine*. State exam. thesis. Marburg.
24. Lübeck
Schumann, Colmar (1907). *Der Wortschatz von Lübeck. Probe planmäßiger Durchforschung eines mundartlichen Sprachgebiets*. Trübner.
25. Otterndorf
Stellmacher, Dieter (2000). Die niederdeutsche Mundart Otterndorfs im Spiegel der Flur- und Gemarkungsnamen. In: Behne, Axel (ed.). *Otterndorf – 600 Jahre Stadtgeschichte an der Nordsee*. 53-58. Otterndorf.
26. Wewelsfleth
Hildebrandt, Bruno (1963). *Experimentalphonetische Untersuchungen zur Bestimmung und Wertung der 'durativen Funktion' akzentuierter Vokale im Nordniedersächsischen. Zugleich ein suppletorischer Beitrag zur Methodik phonetischer Lautdauerforschung*. PhD diss. Hamburg.
27. Glückstadt
Bernhardt, J. (1892; 1894). Lautstand der Glückstädter Mundart. In: Jahrbuch des Vereins für niederdeutsche Sprachforschung 18, 81-104 and 20, 1-39.
Bernhardt, J. (1903). Zur Syntax der gesprochenen Sprache. Ein Versuch. In: Jahrbuch des Vereins für niederdeutsche Sprachforschung 29, 1-25.
28. Ratzeburg
Kolz, Willy (1914). *Das Lautsystem der haupttonigen Silben des Westmecklenburgischen Dialekts*. PhD diss. Rostock, Schönberg in Mecklenburg: Lehmann & Bernhard.
29. Haseldorf
Horn, Margareta (1984). *Der holsteinische Niederelberaum. Eine dialektgeographische Untersuchung. Teil I. Textband, Teil II. Register und Karten*. Marburg: Elwert.
30. Blankenese
Sass, Johannes (1927). *Die Sprache des niederdeutschen Zimmermanns dargestellt auf Grund der Mundart von Blankenese (Holstein)*. Hamburg. Wachholtz.
31. Horneburg
Zahrenhusen, Heinrich (1909). *Lautstand der Mundart von Horneburg (Hannover). I. Teil. Vokalismus.* Hannover: Geibel.
32. Estebrügge (Altes Land)
Furcht, Otto (1934). Die Mundart des Alten Landes (bei Hamburg). In: Stader Archiv NF 24, 114-172.
33. Finkenwerder
Kloeke, Gesinus Gerhardus (1913). *Der Vokalismus der Mundart von Finkenwärder bei Hamburg.* Hamburg: Graefe & Sillem.
34. Hamburg
Auer, Peter (1998). Hamburger Phonologie. Eine variationslinguistische Skizze zur Stadtsprache der Hansestadt heute. In: ZDL (= Zeitschrift für Dialektologie und Linguistik), 65.2 (1998), 179-197. Stuttgart: Steiner.
Bellamy, Sidney Eugene (1968). *Hamburg Low German. Current Status and Phonology*. PhD diss. University of Texas at Austin.
35. Tötensen, Leversen, Westerhof, Asendorf, Brackel, Marxen,
Niekerken, Walther (1935). *Das Feld und seine Bestellung im Niederdeutschen. Dargestellt auf Grund der Ortschaften Tötensen, Leversen, Westerhof, Asendorf, Brackel, Marxen und Schmalenfelde, sämtlich belegen im Kreise Harburg, Re.-Bez. Lüneburg*. Hamburg: Wachholtz.
36. Altengamme
Larsson, Hugo (1917). *Lautstand der Mundart der Gemeinde Altengamme (in den Vierlanden bei Hamburg)*. PhD diss. Uppsala, Hamburg: Meissner.
37. Lauenburg
Heigener, Hans (1937). *Niederdeutsche Mundarten im Kreise Herzogtum Lauenburg*. Neumünster: Wachholtz.
Pirk, Kurt (1928). *Grammatik der Lauenburger Mundart. ein Beitrag zur niederdeutschen Sprache in Ostpommern*. PhD diss. Greifswald.
38. Bleckede
Rabeler, Th. (1911). Niederdeutscher Lautstand im Kreis Bleckede. In: Zeitschrift f. deutsche Philologie, Vol 43, 141-202 / 320-377.
39. Fintel
Tödter, Regina (1982). Phonetiche Untersuchungen zur Vokaldauer in einem niederdeutschen Dialekt. In: Kohler, Klaus. J. & Barry, William J. (eds.), (AIPUK 17). 49-93. University of Kiel:

Institut für Phonetik.
Kohler, Klaus J. (1986a). Überlänge und Schleifton im Niederdeutschen. Zusammenfassung der Ergebnisse aus vier Dialektuntersuchungen. Phonetische Forschung in der Niederdeutschen Dialektologie (AIPUK 23). Kohler, Klaus. J. & Tödter, Regina & Weinhold, Michael (eds.). 5-17. University of Kiel: Institut für Phonetik.
40. Ostlüneburg
Dützmann, Heinz Wilhelm (1931). *Ostlüneburgische Dialektstudien*. PhD diss. Marburg.
41. Bereich Unterweser
Stellmacher, Dieter (2005). Das Niederdeutsche an der Unterweser. In: Niederdeutsches Jahrbuch 128, 163-174.
42. Grambkermoor (Bremen)
Bollmann, Heinrich (1942). *Mundarten auf der Stader Gees*t. Oldenburg: Stalling.
43. Bremen
Bunning, Heinrich (1933). *Studien zur Geschichte der Bremischen Mundart (seit dem Untergang der mittelniederdeutschen Schriftsprache)*. In: Jahrbuch des Vereins für niederdeutsche Sprachforschung 60/61, 63-147.
Heymann, Wilhelm (1909). *Das bremische Plattdeutsch. Eine grammatische Darstellung auf sprachgeschichtlicher Grundlage*. Bremen.
Hoopmann, D. (1893). *Plattdeutsche Grammatik des niedersächsischen Dialektes. Nach den neuesten Sprachquellen aufgestellt*. Bremen: Friedrich Kaiser.
44. Baden (Kreis Verden), Beppen, Schwarme
Feyer, Ursula (1941). *Deutsche Mundarten. Die Mundart des Dorfes Baden, Kreis Verden grammatisch und phonetisch dargestellt, mit einer quantitativen Analyse der Vokale*. Leipzig.
45. Harpstedt (Kreis Syke)
Warnecke, Rudolf (1939). *Haus und Hof in der niederdeutschen Sprache zwischen Weser und Hunte*. Marburg: Elwert.
46. Heiligenbruch, Graftschaft Hoya, Grafschaft Diepholz, Barnstorf
Lüssenhoop, Hermann (1922). *Historische Dialektgeographie im Gebiete der früheren Grafschaften Hoya und Diepholz*. PhD diss. Marburg.
47. Greetsiel
Hobbing, Johann (1879). *Über die Mundart von Greetsiel in Ostfriesland. Ein lautphysiologischer Versuch. I. Einleitung. Über die einzelnen Sprachlaute*. Nienburg.
48. Campen (Ostfriesland)
Reershemius, Gertrud (2004). *Niederdeutsch in Ostfriesland. Zwischen Sprachkontakt, Sprachveränderung und Sprachwechsel*. Stuttgart: Steiner.
49. Emden
Deiter, Heinrich (1913). Niederdeutsche Sprachprobe aus Emden vom Jahre 1900. In: Zeitschrift für deutsche Mundarten 8, 271-274.
Krüger, Eduard (1843). *Übersicht der heutigen Plattdeutschen Sprache (besonders in Emden)*. Emden.
Kruse, Antje (1993). Zur Lage des Niederdeutschen im nordwestlichen Ostfriesland. Ergebnisse einer Befragung von Schülerinnen und Schülern aus Emden und Umgebung. In: Quickborn 83, 64-83.
Nörrenberg, Erich (1932). Zwei lautliche Eigentümlichkeiten der Emder Mundart. In: Niederdeutsche Studien. Festschrift für Conrad Borchling. 287-305. Neumünster.
50. Großefehn-Moorlager
Bender, Jan Eilhard (1971). *Die getrennte Entwicklung gleichen niederdeutschen Sprachgutes in Deutschland und Nebraska*. PhD diss. University of Nebraska.
51. Borgstede (Friesische Wede)
Feyer, Ursula (1937). Über die Stimmtonassimilation in niederdeutschen Mundarten. Einfluß des stimmhaften Anlauts auf vorher-gehenden Auslaut, ausgehend von Borgstede bei Varel am Jadebusen (Oldenburg). In: Archiv für Vergleichende Phonetik 1, 48-50.
Feyer, Ursula (1939). *Deutsche Mundarten. Nordniedersächsisch aus Oldenburg (Friesische Wede und Ammerland) / auf Grund von Schallplatten*. Inst. für Lautforschung an der Univ. Leipzig: Harrassowitz in Komm.
52. Moormerland - Wahrsingfehn
Remmers, Arend (1997). *Plattdeutsch in Ostfriesland. Die Mundart von Moormerland-Warsingsfehn; Lautlehre (Phonologie), Formenlehre (Morphologie), Satzlehre*

(Syntax). Leer: Sollermann.

53. Weener (Rheiderland)

Wiesenhann, Tjabe (1936). *Einführung in das ostfriesische Niederdeutsch. Leer: Schuster*. (Corrected reprint 1977).

54. Leer

Olthoff, Antje (2005). *Das Niederdeutsche in Leer (Ostfriesland). phonologische Beschreibung, orthographische Darstellung und Exemplifizierung anhand einer Übersetzung aus Der Kleine Prinz von Antoine de Saint-Exupéry*. Unpubl. M.A. thesis, Hamburg.

55. Apen

Janßen, Hans (1937). *Die Gliederung der Mundarten Ostfrieslands und der angrenzenden Gebiete*. Marburg: Elwert.

56. Elmendorf-Langebrügge

Mews, Hans-Joachim (1967). *Die Mundart des Oldenburger Ammerlandes. Historische Grammatik, Laut- und Wortgeographie*. PhD diss. Göttingen.

57. Aschhauserfeld (Ammerland)

Feyer, Ursula (1939). *Deutsche Mundarten. Nordniedersächsisch aus Oldenburg (Friesische Wede und Ammerland) / auf Grund von Schallplatten*. Inst. für Lautforschung an der Univ. Leipzig: Harrassowitz in Komm.

58. Oldenburg

Mohr, Artur von (1904). *Vocalstand des oldenburgischen Niederdeutsch auf historischer Grundlage. Ein Beitrag zur Mundartenforschung*. PhD diss., Göttingen, Norden: D. Soltau.

59. Emsland

Schönhoff, Hermann (1908). *Emsländische Grammatik. Laut- und Formenlehre der emsländischen Mundarten*. Heidelberg.

Taubken, Hans (1985). Die Mundarten der Kreise Emsland und Grafschaft Bentheim. Teil 1. Zur Laut- und Formengeographie. In: *Penners, Theodor. Emsland/Bentheim, Beiträge zur neueren Geschichte*. 271-420. Sögel: Verlag der Emsländischen Landschaft für die Landkreise Emsland und Grafschaft Bentheim e.V.

60. Lathen (Ems)

Schönhoff, Herrmann (1906). *Vokalismus der unteremsländischen Mundarten auf Grundlage des Dialektes von Lathen a. Ems*. Borna-Leipzig: Noske.

61. Hahlen

Frederking, Christian (1939). *Plattdeutsches Dorfwörterbuch des Dorfes Hahlen bei Minden in Westfalen. Wortschatz, Spruchweisheit, Volkskunde*. Bielefeld, Leipzig: Velhagen & Klasing.

62. Badbergen

Vehslage, Hermann (1908). *Die Mundart des Artlandes auf der Grundlage der Mundart des Kirchspiels Badbergen*. PhD diss., Münster, Borna-Leipzig: Noske.

63. Südliches Emsland

Borchert, Hans (1955). *Dialektgeographie des südlichen Emslandes (Kr. Lingen und Kr. Steinfurt)*. PhD diss. Marburg.

64. Lavelsloh

Schmeding, Heinrich (1937). *Die Mundart des Kirchspiels Lavelsloh und der angrenzenden Ortschaften*. Münster.

65. Windheim

Hartwig, Hermann (1927). Von der Sprache des Dorfes Windheim. In: Meyer, Wilhelm. *Ein niedersächsisches Dorf am Ende des 19. Jahrhunderts*, 239-246. Bielefeld.

(B) Speech material

Minimal pairs used in the 176 basic LG sentences of the Production Task

[riːs] ‘rice-Sg.’	*vs.*	[riiːz̯] ‘giant-Sg.’
[viːn] ‘wine-Sg.’	*vs.*	*[viiːn] ‘city of Vienna’
[veːx̯] ‘way-Sg.’	*vs.*	[veeːx̯] ‘way-Pl.’
[loːt] ‘to let-1.Sg.Pres.’	*vs.*	[looːd̯] ‘to load-1.Sg.Pres.’
[ɡroːt] ‘degree-Sg.’	*vs.*	[ɡrooːd̯] ‘just; straight’
[døːɐ] ‘door-Sg.’	*vs.*	[døøːɐ] ‘through’
*[fɑːl] ‘trap-Sg.’	*vs.*	*[fɑːl] ‘to fall-1.Sg.Pres.’
[ɑːl] ‘already’	*vs.*	*[ɑɑːl] ‘all-Nom.’
[brɛɪɣ̯] ‘letter-Sg.’	*vs.*	[brɛːɪɣ̯] ‘letter-Pl.’
[stɛɪm] ‘stone-Sg.’	*vs.*	*[steːɪn] ‘stone-Pl.’
[mɑːɪn] ‘river Main’	*vs.*	[mɑɑːɪn] ‘to mow-Inf.’

Surrogate minimal pairs

[lɛɪç] ‘bad-adj.’	*vs.*	[lɛːɪx̯] ‘to tell a lie-1.Sg.Pres.’
[lɛɪɣ̯] ‘dear-adj.’	*vs.*	[lɛːɪɣ̯] ‘darling-Sg.’
[dɛɪɣ̯] ‘thieve-Sg.’	*vs.*	[dɛːɪɣ̯] ‘thieve-Pl.’
[mɛot] ‘courage-Sg.’	*vs.*	[mɛoːd̯] ‘fashion-Sg.’
[blɔɪt] ‘to bloom-3.Sg.Pres.’	*vs.*	[blɔːɪt] ‘shy-adj.’
[krɑːm] ‘stuff-Sg.coll.’	*vs.*	[krɑːmm̩] ‘to rummage-Inf./1.3.Pl.Pres.’
*[nɑːt] ‘seam-Sg.’	*vs.*	*[nɑɑːt] ‘to approach-3.Sg.Pres.’

Supplementary recordings of isolated speech items

closed V	[rɪt] ‘to ride-3.Sg.Pret.’ [riːt] ‘to rip-1.Sg.Pres.’ [riiːd̯] ‘to ride-1.Sg.Pres.’	[vɪt] ‘white’ [viːt] ‘wide’ [viiːz̯] ‘wise; manner’	[priːz̯] ‘price-Sg.’ [priiːz̯] ‘price-Pl.’
	[dɪk] ‘thick’ [deːk] ‘blanket-Sg.’	[zɪt] ‘to sit-3.Sg.Pres.’ [ziːt] ‘side-Sg.’ [ziiːd̯] ‘silk-Sg.’	[miːn] ‘my-Poss.Pron.’ *[miiːn] ‘(coal-)mine-Sg.’ [miːnn̩] ‘(coal-)mine-Pl.’ [sviːn] ‘pig-Sg.’ *[sviiːn] ‘pig-Pl.’
	[bruːt] ‘bride-Sg.’ [brɛot] ‘bread-Sg.’ [brɛoːt] ‘to brew-3.Sg.Pres.’	[huːs] ‘house-Nom.Sg.’ [huuːz̯] ‘house-Dat.Sg.’ [hyyːz̯] ‘house-Pl.’	[muːl] ‘mouth-Sg.’ *[uuːl] ‘owl-Sg.’
		[duuːɣ̯] ‘pigeon-Sg.’	[duːnn̩] ‘down feather-Pl.’ *[duuːn] ‘drunk’
	[hʏt] ‘cottage-Sg.’ [hyːt] ‘today’	[lʏt] ‘little’ [lyyːd̯] ‘people-Pl.tantum’	[rʏs] ‘rust-Sg.’ [ryyːz̯] ‘bow net-Sg.’

mid V	[brɛt] ‘plank-Sg.’ [breː] ‘plank-Pl.’ [vɛit] ‘to know-3.Sg.Pres.’	[heːn] ‘hen-Sg.’ [dɛil] ‘part-Sg.’ *[dɛːil] ‘hallway-Sg.’	[bɛin] ‘leg-Sg.’ *[bɛːin] ‘leg-Pl.’
	[stroːt] ‘street-Sg.’ [foʊt] ‘foot-Sg.’ [zoːk] ‘thing-Sg.’ [doːf] ‘deaf’ [døːp] ‘baptism-Sg.’	[ʃoːl] ‘scarf-Sg.’ [ʃoːl] ‘shallow’ *[ʃooːl] ‘bowl-Sg.’	[boʊm] ‘tree-Sg.’ *[bɔiːm] ‘tree-Pl.’ [droʊm] ‘dream- Sg.’ *[drøøːm] ‘dream-Pl.’
open V	[dax] ‘day-Nom.Sg.’ [dooːx] ‘day-Pl.’	[klɑːot] ‘to steal-3.Sg.Pres.Perf.’	[frɑːɪd̥] ‘joy-Sg.’ [vɑːɪt] ‘meadow-Sg.’ [gɑːɪt] ‘to go-3.Sg.Pres.’ [bɑːɪd̥] ‘both’
Pre-geminate V	[vɪl] ‘will-Sg.’ < MLG *wille*, OSax. *willio* [mʏk] ‘mosquito-Sg.’ < MLG *mugge*, OSax. *muggia* [zʏn] ‘sun-Sg.’ < MLG *sunne* [pan] ‘pan-Sg.’ < MLG *panne*, OSax. *panna* [dan] ‘fir-Sg.’ < MLG *danne*, OHG *tanna* [kan] ‘can-3.Sg.Pres.’ [kann̥] ‘jug-Sg.’		

(C) Informants

Pilot test group

The three informants of the pilot test group are all L2 speakers of LG who do not use it actively in everyday life. They do, however, have passive language competence and were therefore chosen to test the experimental setup of the perception test.

PT1 is a male informant, age 75, originally from the city of Buchholz, some 40 km south of Hamburg. His L1 is Standard High German, his L2 is Low German (age 4-8, and 14-17), which he does not use actively in everyday life. He is, however, a competent listener and is used for a pilot test of the experiment.

PT2 is a female informant, age 66, originally from the city of Neumünster, some 40 km north of Hamburg. Her L1 is Standard High German, her L2 is Low German, which she does not use in every day life. She is a competent listener and is thus also used for pre-testing the experiment.

PT3 is a female informant, age 75, from the city of Hamburg, where she has lived all her life. Her L1 is Standard High German, her L2 is Low German, which she did not learn form her parents but in the schoolyard. She claims not to use LG in every day life, although she translates HG poems to LG for her website (using a dictionary from time to time). The LG dialects are basically interchangeable from her point of view, being very similar to each other. She is, however, a competent listener, making her a suitable candidate for the perception pilot test.

Kirchwerder

Only two informants resident in the village of Kirchwerder (Kw.) participated in the study. This is the reason why only the Production Task described below in section 2.4 was conducted. Participants for the Perception Task were not obtained.

The informant I.1.Kw, age 74, has lived in her birthplace in Kirchwerder all her life. Her L1 is the local variety of LG, and she learned Standard German only when she came to school. She is a highly proficient speaker of the Kw. variety of LG, using it frequently and on a regular basis with family, friends and neighbors. Her speech is therefore likely to be prototypical of the dialect. It was taken as the point of reference with respect to pitch movements.

The second informant I.2.Kw, age 77, was born in Neuengamme and has lived in Kirchwerder for the past 34 years. His L1 is Standard German. He acquired the LG variety of the Vierlande area[330] as an L2 from friends in the school yard and from colleagues. He actively uses LG in communication with family and friends.

Altenwerder

16 out of the 17 informants of Altenwerder Low German were born and raised in Altenwerder and have the local dialect as L1. The mean age of the informants who joined the tests is 65.59 years.

Informant I.1.Aw, age 83, lived in Altenwerder until 1977. She is a proficient speaker of the dialect and uses it frequently not only with friends and family, but also with neighbors and strangers. Because of her age she is slightly hard of hearing. Informant I.1.Aw provided the production data for the Perception test together with informants I.2.Aw and I.3.Aw.

Informant I.2.Aw, age 79, is equally proficient in her dialect use as I.1, and speaks Low German actively with family and friends. She lived in Altenwerder until 1973.

Informant I.3.Aw / III.4.Aw, age 60, is the daughter of I.2. She is also a competent speaker of the Altenwerder dialect, having lived in the village until 1976. She uses Low German with family and friends, and also teaches Low German classes in elementary school.

Informant II.1.Aw, age 62, was raised in Altenwerder. He is a proficient speaker of the dialect, though he only uses it with friends.

Informant II.2.Aw, age 60, is the daughter of II.5 and III.5. She was born and raised in Altenwerder, and moved in 1973; first to Finkenwerder, later to Rosengarten. She actively uses the dialect with her friends and with her parents, but not with the rest of the family.

Informant II.3.Aw, age 60, is a proficient and enthusiastic speaker of the Altenwerder dialect. She was raised in Altenwerder and moved to Langenbek around 1975.

[330] A neighboring dialect slightly different from Kirchwerder with respect to some vowel qualities. This is of no further concern here.

II.4.Aw, age 56, is the son of II.5.Aw and III.5.Aw. He was raised in Altenwerder and lived there until 1976. He speaks Low German only with his parents.

Informants II.5.Aw, age 78, is hard of hearing, but she stated to be capable of distinguishing items with the help of her hearing device. She was born in 1927 in Altenwerder and raised there. Due to the relocation process, she moved in 1976. She actively uses Low German in family conversations and with friends.

II.6.Aw, age 44, is the daughter of III.6.Aw. She lived in Altenwerder until 1968, when she was age 5. She only uses the dialect in family context, especially with her mother.

Informant II.7.Aw, age 59, was born and raised in Altenwerder. She lived there for 21 years until 1969. She speaks the dialect on a regular basis with friends and famliy.

Informant III.1.Aw, age 30, belongs to the younger generation of LG informants and is the daughter of II.1. She states not to be able to actively use LG, but to have passive (listening) competence in the dialect. Her grandparents talked to her in Altenwerder Low German. Her L1 is Standard High German, her first L2 is Altenwerder LG, which she only scarcely uses with her grandparents.

III.2.Aw, age 59, was raised in Altenwerder, from where she moved to Bergedorf around 1975. She actively uses the dialect with her friends, but not with her family.

III.3.Aw, age 55, was born in Hamburg and raised in Altenwerder. She lived there from 1962 until the relocation in 1978. She speaks the dialect with her family and friends.

III.5.Aw, age 82, is the husband of II.5.Aw. He was born and raised in Altenwerder, where he lived until 1976. He mainly uses Low German in daily conversations. The local dialect of Rosengarten has had some influence on his pronunciation, as he asserts.

Informant III.6.Aw, age 79, is a very proficient speaker of the Altenwerder dialect. The informants II.5.Aw and III.5.Aw referred to her as being ‘the best speaker available’. She was born and raised in Altenwerder and lived in the village from 1927 until 1968. She actively uses Low German with family and friends. Informant III.6.Aw has a tendency to speak with creaky voice and a distinct amount of nasality. She used to be a teacher in kindergarten, where she only talked Low German to the children. This amounts to her claim not to be able to talk to toddlers in Standard High German. Her data shows rather strong tendencies to exaggerate certain aspects of the language so as to make things especially clear for the interviewer – just like mothers would do while talking to small children (*motherese*). We will see later that this results in rather exceptional speech recordings, and thus the need to treat her data separately from the remainder of the Aw. speakers.

III.7.Aw, age 51, is the son of informant III.6.Aw He was born in Altenwerder and lived there until 1968. He still uses the dialect, although mainly restricted to his family.

III.8.Aw, age 59, was born and raised in Altenwerder, where she lived until 1969. She regularly uses the dialect with her family and her friends.

Alfstedt

14 of the 22 Alfstedt informants were born and/or raised in Alfstedt. The remaining 8 informants were born and raised within a radius of 3 km to 38 km. They use LG actively on a daily basis. The mean age of the informants who participated in the recordings and the listening experiment is 60.46 years.

The informant I.1.As, age 28, belongs to the younger generation of LG speakers and claims that he is not as proficient in the language use as his parents and grandparents are. He learned Low German as an L2 from his family (grandparents) and neighbors.

II.1.As, age 51, learned Low German and Standard German simultaneously as L1. She has lived in Alfstedt all her life.

II.2.As, age 69, has a hearing device. He has lived in Alfstedt all his life and is a very proficient speaker of the local dialect.

Informant II.3.As, age 51, is very educated in the dialect, having co-published books on / in the dialect and giving readings on radio broadcasting (Radio Bremen). He learned Low German as an L2 from friends, neighbors and his family. He has lived in Alfstedt almost all of his life.

II.4.As, age 54, is together with informants II.5.As, II.7.As, III.3.As, and III.6.As involved in the club 'Alfster Heimatfrünn e.V.' on an honorary basis. Amongst others, they are teaching Low German in the 1st to 4th grade in the elementary school of Alfstedt / Ebersdorf. She has a high interest in Low German in general, and the local dialect in particular. She has lived in Alfstedt some 30 years.

II.5.As, age 68, has lived in Alfstedt for all her life and is involved in all kinds of activities around Low German such as a Low German theatre group, local costume group, and traditional dancing group. Accordingly, she is highly interested in the Low German language.

II.6.As, age 67, has lived in Alfstedt most of his life. He speaks Low German actively with family and friends. Before he went into retirement, he also used it with colleagues in Bremen and Bremervörde.

Informant II.7.As, age 64, has lived in Alfstedt for most of her life. She is a competent speaker of Low German.

II.8.As, age 78, has lived in Alfstedt all his life. He is hard of hearing on his left ear but has no hearing device. He states that he rarely uses Standard High German.

II.9.As, age 57, was born in Bremervörde. She has lived in Alfstedt for some 30 years and asserts that she has almost completely adopted the local dialect.

II.10.As, age 50, has lived in Alfstedt all his life. His L1 is Standard High German. He has learned Low German as an L2 from friends and neighbors, but not his family. He has noticed a strong increase of his own interest in the dialect since his 30th.

III.1.As, age 53, has Low German as L2, having learned it from family and friends. He has lived in Alfstedt almost all his life and is the husband of II.1.As.

III.2.As, age 69, has lived in Alfstedt all his life. He is a very competent speaker of the local variety.

III.3.As, age 65, has lived in Alfstedt all her life. She has a strong interest in Low German.

III.4.As, age 68, has lived in Alfstedt all his life. He as well is a proficient speaker of Alfstedt Low German and the husband of III.3.As.

III.5.As, age 57, has lived in Alfstedt for some 35 years and teaches Low German in elementary school.

III.6.As age 63, has lived in Alfstedt for approx. 35 years and is a competent and enthousiastic speaker of Low German. She is the wife of II.6.As.

III.7.As age 72, has lived in Alfstedt all his life and is a very capable and highly motivated speaker of the dialect. He has a strong interest in Low German, and is the husband of II.7.As.

III.8.As, age 61, has lived in Alfstedt almost all of his life. He is the husband of II.9.As. He is a proficient speaker of the dialect.

III.9.As, age 68, is a very proficient speaker of Alfstedt Low German, having lived in the village all of his life. He has a hearing device.

III.10.As, age 57, has lived in Alfstedt all her life and is a proficient speaker of the local dialect. She is very interested in Low German.

III.11.As, age 60, has lived in Alfstedt for some 35 years. He is a competent speaker of Low German and familiar with Alfstedt Low German. He asserts, however, that he is not a speaker of this variety. He is the husband of III.10.As.

(D) Perception Test details

Praat scripts generating artificial speech items

Manipulation of ELD 2-items to ELD 3-items

```
##############################################################################
##This script generates durational manipulations and F0 manipulations of a given sound by      ##
##lengthening automatically the vowel V from normal ELD 2 duration to normal ELD 3             ##
##duration. The manipulated sound files are listed from 1 (original ELD 2 duration) to 3 (ELD 3  ##
##duration, long) in the object window. The F0 pattern of originally LG ELD 2 words is changed ##
##optionally towards a generalized Acc.1, Acc.1.5 or Acc.2 pitch pattern.                       ##
##Before running the script, one needs to create a TextGrid of the sound, defining the vowel   ##
##segment and naming it V.                                                                      ##
##For the manipulations, we select the first sound file as well as the first TextGrid in the object  ##
## window.                                                                                      ##
##############################################################################
form Manipulations Accent 1 getting longer
  positive Minimum_relative_Dauer 1.0
  positive Schrittgroesse_relative_Dauer 0.33
  natural Anzahl_relativen_Dauern 3
  choice Pitch_Accent 1
        option Accent1
        option Accent1.5
        option Accent2
  choice Gender 2
        option Male
        option Female
endform
select all
```

```
sound = selected ("Sound", 1)
textgrid = selected ("TextGrid", 1)
if gender$ = "Female"
   f0min = 120
   f0max = 400
else
   f0min = 75
   f0max = 300
endif
select textgrid
text$ = Get label of interval... 1 2
if text$ <> "V"
  exit Keinen V gefunden
endif
tmin = Get starting point... 1 2
tmax = Get end point... 1 2
duration = Get duration
select sound
soundName$ = selected$ ()
To Manipulation... 0.01 f0min f0max
manip = selected ("Manipulation")
pitchTier = Extract pitch tier
f0 = Get value at time... tmin
Remove points between... tmin tmax

if pitch_Accent$ = "Accent1"
   Add point... tmin f0*1.05
   Add point... 0.85*tmin+0.15*tmax f0*1.15
   Add point... 0.65*tmin+0.35*tmax f0*1.125
   Add point... 0.55*tmin+0.45*tmax f0*1.075
   Add point... 0.4*tmin+0.6*tmax f0*0.9
   Add point... 0.2*tmin+0.8*tmax f0*0.8
   Add point... tmax f0*0.8
elsif pitch_Accent$ = "Accent1.5"
   Add point... tmin f0*1.025
   Add point... 0.9*tmin+0.1*tmax f0*1.15
   Add point... 0.775*tmin+0.225*tmax f0*1.1375
   Add point... 0.55*tmin+0.45*tmax f0*1.2625
   Add point... 0.3875*tmin+0.6125*tmax f0*0.95
   Add point... 0.2*tmin+0.9*tmax f0*0.8
   Add point... tmax f0*0.775
else
   Add point... tmin f0*0.925
   Add point... 0.95*tmin+0.05*tmax f0*0.95
   Add point... 0.75*tmin+0.25*tmax f0*1.05
   Add point... 0.55*tmin+0.45*tmax f0*1.125
   Add point... 0.35*tmin+0.65*tmax f0*1.175
   Add point... 0.2*tmin+0.8*tmax f0*0.95
   Add point... tmax f0*0.9
endif
plus manip
Replace pitch tier

for i from 1 to anzahl_relativen_Dauern
   relativeDauer = minimum_relative_Dauer + (i - 1) * schrittgroesse_relative_Dauer
   Create DurationTier... Dauer 0 duration
   Add point... tmin-0.000001 1.0
   Add point... tmin+0.000001 relativeDauer
   Add point... tmax-0.000001 relativeDauer
```

```
   Add point... tmax+0.000001 1.0
   plus manip
   Replace duration tier
   select manip
   Get resynthesis (overlap-add)
   absoluteDauer = (tmax-tmin) * relativeDauer * 1000
   printline 'absoluteDauer' 'soundName$'_'pitch_Accent$'_dur'i'
   select DurationTier Dauer
   Remove
endfor
select PitchTier untitled
Remove
select sound
plus textgrid
```

Manipulation of ELD 3-items to ELD 2-items

```
##############################################################################
##This script generates durational manipulations and F0 manipulations of a given sound by    ##
##shortening automatically the vowel V from normal ELD 3 duration to normal ELD 2 duration.  ##
##The manipulated sound files are listed from 1 (original ELD 3 duration) to 3 (ELD 2 duration,  ##
##short) in the object window. The F0 pattern of original LG ELD 3 words is changed optionally  ##
##towards a generalized Acc.1, Acc.1.5 or Acc.2 pitch pattern.                              ##
##Before running the script, one needs to create a TextGrid of the sound, defining the vowel   ##
##segment and naming it V.                                                                  ##
##For the manipulations, we select the first sound file as well as the first TextGrid in the object  ##
## window.                                                                                  ##
##############################################################################

form Manipulations Accent 2 getting shorter
   positive Maximum_relative_Dauer 1.2
   positive Schrittgroesse_relative_Dauer 0.22
   natural Anzahl_relativen_Dauern 3
   choice Pitch_Accent 1
         option Accent1
         option Accent1.5
         option Accent2
   choice Gender 2
         option Male
         option Female
endform
select all
sound = selected ("Sound", 1)
textgrid = selected ("TextGrid", 1)
if gender$ = "Female"
   f0min = 120
   f0max = 400
else
   f0min = 75
   f0max = 300
endif
select textgrid
text$ = Get label of interval... 1 2
if text$ <> "V"
  exit Kein V gefunden
endif
tmin = Get starting point... 1 2
tmax = Get end point... 1 2
duration = Get duration
```

```
select sound
soundName$ = selected$ ()
To Manipulation... 0.01 f0min f0max
manip = selected ("Manipulation")
pitchTier = Extract pitch tier
f0 = Get value at time... tmin
Remove points between... tmin tmax

if pitch_Accent$ = "Accent1"
   Add point... tmin f0*1.05
   Add point... 0.85*tmin+0.15*tmax f0*1.15
   Add point... 0.65*tmin+0.35*tmax f0*1.125
   Add point... 0.55*tmin+0.45*tmax f0*1.075
   Add point... 0.4*tmin+0.6*tmax f0*0.9
   Add point... 0.2*tmin+0.8*tmax f0*0.8
   Add point... tmax f0*0.8
elsif pitch_Accent$ = "Accent1.5"
   Add point... tmin f0*1.025
   Add point... 0.9*tmin+0.1*tmax f0*1.15
   Add point... 0.775*tmin+0.225*tmax f0*1.1375
   Add point... 0.55*tmin+0.45*tmax f0*1.2625
   Add point... 0.3875*tmin+0.6125*tmax f0*0.95
   Add point... 0.2*tmin+0.9*tmax f0*0.8
   Add point... tmax f0*0.775
else
   Add point... tmin f0
   Add point... 0.95*tmin+0.05*tmax f0
   Add point... 0.9*tmin+0.1*tmax f0*1.15
   Add point... 0.55*tmin+0.45*tmax f0*1.45
   Add point... 0.375*tmin+0.625*tmax f0
   Add point... 0.2*tmin+0.8*tmax f0*0.8
   Add point... tmax f0*0.75
endif
plus manip
Replace pitch tier

for i from 1 to anzahl_relativen_Dauern
   relativeDauer = maximum_relative_Dauer - (i - 1) * schrittgroesse_relative_Dauer
   Create DurationTier... Dauer 0 duration
   Add point... tmin-0.000001 1.0
   Add point... tmin+0.000001 relativeDauer
   Add point... tmax-0.000001 relativeDauer
   Add point... tmax+0.000001 1.0
   plus manip
   Replace duration tier
   select manip
   Get resynthesis (overlap-add)
   absoluteDauer = (tmax-tmin) * relativeDauer * 1000
   printline 'absoluteDauer' 'soundName$'_'pitch_Accent$'_dur'i'
   select DurationTier Dauer
   Remove
endfor
select sound
plus textgrid
```

Altenwerder Perception Test

The first informant (II.1.Aw) showed one peculiarity: he had particular difficulties choosing between *schon* ‘already’ *vs. alle* ‘all’. The interviewer interpreted this as

being orthographically influenced behavior and thus changed the textualization for ‘already’ from *schon* into *al (schon)*. As a result, the other informant did not resemble informant II.1.Aw’s judgment problems.

Informant II.2.Aw conducted the test parallel to III.1.Aw. She was very interested and listened carefully to every stimulus. She worked on the experiment for 35 minutes.

Informant II.3.Aw was very attentive in her judgments. Her experiment took the full 45 minutes, since she often used the repeat-button and thoroughly decided between the tokens.

Informant III.1.Aw occasionally repeated stimuli and listened very carefully. The test took her 30 minutes.

Informant III.2.Aw, however, has to be excluded from the evaluation, since she repeatedly chose a token before having listened to the actual stimulus. Additionally, she habitually chose for only one category of words, i.e. the ELD 2 *vs*. TA1 forms. The experiment took in result approximately 20 minutes.

Informant III.3.Aw and informant III.4.Aw both only used one of the offered pauses and never listened to a stimulus twice. They are in the middle range of the experiment duration with approximately 35 minutes each.

The third session was conducted with the informants II.4.Aw, II.5.Aw, and III.5.Aw. The informants II.4.Aw and II.5.Aw did the Experiment II., informant III.5.Aw did the Experiment III. Each of the experiments took approximately 35 minutes.

Speaker III.6.Aw performed the fourth test session. She listened thoroughly to the stimuli, occasionally repeating the sentences, and used three of the four pauses offered during the experiment. This task took approximately 40 minutes in total.

Informant III.7.Aw did the fifth experiment session. He was very careful in his choices, took every pause offered, and often used the repeat-button to listen to the stimulus a second time.

Informant II.6.Aw conducted the sixth session. She also was very attentive in her judgments, took two of the offered pauses and occasionally repeated some sentences. The Perception Task took her 30 minutes.

The seventh and thus final interview was conducted at the house of informant II.7.Aw, where III.8.Aw joined the test. II.7.Aw was careful about her choices but rarely repeated a stimulus. She used two of the pauses for questions and comments. She worked on the experiment for 35 minutes.

Informant III.8.Aw felt in a hurry to get through the experiment since a meeting with her friends was held in parallel. She had some difficulties hearing some of the stimuli due to noise. Despite these unfavorable circumstances she worked rather concentrated with only little distractions, and she made thorough choices. She used one of the pauses to comment on the stimuli and exchange experiences with her friends, who attended the first interview session. The experiment took her 30 minutes in total.

Alfstedt Perception Test

Informant II.1.As conducted the first test series in Alfstedt. She listened to the sentences carefully and rarely repeated a stimulus. The informant used two of the given pauses and worked on the test for approx. 30 minutes.

Informant II.2.As was tested in a quiet room in his house. He has a hearing device and stated that no difference exists between the words 'wine' *vs*. 'Vienna' and 'stone-Sg.' *vs*. 'stone-Pl.'. The test took him 35 minutes with two pauses being used and occasional repetitions of a stimulus.

The Perception Test with informant II.3.As was conducted in a quiet room in his house. The experiment took 30 minutes with no pause being used. He frequently repeated stimuli and listened very carefully to the items.

Informant II.4.As did the Perception Test at the community hall in Alfstedt. She was an enthusiastic participant, who listened thoroughly to each sentence. She used two of the four offered pauses. The experiment took her 30 minutes.

Informant II.5.As was equally enthusiastic and interested in the experiment as II.4.As. She as well was tested at the community hall, and stated that 'wine' vs. 'Vienna' is identical in the dialect. II.5.As had some difficulties in hearing the sentences (she has no hearing device) and complained that the intensity was too low. She, thus, repeated most of the sentences two to three times before making her choice. She used three pauses and the experiment took her 40 minutes.

The informant II.6.As participated in the experiment at the community hall. He stated that 'stone-Sg.' *vs*. 'stone-Pl.' is identical in the dialect. He used one of the pauses and rarely repeated a sentence. The experiment took him 35 minutes. Although he had a strong tendency to choose only one of the categories, he nevertheless judged carefully. His data is, thus, included in the analysis.

Informant II.7.As did the Perception Test also in the community hall in Alfstedt. Informant II.5.As had explained the experiment to her already earlier. She used one of the pauses and rarely repeated a sentence. She worked on the experiment for approx. 35 minutes.

Informant II.8.As repeated almost every stimulus at least once. Additionally, he often commented on the stimuli and used two of the pauses for copious annotations. He pointed out that all the minimal pairs containing a final sonorant are indistinguishable, relying in for their lexical or grammatical contrast solely on the semantic context. Furthermore, he stated that the difference between 'rice' and 'giant' lies within the final fricative: 'giant' comprises a longer fricative as compared to 'rice'. The test took him 50 minutes.

Participant II.9.As on the other hand performed the test without any pause and only two repetitions of a stimulus. She worked on the task for 25 minutes.

The last informant of experiment II.'s test series was II.10.As .The test took him 25 minutes in total. He used none of the pauses and repeated only very few stimuli. He appeared to be thorough in his judgments of the minimal pairs 'stone-Sg.' *vs*. 'stone-Pl.', 'rice' *vs*. 'giant', and 'wine' *vs*. 'Vienna', yet not perceiving a difference. Also, he chose only for one word category in the remaining three minimal pairs. His data is therefore excluded from the analysis.

Informant III.1.As participated also in the first test series. He was careful in his choices and repreated the stimuli rather frequently. The experiment took him 35 minutes.

The informant III.2.As was interviewed in the quiet living room of his house in Alfstedt. He was very interested in the experiment and thorough in his choices. He used three of the pauses and occasionally repeated a sentence. The Perception Test took him 40 minutes.

Both informant III.3.As and informant III.4.As were tested in the community hall in Alfstedt. They had no remarks on the experiment, used two pauses and worked on the test for 35 minutes. The judgments of informant III.3.As, however, were limited to one category of lexemes only (i.e. the ELD 2 items of the pairs 'already' *vs*. 'all', and 'stone-Sg.' *vs*. 'stone-Pl.', and the ELD 3 items of the pairs 'house-Nom.' *vs*. 'house-Dat.', 'river Main' *vs*. 'to mow', 'rice' *vs*. 'giant', and 'wine' *vs*. 'Vienna'), which is why her data is excluded from the analysis.

Another informant interviewed at the community hall was informant III.5.As. She is educated in the dialect, teaching a facultative dialect class in school. She stated that the words 'wine' *vs*. 'Vienna' are identical. She used one pause and the experiment took her 25 minutes. Similar to informant III.3.As, she started choosing for only one class of items after the first 50 stimuli (i.e. she chose only for the ELD 2 item of a pair, except for the 'river Main' *vs*. 'to mow' cases where she chose for the ELD 3 item). As a result, her data is excluded from the analysis as well.

This is also true for informant III.6.As. She made no 'real' judgments but chose constantly for only one word category (i.e. the ELD 3 items of 'already' *vs*. 'all', and 'river Main' *vs*. 'to mow', and the ELD 2 items in all other cases). The experiment took 35 minutes with one pause being used and almost no repetitions of the sentences.

Informant III.7.As was the most professional participant and showed a profound knowledge of the dialect. He was very careful in his choices and occasionally repeated a sentence. He used two of the pauses to discuss the stimuli and worked 40 minutes on the experiment.

Subject III.8.As, age 61, was very thorough in his judgments and frequently repeated the stimuli. Additionally, he often pronounced the words himself. He took none of the pauses and carried out the test in 30 minutes.

Informant III.9.As had some difficulties hearing the sentences in the beginning of the experiment. However, he only took one of the pauses and almost never repeated a stimulus. He reported that the minimal pairs 'stone-Sg.' *vs*. 'stone-Pl.', 'wine' *vs*. 'Vienna', and 'already' *vs*. 'all' are indistinguishable. Also, he chose with regards to the other minimal pairs for one word category only throughout the test, stating that the only difference between those words – if any – would be the final fricative: for 'giant' the final [s] would be longer as compared to 'rice'. This is especially worth noting since in his speech he made clear distinctions in vowel duration - while saying that e.g. the words [a:l] and [aa:l] are alike. His experiment data is, hence, excluded from the analysis.

Informant III.10.As showed a high degree of motivation and concentration throughout the whole experiment. Her judgments were considerate and she rarely

repeated a stimulus. She stated that she had difficulties in particular with those stimuli comprising a final sonorant. Her main concern was to deliver a relevant result for the study. She performed the experiment in 30 minutes.

Informant III.11.As was very interested in the experiment and had several critical remarks. He used all of the offered pauses for further inquiries and comments. He was deliberate in his choices and occasionally repeated a stimulus. The test took him 30 minutes, and he, as well, noted that to his mind 'stone-Sg.' *vs*. 'stone-Pl.', and 'wine' *vs*. 'Vienna' are identical.

(E) Statistical Analyses

Table 54. Kw. non-minimal items ending in lenis or fortis C.

Informant	Stimuli	ELD	fortis	closure dur. / ms	h dur. / ms
I.1.Kw.	side-Sg.	2	1	78.930	209.471
I.2.Kw.		2	1	71.395	65.337
I.1.Kw.	wide	2	1	48.210	124.774
I.2.Kw.		2	1	65.730	57.895
I.1.Kw.	to rip-1.Sg.Pres.	2	1	87.092	83.006
I.1.Kw.	to know-3.Sg.Pres.	2	1	18.313	132.474
I.2.Kw.		2	1	65.217	30.817
I.1.Kw.	bride-Sg.	2	1	60.462	139.276
I.2.Kw.		2	1	72.217	138.689
I.1.Kw.	today	2	1	33.750	122.633
I.2.Kw.		2	1	65.584	32.273
I.1.Kw.	degree-Sg.	2	1	30.697	10.537
I.1.Kw.		2	1	83.185	27.822
I.2.Kw.		2	1	69.379	21.548
I.2.Kw.		2	1	78.755	42.439
I.1.Kw.	cottage-Sg.	2	1	46.745	62.688
I.1.Kw.		2	1	70.563	145.068
I.2.Kw.		2	1	79.612	29.916
I.2.Kw.		2	1	77.565	36.862
I.2.Kw.		2	1	88.812	40.890
I.2.Kw.		2	1	76.921	43.538
I.2.Kw.	map-Sg.	2	1	80.893	71.750
I.2.Kw.		2	1	72.218	77.145
I.2.Kw.		2	1	36.207	65.108
I.2.Kw.	to let-1.Sg.Pres.	2	1	74.968	30.323
I.2.Kw.	foot-Sg.	2	1	69.034	38.542

I.2.Kw.	street-Sg.	2	1	87.104	44.911
I.1.Kw.	courage	2	1	42.670	176.792
I.1.Kw.		2	1	80.792	120.866
I.1.Kw.		2	1	61.358	72.875
I.1.Kw.		2	1	85.757	78.715
I.2.Kw.		2	1	70.424	39.720
I.2.Kw.	silk-Sg.	3	0	86.956	28.157
I.2.Kw.		3	0	66.319	34.842
Informant	Stimuli	ELD	fortis	closure dur. / ms	h dur. / ms
I.1.Kw.	people	3	0	94.998	110.539
I.2.Kw.		3	0	83.951	55.697
I.1.Kw.	just; straight	3	0	31.760	68.083
I.2.Kw.		3	0	73.012	96.049
I.2.Kw.		3	0	127.433	15.813
I.1.Kw.	to brew-3.Sg.Pres.	3	1	70.992	173.463
I.2.Kw.		3	1	65.034	55.253
I.1.Kw.	fashion	3	0	108.731	51.742
I.2.Kw.		3	0	65.674	62.495
I.2.Kw.	to bloom-3.Sg.Pres.	3	1	65.203	64.764
I.1.Kw.	joy-Sg.	3	0	66.248	162.002
I.2.Kw.		3	0	66.879	37.105
I.2.Kw.	to mow-3.Sg.Pres.	3	1	74.103	34.618

Table 55. Kw. (near) minimal pairs

Informant	Paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD2-ELD3 / %
I.1.Kw.	letter-Sg./letter-Pl.	0	0	21	-0.104	19.592
	degree-Sg./just	1	0	2	0.120	-24.942
	house-Nom./Dat.	1	0	1	0.250	-
	river Main/to mow	0	1	31	0.170	11.503
		1	1	31	0.011	-9.997
	my-Poss.Pron./mine-Sg.	1	1	1	-0.241	36.137
	courage/fashion	1	0	21	0.067	-12.086
		1	0	21	0.218	-17.003
	rice/giant-Sg.	0	0	1	-0.026	-19.680
		1	0	1	-0.033	18.276
	to rip-1.Sg./ro ride-1.Sg.	1	0		0.338	55.353
	side-Sg./silk-Sg.	1	0	1	0.164	-38.568

Informant	Paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD2-ELD3 / %
	stone-Sg./Pl.	0	1	21	0.064	-34.637
	way-Sg./Pl.	1	0	2	0.283	25.965
	wine/Vienna	0	1	1	0.046	-6.222
	wide/wise	1	0	1	0.215	-20.104
I.2.Kw.	already/all	0	1	3	0.063	62.074
	letter-Sg./letter-Pl.	0	0	21	0.061	-16.873
		1	0	21	0.045	-19.464
	degree-Sg./just	0	0	2	0.172	21.027
		1	0	2	0.039	1.412
	to let-1.Sg./to load-1.Sg.	1	0	2	0.282	-2.932
	river Main/to mow	0	1	31	0.026	0.117
		1	1	31	0.031	-3.948
	my-Poss.Pron./mine-Sg.	1	1	1	0.066	6.421
	courage/fashion	1	0	21	0.229	-73.731
	rice/giant	0	0	1	0.081	12.698
		1	0	1	0.025	-16.837
	side-Sg./silk-Sg.	1	0	1	-0.122	23.841
	stone-Sg./Pl.	0	1	21	0.037	18.195
		0	1	21	-0.061	43.973
		0	1	21	-0.048	26.824
		1	1	21	-0.086	-15.398
	way-Sg./Pl.	0	0	2	0.018	-14.592
		1	0	2	0.103	10.665
	wine/Vienna	0	1	1	0.003	-44.350
		1	1	1	-0.026	-26.869
		1	1	1	0.039	-0.961
	wide/wise	1	0	1	0.263	23.957

Table 56. Between subjects effects of the complete Kw. ELD 2 : ELD 3 data

Dependent Variable: V dur. / log10 ms

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.154[a]	32	.036	2.544	.000
Intercept	416.738	1	416.738	29401.780	.000
ELD	.035	1	.035	2.470	.118
coda C	.016	1	.016	1.136	.288
jaw opening	.322	4	.080	5.676	.000
finality	.090	1	.090	6.350	.013
ELD * jaw opening	.036	4	.009	.633	.639
ELD * finality	.003	1	.003	.231	.631
ELD * coda C	.002	1	.002	.128	.721
jaw opening * finality	.024	4	.006	.422	.792
jaw opening * coda C	.042	3	.014	.979	.404
finality * coda C	.020	1	.020	1.395	.240
ELD * jaw opening * finality	.015	3	.005	.361	.781
ELD * jaw opening * coda C	.014	3	.005	.328	.805
ELD * finality * coda C	.036	1	.036	2.574	.111
jaw opening * finality * coda C	.011	3	.004	.268	.849
ELD * jaw opening * finality * coda C	.001	1	.001	.052	.821
Error	2.084	147	.014		
Total	994.149	180			
Corrected Total	3.238	179			

a. R Squared = .356 (Adjusted R Squared = .216)

Table 57. Paired samples t-test of the Kw. minimal pairs

pairs	Mean	Std. Deviation	Std. Error Mean	95.0% C.I. of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
V dur. ELD2 – V dur. ELD3	-.0713	.126	.0201	-.112	-.0305	-3.540	38	.001
R dur. ELD2 – R dur. ELD3	.0537	.134	.0334	-.0175	.125	1.608	15	.129
F0 peak ELD2 – F0 peak ELD3	-.0306	27.927	4.530	-9.210	9.149	-.007	37	.995

Table 58. Between subjects effects on the V dur. of the Kw. minimal pairs

Dependent Variable: V dur. ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.227[a]	12	.019	1.318	.267
Intercept	.068	1	.068	4.716	.039
coda C	.045	1	.045	3.098	.090
jaw opening	.036	4	.009	.624	.649
finality	.002	1	.002	.121	.731
finality * jaw opening	.004	3	.001	.100	.959
finality * coda C	.052	1	.052	3.635	.068
jaw opening * coda C	.000	1	.000	.013	.910
finality * jaw opening * coda C	.001	1	.001	1	.001
Error	.374	26	.374	26	.374
Total	.799	39	.799	39	.799
Corrected Total	.601	38	.601	38	.601

a. R Squared = .378 (Adjusted R Squared = .091)

Table 59. Between subjects effects on the F0 peak location of the Kw. minimal pairs

Dependent Variable: F0 peak location ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	10435.495[a]	12	869.625	1.180	.348
Intercept	550.689	1	550.689	.747	.396
coda C	2.197	1	2.197	.003	.957
jaw opening	4214.979	4	1053.745	1.430	.253
finality	254.346	1	254.346	.345	.562
finality * jaw opening	3280.279	3	1093.426	1.484	.243
finality * coda C	140.877	1	140.877	.191	.666
jaw opening * coda C	799.258	1	799.258	1.085	.308
finality * jaw opening * coda C	75.208	1	75.208	.102	.752
Error	18420.559	25	736.822		
Total	28856.090	38			
Corrected Total	28856.054	37			

a. R Squared = .362 (Adjusted R Squared = .055)

Table 60. Aw. group 1 and III.6.Aw's non-minimal items ending in lenis or fortis C.

Informant	Stimulus	ELD	fortis	closure dur. / ms	h dur. / ms
I.I.Aw	bride-Sg.	2	1	19.375	150.814
I.2.Aw	plank-Sg.	2	1	32.735	114.777
I.I.Aw	blanket-Sg.	2	1	5.957	154.779
II.5.Aw		2	1	27.342	130.659
II.5.Aw		2	1	48.180	109.674
II.5.Aw		2	1	26.941	163.150
III.5.Aw		2	1	14.157	206.888
III.6.Aw		2	1	27.594	241.958
III.6.Aw		2	1	32.253	201.973
III.6.Aw		2	1	36.236	219.457
III.7.Aw		2	1	41.939	189.057
III.7.Aw		2	1	33.331	289.102
III.7.Aw		2	1	37.976	181.597
I.I.Aw	degree-Sg.	2	0	41.018	175.945
I.I.Aw		2	0	18.264	124.130
I.I.Aw		2	0	16.341	130.850
I.2.Aw		2	0	113.662	177.486
I.2.Aw		2	0	83.661	160.643
I.3.Aw		2	0	59.758	57.994
I.3.Aw		2	0	69.330	72.442
I.I.Aw	today	2	1	13.445	185.771
I.I.Aw	to let-3.Sg.	2	1	8.479	128.508
I.I.Aw	courage	2	1	41.605	142.735
I.2.Aw		2	1	26.911	142.298
II.5.Aw		2	1	33.039	161.599
II.5.Aw		2	1	59.946	80.133
II.5.Aw		2	1	42.091	128.663
III.6.Aw		2	1	23.684	185.710
III.6.Aw		2	1	39.229	187.039
III.6.Aw		2	1	26.183	201.860
III.7.Aw		2	1	20.801	115.254
III.7.Aw		2	1	39.450	225.516
III.7.Aw		2	1	34.902	203.001
I.I.Aw	seam-Sg.	2	1	11.329	166.407
I.I.Aw	side-Sg.	2	1	24.496	140.668
I.I.Aw		2	1	3.083	140.070
II.5.Aw	baptism	2	1	60.707	108.617
II.5.Aw		2	1	29.553	90.268

Informant	Stimulus	ELD	fortis	closure dur. / ms	h dur. / ms
III.5.Aw	baptism	2	1	51.797	101.125
III.5.Aw		2	1	19.892	137.689
III.6.Aw		2	1	23.521	177.873
III.6.Aw		2	1	24.330	79.303
III.7.Aw		2	1	26.661	92.115
III.7.Aw		2	1	21.146	105.671
I.2.Aw	to know.3.Sg.	2	1	25.751	128.674
II.5.Aw		2	1	28.267	175.031
II.5.Aw		2	1	64.578	170.378
II.5.Aw		2	1	37.952	155.050
III.5.Aw		2	1	17.336	251.756
III.7.Aw		2	1	45.823	229.246
III.7.Aw		2	1	26.569	202.350
III.7.Aw		2	1	57.333	275.748
II.5.Aw	both	3	0	42.014	108.567
II.5.Aw		3	0	40.445	89.057
II.5.Aw		3	0	38.983	88.685
III.5.Aw		3	0	56.059	141.307
III.6.Aw		3	0	75.315	117.113
III.6.Aw		3	0	54.642	107.297
III.6.Aw		3	0	55.979	136.822
III.7.Aw		3	0	80.353	105.866
III.7.Aw		3	0	45.051	131.096
I.I.Aw	just; straight	3	0	26.387	163.441
I.2.Aw		3	0	99.793	116.980
I.2.Aw		3	0	41.013	151.512
I.I.Aw	people	3	0	23.017	170.263
I.I.Aw	fashion	3	0	32.767	157.251
II.5.Aw		3	0	19.307	123.191
II.5.Aw		3	0	51.322	185.005
II.5.Aw		3	0	82.786	176.144
II.5.Aw		3	0	63.126	104.368
II.5.Aw		3	0	43.812	105.303
III.6.Aw		3	0	47.920	188.321
III.6.Aw		3	0	39.573	130.175
III.6.Aw		3	0	152.592	177.296
III.6.Aw		3	0	89.625	158.542
III.6.Aw		3	0	67.107	110.746
III.6.Aw		3	0	83.179	115.262
III.7.Aw		3	0	49.658	112.670

Informant	Stimulus	ELD	fortis	closure dur. / ms	h dur. / ms
III.7.Aw	fashion	3	0	57.181	148.435
I.I.Aw	silk	3	0	20.666	162.129
II.5.Aw	meadow-Sg.	3	0	38.989	114.042
II.5.Aw		3	0	38.157	155.670
II.5.Aw		3	0	38.975	117.148
III.5.Aw		3	0	43.530	191.953
III.5.Aw		3	0	36.090	223.282
III.6.Aw		3	0	72.063	163.153
III.6.Aw		3	0	72.257	142.468
III.6.Aw		3	0	79.932	102.233
III.7.Aw		3	0	45.095	127.227
III.7.Aw		3	0	81.961	106.895
III.7.Aw		3	0	75.309	125.994

Table 61. Aw. group 1 and III.6.Aw's (near) minimal pairs

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
I.2.Aw	already/all	1	1	3	0.0126	-30.56
I.3.Aw		0	1	3	0.205	8.59
I.3.Aw		1	1	3	0.328	-11.01
II.5.Aw		0	1	3	0.195	-24.23
III.5.Aw		1	1	3	0.134	13.72
III.6.Aw		1	1	3	0.266	-6.58
III.5.Aw	tree-Sg./Pl.	1	1	2	-0.009	3.38
III.6.Aw		0	1	2	0.056	91.44
III.6.Aw		1	1	2	0.135	25.11
I.1.Aw	bread-Sg./to brew-3.Sg.	1	0	22	0.237	15.67
I.2.Aw	letter-Sg./Pl.	0	0	21	-0.031	13.4
I.2.Aw		1	0	21	0.038	-5.57
I.3.Aw		0	0	21	0.041	3.38
I.3.Aw		1	0	21	0.142	0
III.5.Aw		0	0	21	0.038	50.77
III.5.Aw		1	0	21	-0.034	41.975
III.6.Aw		0	0	21	44.684	30.495
III.6.Aw		1	0	21	0.176	-9.48
III.7.Aw		0	0	21	0.042	-14.47
III.7.Aw		1	0	21	0.087	-3.14
III.5.Aw	down feather-Pl./drunk	1	1	1	0.101	-31.505

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
II.5.Aw	thief-Sg./Pl.	0	0	21	-0.048	2.91
II.5.Aw		1	0	21	-0.109	35.24
III.5.Aw		0	0	21	0.138	19.95
III.6.Aw		0	0	21	0.298	-85.03
III.6.Aw		1	0	21	0.259	-66.75
II.5.Aw	deaf/pigeon-Sg.	1	0	22	-0.040	-7.05
III.5.Aw		1	0	22	0.094	3.07
III.5.Aw		1	0	22	-0.046	-0.78
III.5.Aw		1	0	22	0.011	-14.03
III.6.Aw		1	0	1	0.146	-9.305
I.2.Aw	degree/just	0	0	2	0.149	0
I.2.Aw		1	0	2	-0.035	19.97
I.3.Aw		0	0	2	-0.007	13.26
III.5.Aw	house-Nom./Dat.	1	0	1	0.213	-12.48
III.6.Aw		0	0	1	0.454	27.11
III.6.Aw		1	0	1	0.528	34.38
III.7.Aw		0	0	1	0.350	85.85
I.2.Aw	to let-3.Sg./to load-3.Sg.	0	0	2	0.028	-46.62
I.2.Aw		1	0	2	0.201	46.72
I.1.Aw	river Main/to mow	0	1	31	0.145	-59.66
I.3.Aw		1	1	31	0.106	7.58
III.5.Aw		1	1	31	0.154	0.4
III.5.Aw	mouse-Sg./Pl.	1	0	1	0.237	-16.04
III.6.Aw		0	0	1	0.565	-15.4
III.6.Aw		1	0	1	0.409	-18.45
III.7.Aw		0	0	1	0.201	5.87
III.7.Aw		1	0	1	0.024	61.68
I.1.Aw	my-Poss.Pron./mine-Sg.	1	1	1	0.002	-0.01
III.5.Aw		0	1	1	0.114	11.06
III.5.Aw		1	1	1	0.133	24.655
III.6.Aw		0	1	1	0.029	-27.755
I.1.Aw	courage/fashion	1	0	22	0.064	-18.86
III.5.Aw		0	0	22	0.249	1.405
III.5.Aw		1	0	22	0.242	-26.205
III.6.Aw		0	0	22	0.205	-53.76
III.6.Aw		1	0	22	0.236	-15.62
II.5.Aw	price-Sg./Pl.	1	0	1	0.066	20.34
III.6.Aw		1	0	1	0.563	17.36
III.7.Aw		0	0	1	0.285	-60.62

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
I.2.Aw	rice/giant-Sg.	0	0	1	-0.078	-8.46
I.2.Aw		1	0	1	0.173	5.78
I.3.Aw		1	0	1	0.133	11.18
II.5.Aw		0	0	1	0.151	-24.46
II.5.Aw		1	0	1	0.268	67.97
III.5.Aw		0	0	1	0.117	2.46
III.5.Aw		1	0	1	0.225	-47.2
III.5.Aw		1	0	1	0.180	11.1
III.6.Aw		0	0	1	0.468	-67.19
III.6.Aw		1	0	1	0.478	2.655
III.7.Aw		0	0	1	0.321	27.88
III.7.Aw		1	0	1	0.298	-20.39
II.5.Aw	scarf-Sg./bowl-Sg.	0	1	2	-0.031	-10.36
II.5.Aw		1	1	2	-0.049	-12.87
I.1.Aw	side-Sg./silk	1	0	1	0.201	0.155
I.2.Aw	stone-Sg./Pl.	0	1	21	0.148	-23.52
I.2.Aw		1	1	21	0.174	0
I.3.Aw		0	1	21	-0.056	5.25
I.3.Aw		1	1	21	0.106	0
II.5.Aw		1	1	21	-0.072	22.21
III.5.Aw		1	1	21	0.036	-43.04
III.6.Aw		0	1	21	0.208	6.21
III.6.Aw		1	1	21	0.156	-7.56
I.1.Aw	day-Sg./Pl.	1	0	2	0.191	2.5
III.6.Aw	part-Sg./hallway-Sg.	0	1	21	0.100	-18.07
III.7.Aw		0	1	21	0.069	-0.35
III.7.Aw		1	1	21	-0.042	6.07
III.6.Aw	dream-Nom./Dat.	0	1	2	0.014	-76.88
III.6.Aw		1	1	2	0.070	13.83
I.2.Aw	way-Sg./Pl.	1	0	2	0.291	9.65
I.2.Aw	wine/Vienna	1	1	1	0.050	7.56
I.3.Aw		0	1	1	0.138	34.73
I.3.Aw		1	1	1	-0.106	-4.19
II.5.Aw		1	1	1	0.071	11.505
III.5.Aw		0	1	1	0.050	-65.34
III.5.Aw		1	1	1	0.050	24.07
III.6.Aw		1	1	1	-0.078	-30.37
III.7.Aw		0	1	1	-0.138	-81.91
III.7.Aw		1	1	1	-0.001	4.575

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
II.5.Aw	wide/wise	0	0	1	-0.048	-76.74
II.5.Aw		1	0	1	0.062	-16.72
III.5.Aw		0	0	1	0.165	-10.86
III.6.Aw		0	0	1	0.104	-19.985
III.6.Aw		1	0	1	30.424	4.565

Table 62. Paired samples t-test of the Aw. group 1 minimal pairs

pairs	Mean	Std. Deviation	Std. Error Mean	95.0% C.I. of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
V dur. ELD2 – V dur. ELD3	-.096	.116	.013	-.122	-.070	-7.309	77	.000
R dur. ELD2 – R dur. ELD3	-.0001	.163	.029	-.060	.060	-.004	30	.997
F0 peak ELD2 – F0 peak ELD3	.817	29.593	3.351	-5.855	7.490	.244	77	.808

Table 63. Between subjects effects on the V dur. of the Aw. group 1 minimal pairs

Dependent Variable: V dur. ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.356[a]	17	.021	1.845	.043
Intercept	.456	1	.456	40.175	.000
coda C	.070	1	.070	6.125	.016
jaw opening	.161	5	.032	2.834	.023
finality	.005	1	.005	.435	.512
finality * jaw opening	.038	5	.008	.676	.643
finality * coda C	.004	1	.004	.387	.536
jaw opening * coda C	.068	2	.034	2.974	.059
finality * jaw opening * coda C	.003	2	.002	.151	.860
Error	.681	60	.011		
Total	1.757	78			
Corrected Total	1.037	77			

a. R Squared = .343 (Adjusted R Squared = .157)

Table 64. Between subjects effects on the F0 peak location of the Aw. group 1 minimal pairs

Dependent Variable: F0 peak location ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11875.186[a]	17	698.540	.754	.735
Intercept	1136.901	1	1136.901	1.228	.272
coda C	1751.201	1	1751.201	1.891	.174
jaw opening	2146.980	5	429.396	.464	.802
finality	2333.856	1	2333.856	2.520	.118
finality * jaw opening	3367.840	5	673.568	.727	.606
finality * coda C	7.234	1	7.234	.008	.930
jaw opening * coda C	172.808	2	86.404	.093	.911
finality * jaw opening * coda C	732.879	2	366.439	.396	.675
Error	55557.854	60	925.964		
Total	67485.160	78			
Corrected Total	67433.040	77			

a. R Squared = ,176 (Adjusted R Squared = -,057)

Table 65. Paired samples t-test of the III.6.Aw minimal pairs

pairs	Mean	Std. Deviation	Std. Error Mean	95.0% C.I. of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
V dur. ELD2 – V dur. ELD3	-.235	.182	.0358	-.309	-.162	-6.577	25	.000
R dur. ELD2 – R dur. ELD3	-.022	.152	.0482	-.131	.087	-.456	9	.659
F0 peak ELD2 – F0 peak ELD3	10.578	38.990	7.647	-5.171	26.327	1.383	25	.179

Table 66. Between subjects effects on the V dur. of the III.6.Aw minimal pairs

Dependent Variable: V dur. ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	937.214[a]	12	78.101	.585	.819
Intercept	73.183	1	73.183	.548	.472
coda C	162.546	1	162.546	1.218	.290
jaw opening	130.982	4	32.746	.245	.907
finality	25.369	1	25.369	.190	.670
finality * jaw opening	172.743	3	57.581	.431	.734
finality * coda C	59.764	1	59.764	.448	.515
jaw opening * coda C	55.566	1	55.566	.416	.530
finality * jaw opening * coda C	152.801	1	152.801	1.145	.304
Error	1735.259	13	133.481		
Total	2924.513	26			
Corrected Total	2672.472	25			

a. R Squared = .351 (Adjusted R Squared = -.249)

Table 67. Between subjects effects on the F0 peak location of the III.6.Aw minimal pairs

Dependent Variable: F0 peak location ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8931.022[a]	12	744.252	.333	.967
Intercept	3731.052	1	3731.052	1.668	.219
coda C	11.237	1	11.237	.005	.945
jaw opening	2588.585	4	647.146	.289	.880
finality	611.581	1	611.581	.273	.610
finality * jaw opening	741.900	3	247.300	.111	.952
finality * coda C	62.036	1	62.036	.028	.870
jaw opening * coda C	1888.215	1	1888.215	.844	.375
finality * jaw opening * coda C	262.125	1	262.125	.117	.738
Error	29075.332	13	2236.564		
Total	40915.642	26			
Corrected Total	38006.353	25			

a. R Squared = .235 (Adjusted R Squared = -.471)

Table 68. Alfs. non-minimal items ending in lenis or fortis C.

Informant	Stimuli	ELD	fortis	closure dur. / ms	h dur. / ms
II.3.Alfs	side-Sg.	2	1	49.120	143.807
II.3.Alfs		2	1	55.006	60.104
III.7.Alfs		2	1	47.062	62.661
II.3.Alfs	wide	2	1	46.668	160.369
III.5.Alfs		2	1	85.053	95.215
III.6.Alfs		2	1	99.328	120.579
III.7.Alfs		2	1	45.360	64.748
II.3.Alfs	bride-Sg.	2	1	51.326	244.437
III.6.Alfs		2	1	29.677	84.714
III.7.Alfs		2	1	31.845	50.506
III.7.Alfs		2	1	14.478	36.139
II.3.Alfs	thing-Sg.	2	1	79.100	127.828
II.3.Alfs		2	1	111.766	154.170
II.3.Alfs	baptism	2	1	91.536	32.494
II.3.Alfs		2	1	69.584	47.632
III.6.Alfs		2	1	74.034	58.187
III.7.Alfs		2	1	55.813	36.230
III.5.Alfs	blanket	2	1	19.530	157.304
III.7.Alfs		2	1	53.322	95.635
III.7.Alfs		2	1	48.137	84.145
III.6.Alfs	bread-Sg.	2	1	11.396	71.444
II.3.Alfs	courage	2	1	36.633	199.551
III.6.Alfs		2	1	30.955	125.717
III.7.Alfs		2	1	29.908	97.073
III.7.Alfs		2	1	24.167	57.582
III.7.Alfs		2	1	26.802	60.728
II.3.Alfs	to brew-3.Sg.	3	1	68.380	32.072
II.3.Alfs		3	1	71.988	49.672
III.7.Alfs		3	1	24.712	52.110
II.3.Alfs	fashion	3	0	55.070	144.076
II.3.Alfs		3	0	76.242	77.067
II.3.Alfs		3	0	60.609	67.545
II.3.Alfs		3	0	50.111	88.964
III.6.Alfs		3	0	59.347	53.836
III.7.Alfs		3	0	59.968	65.918
II.3.Alfs	both	3	0	54.981	107.915
II.3.Alfs		3	0	48.567	135.514
III.5.Alfs		3	0	63.522	56.012

Informant	Stimuli	ELD	fortis	closure dur. / ms	h dur. / ms
III.5.Alfs	both	3	0	20.541	78.815
III.5.Alfs		3	0	31.104	72.636
III.7.Alfs		3	0	33.517	43.715
II.3.Alfs	to go-3.Sg.	3	1	23.053	37.256
II.3.Alfs		3	1	44.355	68.654
II.3.Alfs		3	1	42.115	52.711
II.3.Alfs	to mow-1.Pl.	3	1	62.847	158.347
III.6.Alfs		3	1	55.209	78.831
III.6.Alfs		3	1	88.723	64.801
III.6.Alfs		3	1	97.607	110.603
III.6.Alfs		3	1	97.154	69.255
III.6.Alfs		3	1	105.215	76.933
III.7.Alfs		3	1	43.250	70.017
III.7.Alfs		3	1	52.375	89.986
II.3.Alfs	meadow-Sg.	3	0	67.544	64.146
II.3.Alfs		3	0	44.248	76.299
II.3.Alfs		3	0	45.746	75.090
III.6.Alfs		3	0	28.952	106.374
III.7.Alfs		3	0	20.945	91.056
III.7.Alfs		3	0	43.910	97.694
III.6.Alfs	to steal-3.Sg.Pres.Perf.	3	1	52.603	144.279
III.6.Alfs		3	1	83.319	41.417
III.7.Alfs		3	1	41.153	69.645
III.7.Alfs		3	1	61.743	62.060

Table 69. Alfs. (near) minimal pairs

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
I.1.Alfs	already/all	0	1	3	0.081	-9.55
I.1.Alfs		1	1	3	0.182	-7.71
II.3.Alfs		0	1	3	0.267	0
III.6.Alfs		1	1	3	-0.110	0
III.7.Alfs		0	1	3	0.158	-61.654
III.7.Alfs		1	1	3	-0.035	10.218
III.6.Alfs	tree-Sg./Pl.	0	1	2	0.127	3.5
III.7.Alfs		1	1	2	-0.036	-6.525
III.6.Alfs	leg-Sg./Pl.	0	1	31	0.012	8.11
III.7.Alfs		0	1	31	0.006	-0.08

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
III.6.Alfs	letter-Sg./letter-Pl.	0	0	21	-0.070	-0.95
II.3.Alfs	bread-Sg./to brew-3.Sg.	0	0	21	0.218	27.45
II.3.Alfs		0	0	21	0.178	7.04
III.7.Alfs		0	0	2	0.074	2.405
I.1.Alfs	house-Nom./Dat.	0	0	1	0.002	1.33
II.3.Alfs		0	0	1	0.408	33.735
III.6.Alfs		0	0	1	-0.088	-6.78
III.6.Alfs		1	0	1	-0.025	56.1
III.7.Alfs		0	0	1	0.157	-13.55
III.7.Alfs		1	0	1	0.167	-11.94
I.1.Alfs	house-Nom.Sg./Pl.	1	0	1	0.104	0.515
I.1.Alfs	river Main/to mow	0	1	31	0.037	9.56
I.1.Alfs		1	1	31	0.157	2.31
II.3.Alfs		0	1	31	0.085	0
III.6.Alfs		0	1	31	-0.082	-90.89
III.6.Alfs		1	1	31	-0.059	0
III.7.Alfs		1	1	31	0.126	-4.27
II.3.Alfs	mouse-Sg./Pl.	0	0	1	0.312	10.1
III.6.Alfs		0	0	1	0.066	-4.64
III.7.Alfs		0	0	1	0.157	0.94
III.7.Alfs		1	0	1	0.208	66.39
III.5.Alfs	my-Poss.Pron./mine-Sg.	1	1	1	0.097	-26.1
III.5.Alfs		1	1	1	0.190	-13.06
III.6.Alfs		0	1	1	-0.227	74.97
III.7.Alfs		0	1	1	-0.082	0.68
III.7.Alfs		1	1	1	0.028	-11.66
II.3.Alfs	price-Sg./Pl.	0	0	1	0.236	-66.61
I.1.Alfs	rice/giant-Sg.	0	0	1	0.033	2.61
I.1.Alfs		1	0	1	0.238	-10.86
III.6.Alfs		1	0	1	0.065	-0.02
III.7.Alfs		0	0	1	0.099	11.763
II.3.Alfs	scarf-Sg./bowl-Sg.	0	1	2	-0.111	-0.08
II.3.Alfs		0	1	2	-0.019	2.13
II.3.Alfs		1	1	2	-0.086	-0.7
II.3.Alfs		1	1	2	-0.040	-3.1
III.6.Alfs		1	1	2	-0.040	0.057
III.7.Alfs		0	1	2	-0.075	-0.22
III.7.Alfs		1	1	2	0.049	-0.582
III.7.Alfs	pig-Sg./Pl.	0	1	1	0.016	27.26

Informant	paired items	finality	sonorant coda	jaw opening	log10 V dur. ELD3-ELD2	F0 peak ELD3-ELD2 / %
III.7.Alfs	side-Sg./silk	0	0	1	0.339	39.61
II.3.Alfs	son-Sg./Pl.	0	1	2	-0.312	-82.03
II.3.Alfs		1	1	2	-0.152	-6.55
I.1.Alfs	stone-Sg./Pl.	0	1	31	-0.092	49.01
I.1.Alfs		1	1	31	0.135	44.49
II.3.Alfs		0	1	31	0.066	81.085
III.7.Alfs		0	1	31	0.122	-5.14
III.7.Alfs		1	1	31	-0.078	-2.71
II.3.Alfs	deaf/pigeon-Sg.	0	0	2	0.092	-2.29
II.3.Alfs		1	0	2	0.035	25.72
II.3.Alfs		1	0	2	0.099	9.48
III.6.Alfs		1	0	2	0.148	-7.28
III.7.Alfs		1	0	1	0.121	0.46
II.3.Alfs	part-Sg./hallway-Sg.	0	1	2	0.095	1.84
III.5.Alfs		0	1	2	0.023	-0.92
III.7.Alfs		0	1	2	-0.053	-10.29
III.6.Alfs		0	1	2	-0.028	-47.08
III.5.Alfs	dream-Nom./Dat.	0	1	2	0.015	39.357
III.6.Alfs		0	1	2	0.022	-4.64
III.7.Alfs		1	1	2	0.099	41.27
I.1.Alfs	wine/Vienna	0	1	1	0.123	24.32
I.1.Alfs		1	1	1	0.111	1.19
II.3.Alfs		0	1	1	0.013	77.94
II.3.Alfs		1	1	1	0.166	-8.353
III.5.Alfs		1	1	1	0.090	3.42
III.6.Alfs		1	1	1	0.025	0
III.6.Alfs		1	1	1	-0.035	-2.54
III.7.Alfs		0	1	1	0.171	-4.225
III.7.Alfs		1	1	1	-0.034	8.93
II.3.Alfs	wide/wise	0	0	1	0.040	-1.615
III.6.Alfs		0	0	1	0.058	16.625

Table 70. Paired samples t-test of the Alfs. minimal pairs

pairs	Mean	Std. Deviation	Std. Error Mean	95.0% C.I. of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
V dur. ELD2 – V dur. ELD3	-.057	.123	.0137	-.085	-.030	-4.169	79	.000
R dur. ELD2 – R dur. ELD3	-.017	.140	.0208	-.059	.025	-.795	44	.431
F0 peak ELD2 – F0 peak ELD3	-3.584	29.006	3.243	-10.039	2.871	-1.105	79	.272

Table 71. Between subjects effects on the V dur. of the Alfs. minimal pairs

Dependent Variable: V dur. ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.343[a]	12	.029	2.257	.018
Intercept	.234	1	.234	18.485	.000
coda C	.117	1	.117	9.211	.003
jaw opening	.079	4	.020	1.562	.195
finality	.004	1	.004	.286	.595
finality * jaw opening	.049	3	.016	1.292	.284
finality * coda C	.003	1	.003	.255	.616
jaw opening * coda C	.001	1	.001	.093	.761
finality * jaw opening * coda C	.006	1	.006	.453	.503
Error	.848	67	.013		
Total	1.453	80			
Corrected Total	1.191	79			

a. R Squared = .288 (Adjusted R Squared = .160)

Table 72. Between subjects effects on the F0 peak location of the Alfs. minimal pairs

Dependent Variable: F0 peak location ELD3-2

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11389.456[a]	12	949.121	1.155	.334
Intercept	1026.149	1	1026.149	1.248	.268
coda C	5.567	1	5.567	.007	.935
jaw opening	2799.829	4	699.957	.851	.498
finality	621.019	1	621.019	.755	.388
finality * jaw opening	3354.245	3	1118.082	1.360	.263
finality * coda C	1491.167	1	1491.167	1.814	.183
jaw opening * coda C	460.889	1	460.889	.561	.457
finality * jaw opening * coda C	1899.837	1	1899.837	2.311	.133
Error	55076.721	67	822.041		
Total	67493.816	80			
Corrected Total	66466.177	79			

a. R Squared = .171 (Adjusted R Squared = .023)

Table 73. Aw. Perception Test results of the multivariate analysis (binary logistic regression).[331] Criterion: ELD 3 choice; method: Backward Wald.

predictor	B	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
non-final	1.414	1	.000	4.111	3.401	4.968
V duration (long)	-.793	1	.000	.452	.397	.516
V duration (overlong)	.775	1	.000	2.172	1.902	2.479
Informant II.5.Aw	-.715	1	.000	.489	.359	.666
Constant	-.496	1	.000	.609		
Informant III.6.Aw	.373	1	.016	1.452	1.071	1.968
Informant II.4.Aw	-.373	1	.015	.689	.509	.931
Informant II.6.Aw	.242	1	.116	1.274	.942	1.724
Informant II.7.Aw	-.219	1	.153	.804	.595	1.085
Informant III.4.Aw	.216	1	.160	1.242	.918	1.679
Informant III.7.Aw	.113	1	.460	1.120	.829	1.513
Informant III.1.Aw	.113	1	.460	1.120	.829	1.513
Informant II.3.Aw	.113	1	.460	1.120	.829	1.513
Informant III.3.Aw	.088	1	.567	1.092	.808	1.474
Informant II.2.Aw	,088	1	,567	1,092	,808	1,474
-2 Log likelihood	2702.837					
Nagelkerke R^2	.234					
Model χ^2	437.043	14	.000			

[331] Exclusive of the informants II.1.Aw, III.2.Aw, and III.8.Aw.

Figure 89. Aw. word-choices in % of the total per factor, depending on sentence position

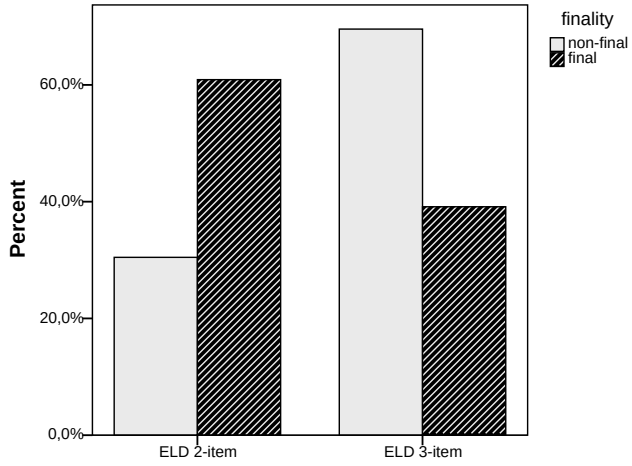


Figure 90. Aw. word-choices in % of the total per factor, depending on the artificial V duration

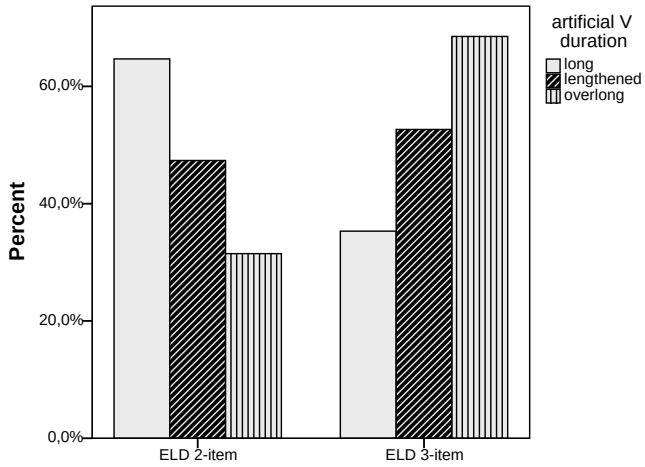


Figure 91. Aw. word-choices in % of the total per factor, depending on the coda C

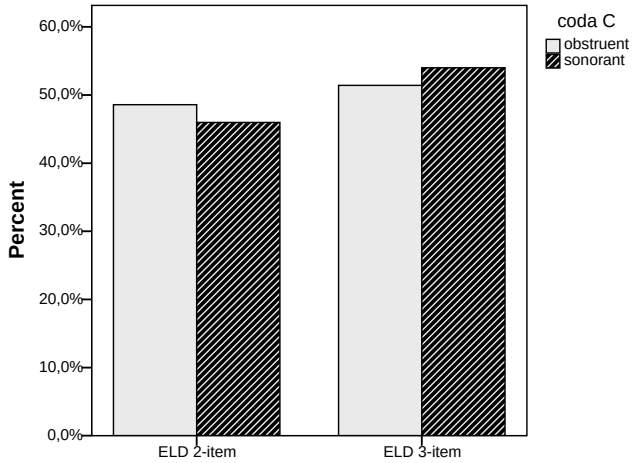


Figure 92. Aw. categorical word-choices in % of the total per factor, depending on the artificial F0 contours

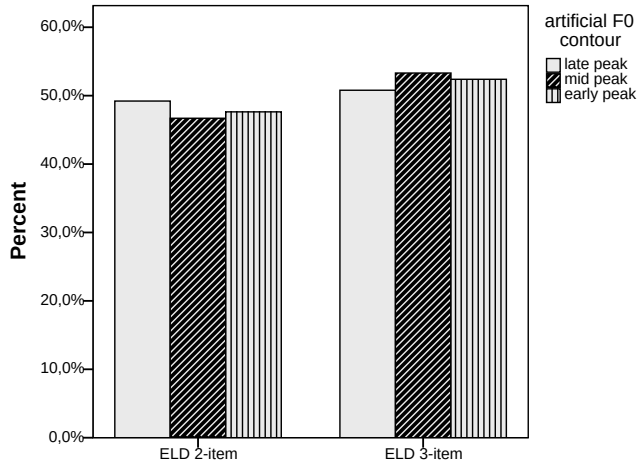


Table 74. Aw. experiment II. results of the multivariate analysis (binary logistic regression). Criterion: ELD 3 choice; method: Backward Wald.

predictor	B	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
non-final	1.752	1	.000	5.766	4.322	7.693
V duration (long)	-1.110	1	.000	.330	.268	.405
V duration (overlong)	.923	1	.000	2.518	2.068	3.066
Informant II.5.Aw	-.627	1	.000	.534	.393	.728
Constant	-.520	1	.000	.595		
Informant II.6.Aw	.424	1	.006	1.527	1.129	2.067
coda obstruent	-.382	1	.013	.683	.505	.922
Informant II.3.Aw	.282	1	.066	1.326	.981	1.792
Informant II.2.Aw	.254	1	.098	1.289	.954	1.741
Informant II.4.Aw	-.251	1	.103	.778	.575	1.052
-2 Log likelihood	1250.810					
Nagelkerke R^2	.329					
Model χ^2	320.962	9	.000			

Table 75. Aw. experiment III. results of the multivariate analysis (binary logistic regression). Criterion: ELD 3 choice; method: Backward Wald.

predictor	B	df	Sig.	Exp(B)	95.0% C.I.for EXP(B) Lower	Upper
non-final	1.155	1	.000	3.174	2.449	4.113
V duration (overlong)	.669	1	.000	1.952	1.627	2.342
V duration (long)	-.548	1	.000	.578	.485	.689
Constant	-.518	1	.000	.595		
coda C	.368	1	.009	1.446	1.095	1.909
-2 Log likelihood	1418.3663					
Nagelkerke R^2	.157					
Model χ^2	141.805	4	.000			

Table 76. Alfs. Perception Test results of the multivariate analysis (binary logistic regression).[332] Criterion: ELD 3 choice; method: Backward Wald.

					95.0% C.I.for EXP(B)	
predictor	B	df	Sig.	Exp(B)	Lower	Upper
Informant III.8.As	-.731	1	.000	.481	.359	.645
Informant II.8.As	.583	1	.000	1.791	1.331	2.410
V duration (long)	-.525	1	.000	.591	.529	.662
coda obstruent	.478	1	.000	1.613	1.350	1.927
V duration (overlong)	.446	1	.000	1.562	1.395	1.749
Informant III.10.As	.394	1	.008	1.483	1.108	1.984
Informant II.2.As	-.291	1	.044	.747	.563	.992
non-final	.284	1	.001	1.328	1.132	1.559
Informant II.1.As	.203	1	.163	1.226	.921	1.631
Informant III.4.As	-.179	1	.214	.836	.630	1.109
Constant	-.177	1	.007	.838		
pitch (TA2)	-.145	1	.011	.865	.773	.967
Informant II.3.As	.135	1	.352	1.145	.861	1.521
pitch (TA1)	.075	1	.190	1.078	.964	1.206
Informant II.4.As	-.067	1	.640	.935	.705	1.240
Informant III.7.As	.045	1	.757	1.046	.788	1.388
Informant III.2.As	-.045	1	.755	.956	.720	1.268
Informant II.7.As	-.023	1	.875	.978	.737	1.297
Informant III.1.As	.022	1	.878	1.022	.770	1.357
Informant III.11.As	-,021	1	,885	,979	,737	1,301
-2 Log likelihood	3463.934					
Nagelkerke R^2	.095					
Model χ^2	195.918	19	.000			

[332] Exclusive of the informants II.5.As, II.6.As, II.10.As, III.3.As, III.5.As, III.6.As, and III.9.As.

Figure 93. Alfs. word-choices in % of the total per factor, depending on the artificial V duration

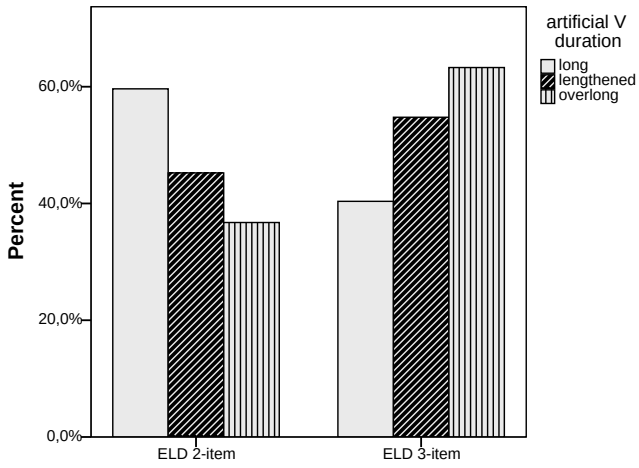


Figure 94. Alfs. word-choices in % of the total per factor, depending on sentence position

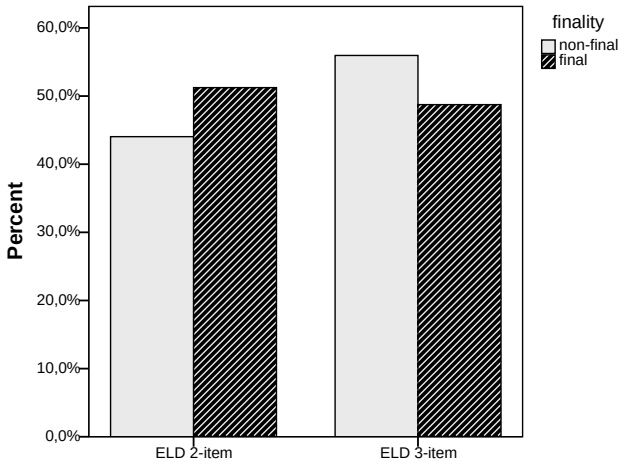


Figure 95. Alfs. word-choices in % of the total per factor, depening on the coda C

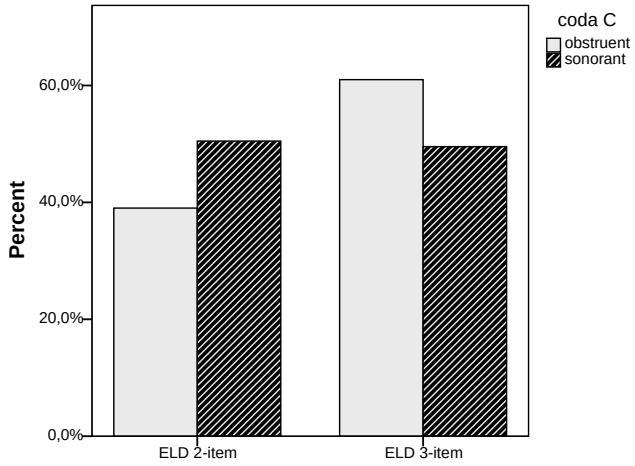


Figure 96. Alfs. categorical word-choices in % of the total per factor, depending on the artificial F0 contours

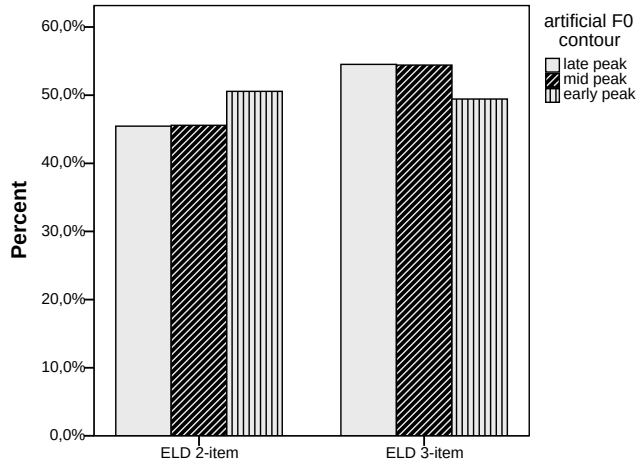


Table 77. Alfs. experiment II. results of the multivariate analysis (binary logistic regression). Criterion: ELD 3 choice; method: Backward Wald.

					95.0% C.I.for EXP(B)	
predictor	B	df	Sig.	Exp(B)	Lower	Upper
non-final	.865	1	.000	2.374	1.881	2.996
V duration (long)	-.646	1	.000	.524	.445	.617
Informant II.8.As	.520	1	.000	1.682	1.257	2.250
coda obstruent	.518	1	.000	1.678	1.297	2.173
V duration (overlong)	.483	1	.000	1.621	1.375	1.911
Constant	-.428	1	.000	.652		
Informant II.2.As	-.395	1	.006	.674	.510	.891
Informant II.4.As	-.160	1	.259	.852	.645	1.125
Informant II.7.As	-.114	1	.424	.893	.676	1.179
Informant II.1.As	.123	1	.391	1.131	.854	1.498
Informant II.3.As	.051	1	.719	1.053	.796	1.393
-2 Log likelihood	1670.098					
Nagelkerke R^2	.147					
Model χ^2	153.609	10	.000			

Table 78. Alfs. experiment III. results of the multivariate analysis (binary logistic regression). Criterion: ELD 3 choice; method: Backward Wald.

					95.0% C.I.for EXP(B)	
predictor	B	df	Sig.	Exp(B)	Lower	Upper
Informant III.8.As	-.650	1	.000	.522	.394	.691
coda obstruent	.492	1	.000	1.636	1.275	2.099
Informant III.10.As	.455	1	.001	1.577	1.196	2.078
V duration (long)	-.426	1	.000	.653	.558	.765
V duration (overlong)	.424	1	.000	1.528	1.304	1.791
non-final	-.274	1	.018	.760	.607	.953
Informant III.7.As	.119	1	.389	1.127	.859	1.478
Informant III.1.As	.097	1	.483	1.102	.840	1.445
Constant	.064	1	.484	1.066		
Informant III.11.As	.051	1	.713	1.052	.803	1.378
Informant III.2.As	.030	1	.826	1.031	.786	1.351
-2 Log likelihood	1748.943					
Nagelkerke R^2	.082					
Model χ^2	84.398	10	.000			

Table 79. On-line experiment results of the multivariate analysis (binary logistic regression).[333] Criterion: ELD 3 choice; method: Backward Wald.

					95.0% C.I.for EXP(B)	
predictor	B	df	Sig.	Exp(B)	Lower	Upper
II.4.online	-1.708	1	.001	.181	.068	.484
IV.9.online	1.059	1	.007	2.885	1.328	6.267
IV.8.online	1.052	1	.008	2.862	1.318	6.215
II.5.online	-.964	1	.020	.381	.169	.861
II.9.online	-.964	1	.020	.381	.169	.861
II.7.online	-.964	1	.020	.381	.169	.861
coda obstruent	-.816	1	.000	.442	.343	.570
I.5.online	.815	1	.024	2.260	1.113	4.589
III.2.online	.815	1	.024	2.260	1.113	4.589
non-final	.680	1	.055	1.973	.985	3.953
III.1.online	-.663	1	.014	.515	.304	.874
III.10.online	.625	1	.086	1.868	.916	3.811
II.8.online	-.539	1	.165	.583	.272	1.250
III.8.online	.528	1	.149	1.695	.828	3.472
Constant	-.464	1	.034	.629		
I.4.online	.429	1	.244	1.536	.747	3.160
III.4.online	.418	1	.257	1.518	.737	3.128
IV.4.online	-.410	1	.285	.664	.313	1.406
III.7.online	-.362	1	.376	.696	.312	1.552
V duration (overlong)	.354	1	.000	1.424	1.194	1.698
IV.2.online	.311	1	.404	1.364	.658	2.830
V duration (long)	-.293	1	.002	.746	.622	.894
III.5.online	.283	1	.444	1.327	.643	2.738
I.3.online	-.232	1	.561	.793	.362	1.735
III.9.online	.212	1	.572	1.236	.592	2.581
IV.5.online	-.164	1	.662	.848	.406	1.773
II.2.online	-.163	1	.664	.850	.407	1.774
IV.10.online	-.163	1	.664	.850	.407	1.774
III.6.online	.117	1	.757	1.125	.535	2.366
II.1.online	.075	1	.840	1.078	.520	2.236
II.6.online	.018	1	.961	1.018	.494	2.096
-2 Log likelihood	1403.333					
Nagelkerke R^2	.156					
Model χ^2	141.339	30	.000			

[333] Exclusive of age group 45+.

Figure 97. On-line Test categorical word-choices in % of the total per factor, depending on the coda C

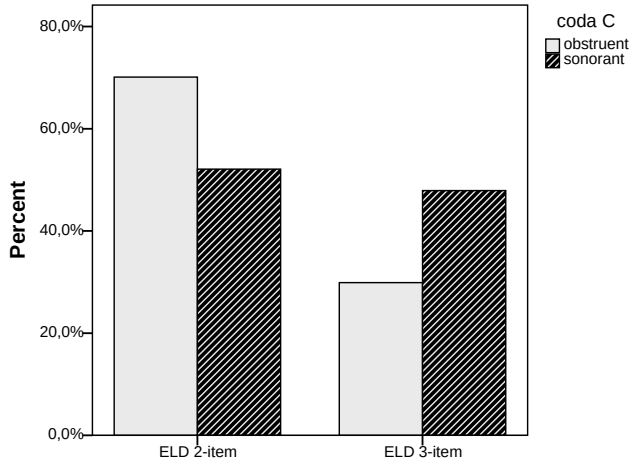


Figure 98. On-line Test categorical word-choices in % of the total per factor, depending on the sentence position

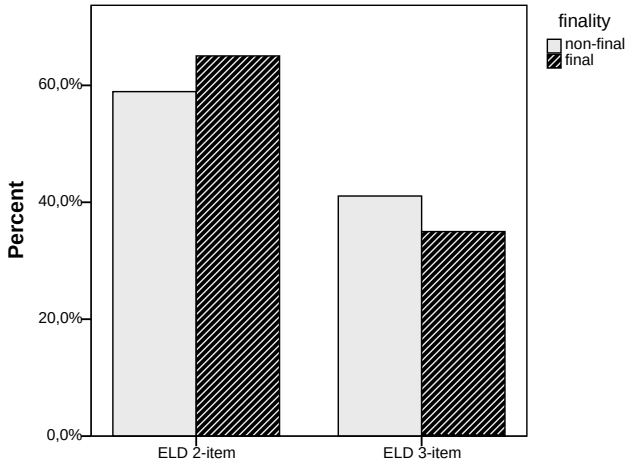


Figure 99. On-line Test categorical word-choices in % of the total per factor, depending on the artificial V duration

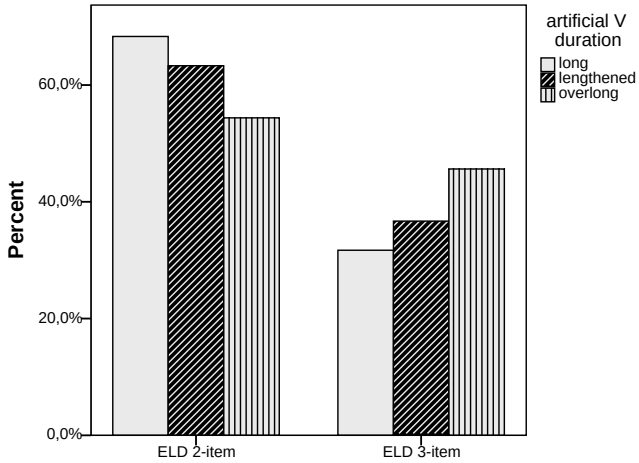
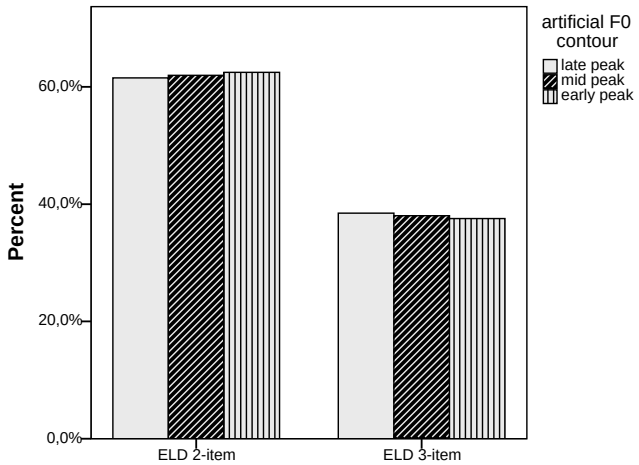


Figure 100. On-line Test categorical word-choices in % of the total per factor, depending on the artificial F0 contour



(F) LG noun classes containing a moraic (allo)morpheme]$^{\mu}$

This is an abbreviated overview of LG noun classes as described in Lasch (1974:191-203), yielding a final -ə# and hence a floating moraic (allo)morpheme.

a) MLG strong declension (originally vocalic declensions)

i) Masculine:

Without ending *e* in Nom.Sg.] *e* in the Dat. and Plural:

- *a*-stems. like MLG *dach* 'day-Nom.Sg.', *dāge* 'day-Dat.Sg. + Pl.',
- some *wa*-stems like MLG *snê* 'snow-Nom.Sg.'
- original *u*-stems with complex syllable like MLG *wolt* 'forest-Nom.Sg.'
- *i*-stems with originally complex syllable like *gast* 'guest-Nom.Sg.',

With ending *e* in Nom.Sg.:

- *ja*-stems like *wête* 'wheat-Nom.Sg.',
- some *wa*-stems,
- *i*- and *u*-stems with short syllable like MLG *brōke* 'breach-Nom.Sg.' and *sōne* 'son-Nom.Sg.'.

ii) Neuter:

Without ending *e* in Nom.Sg.] *e* in Dat. and Plural:

- *a*-stems like MLG *bên* 'leg-Nom.Sg.', *dāl* 'valley-Nom.Sg.', *hûs* 'house-Nom.Sg.', *swîn* 'pig-Nom.Sg.', *wîf* 'wive-Nom.Sg.', etc.,
- stems ending in vowels like the MLG original *u*-stem *vê* 'lifestock-Nom.Sg.', the original *wa*-stem *knê* 'knee-Nom.Sg.', or the original *j*-stem *touw* 'rod-Nom.Sg.',
- original *es*/*os*-stems like MLG *kalf* 'calf-Nom.Sg.',

With Nom.Sg. in *e*:

- *ja*- and *wa*-stems like MLG *bedde* 'bed-Nom.Sg.' and *mēle* 'flour-Nom.Sg.'.

iii) Feminine:

Mostly without *e* in the Nom.Sg.] *e* in Dat. and Plural:

- *i*-stems like MLG *hût* 'skin-Nom.Sg.', *brût* 'bride-Nom.Sg.', *tît* 'time-Nom.Sg.',
- originally consonantal stems like MLG *kô* 'cow-Nom.Sg.', *gôs* 'goose-Nom.Sg.', *nacht* 'night-Nom.Sg.'.

Mostly with *e* in Nom.Sg.:

- abstract nouns ending originally in *-î* like MLG *dôpe* 'baptism-Nom.Sg.',
- *ô*-stems (= *ô*-, *wô*-, and *jô*-stems) like MLG *wîse* 'manner-Nom.Sg.', *sprâke* 'language-Nom.Sg.'.

b) MLG weak declension (including originally consonantic declension)

With *e* in Nom.Sg.] Dat. and Plural in *-en*:

- m./n./f. *n*-stems like MLG *nāme* 'name-Nom.Sg.', *ôge* 'eye-Nom.Sg.', *tunge* 'tongue-Nom.Sg.',
- *jan*-stems like MLG *wille* 'will-Nom.Sg.', *erve* 'heritage-Nom.Sg.'.

Het hier beschreven onderzoek werd mede mogelijk gemaakt door de steun van NWO.



