

# Paradigm Generation and Northern Sámi Stems

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## 1 Introduction

Northern Sámi, a Finno-Ugric language spoken mainly in Northern Norway, Sweden, and Finland, has a system of consonant gradation which affects consonants at the center of a prosodic foot: the coda of the stressed syllable and the onset of the following syllable (stress is word-initial). Consonant gradation is illustrated in (1) for two typical nouns (angle brackets signal that the example is given in the standard orthography, based largely on Nickel 1990 unless stated otherwise).<sup>1</sup>

(1)    *⟨viessu⟩* ‘house,’ *⟨čiehkka⟩* ‘corner’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	<i>⟨viessu⟩</i>	<i>⟨viesut⟩</i>	<i>⟨čiehkka⟩</i>	<i>⟨čiegat⟩</i>
Acc	<i>⟨viesu⟩</i>	<i>⟨viesuid⟩</i>	<i>⟨čiega⟩</i>	<i>⟨čiegaid⟩</i>
Ill	<i>⟨vissui⟩</i>	<i>⟨viesuide⟩</i>	<i>⟨čihkii⟩</i>	<i>⟨čiegaide⟩</i>
Loc	<i>⟨viesus⟩</i>	<i>⟨viesuin⟩</i>	<i>⟨čiegas⟩</i>	<i>⟨čiegain⟩</i>
Com	<i>⟨viesuin⟩</i>	<i>⟨viesuiguin⟩</i>	<i>⟨čiegain⟩</i>	<i>⟨čiegaiguin⟩</i>
Ess	<i>⟨viessun⟩</i>		<i>⟨čiehkan⟩</i>	

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<sup>1</sup>The data in this paper represent the Kautokeino (Guovdageaidnu) dialect (see Sammal-lahti 1998, Bals et al. to appear for further information about the phonological details). Phonemic and phonetic representations, when used, are based on the conventions presented in Bals et al. (to appear) and Bals (in preparation), using the following non-IPA symbols (adopted from the standard orthography):

Here:    š    č    ž    c    z  
 IPA:    ʃ    tʃ    dʒ    ts    dz

Overlong geminates are written C:C. Other symbols correspond more or less to their usual IPA values, in phonetic and phonemic representations marked with square brackets and slashes.

Abbreviations used here Nom[inative], Acc[usative], Ill[ative], Loc[ative], Com[itative], Ess[ive]. Some works on Northern Sámi grammar recognize a Genitive, but it is always identical to the Accusative.

Observe the pattern of geminate versus non-geminate *s* in the root of the first example, and the corresponding pattern of *g* alternating with *hk* in the second. The long (two segment, CC) examples appear in cells in the paradigm that call for Strong Grade, while the short (C) examples are Weak Grade. Specifically, Strong Grade is found in the nominative singular, the illative singular, and the essive.

A different distribution of Strong and Weak Grade is seen in (2).

(2)    *⟨gielu⟩* ‘bloodclot,’ *⟨vuoluš⟩* ‘that which is underneath’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	⟨gielu⟩	⟨gillomat⟩	⟨vuoluš⟩	⟨vullošat⟩
Acc	⟨gilloma⟩	⟨gillomiid⟩	⟨vulloša⟩	⟨vullošiid⟩
Ill	⟨gillomii⟩	⟨gillomiidda⟩	⟨vullošii⟩	⟨vullošiidda⟩
Loc	⟨gillomis⟩	⟨gillomiin⟩	⟨vullošis⟩	⟨vullošiin⟩
Com	⟨gillomiin⟩	⟨gillomiiguin⟩	⟨vullošiin⟩	⟨vullošiiguin⟩
Ess	⟨gielun⟩		⟨vuolušin⟩	

Here, the nominative singular and the essive are *not* in the Strong Grade, rather the other forms are (the illative singular is Strong in both (1) and (2)). Another example of this pattern is shown in (3), where ⟨hcc⟩ and ⟨lg⟩ are Strong Grade centers, and ⟨z⟩ as well as (counterintuitively) ⟨lgg⟩ are Weak.

(3)    *⟨boazu⟩* ‘reindeer,’ *⟨bálggis⟩* ‘path’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	⟨boazu⟩	⟨bohccot⟩	⟨bálggis⟩	⟨bálgát⟩
Acc	⟨bohcco⟩	⟨bohccuid⟩	⟨bálgá⟩	⟨bálgáid⟩
Ill	⟨bohccui⟩	⟨bohccuide⟩	⟨bálgái⟩	⟨bálgáide⟩
Loc	⟨bohccos⟩	⟨bohccuin⟩	⟨bálgás⟩	⟨bálgáin⟩
Com	⟨bohccuin⟩	⟨bohccuiguin⟩	⟨bálgáin⟩	⟨bálgáiguin⟩
Ess	⟨boazun⟩		⟨bálggisin⟩	

Similar alternations can be observed in the adjectival and verbal paradigms. There are also nouns which do not show any alternation, like those in (4) (⟨á⟩ = /aa/).

(4)    *⟨gahpir⟩* ‘cap’ *⟨ákšu⟩* ‘axe’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	⟨gahpir⟩	⟨gahpirat⟩	⟨ákšu⟩	⟨ákšut⟩
Acc	⟨gahpira⟩	⟨gahpiriid⟩	⟨ákšu⟩	⟨ákšuid⟩
Ill	⟨gahpirii⟩	⟨gahpiriidda⟩	⟨ákšui⟩	⟨ákšuide⟩
Loc	⟨gahpiris⟩	⟨gahpiriin⟩	⟨ákšus⟩	⟨ákšuin⟩
Com	⟨gahpiriin⟩	⟨gahpiriiguin⟩	⟨ákšuin⟩	⟨ákšuiquin⟩
Ess	⟨gahpirin⟩		⟨ákšun⟩	

There are two different aspects to the complexity of the system: One is the paradigmatic distribution of the Strong and Weak forms, which is historically but not synchronically phonologically conditioned, and the other is the complexity of the phonological relationship between the Strong and Weak forms.

In this paper, I present an analysis which is based on a phonologically somewhat abstract element (an infixal timing slot which is responsible for the Strong Grade) interacting with a simple concatenative morphology and declension class features. Once these devices are accepted, then a fairly simple analysis emerges.<sup>2</sup>

Historically, a process of lengthening applied to consonants immediately following a stressed foot nucleus, if the following syllable was open (Sammallahti 1998, Bye 2001). Thus, the alternation between nominative and accusative would have looked something like the following, for a few common stem shapes, given an accusative suffix *-m*.<sup>3</sup>

(5)	<b>Root</b>	<b>Nominative</b>	<b>Accusative</b>	
	CVCV	CVC.CV	CV.CV-m	
	<i>*viesu</i>	<i>*vies.su</i>	<i>*vie.sum</i>	(cf. (1))
	CVCVC	CV.CVC	CVC.CV.C-em	
	<i>*gielum</i>	<i>*gie.lum</i>	<i>*giel.lu.mem</i>	(cf. (2))
	<i>*poazoj</i>	<i>*poa.zoj</i>	<i>*poaz.zo.jem</i>	(cf. (3))
	CVCVCV	CVC.CV.CV	CVC.CV.CV-m	
	<i>*kapera</i>	<i>*kap.pe.ra</i>	<i>*kap.pe.ram</i>	(cf. (4))

After various phonological changes, including the loss of many word-final consonants including the accusative *-m* suffix, obscured the phonological basis for the alternations, they became morphologized. I propose that this be represented in terms of sets of stem-forming suffixes, some of which have as a component a floating autosegment. This floating autosegment, which I represent as  $\mu$ , adds a timing slot to the coda of the first stressed syllable to its left, in other words it is infixal. I annotate its infixal character by superscripting  $\mu$  and attaching an arcing line to it, thus:  ${}^{\mu}\frown$ ; when this is attached to a root, for example of form CVCV, it can be represented as in (6a), exemplified for *viessu* ‘house’ in (6b).

- (6) a.  $C\acute{V}CV-{}^{\mu}\frown \rightarrow CV^{\mu}CV$   
b.  $viesu-{}^{\mu}\frown \rightarrow vie^{\mu}su \rightarrow viessu$

The table in (7) shows the synchronic derivation of some of the nouns displayed in the examples above; various phonological details will be discussed below. The symbol  $\surd$  stands for the root.

<sup>2</sup>Diphthong simplification can also been seen at work in the paradigms above. I believe this to be fully regular and phonologically conditioned, but will not discuss it in this article.

<sup>3</sup>These starred examples are oversimplified approximations of historical reconstructions for illustrative purposes; for careful reconstructions see Sammallahti 1998.

(7)	<b>Root</b>	<b>Nominative</b>	<b>Accusative</b>	
	Class 1 (E)	$\sqrt{-\mu\sim}$	$\sqrt{-a}$	
	<i>viesu</i> - ‘house’	$\langle viessu \rangle$	$\langle viesu \rangle$	(cf. (1))
	Class 2 (O)	$\sqrt{-}$	$\sqrt{-\mu\sim a}$	
	<i>gielum</i> - ‘bloodclot’	$\langle gielu \rangle$	$\langle gilloma \rangle$	(cf. (2))
	Class 3 (C)	$\sqrt{-u}$	$\sqrt{-\mu\mu\sim o}$	
	<i>boazu</i> - ‘reindeer’	$\langle boazu \rangle$	$\langle bohcco \rangle$	(cf. (3))
	Class 4 (NA)	$\sqrt{-}$	$\sqrt{-a}$	
	<i>gahpir</i> - ‘cap’	$\langle gahpir \rangle$	$\langle gahpira \rangle$	(cf. (4))

Historically, something like the CVCV pattern in (5) gave rise to Class 1 in (7), which I call E below (for Even number of syllables). Something like the CVCVC pattern gave rise to Classes 2 (O, for Odd number of syllables) and 3 (for Contracted), while the CVCVCV pattern gave rise to Class 4 (NA, for Non-Alternating).

Synchronically, class membership must be learned along with a root (though there are some phonological clues), and is necessary in order to derive the right pattern of Strong and Weak Grade. A paradigm is entirely determined by a set of two or three stem-forming suffixes like the ones displayed in (7). For instance, the locative and comitative case forms are always built from the same stem as the accusative, and the essive is always built from the same stem as the nominative singular (the illative behaves differently in different classes).

This analysis makes clear predictions which can be tested. It predicts, for example, that the locus of the consonant mutation characteristic of Strong Grade must bear a certain phonological relationship to the position of the suffix triggering it. Since syntax narrowly constrains the ordering of affixes (see for example Julien 1996; 2002), predictions are made even when the affix contains no other phonological material than  $\mu\sim$ .

For example, consider the pattern of consonant mutation in the E Class noun *muitalus* ‘story,’ illustrated in (8).

(8)	$\langle mitalus \rangle$ ‘story’		
	<b>Singular</b>	<b>Plural</b>	
	Nom $\langle mitalus \rangle$	$\langle mitalusat \rangle$	
	Acc $\langle mitalusa \rangle$	$\langle mitalusaid \rangle$	
	Ill $\langle mitalussi \rangle$	$\langle mitalusaide \rangle$	
	Loc $\langle mitalusas \rangle$	$\langle mitalusain \rangle$	
	Com $\langle mitalusain \rangle$	$\langle mitalusaiguin \rangle$	
	Ess $\langle mitalussan \rangle$		

The E pattern shows Strong Grade in the nominative singular, the illative singular, and the essive. The third syllable here bears secondary stress. Thus,  $\mu\sim$  is predicted to target the root-final *s*. Since there is no length contrast in consonants word-finally, this is imperceptible in the nominative singular, but visible in the illative and essive.

Derivational suffixes, which on independent grounds are expected to attach more closely to the root than a case suffix, can change the class membership

of a root. For example, the derivational suffix *-s* illustrated in (9) derives O Class nouns, as can be seen by comparing the E pattern of the underived noun *suorbma* ‘finger’ on the left to the O pattern of the derived noun *suorpmas* ‘ring’ on the right.

(9)    *⟨suorbma⟩* ‘finger,’ *⟨suorpmas⟩* ‘finger ring’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	<i>⟨suorbma⟩</i>	<i>⟨suorpmat⟩</i>	<i>⟨suorpmas⟩</i>	<i>⟨suorbmaset⟩</i>
Acc	<i>⟨suorpmas⟩</i>	<i>⟨suorpmasid⟩</i>	<i>⟨suorbmaset⟩</i>	<i>⟨suorbmasetid⟩</i>
Ill	<i>⟨surbmii⟩</i>	<i>⟨suorpmaside⟩</i>	<i>⟨suorbmaseti⟩</i>	<i>⟨suorbmasetidda⟩</i>
Loc	<i>⟨suorpmas⟩</i>	<i>⟨suorpmasid⟩</i>	<i>⟨suorbmaseti⟩</i>	<i>⟨suorbmasetiin⟩</i>
Com	<i>⟨suorpmasid⟩</i>	<i>⟨suorpmasiduin⟩</i>	<i>⟨suorbmasetiin⟩</i>	<i>⟨suorbmasetiuguin⟩</i>
Ess	<i>⟨suorbmaset⟩</i>		<i>⟨suorbmasetin⟩</i>	

In fact, derivational suffixes can themselves undergo consonant gradation, if they fall within the phonologically defined position where  $\mu$  must be affixed. For example, the suffix *-huoč*, illustrated in (10), the *č* in the suffix exhibits consonant gradation.

(10)    *⟨bárdni⟩* ‘boy,’ *⟨bártnehuoš⟩* ‘poor boy’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	<i>⟨bárdni⟩</i>	<i>⟨bártnit⟩</i>	<i>⟨bártnehuoš⟩</i>	<i>⟨bártnehuoččat⟩</i>
Acc	<i>⟨bártni⟩</i>	<i>⟨bártniid⟩</i>	<i>⟨bártnehuočča⟩</i>	<i>⟨bártnehuoččaid⟩</i>
Ill	<i>⟨bárdnái⟩</i>	<i>⟨bártniide⟩</i>	<i>⟨bártnehuoččii⟩</i>	<i>⟨bártnehuoččaidda⟩</i>
Loc	<i>⟨bártnis⟩</i>	<i>⟨bártniin⟩</i>	<i>⟨bártnehuoččas⟩</i>	<i>⟨bártnehuoččain⟩</i>
Com	<i>⟨bártniin⟩</i>	<i>⟨bártniiguin⟩</i>	<i>⟨bártnehuoččain⟩</i>	<i>⟨bártnehuoččaiguin⟩</i>
Ess	<i>⟨bárdnin⟩</i>		<i>⟨bártnehuoččan⟩</i>	

In the derived form, the autosegment  $\mu$  attaches to the final *č* of the suffix, as seen in the illative singular and essive forms (word-finally the segment surfaces only as a *š*). The root is too far from the stem-forming suffixes and does not undergo consonant gradation, surfacing in the Weak Grade, as shown.

In the next section, I motivate the assumption that the Strong Grade is essentially derived from the Weak Grade.

## 2 The nature of the alternation

The previous section exhibited many different manifestations of the Strong–Weak Grade alternation, including the following, presented here with orthographic representations side-by-side with broad phonemic representations.

(11)	<b>Strong</b>	<b>Weak</b>		
	⟨ss⟩	[ss]	⟨s⟩	[s] (cf. (1))
	⟨hk⟩	[hk]	⟨g⟩	[g] (cf. (1))
	⟨ll⟩	[ll]	⟨l⟩	[l] (cf. (2))
	⟨hcc⟩	[hhc]	⟨z⟩	[z] (cf. (3))
	⟨lg⟩	[ləg]	⟨lgg⟩	[lgg] (cf. (3))
	⟨rbm⟩	[rəʔm]	⟨rpm⟩	[rʔm] (cf. (9))
	⟨rdn⟩	[rəʔn]	⟨rtn⟩	[rʔn] (cf. (10))
	⟨čč⟩	[tč]	⟨žž⟩	[dč] (cf. (10))

Nickel (1990:27–30) lists 147 such Strong–Weak pairs, organized into various groupings. Superficially, the alternations seem heterogeneous, but I suggest that consonant gradation can be modelled in every case as the result of a timing slot, which I have represented above as  $\mu$ , being added to the consonant center.  $\mu$  is essentially a phonological segment in the language, like  $h$  or  $ʔ$ , but surfaces with different values depending on its phonological environment (this does not rule out the possibility that  $\mu$  is underlyingly the same as  $ʔ$  or  $h$ ). Various phonological rules apply to the combination of  $\mu$  plus a consonant or sequence of consonants to derive the surface output.

## 2.1 Productivity

The system of consonant gradation is highly productive and is applied to new coinages and loans in the language. In general, new words are assigned to the E class; for instance the examples in (12) show pairs in which the nominative singular (the first of each pair) is Strong Grade and the accusative singular is Weak Grade. I give Norwegian cognates though the words might have been borrowed from Swedish or some other language.

- (12) a. ⟨porseliidna⟩ ~ ⟨porseliinna⟩ (cf. Nor. *porselen*, ‘porcelain’)  
b. ⟨parlameanta⟩ ~ ⟨parlameantta⟩ (cf. Nor. *parlament*, ‘parliament’)  
c. ⟨diftongga⟩ ~ ⟨diftongga⟩ (cf. Nor. *diftong*, ‘diphthong’)

Certain suffixes (as noted in §1) are associated with the O class, and this may lead to new words being O class; the following examples illustrate this, as the nominative singular (the first one) is Weak Grade and the accusative singular Strong Grade.

- (13) a. ⟨politihkar⟩ ~ ⟨politihhkar⟩ (cf. Nor. *politiker*, ‘politician’)  
b. ⟨mekanihkar⟩ ~ ⟨mekanihhkar⟩ (cf. Nor. *mekaniker*, ‘mechanic’)  
c. ⟨teknihhkar⟩ ~ ⟨teknihhkar⟩ (cf. Nor. *tekniker*, ‘technician’)

Whether the original word more closely resembles the Weak or Strong Grade varies.<sup>4</sup> For example, a cognate to *charm* (Nor. *sjarm*, [šarm]) has recently been borrowed, and alternates between Strong [šarəʔma] (nominative) and Weak [šarʔma] (accusative); judging from the phonological dissimilarity of the Strong

<sup>4</sup>Special thanks to Berit Anne Bals for discussion on this point.

form to the Norwegian, it seems that the word was introduced into Sámi as a Weak form.<sup>5</sup> On the other hand, words including *ks* and *kt* and *kst* clusters (among others) in their centers may tend to be borrowed as Strong, since there are Strong centers with those clusters in Northern Sámi, but not Weak ones. For instance, the word *doctor* (Norwegian *doktor*) has entered the language as Strong *doaktaara*, Weak *doavttiir* (the Northern Sámi word is class O so the Weak form is nominative singular, and the Strong form is accusative singular).

The same  $k \sim v$  alternation is seen in the minimal pair in (14). Norwegian *lefse*, a thin potato-meal tortilla, has been borrowed as Weak *leavssa* in the accusative, alternating with Strong *leaksa* in the nominative; but ‘text’ (Nor. *tekst*) has been borrowed as Strong, alternating with a form with *v*.

- (14) a.  $\langle \text{leaksa} \rangle \sim \langle \text{leavssa} \rangle$  (cf. Nor. *lefse*, ‘potato tortilla’)  
 b.  $\langle \text{teaksta} \rangle \sim \langle \text{teavstta} \rangle$  (cf. Nor. *tekst*, ‘text’)

New words are also sometimes assigned to the NA class. This may happen if a consonant center is not gradable, or if the word is somehow inconsistent with Northern Sámi patterns. I know of no recent loan words entering Class C, but Class C nouns can be derived.

Because of the productivity of consonant gradation, root alternants cannot simply be listed. Part of competence in Northern Sámi is the presence of a system that predicts the Weak from the Strong form, or the Strong from the Weak form, or both from some underlying representation. Bals (2002) has shown that children learn to correctly use the Consonant Gradation process before the age of three (in fact, the phonologically simplest alternation—gemination—is already being correctly used by the age of two).

## 2.2 The direction of the alternation

I have argued that part of the linguistic competence of a Northern Sámi speaker is knowing how to create an alternating Strong–Weak pair; the simplest statement of this knowledge will be as a rule applying to an underlying form. This leads us to the question of which form is the underlying one, a question that turns out to be surprisingly difficult to answer. I briefly discuss the complications, then turn to the solution.

A possible clue regarding the direction of the alternation is the morphological markedness of the forms themselves. For example, since the Strong Grade is used in the nominative singular of class E nouns and for the infinitive and third person singular present of bisyllabic verbs, it might be thought that Strong Grade is the unmarked form. However, Weak Grade is also used for some extremely frequent forms, including the syncretized accusative/genitive in the class E nominal paradigm, and the first person singular present and second person singular present in the verbal paradigm; so both Strong and Weak Grade appear in forms which are high in frequency and low in markedness.

<sup>5</sup>If the donor word had been used as a Strong Grade form, then the alternation would presumably be between *šar?ma* and *\*šarma*.

Another kind of attempt to establish the directionality of an alternation is to examine its acquisition. The forms that children acquire first might be taken as unmarked, and their overgeneralizations might reveal what kinds of rules they are postulating. Here the data reported in Bals (2002) gives a complex picture. For many C–CC alternations, children appear to prefer C over CC, that is, they use the Weak Grade. However, for several CC–C:C alternations, they prefer C:C over CC, that is, they prefer the Strong Grade. There seem to be overgeneralizations in both directions. Furthermore, the phonological processes which obscure or even reverse the length contrasts (a few of which were illustrated above) are being acquired at the same time as the morphological process. Thus, while the examination of the acquisition process may eventually determine which form is to be treated as basic, the data currently available do not settle the matter.

A more useful indication might come from non-alternating forms. If the process is a shortening process, then any form which entered the lexicon as underlying short would remain short, never lengthening morphologically; so if the process is a shortening process then there should be a set of non-alternating short words. There is a set of non-alternating words with C centers, but I suggested above that they have been assigned to Class NA. There are also a few non-alternating words with C:C centers; but these could also be in the NA class. Alternatively, they could be the result of a regular phonological rule applying to lengthen certain underlying geminates. The upshot is that the vast majority of words in Northern Sámi regularly undergo Consonant Gradation, and there are not enough kinds of neutralizations to settle the matter.

An example discussed in Bals et al. (to appear) is the alternation between /nn/ and /n/ in Strong [*meannu*] Weak [*meanu*] ‘disposition,’ and between /ʔn/ and /n/ in Strong [*deaʔnu*] Weak [*deanu*] ‘large river.’ This would seem to favor an account in terms of shortening, if no underlying distinction between the two short forms could be found. But Bals et al. (to appear) point out that all four examples in their database of Strong non-glottalized geminate nasals are in words with an initial nasal (like *meannu*), and no words with glottalized nasals begin with a nasal (cf. *deaʔnu*). Thus, a systematic lengthening process can be stated even here. Bals et al. (to appear) also note that some speakers have alternations in recent loans which involve geminate and overlong nasals without pre-stopping (e.g. [*seam:maa*]~[*seammaa*] ‘same’). On the analysis here, this represents an underlying Weak /mm/, lengthened in the Strong Grade; but on an alternative account which proposed derivation of Weak forms from Strong ones, it would be unclear why shortening could not also apply to a geminate nasal (e.g. /mm/) to produce a singleton nasal. Thus, at least this one example points in the direction of lengthening over shortening.

Since Consonant Gradation is morphologized, and it is far more common for morphology to be essentially additive, I will assume that Consonant Gradation involves the addition of material to a basic form. This means that the accusative form of E nouns (and e.g. the infinitive form of bisyllabic verbs) are taken to be basic, or closer to the basic form. If the basic form has a single C center, then a morphological process of Strengthening makes it CC, and if



a basic form is CC, then Strengthening makes it C:C. This has the appealing result that the three-way length contrast need not be represented underlyingly; non-alternating C:C roots can be analyzed as underlyingly CC, undergoing a phonological lengthening process in their Weak Grade form. If so, all C:C forms can be derived.

Another reason to assume lengthening over shortening is that the extra segment has predictable phonological properties. That is, the Strong Grade usually (or even always) has a segment which can be analyzed as relatively underspecified, its features predictable from the other segments present. It is not clear whether a shortening rule could be stated that would make the right predictions.

Specifically (as already outlined in §1), I will assume that the consonant gradation process is the addition of a timing slot (or two, in the case of the C class) to the coda of a stressed syllable. In the nominal domain, I associate it with a set of stem-forming suffixes; they attach to the right edge of the word, and consonant gradation affects the closest stressed syllable to the left. In the verbal domain, I associate consonant gradation with agreement suffixes. Again, the process affects the closest suitable consonant center. I also show that many derivational suffixes include the segment that leads to consonant gradation.

### 3 The phonological manifestations of Strong and Weak Grade

The simplest examples of consonant gradation involve an alternation between geminate and simple consonants, as illustrated in (1) and (2) in §1. The morphological paradigms have been illustrated in detail, so henceforth I generally only give two forms, usually the nominative singular and the accusative singular, to illustrate the Strong and Weak Grade. Since the phonology is now in focus, I switch to a phonemic transcription, signalled by slashes, occasionally supplemented by a broad phonetic transcription in square brackets.

#### 3.1 Alternations where Strong is one segment longer than Weak

Gemination is the manifestation of Strong Grade for all singleton fricatives and non-nasal sonorants.

- (15) a. /guollii/ ‘fish’ NOMINATIVE, Strong, CC  
 b. /guolii/ ‘fish’ ACCUSATIVE, Weak, C

Northern Sámi has a three-way length contrast in consonants, so that alternations like that in (16) are also found.

- (16) a. /gol:li/ ‘gold’ NOMINATIVE, Strong, C:C  
 b. /gollii/ ‘gold’ ACCUSATIVE, Weak, CC

The extra-long consonant center in ?? is the manifestation of the Strong Grade, alternating with a Weak Grade geminate in (16b). Thus, it is important to keep in mind that C, CC, and C:C are phonological descriptions, while Strong and Weak Grade are morphological notions.

The general pattern is the one already illustrated in (15)–(16):

- (17) a. Strong Grade CC — Weak Grade C  
b. Strong Grade C:C — Weak Grade CC

I argued above that consonant gradation is essentially additive, and that the Weak Grade is closer to the underlying representation. The Strong Grade is the surface realization of the underlying form plus one extra timing slot in the coda, which is added morphologically, in a fashion to be detailed below.

The simplest pattern is illustrated in (18), for a few selected consonant centers; for fuller inventories see Sammallahti (1998), Bye (2001), or Bals et al. (to appear).

(18) Fricatives and Sonorants

	Short			Long		
Underlying	l	s	f	ll	ss	ff
Weak Grade	l	s	f	ll	ss	ff
Strong Grade	ll	ss	ff	l:l	s:s	f:f

In such examples, it can easily be seen how the Strong Grade can be derived from the underlying form by the addition of a timing slot or mora. However, consonant gradation is not always a simple matter of consonant length. For certain stops, it involves preaspiration, as illustrated in (19) for the CC—C alternation, and in (20) for the C:C—CC alternation.

- (19) a. /neahpii/ ‘nephew’ nominative, Strong, CC  
b. /neapii/ [neabi] ‘nephew’ accusative, Weak, C
- (20) a. /lahhtii/ ‘floor’ nominative, Strong, C:C  
b. /lahtii/ ‘floor’ accusative, Weak, CC

The pattern in (19) also involves voicing, and frication in the case of /t/, e.g. in [goahtii]—[goaðii], a word for a kind of hut. The general pattern is outlined in (21).

(21) Stops and Affricates, and Preaspirated Stops and Affricates

	Short			Long		
Underlying	p	t	c	hp	ht	hc
Weak Grade	b	ð	z	hp	ht	hc
Strong Grade	hp	ht	hc	hhp	hht	hhc

There are also alternations involving prestopped nasals. I depict these with a glottal stop, following Bals et al. (to appear), though it could also be represented as a homorganic stop as in Sammallahti (1998:51) (e.g. /gopmii/ rather than /goʔmii/); there may be a dialectal difference along these lines.

- (22) a. /joʔna/ ‘lingonberry’ NOMINATIVE, Strong, CC  
 b. /jona/ ‘lingonberry’ ACCUSATIVE, Weak, C
- (23) a. /goʔʔmii/ [gomʔmii] ‘ghost’ nominative, Strong, C:C  
 b. /goʔmii/ ‘ghost’ accusative, Weak, CC

The prestopped nasal series can be represented as in (24), assuming that prestoping is completely predictable from the morphological contexts of the Strong and Weak Grade.

(24) Prestopped nasals

	Short			Long		
Underlying	m	n	ɲ	ʔm	ʔn	ʔɲ
Weak Grade	m	n	ɲ	ʔm	ʔn	ʔɲ
Strong Grade	ʔm	ʔn	ʔɲ	mʔm	nʔn	ɲʔɲ

These tables are far from exhaustive; Northern Sámi has a rich inventory of consonants, and I am only providing a tiny representative sample of the full range of alternations.

### 3.2 Alternations where Strong is two segments longer than Weak

There are two main kinds of examples where the Strong is two segments longer than the Weak Grade. First, there are cases like /jahhkii/, ‘year,’ or /viv:vaa/, ‘son-in-law,’ given here in (25)–(26).

- (25) a. /jahhkii/ ‘year’ nominative, Strong, C:C  
 b. /jagii/ ‘year’ accusative, Weak, C
- (26) a. /viv:vaa/ ‘son-in-law’ nominative, Strong, C:C  
 b. /vivaa/ ‘son-in-law’ accusative, Weak, C

Sammallahti (1998:49) proposes a rule which he calls Primary Lengthening, which lengthens a geminate consonant (or a cluster starting with *h*) following a short vowel and preceding a long one. On the analysis here, the underlying center in /jahhkii/ is a /k/, and consonant gradation lengthens that /k/ to /hk/, which satisfies the conditions for Primary Lengthening. Thus the center of the Strong form in (25) is phonologically changed from CC to C:C, and similarly for /vivaa/ in (26).

The second situation in which a C ~ C:C alternation arises is in a certain class of nouns known as ‘contracted’ nouns and illustrated by /boazu/ ‘reindeer’ in (3) above. The essential part of the pattern is shown in (27)–(28). Here I place accusative above nominative in order to maintain a consistent order of Strong and Weak forms.

- (27) a. /bohho/ ‘reindeer’ accusative, Strong, C:C  
 b. /boacu/ [boazu] ‘reindeer’ nominative, Weak, C
- (28) a. /sul:lo/ ‘island’ accusative, Strong, C:C

- b. /suoluu/ ‘island’ nominative, Weak, C

Here, the structural conditions for secondary lengthening are not met, and the overlong consonant center must be derived morphologically. This has been hinted at in (7) in §1 above: there is a stem suffix in this class of noun (the C class) which adds not one but two timing slots. This will be discussed further in §4.

### 3.3 Alternations where Strong is the same length as Weak

For certain consonant centers, both Strong and Weak forms are approximately the same length, but the Strong form is voiced while the Weak form is voiceless, e.g. as illustrated in (29).

- (29) a. /ruž:žuu/ [rud:čuu] ‘ravine’ nominative, Strong, C:C  
 b. /ruč:čuu/ [rut:čuu] ‘ravine’ accusative, Weak, C:C
- (30) a. /gieddii/ ‘meadow,’ nominative, Strong, CC  
 b. /giettii/ ‘meadow,’ accusative, Weak, CC

Both examples in (29) are overlong due to secondary lengthening, while both are simply geminate in (30). Bye (2001) analyzes such forms as underlyingly clusters of a voiced and a voiceless stop (or affricate). In the Weak Grade, the voiced stop assimilates and the cluster surfaces as a geminate. In the Strong Grade, a timing slot is added to the coda of the stressed syllable, and this preserves the voicing in the voiced segment. See Bye 2001 for details of the phonological rules at work.

It seems that a similar surface neutralizing effect takes place in certain /s/-initial clusters. There are many apparently non-alternating forms like *beaska*, a word for a reindeer-skin tunic, repeated here in (31) (represented here as neither phonemic nor phonetic, for the moment).

- (31) a. *beaska* ‘tunic’ nominative, Strong  
 b. *beaska* ‘tunic’ accusative, Weak

There is no perceptible difference here in consonant length, and thus there is a contrast with forms like that in (32).

- (32) a. /muoskii/ ‘isthmus’ nominative, Strong, C:C  
 b. /muoskii/ ‘isthmus’ accusative, Weak, CC

However, for many speakers, there is a difference in the quality of the diphthong in (31) (this was brought to my attention by Berit-Anne Bals). Descriptively, it is as if the stress peaks earlier in the nominative form than in the accusative; this might be analyzed in terms of the diphthong being shortened by the following C:C center (cf. Sammallahti 1998:40). This suggests that there is in fact a consonant gradation alternation which is obscured by some phonological or phonetic process, as implied by (33) (adapting conventions from Sammallahti 1998:40 to mark the diphthong in the Strong Grade as short).

- (33) a. /beasska/ [běšska] ‘tunic’ nominative, Strong, C:C  
 b. /beaska/ [beaska] ‘tunic’ accusative, Weak, CC

This would be a case where the underlying phonemic difference is very nearly phonetically neutralized. I will not attempt a more formal statement of the rule affecting (31) but not (32).<sup>6</sup>

### 3.4 Alternations where the Weak is longer than the Strong

I turn to a situation in which the Weak Grade is phonetically longer than the Strong Grade, illustrated with *nieida* in (34).

- (34) a. [nieida] ‘daughter’ nominative, Strong  
 b. [nieitta] ‘daughter’ accusative, Weak  
 (35) a. [jaaurii] ‘lake’ nominative, Strong  
 b. [jaaurrii] ‘lake’ accusative, Weak

The usual effect of consonant gradation is to lengthen the coda of the stressed syllable. But the coda in each of these clusters is underlyingly a glide, which shows no length contrast preconsonantly. Furthermore, the lengthening of consonants after glides is phonologically systematic in the language. Therefore, following Bye (2001), I assume that stops lengthen phonologically after short glides, while long glides surface as vowels. This is roughly suggested by the representations below, representing the labial glide as /v/.

- (36) a. /niejta/ [nieida] ‘daughter’ nominative, Strong  
 b. /niejta/ [nieitta] ‘daughter’ accusative, Weak  
 (37) a. /jaavvrii/ [jaaurii] ‘lake’ nominative, Strong  
 b. /jaavvrii/ [jaaurrii] ‘lake’ accusative, Weak

This pattern is systematic for what I analyze as glide-initial clusters (following Bye 2001), a few examples of which are illustrated in (38).

- (38) Glide-initial clusters
- |              |     |      |     |     |     |     |
|--------------|-----|------|-----|-----|-----|-----|
| Underlying   | jv  | jst  | jt  | vr  | vg  | vs  |
| Weak Grade   | ivv | isst | itt | urr | ukk | fss |
| Strong Grade | iv  | ist  | id  | ur  | ug  | ks  |

### 3.5 Other Alternations

A rather exotic-looking alternation (already exemplified in (14) in §2 above) is one between *k* as the initial member of a cluster and *v* (variously surfacing as

<sup>6</sup>It may be predictable on the basis of vowel quality. Bals et al. (to appear) give the following words as failing to undergo consonant gradation, like *beaska*: *meastu*, *feasta*, *leastu*, *faasmi*, *maaski*, *goaski*; all have /a/ before the /sC/ cluster. Like *muoskii* are words with some other vowel before the cluster, for example (in the Weak Grade): *giista*, *biistu*, *duuski*, *luosti*, *luosku*, *šuušmi*, *luuspi*, *oostu*, and *oosku*; but Bals et al. (to appear) also list three alternating words with /a/ before an /s/-initial cluster: *baaste*, *laasta*, and *aaski*.

*f*, usually before an obstruent, or *u*, usually before /s/ and /š/).<sup>7</sup>

- (39) a. /gaaktii/ ‘jacket’ nominative, Strong
- b. /gaavtii/ [gaaftii] ‘jacket’ accusative, Weak
- (40) a. /raksa/ ‘diaper’ nominative, Strong
- b. /raavssa/ [raaussa] ‘diaper’ accusative, Weak

The lengthening of the fricative in the Weak Grade in (40) is a case of Bye’s (2001) Coda Maximization. Certain other details of the phonological alternation remain unclear, for example how the Strong-Weak alternation manifests itself in an alternation between *k* and *v*. This is perhaps the most challenging example to motivate in terms of the addition of a timing slot to derive the Strong Grade.

One final example I will point out is the one in which a schwa appears in the Strong Grade, seen in (41). Since ⟨*bálggis*⟩, ‘path’ is a member of the O class of nouns in which the nominative is Weak Grade, I place accusative over nominative in (41).

- (41) a. /baallka/ [baaləga] ‘path’ accusative, Strong
- b. /baalkkiis/ [baalggiis] ‘path’ nominative, Weak
- (42) a. /maarrfii/ [maarəfi] ‘sausage’ nominative, Strong
- b. /maarrfii/ [maarrfi] ‘sausage’ accusative, Weak

This pattern is systematic for heterorganic clusters starting with /r/ and /l/ and /ð/. Homorganic clusters do not surface with schwa, as illustrated in (43).

- (43) a. /alltuu/ [alduu] ‘female reindeer’ nominative, Strong
- b. /alttuu/ [aldduu] ‘female reindeer’ accusative, Weak

The Weak members of all three of the above pairs show the effects of a rule Bye (2001:124) calls Coda Maximization, which lengthens the second member of a sonorant-initial consonant cluster.

As usual, I assume that the Strong Grade adds a timing slot to the stressed syllable, which ends with /r/ or /l/ here. In (43), this has the expected effect, namely lengthening the /l/. The realization of the extra timing slot as a schwa just in case the liquid-initial cluster is heterorganic must be due to another phonological rule.

There remain many more phonological details concerning the derivation of surface forms from underlying root forms plus the addition of a timing slot. I first presented the simplest ones in §§3.1–3.2 (gemination of liquids and fricatives, addition of preaspiration to stops and affricates, addition of preglottalization to nasals), in which something essentially consonantal is added. I then moved in §§3.3–3.4 to alternations which are less transparent but still relatively phonologically tractable (the voicing alternation, the glide-initial clusters). Finally, in §3.5 I presented the ones which are least natural-looking from this

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<sup>7</sup>Bals et al. (to appear) suggest rather that these can be understood in terms of an alternation between *k* and *u*. If the consonant following *u* in (39) is preaspirated, and the sequence *uh* is realized as *y*, which sounds like *f*.

perspective ( $k \sim v$ , insertion of schwa), for which phonological rules have to be posited.

There are many more complicated phonological rules at work in Northern Sámi, but I will not attempt to elucidate them here (the works I have cited go much further than I could in this space toward a phonologically responsible account). I have mainly tried to outline the idea that the Strong Grade systematically represents (the phonetic manifestation of) the addition of a timing slot to the stressed syllable. This is important because it reduces a great deal of the apparent morphological complexity of the Northern Sámi paradigm to phonology. I hope to have at least made plausible the claim that the phonological effects of consonant gradation can be unified under an analysis in which something is added morphologically in the Strong Grade, with various phonological interpretations.

I turn in §4 to various ways in which Strong Grade emerges in the morphological system, and show that they are cleanly captured by assuming that  $\mu$  is a part of certain suffixes, both derivational and inflectional. These facts would not be equally easily captured if Strong and Weak Grade were assumed to be properties of words, or of stems, or of roots.

## 4 The nominal paradigm

Here I detail the analysis which I so briefly outlined in (7) in §1. Recall the paradigm with no consonant gradation from (4) in §1 above, repeated below in (44) with hyphens to indicate the case and number suffixes.

(44)     $\langle gahpir \rangle$  ‘cap’     $\langle ákšu \rangle$  ‘axe’

	<b>Singular</b>	<b>Plural</b>	<b>Singular</b>	<b>Plural</b>
Nom	$\langle gahpir \rangle$	$\langle gahpir-at \rangle$	$\langle ákšu \rangle$	$\langle ákšu-t \rangle$
Acc	$\langle gahpir-a \rangle$	$\langle gahpir-ii-d \rangle$	$\langle ákšu \rangle$	$\langle ákšu-i-d \rangle$
Ill	$\langle gahpir-ii \rangle$	$\langle gahpir-ii-dda \rangle$	$\langle ákšu-i \rangle$	$\langle ákšu-i-de \rangle$
Loc	$\langle gahpir-is \rangle$	$\langle gahpir-ii-n \rangle$	$\langle ákšu-s \rangle$	$\langle ákšu-i-n \rangle$
Com	$\langle gahpir-iin \rangle$	$\langle gahpir-ii-guin \rangle$	$\langle ákšu-in \rangle$	$\langle ákšu-i-guin \rangle$
Ess	$\langle gahpir-in \rangle$		$\langle ákšu-n \rangle$	

This I called the NA paradigm, as there is No Alternation of consonant gradation. As indicated, a plural suffix can be isolated in all non-nominative cases, with allomorphs *-ii* after consonants and *-i* after vowels.

The singular case suffixes can be analyzed as having allomorphs which follow consonants and allomorphs which follow vowels; I abbreviate that below by putting the extra postconsonantal vowel in parentheses (the *a* before the nominative plural is inserted by regular epenthesis and so is not indicated). The non-nominative plural case suffixes follow the plural morpheme, which is vocalic, and so have only a postvocalic allomorph. There is no essive plural.

(45)		<b>Singular</b>	<b>Plural</b>
	NOM	-	-t
	ACC	-(a)	-d
	ILL	-(i)j	-de,-da
	LOC	-(i)s	-n
	COM	-(i)jn	-kujn
	ESS	-(i)n	

These suffixes can be used for all the different classes of nominals, with their many different forms of consonant gradation, if a few simple rules of stem formation are adopted.<sup>8</sup> The first important observation to make is that throughout all the different classes of nouns, the essive form always has the same Grade as the nominative singular. Thus they are formed from the same stem. Since the nominative singular is the most basic case, arguably caseless (Bittner and Hale 1996), and the essive is used mainly as a predicative case, I assume this is a semantically grounded fact.

Consider the class which Sammallahti (1998) calls *imparisyllabic*, because historically, the key forms have an odd number of syllables; this is the class that I called O, for Odd, in §1. A full paradigm was presented in (2); here the (Strong) accusative singular and (Weak) nominative singular represent the paradigm.

- (46) a. /gilloma/, ‘bloodclot,’ accusative, Strong  
b. /gielu/ ‘bloodclot,’ nominative, Weak
- (47) a. /vulloša/, ‘thing underneath,’ accusative, Strong  
b. /vuoluš/ ‘thing underneath,’ nominative, Weak

The nominative in each case is identical to the stem for the essive in *-n*; stripping off the accusative *-a* gives the stem to which all the other case suffixes in (45) are attached. The formation of the two stems can be assumed to involve suffixation of a categorial nominal suffix to a categoriless root, as proposed by Marantz (2001). One suffix is chosen in a nominative singular or essive context; call this the ‘absolute’ suffix. It is null for class O. Another suffix is chosen for all other cases. Call this the ‘basic’ suffix. For class O, it consists only of the infixal timing slot,  $^{-\mu}\frown$ , whose effects were discussed in some detail in §3.<sup>9</sup>

The nouns in (46) and (47) also show other differences between their absolute and basic stems. In this they are typical of class O nouns. Another pair is given in (48)–(49).

- (48) a. /beaʔnaga/, ‘dog,’ accusative, Strong  
b. /beana/ ‘dog,’ nominative, Weak
- (49) a. /oahhpaas/, ‘guide,’ accusative, Strong

<sup>8</sup>The illative plural makes an additional distinction: *-de* is the default, but *-da* also appears, often with phonologically motivated gemination to *-dda*.

<sup>9</sup>As before, I abstract away from the alternation in the diphthong (assume that the diphthong simplifies preceding a center vowel).



- b. /oahpis/ ‘guide,’ nominative, Weak

In both (46) and (48), the final consonant in the basic stem is absent from the absolutive. Northern Sámi allows only a very small class of consonants to remain word-finally; these consonants may in most cases be assumed to be deleted at the right edge of the absolutive stem; there are, however, some irregularities, for example some cases of final /m/ are deleted, while others surface as /n/; so some underlying distinctions must also be made (for instance the ones that surface as /n/ might be underlying prestopped, therefore heavier and more resistant to deletion).

In (47) and (49), the final consonant is *s* or *š*, which are among the consonants which are permitted word-finally. Thus nothing exceptional needs to be said about that. In addition, there is a vowel before that consonant which changes from the absolutive to the basic stem. There are two ways to analyze this. One is to assume that the stem-forming suffixes include the vowel in question. For example, the root *oahp-* could combine with the suffix  $^{-\mu} \text{aas}$  to form a basic stem or with the suffix *-is* to form an absolutive stem. This is especially plausible when there is a class of nouns showing the same alternation. Another way to analyze such alternations is in terms of a suffix which causes a phonological rule to apply to change the vowel in the last suffix. This would be more plausible if a range of different O class stems show, for example, a *u*  $\sim$  *o* alternation, but with different consonants (cf. (46) and (47)). I leave the decisions for these specific nouns open for the time being.

The third class to be dealt with here is the Contracted class, henceforth C, historically a class which had consonant-final stems, illustrated in (3) in §1, the crucial forms of which are given here in (50)–(51).

- (50) a. /bohho/, ‘reindeer,’ accusative, Strong  
 b. /boacuu/ ‘reindeer,’ nominative, Weak
- (51) a. /baallga/, ‘path,’ accusative, Strong  
 b. /baalggiis/ ‘path,’ nominative, Weak

The main difference between the O class and the C class is that in the C class, the Strong Grade is always overlong, C:C, regardless of whether the Weak Grade is short or long. This can be perfectly captured if the basic stem-forming suffix contains two instances of  $\mu$ ; two timing slots attached to a short consonant center will create an overlong one, and since a syllable cannot be longer than overlong, two timing slots attached to a long consonant center will simply have the same effect, overlength.

In (51), there is an absolutive suffix  $^{-\mu} \text{iiis}$ .

Common in the C class is the *o*  $\sim$  *u* alternation seen in (50), identical to the alternation in the O class examples in (46) and (47), and suggesting a more regular rule unifying the absolutive stem suffixes of the two classes, perhaps a floating [+high] feature.

The case and number suffixes are identical to those in the NA paradigm.

The last class is the most important one in terms of productivity and sheer number of members, certainly in the thousands. I present it last of the four classes because in one way it is the most complex. In the E class, three different stem types must be distinguished, as seen in (1) in §1. Crucial forms for key examples are given here.

- (52) a. /viessuu/, ‘house,’ nominative, Strong  
b. /viesuu/, ‘house,’ accusative, Weak  
c. /viissuj/, ‘house,’ illative, Strong
- (53) a. /basste/, ‘spoon,’ nominative, Strong  
b. /baste/, ‘spoon,’ accusative, Weak  
c. /bastii/, ‘spoon,’ illative, Strong
- (54) a. /čiehkka/, ‘corner,’ nominative, Strong  
b. /čiega/, ‘corner,’ accusative, Weak  
c. /čiihkii/, ‘corner,’ illative, Strong
- (55) a. /goahtii/, ‘hut,’ nominative, Strong  
b. /goađii/, ‘hut,’ accusative, Weak  
c. /goahtaaj/, ‘hut,’ illative, Strong

As with the O and C classes, there is consonant gradation in a stem-forming affix, but unlike the the O and C classes,  $\mu$  is in the absolutive suffix, and absent from the basic suffix. This derives the pattern of consonant gradation seen in the nominative and accusative forms (recall that the essive is based on the absolutive, and the comitative and locative are based on the basic form, as are the plurals).

The illative, however, cannot be simply based on the basic form as it was in the other classes. In the E class, it always has the same Strong Grade as the absolutive-based forms. However, the illative also has some peculiarities. For one thing, the *a* which is otherwise part of the stem in nouns like *čiehkka* is changed to *i* in the illative, as does the *e* in *basste*; and the *ii* that appears on all stem forms in *goahtii* changes to *aa* in the illative (these changes apply only to the singular forms). Thus, rather than trying to derive the E-class illative singular from the absolutive stem, I suggest that the E class has three stem-forming suffixes. I call the third ‘dative’; it is only selected for E class nouns in the context of illative singular features. I assume that it is a categorial nominal head, in complementary distribution with the heads that derive absolutive and basic stems.

## 5 Derivation

The way I have employed the autosegmental  $\mu$ , it is not connected to any particular meaning; it is like a phonemic segment in the language in that it turns up as a phonological part of various morphemes. If it were a part of a root, its effects would never be seen, since no process deletes it; it would simply be realized as an unvarying consonantal segment in a coda. Its importance to the

nominal inflectional system has already been seen. Here I show that it can also be part of a derivational morpheme, verifying the claim made in §1. The discussion is based largely on data and descriptive observations presented in Nickel’s (1990) Chapter 12.

## 5.1 Derivation without $\mu$

First, there are derivational morphemes which do not have any  $\mu$  associated with them. For example, the suffix *-u* can be added to a verb root to derive an abstract nominal; it attaches to verb roots, replacing the thematic vowel and deriving regular nouns of the E class. As with all E nouns, the derived nominal gets Strong Grade in the nominative singular, illative singular, and the essive.

- (56) bal-a- *v.* ‘fear’ (infinitive /*ballaht*/)  
 a. /balluu/ *n.* ‘fear’ nominative, Strong  
 b. /baluu/ *n.* ‘fear’ accusative, Weak

Similarly, the suffix *-uus* can be added to a verb root to derive a noun of the O class, which undergoes regular consonant gradation in all forms except the nominative singular and the essive, as expected.

- (57) jug-a- *v.* ‘drink’ (infinitive /*juhkaht*/)  
 a. /juguus/ *n.* ‘drink’ nominative, Weak  
 b. /juhkosa/ *n.* ‘drink’ accusative, Strong

Derivational suffixes can also derive nouns of class NA, which do not undergo any consonant gradation. One such suffix is deverbal *-n*, which gives a kind of habitual agentive, ‘one who habitually V’s.’

- (58) soađ-a- ‘combat, make war’ (infinitive /*sohtaht*/)  
 a. /soađan/ *n.* ‘combatant, one who fights’ nominative  
 b. /soađana/ *n.* ‘combatant, one who fights’ accusative

## 5.2 Consonant Gradation in suffixes

I have suggested that  $\mu$  when it is part of a suffix attaches to the coda of the nearest stressed syllable, viewed from its point of attachment at the right edge of a word. This means that if a derivational suffix is large enough,  $\mu$ -bearing affixes attaching to it will induce Consonant Gradation in the suffix, not in the root. This can be seen with various derivational suffixes, for example the instrument nominalizer *-aaldaak*.

- (59) siihk-uu- *v.* ‘wipe’ (infinitive /*sihhkuuht*/)  
 a. /siihkaaldaat/ *n.* ‘cloth for wiping’ nominative  
 b. /siihkaaldaaga/ *n.* ‘cloth for wiping’ accusative  
 c. /siihkaaldaahkii/ *n.* ‘cloth for wiping’ illative

The underlying /k/ of the suffix surfaces as /g/ in the Weak Grade form seen in the accusative. In the Strong Grade, it is preaspirated by  $\mu$  to form /hk/; but this is not a licit word-final cluster in Northern Sámi, so the nominative surfaces with a final /t/. The expected Strong Grade form surfaces where it is followed by a vowel, for example the illative singular form in (59c).

### 5.3 Derivation with $\mu$

There are also derivational suffixes which include  $\mu$  as part of their lexical entry. One important one is the ‘Aktio’ suffix  $-\mu \curvearrowright m$  (the suffixal part surfaces as *-n* when word-final). It derives Class NA nouns from verb roots.

- (60) čaal-ii- *v.* ‘write’ (infinitive /čaalliht/)
- a. /čaalliin/ *n.* ‘writing’ nominative
  - b. /čaalliima/ *n.* ‘writing’ accusative

Another one is deverbal  $-\mu \curvearrowright iluuš$ , which derives E nouns denoting undergoers.

- (61) soj-a- *v.* ‘yield’ (infinitive /soččaht/)
- a. /sožžiluuš/ *n.* ‘something that yields easily’ nominative
  - b. /sožžiluuša/ *n.* ‘something that yields easily’ accusative
  - c. /sožžiluuššii/ *n.* ‘something that yields easily’ illative

Two important facts can be noted about the nominal forms in (61). One is that the verbal root appears in its C:C form, as if the nominalization were added to the infinitive stem rather than to the root. This means that two  $\mu$ ’s can be added to a single root. The effect is productive, and gives rise to three-way C—CC—C:C contrasts, for example *sojaan—sočče—sožžiluuš* ‘I yield, it/he/she yields, sth that yields,’ or *caagaan—caahke—cahkhiluuš* ‘I smolder, it/he/she smolders, sth that catches fire easily.’

The other thing to notice is that just as already seen in (59), the consonant gradation induced by stem suffixes occurs not in the root, but in the suffix, because the infixal  $\mu$  seeks the first stressed coda to the left of its point of attachment. In the nominative singular, the consonant gradation is undone by the fact that the affected coda is word-final; thus it surfaces short. But the effects of gradation can be seen by examining the illative singular form in (61c).

The structure can be represented as a cyclic derivation of suffixation and infix alignment.

- (62) Derivation of illative *sožžiluuššii*, ‘something which yields easily, pushover’

Root:	soj-
Verbal Stem Affix:	soj- $\mu^{\wedge}$
Infix Aligned:	so $\mu^{\mu}$ j-
Derivational Suffix:	so $\mu^{\mu}$ j- $\mu^{\wedge}$ iluuš
Infix Aligned:	so $\mu^{\mu\mu}$ j-iluuš
Dative Stem Suffix:	so $\mu^{\mu\mu}$ j-iluuš- $\mu^{\wedge}$
Infix Aligned:	so $\mu^{\mu\mu}$ j-iluu $\mu^{\mu}$ š
Illative Case Suffix:	so $\mu^{\mu\mu}$ j-iluuš- $\mu^{\wedge}$ ij
Surface realization:	sožžiluuššii

I know of no empirical evidence bearing on the order of operations, apart from the obvious linear order of the suffixes. Thus the construction could also be represented as below.

(63) A representation of illative *sožžiluuššii*

soj	- $\mu^{\wedge}$	- $\mu^{\wedge}$ iluuš	- $\mu^{\wedge}$	-ij
<i>yield</i>	-v	-UNDRGO	-DAT	-ILL
sožžiluuššii				

## 6 $\mu$ in the verbal paradigms

There are several morphemes with the property  $\mu$  in the verbal paradigm as well. With verbs, it is less clear that class distinctions are needed, but allomorphy is clearly sensitive to syllable count or stress. The difference between even-syllabled and odd-syllabled stems is important, and odd-syllabled verbs generally do not show consonant gradation in the root at all. I will refer to verbs whose prosodic structure makes them pattern with simple disyllables as the ES verbs, for Even-Syllabled, and to the others as OS.

### 6.1 Inflectional suffixes

First, there are agreement affixes which have the infixal component. In the most common paradigm, the first and second person singular are in the Weak Grade, while the third person singular is in the Strong Grade, as are all the dual and plural forms, in the present tense.

(64) ES verb, present tense: *boahtit* ‘come’

PERSON	<b>Singular</b>	<b>Dual</b>	<b>Plural</b>
1	/boaḏaan/	/boohte/	/boahtiih/
2	/boaḏaah/	/boahtibeahhtii/	/boahtibehteht/
3	/boahtaa/	/boahtiba/	/boohteht/

In the past tense, the pattern is nearly the reverse, with the first and second person being in the Strong Grade, and all the other forms being Weak, except the third person plural.

(65) ES verb, past tense: *boahtit* ‘come’

PERSON	Singular	Dual	Plural
1	/boohten/	/boođijme/	/boođiimeht/
2	/boohteht/	/boođijde/	/boođiideht/
3	/boođii/	/boođijka/	/boohte/

Since the suffixes are also largely distinct in the different tenses, and given the hypothesis tendered here that the language has an infixal  ${}^{\mu}\frown$  segment which exists as a part of certain morphemes, it is a simple matter to identify which agreement suffixes bear  ${}^{\mu}\frown$  and which do not; in the present tense, the third singular, the dual, and the plural do, and in the past tense, the first singular, the second singular, and the third plural do.

The pattern of reversal, where the forms which are Strong in the present are Weak in the past, has historical origins just as was seen for the nominal paradigm in §1. Roughly, something like (66) must have occurred (for a more careful reconstruction see Sammallahti 1998, Appendix F).

(66) Rough historical reconstruction for *boahtit* ‘come’

	First person	Third person
PRESENT	*poa.te-em	*poat.te
PAST	*poat.te-j-em	*poa.te-j

Just as with the nouns, the consonant center is strengthened before an open syllable. This happened in the third person past and in the first person present.

On the analysis presented here, the association in the modern language of Strong Grade with first person singular in the past tense is completely independent of what happens to the first person singular in the present.

## 6.2 Derivational suffixes

Derivational suffixes that create verbs can also carry  $\mu$ , as expected, for example the transitivizer  $-{}^{\mu}\frown d$ , which attaches to unaccusatives to form transitive verbs (Julien to appear).

- (67) *vuojuu-* *v.* ‘sink’ (unaccusative) (infinitive /*vuoččuuh*/)
- /*vuoččuudih*/ *v.* ‘sink’ (transitive) infinitive
  - /*vuoččuudaan*/ *v.* ‘sink’ (transitive) first person singular present

Because the output of  $-{}^{\mu}\frown d$  suffixation is a three-syllabled or OS verb, there is no consonant gradation in the first person singular, as shown.

If a derivational suffix is large enough, then consonant gradation will occur in the suffix, just as was seen above for nouns. For example, the inadvertent causativizer *-haah*, which attaches to transitive and unergative verbs.

- (68) *čieruu-* *v.* ‘cry’ (infinitive /*čierruuh*/)
- /*čieruhaahhtih*/ *v.* ‘inadvertently make cry’ infinitive

- b. /čieruhaahtaan/ *v.* ‘inadvertently make cry’ first person singular present

As can be seen, the suffixed form has four syllables and is a regular verb of the ES paradigm. Hence, the suffixal part of the causative, /haaht/, appears in the Strong Grade in the infinitive (the preaspiration lengthening from /ht/ to /hht/), and in the Weak Grade in the first person singular.

In fact, a suffix can cause a non-alternating OS verb to become ES, by adding a single syllable. When it becomes ES, it shows consonant gradation effects. For example *-ast* is called a ‘diminutive’ suffix, and when added to a verb it gives an attenuative sense or a sense of something done in haste (it also replaces the stem vowel of OS stems).

- (69) mujtalii- *v.* ‘tell’ (infinitive /*mujtaliiht*/)  
 a. /mujtalasstiht/ ‘tell a little, tell in haste’ infinitive  
 b. /mujtalastaan/ ‘tell a little, tell in haste’ first person singular present

Because consonant gradation is triggered by a suffix, it is the third syllable of the infinitive which receives a lengthened coda, not the first, just as was seen in the nominal paradigms.

### 6.3 Inflectional suffixes on top of inflectional suffixes

The richness of the inflectional system of Northern Sámi provides a sight not seen in the nominal system, namely that of an inflectional suffix showing consonant gradation. Hitherto we have only seen roots and derivational suffixes affected by consonant gradation, but here we see that even inflectional suffixes undergo it. In order to see the effect it is first necessary to present the OS conjugation paradigm.

As mentioned above, there is a separate series of agreement suffixes for OS verbs, i.e. those with three-syllabled stems. None of these agreement suffixes bear  $\mu$ , so there is no consonant gradation in the OS paradigm. However, certain mood suffixes, namely the Potential and the Conditional, have the effect of causing a stem to change class, so that an ES verb with a Potential or Conditional suffix takes OS agreement, and an OS verb with a Potential or Conditional Suffix takes ES agreement.

- (70) Comparison of an OS verb (/mujhtaliiht/ ‘tell’) and an ES verb in the Potential mood (/gullaahht/ ‘hear’)

AGR	OS Indicative	ES Potential
1 sg	/mujhtaalan/	/gulaačan/
2 sg	/mujhtaalaht/	/gulaačaht/
3 sg	/mujhtaala/	/gulaača/
1 du	/mujhtaaleʔne/	/gulaačeʔne/
2 du	/mujhtaaleahhpīi/	/gulaačeahhpīi/
3 du	/mujhtaaleabaa/	/gulaačeabaa/
1 pl	/mujhtaaliht/	/gulaačiht/
2 pl	/mujhtaalehpeht/	/gulaačehpeht/
3 pl	/mujhtaaliht/	/gulaačiht/

The potential morpheme for ES stems, as seen above, is -č; for OS stems, it is *eačč*; attached to an OS stem, it induces the ES agreement paradigm, as can be seen below. The ES agreement paradigm was already presented above but is repeated here for convenience.

- (71) Comparison of an ES verb (/gullaht/ ‘hear’) and an OS verb in the Potential mood (/mujhtaaliht/ ‘tell’)

AGR	ES Indicative	OS Potential
1 sg	/gulaan/	/mujhtaaleaččaان/
2 sg	/gulaaht/	/mujhtaaleaččaht/
3 sg	/gullaa/	/mujhtaaleažžaa/
1 du	/gulle/	/mujhtaaležže/
2 du	/gullaabeahhtii/	/mujhtaaleažžaabeahhtii/
3 du	/gullaabaa/	/mujhtaaleažžaabaa/
1 pl	/gullaahht/	/mujhtaaleažžaahht/
2 pl	/gullaabehteht/	/mujhtaaleažžaabehteht/
3 pl	/gulleht/	/mujhtaaležžeht/

The important point to note here is that the third person singular, the dual, and the plural all show Strong Grade forms. Since I have coupled the consonant gradation to the suffixes themselves, rather than to cells in a paradigm, exactly the right result is achieved: the suffixes which trigger Strong Grade forms in the simple ES present indicative do the same thing in the OS potential, but since they are removed from the root by a morpheme that constitutes a (secondarily) stressed syllable, the consonant gradation effect is seen only on the Potential suffix.

The fact that consonant gradation affects roots, derivational suffixes, and even inflectional suffixes shows its phonological nature: if it is in the right phonological environment, it occurs. The fact that its distribution is absolutely constrained by inflectional and derivational categories shows its morphological nature; it is never triggered simply by a phonological environment.



## 7 Conclusion

I have shown that Northern Sámi makes extensive use of a phonologically sophisticated system of consonant gradation. I have only illustrated a few of the many dozens of phonological alternations, and only sketched a representative sample of the morphological contexts in which they occur. Still, I hope to have given the reader an impression of the intricacy of the surface pattern.

I have argued that these patterns of consonant gradation can be understood as a simple expression of a relatively well-understood kind of morphological system, one in which affixes, which are pairings of syntactico-semantic function and phonological content, are concatenated. I have tried to keep mechanisms to a minimum, in search of a kind of minimalist morphology.

The devices necessary in this account include the following. First, there must be a phonological segment in the language ( $\mu$ ) which has a range of surface manifestations depending on its phonological environment (e.g. /l/ before /l/, /h/ before /t/, etc.). This segment must also have a particular prosodic property which causes it to infix (this property could either be a phonological or a morphological property). Also on this account, some morphemes must have distinct synonymous allomorphs, for example there can be a stem-forming suffix with  $\mu$  as a component and one without it. Allomorphy can be sensitive to phonology (a suffix can be sensitive to whether the last foot in the stem has two syllables or not, for example), or it can be sensitive to class features (roots can be divided into classes on grounds that are not transparently semantic nor phonological, and a suffix can be specified to attach only to a root of a given class).

All of these assumptions, I think, are fairly well-motivated by phenomena documented in other languages. One consequence of the analysis is that some phonological rules must be fairly ‘unnatural,’ for example a phonological rule must be able to yield the  $k \sim v$  alternation in examples like *leaksa*  $\sim$  *leavssa* mentioned in §2.

The unnatural phonological rules cannot be replaced with sets of allomorphs. To see why, consider an attempt to do so which is not very different from the analysis suggested here. Suppose that instead of a stem-forming suffix with  $\mu$ , there is a different stem-forming suffix including an infixal /k/ which attaches to roots like the one in *leavssa*. Then the  $k \sim v$  alternation could be separated from the other alternations, in order to avoid positing phonologically unnatural rules. The problem is the generality of the alternation: it is productive and fully general; it is induced by every stem-forming suffix, agreement suffix, and derivational suffix that induces Strong Grade anywhere. Each one of those suffixes would have to have two allomorphs, one for changing  $v$  to  $k$  and another for other alternations. The generality of the process strongly suggests unifying consonant gradation in the way I have done, by making the substance of the alternations a matter of phonology, and the distribution of the Grades a matter of morphology.

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