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

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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* [bruːt] '(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 Vː to overlong VVː. 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

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[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
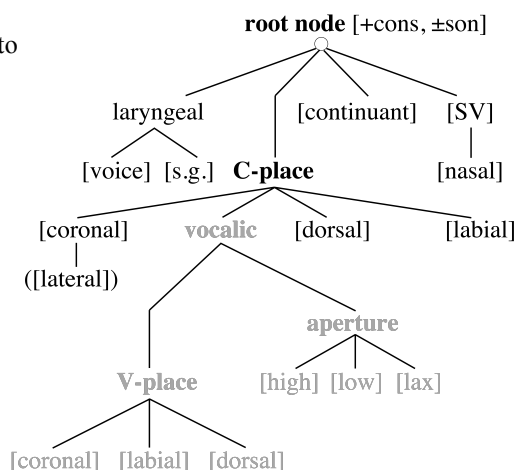
In the course of this study we have come across a number of minimally different pairs of words. At the overt level, they differ most notably in terms of the duration of the vocalic nucleus. A possible 'voicing' difference in the coda at the underlying level or surface level is (almost) completely neutralized 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' [mɛotʰ] *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	tʰ
	/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	tʰ
	/ziid/ 'silk-Sg.'	d	d	t / d̥
(e)	/brɛod/ 'bread-Sg.'	d	t	tʰ
	/brɛoːt/ 'to brew-3.Sg.Pres.'	t	t	tʰ

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[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 *bruw-et* > [brɛoːt]) or was deleted (e.g. MLG *meid-et, meig-et, meih-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.

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[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 *bruw-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 [sloː.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

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[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

LAR

Root node [+cons]

Place node

[spread glottis]

(b)   lenis obstruents

Root node [+cons]

Place node

(c)   sonorants consonants

[SV]

Root node [+cons]

Place node
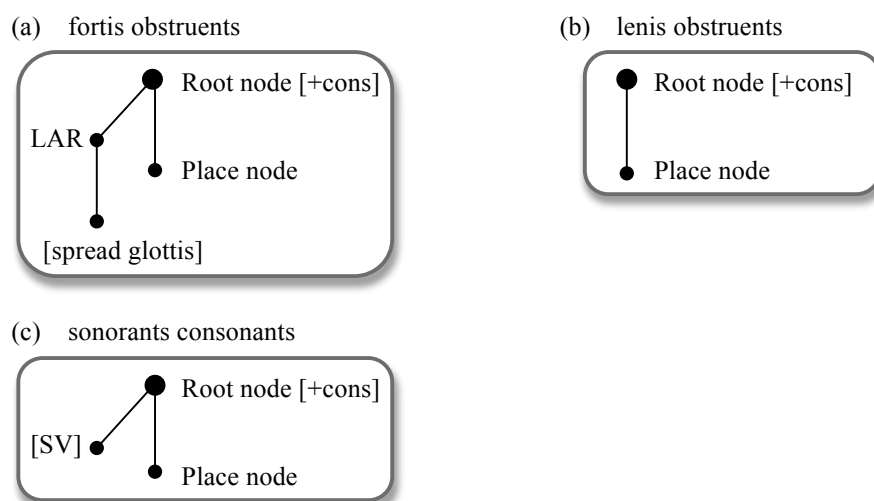
The structural complexity of the fortis Cs and sonorant Cs as compared to the simplex lenis Cs has basically two immediate consequences. It determines the necessity for moraic licensing, and it creates configurations that are resistant with respect to assimilatory processes. I treat licensing by a mora 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

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[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, CəC, CV**C**
heavy	CVVC$_{lenis}$, CVC$_{fortis}$C$_{fortis}$, CV**RC**$_{fortis}$

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$_1$V$_1$C$_2$V$_2$

> **kasu* >   *kas*   'bodice'
> **mutu* >   *mut*   'mute'
> **fine* >   *fin*   'end'
> **cane* >   *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

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.' > [loːtn̩], *māken* 'to make-Inf.' > [moːkŋ̩], *bīten* 'to bit-Inf.' > [biːtn̩], *vāten* 'to grab-Inf.' > [fattn̩], *balke* 'balk-Sg.' > [balk], *māten* 'extent-Pl.' > [mɑːtn̩], *koken* 'cake-Sg.' > [koʊkŋ̩], *lēpel* 'spoon-Sg.' > [leˑˑpl̩], *wassen* 'to grow-Inf.' > [vassn̩], *derschen* 'to flail-Inf.' > [dœʃʃn̩], *slāpen* 'to sleep-Inf.' > [sloːpn̩], *snacken* 'to talk-Inf.' > [snakkŋ̩]. Even though the place specifications may be identical for the obstruent and the following nasal (e.g. [coronal] as in [loːtn̩] 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' > [kɪnnəʁ] 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 [bliːmm̩], *lēven* 'life-Sg.' > [leːmm̩], *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' > [vɪnnəʁ].

[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 [kɪnnəɐ]) 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

[+cons]   [+cons]

[SV]
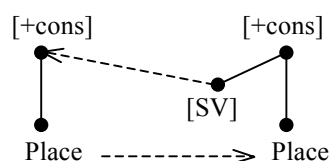
Place   - - - - - - - - ≫   Place

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

[+cons]   [+cons]

LAR   [SV]

Place   Place
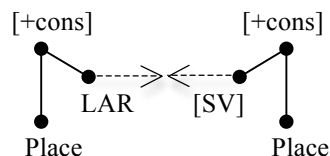
We see that phonological complexity can be employed to explain certain behavioral peculiarities of fortis Cs. After having established the structural differences between the two obstruent categories of lenis and fortis, we can move on to a detailed OT analysis of the matter. Starting point are the lenis 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

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[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.

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[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.

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[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. [huːz] 'house-Dat.Sg.'[252]

$[\,[\,C\,V^{\mu}\,D\,]_{\sigma}\,^{\mu}]_{\phi}$ [253]	MaxBin	RM	WEAKEDGE	$*V_{\mu\mu}$	DEP-μ	FTBIN
(a) $[[CV^{\mu}D^{\mu}]_{\sigma}]_{\phi}$			*!			
(b) ☞ $[[CV^{\mu\mu}]_{\sigma}]_{\phi}<D>$				*		
(c) $[[CV^{\mu\mu\mu}]_{\sigma}]_{\phi}<D>$	*!			*	*	
(d) $[[CV^{\mu\mu}D^{\mu}]_{\sigma}]_{\phi}$	*!		*	*	*	
(e) $[[CV^{\mu}]_{\sigma}\,D^{\mu}]_{\phi}$			*!			
(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 >> $*V_{\mu\mu}$ 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

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[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. [VᵘD]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 $[[CV^{\mu}]_{\sigma}]_{\phi}<D>$ 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.

surface form:

underlying form:

house-Nom.Sg.   house-Dat.Sg.
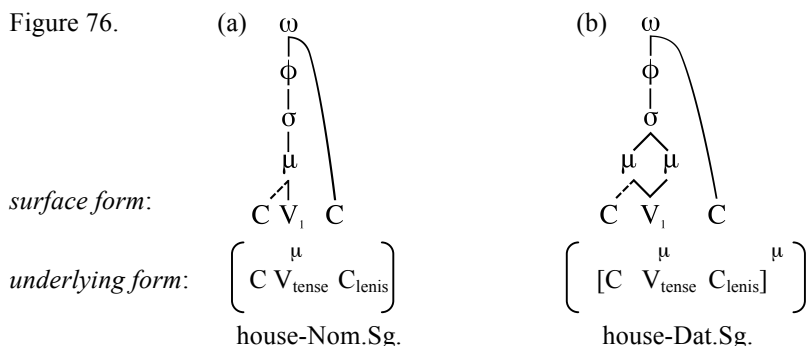
These representations show not only the syllable level but also the dominating Prosodic Hierarchy at the foot level (φ) and the PrWd level (ω). The form in Figure 76 (a) represents cases like *Huus* 'house-NomSg.' with a tense V in the nucleus and no $^\mu$] latched to the right edge of the word. Forms 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.'

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[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$^{\mu}$ C]   'house-Nom.Sg.'
              tense

    (b)   [[C V$^{\mu}$ 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.

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[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. [kɔmˈbyyːz] 'caboose-Sg.'

$[CV^\mu R^\mu]_\sigma[[CV^\mu D]_\sigma{}^\mu]_\phi$	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	*V$_{\mu\mu}$	FTBIN
(a) $[CV^\mu R^\mu]_\sigma[[CV^\mu D^\mu]_\sigma]_\phi$	*	*!	*				
(b) $[CV^\mu R^\mu]_\sigma[[CV^{\mu\mu} D]_\sigma]_\phi$	*	*!	*			*	
(c) ☞ $[CV^\mu R^\mu]_\sigma[[CV^{\mu\mu}]_\sigma]_\phi<D>$	*		*	*	*	*	

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[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$_{μμ}$ and FTBIN can be determined. Leaving them here unranked with respect to *V$_{μμ}$ 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$_{μμ}$} >>
            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 [mɑˈtrats] '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 (**LL**)<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]

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[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. [deːk] 'blanket-Nom.Sg.'

$[[CV^{\mu}T^{\mu}]_\sigma{}^{\mu}]_\phi$	MaxBin	RM	Dep-μ	RhType =T	Fortis-μ	WeakEdge	RightM	Parse (Σ)	*V_μμ	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) $[[CV^{\mu}]_\sigma]_\phi<T>$				*!	*		*	*		*
(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

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[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. ['bannɪç] '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 [riːs] 'rice'. Similar to the [deːk] '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 $[[CV^\mu T^\mu]_\sigma]_\phi$.

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[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. [riːs] 'rice'

$[[C\,V^{\mu}\,T^{\mu}]_{\sigma}]_{\phi}$	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.
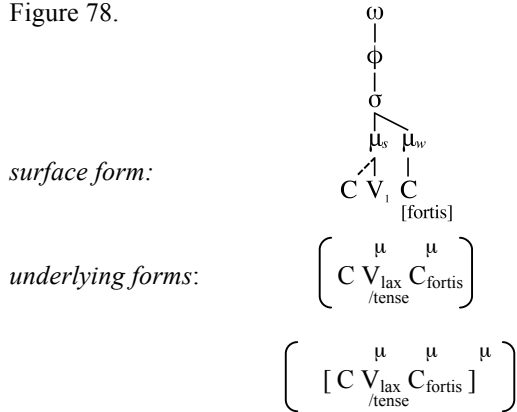
The constraint ranking produces a somewhat different result in bisyllabic items. I provide a brief evaluation of forms such as ['kiːvɪt] 'peewit-Sg.' with a foot structure (**LL**)<C> in Tableau 23. The two candidates (a) and (b) are the closest competitors as determined in the simplified Tableau 9 in section 4.2.1. MaxBin, RM, RʜTʏᴘᴇ=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 $[[CV^\mu T^\mu]_\sigma]_\phi$ with a monomoraic vowel preceding a syllabified and footed moraic fortis C. Additionally, ranking PARSE (σ) >> RIGHTM is a necessary means to decide between (**LL**)<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

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[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 [miːn] '(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. [miːn] '(coal-)mine-Nom.Sg.'

$[[CV^\mu R^\mu]_\sigma{}^\mu]_\phi$	MaxBin	RM	Dep-μ	RhType =T	Son-μ	WeakEdge	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>				*!	*		*	*		*

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 $[[CV^\mu R^\mu]_\sigma]_\phi$ 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) $[[CV^\mu R^\mu]_\sigma]_\phi$, the overlong candidate (e) $[[CV^{\mu\mu}]_\sigma]_\phi$<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 $[[CV^{\mu\mu}]_\sigma]_\phi$ <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 [miːn] '(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 [zøːn] '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.
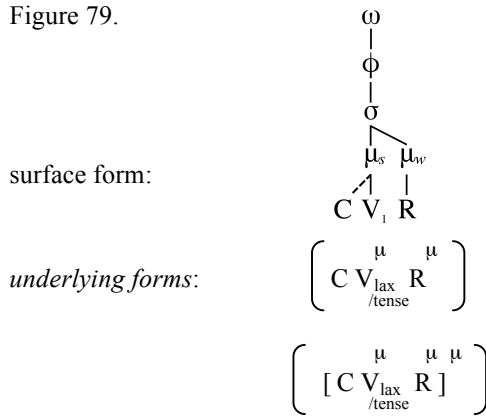
Tableau 25. [zøːn] 'son-Nom.Sg.'

$[\,[\,C\,V^\mu\,R^\mu\,]_\sigma\,]_\phi$	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:

$$
\omega \\
\mid \\
\phi \\
\mid \\
\sigma \\
\diagup\diagdown \\
\mu_s \quad \mu_w \\
\diagup \quad \mid \\
C\ V_1\ R
$$

underlying forms:

$$
\begin{pmatrix} & \overset{\mu}{} & \overset{\mu}{} \\ C & V_{\substack{lax \\ /tense}} & R \end{pmatrix}
$$

$$
\begin{pmatrix} & \overset{\mu}{} & \overset{\mu}{}\ \overset{\mu}{} \\ [\ C & V_{\substack{lax \\ /tense}} & R\ ] \end{pmatrix}
$$

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 ['faslam] '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 (**LL**)<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 (**LL**)<C>. Output forms with a trimoraic final syllable are left out because they are excluded by MaxBin anyway.

Tableau 26. ['faslam] 'carnival-Sg.'

$[[CV^{\mu}T^{\mu}]_\sigma[TV^{\mu}R^{\mu}]_\sigma]_\phi$	FORTIS-μ	SON-μ	WSP	WEAKEDGE	PARSE (σ)	RIGHTM	PARSE (Σ)	*Vμμ	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 (**LL**)<C> outranks (**LH**) 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$_{µµ}$} >>
           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.

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[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. [mo'rats] '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 [ʔoːvt] '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. [ʔoːvt] 'fruit-Pl.tantum'

$[[C V^\mu DT^\mu]_\sigma]_\phi$	MaxBin	RM	DEP-μ	RHTYPE =T	FORTIS-μ	WEAKEDGE	RIGHTM	PARSE (Σ)	*V$_{\mu\mu}$	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.'

$[[C V^{\mu} R^{\mu} T^{\mu}]_{\sigma}]_{\phi}$	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 [maːnd] 'month-Sg., moon-Sg.'. The respective evaluation follows in Tableau 31.

Tableau 31. [pʊnd] 'pound-Sg.'

$[\,[\,C\,V^{\mu}\,R^{\mu}\,D]_{\sigma}]_{\phi}$	MaxBin	RM	Dep-μ	RhType =T	Son-μ	WeakEdge	RightM	Parse (Σ)	*Vμμ	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$_{\mu\mu}$} >>
         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.

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[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.