

SEGMENTAL ALTERNATIONS AND METRICAL THEORY

by

Olga Vaysman

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Cornell University, 1998

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Signature of Author _____

Department of Linguistics and Philosophy
October 22, 2008

Certified by _____

Michael Kenstowicz
Professor of Linguistics
Thesis Supervisor

Accepted by _____

Irene Heim
Professor of Linguistics
Head, Department of Linguistics

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ABSTRACT

This dissertation focuses on phonological alternations that are influenced or constrained by word-internal prosody, i.e. prominence and foot structure, and what these alternations can tell us about metrical theory. Detailed case studies of several cases of prosody-sensitive segmental alternations, as well as a survey of such phenomena mentioned in the literature were the empirical basis for this study. I have offered an empirically motivated proposal that constituency and prominence have to be separate entities in the grammar, since some segmental alternations cannot be accounted for without reference to foot boundaries, while others require reference to prominence. The data also shows that there are languages with mismatches between stress assignment pattern and foot structure.

Based on the empirical data that prosody-sensitive alternations provide, I develop the formal proposal of representation of prominence and foot structure and their interaction. Prominence is represented by gridmarks on an autosegmental tier, while foot structure is not built on the gridmarks, but is a function of syllables grouped into higher-level constituents. I propose that the relationship between foot structure and prominence should be mediated by violable constraints relating the two entities. I call them Prominence Alignment constraints. Mismatches between foot structure and prominence assignment in a given language are caused, under the present theory, when one of the constraints that refer to prominence but not to foot structure outranks a Prominence Alignment constraint. The factorial typology generated by such ranking is substantiated by the case studies throughout this dissertation.

I argue that the model developed in this dissertation generates all types of interaction between foot structure and prominence attested and does not generate unattested patterns.

Thesis Supervisor: Michael Kenstowicz
Title: Professor of Linguistics

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To my father

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CHAPTER 1

INTRODUCTION

1.1 The Problem

Contemporary practice in formulating generalizations about segmental phenomena implicitly does not restrict to what kind of word-internal prosodic units or notions a rule or constraint can make reference. An analysis can refer to all aspects of metrical structure in any part of a generalization, as exemplified below¹:

(1) *A high unstressed vowel deletes before a high stressed vowel*

$$\begin{array}{ll} \text{a. } [\text{high}] \rightarrow \emptyset / \begin{array}{c} _ \\ | \\ [-\text{str}] \end{array} [\text{high}] & \text{b. } *V_{[\text{high}, -\text{stressed}]} V_{[\text{high}, -\text{stressed}]} \\ & \begin{array}{c} | \\ [+str] \end{array} \end{array}$$

(2) *Vowels agree for [+front] feature within a foot*

$$\begin{array}{ll} \text{a. } \begin{array}{c} [+front] \\ / \\ (\acute{t}i.ta)(\grave{t}\grave{a}.ta) \end{array} \rightarrow \begin{array}{c} [+front] \\ \wedge \\ (\acute{t}i.ti)(\grave{t}\grave{a}.ta) \end{array} & \text{b. } \text{ALIGN-R, } [+high], \text{ Ft} \end{array}$$

It has been long recognized that, in most cases, references to stress and references to foot boundaries are interchangeable, and thus it is desirable to limit our theory to reference to one type of word-internal prosodic notion to avoid the theoretical indeterminacy.

The most straightforward, and thus very promising way to resolve the indeterminacy and to limit references to prosody in generalizations about segmental alternations is to hypothesize that the grammar can refer **only** to stressed vs. stressless opposition, or **only** to foot boundaries.

¹ The constraints in (1b) and (2b) are assumed to interact with other constraints that would choose which vowel to delete (and whether to delete it at all) in (1), and would drive vowel harmony in (2). For clarity, I only put down constraints with reference to prosody here.

Indeed, both of these extreme hypotheses have been put forth. Thus, Selkirk (1984:31) proposes that “most alleged foot-sensitive rules can be recast as rules sensitive to stressed-stressless distinction”. In contrast, Flemming (1994) argues that “attested patterns of assimilation which appear to be influenced by stress can be analyzed in terms of autosegmental spreading bounded by a metrical foot” and that “attested stress conditioned processes [are] processes of neutralization of vowel or consonant contrasts or deletion.”

Both of these proposals are attractive theoretically because they limit the ability of the grammar to refer to word-internal prosody when formulating generalizations about segmental phonology (or part of segmental phonology in case of the specific Flemming (1994) proposal). These hypotheses, however, are genuinely difficult to test empirically. The reason is that stress placement and foot boundaries normally go hand in hand, and thus the empirical predictions of these hypotheses are indistinguishable in most cases.

One well known counterexample to the “reference to stress only” extreme appears to be the cases of syllable-counting allomorphy, as exemplified in (3) for Northern Sámi (Saami, Lapp, Lappish)²:

(3) Sámi. Data from Dolbey (1997)

	jearra- ‘to ask’	veahkehea- ‘to help’	‘even’	‘odd’
1du	je:r.re.-ø	veah.ke.he:-t.ne	ø	-tne
2du	jear.ra.-beht.ti	veah.ke.heh-hp.pi	-behtti	-hppi
2pl	jear.ra.-beh.tet	veah.ke.he:-h.pet	-behtet	-hpet
3pl pret	je:r.re.-ø	veah.ke.he:-d.je	ø	-d.je

While allomorph selection in Sámi is clearly based on the odd vs. even number of syllables, i.e. on prosodic shape of the stem and resulting suffixed form, the verbs of this

² It is deceptive to refer to one language when we are talking about Sámi. Sámi languages are spoken from Kola Peninsula (Kildin, Ter dialects among others) in the Far East to Norway and Sweden (Northern dialects) in the West, and most geographically non-adjacent dialects are definitely not mutually comprehensible. According to most of the last counts, there are from 9 to 11 Sámi languages that are sufficiently different in grammar and pronunciation that they are not mutually comprehensible.

shape have only one stress, which is on the initial syllable, according to Bergsland (1976). It seems, therefore, that short of putting stress on odd syllables and deleting it post-allomorph selection, we have to refer to prosodic boundaries, as indeed Dolbey (1997) does in his analysis, and cannot refer only to stressed/stressless opposition in this case.

For the second hypothesis, the “metrical boundaries only” extreme, we have to assume several specific principles of foot structure assignment, for example “stray syllables are adjoined to feet where possible, and the head of a foot is always at one edge of the foot” (Flemming (1994)) to be able to account for the phenomena that are prosodically conditioned. In this view, whenever we see a stressed syllable (i.e. head of the foot), we see a foot boundary. Again, we would be hard-pressed to provide empirical (and not just theory internal) reasons why we should refer to metrical structure and not to the stressed/stressless opposition.

1.2 The Proposal

In this dissertation, I claim that it is possible to test the two hypotheses empirically when we consider segmental alternations that are influenced by either stress or prosodic constituency. In particular, this dissertation concentrates on patterns of mismatch between patterns of stress assignment and prosodically-influenced segmental alternations in world’s languages. Given such empirical disparities, we are forced to conclude that both of the attractive minimalist theories undergenerate patterns of mismatches between prominence and foot structure discussed in present work. Not only both reference to stress and reference to metrical boundaries are necessary to account for patterns of segmental alternations, prominence and foot structure are shown to be **independent entities in the grammar**. The relationship between foot structure and prominence is regulated in the grammar by a series of constraints. The thesis proposes a set of constraints generating a factorial typology of possible misalignments between constituency on foot level and prominence.

Building on earlier work by Liberman (1975), Liberman and Prince (1977), Prince (1983), Hayes (1981), (1995), Halle and Vergnaud (1987), Gordon (2001), among others, I will represent degrees of stress as marks on different levels of metrical grid (liberman (1975)), all dominating syllables on Level₀. If Level_{n+1} has no gridmarks, gridmarks on Level_n would be interpreted as primary stress. For example, if there is no gridmarks on Level₃, Level₂ gridmark represents primary stress, and Level₁ gridmark(s) represent secondary stress. If, on the other hand, Level₂ has no gridmarks, it would be gridmarks on Level₁ that represent primary stress.

Considering that various languages can have more or less degrees of stress, we need constraints to differentiate between such languages. For example, English (for most speakers) has three degrees of stress³: a syllable can have no stress, secondary stress, or primary stress. Therefore, English would have gridmarks on Level₁ and Level₂, and no gridmarks on Level₃ (for the dialects that do not distinguish between secondary and tertiary stress); Level₂ gridmarks would be interpreted as primary stress, and Level₁ secondary stress. Simply put, gridmark on the highest level that has a gridmark would be interpreted as primary stress:

(4)

Level 2	*	interpreted as primary stress
Level 1	* *	interpreted as secondary stress
Level 0	* * * *	

Alabama

Given that some languages (e.g. Cairene Arabic) do not have secondary stress, we need a simple constraint in the CON component of the grammar that bans secondary stress:

(5)

***LEVEL₂ GRIDMARK** There must not be a gridmark on Level₂

Similarly, to ban tertiary stress or the fourth, fifth etc. degrees of stress, we will postulate constraints of the same type. In generalized form:

³ Excluding compounds and constituents larger than Phonological Word.

(6)

***LEVEL_n GRIDMARK** There must not be a gridmark on Level_n

Theoretically, *n* stands for any whole number, and its upper value is only limited by human perceptual ability to distinguish between degrees of stress. Obviously, the ranking of constraints of this group has to be fixed universally, to derive in part the Continuous Column constraint (due to Prince (1983)), which, among other things, prohibits languages from having secondary stress but no primary stress:

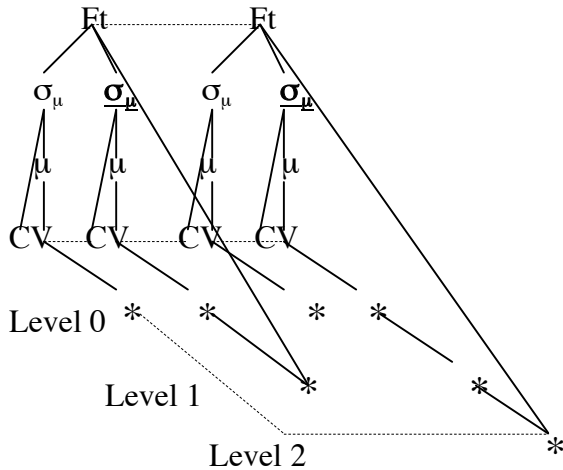
(7) *Prominence Hierarchy*

...*LEVEL₅ GRIDM >> *LEVEL₄ GRIDM >> *LEVEL₃ GRIDM >> *LEVEL₂ GRIDM

It is difficult to say whether we have a constraint that bans Level₁ gridmarks. The question is largely empirical, and amounts to whether there is a language without a primary stress (or accent), i.e. a language without a single syllable within a word being more prominent than any other syllable within the same word. I will leave this question outside the scope of this thesis.

Foot structure, on the other hand, is not built on the gridmarks, like many previous theories suggest (e.g Halle and Idsardi (1995)). Instead, foot structure is a function of syllables grouped into higher-level constituents. I assume that syllable nodes themselves have access to information concerning the lower levels, at least, whether a syllable is heavy or light, and possibly even to whether a certain mora is projected by a segment with particular root features ([±consonantal], [±sonorant]). These two dimensions, however, are (ideally) aligned by the group of constraints I call Prominence Alignment constraints that require that a gridmark on a certain Level must correspond to the {L, R} edge of a foot, and that the {R, L} of a foot must be aligned with a gridmark on a certain level. In short, prominence and constituency are computed independently of each other, but Prominence Alignment constraint(s) require that they coincide. The outputs, therefore, present the following picture:

(8) Multidimensional Representation of Segment Root Features, Moras, Syllables and Feet, and Prominence Projections⁴:



The above representation is essentially of iambic systems, where prominent (either primary or secondary stress) coincides with heads of iambic feet, i.e. the right edges of binary feet. Given the misalignment between foot edges and prominence languages discussed in this dissertation exhibit, it is our task to determine possible misalignments of prominence marks of Level_n with edges of feet, and possibly foot heads.

Note again, that according to the present proposal, feet are not built on the prominence gridmarks, and neither are prominence marks assigned to the heads of feet. Their (mis)alignment is determined by violable constraints.

While the principal ideas put forward here are applicable to a wide range of theories of linguistic competence, they are particularly suited to formal expression within Optimality Theory (Prince & Smolensky 1993) and will, therefore, be presented here within this particular framework.

⁴ Dotted lines are there purely for visual purposes, and do not represent any associations; other levels, like levels of different features that are connected to the root nodes are omitted. Boldface and underlying represent heads of feet.

1.2.1 Constraints Relating Prominence to Foot structure

Since, according to the present proposal, which is based on prosody-dependent segmental alternations, foot structure and prominence are separate notions, we have to consider both languages that do show such a mismatch as well as the majority of languages where foot structure and prominence are perfectly matched. To do this, two groups of constraints are proposed:

(9)

- a. $\text{ALIGN-}\{L,R\}(\text{FT}, \text{GRID}_n)$
 $\forall \text{Level}_n \text{ gridmark } \exists \text{ a } \{L, R\} \text{ foot edge such that it is aligned with the gridmark.}$
- b. $\text{ALIGN-}\{L,R\}(\text{GRID}_n, \text{FT})$
 $\forall \{L, R\} \text{ foot edge } \exists \text{ a Level}_n \text{ gridmark such that it is aligned with that edge.}$

The foot structure of any given language is determined independently by constraints such as BINARITY, PARSE (σ , FT), Alignment of foot edges to edges of Phonological Word etc.

Note that groups of constraints in (9), to which I refer as **Prominence Alignment** constraints, are only the constraints that align foot edges and gridmarks. Other types of alignment constraints that refer to prominence are present in the grammar, but they do not align prominence and foot boundaries.

1.2.2 Factorial Typology of Mismatches Generated by Constraints

Since Prominence Alignment constraints relate prominence and foot structure, any misalignment has to be caused by a constraint that specifically refers to prominence and **not** to foot structure, when such a constraint outranks the relevant Prominence Alignment constraint. We will give a hypothetical example of how ***LEVEL₂ GRID** constraint that bans secondary stress can account for feet without any prominence assigned to them.

In a way, it is often assumed that foot structure might exist in a language without each foot receiving a stress mark on any of its syllables. Two of the most obvious types of analyses like that are, first, cases where location of accent on one of the edges of a word depends on footing that is aligned with the opposite edge of the word (e.g. Cairene

Classical Arabic, Kenstowicz (1994a)). The other, albeit less common, type of feet without accent is the type where, despite the lack of accent on each foot, some sort of footing is needed to predict allomorphy.

Schematically, the first case arises, according to our proposal, when the constraint *Level₂Grid outranks a Prominence Alignment constraint of the second type, i.e. ALIGN-L (FT, GRID_n): (FT, GRID_n):

Tableau 1

/σ σ σ σ/	*Level ₂ Grid	ALIGN-L (FT, GRID _n)
☞ a. (σσ)(σσ)(ó)		**
b. (òσ)(òσ)(ó)	*!	

Tableau 2

/σ σ σ σ/	*Level ₂ Grid	ALIGN-L (FT, GRID _n)
☞ a. (σσ)(óσ)		*
b. (òσ)(óσ)	*!	

The ranking of the *Level₂Grid constraint (refers only to prominence) above a Prominence Alignment constraint leaves us with the mismatch between prominence and foot structure: if there is an odd number of syllables in a word with the foot structure above, the stress is placed on the final syllable, and since *Level₂Grid bans secondary stress, there are two left foot edges that are not aligned with a gridmark. In a word with an even number of syllables, stress is placed on the penult, and the prohibition on secondary stress again causes mismatch between stress and foot structure.

A case where foot structure is manifested by allomorph selection, but there is only one stress per word, such as Sámi case we mentioned in (3) above receives exactly the same analysis to account for feet without prominence.

The general scheme above, where a constraint that refers to prominence and not to foot structure outranks one or both of the Prominence Alignment constraints predicts that the following constraints should cause mismatch between prominence and footing:

(10)

Weight-to-Stress (results in misalignment of stress)

ex. Ngalakgan, Shipibo

Constraints on sonority of stressed vowels (results in misalignment of stress)

ex. Nganasan, Mokša, Shipibo allomorphy, Eastern Mari

WordFinality (results in misalignment of stress and/or feet without prominence)

ex. Nganasan

Alignment with Prosodic Word edges (results in misalignment of stress and/or feet without prominence)

ex. Eastern Mari, Mokša, Southwestern Khanty

Constraints on prominence on roots vs. affixes (results in misalignment of stress and/or feet without prominence)

ex. Eastern Mari

Clash (results in feet without prominence)

ex. Nganasan secondary stress, Maŋši

Lapse (results in misalignment, feet without prominence)

ex. Maŋši

Faithfulness constraints to underlying prominence (results in misalignment)

ex. borrowings into Maŋši, Shipibo exceptional suffixes

Since the effect of all the constraints listed above will be illustrated throughout this dissertation, I will not give examples of each of the constraints' effect in this introduction apart from the schematic example with the Level₂Grid constraint above.

1.3 The Extent of the Survey

In this dissertation, we are not concerned with an exhaustive survey of all the languages with prosody-dependent segmental alternations. Rather, we present a number of case studies with significant mismatches between foot boundaries and position of prominence. The detailed case studies allow us to address many issues that arise when we study the relevant mismatches and implement the main theoretical proposal of this thesis. Because of my background and knowledge, many languages used in case studies are from various branches of the Uralic family, but I believe that they are fully representative of the kinds

of mismatches that are found in languages that are not related to Uralic. Furthermore, most segmental alternations and/or prominence assignment systems are independent innovations rather than the legacies of Proto-Uralic (arguably, consonant gradation in Nganasan is a Proto-Uralic phenomenon, but the precise reflexes and principles of their distribution differ from the parent language).

1.4 Organization of the Thesis

Chapter 2 of the dissertation deals with two case studies, Nganasan and Eastern Mari, to establish the independence of prominence and foot structure, which both of these languages show empirically. We will see that for each of those languages, segmental alternations have to be accounted with reference to binary foot structure, whereas stress assignment shows deviations from this foot structure. We will, therefore, establish the main proposal of this thesis, stating that prominence and foot structure are independent entities in the grammar, and have to be related by Prominence Alignment constraints.

Chapters 3 and 4 seek to establish if there is a difference in the ways prominence (Chapter 3) and foot structure (Chapter 4) influence segmental alternations. In addition, we further investigate how constraints on prominence alone interact with constraints on Prominence Alignment.

Chapter 5 specifically explores interaction between morphological phenomena, notably allomorph selection and prosody with detailed case studies of Maŋsi and Shipibo.

Finally, Chapter 6 gives overall conclusions on interactions of segmental alternations and prosody, and on two prosodic notions, prominence and foot structure.

CHAPTER 2

PROMINENCE AND METRICAL CONSTITUENCY IN SEGMENTAL PHONOLOGY

2.1 Introduction

While situations where there is a clearly seen mismatch between the placement of stress and foot structure are rare, they are possible, mostly due to diachronic stress shifts that did not affect foot boundaries since the latter were marked by some alternation.

We start with the case that, I claim, shows that the “stress only reference” hypothesis cannot be sustained. The case study is of the Uralic Samoyedic language Nganasan. I argue that Nganasan has an alternation (consonant gradation) that is restricted by foot structure. Furthermore, the foot structure that is marked by gradation **does not match** the stress pattern, namely the placement of the primary stress and its shifts from [ə] and [i] leftwards. I analyze the pattern as one affected by several sonority constraints on stressed vowels and a NonFinality constraint that outrank Prominence Alignment constraints. The pattern of consonant gradation is perfectly predictable from foot structure, but cannot be accounted for by making reference only to the stressed/stressless opposition.

Similarly, the second case study I present in this chapter discusses another demonstrable stress placement/foot structure mismatch. The language I discuss is a dialect of Eastern (Meadow) Mari. First, I discuss the pattern of stress assignment in the language that depends on vowel quality and other principles, but not on binary foot structure. Next, I demonstrate that the language’s foot structure is strictly binary, as evidenced by a pattern of full/reduced vowel alternations. The Eastern Mari mismatch between foot structure and stress placement is analyzed as vowel sonority and stress-to-Phonological Word alignment outranking constraints on stress alignment to foot boundaries. Another segmental alternation, rounding harmony, is demonstrated to be conditioned by stress, and not by metrical structure, thus showing that the “metrical boundaries only” hypothesis falls short of accounting for the full range of facts as well.

What Nganasan and Eastern Mari cases have in common is a demonstrable mismatch between the foot structure and stress, so we can be sure to which of these prosodic categories the grammar must refer in generalizations about segmental alternations. In order to account for cases like these, we need to reject both limitation hypotheses.

2.2 Case Study: Nganasan¹

Nganasan, also known as Tawgy (Tavgy), or Tawgy Samoyed, is a Uralic Samoyedic language spoken on Taimyr Peninsula. Nganasan is split into two very close dialects, Avam (Abam) (spoken in the western and central parts of the ethnic territory by about 75% of all Nganasans) and Vadey (spoken in its eastern part). The data presented in this chapter is from the Avam dialect.

Nganasan has two phenomena that are sensitive to metrical structure: stress assignment and consonant gradation. Especially interesting, in the context of the discussion in this chapter, is the mismatch between consonant gradation and stress placement in the language.

First, we will see the distribution of primary and secondary stress in the language, with obligatory and optional stress shifts from ‘less sonorous’ vowels [ə] and [i]. Next, we discuss the consonant gradation in the language and establish that it is restricted by foot structure.

Importantly, however, the foot structure that we need to predict the appearance of consonant gradation reflexes does not match the location of stress. Due to this mismatch, it is easy to see that in order to account for restrictions on consonant gradation, the

¹ The Nganasan data in this chapter are partly taken from source grammars (Helimsky (1998), Tereshenko (1979), Prokofjev (1937)) and subsequently checked with native speakers, and partly comes from fieldwork on the language in March and October 2000. All the discrepancies between grammars and my fieldwork are noted.

grammar of the language has to make reference to foot structure, and crucially not to the stressed/stressless opposition.

2.2.1 Stress

2.2.1.1 Basic Facts

Nganasan has both primary and secondary stress. Correlates of stress in Nganasan are fundamental frequency, duration and amplitude. Normally, primary stress is assigned to the final syllable if it is heavy (CVV), and to antepenultimate syllable if the final is light:

(4)

- | | | |
|----|---------------------|---------------------------|
| a. | bakúnu ‘salmon’ | bàkunú-mə ‘my salmon’ |
| | jəm̩ɲi ‘salary’ | jem̩ɲi-mə ‘my salary’ |
| | t̩irimi ‘caviar’ | t̩irimí-mə ‘my caviar’ |
| | káðar ‘light’ | kaðár-mə ‘my light’ |
| b. | kümáa ‘knife’ | kümáa-mə ‘my knife’ |
| | biríə ‘wound’ | biríə-mə ‘my wound’ |
| | k̩itaráa ‘only cup’ | k̩itaráa-mə ‘my only cup’ |
| | lehúa ‘board’ | lehúa-mə ‘my board’ |

As the data shows, long vowels are bimoraic. Adjacent vowels are never stressed, presumably due to the clash restriction that we discuss in detail below, as for example in words for ‘wound’ *biríə*, ‘caviar’ *t̩irimi*, ‘knife’ *kümáa*, and others. When the 1st singular possessive suffix /-mə/ is added, the stress shifts to the penultimate syllable of the derived word, i.e. derived words are evaluated as a whole for the purposes of stress assignment.

Secondary stress, on the contrary, is left-aligned: it is assigned to odd vowels, starting from the beginning of a word. Similar to primary stress assignment, when a word starts with a CV.CVV sequence, secondary stress is assigned to the CVV syllable, leaving the leftmost light syllable unstressed:

(5)

- a. bakúnu ‘salmon’ bàkunù-mənú-mə ‘my salmon (Prol.)’
jəm̩pi ‘salary’ jəm̩pi-mənú-mə ‘my salary (Prol.)’
t̩irimi ‘caviar’ t̩irim̩i-mənú-mə ‘my caviar (Prol.)’
káðar ‘light’ kàðar-mənú-mə ‘my light (Prol.)’
- b. kùmáa ‘knife’ kùmàa-mənú-mə ‘my knife (Prol.)’
bir̩iə ‘wound’ bir̩iə-mənú-mə ‘my wound (Prol.)’
k̩itaráa ‘only cup’ k̩itaràa-mənú-mə ‘my only cup (Prol.)’
lehúa ‘board’ lehùa-mənú-mə ‘my board (Prol.)’

It appears, therefore, that while primary stress assignment is concerned with the right edge of a word, in that it is the penultimate mora that gets stressed (except situations where either schwa or [i] is penultimate), secondary stress is assigned ‘from the left’: aside from CV.CVV-initial words and clash restrictions, secondary stress is placed on the odd-numbered moras of a word.

We can notice that, regardless of the foot structure that is marked by consonant gradation to be discussed below, stress is never on the last syllable. This fact, when taken by itself, can be attributed to either a prohibition on degenerate feet, or to the NONFINALITY constraint. Given that we know (from the gradation data) that monosyllabic feet are allowed, the former possibility must be discounted. Thus, the first case of mismatch between footing and stress assignment we discuss must be attributed to the NONFIN constraint that bans prominent final syllables:

Tableau 1

/ɲuhu/-/Tu/ ‘his/her/its mitten’	ALIGN-L (FT, PWD)	NONFIN	ALIGN-L (GRID ₂ , FT)
☞ a. (ɲuhú)-(ðu)			*
b. (ɲùhu)-(ðú)		*!	

The foot alignment constraint is irrelevant for these candidates, since they are footed the same way and neither of them violates the constraint. NONFINALITY, on the other hand, competes with the Prominence Alignment constraint: the word is trisyllabic and its last syllable is also a foot-initial syllable. Candidate (b) is eliminated since it violates

NONFINALITY, and candidate (a) is selected as optimal despite its two violations of the lower-ranked Prominence Alignment constraint².

(6) *Interim ranking of primary stress assignment in Nganasan*

ALIGN-L (FT, PWD); NONFIN > ALIGN-L (GRID₂, FT)

The situation we observe here, therefore, conforms to our schema of a higher-ranking constraint (NONFIN) causing a mismatch between the footing and prominence assignment.

2.2.1.2 Penultimate and/or Antepenultimate [ə] or [i]

The general pattern of Avam Nganasan stress assignment we have just outlined is complicated by several stress shifts that take place if the penultimate vowel of a word is [ə] or [i]. Stress does not shift away from the rest of Nganasan vowels, ([a], [e], [o], [u], [i], and [ü])³.

To account for the range of patterns of stress assignment where [ə] and/or [i] is penultimate and/or antepenultimate, we will follow Kenstowicz's (1994b) insight that less sonorous vowels are worse stress-bearers than more sonorous ones. In particular, we need constraints that ban stress on less sonorous vowels⁴, notably schwa and [i]. A partial scale of constraints with universally fixed ranking is given below:

(7) *Scale for Vowels with Prominence*

*GRID_n/ə >> *GRID_n/i, u >> *GRID_n/ε, ɔ >> *GRID_n/e, o >> *GRID_n/a

²A candidate such as (ŋùhú)-(ǫu), while having only one violation of the prominence alignment constraint, is eliminated by CLASH constraint to be discussed shortly.

³In de Lacy's (2004, 2006) data, there are also cases of stress shift from [u] and [i], but I have found no such shifts in the dialect of Nganasan with which I worked.

⁴For theories of the phonetic interpretation of sonority, see Parker (2002) and references therein.

Each of the constraints in this scale should read as, for example, ‘there must not be a vowel [ə] with a gridmark on Level_n’, i.e. a schwa must bear no prominence. As we will see shortly, however, the Nganasan stress assignment pattern necessitates certain a more relaxed theory than the universally fixed constraints allow us.

Under de Lacy’s (2004, 2006) Markedness Conflation theory, stringent constraints allow all attested types of conflation between members of a sonority scale, while universally ranked constraints in (7) above (cf. Kenstowicz (1994b)) do not. De Lacy’s Stringency Hierarchy sonority constraints are given below:

(8)

- | | |
|--|--|
| a. *HD _{FT} / <i>i</i> | b. *NON-HD _{FT} / <i>a</i> |
| *HD _{FT} / <i>i, ə</i> | *NON-HD _{FT} / <i>a, e • o</i> |
| *HD _{FT} / <i>i, ə, i • u</i> | *NON-HD _{FT} / <i>a, e • o, i • u</i> |
| *HD _{FT} / <i>i, ə, i • u, e • o</i> | *NON-HD _{FT} / <i>a, e • o, i • u, ə</i> |
| *HD _{FT} / <i>i, ə, i • u, e • o, a</i> | *NON-HD _{FT} / <i>a, e • o, i • u, ə, i</i> |

The constraints in the hierarchy above are not universally ranked. Thus, a constraint such as *HD_{FT}/*i, ə* would require that *ə* or *i* be the head of a foot. Since the Nganasan primary stress assignment pattern requires, in some cases, conflation of sonority of *ə* and *i*, de Lacy’s (2002, 2004) proposal will be the one that is utilized in analyses in this thesis⁵, with the following minor adjustments:

First, given the Nganasan data presented throughout this chapter, we must reverse the relative sonority of *ə* and *i* (*i*) at least with respect to their stressability, because while schwa and *i* can be of equal sonority in the language, schwa can also be the least

⁵ An alternative to the Stringency Hierarchy constraints would be to propose that constraints of the form in (7) above can be unranked, though crucially not reranked with respect to each other. Thus, a constraint banning stressed *e* and *o* can be unranked in a given language with respect to a constraint banning stressed *i* and *u*, which would result in the four vowels having the same stressability; however, the former constraint may not outrank the latter, to exclude a grammar which stresses *i* and *u* preferentially to *e* and *o*.

sonorous vowel in the system, whereas *i* cannot. The distinction can be seen in optional penult/antepenult stress assignment, when conflation of sonority is optional (see the discussion of the pattern below). The opposition between schwa and other vowels can depend on the representation of schwa universally or in any given grammar. In particular, Oostendorp (1995), among others, relies on the idea that schwa lacks phonological features, which, combined with other factors, renders it the least desirable stress-bearing vowel. In Nganasan, schwa is very short: at a roughly constant rate of speech, schwa duration was c.25 ms, while short [a] was c.60 ms, and long [aa] c. 90 ms.

Secondly, since one of the main proposals of this dissertation is that prominence and foot structure are two distinct entities in the grammar, we must revise the form of de Lacy's constraints that refer to heads of feet and stress-bearing vowels synonymously. In particular, we must consider the possibility that a trochaic (i.e. left-headed) foot is subject to FTFORM constraints forcing trochaic shortening, while stress falls on the rightmost vowel (for a similar idea, see Hewitt (1992), who posits "flat feet" at some point of derivation to account for stress and quantitative adjustments in Alutiiq). A related possibility is that there can be feet where there is no stressed vowel (as is the case in Nganasan), which does not necessarily mean that such feet are headless. Whether there is a grammar with disparity between foot-headedness and prominence, and not just foot boundaries and prominence is an empirical question that I will leave for future research.

With the above modifications, and given the representation of prominence we developed in Chapter 1, the Stringency Hierarchy sonority constraints for stressed vowels will have the following form:

(9)

- *GRID_n/ə There must not be ə with a gridmark on Level_n
- *GRID_n/ə, i There must not be ə or i with a gridmark on Level_n
- *GRID_n/ə, i, i•u There must not be ə, i or i•u with a gridmark on Level_n
- *GRID_n/ə, i, i•u, e•o There must not be ə, i, i•u or e•o with a gridmark on Level_n
- *GRID_n/ə, i, i•u, e•o, a There must not be ə, i, i•u, e•o or a with a gridmark on Level_n

With this theoretical apparatus, we now turn to the formal analysis of Nganasan primary stress assignment that depends on vowel sonority. Primary stress obligatorily shifts one syllable to the left if the penultimate vowel is schwa⁶ and the antepenult is a vowel other than schwa or [i]:

(10)

a.	bakúnu ‘salmon’	bàkunú- ⁿ tənu ‘salmon (Loc)’
	jəmɲi ‘salary’	ʃəmɲi-təni ‘salary (Loc)’
	tĩrimi ‘caviar’	ʃĩrimí- ⁿ təni ‘caviar (Loc)’
	ʃúhü ‘sledge’	ʃübú-təni ‘sledge (Loc)’
	ʃáte ‘stone’	ʃäðé-tənu ‘stone (Loc)’
	sátu ‘clay’	saðú-tənu ‘clay (Loc)’
	ɲorúmu ‘copper’	ɲòrumú- ⁿ tənu ‘copper (Loc)’
	ʃamáða ‘animal’	ʃàmaðá- ⁿ tənu ‘animal (Loc)’
	kó ‘ear’	kó- ⁿ tənu ‘ear (Loc)’
b.	kümáa ‘knife’	kümáa-təni ‘knife (Loc.)’
	biríə ‘wound’	biríə-təni ‘wound (Loc.)’
	kĩta-ráa ‘only cup’	kĩtaráa-təni ‘only cup (Loc.)’
	lehúa ‘board’	le ^m búa-tənu ‘board (Loc.)’
	ʃàmaða-ráa ‘only animal’	ʃàmaða-ráa- ⁿ tənu ‘only animal (Loc)’
	sòŋil-ʃəə ‘former ⁷ pillow’	sòŋil-ʃəə- ⁿ tənu ‘former pillow (Loc)’

Even though, at this point in our analysis, we are only trying to account for the stress shifts from the penultimate schwas, we will see later on that both schwa and [i] are ‘weaker’ than the rest of the vowels in the language. Hence, we will utilize the more general constraint that bans primary (Level 2) stress on schwa and [i]:

⁶The Locative suffix /-NtəNV/ surfaces as ⁿ-təNV or -təNV, depending on principles of consonant gradation to be discussed in the next subsection. The quality of the final vowel of the suffix is determined by vowel harmony that is greatly morphologized in the language: the stems are divided according to which allomorph of this and similar suffixes they take. This division does not always depend on the shape of the stem itself, but has to be specified lexically.

⁷ The suffix /-ʃəə/ is a denominal suffix with the meaning ‘what used to be N’, ‘former N’

- (11) *GRID₂/ə,i There must not be a schwa or an [i] with a gridmark on Level₂

This constraint outranks the Prominence Alignment constraint responsible for the default (trochaic, in this case) stress, without changing the footing shown by the consonant gradation:

Tableau 2

/jühü/-rəKV/ 'similar to a sledge'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (jühú)-(rəgu)			*
b. (jühü)-(rəgu)		*!	

Similarly to the previous Tableau 1, Tableau 2 only contains candidates that are footed 'correctly' (for presentational purposes), so none of the candidates violates the footing constraint. Candidate (b), however, violates the *GRID₂/ə,i constraint, since it has a Level₂ gridmark on the schwa vowel in the second syllable. This sonority constraint, therefore, eliminates candidate (b). Both of the candidates in the Tableau violate the Prominence Alignment constraint, since candidate (a) does not have a gridmark aligned with the left edge of the second foot, and candidate (b) does not have a gridmark aligned with the left edge of either of the feet.

Note, also, that the stress surfaces on the antepenult rather than on the final syllable, i.e. while we cannot yet rank the NONFINALITY constraint and the *GRID₂/ə,i constraints, we know that the latter does not outrank the former. In order to rank these constraints definitively, we can take a look at an example with a schwa in the antepenult as well as penult, but where the final vowel is a vowel other than schwa:

- (12)
- | | | |
|-----------------------------|------------------------------|---------------------|
| (kĩ ⁿ tə)-(rəkĩ) | *(kĩ ⁿ tá)-(rəkĩ) | 'similar to smoke' |
| (kàmə)-(rəku) | *(kamá)-(rəku) | 'similar to blood' |
| (gətə)-(rəku) | *(gətá)-(rəku) | 'similar to a swan' |
| (tərə)-(tənu) | *(tərə́)-(tənu) | 'hair (Loc)' |
| (məjə)-(tənu) | *(məjə́)-(tənu) | 'house (Loc)' |
| (gəðə)-(tənu) | *(gəðə́)-(tənu) | 'swan (Loc)' |

Tableau 3

/kamə/-rəKV/ 'similar to blood'	ALIGN-L (FT, PWD)	NONFIN	*GRID ₂ /ə,ɪ	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (kàmə)-(rókú)			*	
b. (kamá)-(rəku)			*	*!
c. (kamə)-(rəkú)		*!		*

As we can see, the main stress is **not** word-final and surfaces on the penultimate syllable despite its containing a schwa as a nucleus. In other words, it is more important that the stress is not word-final than that schwas do not carry stress. Candidate (c), therefore, is eliminated by the Word Finality constraint. The remaining two candidates tie on the *GRID₂/ə,ɪ constraint, because candidate (a) has a stressed schwa penult, and in candidate (b), it is the schwa-headed antepenult that bears primary stress. The decision, therefore, is passed to the Prominence Alignment constraint that is violated by candidate (b), but satisfied by candidate (a) that has primary stress aligned with the left edge of a foot. Below is an interim ranking of relevant constraints:

(13)

ALIGN-L (FT, PWD), NONFIN > *GRID₂/ə,ɪ > ALIGN-L (LEV₂GRID, FT)

Primary stress can also shift from penultimate schwa even if the antepenult is also a schwa. This shift, however, only happens if the antepenult is foot-initial, according to the foot structure that we will justify in the next subsection:

(14)

- | | |
|--|---|
| a. (hĩa)(jə-rə)(gĩ) 'similar to a thumb' | b. (hĩa)(jə- ⁿ tə)(nĩ) 'thumb (Loc)' |
| (kàta)(rə-rə)(gĩ) 'similar to light' | (kàta)(rə- ⁿ tə)(nĩ) 'light (Loc)' |
| (bàar)(pə-rə)(gĩ) 'similar to a master, chief' | (bàar)(pə- ⁿ tə)(nĩ) 'master, chief (Loc)' |
| (čĩa)(rə-rə)(gĩ) ⁸ 'similar to benefit' | (čĩa)(rə- ⁿ tə)(nĩ) 'benefit' (Loc) |

⁸ The antepenultimate schwa in this word, but not in the previous examples, is epenthetic. With regard to stress assignment and consonant gradation epenthetic schwas behave in the same manner as underlying schwas.

The examples above, (14a) with the simulative suffix, and examples in (14b) with one of the Locative suffixes, illustrate the pattern where antepenultimate schwas are stressed, but only if the antepenult is foot-initial, not foot-final as in the example we have in the Tableau 3 above (from the data in (13)). In fact, to account for the pattern we observe in (14), we do not need to refer to any constraints other than the ones we have already used:

Tableau 4

/kaTar/-/Ntəni/ 'light' (Loc)	ALIGN-L (FT, PWD)	WDFIN	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (kàta)(rə- ⁿ tə)(nĩ)			*	
b. (kàta)(rə- ⁿ tó)(nĩ)			*	*!
c. (kàta)(rə- ⁿ tə)(ní)		*!	*	

The situation is very similar to the one in the Tableau 3: candidate (c) violates the WORD FINALITY constraint, while the other two candidates satisfy the constraint. The remaining candidates (a) and (b) tie with respect to *GRID₂/ə,i constraint: candidate (a) has a gridmark on its antepenult, and candidate (b) on its penultimate syllable, both of which are headed by schwas. Once again, therefore, the decision is passed on to the Prominence Alignment constraint. In this case, however, in contrast to what we saw in Tableau 3, it is the candidate with the stress on the **antepenult** rather than penult that emerges as a winner: while both of the candidates violate the Prominence Alignment constraint (no gridmark aligned with the left edge of the final foot), only candidate (b) has the second violation of this constraint, since its primary stress is not aligned with the left edge of the second foot. This example also shows that the left-to-right footing plays a crucial role in seating the primary stress⁹.

Note that the situation we have just modelled, when both antepenultimate and penultimate syllables are schwas, i.e. of equal sonority, shows us the Prominence Alignment constraint in action, since it is the constraint that distinguishes between two candidates with stressed schwas, and selects the one where stress is aligned with the left

⁹ De Lacy (2004, 2006) assumes a moraic trochaic foot at the right edge of the word, an assumption that is contradicted by the above pattern of optionality as well as by the pattern of consonant gradation to be discussed in the next subsection.

edge of a foot. Table below shows the pattern of stress assignment where both penult and antepenult are either [ə] or [i]:

(15) *Primary stress assignment with the vowels [ə] and [i]*

antepenult	penult	penult is foot-initial	penult is foot-final
ə	ə	penultimate	antepenultimate
i	ə	variable penultimate ~ antepenultimate	antepenultimate
ə	i	penultimate	variable penultimate ~ antepenultimate
i	i	penultimate	antepenultimate

We will now consider cases where either the penult, or the antepenult, or both is the high central vowel [i] (IPA [ɨ]).

Primary stress shifts if the penultimate vowel of the word is [i] (IPA [ɨ]); this ‘shift’ is obligatory when the preceding vowel is a full vowel, whether the antepenultimate vowel is foot-final (16b) or foot-initial (16a):

(16)

- a. (b̥it̥i)-(bá^hh̥i)-(rə) * b̥it̥i-ba^hh̥i-rə ‘you (sg.) are said to drink’
 (b̥ið̥ir)-(nàⁿt̥i)-(bá^hh̥i)-(rə) * b̥ið̥ir-nàⁿt̥i-ba^hh̥i-rə ‘you (sg.) are said to be thirsty’
- b. (j̥iləb)(t̥i-bá)(h̥i-rə) *(j̥iləb)(t̥i-ba)(h̥i-rə) ‘you (sg.) said to rise’
 (b̥ua)(tə-bá)(h̥i-rə) *(bua)(tə-ba)(h̥i-rə) ‘you (sg.) are said to look up’
 (h̥ii)(lə-bá)(h̥i-rə) *(h̥ii)(lə-ba)(h̥i-rə) ‘you (sg.) are said to spin’

Given the data above, we can see that behavior of penultimate [i] with an antepenultimate vowel that is any vowel other than [ə] or [i], is exactly the same as behavior of schwa:

primary stress obligatorily falls on the antepenult. Following our analysis, the tableau for this pattern should be the same as Tableau 2 above, with the relevant constraint banning both primarily stressed [i] and [ə]:

Tableau 5

/buaNtə/-/HaNhi/-/rə/ 'you (sg.) are said to look up'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (bùa)(tə-há)(hī-rə)			*
b. (bua)(tə-ba)(hī-rə)		*!	

Since the sonority constraint on stressed [i] and [ə] outranks the Prosodic Alignment constraint, candidate (b) is not viable, having primary stress on the high central vowel. The Prosodic Alignment constraint, even though it is violated twice by the winning candidate (a), does not play a role here.

So far, we have not taken into account the relative sonority of [ə] and [i]. According to de Lacy's (2004, 2006) theory, these vowels can either be of equal sonority, when conflation occurs, or the high central vowel can be of lesser sonority than [ə]. As the data below will show, however, schwa is the least sonorous vowel in the language, though, as de Lacy's theory predicts, the two can be of equal sonority. For the purposes of Nganasan, however, schwa is the 'least stressable' vowel, the fact that necessitated our slight revision of de Lacy's constraints.

If the antepenultimate syllable has [i] as a nucleus, and schwa is penultimate, there is a certain variation: primary stress can be assigned to antepenult, but also to the penult if the penult is foot-initial (17a). If the penult is foot-final, the only option for the primary stress is to surface on the antepenultimate [i] (17b):

(17)

- a. (bìni)-(ᵀtəni) ~ (bíní)-(ᵀtəni) 'rope (Loc.)'
- (ɲìni)-(ᵀtənu) ~ (ɲíní)-(ᵀtənu) 'brother (Loc.)'
- (bǐǎi)-(təni) ~ (bǐǎí)-(təni) 'water (Loc.)'
- (kǒli)-(tənu) ~ (kǒlí)-(tənu) 'fish (Loc.)'


(jàli)-(tóni) ~ (jalí)-(təni) ‘day (Loc)’
 (cèbì)-(tənu) ~ (cebí)-(tənu) ‘nail (Loc)’
 (sòŋí)-(ⁿtəni) ~ (soŋí)-(ⁿtəni) ‘pillow (Loc)’
 (mìⁿdí)-(tənu) ~ (míⁿdí)-(tənu) ‘load (Loc)’

b. (ní-ⁿtə)(ni) * (ní-ⁿtə́)(ni) ‘wife (Loc.)’
 (kə̀ə)(lí-ⁿtə)(nu) * (kə̀ə)(lí-tə́)(nu) ‘tear (Loc.)’
 (sìr-ha)(^mbí-ⁿtə)(ni) * (sìr-ha)(^mbí-ⁿtə́)(ni) ‘ice (Loc), evidently’
 (bàŋ-ha)(^mbí-ⁿtə)(ni) * (bàŋ-ha)(^mbí-ⁿtə́)(nu) ‘dog (Loc), evidently’
 (kò-ba)(^mbí-ⁿtə)(ni) * (kò-ba)(^mbí-ⁿtə́)(ni) ‘ear (Loc), evidently’
 (tìri)(mì-ba)(^mbí-ⁿtə)(ni) * (tìri)(mì-ba)(^mbí-ⁿtə́)(ni) ‘caviar (Loc), evidently’
 (çia)(jə̀-ba)(^mbí-ⁿtə)(ni) * (çia)(jə̀-ba)(^mbí-ⁿtə́)(ni) ‘tongue (Loc), evidently’

Two main factors seem to play a role in determining whether there is an option of penultimate main stress in word or not: first, the relative sonority of [ə] and [i], and second, foot structure of the language.

Following that reasoning, one of the options should have the Prominence Alignment constraint select the winner, with the other vowel sonority constraint ranked lower than Prominence Alignment:

Tableau 6

/kòli/-/Ntənv/ ‘fish (Loc)’	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV GRID, FT)	*GRID ₂ /ə
a. (kòlí)-(tənu)		*	*!	
 b. (kòlì)-(tənu)		*		*

In case where the Prominence Alignment constraint outranks the *GRID₂/ə constraint, the winner is candidate (b), even though its primary stress falls on schwa. The candidates tie on the *GRID₂/ə,i constraint, and Prominence Alignment constraint eliminates candidate (a).

If the Prominence Alignment constraint and the *GRID₂/ə constraint are reranked, however, it is always the candidate with primary stress on [i] that emerges as the winner, regardless [i]’s position with respect to foot structure:

Tableau 7

/kolí/-/NtənV/ 'fish (Loc)'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	*GRID ₂ /ə	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (kolí)-(tənu)		*		*
b. (kòlì)-(tənu)		*	*!	

The optionality of (17a), therefore, is explained by the optional reranking of the two sonority constraints, where one of the rankings (Tableau 6) puts the decision between the candidates on the Prominence Alignment constraint, and the other ranking makes the candidate with primary stress on [í] the optimal one. This analysis crucially depends on the stringency hierarchy in (9) allowing the two candidates tie on the constraint that conflates [í] and schwa and allows the lower ranking constraints to decide the winner.

With the same optional reranking of the Prominence Alignment and *GRID₂/ə constraint, however, the examples in (17b) will receive obligatory antepenultimate stress, either because the deciding constraint is the Prominence Alignment constraint:

Tableau 8

/ní/-/NtənV/ 'wife (Loc)'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)	*GRID ₂ /ə
a. (ní- ⁿ tə́)(ní)		*	*!	*
☞ b. (ní- ⁿ tə)(ní)		*		

or because the candidate with the stressed schwa is eliminated by the *GRID₂/ə constraint:

Tableau 9

/ní/-/NtənV/ 'wife (Loc)'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	*GRID ₂ /ə	ALIGN-L (LEV ₂ GRID, FT)
a. (ní- ⁿ tə́)(ní)		*	*!	*
☞ b. (ní- ⁿ tə)(ní)		*		

When the antepenultimate vowel is [i], (and the penult is also [i]), the location of the primary stress does depend on the foot structure: the primary stress surfaces on the penult (18b) or antepenult (18a), depending on which one of the vowels is foot-initial:

(18)			
a.	(mí ⁿ tí)-(mə)	*(mí ⁿ tí)-(mə)	‘my load’
	(bíní)-(mə)	*(bíní)-(mə)	‘my rope’
	(bí ⁿ tí)-(rə)	*(bí ⁿ tí)-(rə)	‘you (sg.) drink’ (intr)
	(bì ⁿ ḏí-p)(tí-tí)-(rə)	*(bì ⁿ ḏí-p)(tí- ⁿ tí)-(rə)	‘you (sg) are drinking’ (tr)
	(lḏḡí-p)(tí-tí)-(rə)	*(lḏḡí-p)(tí- ⁿ tí)-(rə)	‘you (sg) are burning’ (tr)
	(hǐḡí-p)(tí-tí)-(rə)	*(hǐḡí-p)(tí- ⁿ tí)-(rə)	‘you (sg) are cooking’ (tr)
b.	(bì ⁿ ḏí)-(tí-rə)	*(bì ⁿ ḏí)-(tí-rə)	‘you (sg) are drinking’ (intr)
	(kò ⁿ í)-(ⁿ tí-rə)	*(kò ⁿ í)-(ⁿ tí-rə)	‘you (sg) are going’
	(lḏḡí)-(ⁿ tí-rə)	*(lḏḡí)-(ⁿ tí-rə)	‘you (sg) are burning’ (intr)
	(hǐḡí)-(ⁿ tí-rə)	*(hǐḡí)-(ⁿ tí-rə)	‘you (sg) are cooking’ (intr)
	(lḏḡí)-(ⁿ tí-rə)	*(lḏḡí)-(ⁿ tí-rə)	‘you (sg) are yelling’
	(ḡí ⁿ lì)-(ⁿ tí-rə)	*(ḡí ⁿ lì)-(ⁿ tí-rə)	‘you (sg) are living’

In (18a) we see examples of two types: nouns with both root vowels being [i] with the 1st person possessive suffix *-mə*, which constitutes trisyllabic words with stress on the antepenult that is foot-initial, and verbs with three suffixes, transitivity suffix *-PTU-*, continuous action suffix *-NTU-*, and non-alternating suffix *-rə*, which signifies 2nd person singular verb. Here, we also see the primary stress on the antepenult, which is foot-initial.

In (18b), on the other hand, we see verbs with the same continuous action suffix *-NTU-* and personal suffix *-rə*, but without the suffix that makes transitive verbs out of intransitive. Since all the verbal roots here are disyllabic, the penultimate [i] of the continuous action suffix surfaces with primary stress, because it is foot-initial. The antepenult in the examples in (18b) is always foot-final, and thus never receives primary stress. As the data shows, the primary stress assignment clearly depends on the foot structure, since constraints on vowel sonority are irrelevant, because candidates violate them equally:

Tableau 10

a.

/bĩnĩ/-/mə/	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	*GRID ₂ /ə	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (bĩnĩ)-(mə)		*		
b. (bĩnĩ)-(mə)		*		*!
b.				
/ɲĩli/-/Ntĩ/-/rə/				
☞ a. (ɲĩli)-(tĩ-rə)		*		
b. (ɲĩli)-(tĩ-rə)		*		*!

In both tableaux 10a and 10b above, all the candidates violate the *GRID₂/ə,i constraint, and none of them violate the *GRID₂/ə since primary stress is assigned to [i], whether it is penultimate or antepenultimate. The Prominence Alignment constraint, therefore, is the one that chooses the optimal candidate: it is the candidate with the antepenultimate stress in Tableau 10a, and the candidate with penultimate stress in Tableau 10b, since these are the candidates with primary stress aligned with the left edge of a foot.

In the situation where the penultimate [i] is preceded by the antepenultimate schwa, there can be some optionality, just as in the situation we saw in (17) above, where schwa is the penult and [i] is antepenult, i.e. the mirror situation to the data in (19) below. In (19a), we see that if the penult is foot-final, the primary stress can be assigned to the antepenult as well as to the penult. In (19b), on the other hand, all the examples have foot-initial penult, and the primary stress cannot be optionally assigned to the antepenultimate schwa, but only shows up on the penultimate [i]:

(19)

- | | | | |
|----|---|------------------------|----------------------|
| a. | (bĩnĩ)-(ˀtəní)-(mə) ~ (bĩnĩ)-(tónĩ)-(mə) | | ‘my rope (Loc.)’ |
| | (ɲĩnĩ)-(ˀtəní)-(mə) ~ (ɲĩnĩ)-(tónĩ)-(mə) | | ‘my brother (Loc.)’ |
| | (kũ)(màa)-(ˀtəní)-(mə) ~ (kũ)(maa)-(ˀtəní)-(mə) | | ‘my knife (Loc.)’ |
| | (kĩta)-(ràa)-(təní)-(mə) ~ (kĩta)-(raa)-(təní)-(mə) | | ‘my only cup (Loc.)’ |
| | (cèbĩ)-(təní)-(mə) ~ (cèbĩ)-(tónĩ)-(mə) | | ‘my nail (Loc.)’ |
| | (jàli)-(təní)-(mə) ~ (jàli)-(tónĩ)-(mə) | | ‘my day (Loc.)’ |
| b. | (nĩ-ˀtə)(ní-mə) | * (nĩ-ˀtə)(nĩ-mə) | ‘my wife (Loc.)’ |
| | (kəə)(li-ˀtə)(ní-mə) | * (kəə)(li-ˀtə)(nĩ-mə) | ‘my tear (Loc.)’ |

(nǐlu)(jǐ-rə)(gǐ-mə)	*(nǐlu)(ji-rə́)(gǐ-mə)	‘similar to my life’
(sǐ-rə)(gǐ-mə)	*(sǐ-rə́)(gǐ-mə)	‘similar to my ice’
(jòrə)-(tǐ-rə)	*(jorə́)-(tǐ-rə)	‘you (sg) are crying’
(jùlə)-(tǐ-rə)	*(julə́)-(tǐ-rə)	‘you (sg) are lifting’
(hòḏə)-(tǐ-rə)	*(hoḏə́)-(tǐ-rə)	‘you (sg) are writing’

The above pattern is predicted by the constraints with the ranking we have already developed. The optionality of (19a) is predicted by the two options of ranking the *GRID₂/ə constraint with respect to the Prominence Alignment constraint:

Tableau 11

/bǐnǐ/-/Ntəní/-/mə/ ‘my rope (Loc)’	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)	*GRID ₂ /ə
☞ a. (bǐnǐ)-(ᵀtəní)-(mə)		*		
b. (bǐnǐ)-(ᵀtəní)-(mə)		*	*!	*

With this ranking of the Prominence Alignment and *GRID₂/ə constraints, the decision between the candidates is made by the Prominence Alignment constraint. If, however, *GRID₂/ə outranks the Prominence Alignment constraint, the candidate with higher-sonority [i] is the optimal one:

Tableau 12

/bǐnǐ/-/Ntəní/-/mə/ ‘my rope (Loc)’	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	*GRID ₂ /ə	ALIGN-L (LEV ₂ GRID, FT)
a. (bǐnǐ)-(ᵀtəní)-(mə)		*	*!	
☞ b. (bǐnǐ)-(ᵀtəní)-(mə)		*		*

In case of the above ranking, the Prominence Alignment is irrelevant, because the candidate with antepenultimate primary stress on the schwa is eliminated by the *GRID₂/ə constraint. The optional stress assignment disappears, however, if the [i] in the penult is also foot-initial, since both rankings of the sonority constraints give us the same winner:

Tableau 13

/nĩ/-/Ntəni/-/mə/ 'my wife (Loc)'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	ALIGN-L (LEV ₂ GRID, FT)	*GRID ₂ /ə
☞ a. (nĩ- ⁿ tə)(nĩ-mə)		*		
b. (nĩ- ⁿ tə́)(nĩ-mə)		*	*!	*

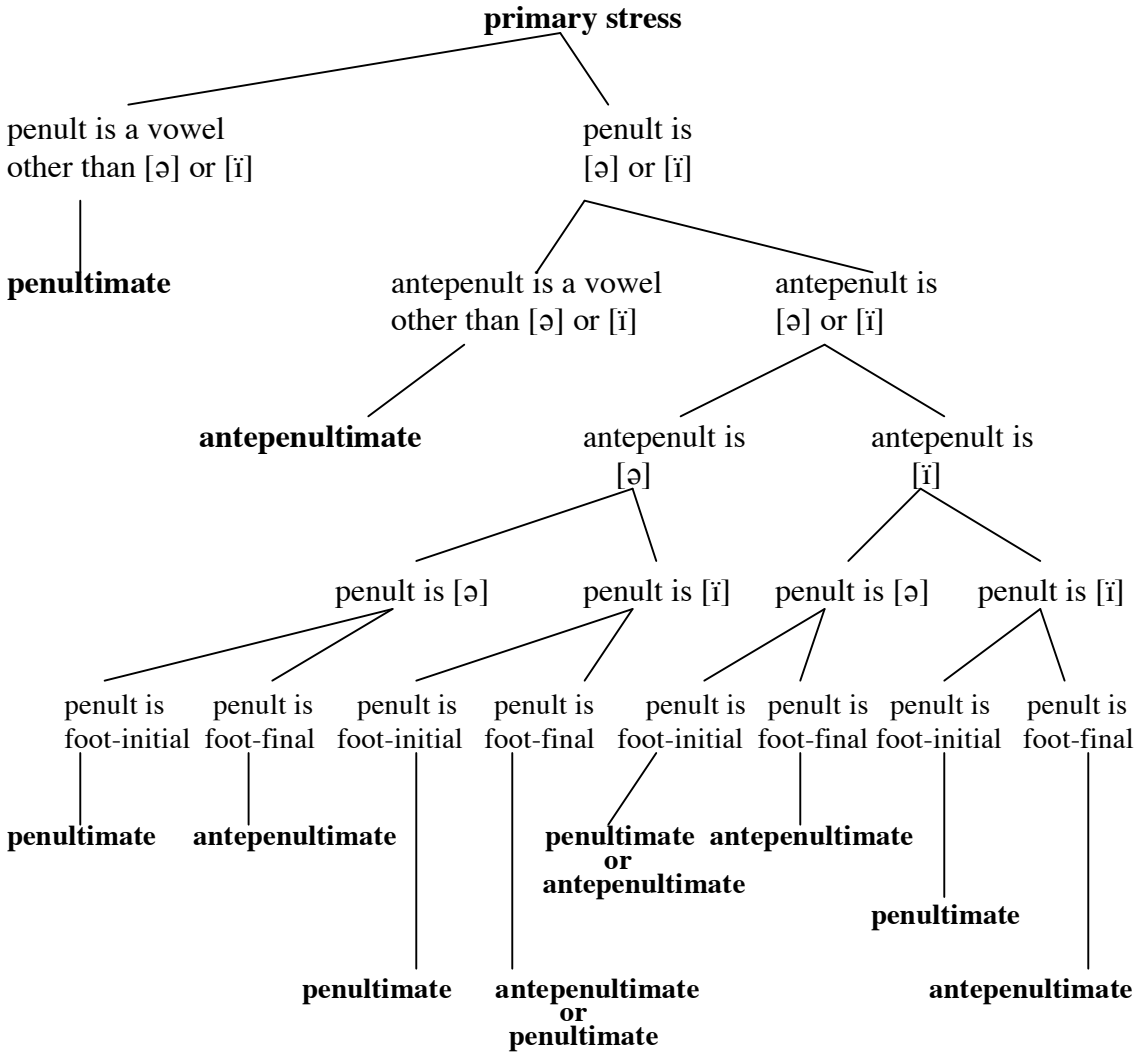
In the above tableau, candidate (b) is eliminated by the Prominence Alignment constraint, since its primary stress is assigned to the rightmost syllable of a foot. The penultimate stress is optimal here.

Tableau 14

/nĩ/-/Ntəni/-/mə/ 'my wife (Loc)'	ALIGN-L (FT, PWD)	*GRID ₂ /ə,i	*GRID ₂ /ə	ALIGN-L (LEV ₂ GRID, FT)
☞ a. (nĩ- ⁿ tə)(nĩ-mə)		*		*
b. (nĩ- ⁿ tə́)(nĩ-mə)		*	*!	

To summarize, the intricate stress pattern of the Avam dialect of Nganasan is assigned according to the following principles: a) secondary stress is assigned to the odd-numbered vowels, starting from the left, with restrictions imposed by avoidance of clash; b) primary stress is always the rightmost prominent syllable in a word; it is assigned to the penultimate vowel of the word if the penult is a vowel other than [ə] or [i]; it obligatorily shifts to antepenult if the penultimate vowel is [ə] or [i] and the antepenult is a vowel other than [ə] or [i]; if both of penult and antepenult are [ə] or [i], primary stress assignment depends on foot structure that we will justify in a moment, and in certain cases varies between penult and antepenult. The variation is explained by ranking the less inclusive *GRID₂/ə either above or below the Prominence Alignment constraint, thus making the sonority conflation optional.

(19) *Summary of Nganasan primary stress assignment*



2.2.2 Consonant Gradation

2.2.2.1 Basic Facts

Nganasan has another phenomenon besides stress that is sensitive to prosody, namely consonant gradation. Consonant gradation is the process that establishes the foot structure we have been assuming for Nganasan up to this point. The gradation establishes that Nganasan words are parsed into binary moraic feet from left to right, with degenerate foot allowed at the left edge of a word.

The grade alternation, or gradation, of consonants is a phenomenon of the alternative appearance of two grades, traditionally called strong and weak, depending on some phonological or morphophonological environment. For Nganasan, consonant grade alternations are alternations between voiceless (“strong” in traditional terminology) and voiced (“weak”) obstruents. The reflexes of gradation are given in the table below:

(21) *Gradation reflexes* (cf. Helimsky 1998, Tereshenko 1968a)

strong grade	h	t	k	s	ç	c	ʰh	ᵀt	ʷk	ˀs	ˀç	ˀc
weak grade	b	ð	g	ʃ	ʃ	ʃ	h	t	k	s	ç	c

We will first examine the distribution of voicing in obstruents that are not intervocalic. Nganasan obstruents after another consonant are always voiceless. In (22) we see the 3rd person possessive suffix. Its obstruent always surfaces as voiceless [t] after consonant-final stems below:

(22)

tár-tu ‘his/her/its hair’	kám-tu ‘his/her/its blood’
kaðár-tu ‘his/her/its light’	máʔ-tu ‘his/her/its house’
bíʔ-ti ‘his/her/its water’	sír-ti ‘his/her/its ice’
heʷjír-ti ‘his/her/its shaman’s drum’	nilúʔ-tu ‘his/her/its life’
húəʔ-tu ‘his/her/its fur overcoat’	sónjíl-tu ‘his/her/its pillow’
ðörúʔ-tu ‘his/her/its cry’	báŋ-tu ‘his/her/its dog’

The same is true of coda obstruents: they are always voiceless in the language. In addition to appearing in their ‘strong’ (i.e. voiceless) grade, coda obstruents in the language are neutralized to glottal stop¹⁰. The underlying place of articulation, however, is clear in forms where the obstruent is intervocalic, like the Accusative singular forms below:

¹⁰ Interestingly enough, the only obstruents that do not get neutralized to glottal stop in the coda are labials. They are also invariably voiceless in the coda position and therefore comprise the alternation [h^(w)] ~ [b] ~ [p].

(23)

bīʔ (cf. Acc Sg *bīðim* with suffix *-m* and epenthesis) ‘water’
huəʔ (cf. Acc Sg *huəjum* with suffix *-m* and epenthesis) ‘fur coat’
maʔ (cf. Acc. Sg *maʒəm* with suffix *-m* and epenthesis) ‘house’
níluʔ (cf. Acc. Sg *niluʒim* with suffix *-m* and epenthesis) ‘life’
ðóruʔ (cf. Acc. Sg *ðörugum* with suffix *-m* and epenthesis) ‘cry’
kéguʔ (cf. Acc. Sg *kekuðum* with suffix *-m* and epenthesis) ‘fog’
sínüʔ (cf. Acc. Sg *sinügüm* with suffix *-m* and epenthesis) ‘memory’
hiaʔ (cf. Acc. Sg *hiaʒim* with suffix *-m* and epenthesis) ‘oak’

The two non-intervocalic positions, therefore, are never contrastive as far as obstruent voicing (and weak/strong gradation reflexes of prenasalized obstruents) are concerned, the obstruents in postconsonantal and coda positions are uniformly voiceless.

Word-initial voicing of the obstruents is not predictable from any principle of consonant gradation, or any other principle for that matter. The data in (24) illustrate this point: a word can start with either a voiced or a voiceless obstruent:

(24)

ʃúhü ‘sledge’	ʃáte ‘stone’
céhī ‘nail’	ʒúəʒə ‘tongue’
sátu ‘clay’	sír ‘ice’
baŋ ‘dog’	bása ‘iron’
h ^h aa ‘tree’	hóðür ‘letter’
kíta ‘cup’	kásu ‘bark’
gátə ‘swan’	gúla ‘crow’
tər ‘hair’	túrku ‘lake’
ðóruʔ ‘cry’	ðájpu ‘dry wood’

While in non-intervocalic positions we see no grade (voicing) alternations, obstruents in the language lenite intervocalically. However, and this is the most important aspect of the alternations in question for the discussion of this chapter, this lenition is prosodically restricted. Intervocalically, obstruents can surface as both voiced and voiceless, depending on their prosodic position. The data in (25) below illustrate this distribution, with the foot structure we need to predict the distribution of obstruent voicing. The words in (25) are examples with the 3rd person possessive singular suffix:

(25)

(jütú)-(ǫü) ‘his/her/its hand’	(táa)-(ǫu) ‘his/her/its deer’
(suu)(ǫ́ǫ)-(ǫu) ‘his/her/its lung’	(cimí)-(ǫi) ‘his/her/its tooth’
(kəə)(lí-ti) ‘his/her/its tear’	(kói)-(ǫi) ‘his/her/its side’
(jálí)-(ǫi) ‘his/her/its day’	(jòru)(mú-tu) ‘his/her/its copper’
(ɲuhú)-(ǫu) ‘his/her/its mitten’	(ci ⁿ té)-(ǫi) ‘his/her/its hill’
(jàma)(ǫ́á-tu) ‘his/her/its animal’	(moo)(já-tu) ‘his/her/its stub’

As the alternation above illustrates, the appearance of voiced and voiceless intervocalic obstruents is predictable from the foot structure of the language as it is marked above. The footing has to be binary and start from the left. The CVV syllables are heavy, and are always footed by themselves. Stray syllables are footed into degenerate monomoraic feet.

The distribution of voicing is the same whether the gradating consonant starts a suffix or is inside a suffix. In (26) there is another example of the same voicing distribution with a similative suffix, where the gradating consonant ([k]/[g]) is in the second syllable of the suffix. The generalization about voicing (grade) distribution still holds: when the obstruent of the suffix is foot-initial, it is voiced, and when it is foot-internal, it is voiceless.

(26)

- a. (jütú)-(rǫkü) ‘similar to a hand’
(bīnī)-(rǫkī) ~ (bīnī)-(rǫkī) ‘similar to a rope’
(suu)(ǫ́ǫ)-(rǫku) ‘similar to a lung’
(taá)-(rǫku) ‘similar to a deer’
(ɲuhú)-(rǫku) ‘similar to a mitten’
- b. (ní-rə)(gī) ‘similar to a woman’
(bàku)(nú-rə)(gu) ‘similar to salmon’
(t̥iri)(mí-rə)(gī) ‘similar to caviar’
(kəə)(lí-rə)(gī) ‘similar to a tear’
(jàma)(ǫ́á-rə)(gu) ‘similar to an animal’

The data in (27) below gives us yet another example of intervocalic obstruent voicing distribution, but in verbs rather than nouns, with a participial suffix with [s]/[j]

alternation. Despite the morphological (nouns vs. verbs) difference, the generalization about consonant gradation is exactly the same: when an intervocalic [s] is foot initial, it voices, and when it is foot-internal it stays voiceless.

(27)

(bíʔi)-(ʃu) ‘drinking’	(búaʔ)(tə-sí) ‘looking up’
(ʃúlə)-(ʃu) ‘lifting’	(bə)(ðúaʔ)(tə-sa) ‘growing’
(ʃórə)-(ʃa) ‘crying’	(hóðəʔ)(tə-sa) ‘writing’
(hótə)-(ʃa) ‘writing out’	(ʃórə)(lə-sa) ‘starting to cry’

It seems clear that intervocalic lenition in Nganasan is prosodically restricted: the obstruents are only allowed to lenite iff they are foot-initial, and the lenition is blocked otherwise.

Importantly, however, the foot structure that we need in order to predict the reflexes of consonant gradation correctly differs from the foot structure that we would posit if we only considered the stressed/stressless syllable opposition in the language. Recall that stress assignment in Nganasan does not exactly match the foot structure as marked by consonant gradation. Primary stress in the language is penultimate, regardless of whether the penultimate vowel is even or odd-numbered when counting from the left. In other words, a stressed vowel in the language can equally be foot-initial and foot-final because of the requirement that the penultimate vowel is stressed.

In addition, the same situation arises when the stress assignment is influenced by the quality of the vowel (stress shifts from [ə] and [i]): the stressed vowel can be foot-initial or foot-final. Consider the following examples with simulative suffix *-rəkV/-rəgV*, and foot structure marked as required by consonant gradation alternations:

(28)

a. (ní-rə)(gī)	‘similar to a woman’
(hĩa)(ʃə-rə)(gī)	‘similar to a thumb’
(kó-rə)(gu)	‘similar to an ear’

(h ^w áa)-(rəku)	‘similar to a tree’
(ɲòru)(mú-rə)(gu)	‘similar to copper’
(là)(təə)-(rəku)	‘similar to a bone’
(bi)(ríə)-(rəki)	‘similar to a wound’
b.	
(bīní)-(rəki) ~ (bīni)-(rəki)	‘similar to a rope’
(kə̀ri)(gə́li)-(rəki)	‘similar to a march’
(bopkú)-(rəku)	‘similar to a coast’
(hiŋhí)-(rəki)	‘similar to night’
(kolí)-(rəki) ~ (kòli)-(rəki)	‘similar to a fish’
(kĩ ⁿ tə)-(rəki)	‘similar to smoke’

Note that, due to the stress shift from the penultimate schwa of the suffix, stress can be placed on the foot-initial syllable (28a), and on the foot-final syllable, as in (28b), unless, as in the word for ‘similar to a fish’ (*kolí*)-(rəki) ~ (*kòli*)-(rəki), there is variation in whether the primary stress falls on the penult or antepenult. Consonant gradation, nevertheless, clearly makes reference to foot structure, regardless of the position of stress. Any reference to stress instead of to foot structure would render the pattern of consonant gradation alternations unpredictable.

Similarly, in forms without stress shifts due to the quality of the penultimate vowel, the stress (i.e. penultimate vowel) can be in foot-initial and foot-final position, while obstruents are only allowed to lenite foot-initially, as in the following examples with the 2nd person dual suffix *-ti/-ði*:

(29)

a.	(kó-ti)	‘your (du.) ear’
	(bàku)(nú-ti)	‘your (du.) salmon’
	(hai)(mú-ti)	‘your (du.) fur boots’
	(hia)(ďá-ti)	‘your (du.) ermine’
	(jàka)(ďá-ti)	‘your (du.) smell’
	(ní-ti)	‘your (du.) wife’
	(ɲòru)(mú-ti)	‘your (du.) copper’
b.	(bahí)-(ði)	‘your (du.) wild deer’
	(béi)-(ði)	‘your (du.) period of time’

(düŋhá)-(ði)	‘your (du.) soft ground’
(kə̀rĩ)(gə̀ɬĩ)-(ði)	‘your (du.) march’
(koʌ)(súo)-(ði)	‘your (du.) worm’
(le)(húa)-(ði)	‘your (du.) board’

In (29a) the consonant of the suffix is always foot-final, and thus is not allowed to lenite, but is required to surface in its ‘strong’ grade, as voiceless [t]. In (29b), on the other hand, the same suffix is concatenated with stems that have an even number of vowels, and thus the consonant of the suffix is in foot-initial position, and surfaces in its ‘weak’ grade, i.e. as a voiced obstruent [ð]. Note that the suffix is stressed in neither case, as it is the word-final syllable, and the grammar therefore cannot refer to stressed/unstressed position to determine whether or not the consonant of the suffix is allowed to lenite. In both (29a) and (29b) the stress can precede the syllable with the suffix consonant, but the presence or absence of stress on the preceding syllable cannot predict the grade of the suffix consonant.

Note that the phenomenon of consonant gradation is pervasive in Nganasan: it applies also to compound words:

(30)		
ciipsinəðə ‘wrist’ + h ^w asa ‘iron’		(ciip)(sinə)(ðəh ^w a)(ja) ‘bracelet’
hi̯aʃə ‘thumb’ + kita ‘cup’		(hi̯a)(ʃəki)(ða) ‘glove’
ʃamaða ‘animal’ + ŋoka ‘numerous’		(ʃama)(ðaŋo)(ga) ‘insect’
bĩʔ ‘water’ + jühü ‘sledge’		(bĩti)(jühü) ‘boat’
ko ‘ear’ + h ^w asa ‘iron’		(koh ^w a)(ja) ‘earring’
hi ^ŋ hi ‘night’ + taabu ‘tail’		(hi ^ŋ hi)(taa)(bu) ‘dawn’

Note that footing is persistent throughout the compounds, so that the first syllable of the second part of the compound can be footed with the last syllable of the first part of the compound, as in the word for ‘glove’ (hi̯a)(ʃəki)(ða).

Borrowings into Nganasan, both fairly recent and older, are also subject to consonant gradation:

(31)

(ðoro)(ga) ‘paved road’	from Russian	/doroga/ ‘road’
(pəko)(ða) ‘nasty weather’	from Russian	/pogoda/ ‘weather’
(h ^w apri)(ga) ‘factory’	from Russian	/fabrika/ ‘factory’
(kəɲi)(guli) ‘holidays’	from Russian	/kan ⁱ ikuli/ ‘school break’
(səha)(ga) ‘small, show dog’	from Russian	/sobaka/ ‘dog’
(çiro)(ða) ‘orphan’	from Russian	/s ⁱ irota/ ‘orphan’

We can see from the data above that while the word-initial consonant can appear as either voiced or voiceless, word-internal consonant voicing is distributed according to principles of consonant gradation, exactly as the voicing of consonants in native words.

2.2.2.2 The Analysis

The essence of consonant gradation seems to be intervocalic lenition restricted by metrical structure, and the conditions on prosody regulate the distribution of grades in certain prosodic positions. More specifically, gradation is a condition on appearance of **weak** grades: they are allowed only if they are aligned with the left edge of a foot. More formally, this generalization can be expressed as an interaction of a lenition constraint and an alignment constraint:

(32) *Constraints (preliminary formulation, to be revised)*

LENITION *V C _(strong) V	No strong grade consonants intervocalically
ALIGNWEAK	Align the left edge of a weak grade segment with the left edge of a foot
IDENT _[voice]	The value of the feature [voice] in the out has to be the same as the value of this feature in the input ¹¹

In the analysis of consonant gradation throughout this thesis I will maintain that underspecification versus prespecification of segments for certain features plays a crucial role in accounting for the facts. Those segments with predictable surface alternates are

¹¹ In this thesis, I am using privative voicing to account for the data, that is, the value for [voice] can be either present or absent in a segment.

underspecified (segments that are underspecified for some feature in the input are written with capital letters), while unpredictable information is encoded with prespecification in the input. In using this kind of underspecification I follow, most notably, Inkelas (1994).

Tableau 15

/ nĩ-rəKV/ 'similar to a wife'	IDENT _[voice]	ALIGNWEAK	LENITION
☞ a. (nĩ-rə)(gĩ)			
b. (nĩ-rə)(kĩ)			*!
/ bĩnĩ-rəKV/ 'similar to a rope'			
a. (bĩnĩ)-(rəgĩ)~ (bĩnĩ)-(rəgĩ)		*!	
☞ b. (bĩnĩ)-(rəkĩ)~ (bĩnĩ)-(rəkĩ)			*

In Tableau 15, the main insight about gradation is formalized: in the upper part of the tableau, the two candidates under consideration differ in that candidate (a) has a weak grade of the suffix consonant, and candidate (b) has the strong grade. Neither candidate violates the IDENT_[voice] constraint (leaving aside momentarily the issue of word-initial voicing), since the grade of the relevant consonant is underspecified in the input /nĩ-rəKV/. Neither candidate incurs an ALIGNMENT violation, either: candidate (a) has its weak grade consonant aligned correctly with the left edge of a foot, and candidate (b) has no weak grade consonant to align. The decision, therefore, is passed on to the LENITION constraint, which favors the candidate (a) since it has a weak consonant [g] intervocalically.

In the second part of Tableau 15 the situation is slightly different. While none of the candidates violate the IDENT_[voice] constraint (underspecified input is /bĩnĩ-rəKV/), candidate (a) is ruled out by the ALIGN constraint: weak grade consonant [g] in [bĩnĩ-rəgĩ] is not aligned with the left edge of any foot. Thus, even though candidate (a) satisfies the LENITION constraint while candidate (b) violates it (due to a strong grade

between vowels), the candidate with the strong grade of the consonant (candidate (b)) emerges as optimal.

The above tableau, therefore, gives us the generalization about gradation that we need: the appearance of the two grades is a product of intervocalic lenition interacting with an alignment condition.

What, however, determines the grade of the consonants that are not positioned between vowels? Initial consonants do not participate in consonant gradation, the initial position is the only position with contrastive voicing.

It appears necessary to prespecify the grade of a word-initial consonant in the input, which, at least in some cases, amounts to specifying a consonant for presence of voice feature. We can prespecify the initial consonant of the word for ‘his/her/its salmon’ *bakunu-tu* with a [voice] feature (weak grade), while leaving the initial consonant of the word for ‘his/her/its caviar’ *tirimi-ti* underspecified. There is one additional constraint we need to give us the default absence of voicing, other conditions permitting:

- (33) $*C_{[+voice]}$ No voiced consonants are allowed.

This constraint can be viewed as part of universal markedness hierarchy that favors voiceless consonants over voiced ones ($*C_{[+voice]} \gg *C_{[\emptyset voice]}$).

Tableau 16

/ baKunu-TV /	IDENT _[voice]	ALIGNWEAK	LENITION	*C _[+voice]
☞ a.(bàku)(nú-tu)			**	
b.(pàku)(nú-tu)	*!		**	
c.(bàku)(nú-đu)		*!	*	
d.(pàku)(nú-đu)	*!	*	*	
/ Tirimi-TV /				
☞ a.(t̥iri)(mí-t̥i)			*	
b.(ðiri)(mí-t̥i)			*	*!
c.(t̥iri)(mí-ði)		*!		
d.(ðiri)(mí-ði)		*!		

As Tableau 16 illustrates, for the input /ba**K**unu-TV/, where the initial consonant is prespecified for the [voice] feature, the two candidates that do not have this feature in the output (candidates (b) and (d)) are ruled out by the IDENT constraint that requires the voicing in the input and output to be the same. The two remaining candidates, (a) and (c), are identical as far as initial voicing is concerned, but they differ in the grade of the suffixal consonant. The choice between these candidates is made by the alignment constraint: candidate (c)'s weak grade is not aligned with a foot edge, which is a fatal violation. The winner, therefore, is candidate (a), with the voicing of the initial consonant identical to the voicing in the input (voiced, weak grade), and the suffixal consonant in its strong grade.

In the lower part of Tableau 16 the situation is slightly different: the initial consonant is not prespecified for voicing in the input. The IDENT constraint, therefore, is inactive, as neither of the candidates violates it. Candidates (c) and (d), with the weak grade of the suffix consonant, are ruled out by the ALIGN constraint, since the weak grade is not aligned properly. The remaining two candidates, (a) and (b) tie on the LENITION constraint: they both violate it, having a strong-grade consonant intervocalically in the suffix. Note that the constraint is indifferent to the initial voicing (it refers only to intervocalic consonants), and the initial strong grade of the consonant in candidate (a) does not cause a violation of this constraint. The decision, therefore, is passed on to the constraint that disallows voiced consonants. The constraint is violated by candidate (b), where initial consonant is voiced. Candidate (a), on the other hand, passes this constraint and becomes a winner.

The grade of the initial consonant, hence, is a matter of specifying it for grade/voicing in the input. Initial consonants that are prespecified for [voice] are going to surface as voiced, while the ones that are not specified, will show up voiceless.

Consonants in another non-intervocalic position, which appear after another consonant, will get similar treatment under the present analysis: since they are not prespecified for

grade in the input, they surface with default grade, strong (voiceless), due to the lower-ranked constraint that forbids voiced consonants.

As we have observed before, after another consonant, a consonant appears in the strong grade (voiceless), regardless of whether it is foot-medial or foot-initial:

Tableau 17

/KaTar-TV/ ¹² 'his/her/its light'	IDENT _[voice]	ALIGNWEAK	LENITION	*C _[+voice]
☞ a.(kaďár)-(tu)				
b.(kaďár)-(đu)				*!

As there are no consonants prespecified for voicing in the input¹³, the IDENT constraint is inoperative in this case. There is no violation of the ALIGN constraint by any of the candidates, either: candidate (a) satisfies the constraint vacuously, since it does not have a weak grade consonant to be aligned, and candidate (b) has its weak grade consonant of the suffix correctly aligned with the edge of a foot. LENITION is inoperative as well: in both candidates, initial and suffixal consonants do not appear in intervocalic position. The voicing of the postconsonantal suffixal consonant, therefore, is determined by the *C_[+voice] constraint, which is violated by candidate (b), since its suffixal consonant is voiced.

The analysis, as a result, insures that a consonant that appears after another consonant invariably surfaces in its strong grade (voiceless).

The same type of analysis should apply for gradation of prenasalized consonants. They differ from all the other gradating consonants at which we have looked so far in that the alternation between strong and weak grade in this case is the alternation between a prenasalized and simple obstruent. The obstruent of the weak grade, as well as of the strong grade, is voiceless. Lenition in this case, therefore, is manifested as a simplification of complex prenasalized consonant in the relevant position (intervocalic

¹² The voicing of the second consonant of the stem depends on another type of gradation, Closed Syllable gradation, discussed in the appendix.

¹³ See previous footnote

and aligned with the left edge of a foot). Let us now illustrate the basic contrast with the suffix **-tənu/-ⁿtənu/-təni/-ⁿtəni**:

(34)

a.

- kubú-tənu (Locative singular, non-possessive) ‘skin, fur’
- ʃübú-tənu (Locative singular, non-possessive) ‘sledge’
- kiðá-təni (Locative singular, non-possessive) ‘cup’
- h^wáa-tənu (Locative singular, non-possessive) ‘tree’

b.

- baarpó-ⁿtənu (Locative singular, non-possessive) ‘master, chief’
- cīĩpsĩnəðó-ⁿtəni (Locative singular, non-possessive) ‘wrist’
- hīajé-ⁿtənu (Locative singular, non-possessive) ‘thumb’
- kəəli-ⁿtəni (Locative singular, non-possessive) ‘tear’

The consonant in the suffix shows up in its weak grade in (34a), and in its strong grade in (34b). This difference is due to the position in the prosody of the consonant in question: in (34a) it is foot-initial, and in (34b) it is foot-internal. The condition on grade distribution, therefore, is identical to the rest of the cases we have discussed, what differs here is only the form of the gradation reflexes. The data above, consequently, should receive treatment parallel to the rest of the gradation facts:

Tableau 18

/jüHü-NTənV/	IDENT _[voice]	ALIGN WEAK	LENITION	*C _[+voice]
☞ a. (ʃübú)-(tənu)				
b. (ʃübú)-(ⁿ tənu)			*!	
/ Kəəli-NTəni/				
a. (kəə)(lí-tə)(ni)		*!		
☞ b. (kəə)(lí- ⁿ tə)(ni)			*	

The tableau for dealing with these reflexes is virtually identical to the one for voiceless/voiced reflexes, owing to the fact that the two operative constraints in this case (ALIGNWEAK and LENITION) refer to grades of consonants rather than specifically to voicing. In the upper part of Tableau 18, both of the candidates satisfy the alignment constraint: candidate (b) satisfies it vacuously with no weak grade to align, and candidate

This disjunction defines what the weak grade of a consonant is: it is a consonant that has either introduced voicing that is not in the input, or lacks nasalization that is in the input, or deletes the feature [+sonorant] that is in the input. The disjoint constraint is violated if any of the three disjuncts is violated.

Note that this type of definition of what the weak/strong opposition is depends heavily on underspecifying predictable surface alternates in the input: it is not the presence of voicing in an output consonant that makes it ‘weak grade’ (and thus subject to alignment constraints), but the faithfulness violation of introducing voicing that is not present in the input form. Similarly, it is not the absence of prenasalization that makes a consonant ‘weak grade’, but deletion of the prenasalization that is present in the input.

To achieve the effect the **ALIGNWEAK** constraint has (limiting weak grades of a consonant to the left edge of a foot), we need to conjoin the constraint that aligns a consonant to the left edge of a foot (**ALIGNC**) with the constraint that determines what a weak grade is (our disjunction **DEP**_[voice] **or** **MAX**_[+nasal] **or** **MAX**_[+sonorant]).

Conjunction of these two constraints will give the effect that all the consonants that are featurally distinct in a certain way from their inputs will have to be aligned with the left edge of a foot. Candidates that are not changed from the input (‘strong grades’) will pass automatically, and so will candidates that have irrelevant featural changes such as place neutralization in the coda, whether they are aligned or not. Candidates that are changed in the relevant way, on the other hand, (‘weak grades’) will satisfy the conjunction only if they are aligned correctly:

Tableau 19

/bĩnĩ-rəKV/	ALIGNC	&	DEP _[voice] or MAX _[+nasal] or MAX _[+sonorant]
☞ a. (bĩnĩ)-(rəki)~ (bĩní)-(rəki)	*	✓	
b. (bĩnĩ)-(rəgi)~ (bĩní)-(rəgi)	*	*!	*

Candidate (a) in Tableau 19, with the strong-grade voiceless consonant [k], violates ALIGNC, since [k] is foot-medial, but it is not changed featurally from the input, that is, it does not violate the disjunction. As a result, the candidate passes the conjunction.

Candidate (b) also has a violation of the ALIGNC constraint: its weak-grade consonant [g] is also foot-medial. However, in contrast with candidate (a), candidate (b) violates DEP_[voice] since it has the voicing that is not in the input, and thus violates the disjunction. This way, candidate (b) violates both ALIGNC and the disjunction, and, as a result, the whole conjoined constraint.

Note that the conjunction of **ALIGN-L C, FT, DEP_[voice] or MAX_[+nasal] or MAX_[+sonorant]** above, responsible for restricting weak-grade consonants to foot-initial positions has a logical equivalent like the following:

$$(36) \quad [\text{ALIGN C \& DEP}_{[voice]}] \text{ or } [\text{ALIGN C \& MAX}_{[+nasal]}] \text{ or } [\text{ALIGNC \& MAX}_{[+son]}]$$

The alignment constraint is conjoined with each of the faithfulness constraints (each determining a type of weak-grade reflexes), and the three conjunctions are disjoint, so that if a candidate violates one of the disjuncts, it violates the whole disjunction.

For example, the candidate (b) in the tableau above (*bini*)-(rəgi) would violate the first of the disjuncts above, since its consonant [g] violates both DEP_[voice] – due to the presence of voicing that is not in the input – and ALIGNC, because it is not aligned with the left edge of a foot. Since one of the disjuncts is violated, the whole disjunction is violated, and the candidate is dismissed.

Let us now turn to a more precise definition of the LENITION constraint, which is the other constraint that exploits the notion of ‘weak’ versus ‘strong’ grade opposition in our preliminary formulation. The constraint is repeated below for convenience:

$$(37) \quad \text{LENITION} \quad \text{No strong-grade consonants intervocalically}$$

LENITION is, in fact, a scale of constraints: $*VNC_{[\emptyset\text{voice}]}V$ (no prenasalized voiceless consonants intervocalically¹⁴) $\gg *V^N CV$ (no complex – prenasalized – consonants intervocalically) $\gg *VC_{[\emptyset\text{voice}]}V$ (no voiceless consonants intervocalically) $\gg *VC_{[-\text{sonorant}]}V$ (no obstruents intervocalically) $\gg *VC_{[+\text{sonorant}]}V$ (no intervocalic sonorants)¹⁵.

The Lenition scale of constraints determines what the weak reflex of a certain strong input really is:

Tableau 20

/K/	$*V^N C_{[\emptyset\text{voice}]} V$	$*V^N CV$	$*VC_{[\emptyset\text{voice}]} V$	$MAX_{[-\text{son}]}$	$*VC_{[-\text{son}]} V$	$*VC_{[+\text{son}]} V$
a. k			*!		*	*
☞ b. g					*	*
c. C ¹⁶				*!		
/j/						
a. j						*!
☞ b. C ¹⁷						

In the Tableau 20 above, an input like /K/ has three relevant candidates. Candidate (a) is the completely faithful one, candidate (b) is unfaithful in that it introduces voicing, and candidate (c) lacks the feature [-sonorant] that is present in the input.

Neither of the candidates violates the first two lenition constraints, since do not have prenasalization. Candidate (a) has a fatal violation of the $*VC_{[\emptyset\text{voice}]}V$ (no voiceless

¹⁴ This constraint is actually is a conjunction of two: $*V^N C V$ (no prenasalized consonants intervocalically) and $*VC_{[\emptyset\text{voice}]} V$ (no voiceless consonants intervocalically) The conjoined constraint is violated iff both of its conjuncts are violated, that is, iff the intervocalic consonant is both prenasalized and voiceless.

¹⁵ The scale goes from a ‘weaker’ requirement (no intervocalic consonants that are both prenasalized (complex structure) and voiceless) to the strongest requirement that there be no intervocalic consonants even if it is a sonorant. It is possible that this scale is more detailed universally, that is, it includes constraints like $*VC_{[-\text{continuant}]}V$ (no stops intervocalically), or $*VC_{[-\text{son}, -\text{nasal}]}V$ (no liquids intervocalically), but here I am using only those constraints that have effect in the language.

¹⁶ here C means that there is a consonant root node that has only the feature [+consonantal] and no other features. Even though this node is a part of the surface phonological representation, it is not read off by phonetics that is unable to supply some essential missing features. See more on that in the section on ‘ghosts’ below.

¹⁷ See previous footnote

consonants intervocally) constraint, and candidate (c) violates the $\text{MAX}_{[-\text{sonorant}]}$ constraint. Candidate (b) is the most harmonic one, with lenition taking the consonant from underlying voiceless stop to surface voiced stop.

For input like [j] that is [+sonorant], on the other hand, candidate (b), that is phonetically a zero, is the most harmonic one, because it does not violate any of the lenition constraints (it does not have any consonantal features intervocally, except the consonantal node itself). Candidate (a), on the other hand, has a violation of the lowest-ranking constraint in the scale, that is nevertheless a fatal one.

A problem with accounting for Nganasan consonant gradation with this scale of lenition arises when we consider the reflexes of prenasalized stops. Consonant gradation reflexes of prenasalized stops are voiceless stops, while the reflexes of underlying voiceless stops are voiced stops¹⁸. This is a chain shift that needs to be accounted for in our system.

The basic facts of the chain shift in consonant gradation of Nganasan are the following:

(38)

- ${}^n\text{t} \rightarrow \text{t}$ and $\text{t} \rightarrow \delta$ in the same environment
- ${}^n\text{h} \rightarrow \text{h}$ and $\text{h} \rightarrow \text{b}$ in the same environment
- ${}^n\text{k} \rightarrow \text{k}$ and $\text{k} \rightarrow \text{g}$ in the same environment
- ${}^n\text{c} \rightarrow \text{c}$ and $\text{c} \rightarrow \text{j}$ in the same environment

This chain shift occurs in all the dialects of the language, as far as I know. The only difference is that there is a small dialectal variation in that the output of the last link is [d] instead of [δ]. This dialect (Vadey) also has no δ 's at all, just as the dialect I am working with here (Avam) has no d 's except the prenasalized ones.

The main challenge in handling this kind of chain shift in OT is to prevent the prenasalized consonant going all the way to a single voiced segment, while the single

¹⁸ or a voiced fricative in case of $\text{t} \sim \delta$ alternation, since the language does not have any voiced dental stop anywhere but word-initially and after nasals.

voiced segment is the most harmonic one for the single voiceless input. Essentially, the problem is in defining ‘one step’ in OT.

The idea of how to deal with this kind of chain shifts in OT here comes from the combination of Orgun’s (1995) analysis of chain shifts (for chain shifts where one of the links contains deletion) and Kirchner’s (1995) analysis.

Orgun exploits difference between deleting a feature and deleting a segment. Kirchner (1995) uses notion of **distantial faithfulness**, i.e. minimization of distance between underlying and surface values along the phonetic scale. Constraints enforcing distantial faithfulness can in turn be derived from ordinary featural faithfulness constraints by local conjunctions (Green 1993, Smolensky 1995)¹⁹. Assuming some phonetic scale, the output cannot be more than a certain distance from its input value along this scale.

(39) *The distantial faithfulness constraint:*

MAX_[+nasal] & DEP_[voice] All the instances of the feature [+nasal] present in the input must be present in the output & All instances of voicing present in the output must be present in the input

The conjunction is violated if and only if both of the conjuncts are violated, i.e. if a candidate both lost prenasalization and introduced voicing. (Green (1993), Smolensky (1995)).

Tableau 21

/NT/	*V ^N C _[Øvoice] V	Max _[+n] & Dep _[v]			*V ^N CV	*VC _[Øvoice] V	MAX _[-son]	*VC _[-son] V	*VC _[+son] V
a. ⁿ t	*!	✓	✓	✓	*	*		*	
b. ⁿ d		✓	✓	*	*!			*	
☞ c. t		*	✓	✓		*		*	
d. ð		*	*!	*				*	
/T/									
a. t		✓	✓	✓		*!		*	
☞ b. ð		✓	✓	*				*	
c. C		✓	✓	*			*!		

¹⁹ Cf. Crowhurst and Hewitt (1997) for a different notion of conjunctions and disjunctions of constraints in Optimality Theory.

The result is that underlying /NT/ does not go all the way to [d] (or [ð] in dialects that have [d] only if the consonant is prenasalized), and underlying /T/ surfaces as [d] ([ð]). In the upper part of the tableau, there are three candidates that are harmonic enough to pass the conjoined constraint: candidate (a) that is most faithful to the input, candidate (b) that keeps the prenasalization while introducing voicing, and candidate (c) that does not introduce voicing but gets rid of the prenasalization. Candidate (d), on the other hand, violates the conjunction because it both introduces voicing **and** does not have underlying prenasalization, and this violation is fatal for the candidate.

Candidate (a) is discarded by the first ‘mild’ lenition constraint that requires that there are no prenasalized voiceless stops intervocalically. Ranking of the $*V^N CV$ constraint (no prenasalized stops intervocalically) above the $*VC_{[\emptyset \text{voice}]} V$ constraint (no voiceless consonants intervocalically), makes candidate (c) the optimal one.

In the lower part of the tableau we have an input without prenasalization. All of the candidates, thus, pass the conjoined constraint, and candidate (b) is selected as the most harmonic one by the lower-ranked lenition constraints.

The problem of the chain shift, therefore, is solved in this analysis: the conjunction of the two faithfulness constraints prohibits the candidates to be distinct more than one step along the lenition scale from the input.

Let us now summarize the analysis of consonant gradation from this section:

(40)

- a) The alternations are caused by intervocalic lenition that requires that there be no strong grade consonants between vowels;
- b) Gradation in itself is an alignment requirement on weak grades: any weak grade consonant must be aligned with the left edge of a foot.

- c) Word-initial consonants show up in the output with the same voicing for which they are specified in the input. In case a word-initial consonant is not specified for voicing, it surfaces as voiceless as a default
- d) Since consonants appearing after consonants are not forced to have a weak grade consonant by the Lenition constraints, they also surface voiceless as a default
- e) Consonant gradation depends on the foot structure of the language that is (i) moraic with CVV syllables heavy and CVC and CV light; (ii) maximally binary; (iii) degenerate feet are allowed at the right edge of a word; and (iv) stress can deviate from the foot structure in certain cases, without changing the foot structure itself.

The grade alternation pattern is only predictable from foot structure, and crucially not from position of stress in the word. Thus, though theoretically appealing, the theory of restriction of reference to prominent/non-prominent opposition cannot be maintained, and there are clear mismatches between prominence and constituency in Nganasan.

2.3 Case Study: Eastern Mari²⁰

The second case we discuss in detail in this chapter is the interaction of three patterns of alternations in Eastern (Meadow) Mari. Mari is a Finno-Ugric Uralic language that has two major literary dialects, Eastern (Meadow) Mari and Western (Hill, Mountain) Mari, each of which has considerable dialectal variations. The dialect from which the data in this chapter is drawn is spoken on the boarder of Nizhni Novgorod region and Mari El republic, in Russia.

Eastern Mari alternations we discuss in this chapter are the following: stress assignment pattern, the full/reduced vowel alternation, and two types of vowel harmony,

²⁰ The Eastern Mari data in this chapter is from fieldwork during the summer of 2002. I owe a debt of gratitude to the Center of Finno-Ugric peoples in Moscow, and to Dmitriy Solovjev, Marina Illarionova and Vladislav Makarov for their invaluable organizational help and moral support.

backness/frontness harmony and rounding harmony. Eastern Mari has the following vowel inventory:

(41)

i	ü		u
e	ö	ə	o
ä			a

Schwa ([ə]) is the vowel to which I will refer as ‘reduced’ and the rest of the vowels are called ‘full’, a distinction that is important for the discussion in this thesis. The front low vowel [ä] is restricted to non-initial syllables, and surfaces only as a result of frontness harmony. There are no such vowels underlyingly. The rest of the vowels appear underlyingly, as well as on the surface, according to the analysis I present in this chapter.

With respect to phonological behavior, there are five types of suffixes in Eastern Mari that are discussed in this chapter:

(42)

	single-consonant suffixes	suffixes with underlying /e/	suffixes with underlying /a/	suffixes with underlying /ʔ/	suffixes with underlying full mid vowel
attract stress	no	from stems in which all underlying vowels are /ə/	from all stems except stems with all underlyingly full vowels	no	no
subject to frontness harmony	—	no	yes	yes	yes
subject to rounding harmony	—	no	no	yes	yes

As can be seen from the table above, the absence or presence of a vowel, as well as the quality of the vowel is the difference between the five types of suffixes, i.e. they are classified here on phonological basis, not morphological categories.

With this essential background, we turn to the discussion of several phenomena in Eastern Mari. First, we discuss the pattern of stress assignment in the language. We show that the placement of stress depends on the quality of the underlying vowels, and exhibit the so-called ‘default-to opposite’ pattern of stress assignment.

Next, we present the full/reduced vowel alternation, which marks the foot structure of the language. The alternation is analyzed as one of unidirectional neutralization, where underlyingly reduced vowels are converted into full vowels under certain conditions, one of which is prosodic.

Of the two types of vowel harmony that we discuss in subsection 2.3.3 one, namely the rounding harmony, is prosody-sensitive. We will show that the trigger of rounding harmony is a stressed vowel.

Given the mismatch between the placement of stress and foot structure that is marked by the full/reduced vowel alternation, the fact that the trigger of rounding harmony must be stressed allows us to see that the generalization in this case must crucially refer to stress, and not to metrical boundaries.

2.3.1 Stress

In the dialect of Eastern (Meadow) Mari that I am investigating in this chapter, there is only one stress per word. The correlates of stress are fundamental frequency, amplitude, and especially duration. At a constant rate of speech, stress adds c.120 ms. to a 70 ms. long unstressed vowel. In underived words, the stress falls on the rightmost full (non-schwa) vowel, as illustrated in (43):

(43)

/koŋga/	koŋgá	‘oven’
/šerge/	šergé	‘comb’
/šudo/	šudó	‘hay’
/kəʎa/	kəʎá	‘mouse’
/čijä/	čijá	‘paint’

/čödrä/	čödrá	‘forest’
/šüzär/	šüzár	‘sister’
/aβam/	awám	‘mother’
/murŋa/	murŋá	‘tube, pipe’
/paša/	pašá	‘work’
/kuβa/	kuβá	‘old woman’
/olma/	olmá	‘apple’
/muča/	mučá	‘end’

Since all of the examples above are underived nouns consisting of two syllables, both of which have unreduced vowels underlyingly, as well as on the surface, the stress in (43) always falls on the second syllable, i.e. on the rightmost vowel in the word. When the second syllable of a word contains an underlying²¹ schwa, the stress falls on the first syllable, since it is the ‘rightmost’ full-vowelled syllable in these words:

(44)

/šörtŋə/	šörtŋö	‘gold’
/pörtə/	pörtö	‘pine forest’
/kürtŋə/	kürtŋö	‘iron’
/teŋgəz/	téŋgəz	‘sea’
/olək/	ólək	‘meadow’
/kində/	kínde	‘bread’
/waštər/	wáštər	‘maple’
/serəš/	sérəš	‘letter’
/šüşpək/	šüşpək	‘nightingale’
/šorək/	šórək	‘sheep’
/pünčə/	púnčö	‘pine’
/šuldər/	šúldər	‘wing’
/júksə/	júksö	‘swan’
/šoŋšə/	šoŋšo	‘hedgehog’

While most synchronically underived roots in Eastern Mari are mono- and disyllabic, there are a few trisyllabic roots that exhibit the same stress pattern: the rightmost underlyingly full vowel is stressed:

²¹ An underlying reduced vowel becomes a full vowel under certain conditions we discuss later in the chapter. For the purposes of stress assignment, however, the underlying reduced vowels count as such, whether or not they become full vowels on the surface.

(45)

/joŋələš/	jóŋələš	‘mistake’
/pušəŋgə/	pušáŋgə	‘tree’
/üremə/	ürémə	‘street’
/kögörčén/	kögörčén	‘dove’
/parəŋə/	paréŋə	‘potato’

As we can observe from the data above, any syllable in a trisyllabic word can be the stressed one: it is the first syllable in the word for ‘mistake’ *jóŋələš*, the second syllable in the words for ‘tree’, ‘street’ and ‘potato’, and the final third syllable in the word for ‘dove’. The generalization, therefore, still stands, the stress is uniformly placed on the rightmost full vowel in the word, regardless of the number of syllables.

The dialect under discussion also has roots that consist entirely of reduced vowels underlyingly. In these roots, the stress is placed on the **leftmost** syllable:

(46)

/βəŋə/	βəŋə	‘canvas’
/jəšəŋ/	jəšəŋ	‘joint’
/əškəl/	əškəl	‘step’
/čərkə/	čərkə	‘church’
/rəβəž/	rəβəž	‘fox’
/təlzə/	təlzə	‘moon, month’
/kəlmə/	kəlmə	‘cold’
/jəlmə/	jəlmə	‘tongue; language’
/kəzət/	kəzət	‘now’
/ləβə/	ləβə	‘butterfly’
/pərəs/	pərəs	‘cat’
/čəβə/	čəβə	‘chicken, hen’

The language, as is evident from the data, exhibits the ‘default-to-opposite’ pattern²²,

²² Dobrovolsky (1999) in his study of Chuvash, suggests that the default initial syllable stress in the language is a mistranscription, since the initial syllable bears high tone rather than appears with such correlates of stress in other positions such as fundamental frequency, duration and amplitude. Such an analysis, however, cannot be extended to the dialect of Eastern Mari under discussion, where stressed initial vowels exhibit the same characteristics as other stressed vowels.

We diverge from Zoll’s model somewhat in that we have two constraints (47 a, c), one of which requires a stressed syllable to be word-final, and the other word-initial. We also have a markedness constraint in (47b), which picks out a marked configuration. We have already used this constraint in the analysis of Nganasan primary stress.

For the purposes of the dialect of Mari under discussion, the marked stressed schwa has to be licensed, which we do by conjoining the *GRID_n/ə constraint with the ALIGN-LEFT constraint in (47c). Thus, without adding a separate group of licensing constraints to the CON component of the grammar, we achieve the licensing effect of a marked configuration (a stressed schwa in this case).

The conjoined licensing constraint ranked above the more general constraint in (47a), which itself outranks the Prominence Alignment constraint, derives the Mari pattern. Note that because the footing constraints outrank the Prominence Alignment constraint, the foot structure stays always binary, regardless of the position of the stress:

Tableau 22

/šudo/ 'hay'	ALIGN-L (FT, PWD)	*GRID _n /ə	&	ALIGN-LEFT (ó, PWd)	ALIGN-RIGHT (ó, PWd)	ALIGN-L (LEV _n , GRID, FT)
☞ a. (šudó)			✓	*		*
b. (šúdo)			✓		*!	

As there are no schwas in the word above, in either underlying representation or the candidates, the conjoined licensing constraint is irrelevant here: there are no schwas to license. Both candidates pass this constraint, and the decision is passed on to the ALIGN-RIGHT constraint, which is violated by candidate (b) with the stress assigned to the leftmost syllable. Note that the Prominence Alignment constraint is inactive here: it is ranked below the alignment to Prosodic Word group of constraints. Even though candidate (a) violates the Prominence Alignment constraint by not having prominence on its foot-head syllable, it still emerges as a winner.

The situation where there are only [ə] vowels in candidates and the stress is assigned to the leftmost syllable is also accounted by the above constraints with their ranking:

Tableau 23

/pə́rəs/ 'cat'	ALIGN-L (FT, PWD)	*GRID _n /ə	&	ALIGN-LEFT (ó, PWD)	ALIGN-RIGHT (ó, PWD)	ALIGN-L (LEV _n GRID, FT)
☞ a. (pə́rəs)		*	✓			*
b. (pə́rás)		*	*!	*		

In the case above, we see the licensing constraint in action: both candidates have stressed schwas, but it is only in candidate (a) that the stressed schwas are licensed: it is aligned with the left edge of the Prosodic Word, hence passing the conjunction. In contrast, candidate (b)'s stressed schwa violates both the sonority constraint *GRID_n/ə and the ALIGN-LEFT constraint, thus violating the whole licensing conjunction. Candidate (a) thus emerges as the optimal one.

Mari also presents a somewhat more challenging situation, when an underlying schwa is vocalized on the surface. We also have to account for the fact that an underlying schwa, even if it is vocalized on the surface, behaves as a non-vocalized schwa with respect to stress. In other words, such an interaction would be handled by opaque ordering of rules in a serial-based framework. The stress assignment rule would be ordered before the vocalization rule, thus deriving the pattern we see, for example, in /šörtɲə/ 'gold' surfacing with initial stress šörtɲə or /kində/ 'bread' similarly showing up as kінде, and not *kindé as our analysis developed so far predicts.

It has been pointed out many times (see, for example Vaux (2003) and references therein) that an output-oriented theory like OT has trouble modeling 'an opaque' phenomenon. Here, however, we will maintain that the interaction of vocalization and stress assignment is a variation on what Kirchner (1995) dubs **distantial faithfulness**, i.e. minimization of distance between underlying and surface values along some phonetic scale. We will argue that adding vocalic features such as [±back] or [±round] at the same time as adding a degree of prominence is too much of a departure of an underlyingly non-prominent schwa that has only root features. In essence, an underlying schwa can either violate DEP constraints on relevant features by showing up as a full vowel, or violate DEP/LEV_nGRID by showing up with a positive degree or prominence, but crucially not both. More

formally, the notion of distantal faithfulness can be expressed as a conjunction of the two constraints²⁴:

(48)

DEP/LEV_nGRID & **DEP_[±back, ±round]**

The constraint in (48) is violated if a segment violates both of the conjuncts, i.e. if it shows up with a positive degree of prominence and features that are not in the input.

Tableau 24

/šörtɲə/ ²⁵ 'gold'	DEP/LEV _n GRID	&	DEP _[±back, ±round]	*GRID _n /ə	&	ALIGN-L (ó, PWd)	ALIGN-RIGHT (ó, PWd)	ALIGN-L (LEV _n GRID, Ft)
☞ a. (šörtɲö)		✓	*		✓		*	
b. (šörtɲó)	*	*!	*		✓	*		*

As the tableau above illustrates, the decision in this case is made by the conjoined distantal faithfulness constraint: candidate (b) enhanced the underlying schwa in both assigning it prominence and adding features, so it fails the constraint. Candidate (a), on the other hand, passes the constraint essentially because of the locality requirement on the conjunction: one segment in the Prosodic Word is enhanced by adding features, while the other one is enhanced by assigning prominence to it. As a result, candidate (a) passes the distantal faithfulness conjunction, and it is the optimal one. Thus, a vocalized (surfacing as a full vowel) schwa is treated the same way as a non-vocalized schwa for the purposes of stress assignment.

Consider a candidate where a schwa does not vocalize because of its position within a binary foot (see the next subsection for the illustration of this pattern):

²⁴ This type of opacity, counterfeeding, can also be easily handled with McCarthy's (2007) model OT-CC.

²⁵ We do not consider any candidates with non-vocalized schwa here. Vocalization of the word-final vowel here is ensured by a vowel harmony constraint that is ranked above the constraints on distantal faithfulness, and outranked only by (a number of) Ident constraint(s). For a model of vocalization, see the next subsection that discusses the pattern of vowel vocalizations.

Tableau 25

/pušaŋgə/ 'tree'	DEP/LEV _n GRID	&	DEP _[±back,±round]	*GRID _n /ə	&	ALIGN-L (ó, PWd)	ALIGN-R (ó, PWd)	ALIGN-L (LEV _n GRID, FT)
a. (pušaŋ)gə	(*)	✓			✓	*	*	*
b. (pušaŋ)gə́	*	✓		*	*!	*		*
c. (púšaŋ)gə	(*)	✓			✓		**!	

All three of the candidates above have a word-final schwa that is not vocalized. In this case, the distancial faithfulness constraint is not relevant, since all three candidates satisfy it. Candidate (b) is eliminated by the licensing constraint, because its stressed schwa is not in the only licensed position (aligned to the left edge of a Prosodic Word). ALIGN-RIGHT makes the choice between candidates (a) and (c): the latter violates the constraint once (the stress is one syllable away from the right edge of a Prosodic Word), while the former violates ALIGN-RIGHT twice, and the second violation is fatal. Candidate (a) becomes optimal in this case.

Note that the Prominence Alignment constraint is inactive here once again, thus creating the illusion that the language has no binary constituency within a Phonological Word. However, the data from the schwa vocalizations prove just the opposite: the language does have binary constituency that regulates, and is marked by, the schwa vocalizations. The dialect of Mari under consideration, therefore, presents a case at the edge of the spectrum of constituency/prominence assignment interaction continuum: its prominence is subject to constraints that outrank Prominence Alignment in such a way that the latter is rendered inactive.

So far, we have only had to consider the separation of schwa from all other vowels along the sonority scale. Next, however, we demonstrate that other sonority constraints, as well as morphological constraints, have to play a role in the stress assignment pattern whenever derived forms are considered.

At the first glance, the stress assignment in the language appears to be strictly cyclic, i.e. the stress assigned on the root cycle does not get reassigned when more morphemes are added, as the following forms with the Dative suffix /-lan/ (49a) and Comitative suffix /-ge/ (49b) suggest:

(49)

a.	pašá ‘work’	pašá-lan ‘work (Dat.)’	* paša-lán
	olmá ‘apple’	olmá-lan ‘apple (Dat.)’	* olma-lán
	kornó ‘road’	kornó-lan ‘road (Dat.)’	*korno-lán
	kawún ‘pumpkin’	kawún-lan ‘pumpkin (Dat.)’	* kawun-lán
	keŋéž ‘summer’	keŋéž-län ‘summer (Dat.)’	* keŋež-lán
	meráŋ ‘hare’	meráŋ-län ‘hare (Dat.)’	* meraŋ-lán
b.	pašá ‘work’	pašá-ge ‘work (Com.)’	* paša-gé
	olmá ‘apple’	olmá-ge ‘apple (Com.)’	* olma-gé
	kornó ‘road’	kornó-ge ‘road (Com.)’	*korno-gé
	kawún ‘pumpkin’	kawún-ge ‘pumpkin (Com.)’	* kawun-gé
	keŋéž ‘summer’	keŋéž-ge ‘summer (Com.)’	* keŋež-gé
	meráŋ ‘hare’	meráŋ-ge ‘hare (Com.)’	* meraŋ-gé

Both the Dative and the Comitative suffixes have full vowels, and these vowels are the rightmost ones in all of the examples in (49); yet, they do not attract stress from the root.

Similarly, the same suffixes added to the following monosyllabic roots surface unstressed²⁶:

(50)

a.	šör	‘milk’	šör-län ‘milk (Dat.)’
	mü	‘honey’	mü-län ‘honey (Dat.)’
	pel	‘half’	pél-län ‘half (Dat.)’
	üšt	‘belt’	üšt-län ‘belt (Dat.)’
	tam	‘taste’	tám-lan ‘taste (Dat.)’
	lum	‘snow’	lúm-lan ‘snow (Dat.)’
	šot	‘sense’	šót-lan ‘sense (Dat.)’
	ij	‘year’	ij-län ‘year (Dat.)’
b.	šör	‘milk’	šör-ge ‘milk (Com.)’
	mü	‘honey’	mü-ge ‘honey (Com.)’

²⁶ Cf. the monosyllabic root with reduced schwa:
šəž ‘fall, autemn’ šəž-lán ‘fall (Dat.)’

pel	‘half’	pél-ge ‘half (Com.)’
ũšt	‘belt’	ũšt-ge ‘belt (Com.)’
tam	‘taste’	tám-ge ‘taste (Com.)’
lum	‘snow’	lúm-ge ‘snow (Com.)’
šot	‘sense’	šót-ge ‘sense (Com.)’
ij	‘year’	ij-ge ‘year (Com.)’

The monosyllabic roots above also keep the initial stress and do not have stress shift to the full vowels of the suffixes. If the stress is always assigned on the root cycle and does not get reassigned on later cycles, it predicts that the suffixes above (and, indeed, all the suffixes in the language) never bear stress. This prediction turns out to be wrong, however, if we consider the following forms:

(51)

a.

rəwəž	‘fox’	rəwəž-lán	‘fox (Dat.)’
təlze	‘moon, month’	təlze-lán	‘moon (Dat.)’
jəlme	‘tongue; language’	jəlmə-lán	‘tongue (Dat.)’
ləβe	‘butterfly’	ləβə-lán	‘butterfly (Dat.)’
pərəs	‘cat’	pərəs-lán	‘cat (Dat.)’
čəβe	‘chicken, hen’	čəβə-lán	‘hen (Dat.)’

b.

rəwəž	‘fox’	rəwəž-gé	‘fox (Com.)’
təlze	‘moon, month’	təlze-gé	‘moon (Com.)’
jəlme	‘tongue; language’	jəlmə-gé	‘tongue (Com.)’
ləβe	‘butterfly’	ləβə-gé	‘butterfly (Com.)’
pərəs	‘cat’	pərəs-gé	‘cat (Com.)’
čəβe	‘chicken, hen’	čəβə-gé	‘hen (Com.)’

Unlike the examples in (49) and (50), where the stress uniformly stays on the root, all the forms in (51), when suffixed, shift stress to the suffixes. Note that all of the roots in (51) contain only reduced vowels underlyingly, the fact that determines the default initial position of stress in the underived forms.

The third type of roots in the language, the roots with initial stress that is due to the first vowel being the full one and the second vowel the reduced one underlyingly, exhibit yet another pattern. These roots treat the Dative suffix differently from the Comitative one:

(52)

a.	ím̄pe	‘horse’	ím̄pə-lán	‘horse (Dat.)’
	múno	‘egg’	munə-lán	‘egg (Dat.)’
	wáštər	‘maple’	wáštər-lán	‘maple (Dat.)’
	sérəš	‘letter’	serəš-lán	‘letter (Dat.)’
	júksö	‘swan’	júksə-lán	‘swan (Dat.)’
	kúzö	‘knife’	küzə-lán	‘knife (Dat.)’
b.	ím̄pe	‘horse’	ím̄pə-ge	‘horse (Com.)’
	múno	‘egg’	múnə-ge	‘egg (Com.)’
	wáštər	‘maple’	wáštər-ge	‘maple (Com.)’
	sérəš	‘letter’	sérəš-ge	‘letter (Com.)’
	júksö	‘swan’	júksə-ge	‘swan (Com.)’
	kúzö	‘knife’	kúzə-ge	‘knife (Com.)’

While the Dative suffix always receives stress in the forms in (52a), the Commitative suffix (52b) fails to attract the stress, which stays on the first syllable of the word.

It seems clear that sonority of the vowels effect stress assignment: full vowels behave differently from the reduced ones, and, as we see with the Dative and Commitative suffixes, the low vowel [a] of the Dative suffix appears to be ‘stronger’, more sonorous, than the mid vowel [e] of the Commitative.

This hypothesis is sustained when we consider that other suffixes with the vowels in question exhibit identical behavior: Modal (or Comparative) suffix /-la/ behaves like the Dative suffix as far as stress assignment is concerned, as do the 1st and 2nd person animate possessive suffixes /-na/ and /-da/; and Ablative suffix /-ěč/ and Caritive suffix /-de/ behave exactly like the Commitative. Similarly, verbal suffixes containing [a] behave differently from verbal suffixes containing [e]. In fact, the only two types of suffixes that **never** attract stress regardless of the type of root to which they attach are the suffixes a) with an underlying schwa, and b) with a full alternating vowels [o]/[ö]/[e], quality of which depends on vowel harmony discussed below. When such a suffix is attached, the stress stays on the vowel of the root.

To summarize, the following factors determine stress placement in the dialect in question:

(53)

a) (Underlyingly) reduced vs. full vowels. In an underived word, the stress falls on the rightmost full vowel; if there is no full vowel in the word, the stress defaults to the leftmost vowel. A suffix with an underlyingly reduced vowel never attracts stress from the root.

b) Low vs. mid vowels. In **derived** environment, suffixes with a low vowel [a] appear to be ‘stronger’ (more sonorous) than suffixes with a mid vowel [e]: when combined with roots of a certain type, the suffixes with [a] attract the stress away from the roots while the suffixes with [e] do not.

c) Finally, whether the root vowels are underlyingly reduced or full plays a role in derived environment as well as in underived words: roots with all schwas in them lose the stress when there are full-voweled suffixes attached to them.

We will start our analysis by showing how morphological constraints affect stress assignment pattern. One constraint that we need to account for this pattern is a constraint that aligns a stressed syllable to the right edge of the root, rather than the Prosodic Word:

(54)

ALIGN-RIGHT (σ, Root)

Stressed syllables must be root-final

It appears that the above constraint is ranked above ALIGN-RIGHT (σ, PWd). When dealing with underived words, there is no difference in the effect of these two constraints, since, by definition, the right edge of a Prosodic Word always coincides with the right edge of the root. In derived words, however, the ranking of the two is crucial:

Tableau 26

/merəŋ/-/lan/ ‘hare (Dat.)’	*GRID _n /ə	&	ALIGN-LEFT (σ, PWd)	ALIGN-RIGHT (σ, Root)	ALIGN-RIGHT (σ, PWd)	ALIGN-L (LEV _n GRID, FT)
☞ a. (meráŋ)-län		✓			*	*
b. (merəŋ)-län		✓	*	*!		*

Since neither of the candidates contain a schwa, the conjoined licencing constraint is not relevant here: both candidates pass it. The decision is made by the ALIGN-RIGHT (ó, Root) constraint, which candidate (b) violates because it has its stress on the suffix. Even though candidate (a) violates the lower-ranked ALIGN-RIGHT (ó, PWd) constraint, it is nevertheless the optimal candidate.

Note that the addition of the ALIGN-RIGHT (ó, Root) constraint does not change the analysis of underived words, and, without any further additions, the constraints that we have with their respective rankings, account for the pattern where a suffix with [a] is added to a root with only schwas:

Tableau 27

/rəwəʒ/-/lan/ 'fox' (Dat)	*GRID _n /ə	&	ALIGN-LEFT (ó, PWd)	ALIGN-RIGHT (ó, Root)	ALIGN-RIGHT (ó, PWd)	ALIGN-L (LEV _n GRID, FT)
a. (rəwəʒ)-lán		✓		*		*
b. (rówəʒ)-lan	*	✓		*	*!	
c. (rəwəʒ)-lan	*	*!	*		*	*

The tableau above illustrates the derivation of the pattern where the root contains only schwas and the suffix has a full vowel. Candidate (c) is eliminated by the licensing conjunction, since its stressed schwa is not word-initial. Both candidates (a) and (b) violate the ALIGN-RIGHT (ó, Root) constraint, since the prominent syllable in either of the candidates is not root-final. Hence, the decision is made here by ALIGN-RIGHT (ó, PWd), which eliminates candidate (b), where stress is not word-final.

The pattern where a suffix with a [-low] full vowel is concatenated with roots, however, does require us to consider constraints other than we already have. First, the pattern clearly shows that, even though there seems to be no difference in sonority of low and non-low vowels in roots, there is such a difference in suffixes. The suffix with the [+low] vowel is stressed with the roots that end in an (underlying) schwa, while the Comitative suffix, that has a [-low] vowel, is not stressed. There are at least two factors, therefore, that we have to consider: relative sonority of [e] and [a] (or [ä]), and the difference between roots and affixes. Let us start with the following constraint:

(55)

***GRID_n/e_{suffix}**

There must be no suffix [e] that is assigned any degree of prominence

Now, we also know that the constraint in (55) must be outranked by some other constraint, since both of the full vowels are stressed in the suffixes concatenated with roots with schwas only. We already have a licensing constraint for stressed schwas, which outranks a more general ALIGN-R (ó, Root) constraint. Another general constraint that is outranked by the licensing conjunction would be the constraint on the stressed schwas in general, whether licensed or not. In other words, the constraint in (55) should be outranked by *GRID_n/ə to ensure that even if the vowel in the suffix is [-low], it is still assigned stress if the root contains only schwas, even if one of the schwas is licensed:

Tableau 28

/rəwəʒ/-/ge/ 'fox (Com.)'	*GRID _n /ə	&	ALIGN-L (ó, PwD)	ALIGN-R (ó, Root)	*GRID _n /ə	*GRID _n /e _{suffix}	ALIGN-R (ó, PwD)	ALIGN-L (LEV _n GRID, FT)
a. (rəwəʒ)-ge	*	✓		*	*!		*	*
☛ b. (rəwəʒ)-gé		✓	*	*		*		
c. (rəwəʒ)-ge	*	*!	*				*	*

In the root meaning 'fox', there are two schwas, one of which is licensed to receive stress by the licensing constraint, while the other one cannot be licensed. Thus, the licensing conjunction eliminates candidate (c), where the stressed schwa is not in a word-initial syllable. Candidates (a) and (b), while tying on the ALIGN-R (ó, Root) constraint, differ with respect to the other general constraint that bans stressed schwas. Candidate (a), therefore, is eliminated, and candidate (b), with the stress on the [e] that belongs to the suffix, emerges as a winner.

Now, if a root has initial full vowel (any vowel other than a schwa, even a [-low] one as in example below, our *GRID_n/e_{suffix} constraint becomes active:

Tableau 29

/serəš/-/ge/ 'fox' (Com)	*GRID _n /ə	&	ALIGN-L (ó, PWd)	ALIGN-R (ó, Root)	*GRID _n /ə	*GRID _n /e _{suffix}	ALIGN-R (ó, PWd)
a. (sérəš)-ge		✓		*			*
b. (serəš)-gé		✓	*	*		*!	
c. (serəš)-ge	*	*!	*		*		*

Candidate (c) in the above tableau is eliminated by the licensing conjunction, but candidates (a) and (b) tie with respect to licensing: neither of the candidates has a stressed schwa. The candidates also tie on the ALIGN-R (ó, Root) constraint, since the stressed syllable is not root-final in either of the candidates. Candidate (b), however, violates the *GRID_n/e_{suffix} constraint, and candidate (a) does not: even though an [e] is stressed in both cases, only in candidate (b) [e] belongs to the suffix rather than the root.

Note that, under the present analysis, more sonorous than [e], [a] or [ä] of the suffix do get assigned the stress:

Tableau 30

/serəš/-/lan/ 'fox' (Dat)	*GRID _n /ə	&	ALIGN-L (ó, PWd)	ALIGN-R (ó, Root)	*GRID _n /ə	*GRID _n /e _{suffix}	ALIGN-R (ó, PWd)	ALIGN-L (LEV _n GRID, FT)
a. (serəš)-län		✓		*				*
b. (sérəš)-län		✓	*	*			*!	
c. (serəš)-län	*	*!	*		*		*	*

Once again, candidate (c) with the stressed schwa that is not word-initial is eliminated by the licensing conjunction. Both candidates (a) and (b) tie on the two more general constraints: in neither candidate the stressed syllable is root-final, and neither of them has a stressed schwa. Neither of the candidates violates the *GRID_n/e_{suffix} constraint, either: candidate (b)'s [e] does not belong to the suffix, and it is the more sonorous [ä] that is stressed in candidate (a). Thus, the constraint that requires that a stressed syllable must be aligned with the right edge of a Prosodic Word is the deciding one here. In contrast with a suffix with [e], as in previous tableau, it is the suffix with [ä] that surfaces stressed in this situation.

We have, therefore, accounted for the influence of morphological conditions on the stress assignment in this dialect of Mari. There are, in fact, two different types of morphology-

based constraints: the difference in alignment of a stressed syllable to root vs. Phonological Word, and a sonority constraint against stressed [-low] vowels that effects only affixes and not roots.

Note that the decision in the case of Mari stress assignment is never made by the constraint(s) that align prominence with the binary foot structure of the language, thus creating the illusion that the languages simply does not have foot structure, or has foot structure that is in complete alignment with prominence. In fact, however, Mari has a segmental alternation that we will refer to as schwa vocalization, or full/reduced vowel alternation, that shows that the language has binary foot structure. To see the misalignment of prominence and foot boundaries, we discuss the schwa vocalization next.

2.3.2 Full/Reduced Vowel Alternations

Besides two types of vowel harmony that we discuss in the subsection 2.3.3, the dialect of Eastern Mari in question also has full vowels alternating with the reduced vowel [ə]. It is this phenomenon that allows us to see the principles of parsing the words in the language into binary feet: the parsing is from left to right, with a ban on degenerate feet. An underlying schwa surfaces as a full vowel at the absolute end of a word:

(56)

/bočkə/	bóčko	‘tub’
/suskə/	súsko	‘scoop’
/kütə/	kútö	‘herd’
/šürə/	šürö	‘soup’
/pöršə/	pöršö	‘frost’
/šošə/	šóšo	‘spring’
/imɲə/	ímɲe	‘horse’
/munə/	múno	‘egg’
/pirə/	píre	‘wolf’
/jeɲə/	jéɲe	‘human’
/jümə/	júmö	‘thirst’
/küzə/	kúzö	‘knife’
/oɲə/	óɲo	‘father-in-law’

In this alternation, which is opposite to vowel reduction, a schwa turns to a full vowel, the quality of which is determined by vowel harmony. There are several important restrictions on this alternation. First, all of the words in (56) above, in which the final vowel turns into a full vowel, end in a vowel. In contrast, if a word ends in a consonant, the schwa in its final syllable remains reduced:

(57)

/waštər/	wáštər	‘maple’
/serəš/	sérəš	‘letter’
/šüšpək/	šúšpək	‘nightingale’
/šorək/	šórək	‘sheep’
/šuldər/	šúldər	‘wing’
/üdər/	údər	‘daughter’
/jɔŋələš/	jóŋələš	‘mistake’

All of the stems in (57) are consonant-final stems, and the reduced vowel in their final syllables does not surface as a full vowel: in order to turn into a full vowel, the schwa has to be at the absolute edge of a word.

Note that there are two sets of facts that argue that this alternation is not a vowel reduction alternation (that would reduce full vowels to schwas unless they are at the end of the word), as, for example, Majors (1998) analyzes the alternation, but quite the opposite process that turns reduced vowels into full ones. First, there are the stress facts that we discussed in the previous subsection: the underlyingly reduced vowels, even if they are converted into full vowels on the surface, behave differently from the vowels that are full underlyingly, in that they do not attract stress if there is another full vowel in the root, as in the examples in (63). Second, the vowels that are underlyingly full (and thus attract the stress), do not, in fact, get reduced to schwas when not in the end of the word. Consider the following examples with the Accusative singular suffix /-m/ and the Lative singular suffix /-ž/:

(58)

	Nom.sg.	Acc.sg. /-m/	Lat sg. /-ž/	Gloss
/čödrä/	čödrá	čödrá-m	čödrá-ž	‘forest’
/kəla/	kəlá	kəlá-m	kəlá-ž	‘mouse’
/kutko/	kutkó	kutkó-m	kutkó-ž	‘ant’
/korno/	kornó	kornó-m	kornó-ž	‘road’
/kəlmó/	kəlmó	kəlmó-m	kəlmó-ž	‘shovel’
/paša/	pašá	pašá-m	pašá-ž	‘work’
/ola/	olá	olá-m	olá-ž	‘city’
/awa/	awá	awá-m	awá-ž	‘mother’
/parŋa/	parŋá	parŋá-m	parŋá-ž	‘finger’
/upša/	upšá	upšá-m	upšá-ž	‘cap’
/tünä/	tüná	tüná-m	tüná-ž	‘world’
/una/	uná	uná-m	uná-ž	‘guest’

In contrast, roots with underlying schwas in the final syllable still have the reduced vowel when suffixed:

(59)

	Nom.sg.	Acc.sg. /-m/	Lat sg. /-ž/	Gloss
/bočkə/	bóčko	bóčkə-m	bóčkə-ž	‘tub’
/suskə/	súsko	súskə-m	súskə-ž	‘scoop’
/kütə/	kútö	kútə-m	kútə-ž	‘herd’
/šürə/	šürö	šürə-m	šürə-ž	‘soup’
/pöršə/	pöršö	pöršə-m	pöršə-ž	‘frost’
/šoša/	šošo	šoša-m	šoša-ž	‘spring’
/imŋə/	ímŋe	ímŋə-m	ímŋə-ž	‘horse’
/munə/	múno	múnə-m	múnə-ž	‘egg’
/pirə/	píre	pírə-m	pírə-ž	‘wolf’
/jeŋə/	jéŋe	jéŋə-m	jéŋə-ž	‘human’
/jümə/	júmö	jümə-m	jümə-ž	‘thirst’
/küzə/	kúzö	kúzə-m	kúzə-ž	‘knife’

Moreover, consonant-final stems with a full vowel in the final syllable also keep the full vowel on the surface:

(60)

/šüzär/	šüzár	‘sister’
/ojləməš/	ojləmáš	‘story’
/pükšer/	pükšér	‘hazel tree’
/aβam/	awám	‘mother’
/joltaš/	joltáš	‘friend’
/kugužan/	kugužán	‘princess’
/kučem/	kučém	‘handle’
/peledəš/	pelédəš	‘flower’
/waštár/	waštár	‘maple’
/kaβun/	kaβún	‘pumpkin’
/keŋež/	keŋéž	‘summer’
/korak/	korák	‘crow’
/kögörčən/	kögörčén	‘dove’
/mardeš/	mardéš	‘wind’
/merän/	merán	‘hare’

Thus, it seems clear that what we are dealing with here is not vowel reduction, but rather a process of conversion of a reduced vowel into a full one at the end of the word, subject to some restrictions. It appears that these alternations are also a type of vowel harmony. Using somewhat antiquated terminology, we can identify the phenomenon as a ‘feature-filling’, rather than a ‘feature-changing’ harmony, that can also be called a DEP-violating type of harmony, and not an IDENT-violating one.

It is the restrictions on this phenomenon that are of the utmost importance for us here, since they manifest that the language has metrical structure that is distinct from the position of stress. One restriction that we determined is that a reduced vowel surfaces as full only if it **immediately** precedes the word boundary, i.e. if there is no intervening consonant. There is, however, an additional restriction that is manifested in the following forms:

(61)

/pušəŋgə/	pušáŋgə	‘tree’
/üremə/	ürémə	‘street’
/pareŋə/	paréŋə	‘potato’

The above (synchronically) underived forms all have a reduced schwa in the final syllable underlyingly, and the final syllable is open, i.e. the schwas immediately precede the word boundary. Those underlying schwas, therefore, satisfy the condition on reduced to full vowel conversion, and should surface as full vowels. However, they surface as schwas. We encounter the same problem if we look at the alternations with the suffix /-lə/, which forms adjectives from nouns:

(62)a.	lüm ‘name’	lúm-lö ‘famous’
	tam ‘taste’	tám-le ‘sweet’
	tüŋ ‘beginning’	túŋ-lö ‘initial’
	jük ‘voice’	júk-lö ‘loud’
	tür ‘edge, border’	túr-lö ‘final’
	lum ‘snow’	lúm-lo ‘snowy, cold’
	šot ‘sense’	šót-lo ‘sensitive’
	jür ‘rain’	júr-lö ‘rainy, wet’
	kü ‘stone’	kú-lö ‘hard’
	taŋ ‘friend, partner’	táŋ-le ‘friendly’
	čən ‘truth’	čón-le ‘true’
	šor ‘mud’	šór-lo ‘dirty’
b.	póršö ‘frost’	póršə-lə ‘frosty’
	šörtŋö ‘gold’	šörtŋə-lə ‘golden’
	túrö ‘edge’	túřə-lə ‘final’
	šóšo ‘spring’	šóšə-lə ‘spring (adj.)’
	kúrtŋö ‘iron’	kúrtŋə-lə ‘iron (adj.)’
	jéŋe ‘human’	jéŋə-lə ‘human (adj.)’
	júmö ‘thirst’	júmə-lə ‘thirsty’
	čijǎ ‘paint’	čijǎ-lə ‘colorful’
	téŋgəz ‘sea’	téŋgəz-lə ‘naval’
	olá ‘city’	olá-lə ‘urban’
	oksá ‘money’	oksá-lə ‘expensive’
	keŋéž ‘summer’	keŋéž-lə ‘summer (adj.)’
	mardéž ‘wind’	mardéž-lə ‘windy’
	óškəl ‘step’	óškəl-lə ‘gradual’
	tólze ‘moon, month’	tólzə-lə ‘monthly’

c.	ürémə ‘street’	ürémə-le ‘street (adj.)’
	šóŋgələk ‘old age’	šóŋgələk-lo ‘senile’
	jóŋələš ‘mistake’	jóŋələš-lo ‘wrong’
	ojləmáš ‘story, fable’	ojləmáš-lo ‘fictional, apocryphal’
	kugužán ‘princess’	kugužán-lo ‘spoilt (about a woman)’
	pelédəš ‘flower’	pelédəš-le ‘flowery, embellished’

In all of the forms in (62a), where the suffix /-lə/ attaches to monosyllabic stems, its final vowel surfaces as a full one, and its exact quality depends on the other types of vowel harmony, which we will discuss below. In (62b), in contrast, the same suffix is put together with a disyllabic stem, and in this case we see no reduced to full vowel conversion. In (62c), on the other hand, the suffix appears with the full grade of the vowel yet again, i.e. forms in (62a) and (62c) pattern together as far as the full/reduced vowel alternation in the attached suffix is concerned, while (62b) points to yet another condition on the alternation in question. Given that both stems in (62a) and (62c) are odd-voweled stems, while the stems in (62b) contain even number of vowels, the restriction on schwa conversion into a full vowel seems to be a prosodic restriction: it is allowed to vocalize (be converted to a full vowel on the surface) if starts a foot, while the conversion is blocked if the vowel of the suffix is foot-final. The fact that it is clearly the number of vowels of the stems that is taken into account for this restriction leads us to conclude that the feet in the language are binary, left-adjacent, and consonants are not moraic, since they seem to have no bearing on the foot assignment. This phenomenon of reduced/full vowel alternations, therefore, **marks the foot structure** of the language, while the stress assignment is independent of the footing, but follows its own set of principles we investigated earlier in this dissertation.

In support of the generalization that the alternation in question is showing us the foot structure, let us consider the conversion of a reduced vowel into a full vowel with another suffix. This suffix, or clitic²⁷ /-sə/, can be concatenated with nouns already inflected for case, number, possessivity and containing a large number of derivational suffixes, and

²⁷ Whether it is a suffix or a clitic morphologically has no bearing on the alternations I discuss here; one might be tempted to classify it as a clitic as it always appears word-finally. Its phonology, however, is no different than phonology of the suffix /-lə/, except that stems to which it attaches can be much longer.

has the meaning ‘the one who is N’ or ‘the one that is N’. When attached to an uninflected form of the noun (Nominative singular of the noun), it exactly matches the behavior of the adjective-forming /-lə/ in (62a-c):

- | | | | |
|------|----|--|--|
| (63) | a. | təŋ ‘friend, partner’
mü ‘honey’
üj ‘butter’
čəŋ ‘truth’ | (təŋ-se) ‘the one who is a friend’
(mü-sö) ‘the one that is honey’
(üj-sö) ‘the one that is butter’
(čəŋ-se) ‘the one that is the truth’ |
| | b. | jéŋə ‘human’
olá ‘city’
oksá ‘money’
érgə ‘boy’ | (jéŋə)-sə ‘the one who is human’
(olá)-sə ‘the one that is a city’
(oksá)-sə ‘the one that is money’
(érgə)-sə ‘the one who is a boy’ |
| | c. | jóŋələš ‘mistake’
pušáŋgə ‘tree’
pelédəš ‘flower’
kögörčén ‘dove’ | (jóŋə)(ləš-so) ‘the one that is a mistake’
(pušáŋ)(gə-so) ‘the one that is a tree’
(pelé)(dəš-se) ‘the one that is a flower’
(kögör)(čén-se) ‘the one that is a dove’ |

With the foot structure of the derived nouns that we see in (63), the generalization of the prosodic restriction on full/reduced vowel alternation can be stated in a straightforward fashion as one that blocks the surfacing of underlyingly reduced vowel as a full one if that vowel is not right-aligned to the foot boundary. Importantly, this generalization does not take the location of stress into account: the words in (63c), for instance, have stress respectively on the first (*jóŋələš-so* ‘the one that is a mistake’), second (*pušáŋgə-so* ‘the one that is a tree’ and *pelédəš-se* ‘the one that is a flower’), and third (*kögörčén-se* ‘the one that is a dove’) syllables, yet the vowel of the suffix uniformly surfaces as the full one in all of the words in (63c).

The generalization that the restriction on full/reduced vowel alternation marks the prosodic structure of the language becomes even clearer if we consider longer stems with the same suffix /-sə/ attached to them:

(64)

	Nom.sg (non-poss) no suffix	Nom.sg (3 rd p.pl. poss) suffix /-na/ (inanimate)	'the one who is N' suffix/-sə/
a.	mü 'honey'	mú-nä 'our honey'	(mú-nä)-sə
	šə 'fall, autumn'	šəž-ná 'our fall'	(šəž-ná)-sə
	tam 'taste'	tám-na 'our taste'	(tám-na)-sə
	šot 'sense'	šót-na 'our sense'	(šót-na)-sə
	ij 'year'	íj-nä 'our year'	(íj-nä)-sə
b.	múno 'egg'	munə-ná 'our egg'	(munə)-(ná-so)
	júksö 'swan'	jüksə-ná 'our swan'	(jüksə)-(ná-se)
	pə̀rəs 'cat'	pə̀rəs-ná 'our cat'	(pə̀rəs)-(ná-se)
	tüná 'world'	tüná-nä 'our world'	(tüná)-(nä-se)
c.	pušáŋgə 'tree'	pušáŋgə-ná 'our tree'	(pušáŋ)(gə- ná)-sə
	kögörčén 'dove'	kögörčén-nä 'our dove'	(kögör)(čén-nä)-sə
	üremə 'street'	üremə-ná 'our street'	(üre)(mə-ná)-sə
	paréŋə 'potato'	pareŋə-ná 'our potato'	(pare)(ŋə-ná)-sə

The roots in (64) above have two suffixes attached to them: first, 1st person possessive suffix /-na/, followed by already familiar /-sə/. Notice that it is clear from this data that the restriction on the schwa conversion into a full vowel takes into account all the syllables (prosodic structure) of the derived stem, i.e. of the [root + suffix /-na/]. Again, using our mechanism of footing (left-aligned binary feet) predicts where the underlying schwa is allowed to surface as a full vowel (64b), and where it stays the reduced vowel because it is not at the right edge of a foot. No matter how many suffixes we add between the root and the underlyingly reduced vowel of the suffix, iterative binary footing, that is crucially a different phenomenon than stress assignment, will determine the full or reduced quality of the underlying schwa. We will return to accounting for the quality of the full vowels converted from an underlying schwa in the next subsection of this chapter and in Chapter 3. A more formal analysis of the schwa/full vowel alternations, however, is in order here.

It appears that the nature of the alternation in question is vowel harmony that is restricted by metrical constituency. While sonority of vowels clearly plays an important role in the

language, we can reasonably rule it out as a driving force for schwa vocalizations: schwas are, according to any sonority scale, ideal vowels to constitute the nucleus of a syllable in the non-head position of a foot, but it is precisely in this position and only in this position that schwas are converted into full vowels. Our analysis of the alternation, therefore, should be more along the lines of some positions (like foot-head position) being more resistant to mismatch between input and output than other positions, i.e. non-head position in our case. Positional Faithfulness (Beckman (1998)), thus, appears to be the nature of the restriction on the schwa vocalizations. For the purposes of this analysis, we will consider schwas to be vowels that are only specified for the root features in the input, and lacking any other specification. A Positional Faithfulness-like constraint, therefore, must have an effect of disallowing any DEP violations in foot-head positions²⁸:

(65)

DEP _[feature]	Any feature present in the output must be present in the input
ALIGN-R, S _[-cons] FT	Every vowel must be aligned with the right edge of a foot

By conjoining the two constraints in (65) above, we are saying that a vowel can either have features in the output that are not present in the input, or be in non-final position within a foot, but crucially not both.

A constraint that forces schwas to vocalize would be a (more general) constraint that triggers vowel harmony:

(66)

AGREE-R [±high] , PRWD	For every segment <i>n</i> , assign one violation for every segment without the same specification for the feature [±high] ²⁹ as <i>n</i> , in the same PrWd, that is to the right of <i>n</i> .
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²⁸ For the reasons that are outside the scope of this dissertation, I will use constraint conjunction rather than a true Positional Faithfulness constraint as formulated in Beckman (1998).

²⁹ It is at least the [±high] feature that is relevant for the harmony. Other features, such as [±ATR], [±round] etc. might be relevant as well, but are omitted here for the purposes of illustration. I also assume that higher-ranking constraint(s) will prevent consonants from having these features.

I am not specifying the position of the trigger: every full vowel triggers this requirement for agreement in principle, and every full vowel starts its own domain for agreement. In practice, it would mean that a schwa must copy the relevant features of a preceding full vowel.

Tableau 31

/jüksə/ 'swan'	DEP _[feature]	&	ALIGN-R, S _[-cons] , FT	AGREE-R, PRWD
a. (jüksə)		✓		*!
☞ b. (jüksö)	*	✓		

The underlying form in Tableau 31 above has two vowels, the second of which is schwa. Both outputs are footed according to the principles we have discovered above in this thesis, and I skip the constraint responsible for such footing, because they are never violated in the language, and outrank any constraints that are in competition with them. Both of the candidates pass the conjoined constraint: they tie on the alignment conjunct, since both have one vowel that is not aligned with the right edge of a foot. Candidate (b) violates the DEP conjunct, but passes the whole conjunction, because of the locality requirement of the conjunction: violations of both of the conjuncts should be incurred in the same domain, a segment in this case³⁰.

The decision between the two candidates, consequently, is made by a lower-ranking AGREE-R constraint that is violated by candidate (a), which is a fully faithful candidate with a final schwa, and is satisfied by candidate (b). Candidate (b), with the schwa vocalization, emerges as optimal in this case.

Let us now compare the situation in Tableau 31 with the potentially vocalizable schwa in a trisyllabic word:

³⁰ On local conjunction, see Green (1993), Smolensky (1995), Crowhurst and Hewitt (1997), Nathan (2002).

Tableau 32

/üre _{mə} / 'street'	DEP _[feature]	&	ALIGN-R, S _[-cons] , FT	AGREE-R, PRWD
☞ a. (üre)mə		✓	*	*
b. (üre)me	*	*!	*	

In contrast with the Tableau 31, both candidates in the Tableau 32 above are trisyllabic. The meaningful difference is in footing: a trisyllabic word is parsed into one binary foot, leaving a stray final syllable unparsed. Candidate (a) passes the conjoined constraint: there are no (relevant) features in the output that not in the input, and that is enough to satisfy the conjunction, regardless of Alignment violation(s). Candidate (b), on the other hand, violates the conjunction, since it both has feature(s) that are not in the input, and the same vowel is not in the rightmost position within a foot. Thus, even though candidate (a) violates the agreement constraint, it still emerges as the optimal one.

The contrast, with the same constraint and their respective ranking, between Tableaux 31 and 32 shows us the main condition for the schwa vocalization in the language: binary foot structure, and crucially not the position of the prominent syllable, is responsible for the restriction on this type of vowel harmony.

To summarize this subsection, we have investigated an alternation that marks the foot structure of the language. Foot structure, as marked by the full/reduced vowel alternation, is binary, left-aligned, and crucially does not depend on the position of stress, in that either right or left syllable of a foot can be stressed, or there might be no stressed syllable in a foot. An underlying schwa surfaces as a full vowel if: 1) it immediately precedes a word boundary; and 2) it is the second part of a binary foot, i.e. it is aligned to the right boundary of such a foot.

We have established, therefore, that the dialect of Meadow Mari under discussion has two distinct and independent potential points of reference for a segmental alternation: binary metrical structure and prominent/non-prominent opposition. Metrical boundaries and position of stress do not match. The DEP-violating harmony (full/reduced vowel alternations), crucially have to refer to the foot structure to be predictable.

2.3.3 IDENT-violating Vowel Harmony

In the previous subsections we have identified two types of potential prosodic points of reference for a segmental alternation: stress and metrical structure, which crucially do not match. Metrical structure restricts and is marked by the reduced/full vowel alternations, while stress is assigned according to a different set of principles and can be assigned to any syllable in a foot.

At this point we come to the phenomenon of a different type of vowel harmony in Meadow Mari. One of the IDENT-violating types of vowel harmony is influenced by prosody, and thus a principle that regulates it has to refer to prosody in some fashion.

Mari has two types of IDENT-violating vowel harmony: backness/frontness harmony and rounded/unrounded harmony. Backness/frontness harmony is conditioned by the quality of the first vowel of the word, regardless of whether it is stressed or unstressed:

(67)

	Nom.sg. non-poss. no suffix	Nom.sg. 2 nd p.pl. possessive suffix /-ta/
a.	ém ‘medicine’ túrö ‘edge’ čödrá ‘forest’ čijǎ ‘paint’	ém-dǎ ³¹ ‘your (pl.) medicine’ türə-tǎ ‘your (pl.) edge’ čödrǎ-tǎ ‘your (pl.) forest’ čijǎ-tǎ ‘your (pl.) paint’
b.	uβér ‘news’ ólək ‘meadow’ aβám ‘mother’ kutkó ‘ant’	uβér-ta ‘your (pl.) news’ ólək-tǎ ‘your (pl.) meadow’ aβám-ta ‘your (pl.) mother’ kutkó-ta ‘your (pl.) ant’

³¹ Underlying suffix /-ta/ has voiced [d] after a nasal as in this word.

c.	čárke ‘church’	čərke-tá ‘your (pl.) church’
	párəs ‘cat’	pərəs-tá ‘your (pl.) cat’
	rəwəž ‘fox’	rəwəž-tá ‘your (pl.) fox’
	təlze ‘moon, month’	təlze-tá ‘your (pl.) moon, month’

In the roots in (67a), the first vowel is front, and it triggers fronting of the vowel of the suffix³². If the first vowel of the word is a back one, as in (67b), the vowel of the suffix also surfaces as a back [a]. Note that it is crucially the first, and not the stressed vowel of the root that causes the fronting: the root *uβér* ‘news’ is disharmonic, its stressed vowel [e] is front. The vowel of the suffix, however, surfaces as back.

In (67c) we see the same suffix attached to roots with all reduced vowels underlyingly. In this case, the vowel of the suffix is not fronted, even though, under appropriate conditions discussed in the previous subsection, the word-final vowel of the underived word surfaces as a front [e] in these roots.

Eastern Mari suffixes of the second type, with the underlying front mid vowel /e/, do not exhibit any frontness/backness harmony alternations, and always surface with [e] in the suffix³³. Similarly, when underlying vowel of the suffix is a schwa, and its conversion into a full vowel is blocked, the schwas appear as such, without fronting or backing:

(68)

Nom.sg. no suffix	Denominal adjective suffix /-lə/	Ablative sg suffix /-leč/
šóšo ‘spring’	šóšə-lə ‘spring (adj.)’	šóšə-leč
kúrtnö ‘iron’	kúrtnə-lə ‘iron (adj.)’	kúrtnə-leč
jéne ‘human’	jéne-lə ‘human (adj.)’	jéne-leč
šúldər ‘wing’	šúldər-lə ‘light, weightless’	šúldər-leč
téngəz ‘sea’	téngəz-lə ‘naval’	téngəz-leč
olá ‘city’	olá-lə ‘urban’	olá-leč
kutkó ‘ant’	kutkó-lə ‘tiny, ridiculous’	kutkó-leč

³² Since, to the best of my knowledge, there is no front low vowel [ä] in first syllables of Eastern Mari words in the dialect I discuss, the [a]/[ä] alternation is allophonic. Front vowels of the first syllable front /a/ to [ä] within roots, as well: see, for example, words for ‘paint’ and ‘forest’ in (19). However, I will still keep [ä] in the inventory for the purposes of this discussion.

³³ Recall also, that it is this set of suffixes that attracts stress in some cases (see (7b)), but not the suffixes with underlying schwa.

As seen in (68), suffixes containing an underlying schwa and the ones with the underlying /e/ behave identically with respect to frontness/backness harmony, but that only happens when a schwa is not allowed to be converted to a full vowel. In cases when the underlying schwa surfaces as a full vowel, the front or back nature of that full vowel is determined by the quality of the first vowel in the word:

(69)

a.	kit ‘hand’	kít-se ‘the one that is a hand’
	mü ‘honey’	mũ-sö ‘the one that is honey’
	šör ‘milk’	šör-sö ‘the one that is milk’
	pelédəš ‘flower’	pelédəš-se ‘the one that is a flower’
	ner ‘nose’	nér-se ‘the one that is a nose’
b.	šor ‘mud’	šór-so ‘the one that is mud’
	šuk ‘worm’	šúk-so ‘the one that is a worm’
	kož ‘spruce’	kóž-so ‘the one that is a spruce’
	jóŋələš ‘mistake’	jóŋələš-so ‘the one that is a mistake’
	pušáŋgə ‘tree’	pušáŋgə-so ‘the one that is tree’
c.	šəž ‘fall’	šəž-se ‘the one that is fall’
	čən ‘truth’	čən-se ‘the one that is truth’
	šəl ‘meat’	šəl-se ‘the one that is meat’
	tam ‘taste’	tám-se ‘the one that is taste’
	taŋ ‘friend, partner’	táŋ-se ‘the one that is a friend’

The words with the front first vowel (69a), when concatenated with the suffix /-sə/, (or any suffix with an underlying schwa, for that matter), determine the front nature of the suffix vowel, which also surfaces as front mid vowel (rounded or unrounded, depending on the rounding harmony we will discuss next).

The initial vowels of the examples in (69b) are back, and consequently the vowel of the suffix surfaces back as well.

Examples in (69c) contain initial vowels of two types: it is either [-front] [-back] vowel schwa, or a back low vowel [a]. The suffix in these cases, however, uniformly surfaces

with a front [e]. It appears, therefore, that neither [ə] nor [a] trigger backness harmony, and the front vowel is the default that surfaces when the initial vowel is neutral, i.e. does not require that the target be either back or front. Note, in addition, that since all the roots in (69c) are monosyllabic, the potential intervention of the vowels between the initial vowel and the vowel of the suffix is not an option here: it is necessary to recognize both schwa and [a] as neutral vowels for the purposes of backness harmony.

Finally, there is the fourth type of suffix in Eastern Mari, namely suffixes with an underlying full mid vowel that alternates between [e], [o] and [ö] on the surface. These suffixes behave identically to suffixes with the underlying schwa, with the obvious exception that the vowel in these suffixes never surfaces as reduced, regardless of its position in prosody, and whether or not it immediately precedes the word boundary. We will talk more about the alternations in these suffixes when we discuss the second type of vowel harmony in this dialect of Mari.

To summarize, the generalization about backness/frontness harmony in Eastern Mari are as follows: the harmony is triggered by the first vowel in the word; the harmony spreads throughout the word; underlying [ə] harmonizes if allowed to surface as full, as do vowels that are underlyingly full, but are not specified for [front] and [back] features; the low vowel [a] gets fronted if the trigger is front; and the underlying vowel [e] does not harmonize. In addition, [ə] and [a] do not trigger this type of harmony.

Now that we have dealt with the backness/frontness harmony in Eastern Mari, we will start to discuss the rounding harmony that is particularly interesting for the present study.

Recall that we have identified two potential points of reference that are prosodic: stressed/stressless opposition and metrical boundaries, which do not coincide, as we demonstrated in previous subsections of this chapter. The vowel harmony, therefore, can refer to either metrical boundaries, or stress, and alternation in the language clearly show us to which notion the segmental phenomenon refers, if at all.

The second type of vowel harmony, the roundness harmony, is prosodically restricted in Eastern Mari. The trigger of this type of harmony crucially has to be **stressed**, as the following data demonstrate:

(70)

- | | | |
|----|------------------------|---|
| a. | šóšo ‘spring’ | šóšə-šo ‘his/her/its spring’ |
| | éрге ‘boy’ | érgə-še ‘his/her/its boy’ |
| | šúrö ‘soup’ | šúrə-šö ‘his/her/its soup’ |
| | kínde ‘bread’ | kíndə-še ‘his/her/its bread’ |
| | kúrtɲö ‘iron’ | kúrtɲə-šö ‘his/her/its iron’ |
| | pórtö ‘pine forest’ | pórtə-šö ‘his/her/its pine forest’ |
| | | |
| b. | šüzâr ‘sister’ | šüzâr-še ‘his/her/its sister’ |
| | pükšermé ‘walnut tree’ | pükšermé-še ‘his/her/its walnut tree’ |
| | ürémə ‘street’ | ürémə-še ‘his/her/its street’ |
| | kəɫmó ‘shovel’ | kəɫmó-šö ‘his/her/its shovel’ ³⁴ |
| | čödrâ ‘forest’ | čödrâ-še ‘his/her/its forest’ |
| | kögörčén ‘dove’ | kögörčén-še ‘his/her/its dove’ |

While in the examples in (70a) above the initial vowel **is** the stressed vowel (these are the words where the second vowel of the root is the underlying schwa, as shown by stress and the vowel surfacing as [ə] before the suffix), we cannot be sure what the condition on the trigger is, the examples in (70b) disambiguate the situation. In these words, the stressed syllable is either the second one, as in words for ‘sister’, ‘street’, ‘shovel’ and ‘forest’, or the third, as in ‘walnut tree’ and ‘dove’. It is crucially the quality of the **stressed** vowel, and not the initial vowel, that determines whether the vowel of the 3rd singular possessive suffix is rounded or unrounded.

Note that in all the examples in (70b), the initial and the stressed vowel do not agree in roundness. The roundness of the suffix vowel, however, only depends on whether or not the stressed vowel is round, and does not take into account the roundness of the initial vowel, only its frontness/backness.

³⁴ The fronting of the suffix vowel in this example is due to the palatal lateral.

The set of suffixes vowels of which harmonize for roundness includes all suffixes with underlying full vowels that are specified only for height, and all suffixes that have underlying reduced schwa. In the latter case, the underlying schwa shows up as a full vowel with the rounding specifications according to the rounding specifications of the stressed vowel if it is in the left part of a foot and immediately precedes the word boundary (see the subsection on the full/reduced vowel alternations), and as non-harmonic reduced vowel if it is not allowed to be converted into a full vowel³⁵. For illustration of these alternations see the data in (63) and (64) above.

We previously saw that suffixes with underlying low vowel /a/ in them show harmonic alternations between back [a] and front [ä] on the surface, the front/back alternation conditioned by the word-initial vowel. The same suffixes, however, do not show any rounding harmony, and neither do suffixes with underlying /e/:

(71)	Nom.sg <u>no suffix</u>	Caritive sg. <u>suffix /-de/</u>	Nom.sg 1p.pl.poss <u>suffix /-na/</u>
a.	súsko ‘scoop’	súskə-de	suskə-ná
	ólək ‘meadow’	ólək-de	olək-ná
	šudó ‘hay’	šudó-de	šudó-na
	júk ‘voice’	júk-te ³⁶	júk-nä
b.	kué ‘birch’	kué-de	kué-na
	kəlá ‘mouse’	kəlá-de	kəla-ná
	ímne ‘horse’	ímne-de	imne-ná
	murǰá ‘tube, pipe’	murǰá-de	murǰá-na

We can see that while in examples in (71a) the stressed vowel of the root is rounded, and in (71b) the stressed vowel is unrounded, the rounding in the suffix vowels stays constant, and does not harmonize, regardless of whether or not it attracts the stress.

³⁵ Isanbaev (1975) transcribes schwas with diacritics for ‘more round’ and ‘less round’ schwas, as well as for ‘more front’ and ‘less front’ schwas for Standard Literary Eastern Mari. I do not know if the difference in presence or absence of these secondary roundings or reduced vowels is due to dialectal variation or historical change, but I could not observe any such harmony on schwas.

³⁶ This suffix shows progressing devoicing after voiceless obstruents.

Besides the 3rd person singular possessive suffix we saw in (70), suffixes that harmonize in roundness with the stressed vowels include Inessive suffix [-šte]/[-što]/[-štö]; Illative suffix [-ške]/[-ško]/[-škö]; adjective-forming suffix [-lə]/[-le]/[-lo]/[-lö], suffix /-sə/ with the meaning “the one that/who is N”, and many others. Suffixes that do not harmonize in roundness include Dative suffix [-lan]/[-län]; Modal (Comparative) [-la]/[-lä]; Ablative [-leč], Caritive [-de]/[-te], etc.

This difference between the suffixes with an alternating vowel, on the one hand, and suffixes with a non-alternating one, on the other hand, is captured straightforwardly within Optimality Theory with the difference between DEP and IDENT constraints, combined with the theory of underspecification like the one proposed in Inkelas and Cho (1993), Kiparsky (1993), Goldsmith (1985), among others.

With the (partial) ranking of IDENT_[round] >> AGREE_[round] >> DEP_[round] the resulting suffix will get a harmonizing (alternating for roundness) suffix vowel if it is not specified for roundness underlyingly, i.e. if the [round] feature is added, violating lower-ranking DEP. A suffix would have a non-alternating vowel if its underlying representation contains specification for roundness, since this specification cannot be changed due to the highly ranked IDENT constraint.

The condition on targets of rounding harmony, therefore, becomes clear: in order to harmonize, a vowel must have no underlying specification for rounding, and vowels that have such a prespecification fail to harmonize.

The condition on trigger of the rounding harmony appears to be quite simple as well: the trigger vowel must be stressed. The problem, however, arises if we consider this prosodic condition on the trigger in light of the hypothesis that asserts that segmental phenomena can only appeal to metrical structure, not to the stressed vs. stressless opposition.

Recall that we know independently from the full/reduced vowel alternations that metrical structure of the language is binary and aligned to the left edge of a PrWd. The stress placement, however, does not depend on these metrical boundaries, but follows its own set of principles. The result is that stress can be placed on either right or left syllable of a foot, and there are feet without a stressed syllable in them at all. Consider the following alternations with the Illative singular non-possessive³⁷ suffix /-škV_[-high,-low]/, with the previously determined binary foot boundaries marked:

(72)

a.	šúšpək ‘nightingale’ ³⁸	(šúšpə)(k-əškö)
	íge ‘young animal’	(ígə)-ške
	óškəl ‘step’	(óškəl)-ške
	kínde ‘bread’	(kíndə)-ške
	wáštər ‘maple’	(wáštər)-ške
	júksö ‘swan’	(júksə)-škö
b.	šergé ‘comb’	(šergé)-ške
	kornó ‘road’	(kornó)-ško
	ürémə ‘street’	(üré)(mə)-ške
	kaβún ‘pumpkin’	(kaβú)(n-əš)ko
	merán ‘hare’	(merá)(ŋ-əš)ke
	pušánŋə ‘tree’	(pušán)(gə)-ške
c.	ojlámáš ‘story’	(ojlə)(máš-əš)ko
	kugužán ‘princess’	(kugu)(žán-əš)ko
	kögörčén ‘dove’	(kögör)(čén-əš)ke

It is obvious from the forms above that the prosodic condition on the trigger cannot be reduced to a reference to metrical boundaries: in (72a) the trigger of the rounding harmony (the stressed vowel) is foot-initial and in the first foot in a word; in (72b) the trigger is, in contrast, foot-final, also in the leftmost foot; and in (72c) the trigger is foot-initial yet again, but in the second foot of the word. Given these facts, the generalization could not be clearer: in order to formulate a uniform condition on the triggering vowel,

³⁷ Illative suffix with possessive forms is shortened to /-š/.

³⁸ When a stem ends in a consonant, an epenthetic schwa is inserted before suffixes that start with [š] to avoid a complex coda/onset; there is no epenthesis when a suffix starts with a liquid or a stop.

we have to refer to stress, and crucially **not to metrical structure** of the word. We will develop a more formal analysis of this type of vowel harmony in Mari in the next chapter.

In conclusion, we demonstrated in this analysis that the hypothesis of limiting the prosodic references to metrical boundaries falls short of explaining the relevant facts of Eastern Mari. Foot structure in this language is established to be independent from the placement of stress, and is marked by full/reduced vowel alternation. In order to account for the pattern of rounding harmony in the language, we specifically have to make reference to stressed vowels. It appears that this pattern is undergenerated by our second hypothesis of limiting prosodic references to metrical structure.

2.4 Local Conclusions

We started the discussion of this chapter with outlining two important hypotheses of limiting reference of segmental generalizations to prosodic categories. While in practice of formulating generalizations about segmental alternations there is unrestricted reference to both metrical boundaries and stressed/stressless opposition in the literature, the two extreme proposals suggest that such references should be limited to one of those prosodic notions.

In our two case studies of this chapter we presented evidence that neither of these extremes can be maintained. The Nganasan case shows that in order to account for restrictions on consonant gradation, the grammar of the language has to make reference to prosodic boundaries and crucially not to stressed/stressless opposition, since this opposition does not always coincide with, or determine, the foot structure of the language. The fact that Nganasan consonant gradation is accountable for with reference to metrical boundaries, but not to stress, renders the ‘reference to the stressed/stressless opposition only’ hypothesis incorrect.

The Eastern Mari case study, in fact, proves both of the extreme hypotheses wrong. In addition to falsifying the ‘reference to stress only’ proposal, it provides evidence that the opposite logical extreme, the ‘reference to metrical boundaries only’ hypothesis cannot be sustained either. The language has a pattern of stress assignment that differs from the foot structure, which is marked by the alternation of full and reduced vowels. This alternation becomes unpredictable if we are only allowed to make reference to stress, and not to metrical boundaries.

Another segmental phenomenon that is sensitive to prosody in Eastern Mari is rounding harmony. In contrast with full vs. reduced vowel alternations, the generalization about rounding harmony, in order to account for the full range of the facts, crucially has to refer to stress, and cannot be predicted with reference to metrical boundaries only.

It appears, therefore, that both of the logically possible ways of limiting segmental generalizations’ reference to prosody fall short of predicting one or both of patterns discussed in this chapter. Limiting reference of segmental generalizations to stressed/stressless opposition fails to predict the pattern of Nganasan consonant gradation, as well as the full/reduced vowel alternations of Eastern Mari, and limiting such references to metrical boundaries is unsuccessful in generating the pattern of Eastern Mari rounding harmony.

Though logically appealing, these hypotheses cannot be sustained in their extreme formulations, and the solution for limiting reference of segmental generalizations to prosodic notions should take into account the typology of patterns that make such a reference, making this one of the major questions I address in this thesis. It is clear at this point that prominence and constituency within a Phonological Word are two different entities in the grammar. However, it is also true that in the majority of languages that have prosody-dependent segmental alternations it is impossible to empirically distinguish which of the notions (foot structure or the position of accent) is relevant for such an alternation since foot boundaries and prominence assignment coincide. We investigate

the relationship between these two notions, and what kinds of constraints can cause misalignment of prominence and foot structure throughout this thesis.

If foot structure and prominence are two distinct entities in the grammar, they may affect foot-dependent and stress-dependent phenomena differently. In the next two chapters of this thesis, therefore, we will investigate this possibility, as well as the question of what kinds of constraints can outrank Prominence Alignment constraints. We will concentrate on stress-influenced phenomena in Chapter 3 and on foot-structure influenced phenomena in Chapter 4.

CHAPTER 3

SEGMENTAL PHENOMENA INFLUENCED BY STRESS

3.1 Introduction

Previously in this dissertation, we established that prominence and foot structure are two distinct entities in the grammar, and discussed several ways in which these entities might interact. Stress and foot structure can be misaligned if there are constraints that outrank Prominence Alignment constraints that refer to alignment of prominence with edges of feet. In Nganasan, misalignment is caused, under the present proposal, by WORDFINALITY, sonority of stressed vowels, and CLASH constraints all outranking the Prominence Alignment constraint. In Meadow Mari, binary foot structure evidenced by full/reduced vowel alternations appears to have no effect on the pattern of stress assignment, because constraints relating stress to Prosodic Word edges, morphological class (root vs. affix) to which stressed vowels belong, and on sonority of stressed vowels all outrank the Prominence Alignment constraint.

The main task of this chapter, as well as Chapter 4, is to investigate whether prominence and foot structure, being distinct in the grammar, can have different effects on segmental alternations. In cases where we find the position of stress and position of foot boundaries misaligned, we will investigate what kind of constraints cause the disparity. The present chapter will discuss cases where prominence influences segmental alternations, proceeding to cases where binary foot structure has effect on segmental alternations in Chapter 4.

By far, the two most common straightforward conditions on segmental alternations that we seem to encounter are (i) on vowel harmony where the trigger has to be stressed, and (ii) conditions on appearance of certain consonants within stressed syllables vs. consonants in unstressed syllables. At this point, we will remain largely agnostic as to whether this is a condition that is better defined using prominence or unbounded foot structure. We will start with some examples of vowel harmony in section 3.2 and then

proceed to the discussion of other phenomena where the same kind of prosodic notion seems to play a role in section 3.3.

3.2 Vowel Harmony

It appears that most, if not all types of vowel harmony can be influenced by position of stress/head of unbounded foot within a Prosodic Word.

Lhasa Tibetan (Sino-Tibetan language family) provides an example of vowel harmony for the feature $[\pm\text{high}]$. In Lhasa Tibetan (Chang and Chang (1967), Majors (1998)), unstressed vowels are raised by adjacent high stressed vowels: before suffixes with high stressed vowels (e.g. negative suffix), vowels in roots are raised.

The Applecross dialect of **Scottish Gaelic** (Ofstedal (1956), Borgstrøm (1940), Ternes (1973)), a Celtic language spoken in Scotland, has nasal harmony, where nasality spreads rightward from a stressed nasal vowel (usually in the initial syllable) blocked by an obstruent stop. It also nasalizes the onset of the syllable containing the stressed vowel, provided the onset is not an obstruent stop.

In **Chamorro** (Topping (1968), Majors (1998), Flemming (1994)), a language spoken in Guam, there is height harmony that applies only morpheme-internally. In morphemes of the form $(X)CV_1CV_2$ non-low vowels are subject to height harmony triggered by preceding stressed non-low vowels. In addition, if the stressed vowel is low, a mid vowel may not follow.

Breton is reported (Falc'hun (1951), Majors (1998)) as a language where a stressed $/e/$, $/o/$ or $/\text{œ}/$ transmits this height to adjacent unstressed mid vowels. The language has three variants of mid vowels in stressed syllables. It appears that instead of a directionality condition (pre-tonic or post-tonic syllables), the condition on this vowel harmony is immediate adjacency, in addition to the stressed/unstressed asymmetry that triggers the harmony.

In **Koya** (Tyler (1969)), the short high vowels [i] and [u] harmonize in unstressed syllables with respect to all vowel features with a following long, and therefore stressed, vowel.

Another well-known case of prosody-dependent harmony (nasal harmony in particular) is presented by **Guaraní**. The language has received a lot of attention among phonologists (Flemming (1994), van der Hulst & Smith (1982), Walker (1998), Beckman (1998), Sportiche (1977), Vergnaud and Halle (1978)) due to several aspects of theoretical interest of the phenomenon of nasalization that include the transparency of voiceless segments, the effect of spreading across morphemes, and the role of prenasalized segments. In this dissertation, we will concentrate on the interaction of nasalization with prosody. The following description of the phenomenon draws on Gregores and Suárez's (1967), Rivas's (1975) grammars, as well as on the data from Walker's (1998) study.

Nasal harmony in Guaraní produces cross-segmental spans of nasalization within words. Bidirectional nasal spreading in the word is initiated by a nasal vowel in a stressed syllable. Nasalization spreads to all voiced segments and is reported to skip voiceless consonants. Spreading is blocked by a stressed syllable containing an oral vowel. In blocking syllables, both the vowel and onset consonant remain oral. In general, all segments in a syllable in Guaraní agree in orality and nasality; in the case of prenasalized segments, they qualify as oral by their oral release.

Nasal spreading is also triggered by nasal closure of a prenasalized stop. In this case, as would be expected, spreading is always regressive:

(1)

- | | | | |
|----|---|---|--------------------------------|
| a. | /ro- ^m bo-he ⁿ dú/
I-you-CAUS-hear | [r̥ ^õ mõh̃ ^ẽ ⁿ dú] | ‘I made you hear’ (Rivas 1975) |
| b. | /ro- ^m bo-γ ^w atá]
I-you-CAUS-walk | [r̥ ^õ ^m boγ ^w atá] | ‘I made you walk’ (Rivas 1975) |
| c. | /a-je-re ⁿ dú/
 | [ã ⁿ ẽ ^ẽ ⁿ dú] | ‘I hear myself’ (Rivas 1975) |

In words with prefixes, nasalization in the root spreads to the prefix. The situation is somewhat more complicated with suffixes. In general, suffixes can be grouped into two classes. One suffix class is characterized by undergoing spreading of nasalization from the root. Suffixes in the other class are characterized by having a fixed oral or nasal quality.

Suffixes that alternate are unstressed, except two derivational suffixes *-ʔó/-ʔõ* and *-sé/-sě* (Gregores and Suarez 1967:103), which I will treat as having two allomorphs each for present purposes. The non-alternating oral suffixes are always stressed, and the non-alternating nasal suffixes can be stressed or unstressed. Fixed suffixes do not usually affect the nasal/oral quality of the roots. However, if a suffix contains a stressed vowel and there is a voiced stop between the stressed suffix vowel and a stressed nasal vowel in the root, then nasalization spreads only as far as the voiced (prenasalized) stop. This produces a root with a nasal span followed by an oral span induced by the oral suffix (Rivas 1975). The pattern is illustrated below with the non-alternating oral suffix */ré/*. In (2a), this suffix remains oral after a nasal stem. In (2b), it produces orality on the final syllable of an otherwise nasal root:

(2)

- | | | | |
|----|---|-------------------------------|---|
| a. | <i>/ir̥-ré/</i>
friend-PAST | [<u>ir̥</u> ré] | ‘ex-friend’ (Rivas 1975) |
| b. | <i>ʰmb̥ⁿda-ré/</i>
marry-PAST | [<u>m̥ⁿ</u> daré] | ‘widow(er)’ (Rivas 1975) |
| c. | <i>ʰmb̥ⁿda/</i> | [<u>m̥ⁿ</u> ã] | ‘husband’
(Gregores and Suárez 1967) |

As mentioned before, the spreading of nasality is blocked by stressed oral vowels, and this blocking creates, in effect, alternating nasal and oral spans:

(3)

- a. /laʃeraʔi-ijakãxatã-itereílaek^wélape/
[laʃeraʔiʔiɲãkã xãtã itẽreílaek^wélape]
- ‘my child is just too stubborn at school’
- b. /rojotopapá^mbarõroxóvarã/
[rojotopapámãrõrõxóvãrã]
‘if now we meet all of us, we will have to go’
- c. /^mbaʔẽmbiaʃi/
‘sadness’ [ʔ^mbaʔẽmbiaʃi]

What is mostly important to us in this dissertation is that Guaraní nasalization is clearly sensitive to stress. This has led some researchers to posit nasalization as limited by righthanded unbounded feet (Flemming 1994, van der Hulst & Smith 1982), or to utilize feature percolation through a metrical tree (Sportiche 1977, Vergnaud and Halle 1978). Beckman (1998) takes a somewhat different approach suggesting that faithfulness constraints may be sensitive to prosodically prominent positions. She proposes that one such constraint, IDENT- $\acute{\sigma}$ [nasal], which enforces nasal feature identity in stressed syllables and can derive the effect of metrical domain-bounded nasal harmony in Guaraní. In combination with featural markedness constraints, Beckman (1998) shows that faithfulness to stressed positions is also capable of deriving the limitation of phonemic nasality to stressed vowels. Therefore, just as in cases of vowel harmony we have seen before, one of the conditions on the nasal harmony in the language can be analyzed as both dependent on stress, and as dependent on unbounded foot structure. The choice between the two analyses appears to be purely theory-internal rather than empirical.

We will now turn to a case of vowel harmony that, as we show, must be analyzed as dependent on the position of stress rather than metrical constituency, which is manifested differently in the language. The choice of the prosodic category in these cases is empirically determined rather than purely theory-internal.

3.2.1 Case Study: Southwestern Khanty Vowel Harmony

Khanty (Xanty, Ostyak) is a Uralic Ob-Ugrian language that is the closest relative of Maŋŋi that we discuss in some detail in the following chapter. In fact, Khanty is a continuum of dialects, some of which are quite different grammatically, and most of which are not mutually comprehensible. The dialect I am describing here is spoken near Krasnojarsk (Russia).

Ten subjects were interviewed in the summer and fall of 2006, all of them in their 50s (three women, seven men). The speakers all live in the same community of about 20 households. The community appears to be somewhat mixed historically: most of the Ostyaks in the community report that their ancestors came from other communities in the beginning of the 20th century, to the best of their recollection, but were not sure where their families lived before the move. Two of the speakers interviewed were third-generation migrants from area around Surgut, where a clearly eastern dialect of Khanty is spoken. I have not noticed any difference in their language with respect to the phenomena I investigate here. However, they were able to pick out some words they comprehend from a recording (made in Khanty-Mansijsk in the spring and summer of 2005) of an eastern dialect, though they could not understand complete sentences from the recording, and pointed out that they pronounced the words they picked out differently than what they heard on the tape. All the speakers are completely fluent in Russian, barring words for some household items and traditional activities.

The dialect differs from dialects of Khanty that were previously described in some detail, which are various Eastern (see Schteinitz (1937), Životikov (1942), Gulya (1966), Katz (1975), Honti (1993), Abondolo (1998)) or Northern or Northwestern (Paasonen (1965), Nikolaeva (1995, 1999), Ackerman and Nikolaeva (1997), Kovgan (1991)) varieties. The dialect is not unlike Northwestern dialects in that it has a reduced vowel inventory compared to Eastern dialects, a reduced consonant inventory, and loss of some case markings (but not as drastic a loss as in Northern dialects that are reported to have only three cases), but it shows vowel harmony that is present in Eastern dialects (though different in details), but is missing in Northwestern dialects.

3.2.1.1 Relevant basics

The dialect of Khanty under investigation has the following vowel system:

(4)

	Short			Long		
	front	central	back	front	central	back
high	i		u	ii		uu
mid	e, ö		o	ee, öö		oo
low			a			aa

The short back mid vowel is slightly higher than its long counterpart (possibly [ɔ]). Long and short [a] (and allophonic [ä]) appear in complementary distribution in non-initial syllables: short [a] appears in final and closed syllables, and long [aa] in open non-final syllables. Hence, there are synchronic alternations with suffixation, e.g.:

(5)

jeernäs ‘dress’	jeernääs-əŋän ‘two dresses’
kuuṣa ‘master’	kuuṣaa-ŋan ‘two masters’

In initial syllables, however, the contrast is preserved:

(6)

taaṣ ‘herd’	* taṣ	taaṣ-əŋan ‘two herds’	
tal ‘year’		tal-əŋan ‘two years’	*taal-əŋan

Long [ee] alternates with short [i] in non-initial syllables: [i] (and its back counterpart [ɨ]) appears in final syllable, while [ee] in non-final (suffixed forms) syllables, both open and closed:

(7)

söör̥ɲi ‘gold’	söör̥ɲee-nä ‘gold’ (Loc)
kasi ‘pain’	kasee-nä ‘pain’ (Loc)

Long [ee], however, can appear in final syllables, and does not change if followed by a suffix:

(8)

ɲawreem ‘child’	*ɲawr̥im	ɲawreem-ənä ‘child’ (Loc)
nareem ‘bridge’	*nar̥im	nareem-ənä ‘bridge’ (Loc)
aaŋkee ‘mother’	*aaŋk̥i	aaŋkee-nä ‘mother’ (Loc)
oopee ‘older sister’	*oop̥i	oopee-nä ‘older sister’ (Loc)

Vowels [ī], [ä], and [ü] do not appear contrastively, and never appear in initial syllables, but only as results of vowel harmony, to be discussed next.

Schwas can always be analyzed as epenthetic, as they (i) never appear in initial syllables, and (ii) serve to break up illicit consonant clusters in the language. There are no complex onsets in Khanty, consonant clusters are allowed inside roots only, and not within suffixes or at morpheme boundaries in the data collected. Finally, a coda can contain two consonants, but only if they have the same place of articulation:

(9)

xatl ‘sun’	*xatəl	cf. xatl-əna ‘sun’ (Loc)
peeŋk ‘tooth’	*peeŋək	peeŋk-ənä ‘tooth’ (Loc)
čeeɲc ‘joint’	*čeeɲəc	čeeɲc-ənä ‘joint’ (Loc)
jiŋk ‘water’	*jiŋək	jiŋk-ənä ‘water’ (Loc)
öömp ‘dog’	*öömɲp	öömp-ənä ‘dog’ (Loc)
lunt ‘wild goose’	*lunət	lunt-əna ‘wild goose’ (Loc)

Schwa is epenthesized if the potential root-final coda contains consonants with different places of articulation:

(10)

ɲeeləm ‘tongue’	*ɲeelm	cf. ɲeelm-ənä ‘tongue’ (Loc)
piixəl ‘fishing line’	*piixl	piixl-ənä ‘fishing line’ (Loc)
nöməs ‘mind’	*nöms	nöms-ənä ‘mind’ (Loc)

laajəm ‘axe’	*laajm	laajm-əna ‘axe’ (Loc)
owəŋ ‘stream’	*owŋ	owŋ-əna ‘stream’ (Loc)

In Locative forms in (10), the consonant clusters are neither complex codas, nor do they appear across a morpheme boundary, hence there is no schwa epenthesis between the last two consonants. In Nominative/Absolutive forms (unaffixed), the complex coda is broken up by a schwa. It is possible to analyze all schwas in the language as derived, even though some suffixes always appear with one, e.g. 2nd person plural possessive *-lən*.

3.2.1.2 Stress

The dialect of Khanty under discussion has only primary stress that falls on the leftmost syllable in a word with light syllables only (including closed syllables), both in underived and derived forms:

(11)

tútjux ‘firewood’	tútjux-ətī ‘firewood’
kólxoz ‘farm’	kólxoz-ətī ‘farm’
nóməs ‘mind’	nóms-ətī ‘mind’
wóntut ‘pine forest’	wóntut-ətī ‘pine forest’
ŋóxəs ‘sable’	ŋóxs-ətī ‘sable’

If, however, a word has a long vowel, whether initial or not, it is the long vowel that receives stress:

(12)

xóotjux ‘log’	wixéeta ‘cry, shout’
xörpáaləx ‘(physically) disabled person’ ¹	xörpáaləx-ətī ‘disabled person’
sáawī ‘guard, shepherds’	naréem ‘bridge’
léetit ‘food’	ŋawréem ‘child’
kúuʂa ‘master’	uléem ‘sleep’

If there is more than one heavy syllable in a word, it is the leftmost heavy syllable that gets stressed, both within roots and when a suffix with a long vowel is added (below,

¹ Originally probably a compound (‘half’ + ‘leg’), ‘a person who limps’, but lexicalized now, speakers revealed no awareness that the word is derived, and use it to describe any physically disabled person.

suffix *-jiin/-iin/-jüin/-iün* forming adverbs from nouns (with the meaning ‘N-ly’, ‘in a manner of N’):

(13)

áaŋkee ‘mother’	áaŋkee-jiin ‘in a motherly fashion’
xǒöseeŋk ‘fish soup’	xǒöseeŋk-iin ‘like fish soup’
xǒöxeeλ ‘female (animal)’	xǒöxeeλ-iin ‘like a female (animal)’
óopee ‘older sister’	óopee-jiin ‘older sisterly’
jóoxeel ‘bow’	jóoxeel-iin ‘like a bow’

Even if a long vowel is derived rather than underlying, the stress still falls on the long vowel, drawing the stress away from the initial syllable (if the initial syllable is light):

(14)

púsi ‘tail’	pusée-ti ‘tail’ (Transl)
jítä ‘enemy’	jítäa-ti ‘enemy’ (Transl)
óxsäm ‘scarf’	óxsäam-ətī ‘scarf’ (Transl)
ɲǒxä ‘meat’	ɲóxäa-tī ‘meat’ (Transl)
sári ‘salmon’	sarée-ti ‘salmon’ (Transl)
xúli ‘dirt’	xulée-ti ‘dirt’ (Transl)
púwləpsī ‘tumor’	puwləpsée-ti ‘tumor’ (Transl)

Finally, a word is evaluated as a whole, i.e. if the leftmost long vowel occurs in a suffix rather than in a root, the suffix vowel receives stress:

(15)

sus ‘autumn’	sus-íin ‘in an autumn(ly) fashion’
tín ‘price’	tín-íin ‘pricily’
loş ‘snow’	loş-íin ‘like snow’
kuλ ‘devil’	kuλ-íin ‘in devil-like fashion’
röp ‘mountain’	röp-íin ‘like a mountain’
sam ‘heart’	sam-íin ‘warmly, sensitively’
xir ‘sack’	xir-íin ‘like a sack’
tútjux ‘firewood’	tútjux-íin ‘like firewood’
népək ‘letter’	népək-íin ‘like a letter’
kólxoʒ ‘farm’	kolxoʒ-íin ‘like on a farm’
nóməs ‘mind’	nöms-íin ‘rationally, cerebrally’

To show that it is not the particular (adverb forming) suffix that causes the stress shift from the root but rather a general pattern of stressing the leftmost heavy syllable, we can take a look at forms that have long vowels in roots:

(16)

óoxsar ‘fox’	óoxsaar-iin ‘like a fox’
sóör̥ni ‘gold’	sóör̥nee-jiin ‘like gold’
úuxəl ‘sledge’	úuxəl-iin ‘like a sledge’
óömp ‘dog’	óömp-iin ‘like a dog’
áaʃ ‘father’	áaʃ-iin ‘fatherly’
íki ‘old man; an ancient’	ikée-jiin ‘like an old man; an ancient’
mútra ‘miracle’	mutráa-jiin ‘miraculously’
mójpar ‘young bear’	mojpáar-iin ‘like a young bear’
rásī ‘fringe’	rasée-jiin ‘like fringe’
jóxän ‘river’	jóxáan-iin ‘like a river’

As we can see from the data above, regardless of whether a long vowel belongs to a root or a suffix, it is the leftmost long vowel that receives the stress, which can therefore be assigned to either first, second, or third syllable of the word, depending on what syllable contains the leftmost heavy syllable.

To summarize, the stress pattern of the dialect of Khanty under discussion can be characterized as a ‘default-to-same’ pattern: stress falls on the leftmost heavy syllable; if a word contains no heavy syllable, the leftmost syllable receives the stress. Stress assignment is not dependent on whether a long vowel is underlying or derived. Neither does it depend on the morphological constituency of a word, as derived and underived words are treated in the same manner for the purposes of stress assignment.

3.2.1.3 Vowel Harmony

As we have mentioned before in this chapter, the dialect of Khanty we are investigating has vowel harmony. In particular, we can observe the type of vowel harmony that affects the feature [±front]. However, we can see that some roots are disharmonic with respect to this feature. In underived environment, there are two types of roots that can be disharmonic:

(17)

- | | |
|--|---|
| a. naréem ‘bridge’
uléem ‘sleep’
ɲawréem ‘child’
apsəjée ‘bear’
nuléex ‘ceremonial ring’ | b. ɲóörəm ‘swampy place’
nóməs ‘mind’
kíimpəl ‘scale (of a cone)’
néepək ‘book’
píixəl ‘fishing line’
jeertəp ‘fence’
xörpáaləx ‘disabled person’ |
|--|---|

In (17a), the initial [-front] vowel is followed by a front vowel, long [ee] (with another front vowel [ə] in between in case of *apsəjée* ‘bear’). The long vowel, being the peak of the leftmost heavy syllable in a word, also bears stress. In (17b), in contrast, a [+front] initial vowel, whether long or short, is followed by [-front] schwa, which does not bear stress. In fact, since schwas are never initial or long, they never bear stress in the language. Both long [ee] and [ə] can appear in harmonic roots as well:

(18)

- | | |
|---|---|
| a. jéewee ‘sister’
xóöseeŋk ‘fish soup’
lixéen ‘fire’
xójéeɿ ‘son-in-law’
xóöxeeɿ ‘female (animal)’ | b. tóxəl ‘wing’
ówəŋ ‘stream’
úuxəl ‘sledge’
láajəm ‘axe’
wóoləx ‘wolf’ |
|---|---|

The data in (18) above suggest that neither [ee] nor [ə] are subject to vowel harmony. The two, however, behave differently in derived environments: while long [ee], if it is the leftmost long vowel in a word, causes every vowel to the right of it to harmonize and show up as [+front] (19a), schwa has no effect on vowels that follow it, and vowels to the right of it can be either [+front] or [-front], depending on the specification of a vowel that precedes schwa and is stressed (19b):

(19)

- | | |
|--|---|
| a. apşée-nä ‘younger brother’ (Loc)
xulée-nä ‘dirt’ (Loc)
taxtée-nä ‘skin’ (Loc) | b. kíimpəl-nä ‘scale (of a cone)’ (Loc)
nóməs-nä ‘mind’ (Loc)
láajəm-na ‘axe’ (Loc) |
|--|---|

sarée-nä ‘salmon’ (Loc)
 uxée-nä ‘head’ (Loc)

lónkər-na ‘mouse’ (Loc)
 xörpáaləx-na ‘disabled person’ (Loc)

The data in (19) show that even though neither [ee] nor schwa can be a target of [±front] harmony in the language, [ə] is always neutral, whereas [ee] can be a trigger of the vowel harmony. Note, however, that if [ee] is preceded by a stressed (i.e. another long) vowel, it is the front/back specification of the stressed vowel that defines whether vowels that follow are front or back:

(20)

a.	áaŋkee ‘mother’	áaŋkee-ja ‘mother’ (Lat)	*áaŋkee-jä
	óopee ‘older sister’	óopee-ja ‘older sister’ (Lat)	*óopee-jä
	xúunteeŋc ‘backpack’	xúunteeŋc-a ‘backpack’ (Lat)	*xúunteeŋc-ä
	jóoxeel ‘bow’	jóoxeel-a ‘bow’ (Lat)	*jóoxeel-ä
b.	xǒöseeŋk ‘fish soup’	xǒöseeŋk-ä ‘fish soup’ (Lat)	*xǒöseeŋk-a
	xǒöxeeλ ‘female (animal)’	xǒöxeeλ-ä ‘female (animal)’ (Lat)	*xǒöxeeλ-a
	jéewee ‘sister’	jéewee-jä ‘sister’ (Lat)	*jéewee-ja
	píixeeλ ‘patch (on a boat)’	píixeeλ-ä ‘patch (on a boat)’ (Lat)	*píixeeλ-a

Even though it is unclear in (20b) whether the harmonic alternations of the Lative suffix is caused by the initial or the second vowel of the root, the data in (20a) show that it is the stressed vowel that triggers the vowel harmony.

When there is an alternation within the root in derived environments, the generalization is even more clear: it is the stressed vowel, whether it is underlyingly short or long, that triggers the harmony forcing vowels to its right (barring short and long [e] and schwa) to surface with the same [±front] specification as the stressed vowel itself:

(21)

a.	rási ‘fringe’	rasée-t-ix ‘my fringes’	*rasée-t-ix
	úxī ‘head’	uxée-t-ix ‘my heads ² ’	*uxée-t-ix
	sári ‘salmon’	sarée-t-ix ‘my salmon (pl)’	*sarée-t-ix
	nári ‘bench’	narée-t-ix ‘my benches’	*narée-t-ix

² Refers to heads of animals killed by the same person.

púsi ‘tail’	pusée-t-ix ‘my tails ³ ’	*pusée-t-ix
xóni ‘stomach’	xonée-t-ix ‘my stomachs’	*xonée-t-ix
jántit ‘toy’	jantéet-ət-ix ‘my toys’	*jantéet-ət-ix
púwləpsi ‘tumor’	puwləpsée-t-ix ‘my tumors’	*puwləpsée-t-ix
b.		
jítä ‘enemy’	jitáa-t-ix ‘my enemies’	*jitáa-t-ix
ɲóxä ‘meat’	ɲöxáa-t-ix ‘my (pieces of) meat’	*ɲöxáa-t-ix
pélän ‘cloud’	peláaŋ-ət-ix ‘my clouds’	*peláaŋ-ət-ix
cöräs ‘trader’	cöráas-ət-ix ‘my traders’	*cöráas-ət-ix
pöskän ‘gun’	pöskáan-ət-ix ‘my guns’	*pöskáan-ət-ix
jínäp ‘hook’	jináap-ət-ix ‘my hooks’	*jináap-ət-ix
óxsäm ‘scarf’	öxsáam-ət-ix ‘my scarves’	*öxsáam-ət-ix
jöxän ‘river’	jöxáas-ət-ix ‘my rivers’	*jöxáas-ət-ix

In the data in (21a) above stress alternates between the initial syllable in underived environment and last syllable of the root in derived environment, since the last syllable surfaces as heavy. The possessive suffix /ix/ (1st person singular possessor, plural possessed) appears with the underlying front vowel when it follows a stressed front vowel [ee]. In contrast, in (21b), the same suffix surfaces with a back vowel following stressed [-front] [aa], despite the initial syllables in these words being [+front]. The roots in derived environment in both (21a) and (21b), therefore, are disharmonic. In fact, the quality of vowels that precede the stressed syllable, and the quality of the stressed vowel itself, is determined purely by the underlying specification. Note that since there are no underlying high non-front vowels or low front vowel in the inventory, there are no such vowels on the surface pre-tonically or in a stressed syllable. Post-tonically, however, both long and short variants of [i], [ä], and [ü]⁴ appear as a result of vowel harmony:

(22)

a.	rex ‘berry’	rex-əlix ‘berry’ (Abess)
	weer ‘business’	weer-əlix ‘business’ (Abess)
	čeeɲc ‘joint’	čeeɲc-əlix ‘joint’ (Abess)

³ Refers to tails of animals killed by the same person.

⁴ [ü] and [u] are rare in non-initial syllables and seem to point to borrowed words, both recent or old. There is, however, at least one suffix with underlying [u], /ut/ ‘the thing/person that/who (always) Vs (repeatedly or habitually)’, so the restriction might have only be relevant for roots. Alternatively, this suffix might be formerly a second part of compounds, cf. *ut* ‘thing’

	lil ‘soul’	lil-əlix ‘soul’ (Abess)
	piixəl ‘fishing line’	piixl-əlix ‘fishing line’ (Abess)
	pöx ‘boy’	pöx-əlix ‘boy’ (Abess)
	öömp ‘dog’	öömp-əlix ‘dog’ (Abess)
b.	uw ‘door’	uw-əlix ‘door’ (Abess)
	kuurt ‘village’	kuurt-əlix ‘village’ (Abess)
	şuuŋ ‘corner’	şuuŋ-əlix ‘corner’ (Abess)
	loş ‘snow’	loş-əlix ‘snow’ (Abess)
	xoop ‘boat’	xoop-əlix ‘boat’ (Abess)
	ŋaŋ ‘bread’	ŋaŋ-əlix ‘bread’ (Abess)
	laaŋk ‘larch’	laaŋk-əlix ‘larch’ (Abess)

All the roots in (22a) are monosyllabic and contain a long or short front vowel. Hence, the vowel in the Abessive suffix (which means ‘without N’, ‘N-less’) is always [+front] after a front stressed vowel of the root. In contrast, the roots in (22b) have non-front vowels, causing the vowel in the suffix to surface as [-front] as well, despite the absence of a high non-front vowel in the underlying inventory. Similarly, appearance of front long or short [ä] is restricted to contexts where vowel harmony applies (see examples with Locative suffix in (19) and Lative in (20)). Deverbal nominalizer /ut/ appears with the front vowel [ü] following, whether immediately or not, a stressed front vowel:

(23)

a.	lipət- ‘feed’	lipt-üt ‘the one who (always) feeds’
	xöł- ‘disappear’	xöł-üt ‘the one who (always) disappears’
	weel- ‘kill’	weel-üt ‘serial killer’
	exət- ‘cut’	ext-üt ‘the one who (always) cuts’
	pööt- ‘freeze’	pööt-üt ‘the one who (always) freezes’
	lip- ‘eat’	lip-üt ‘glutton’
	wiişk- ‘throw’	wiişk-üt ‘the one who (always) throws’
	söj- ‘spit’	söj-üt ‘the one who (always) spits’
b.	ruupit- ‘work’	ruupeet-ut ‘hard-working person’
	ał- ‘sleep’	ał-ut ‘person in a coma’
	part- ‘order’	part-ut ‘leader’
	oom- ‘sit’	oom-ut ‘the one who (always) sits’
	poosa- ‘drip’	poosaa-ut ‘the thing that (always) drips’
	kaas- ‘doubt’	kaas-ut ‘indecisive person’
	aara- ‘break’	aaraa-ut ‘the one who (always) breaks something’

por- ‘bite’	por-ut ‘the one who (always) bites’
paajət- ‘drop’	paajt-ut ‘the one who (always) drop’
nuuxəl- ‘follow’	nuuxl-ut ‘follower’
jowa- ‘wrap (skins)’	jowaa-ut ‘the one who (always) wraps (skins)’

The data in (23) show, among other things, that verbs work the same way nouns do, at least with respect to vowel harmony. The suffix appears with the front vowel following a front stressed vowel in (23a), and with the back vowel after a stressed back vowel. The derived nouns in (23) take the same number, possessive and case suffixes underived nouns do, as illustrated below:

(24)

a.	+Number (dual) ⁵	+Possessive (3 rd p sg)	+Case (Abess)
	lipt-üt-əŋän	lipt-üt-əŋil-äl	lipt-üt-əŋil-äl-əlix
	xöł-üt-əŋän	xöł-üt-əŋil-äl	xöł-üt-əŋil-äl-əlix
	weel-üt-əŋän	weel-üt-əŋil-äl	weel-üt-əŋil-äl-əlix
	ext-üt-əŋän	ext-üt-əŋil-äl	ext-üt-əŋil-äl-əlix
	pööt-üt-əŋän	pööt-üt-əŋil-äl	pööt-üt-əŋil-äl-əlix
	lip-üt-əŋän	lip-üt-əŋil-äl	lip-üt-əŋil-äl-əlix
	wiişk-üt-əŋän	wiişk-üt-əŋil-äl	wiişk-üt-əŋil-äl-əlix
	söj-üt-əŋän	söj-üt-əŋil-äl	söj-üt-əŋil-äl-əlix
b.	ruupeet-ut-əŋan	ruupeet-ut-əŋil-al	ruupeet-ut-əŋil-al-əlix
	ał-ut-əŋan	ał-ut-əŋil-al	ał-ut-əŋil-al-əlix
	part-ut-əŋan	part-ut-əŋil-al	part-ut-əŋil-al-əlix
	oom-ut-əŋan	oom-ut-əŋil-al	oom-ut-əŋil-al-əlix
	poosaa-ut-əŋan	poosaa-ut-əŋil-al	poosaa-ut-əŋil-al-əlix
	kaas-ut-əŋan	kaas-ut-əŋil-al	kaas-ut-əŋil-al-əlix
	aaraa-ut-əŋan	aaraa-ut-əŋil-al	aaraa-ut-əŋil-al-əlix
	por-ut-əŋan	por-ut-əŋil-al	por-ut-əŋil-al-əlix
	paajt-ut-əŋan	paajt-ut-əŋil-al	paajt-ut-əŋil-al-əlix
	nuuxl-ut-əŋan	nuuxl-ut-əŋil-al	nuuxl-ut-əŋil-al-əlix
	jowaa-ut-əŋan	jowaa-ut-əŋil-al	jowaa-ut-əŋil-al-əlix

⁵ It appears that the number markers used with possessive suffixes differ from the number markers used with non-possessive forms. /ŋan/ is used with non-possessive nouns to mark dual, while /ŋil/ is used before possessive suffixes to mark that the possessed is dual.

The data above confirm the generalization we have made: despite the length of a word or a number of affixes, every post-tonic vowel has the same specification for the feature [front] as the stressed vowel.

The generalizations about vowel harmony in the dialect of Khanty discussed here can be summarized as follows:

(25)

- a. every vowel to the right of a stressed vowel agrees with the stressed vowel with respect to the feature [\pm front];
- b. schwa, which is always epenthetic in the language, does not alternate, and there are no stressed (or long) schwas;
- c. long or short front central [e] can be a trigger for vowel harmony, causing all post-tonic vowels to be [+front], but does not alternate itself even when in post-tonic position;
- d. pre-tonic vowels can agree or disagree with each other or with the tonic vowel with respect to feature [\pm front], depending on underlying representation;
- e. the propagation of the feature [\pm front] does not depend on morphological structure or length of the word.

So far, this case of [\pm front] harmony looks exactly like the cases mentioned previously in this chapter: we have seen no evidence to distinguish between stress and head of an unbounded right-headed foot as a trigger of the vowel harmony. There is, however, some evidence that the language has binary foot structure, independent of the accent position. The evidence comes from two similar types of allomorphy, which we will be discussing next.

3.2.1.4 Rhythmic Allomorphy

There are at least a few suffixes in the dialect of Khanty under discussion, whose distribution depends on the prosodic shape of the stem. The distribution of these suffixes can only be predicted from binary foot structure, but not from the position of stress. One of these suffixes is the suffix marking the infinitive. In contrast with Eastern dialects, where the suffix appears optionally as /ta/ or /taʧə/ according to Honti (1993), (the first

part of the suffix, /ta/, is the same as present tense participial suffix, and the second part, /ɣə/, has the same form as Translative case suffix), in the dialect of Khanty we are investigating, the infinitive suffix appears as /ta/ if the base is completely parsed into a (moraic) binary foot and ends in a consonant, but as /taxi/ if there is material in the stem that is not parsed into binary feet:

(26)

a.

taal- ‘carry’	(taa)(l-əta) ‘to carry’	*(taa)(l-əta)xī
paajət- ‘drop’	(paaɟ)(t-əta) ‘to drop’	*(paaɟ)(t-əta)xī
kaas- ‘doubt’	(kaa)(s-əta) ‘to doubt’	*(kaa)(s-əta)xī
weel- ‘kill’	(wee)(l-ətä) ‘to kill’	*(wee)(l-ətä)xī
oom- ‘sit’	(oo)(m-əta) ‘to sit’	*(oo)(m-əta)xī
pööt- ‘freeze’	(pöö)(t-ətä) ‘to freeze’	*(pöö)(t-ətä)xī
laax- ‘wait’	(laa)(x-əta) ‘to wait’	*(laa)(x-əta)xī
wiişk- ‘throw’	(wiiş)(k-ətä) ‘to throw’	*(wiiş)(k-ətä)xī
ruupit- ‘work’	(ruu)(pee)(t-əta) ‘to work’	*(ruu)(pee)(t-əta)xī
wuuj- ‘see’	(wuu)(j-əta) ‘to see’	*(wuu)(j-əta)xī
ɟuuxəl- ‘follow’	(ɟuux)(l-əta) ‘to follow’	*(ɟuux)(l-əta)xī

b.

lip- ‘eat’	(lip-ə)(täxi) ‘to eat’	*(lip-ə)tä
xoc- ‘remain’	(xoc-ə)(taxi) ‘to remain’	*(xoc-ə)ta
aara- ‘break’	(aa)(raa)-(taxi) ‘to break’	*(aa)(raa)-tä
xöł- ‘disappear’	(xöł-ə)(täxi) ‘to disappear’	*(xöł-ə)tä
töj- ‘have’	(töj-ə)(täxi) ‘to have’	*(töj-ə)tä
lipət- ‘feed’ ⁶	(lipt-ə)(täxi) ‘to feed’	*(lipt-ə)tä
ał- ‘sleep’	(ał-ə)(taxi) ‘to sleep’	*(ał-ə)ta
part- ‘order’	(part-ə)(taxi) ‘to order’	*(part-ə)ta
soş- ‘walk’	(soş-ə)(taxi) ‘to walk’	*(soş-ə)ta
pax- ‘burst’	(pax-ə)(taxi) ‘to burst’	*(pax-ə)ta
exət- ‘cut’	(ext-ə)(täxi) ‘to cut’	*(ext-ə)tä
łaq- ‘enter’	(łaq-ə)(taxi) ‘to spit’	*(łaq-ə)ta
söj- ‘spit’	(söj-ə)(täxi) ‘spit’	*(söj-ə)tä
poɟc- ‘ripen’	(poɟc-ə)(taxi) ‘to ripen’	*(poɟc-ə)ta
por- ‘bite’	(por-ə)(taxi) ‘to bite’	*(por-ə)ta

⁶ Causative from *lip-* ‘eat’

jowa- ‘wrap (skins)’	jo(waa)-(taxi) ‘to wrap (skins)’	*jo(waa)-ta
poosa- ‘drip’	(poo)(saa)-(taxi) ‘to drip’	*(poo)(saa)-ta
xölä- ‘hear’	xö(laa)-(taxi) ‘to hear’	*xö(laa)-ta

Evidently, the distribution of the infinitive allomorphs depends on bimoraic foot parsing, i.e. the choice between allomorphs is determined by a requirement on complete parsing of a Phonological Word. In Maŋŋi, the language that is the closest relative of Khanty, we see cases of similar allomorphy (see Chapter 5 for a more detailed discussion). Note that the stems themselves are not altered, indicating that the alternation is indeed a case of genuine allomorphy rather than segmental alternation (deletion of the last syllable) of suffixes. Note also that epenthetic schwas are parsed into feet the same way underlying vowels are, and there is no change in epenthesis conditions to accommodate the requirement on complete parsing.

Within nominal domains, there are also a few suffixes that exhibit distribution of allomorphs similar to the infinitive. A suffix that attaches to nouns to form nouns with the meaning ‘the one possessing N’ has two allomorphs, /ŋ/ and /pi/. The suffix surfaces in several forms: *-ŋ/-əŋ/-pi/-pi/-əpi/-əpi*. The suffix is very productive, though not absolutely, and allomorphy seems to depend on the same requirement for complete parsing as the infinitival suffix:

(27)

a.	söörŋi ‘gold’	(söör)(ŋee-ŋ) ‘a rich person’
	ooxti ‘snake’	(oox)(tee-ŋ) ‘the one who has a snake’
	keesi ‘knife’	(kee)(see-ŋ) ‘the one who has a knife’
	kuuŋa ‘master’	(kuu)(ŋaa-ŋ) ‘slave’
	pusi ‘tail’	pu(see-ŋ) ‘the one who has a tail’
	apŋi ‘younger brother’	ap(ŋee-ŋ) ‘the one who has a younger brother’
	sari ‘salmon’	sa(ree-ŋ) ‘the one who has salmon’
	soxa ‘partridge’	so(xaa-ŋ) ‘the one who has a partridge’
	saa ‘tea’	(saa-ŋ) ‘grocery store’
	maŋeenä ‘car’	ma(ŋee)(näa-ŋ) ‘the one who has a car’
	ruupeeta ‘work’	(ruu)(pee)(taa-ŋ) ‘an employed person’
	oopee ‘older sister’	(oo)(pee-ŋ) ‘the one who has an older sister’
	ŋeemjä ‘family’	(ŋeem)(jää-ŋ) ‘a family man’

aaxee ‘daughter’	(aa)(xee-ŋ) ‘the one who has a daughter’
puwləpsi ‘tumor’	(puwləp)(see-ŋ) ‘a cancer patient’
apsəjee ‘bear’	(apsə)(jee-ŋ) ‘the one who has a bear’
b. jɪŋk ‘water’	(jɪŋk-əŋ) ‘a spring’
jik ‘son’	(jik-əŋ) ‘the one who has a son’
kew ‘stone’	(kew-əŋ) ‘the one that has stone ⁷ ’
xul ‘fish’	(xul-əŋ) ‘the one who has fish’
ɲaŋ ‘bread’	(ɲaŋ-əŋ) ‘the one who has bread’
lil ‘soul’	(lil-əŋ) ‘the one who has a soul’
tut ‘fire’	(tut-əŋ) ‘the one who has fire’
sam ‘heart’	(sam-əŋ) ‘kind person’
pöx ‘boy’	(pöx-əŋ) ‘mother of a boy’
nepək ‘letter’	(nepk-əŋ) ‘the one who has a letter’
toxəl ‘wing’	(toxl-əŋ) ‘an airplane ⁸ ’
toorum ‘god’	(too)(rum-əŋ) ‘shaman, priest’
xootjux ‘log’	(xoot)(jux-əŋ) ‘the one who has a log’

In (27a), the roots in derived environment end in a vowel and in a heavy syllable that is parsed into a bimoraic foot by itself, regardless of whether it is preceded by another bimoraic foot or a (parsed or unparsed) light syllable. The roots in (27b), on the other hand, differ from roots in (27a) in two respects: they end in a consonant, and they end in an unparsed light syllable. In both cases in (27) the allomorphs are distributed in such a way as to make the whole word parsed into bimoraic feet.

After roots that end in a consonant but can be parsed completely into binary feet, the allomorphs *-əpi/-əpī* are concatenated with the roots, instead of the *-əŋ/-ŋ* allomorphs:

(28)

a. kolxoz ⁹ ‘farm’	(kolxo)(z-əpī) ‘the one who has a farm’
malat ‘depth’	ma(laa)(t-əpī) ‘the one that has depth’
tutjux ‘firewood’	(tutju)(x-əpī) ‘the one that has firewood’
xoram ‘beauty’	xo(raa)(m-əpī) ‘a beauty, beautiful person’
wontut ‘pine forest’	(wontu)(t-əpī) ‘pine forest owner’

⁷ the meaning is lexicalized somewhat, ‘a place where one can get stones to use for different needs’.

⁸ Only acceptable to two of the speakers, and only as an outdated word, could be used in the ‘we used to call it ...’ context. Modern word for ‘airplane’ is a Russian borrowing *saamolt* < Russ. *samolot* (самолет).

⁹ Fairly recent borrowing from Russian.

kalaŋ ‘reindeer’	ka(laa)(ŋ-əpī) ‘the one who has reindeer’
uunltətīt ‘teacher’	(uunl)tə(tee)(t-əpī) ‘school principal’
palat ‘hight’	pa(laa)(t-əpī) ‘a tall person’
mojpar ‘young bear’	moj(paa)(r-əpī) ‘bear who recently had cubs’
xuunteejc ‘backpack’	(xuu)(ntee)(ŋc-əpī) ‘hiker, tourist’
pöskän ‘gun’	pös(kaa)(n-əpī) ‘the one who has a gun’
peλän ‘cloud’	pe(λaa)(ŋ-əpī) ‘thunderstorm’
jöxän ‘river’	jö(xaa)(n-əpī) ‘terrain near a river’
b.	
nareem ‘bridge’	na(ree)(m-əpī) ‘the one (river) with a bridge’
ŋawreem ‘child’	ŋaw(ree)(m-əpī) ‘a pregnant woman’
weer ‘business’	(wee)(r-əpī) ‘boss’
neepək ‘book’	(neep)(k-əpī) ‘library’
lixeen ‘fire’	li(xee)(n-əpī) ‘a burnt place’
xöjeeλ ‘son-in-law’	xö(jee)(λ-əpī) ‘mother-in-law’ ¹⁰
leetit ‘food’	(lee)(tee)(t-əpī) ‘(free) diner’
ŋeeləm ‘tongue’	(ŋeel)(m-əpī) ‘chatterbox, a talkative person’
xööxeeλ ‘female (animal)’	(xöö)(xee)(λ-əpī) ‘the one who has a mate’
öömp ‘dog’	(öö)(mp-əpī) ‘the one who has a (hunting) dog’

The remaining two shapes of the allomorph /pī/, -pī/-pī, are fairly rare, but just because the type of stems they attach to, that end in a vowel and an unparsed syllable, are rare. We do see these in some words, however, mostly with stems that are either borrowed or derived:

(29)

a.	luučē ‘incident’	(luu)(če-pī) ‘famous person’
	aakse ‘post office’	(aak)(se-pī) ‘mailman’
	aarne ‘rent’	(aar)(ne-pī) ‘landlord’
	toŋheto ‘little piece’	(toŋhe)(to-pī) ‘poor man’ ¹¹
	wuuloomu ‘grandmother’	(wuu)(loo)(mu-pī) ‘the one who has a large family’
	uurŋo ‘reason’	(uur)(ŋo-pī) ‘a useful thing’
	kaano ‘space’	(kaa)(no-pī) ‘the one that space’

¹⁰ Rarely used, usually in context ‘she has her daughters married off, she is a mother-in-law’.

¹¹ Pejorative.

b.	röömö ‘darkness’	(röö)(mö-pi) ‘lunar eclipse’
	koleeΛü ‘fiancé’ ¹²	ko(lee)(Λü-pi) ‘engaged, spoken for girl’
	siijü ‘reindeer calf’	(sii)(jü-pi) ‘reindeer who recently had calves’
	kuteeşü ‘a drunk’	ku(tee)(şü-pi) ‘a bar, known drinking spot’
	weelpe ‘criminal’	(weel)(pe-pi) ‘holding facility, jail’

In the data above, again, we see the confirmation of the generalizations we have made: the allomorphs of this suffix are distributed according to the requirement that the entire phonological word be parsed bimoraic feet. The generalizations about vowel harmony in the language are not changed: it is triggered by a stressed vowel and applies to all vowels to the right of it, regardless of the binary footing that is responsible for the allomorphy.

An inflectional suffix that also shows rhythmic allomorphy, though of a slightly different type, is the 1st person singular possessive suffix that is used with nouns that are also singular. The suffix has two allomorphs, /m/ and /eem/:

(30)

laaŋk ‘larch’	(laa)(ŋk-eem) ‘my larch’
weer ‘business’	(wee)(r-eem) ‘my business’
kuurt ‘village’	(kuu)(rt-eem) ‘my village’
xoot ‘house’	(xoo)(t-eem) ‘my house’
öömp ‘dog’	(öö)(mp-eem) ‘my dog’
taaş ‘herd’	(taa)(ş-eem) ‘my herd’
piixəl ‘fishing line’	(piix)(l-eem) ‘my fishing line’
neepək ‘book’	(neep)(k-eem) ‘my book’
jeernäs ‘dress’	(jeer)(nää)(s-eem) ‘my dress’
xöjeeΛ ‘son-in-law’	xö(jee)(Λ-eem) ‘my son-in-law’
mojpar ‘young bear’	moj(paa)(r-eem) ‘my young bear’
pöskän ‘gun’	pös(kaa)(n-eem) ‘my gun’
xuunteeŋc ‘backpack’	(xuu)(ntee)(ŋc-eem) ‘my backpack’

In contrast, if a stem ends in an unparsed syllable also ending in a consonant, the variant of the suffix concatenated with such a stem is *-əm*:

¹² In a pre-arranged marriage.

(31)

xatl ‘sun’	(xatl-əm) ‘my sun’
lunt ‘wild goose’	(lunt-əm) ‘my wild goose’
jik ‘son’	(jik-əm) ‘my son’
rex ‘berry’	(rex-əm) ‘my berry’
xul ‘fish’	(xul-əm) ‘my fish’
ɲaɲ ‘bread’	(ɲaɲ-əm) ‘my bread’
lil ‘soul’	(lil-əm) ‘my soul’
sam ‘heart’	(sam-əm) ‘my heart’
mit ‘salary’	(mit-əm) ‘my salary’
pöx ‘boy’	(pöx-əm) ‘my boy’
ox ‘head’	(ox-əm) ‘my head’
loŋkər ‘mouse’	(loŋkr-əm) ‘my mouse’
nepək ‘letter’	(nepk-əm) ‘my letter’
ɲoxəs ‘sable’	(ɲoxs-əm) ‘my sable’
xootjux ‘log’	(xoot)(jux-əm) ‘my log’

In cases where a stem ends in a vowel that is parsed into a bimoraic foot within the stem, *-m* is the allomorph that surfaces:

(32)

söörɲi ‘gold’	(söör)(ɲee-m) ‘my gold’
ooxti ‘snake’	(oox)(tee-m) ‘my snake’
keesi ‘knife’	(kee)(see-m) ‘my knife’
kuuʂa ‘master’	(kuu)(ʂaa-m) ‘my master’
jitä ‘enemy’	ji(taa-m) ‘my enemy’
ruupeeta ‘work’	(ruu)(pee)(taa-m) ‘my work’
xoni ‘stomach’	xo(nee-m) ‘my stomach’
ʂeemjä ‘family’	(ʂeem)(jää-m) ‘my family’
ɲöxä ‘meat’	ɲö(xaa-m) ‘my meat’
taxtī ‘skin’	tax(tee-m) ‘my skin’
maʂeenä ‘car’	ma(ʂee)(näa-m) ‘my car’
aaŋkee ‘mother’	(aa)(ŋkee-m) ‘my mother’
oopee ‘older sister’	(oo)(pee-m) ‘my older sister’

Note that another allomorph, *-jeem*, could be concatenated with the stems above and result in complete parsing. [j] is routinely epenthesized to avoid hiatus in the language, but this allomorph is ungrammatical for the speakers. One possible explanation is that, other things being equal, epenthesis is avoided, and the allomorph that is completely faithful to its underlying representation is selected.

Finally, when a stem ends in an unparsed vowel, we see the suffix surface in form *-jem*. It is difficult to say whether it is the third genuine allomorph of this possessive suffix or there is shortening of the long [ee] and [j] epenthesis. It is certainly the case that long [ee] is not shortened in closed syllables within roots, and there are suffixes of the same form /VVC/ that are **not** shortened to accommodate the requirement on foot structure, which I take as an indication that /-jem/ is the third allomorph. I could not, however, find another suffix with the long [ee] rather than [aa] or [ii]/[īi], and I leave the question whether *-jem* is the third allomorph of this suffix open here. The examples with this variant are below:

(33)

luučē ‘incident’	(luu)(če-jem) ‘my incident’
uurŋo ‘reason’	(uur)(ŋo-jem) ‘my reason’
röömö ‘darkness’	(röö)(mö-jem) ‘my darkness’
kuteeşü ‘a drunk’	ku(tee)(şü-jem) ‘my drunk’
aakse ‘post office’	(aak)(se-jem) ‘my post office’
koleeλü ‘fiancé’	ko(lee)(λü-jem) ‘my fiancé’
kaano ‘space’	(kaa)(no-jem) ‘my space’
aarne ‘rent’	(aar)(ne-jem) ‘my rent’

When we combine the two suffixes with foot structure-dependent allomorphy, the derivational suffix with the meaning ‘the one who has N’ /pi/ ~ /ŋ/ and the inflectional 1st person possessive suffix /eem/ ~ /m/ ~ /jem/, it is only the longest allomorph of the latter suffix that attaches to the stem ending in a consonant ([ŋ]) and the shortest allomorph surfaces with the stem ending in a vowel ([i] or [ī]):

(34)

a.	(şeem)(jää-ŋ) ‘a family man’	(şeem)(jää)-(ŋ-eem) ‘my family man’
	(too)(rum-əŋ) ‘shaman, priest’	(too)(rum-ə)(ŋ-eem) ‘my shaman, priest’
	(ruu)(pee)(taa-ŋ) ‘bread-winner’	(ruu)(pee)(taa)-(ŋ-eem) ‘my bread-winner’
	(sam-əŋ) ‘kind person’	(sam-ə)(ŋ-eem) ‘my kind person’
b.	(uunl)tə(tee)(t-əpī) ‘school principal’	(uunl)tə(tee)(t-əpī-m) ‘my school principal’
	pa(laa)(t-əpī) ‘a tall person’	pa(laa)(t-əpī-m) ‘my tall person’
	(wee)(r-əpī) ‘boss’	(wee)(r-əpī-m) ‘my boss’
	(neep)(k-əpī) ‘library’	(neep)(k-əpī-m) ‘my library’

Note that the alternating suffix /ŋ/ ~ /pi/ has the same distribution when followed by the (also alternating) /eem/ ~ /m/ ~ /jem/ as when it ends the word, so both the derived stem and the whole phonological word are parsed into bimoraic feet. In fact, the only morphological constituent here that might or might not be completely parsed into bimoraic feet is the root. One explanation would be a constraint that forces every morphological constituent (not just the entire grammatical word that seems to be equal to Prosodic Word) to be parsed, unless prevented from it by faithfulness constraints. Alternatively, these data might be explained by cyclic derivation within serial rule-based theory, and referring to a model that uses output-output constraints within OT, like Steriade's (1996) theory of Paradigm Uniformity, or Kenstowicz' (1995) theory of Uniform Exponence. The following set of data, however, rather points to the former type of analysis.

In contrast with the previous combination of two alternating suffixes, when an alternating suffix (the same /ŋ/ ~ /pi/ we previously discussed) is followed by a non-alternating one, the alternating suffix does not have the same distribution as without the non-alternating suffix (Lative /a/ in the examples below):

(35)

- | | | |
|----|--|---|
| a. | pe(ʎaa)(ŋ-əpi) ‘thunderstorm’ | pe(ʎaa)(ŋ-əŋ-a) ‘thunderstorm’ (Abess) |
| | | *pe(ʎaa)(ŋ-əpi)-ja |
| | (neep)(k-əpi) ‘library’ | (neep)(k-əŋ-ä) ‘library’ (Abess) |
| | | *(neep)(k-əpi)-jä |
| | xo(raa)(m-əpi) ‘a beauty’ | xo(raa)(m-əŋ-a) ‘a beauty’ (Abess) |
| | | *xo(raa)(m-əpi)-ja |
| | li(xee)(n-əpi) ‘a burnt place’ | li(xee)(n-əŋ-ä) ‘a burnt place’ (Abess) |
| | | *li(xee)(n-əpi)-jä ‘a burnt place’ |
| b. | (aar)(ne-pi) ‘landlord’ | (aar)(ne-ŋ-a) ‘landlord’ (Abess) |
| | | *(aar)(ne-pi)-ja |
| | (weel)(pe-pi) ‘holding facility, jail’ | (weel)(pe-ŋ-ä) ‘jail’ (Abess) |
| | | *(weel)(pe-pi)-jä |
| | (aak)(se-pi) ‘mailman’ | (aak)(se-ŋ-a) ‘mailman’ (Abess) |
| | | *(aak)(se-pi)-ja |

	ku(tee)(ʃü-pi) ‘a bar’	ku(tee)(ʃü-ŋ-ä) ‘a bar’ (Abess) *ku(tee)(ʃü-pi)-jä
c.	(söör)(nee-ŋ) ‘a rich person’	(söör)(nee)-(pi-jä) ‘a rich person’ (Abess) *(söör)(nee)-ŋ-ä
	(puwləp)(see-ŋ) ‘a cancer patient’	(puwləp)(see)-(pi-jä) ‘a cancer patient’ (Abess) *(puwləp)(see)-ŋ-ä
	(saa-ŋ) ‘grocery store’	(saa)-(pī-ja) ‘grocery store’ (Abess) *(saa)-ŋ-a
	(kuu)(ʃaa-ŋ) ‘slave’	(kuu)(ʃaa)-(pī-ja) ‘slave’ (Abess) *(kuu)(ʃaa)-ŋ-a
d.	(toxl-əŋ) ‘an airplane’	(toxl-ə)(pī-ja) ‘an airplane’ (Abess) *(toxl-ə)ŋ-a
	(sam-əŋ) ‘kind person’	(sam-ə)(pī-ja) ‘kind person’ (Abess) *(sam-ə)ŋ-a
	(jiŋk-əŋ) ‘a spring’	(jiŋk-ə)(pi-jä) ‘a spring’ (Abess) *(jiŋk-ə)ŋ-ä
	(pöx-əŋ) ‘mother of a boy’	(pöx-ə)(pi-jä) ‘mother of a boy’ (Abess) *(pöx-ə)ŋ-ä

As you can see from the data, the distribution of the /pi/ ~ /ŋ/ allomorphs is the opposite from the one we saw before, where the suffix is either word-final or followed by an alternating suffix. When followed by the Abessive suffix /a/, a variant of allomorph /ŋ/ is attached to the same stems that are concatenated with /pi/ otherwise, and a variant of /pi/ surfaces with the stems that take /ŋ/ when not followed by a non-alternating suffix. The opposite distribution makes sense if we consider the form of Abessive suffix that can surface as *-ja*, *-a*, *-jä*, and *-ä*, where all the forms are monosyllabic. The distribution of the suffix /ŋ/ ~ /pi/ is adjusted so that the monosyllabic Abessive suffix can attach to an unparsed syllable and ensure the complete bimoraic parsing of the resulting phonological word. Such a distribution rules out a cyclic analysis, as well as an output-output effect, and shows that there are two requirements on parsing, where a constraint requiring that every morphological constituent be parsed into bimoraic feet ranks lower than the constraint requiring every phonological word is parsed exhaustively. The latter constraint itself is outranked by constraints on syllable structure (schwa epenthesis is never

compromised to satisfy the binary parsing constraint), phonotactic constraints on roots (like complementary distribution of [aa] and [a] within roots), and phonotactic constraints on affixes (no alternations within suffixes, except the ones that are needed for syllable structure or vowel harmony).

To sum up, the dialect of Khanty under discussion has two separate phenomena that are influenced by word-internal prosody:

(36)

- a. [\pm front] vowel harmony that depends on the position of stress, since the trigger must be stressed; and
- b. allomorph selection that depends on binary (on the moraic level) foot structure of the language.

Since one of our tasks in this chapter is to discover whether or not the grammar refers to unbounded feet to account for segmental alternations, the case we have just investigated is of importance: the vowel harmony clearly depends on prominence and not constituency. We cannot refer to the notion of constituency (unbounded foot) to model the prosodic condition on vowel harmony, since the language has constituency that is incongruent with unbounded feet, namely bounded bimoraic feet that are marked by the allomorphic alternations.

The case we have just investigated also confirms one of the main theoretical proposals of the thesis, namely the hypothesis that prominence and constituency are distinct notions that may or may not be distinguishable in any particular language.

Note also, that while prominence and foot structure in the language are mismatched, it is not the constraint that forces all prominence to be aligned with an edge of a foot that is violated: stress is always aligned with the left of some foot in any word. However, because of rhythmic allomorph selection, we know that words in Khanty are parsed into multiple binary feet when the length allows, and not every foot has a prominent syllable in it. In other words, the constraint on aligning every edge of a foot to a gridmark is violated:

Tableau 1

/põx/-/pi/-/ja/ 'mother of a boy' (Abess)	WTS	ALIGN-L ó, PWD	ALIGN-L (FT, LEV _n GRID)
☞ a. (põx-ə)(pi-jä)			*
b. (põx-ə)(pĩ-jä)		*!	

The Weight-to-Stress constraint outranks the constraint on aligning the stressed syllable with the left edge of a word, as demonstrated by the following example:

Tableau 2

/wixeeta/ 'cry, shout'	W-t-S	ALIGN-L ó, PWD	ALIGN-L (FT, LEV _n GRID)
☞ a. wi(xée)ta		*	
b. wí(xee)ta	*!		*

Since the foot type in the language is moraic, and the Weight-to-Stress principle is violated only when there is more than one syllable containing a long vowel, the stress in the language is always aligned with the left edge of **some** foot, so the ALIGN-L (LEV_nGRID, FT) is never violated; the mismatch, however is caused by not all feet receiving a degree of prominence. The parsing of words into binary moraic feet is manifested by rhythmic allomorph selection. Vowel harmony, however, takes into account only prominence, and not the foot structure of the language.

Recall that another case similar to Khanty that we examined in the preceding chapter of this thesis is the case of Meadow Mari vowel harmony. We will briefly return to the Mari case to compare it with Khanty and because it also presents a type of prosody-dependent vowel harmony that we have been investigating in this chapter.

3.2.2 Eastern Mari Rounding Harmony Revisited

In the previous chapter of this dissertation we examined vowel alternations in Meadow Mari with respect to the features [±round] and [±front]. While both types of vowel harmony are present in the language, only the rounding harmony, and not the [±front] harmony, has a prosodic condition on the trigger. The contrast is shown below:

(37)

- | | | |
|----|-----------------|--------------------------------|
| a. | kə́lmó ‘shovel’ | kə́lmó-šö ‘his/her/its shovel’ |
| | kaβún ‘pumpkin’ | kaβún-əško ‘pumpkin’ (III) |
| | ʃełó ‘wheat’ | ʃełó-škö ‘wheat’ (III) |
| b. | kögörčén ‘dove’ | kögörčén-še ‘his/her/its dove’ |
| | ürémə ‘street’ | ürémə-ške ‘street’ (III) |
| | čödrá ‘forest’ | čödrá-še ‘his/her/its forest’ |

In (37a), the roots are disharmonic in that the initial vowel of the root is [-round], and the second vowel, which is always stressed in both derived and underived forms, is [+round]. The vowel of the suffixes surfaces as a [+round] vowel, harmonizing with the stressed, rather than the initial vowel of the root.

The data in (37b) illustrates the same generalization: the condition on the trigger of the rounding harmony is stress. The roots have a round initial vowel, but the stressed vowel is [-round]. The vowel of the possessive or the Illative suffix, therefore, harmonizes with the stressed vowel and shows up unrounded.

Similar to what we see in the dialect of Khanty we discussed in the previous subsection, such a pattern can be analyzed either as triggered by the stressed vowel, or by the head of an unbounded foot. Just as in Khanty, however, we see a phenomenon in Meadow Mari that suggests that an unbounded foot cannot be relevant here, because the language also has a binary foot structure, not an unbounded one. While in Khanty the phenomenon is unrelated to vowel harmony, in Meadow Mari binary foot structure restricts the stress-triggered (as well as [±front] harmony that is triggered by initial vowel regardless of whether or not it is stressed) rounding harmony itself. Recall that only foot-final, but not foot-initial underlying schwas are subject to vowel harmony. Therefore, while the **trigger** of IDENT-violating rounding harmony has the same ‘must bear stress’ condition as in DEP-violating harmony (schwa vocalization), foot structure of the language **restricts** the former, but not the latter type of rounding harmony. Our analysis of DEP-violating harmony in chapter 2, therefore, should be essentially the same for the IDENT-violating

rounding harmony, where the foot structure restriction just does not apply when the underlying target is not a schwa:

Tableau 3

/kaβun/-/škV _{[-high, -low, -round]/} 'pumpkin' (Ill)	DEP _[±round] & ALIGN-R (V, FT)	AGREE-R (V _[±round] , V̆)	IDENT _[±round]
a. (kaβú)(n-əško)	✓		*
b. (kaβú)(n-əške)	✓	*!	

Neither of the candidates in the tableau above violates the highest-ranked (conjoined) constraint, since there is no [round] feature in any of the outputs that is not present in the input. Candidate (b) violates the AGREE-R constraint, since the final vowel in this candidate does not agree with the stressed vowel with respect to the specification of the feature round. Therefore, even though candidate (a) violates the IDENT_[±round] constraint, it is still the optimal candidate. The restriction of the binary footing has no effect here, simply because it is a restriction on DEP-violating harmony (schwa vocalization), not on IDENT-violating one, i.e. it is a restriction on the target of the rounding harmony that is not relevant for the candidates in the tableau above.

To summarize, the case of Meadow Mari rounding harmony is similar to the [±front] harmony in Khanty in that (i) both have a prosodic condition on the trigger of the respective types of harmony, and (ii) both have evidence of binary foot structure that excludes analyses utilizing a notion of unbounded foot, as done in Flemming (1994), among other similar analyses. The difference between the two cases of rounding harmony lies in the fact that while the evidence of binary foot structure in Khanty comes from a phenomenon unrelated to vowel harmony (restriction on allomorph selection), binary footing in Meadow Mari restricts the rounding (as well as [±front]) harmony itself, when the harmony would result in a DEP violation.

Thus, at least in the two cases of vowel harmony just discussed, the notion of unbounded foot cannot be the right notion to use to model these patterns.

3.2.3 Preliminary Remarks on Stress-dependent Vowel Harmony

There are a few preliminary typological remarks on the prosodic conditions that stress or head of an unbounded foot imposes on vowel harmony. First of all, the influence of stress always seems to be on the trigger rather than on the target of a segmental alternation, namely that the trigger must be stressed/be the head of an unbounded foot. Secondly, the appearance of stress never seems to restrict vowel harmony, only to serve as a cause for it. Guaraní might be considered a counterexample to this claim, but the data can be analyzed as involving **triggering** of [-nasal] harmony to its right by a stressed oral vowel rather than **restricting** preceding [+nasal] percolation. Finally, the domain of all the harmony phenomena considered above seems to be a Prosodic or morphological word, not a sub-word constituent like a foot.

With these preliminary typological generalizations in mind, we now turn to other most typical set of phenomena that can be influenced by prominence/unbounded foot boundary, various consonantal alternations in the onset of an accented or unaccented syllable.

3.3 Consonants In Tonic and Post-tonic Syllables

Lenition is one of the most commonly mentioned phenomena influenced by the position of accent.

According to Christmas and Christmas (1975), intervocalic consonants in **Kupia** are generally more lenis in non-prominent syllables than word-initial consonants that are onsets of stressed syllables. /p, t, d/ are reported to have distinctive variants in this position. /p/ is optionally realized as lenis intervocalically in the onset of unstressed syllables. Unfortunately, Christmas and Christmas (1975) do not mention whether the preceding syllable has to be stressed or not.

The realization of lenis /p/ is unclear. Kirchner (1998) represents this segment as [ϕ], so the change can be either in voicing, or frication, or both.

Kupia also has another stress-sensitive alternation: the retroflex coronal /ʈ/ is optionally flapped intervocalically in onsets of unstressed syllables, according to Christmas and Christmas (1975).

In contrast, the retroflex voiced stop /ɖ/ is always flapped intervocalically, i.e. in onsets of unstressed syllables.

In **Silacayoapan Mixteco**, /t/ and /ʒ/ lenite in onsets of unstressed syllables (North and Shields 1977). The consonant inventory of the language is /p, t, c, k, k^w, ʔ, ^mb, ⁿd, ^jʃ, ^ɲg, β, s, ʃ, ʒ, h, m, n, ɲ, l, r, j/. The language has only primary stress that is assigned to the first part of a leftmost foot. All feet are aligned with the right edge of the word, so the stressed syllable might be either word-initial or the second syllable in the word.

Voiceless stops are unaspirated except for word-initial [t], which has some aspiration. Lenition of /t/ applies in onsets of unaccented syllables. The reflex of this lenition is unclear: North and Shields (1977) describe it as ‘softened’ and represent with [ɛ̃]. In addition, /ʒ/ in the language alternates with [j] in post-tonic syllables in rapid speech. It is unclear what, if any, role tone plays in these alternations.

Possibly another expression of lenition comes from voicing of prenasalized stops foot-initially. According to North and Shields (1977), prenasalized stops are also optionally devoiced in onsets of unaccented syllables. Glottal stop is inserted word-initially in underlyingly onsetless syllables and in onsets of stressed syllables.

In **Djabugai**, /r/ is pronounced as [r] between a stressed and an unstressed vowels (Patz (1991)). According to Patz, the flapping is more noticeable between two low [a]s, less obvious between identical high vowels, and least obvious between different vowels. Between different vowels, [r] and [ɾ] are in free variation.

The opposite of lenition, various phenomena involving fortition, are also fairly commonly triggered by stress.

For example, **Gualavia Zapotec** has a contrast between fortis and lenis consonants. Fortis consonants are /p, t, k, ts, tʃ, tʃ, s, ʃ, ɕ, m, n, l/. According to Jones and Knudson (1977), these consonants are generally longer and more tense than lenis consonants. Although Jones and Knudson do not discuss what the difference between the fortis /m, n, and l/ on the one hand, and the lenis /m, n, and l/, on the other hand, is, it appears to be a voicing contrast: the rest of the fortis/lenis distinction certainly seems to be that of voicing (possibly in addition to length distinction, or even the primary distinction as opposed to length or ‘tensing’).

Lenis consonants are /b, d, g, dz, dʒ, z, ʒ, j, m, n, l, r/. Lenis consonants make the preceding oral vowel lengthen.

The language has both stress and tone. There is one stress per word, usually in the penultimate syllable. Stressed syllables are reported to have higher pitch. Fortis consonants geminate intervocalically after stressed vowels. Fortis stops and the nasal are also geminated after stressed vowels before the glides /j, w/ or before a voiced consonant. Gemination does not occur word-initially or in onset of stressed syllables.

(38)

[ɕíttjaʔ]	‘my onion’	cf.	[ɕágaʔ]	‘my tree’	*[ɕágggaʔ]
[ɕlámmaʔ]	‘my boss’				
[ɕapínnaʔ]	‘my pine tree’				
[ɕpákkaʔ]	‘my tadpole’				
[déttsaʔ]	‘my back’				
[náɕɕiŋ]	‘it is sweet’				
[náannaʔ]	‘I know’				
[ráppaʔ]	‘I have’				

Additional durational processes occur in stressed vowels. Stressed oral vowels lengthen before lenis consonants (that presumably cannot geminate), as in /ragoʔ/ [ráʔoʔ] ‘you bite’. Stressed laryngeal vowels become interrupted, as in /ti^ʔ.sj/ [tí^ʔ.i.sj]. It could be that all of these phenomena are caused by the requirement that stressed syllables must surface heavy. If this is the case, gemination should be considered ‘real’ gemination, where the first part of the geminate closes a syllable and contributes to the syllable’s weight, rather than ‘lengthening’ or ‘tensing’ of voiceless consonants.

Kakumasu (1986) reports that in **Urubu-Kaapor**, oral stops /p, t, k, k^w, ʔ/ lengthen in the onsets of syllables that receive primary stress (39 a-c). Primary stress is assigned to the ultimate syllable in a word. Lengthening does not occur in secondary-stressed syllables (39c), or in primary-stressed syllables for nasals, sonorants or fricatives (39d-f):

(39)

a.	/katu/	[kattú]	‘it is good’
b.	/kaʔa/	[kaʔá]	‘forest’
c.	/nupãta/	[nupãttá]	‘he will hit’
d.	/uruma/	[urumã]	‘duck’
e.	/waruwa/	[wàruwá]	‘glass’
f.	/ixa/	[i.ʃá]	‘it is a fact’

It is unclear how stress assignment works in this language. However, the data in (39) suggests that secondary stress is assigned to heads of moraic iambs where the last (or the only) foot is aligned with the right edge of the Prosodic Word. In cases of ‘lengthening’, secondary stress can precede the primary stress, so it is possible that, once again, the gemination makes the antepenultimate syllable heavy.

In **West Tarangan** (Nivens (1992)), /j/ affricates and /w/ occlusivizes in word-initial (40a) and in onsets of stressed syllables (40b). In onsets of unstressed non-initial syllables, the glides surface as such, without affrication or occlusivization (40c). The language has moraic trochees, with parsing starting from the right.

(40)

a.	/wɔwa/	[gɔ́wə]	‘blossom’
	/wajmoj+na/	[gajmójnə]	‘slow’ 3sg
	/jabin/	[dʒábin]	‘many’
	/jirua/	[dʒíruə]	‘(sp. of) tree’
b.	/suwakan/	[sugákən]	‘elephant tusk’
	/bijarum/	[bidʒárum]	‘whale’
	/i/-/jɔw/	[idʒów]	‘see’ 3 sg
c.	/kawar/	[káwər]	‘(sp. of) fish’
	/rajan/	[rájan]	‘boat shelter’
	/rɔraw/	[rɔ́.rəw]	‘heat’

Given that the fortition of the glides applies to both onsets of stressed syllables and word-initial glides, it is possible that the phenomenon is foot-dependent rather than stress-dependent if the language allows degenerate feet, so every word-initial glide is also foot-initial, and the constraint that drives this type of fortition is similar to an Onset Condition, requiring that every foot start with the strongest (or least sonorous) possible consonant.

In **Guayabero**, stress-sensitive fricativization of /w/ is reported in Keels (1985) (see also Kirchner (1998)). Stress falls on the last or penultimate syllable of the stem, and it does not seem to be predictable which one of the two.

There are additional conditions on fricativization of the glide: it fricativizes to [β] before a stressed front vowel, and after a front or high central vowel. After a back or low vowel, /w/ is realized as a high back rounded off-glide [ʷ] in codas. In all other contexts, /w/ is pronounced as [w].

In **Los Reyes Metzontla Popoloca** (Veerman-Leichsenring (1984)), onset liquids, approximants and voiced nasals are geminated after a stressed syllable. Stress in the language generally falls on the penultimate syllable of the word. Stressed syllables have a coda or a long vowel or diphthong.

In addition, according to Veerman-Leichsenring's analysis, complex segments such as prenasalized, aspirated and voiceless nasal consonants are 'disintegrated' into a coda and an onset.

Since there are no actual alternations shown in the source, it is hard to see whether 'disintegration' really does happen, though the description presumably reflects speakers' intuitions. Both gemination and disintegration appear to be similar to some of the above examples in that they are caused by the position of stress, where stressed syllables are required to be heavy. The cases of lenition we saw in this chapter above, as well as additional examples in Lavoie (2001) and González (2003), seem to also be **caused** rather than restricted by stress, though additional restrictions like the word-initial vs. non-initial environment, height of vowels etc. might apply.

We will now turn to another case of similar lenition before stressed vowels (with additional restrictions), where we can actually see synchronic alternations that are due to the different position of stress in different morphophonological environments.

3.3.1 Mokša Lenition

Mokša is a Uralic Mordvin (Mordovian) language spoken in western part of Autonomous Republic of Mordva in Russia, as well as in Samara, Orenburg, Nizhni Novgorod, Saratov and Penza regions; some scattered speakers can be found in many other parts of Russian Federation. Mokša's closest relative is Erzja; the two differ mostly in phonology, and in lesser degree in morphology.

The data presented here was collected in summer (2006) only in Nizhni Novgorod region. The speakers interviewed are all bilingual in Russian and Mokša, though all identify themselves as Mokša-Mordva ethnically. I interviewed 14 subjects total, 7 men and 7 women, from 45 to 60 years old. The judgments of speakers were consistent, with some minor exceptions that are noted below.

Mokša has stress-sensitive lenition of some consonants that is of interest to us, since stress shifts cause synchronic alternations of lenited and non-lenited consonants. One unusual property of Mokša consonant system is that it includes both voiced and voiceless liquids and glide underlyingly. Voiceless liquids and glide are marked with a circle ($l̥$, $r̥$ and $j̥$) under the consonant; the superscript (j) indicates palatalized consonants.

3.3.1.1 Stress

There is one stressed syllable per word in Mokša that depends on relative sonority of vowels and their position. Below is the vowel inventory of the dialect of Mokša under investigation:

(41)

i		u
e	ə	o
ä	a	

For the purposes of stress assignment, there are two classes of vowels in the language: lower-sonority [i, u, ə], and higher-sonority [a, ä, o, e]. Here, as in Nganasan, we see some sonority conflation. When a word contains only vowels of the same sonority class, the stress is assigned to the initial syllable in the word:

(42)

- | | |
|---|--|
| <p>a. tʰádʲä ‘mother’
 kózjā ‘rich person’
 lópa ‘leaf’
 érʲgʲä ‘force’
 áka ‘older sister; aunt’
 rádnʲä ‘family, a relative’
 ármak ‘money’
 pángo ‘mushroom’
 móda ‘earth’</p> | <p>b. bʲónʲəč ‘boat’
 ínʲzʲəts ‘raspberry’
 mǽkur ‘buttocks’
 kǽšnʲi ‘iron’
 júžə ‘skin’
 kúšin ‘jug’
 pǽjəʲʲi ‘knife’
 sʲiʳək ‘elm’
 kílʲuj ‘birch’</p> |
|---|--|

s'éja 'goat'
 ézna 'brother-in-law'
 s'él'm'ä 'eye'

púŕ'kinə 'thunder'
 účit'əl' 'teacher'
 sǒku 'tuft'

Note that there is no difference in sonority within a sonority class, at least as far as stress is concerned: in (42a), all the vowels in the examples are of higher-sonority class, and the position of stress does not vary dependent on what particular vowel is in the initial syllable, even though if the second or third syllable contains a more sonorous vowel according to universal sonority hierarchy. For example, a word for 'earth' *móda* has a mid vowel [o] followed by a higher-sonority [a], but the stress is assigned to the initial syllable nevertheless. Similarly, the words in (42b) contain vowels of the lower-sonority class only, and the initial syllable is always prominent, even if a schwa is followed by [u], as in the word for 'tuft' *sǒku*, or [i], as in *kǎš'ni* 'iron'.

Stress, however, is not restricted to the initial syllable in the language. Below we can see the distribution of stress in nouns that have vowels of different sonority classes:

(43)

a. páŕsi 'silk'
 šánžə 'spider'
 šári 'wheel'
 áši 'well'
 k'énk'ǎš 'door'
 kágəd 'paper'
 stólpə 'pillar'
 álkəs 'bed'
 kán'ǎst 'hemp'
 bál'mi 'window'
 bārəs 'lamb'
 čáŕə 'acorn'
 l'éngə '(tree) bark'
 ájkər 'stallion'

b. ulá ~ uwá 'car'
 viná 'alcohol'
 r'ib'éž ~ r'ib'j'éž 'fox'
 kurká ~ kurgá 'turkey'
 kir'ká ~ kir'gá 'neck'
 t'əb'é ~ t'əβ'j'é 'work'
 kundáj ~ kunǎáj 'catcher'
 əzná 'older sister's husband'
 pingá ~ pinǎá 'period of time'
 ts'ərǎ 'son'
 mir'd'ǎ ~ mir'ǎ'ǎ 'man, husband'
 čutó ~ čudó 'tree'
 kər's'ǎ ~ kər'z'ǎ 'bread'
 t'ətrát'ka ~ t'ədrát'ka 'notebook'

¹³ Two of the speakers have voiced liquid in this word instead of the voiceless liquid the rest of the speakers have. It is also worth mentioning that the two speakers who have voiced liquid are illiterate in Moksa, while the rest are not, and that the (Cyrillics based) writing system does reflect the voiceless liquids and the glide with a combination of letters (*lx* for [l], *lβx* for [l^β], *px* for [ɾ], *pβx* for [ɾ^β], and *ǎx* for [j]).

We can tell from the data above that when a higher-sonority vowel is followed by a lower-sonority vowel (43a), the stress is still assigned to the initial syllable. When, however, a lower-sonority vowel is followed by a higher-sonority vowel (43b), it is the higher-sonority vowel that receives the stress. When there are two higher-sonority vowels following a lower-sonority vowel, like in the word for ‘notebook’ *tʰətrátʰka* ~ *tʰədrátʰka*, it is the leftmost higher-sonority vowels that emerges as the prominent one. In short, the pattern is a ‘default-to-same’: stress is assigned to the leftmost higher-sonority vowel, otherwise, to the leftmost.

Derived words are apparently evaluated the same way as underived. If a suffix with a higher-sonority vowel is added to a root with all lower-sonority vowels, stress surfaces on the vowel of the suffix. If, on the other hand, there is a higher-sonority vowel in the root, the stress is assigned to the same vowel in derived and underived words:

(44)

- | | | |
|----|---|--|
| a. | <p>tul ‘fire’</p> <p>kud ‘house’</p> <p>pilʲiʒʲi ‘leg’</p> <p>idʲ ‘baby’</p> <p>virʲ ‘forest’</p> <p>sʲtʲirʲ ‘girl, young woman’</p> <p>kud ‘house’</p> <p>piks ‘rope’</p> <p>bʲənʲəč ‘boat’</p> <p>inʲzʲəts ‘raspberry’</p> <p>pəjəʲi ‘knife’</p> <p>kəʂnʲi ‘iron’</p> <p>sʲimənʲ ‘tribe’</p> <p>juʒə ‘skin’</p> <p>sʲiʀək ‘elm’</p> <p>puʀʲkinə ‘thunder’</p> | <p>tul-gá ~ tul-γá ‘fire’ (Prol)</p> <p>kud-gá ‘house’ (Prol)</p> <p>pilʲiʒʲi-gá ‘leg’ (Prol)</p> <p>idʲ-gá ‘baby’ (Prol)</p> <p>virʲ-gá ~ virʲ-γá ‘forest’ (Prol)</p> <p>sʲtʲirʲ-gá ~ sʲtʲirʲ-γá ‘girl, young woman’ (Prol)</p> <p>kud-gá ‘house’ (Prol)</p> <p>piks-ká ‘rope’ (Prol)</p> <p>bʲənʲəč-ká ‘boat’ (Prol)</p> <p>inʲzʲəts-ká ‘raspberry’ (Prol)</p> <p>pəjəʲi-ká ~ pəjəʲi-ga ~ pəjəʲi-γa ‘knife’ (Prol)</p> <p>kəʂnʲi-gá ~ kəʂnʲi-γá ‘iron’ (Prol)</p> <p>sʲimənʲ-gá ~ sʲimənʲ-γá ‘tribe’ (Prol)</p> <p>juʒə-gá ~ juʒə-γá ‘skin’ (Prol)</p> <p>sʲiʀək-ká ‘elm’ (Prol)</p> <p>puʀʲkinə-gá ~ puʀʲkinə-γá ‘thunder’ (Prol)</p> |
| b. | <p>mólatka ‘hammer’</p> <p>kárəskə ‘shoelace’</p> <p>māʲi ‘desire, hope’</p> | <p>mólatka-ga ‘hammer’ (Prol)</p> <p>kárəskə-ga ‘shoelace’ (Prol)</p> <p>māʲi-ga ‘desire, hope’ (Prol)</p> |

k ⁱ ed ⁱ ‘(animal) skin’	k ⁱ éd ⁱ -ga ‘(animal) skin’ (Prol)
val ‘word’	vál-ga ‘word’ (Prol)
p ^r í ^a ‘head’	p ^r í ^a -ga ‘head’ (Prol)
kan ⁱ p ‘hemp’	kán ⁱ p-ka ‘hemp’ (Prol)
ármak ‘money’	ármak-a ‘money’ (Prol)
pángo ‘mushroom’	pángo-ga ‘mushroom’ (Prol)
kárdaž ¹⁴ ‘yard’	kárdaž-ga ‘yard’ (Prol)
ál ⁱ ä ‘young man’	ál ⁱ ä-ga ‘young man’ (Prol)
kudá ~ kuďá ‘matchmaker’	kudá-ga ~ kuďá-ga ‘matchmaker’ (Prol)
kənák ‘guest’	kənák-a ‘guest’ (Prol)
čutó ~ čudó ‘tree’	čutó-ga ~ čudó-ga ‘tree’ (Prol)
kər ⁱ s ⁱ á ~ kər ⁱ z ⁱ á ‘bread’	kər ⁱ s ⁱ á-ga ~ kər ⁱ z ⁱ á-ga ‘bread’ (Prol)

Note again that sonority of the vowels matters only as far as the distinction of [i, u, ə] vs. [e, o, a, ä] is concerned. There is no more detailed division within these sonority classes, i.e., for the purposes of stress assignment, [i] is not more sonorous than [ə], and [a] is not more sonorous than [o]. There is a stressed vowel sonority constraint that we need to account for the stress pattern in the language (see more general stressed vowel sonority constraints formulated in chapter 2), in addition to the constraint that draws prominence to the left edge of a Prosodic Word:

(45)

*GRID_n/ə, i, i•u There must not be ə, i or i•u with a gridmark on Level_n¹⁵

ALIGN-L (ó, PWD) Align the left edge of a stressed syllable with the left edge of a Prosodic Word

The sonority of the stressed vowel constraint does not make a distinction between different vowels within the set, so a stressed vowel that belongs to the set above equally violates the constraint.

¹⁴ Two of the speakers do not use this word, though they do recognize it; they use what appears to be a Russian borrowing *dur* < Russ. *dvor* ‘yard’

¹⁵ *i* is not part of vowel inventory of the language, so its inclusion in this constraint is for the purposes of consistency.

Suffixes that have one of the lower-sonority vowels do not attract stress from the root, even if the root itself contains only lower-sonority vowels itself (46b):

(46)

a.	<p> âkšama ‘cold’ pótalak ‘ceiling’ káræskə ‘shoelace’ kumánža ‘knee’ tsʲərá ‘son’ kudá ~ kuďá ‘matchmaker’ ájkər ‘stallion’ bálʲmi ‘window’ </p>	<p> âkšama-ndi ‘cold’ (Dat) pótalak-əndi ‘ceiling’ (Dat) káræskə-ndi ‘shoelace’ (Dat) kumánža-ndi ‘knee’ (Dat) tsʲərá-ndi ‘son’ (Dat) kudá-ndi ~ kuďá-ndi ‘matchmaker’ (Dat) ájkər-əndi ‘stallion’ (Dat) bálʲmi-ndi ‘window’ (Dat) </p>
b.	<p> sʲibəsʲ ‘collar’ bʲənʲəč ‘boat’ lúgə ‘meadow’ írʲdʲəzʲ ‘rib’ pəjəʲ ‘knife’ kárkəs ‘belt’ sʲálʲbʲedʲ ‘tear’ kíʲuj ‘birch’ úškər ‘drawstring’ júžə ‘skin’ sáku ‘tuft’ kúšin ‘jug’ sʲĩrək ‘elm’ sʲimənʲ ‘tribe’ súra ‘millet’ </p>	<p> sʲibəsʲ-əndi ‘collar’ (Dat) bʲənʲəč-əndi ‘boat’ (Dat) lúgə-ndi ‘meadow’ (Dat) írʲdʲəzʲ-əndi ‘rib’ (Dat) pəjəʲ-əndi ‘knife’ (Dat) kárkəs-əndi ‘belt’ (Dat) sʲálʲbʲedʲ-əndi ‘tear’ (Dat) kíʲuj-əndi ‘birch’ (Dat) úškər-əndi ‘drawstring’ (Dat) júžə-ndi ‘skin’ (Dat) sáku-ndi ‘tuft’ (Dat) kúšin-əndi ‘jug’ (Dat) sʲĩrək-əndi ‘elm’ (Dat) sʲimənʲ-əndi ‘tribe’ (Dat) súra-ndi ‘millet’ (Dat) </p>

The data above confirm our generalization about the principles of stress assignment in Mokša: prominence is assigned to the leftmost vowel of the higher-sonority set of vowels {a, ä, o, e}. If there is no higher-sonority vowel in the word, stress falls on the leftmost vowel. Morphological makeup of the word is not significant for stress assignment that treats derived words the same way as underived. Within each of the two sonority classes, there is no difference in sonority with respect to stress assignment.

The pattern of stress assignment in the language, therefore, can be accounted for by the two constraints formulated in (45) above, with the stressed vowel sonority constraint outranking the constraint that requires that prominence be aligned with the left edge of a Prosodic Word:

Tableau 4

/piks/-/ka/ 'rope' (Prol)	*GRID _n /ə, i, i•u	ALIGN-L (σ, PWD)
☞ a. piks-ká		*
b. pík-s-ka	*!	

As the tableau above shows, the candidate with the stress on the initial syllable, while satisfying the alignment constraint, violates the higher-ranking constraint on the sonority of stressed vowels and is, therefore, discarded.

The following tableau shows that the same constraints with the same ranking will pick a candidate with the leftmost higher-sonority vowel:

Tableau 5

kumánža-ndi 'knee' (Dat)	*GRID _n /ə, i, i•u	ALIGN-L (σ, PWD)
☞ a. kumánža-ndi		*
b. kumanžá-ndi		**!
c. kúmanža-ndi	*!	

Candidate (c) in the above tableau has stress on the initial vowel [u], which belongs to the lower-sonority set and is therefore banned by the sonority constraint. Of the remaining two candidates, candidate (b) has its stress assigned one syllable further away from the left edge than candidate (a). In this case, therefore, candidate (a), with the stress on the second syllable, emerges as the winner.

Finally, the next tableau illustrates that the same constraints with the same ranking account for stress in examples with only lower-sonority (the upper part of the tableau) and with only higher-sonority vowels (the lower part of the tableau):

Tableau 6

/puṛ ^h kinə/ 'thunder'	*GRID _n /ə, i, i•u	ALIGN-L (ó, PWD)
☞ a. púṛ ^h kinə	*	
b. puṛ ^h kínə	*	*!
c. puṛ ^h kinó	*	*!*
/pango/-/ka/ 'mushroom' (Prol)		
☞ a. pángo-ga		
b. pangó-ga		*!
c. pango-gá		*!*

In both cases in the above tableau, the sonority constraint is inactive: in the upper part of the tableau, the candidates contain only vowels of the lower-sonority set; hence, each of these candidates violates the constraint, regardless of stress placement. The decision is made by the constraint aligning the stressed syllable to the left edge of a Phonological Word, and only candidate (a) satisfies this constraint.

Similarly, in the lower part of Tableau 6, all the candidates satisfy the sonority constraint, since none of them contain the vowels to which the constraint refers; the alignment constraint bans candidates (b) and (c), where stressed syllables are not aligned with the left edge of the Phonological Word.

Note that we have accounted for the pattern of stress placement in Mokša without any reference to foot structure of the language. The reason for such an account is that, even though Mokša also has a pattern of prosody-dependent lenition, discussed in detail below, there is no empirical evidence of foot structure in the language. Under the present proposal, however, constraints on Prominence Alignment will cause the stressed syllable to be aligned with an edge of a foot, if the constraints we have used above do not outrank Prominence Alignment constraints. Given that there is no empirical evidence of such a situation, economy dictates that prominence and foot structure in the language match.

3.3.1.2 Lenition

As the reader might have noticed from the previous subsection, certain consonants can appear in two variants in Mokša. The variation appears only in onsets of stressed syllables. It appears that a stressed vowel is triggering optional lenition of a consonant preceding it. Word-initial consonants, even if they are onsets of stressed syllables, never lenite. There is also no lenition if the target consonant is preceded by an obstruent¹⁶, and voiced sonorants are not subject to lenition. Below are the reflexes of the lenition:

(47)

Underlying	p p ^j	t t ^j	k k ^j	b b ^j	d d ^j	g g ^j	r r ^j	l l ^j	j	s s ^j	š š ^j	č	ts	m	n
Onset of a stressed syllable	b b ^j	d d ^j	g g ^j	β β ^j	ð ð ^j	ɣ ɣ ^j	r r ^j	l l ^j	j	z z ^j	ž ž ^j	dʒ ^j	dz	w	∅ ¹⁷

Voiced liquids¹⁸ and the glide do not lenite. Note that there is a chain shift in lenition of obstruents, e.g. /p/ surfaces as [b] in onset of a stressed syllable, and /b/ surfaces as [β]. Note also that lenited voiced stops have reflexes that do not belong to the set of consonants in the inventory of (at least this dialect of) Mokša.

Whether the word is derived or underived, does not matter for onset lenition. Even if the stress position in the derived word does not match the position of stress in corresponding underived word, it is the onset of the syllable that receives stress in any given form that is subject to lenition:

(48)

- a. r'ib'éž ~ r'jβ'éž 'fox' r'ib'éž-eze ~ r'jβ'éž-eze 'my fox'
 kurká ~ kurgá 'turkey' kurká-ze ~ kurgá-ze 'my turkey'
 kukó ~ kugó 'cuckoo' kukó-ze ~ kugó-ze 'my cuckoo'

¹⁶ Though if a voiced sonorant is preceded by a voiceless obstruent, the obstruent itself surfaces as voiced (only if the sonorant is the onset of a stressed syllable).

¹⁷ With nasalization of the stressed vowel.

¹⁸ Speakers claim a 'weaker' pronunciation for voiced liquids in onsets of stressed syllables; it is not audible, and the only difference I was able to notice on spectrograms is occasional [r] with one roll, compared to two or three rolls of [r] in other positions.

kir ^l ká ~ kir ^l gá ‘neck’	kir ^l ká-ze ~ kir ^l gá-ze ‘my neck’
t ^l əb ^l é ~ t ^l əβ ^l é ‘work’	t ^l əb ^l é-ze ~ t ^l əβ ^l é-ze ‘my work’
s ^l ərpé ~ s ^l ərbé ‘heart’	s ^l ərpé-ze ~ s ^l ərbé-ze ‘my heart’
kundáj ~ kundáj ‘catcher’	kundáj-oze ~ kundáj-oze ‘my catcher’
pingá ~ pinḡá ‘period of time’	pingá-ze ~ pinḡá-ze ‘my period of time’
kənák ~ kəák ‘guest’	kənák-oze ~ kəák-oze ‘my guest’
kudá ~ kuďá ‘matchmaker’	kudá-ze ~ kuďá-ze ‘my matchmaker’
mir ^l djá ~ mir ^l ďjá ‘man, husband’	mir ^l djá-ze ~ mir ^l ďjá-ze ‘my man, husband’
p ^l imá ~ p ^l iwá ‘large cup, mug’	p ^l imá-ze ~ p ^l iwá-ze ‘my large cup, mug’
kirčén ~ kirdžén ‘swamp’	kirčén-eze ~ kirdžén-eze ‘my swamp’
čutó ~ čudó ‘tree’	čutó-ze ~ čudó-ze ‘my tree’
bujá ~ bujá ‘end’	bujá-ze ~ bujá-ze ‘my end’
kər ^l sá ~ kər ^l zá ‘bread’	kər ^l sá-ze ~ kər ^l zá-ze ‘my bread’
kušmá ~ kužmá ‘radish’	kušmá-ze ~ kužmá-ze ‘my radish’
t ^l ətrát ^l ka ~ t ^l ədrát ^l ka ‘notebook’	t ^l ətrát ^l ka-ze ~ t ^l ədrát ^l ka-ze ‘my notebook’
b.	
s ^l ibəs ^l ‘collar’	s ^l ibəs ^l -óze ~ s ^l ibəz ^l -óze ‘my collar’
kum ‘(close) friend’	kum-óze ~ kuw-óze ‘my (close) friend’
b ^l ən ^l əč ‘boat’	b ^l ən ^l əč-óze ~ b ^l ən ^l ədž-óze ‘my boat’
kud ‘house’	kud-óze ~ kuď-óze ‘my house’
ín ^l z ^l əts ‘raspberry’	ín ^l z ^l əts-óze ~ ín ^l z ^l ədž-óze ‘my raspberry’
b ^l in ^l ‘stump’	b ^l in ^l -éze ~ b ^l i-ěze ‘my stump’
rug ‘horn’	rug-óze ~ ruḡ-óze ‘my horn’
kərkəs ‘belt’	kərkəs-óze ~ kərkəz-óze ‘my belt’
l ^l ik ‘face (in a painting or statue)’	l ^l ik-éze ~ l ^l iḡ-éze ‘my face (in a painting or statue)’
s ^l əl ^l b ^l ed ^l ‘tear’	s ^l əl ^l b ^l ed ^l -éze ~ s ^l əl ^l b ^l eď ^l -éze ‘my tear’
id ^l ‘baby’	id ^l -éze ~ iď ^l -éze ‘my baby’
kil ^l uj ‘birch’	kil ^l uj-óze ~ kil ^l uj-óze ‘my birch’
kurg ‘mouth’	kurg-óze ~ kury-óze ‘my mouth’
pəjə ^l ‘knife’	pəjə ^l -óze ~ pəjəl ^l -óze ‘my knife’
s ^l irək ‘elm’	s ^l irək-óze ~ s ^l irəḡ-óze ‘my elm’
púrtəb ‘ox’	púrtəb-óze ~ púrtəβ-óze ‘my ox’

In (48a), there is variation within the root, since the consonants are not word-initial and are in onsets of stressed syllables. When concatenated with the 1st person singular possessive suffix that surfaces as *-ze*, *-oze* (after a stem preceded by a [-front] vowel), or as *-eze* (after a stem ending in a consonant preceded by a front vowel), the variation in the stem remains the same, since there is no stress shift because the root itself contains a vowel from the higher-sonority set. In (48b), on the other hand, there is no variation of

consonants within roots, since stress is always assigned to the word-initial syllable. In derived forms with the same possessive suffix, however, stress is assigned to the suffix, since it contains the leftmost higher-sonority vowel in a word. Consequently, the last consonant of a root varies between lenited and non-lenited consonant, being the onset of a stressed syllable.

Note a few properties of the stress (or unbounded foot)-dependent phenomenon of lenition that we can observe here:

(49)

- a. surface segments are often allophones, e.g. there is no underlying /w/ in consonant inventory of the language;
- b. the lenition occurs only when a consonant or consonants are adjacent to the triggering stressed vowel;
- c. the lenition itself is optional, i.e. consonants in the relevant position are in free variation¹⁹;
- d. the lenition appears to be **triggered** by stress rather than a more general phenomenon like intervocalic lenition and restricted to onsets of stressed syllables.

With these properties in mind, we will now make some preliminary remarks on the phenomena we discussed in this chapter so far.

3.4 Preliminary Remarks on Stress-dependent Alternations

Before we move on to see some cases where segmental alternations are influenced by binary feet, let us try and make some generalizations about the cases we have discussed in this chapter.

It appears that all the cases of segmental alternations that depend on stress/unbounded feet have some properties in common. First, all the prosodic conditions in these cases are

¹⁹ The only preference for one or the other option I could find is the preference to use the lenited version when word stress is also phrasal stress. Otherwise, the speakers judged lenited and non-lenited versions as equally acceptable in any register; none of the options sounds stylistically marked to them.

conditions on triggers of the alternations: it is the trigger in all the vowel harmony cases that must be stressed, and a vowel before/after an alternating consonant must be stressed as well. In some cases of fortition that involve gemination, stress is a condition that influences the alternation through the requirement of maximizing the weight of the stressed syllable. In cases of lenition, on the other hand, the condition on the trigger seems to be more phonetically grounded, basically making a transition between a consonant and a stressed vowel easier by leniting the consonant.

Both alternations in cases of stress-triggered vowel harmony and stress-triggered cases of lenition often produce allophonic alternations, i.e. the alternations are not restricted to producing only segments present in the underlying segmental inventories, these alternations are not ‘structure-preserving’ in Lexical Phonology terminology (Kiparsky (1982), among others).

Another notable characteristic of stress-dependent segmental alternations seems to be optionality. A lot of phenomena, most notably lenition alternations discussed above, are optional in whether or not alternation occurs, and in what segments are involved in alternations.

Finally, the stress-triggered alternations appear to be strictly local, where affected segments have to be immediately adjacent to the stressed vowel or to a segment affected by the alternation, with other factors overriding this strict locality in some cases.

Keeping these preliminary generalizations in mind, we now move on to examine some alternations that depend prosodic structure, i.e. bounded feet. If there are no typological differences between how the two prosodic entities, prominence and constituency, influence segmental generalizations, it is possible that the cases we have discussed in the present chapter also depend on constituency, and not on prominence itself, i.e. it is unbounded foot boundaries and headedness that influence the segmental alternations. If, on the other hand, there are any noticeable typological differences between stress-dependent and bounded foot-dependent alternations, it is more likely that we should refer

to prominence directly, without utilizing the notion of ‘unbounded foot’ that would not be a possible prosodic constituent.

CHAPTER 4

PROSODIC STRUCTURE-DEPENDENT SEGMENTAL ALTERNATIONS

4.1 Introduction

In this chapter, we will investigate several cases of segmental alternations that are best analyzed as depending on binary foot structure, either foot boundaries or headedness.

There are quite a few cases in the literature that are ambiguous as to whether stress or binary feet are responsible for (some aspects of) segmental alternations. After a brief survey of a few of these, we turn to case studies from Mwotlap, Kera and Ibibio.

In **Old Norwegian**, a Scandinavian language spoken in High Middle Ages (roughly XI – XIV centuries) described by Hagland (1978), the non-low unstressed vowels agree in height with the initial stressed vowels. In the behavior of low vowels, the length distinction has to be taken into consideration: long low vowels trigger a lowering of high vowels to mid, whereas short low vowels do not.

(1) Vowel System of Old Norwegian

Short:

i ü u
e ö o
æ a

Long:

i: ü: u:
e: ö o:
æ: a:

With the exception of loanwords and weakly accented prefixes, the word initial syllable carries the stress.

(2)

a. [+high] stressed vowel			b. [-high] stressed vowel		
ínni	'inside'	*ínne	dómdu	'sentenced'	*dómdu
úndir	'under'	*únder	Þésser	'these'	*Þéssir
pínur	'plagues'	*pínor	ópet	'open'	*ópit
súnir	'sons'	*súner	rétto	'right'	*réttu
sústur	'sister'	*sústor	tóko	'took'	*tóku

It might appear that all examples in (2) above show is that the language inherited harmonic stems from Old Norse, since we do not see any alternations. However, at least with respect to the plural suffix, that cannot be true: the suffix does appear as *-er* (with non-high vowel) when it follows a non-high vowel. Another issue in classifying the Old Norwegian case as one dependent on stress or the head of an unbounded foot, is that the stress is initial in all examples available to us, so the data is ambiguous as to whether it is the stressed or the initial vowel that causes the height harmony. In addition, the harmony clearly is sensitive to vowel length, in that long vowels are always followed by mid vowels, regardless of the height of the initial long vowel:

(3)

a. [+high] stressed vowel		b. [-high] stressed vowel	
vá:rer	'our'	læ:rder	'learned'
á:re	'year'	væ:re	'were'
vá:rom	'owned'	mæ:lto	'said'

Similarly, regardless of the harmony, the final (unstressed) vowels of trisyllabic words are uniformly mid:

(4)

kælingom	'woman'
stúkunne	'chapel'
játtado	'affirmed'

Finally, short low vowels can be followed by either high or mid vowels:

(5)

ádrum	‘other’ (Dat sg masc)
ǎ́llu	‘all’ (Dat sg neut)
ǎ́ller	‘all’ (Nom pl masc)

Both Hagland (1978) and Majors (1998) analyze the contrast between (3) and (5) as a condition that reduces all vowels outside the initial bimoraic foot to mid vowels.

Tzeltal (Slocum (1948), Kaufman (1971), Brown (1996), Dickey (1999)) is a Mayan language spoken in Southern Mexico, mostly in the state of Chiapas. The language currently has 150,000 speakers; the data reported here are taken from Brown (1996) and Dickey (1999) and are from a community of Tenejapa, which has about 10 thousand speakers. Tzeltal exhibits allomorphy similar to the type we will see later in this chapter, in the language called Mwotlap, and Northern Sámi, Estonian, and Shipibo that we examine later in this dissertation.

The vowel system of Tzeltal includes five vowels:

(6)

	Front	Central	Back
High	i		u
Mid	ɛ		o
Low		a	

The consonant system of the language is much richer, and includes 21 contrastive segments¹:

¹ I changed the transcription somewhat from different systems used in Kaufman (1971), Brown (1996) and Dickey (1999) for convenience.

(7)

	Bilabial	Apico-dental	Postalveolar	Palatal	Velar	Glottal
Stops	voiceless	p	t		k	ʔ
	voiced	b ²				
Affricates		ts	tʃ			
Glottalized stops	pʔ	tʔ			kʔ	
Glottalized affricates		tsʔ	tʃʔ			
Fricatives		s	ʃ			h
Nasals	m	n				
Laterals		l				
Tap		r				
Glides	w			j		

Tzeltal stress is always word-final, except for Spanish borrowings.

The allomorphy that we are interested in is the allomorphy of the perfective suffix *-oh/-eh*. The suffix is reported to be extremely productive, and is taken by transitive verbs to form the perfective. As the data below shows, when the stem is monosyllabic, the perfective suffix surfaces as [oh]:

(8)

Transitive Monosyllabic
Verbs (Imperfective)

ja s-mah 'he hits something'
ja j-il 'he sees something'
ja s-pas 'he makes something'
ja s-nɛtʔ 'he squashes something'
ja s-nuts 'he chases something'
ja j-al 'he tells something'
ja s-tsak 'he takes something'
ja s-jom 'he gathers something'

Perfective

s-mah-oh 'he has hit something'
j-il-oh 'he has seen something'
s-pas-oh 'he has made something'
s-nɛtʔ-oh 'he has squashed something'
s-nuts-oh 'he has chased something'
j-al-oh 'he has told something'
s-tsak-oh 'he has taken something'
s-jom-oh 'he has gathered something'

In the left-hand column, we see the 3rd person singular forms of verbs, with required person marking since these monosyllabic roots are bound morphemes. In the right-hand column, the trimorphemic perfective forms of the verbs are given, with the perfective

² The bilabial stop is implosive when not word-final.

suffix appearing as [oh] in all of the above forms. Other suffixes can be concatenated with the perfective forms, without changing the shape of the perfective suffix:

(9)

s-pas-oh 'he has made something'
 s-pas-oh-ik 'they have made something'
 s-pas-oh-be 'he has made something for someone'
 s-pas-oh-ij 'he has already made something'

When the stem itself has more than one syllable, on the other hand, the perfective suffix surfaces as [ɛh], as is illustrated below with disyllabic stems:

(10)

Transitive Monosyllabic Verbs (Imperfective)	Perfective
ja s-majlij 'he waits for something'	s-majlij-ɛh 'he has waited for something'
ja s-mak ^ʔ lin 'he feeds someone'	s-mak ^ʔ lin-ɛh 'he has fed someone'
ja s-tikun 'he sends something'	s-tikun-ɛh 'he has sent something'
ja s-maklij 'he listens to something'	s-maklij-ɛh 'he has listened to something'

The allomorph -ɛh also surfaces invariably if other suffixes are added between the root and the perfective suffix itself:

(11)

Imperfective	Perfective
ja s-hol-intaj 'he thinks about it'	s-hol-intaj-ɛh 'he has thought about it'
ja h-pak ^ʔ -antaj 'I patch it'	h-pak ^ʔ -antaj-ɛh 'I have patched it'
ja s-kutʃ-laj 'she carries it repeatedly'	s-kutʃ-laj-ɛh 'she has carried it repeatedly'
	cf. s-kutʃ-oh 'she has carried it'

While the allomorphy of the perfective suffix clearly depends on following the initial syllable as opposed to following any other syllable in the word, it can be analyzed as either dependent on the difference between being footed together with the initial syllable and being unfooted at all; the analysis would be based on the stipulation that it is only the

initial two syllables that comprise a binary foot, and the rest of the string is unfooted. While ambiguous, such an analysis is certainly possible.

Koniag Alutiiq is a group of dialects of Alutiiq (Pacific Yupik) that has the most well-studied phenomenon of foot-structure influenced fortition or tensing. The language has a left-to-right iambic stress system with main stress on the leftmost foot (Van de Vijver (1998)). Closed initial syllables are always stressed, unlike closed syllables in the rest of the word:

(12)

- a. án.ci.qùa ‘I’ll go out’
 áp.qay.làa.qa ‘I always ask her’

Fortition occurs for all onset consonants that are foot-initial and involves ‘pre-closure’ and complete lack of voicing for voiceless consonants. Fortition makes consonants ‘more audible’ (Leer (1942, 1989), van de Vijver (1998)). According to the sources, fortition always occurs foot-initially (fortis consonants are bold and underlined):

(13)

- kúm.la.cì.wi.lì.ja.**q**u.tà.qu.**n**i.kì
‘if he (refl) is going to undertake constructing a freezer’**
- méχ.**t**a.qán ‘if she fetches water’
néχ.t**áá.qan ‘if she (always) eats’
qa.já:.kun ‘by boat’
qa.ját.xun ‘by boats’****

Fortition is claimed to be a key diagnostic of foot structure in Alutiiq. Leer (1985, 1989) describes fortition as having two main phonetic traits: complete voicelessness in voiceless obstruents, and preclosure. Preclosure apparently is similar to gemination, but does not close the preceding syllable (if it is open), thus a fortis consonant can occur even with a preceding closed syllable.

There is no distinction between a fortis geminate and a lenis geminate. Since fortition can occur with a preceding closed syllable, it cannot be the same as canonical gemination with a consonant linked to both coda and onset of the following syllable (see Topinzi (2008) for arguments motivating onset geminates in some languages). Leer sets the syllable template in Alutiiq to CV(V)(C) for non-initial syllables (initial syllables allow complex onsets in borrowings, and vowel-initial medial syllables may be created through fricative deletion).

The environment for fortition cannot be expressed merely in terms of either stressed or unstressed syllables without resorting to disjunctive rule statements. Leer's insight is that if we characterize all the strings above as feet we have a coherent environment for assigning fortition.

Several quantitative phenomena, such as degemination, vowel lengthening and shortening are also found in Koniag Alutiiq. Most researchers (see Leer (1985, 1989), Hewitt (1992, 1994), Baković (1996), Van de Vijver (1998), among others) attribute these quantitative adjustments to the iambicity of Koniag foot, as the adjustments serve to promote an optimal iambic foot on the surface.

Even though it seems clear that the foot-initial fortition cannot be triggered by the same cause as other quantitative adjustments, since consonants are only moraic in the coda of the initial syllable, fortition might have originated as such: if a consonant was geminated to occupy an onset position in the first syllable of the foot as well as coda position of the syllable of the preceding foot, the final, head syllable of a foot would be heavier than the initial, or non-head syllable of that foot, creating a better iambic foot. In fact, there still exists a phenomenon in Koniag Alutiiq, gemination, which allows a syllable with a schwa that cannot be lengthened to surface as its own foot word-initially, rather than to remain unparsed:

(14)

/pəLu/-/t/	(pəLút)	'leaves'	(no gemination)
/pəLu/-/i/	(pəl)(Luí)	'its leaves'	gemination to prevent *pə(Luí)

Moreover, gemination can also occur word-medially after a schwa that heads an iambic foot, perhaps suggesting that geminates in this position are also counted as moraic:

(15)

/agajutə/-/ma/-/ang/	(aγá:)(jútóm)(máγ) ³	‘O my God’ (vocative)
/pi/-/sur/-/pəkə/-/nii/	(písúγ)(pəkón)(ní)	‘without my hunting’
/qəčəγ-uq/	(qəčəđγ)γuq	‘she is running’

In addition, degemination is also present in the language in the context where an underlying geminate follows a non-head syllable:

(16)

/atur/-/nnir/-/tuq/	(atún)(nirtúq)	‘he stopped V-ing’ ⁴	(no degemination)
/iqLu/-/nnir/-/tuq/	(íq)(Luníγ)tuq	‘he stopped lying’	(degemination)

Thus, while synchronically foot-initial fortition and (de)gemination in the language seem to be different phenomena, they might have started out as a uniform phenomenon driven by a constraint on foot form. This suggestion would at least begin to account for the fact that there is no contrast between lax and tense geminates, as tensing itself started out as geminat consonants, but was reinterpreted as tensing except in some cases.

Note that Koniag fortition differs from other foot-structure sensitive phenomena that we discuss in this dissertation in that the foot structure does not seem to **restrict** a differently motivated phenomenon like Nganasan intervocalic lenition or Kera vowel harmony (see below), but rather **cause** the alternation that marks the foot structure of the language, making it more similar to alternations that are influenced by stress rather than foot structure. The origin of the alternation in Koniag, if it indeed was a quantity-adjustment phenomenon, might account for this typological discrepancy: other foot structure-influenced phenomena started independently of foot structure, and later acquired an

³ Monomoraic final feet are common in Koniag due to vowel shortening in final syllables.

⁴ Leer (1985), where this piece of data comes from, does not give a gloss for the root of this verb.

additional restriction that limited the occurrence of certain alternations to a particular position within a foot.

Similar to what the situation used to be in Koniag is the situation in **Huariapano**, a recently extinct Panoan language close to Shipibo that we will be investigating in the following chapter, as described in Parker (1994) and Parker (1998). Parker (1998) proposes that coda [h]-epenthesis is a rhythmic process. Parker argues that the coda [h]-epenthesis, though rhythmic, is not always directly related to stress, and there are cases where the two (stress assignment pattern, on the one hand, and /h/-insertion, on the other hand) have to be accounted for with two different autosegmental tiers, the stress tier and the foot structure tier.

In Huariapano, main stress occurred on the first syllable if the second was open, and on the second syllable if it was closed⁵:

(17)

a.	βí.na	‘male’
	kóʂ.ni	‘beard’
	bǐ.na.bó.ra	‘males’ (emphatic)
	hí.wi	‘branch, stick’
	wín.ti	‘oar, paddle’
	rís.βi	‘rope’
	pó.a	‘potato’
b.	ja.wíʃ	‘opossum’
	hon.tsís	‘claw, fingernail’
	ta.póʔ	‘cot’
	ʂa.βín	‘bee’
	ka.nó.ti	‘bow (weapon)’

⁵ There are forms in Huariapano where primary stress falls on the second light (open) syllables. Words with this stress pattern form about a quarter of disyllabic nouns in the language (Parker 1994:98). Below are some of the examples of words with lexical stress:

βis.má	‘to forget’
uʃ.tá	‘garbage’
jo.βí	‘witch’

bi.ná.bo	‘males’
ram.βo.şó.βo	‘knees’

Huariapano does show secondary stress, which is left-, instead of right-oriented:

(18)

tʃih.ki.na.mán	‘corner’
jò.mi.rà.no.şih.kájn	‘they will hunt’
mà.na.páj.ri	‘I will wait’
jò.mi.rà.no.şí.ki	‘he is going to hunt’
kù.βjaj.βa.şí.ki	‘I cooked’
wà.ni.ki.ráŋ.ki	‘they have returned’
jò.mi.rày.βa.kan.şí.ki	‘they hunted’
kàj.ba.kan.şí.ki	‘they went’

Closed syllables in Huariapano attract secondary stress as well as primary stress:

(19)

ma.nàn.kih.ká.si	‘I am going to speak to you’
mi.βòm.bi.rá.ma	‘you (pl)’
kǐ.na.mah.kán.ki	‘when they called’
ih.kàş.tʃan.ká.ri	‘they will shake with fear’

The insertion of /h/ occurs in codas of odd-numbered syllables before voiceless onsets. The quality of /h/ varies depending on the nature of the previous vowel. It has the following allophones: [h] after [a], [ç] after [i], [x] after [i], and voiceless glide [w̥] after [o]; in onset position, /h/ only appears word-initially and surfaces as [h], where it is phonemic, as the following minimal pairs illustrate (Parker 1994:96-7):

(20)

há.naʔ	‘tongue’
á.noʔ	‘paca rodent’
ká.naʔ	‘macaw’

Following Parker (1994, 1998) and Elías-Ulloa (2003), I do not show the allophones of /h/ in the Huariapano data discussed here.

Epenthetic /h/ occurs word-internally in coda position before voiceless consonants. Epenthesis does not occur initially if the syllable has main stress; neither does it occur if a syllable already has a coda.

Huariapano /h/ insertion occurs in the left syllable of a disyllabic foot. Elías-Ulloa (2003) schematizes the epenthesis in the following way:

(21)

#(σh.σ)(σh.σ)(σh.σ)...

Quite conspicuously, the scheme above does not show the position of stress, though it does show the foot structure needed to correctly predict the location of the coda [h]-insertion. The foot structure shown does not always correspond with the position of stress, which is certainly not assigned in a syllabic trochee left-to-right fashion, but rather obeys a set of complex requirements outlined above.

The following examples of rhythmic /h/-insertion are all from Parker (1998). The inserted [h]s are underlined and in bold face for visibility:

(22)

- | | | |
|----|---|-----------------------------|
| a. | no <u>h</u> .póʃ | ‘snail’ |
| | tʃi <u>h</u> .ki.na.mán | ‘corner’ |
| | jò.mi.rà <u>h</u> .ka.ti <u>h</u> .kajn | ‘they hunted’ ⁶ |
| | ki <u>h</u> .pĩn | ‘I open’ |
| | βi <u>h</u> .tsa.káŋ.ki | ‘they laughed’ |
| | pa <u>h</u> .tsá.ki | ‘we washed’ |
| | i <u>h</u> .kàʃ.tʃan.ká.ti | ‘they will shake with fear’ |
| b. | ĩʃ.to.kí.ra | ‘although he may run’ |
| | ná.kaʔ | ‘flea’ |
| | βoʃ.káʔ | ‘head’ |
| | pí.ki | ‘he ate’ |

⁶ In this example, *jò.mi.ràh.ka.tih.kajn* (hunt-PAST-3RD PL), the suffix /-ka.'ti/ has a lexical stress so that it prevents the next closed syllable from attracting stress.

ma.níʃ		‘jungle’
ka.nó.ti		‘bow’
pa.já.ti		‘hand-held fan’
pà.ja.tí.ra		‘hand-held fan (topic)’
ní.ti		‘day’
ni <u>h</u> .tí.no		‘day (locative)’

As noted above, the insertion has some restrictions, one of which is that the onset of the following syllable has to be voiceless. This restriction accounts for the absence of epenthesis in such forms as *ʃf.to.kí.ra* ‘although he may run’. The form with /h/-insertion in the initial syllable of the second foot is ungrammatical: **ʃf.to.kíh.ra*. The absence of insertion in the first syllable of the form is due to the already present onset [ʃ]. The same explanation applies to the form *βoʃ.káʔ* ‘head’: the initial syllable has a coda, hence there is no /h/ epenthesis.

An additional restriction prevents epenthesis in initial syllables: the insertion does not apply in the first syllable of the word if that syllable carries primary stress. This additional condition accounts for the absence of /h/-insertion in forms like *ná.kaʔ* ‘flea’ and *ní.ti* ‘day’ in (22b) above. The minimal contrast is with the form *nih.tí.no* ‘day (locative)’: the main stress in this form is shifted onto the second syllable, thus leaving the initial one be available for the epenthesis. With other conditions on /h/-epenthesis satisfied, the first syllable surfaces with a coda.

According to Parker (1994), coda /h/ epenthesis is quite regular. Out of 115 morphemes, only 9 are exceptional and do not undergo epenthesis even if all the conditions we discussed above are met. The following morphemes are exceptional in that they show no /h/ epenthesis in the initial unstressed syllable before a voiceless consonant:

(23)

ki.pú.ki	* ki <u>h</u> .pú.ki	‘he/it closed’
tʃu.ʃí.ki	*tʃu <u>h</u> .ʃí.ki	‘he/it dried (up)’
hi.kí.ki	*hi <u>h</u> .kí.ki	‘he/it entered’

Apart from additional conditions on /h/-epenthesis, like the voicelessness of the following onset, the situation in Huariapano is similar to what we have hypothesized is the diachronic source of Alutiiq degemination: both phenomena are related to promoting optional foot structure, rather than to a segmental process that is restricted by foot structure.

Several more detailed case studies are presented in this chapter. First, we will present two cases of vowel harmony, especially useful here as we can compare the properties of foot-dependent vowel harmony with those cases of vowel harmony presented in the previous chapter, i.e. cases that involve reference to stress.

Mwotlap vowel harmony will be investigated first. The pattern shows that the domain for the harmony is both morphological and prosodic, i.e. it depends on foot boundaries as well as difference between roots and affixes, in addition to underlying representations of two classes of prefixes. It is crucial that, synchronically, stress plays no role in determining whether or not certain vowels surface as harmonic.

The next case study presented here is from the language Kera, where there is a vowel-sonority alternation that, I argue, shows where prominence is placed in the language. Secondly, Kera has [\pm front] vowel harmony that is restricted by foot structure.

Next, we turn to Ibibio that has voiceless stop lenition also dependent on the foot structure of the language.

4.2 Case Study: Mwotlap Vowel Harmony

Mwotlap, or Motlav, is described as having a phonological phenomenon of ‘vowel shifting’ (Codrington (1885), Kasarhérou (1962), François (2000)), where a number of prefixes change their vowel to agree with that of the following root. This process, however, applies only to one type of root, namely CV roots, but is blocked in roots of

CCV shape. Given historical facts and synchronic phonotactics of the language, the ‘vowel shifting’ alternation seems to depend on prosody.

Mwotlap is an Oceanic language spoken in Northern Vanuatu (Banks Is.), on the island of Mwotlap/Motalava, by approximately 1800 speakers. It is geographically and historically close to Mota, a more conservative (François (2000)) language, which was first described in detail by Reverend Codrington (1885).

4.2.1 Relevant Basics

Mwotlap has 16 consonants: /^kp^w, ^ŋm^w, ^mb, w, p, m, t, ⁿd, s, n, l, j, k, ɣ, ŋ, h/. Underlying /p/ surfaces as [v] in the onset position, and as [p] in the coda⁷:

(24)

- | | | | |
|----|-------------------------|--------|------------------|
| a. | /p ⁿ ʊ/ | vʊnʊ | ‘country’ |
| | /na/-/p ⁿ ʊ/ | napnʊ | ‘the/a country’ |
| | DEF/INDEF-country | | |
| b. | /wʝit/ | wiʝit | ‘octopus’ |
| | /na/-/wʝit/ | nawʝit | ‘the/an octopus’ |
| | DEF/INDEF-octopus | | |

The vowel system has no long vowels or diphthongs and it contains the following elements: /i, u, ɪ, ʊ, e, o, a/. The language’s syllable structure is (C)V(C), i.e. both codas and onsetless syllables are allowed; however, there are no complex codas or onsets in the language. Restrictions on complex onsets are responsible for several alternations in the language such as **epenthesis**:

⁷ François (2000) has /v/ in the consonant inventory, and [p] is derived on the surface in the coda position. Given that this segment is reconstructed as *p for Proto-Oceanic, I set up /p/ as underlying. Phonotactically, however, it does not seem to make any difference.

(25)

- | | | | |
|-----|-------------|--------------------|-----------------------|
| a. | /mtij/ | mitij | ‘sleep!’ (imperative) |
| cf. | /ni/-/mtij/ | nimtij | ‘he/she sleeps’ 3sg |
| b. | /mtiy/ | mitiy | ‘coconut’ |
| cf. | /le/-/mtiy/ | lenti ^y | ‘in the coconut’ |
| c. | /pnu/ | vunu | ‘country’ |
| cf. | /le-pnu/ | lepnu | ‘in the country’ |

In first examples in (25), we see epenthesis that breaks up onset clusters if the first of the two consonants cannot be syllabified to the previous syllable like in the second examples in (25)⁸, where the root is preceded by a prefix of the shape CV. Note the quality of the epenthetic segments: it is not a particular vowel that epenthesizes to break up the banned complex onsets; rather, the epenthetic vowel is fully harmonized with the vowel that follows it in the next syllable. This observation will become important when we discuss vowel harmony in certain prefixes later in this case study.

4.2.2 Stress

Synchronically, Mwotlap has only one stress per word, always on the last syllable. It is essential, however, to sketch the historical stress system of the language, since it is the key to understanding some aspects of the ‘vowel shifting’ phenomenon that concerns us in this chapter.

Former linguistic stages of Mwotlap followed Proto-Oceanic in having mainly open syllables of the form (C)V (Ross (1998)). The closed CVC syllables of Mwotlap are obviously an innovation, and were evidently formed through unstressed vowel syncope (François (2000)).

The basic stress rules of pre-Mwotlap included a primary stress on the penultimate syllable of the phonological word, and ‘secondary stresses on every second syllable

⁸ An alternative explanation could be some sort of Minimal Word requirement here, but see the examples below.

towards the left of the word' (François (2000)). In other words, the pattern can be described as right-to-left syllabic trochee. On the way to its modern stage, all post-tonic vowels in the language were deleted, causing closed (CVC) syllables to appear word-finally. Below are some examples of pre-Mwotlap and modern language place names and nouns as reconstructed in Ross (1998):

(26)

	Pre-Mwotlap	Mwotlap	Gloss
a.	*m ^w òtaláva	ᵐm ^w otlap	'Mwotlap island'
	*àlakóna	alkon	'Gaua island'
	*àravéŋa	ajveŋ	'Ravenga islet'
	*àm ^w osína	aᵐm ^w sin	'Mosina village'
	*àvalúwa	aplow	'Valuwa village'
b.	*àvanùaláva	apnolap	'Vanua Lava island'
c.	*vanúa	vunu (/pnu/)	'country'
	*wuríta	wijit (/wjit/)	'octopus'
d.	*p ^w óe	p ^w o	'pig'
	*yáú	ye	'fish-hook'

As can be seen from the above examples, not only post-tonic, but all the pre-tonic vowels were lost in the language. In other words, all unstressed vowels fell out, creating closed syllables in many cases. Words with four open (CV) syllables were eventually reduced to two closed (CVC) syllables (26a), or from six to three (26b). Yet other words shortened from three syllables to one (open or closed) syllable with complex onset (26c); disyllabic words were shortened to monosyllables (26d). In all of the examples, only stressed syllables were retained in the language, while unstressed vowels were lost.

The evolution of stress from the penultimate to the final syllable is easy to understand from the deletion rules outlined here; it is very similar to the evolution of stress from Latin to French. More important, for our present purposes, is that syncope of unstressed syllables seems to have **preserved** the foot structure: a disyllabic and bimoraic CVCV

foot, for example, would be turned into monosyllabic, but still bimoraic CVC foot, where the second mora would dominate the coda consonant, for example:

(27)

- | | | | |
|----|----------------------------|-------------|---------------------|
| a. | *(<i>à</i> va)(lúwa) | (ap)(lɔw) | ‘Valuwa village’ |
| b. | *(<i>à</i> va)(nùà)(láva) | (ap)nù(lap) | ‘Vanua Lava island’ |

It is not entirely clear from these data, however, whether the light syllable in (27b), which resulted from the loss of an unstressed onsetless vowel, is footed with one of the closed syllables or left unparsed. I will argue that there are no degenerate feet in Mwotlap, since it is essential for our understanding of vowel harmony.

4.2.3 Vowel Harmony

Vowel harmony has traditionally been called ‘vowel shifting’ in the literature, perhaps to emphasize the fact that vowels harmonize in all features, producing vowels identical to their triggers. The phenomenon has customarily been presented (Codrington 1885, Kasarhérou 1962) as involving a series of prefixes, e.g. the definite/indefinite determiner /nA-/, verbal prefix /nA-/, the perfect marker /mE-/, and ‘numeralizer’ /pE-/. These prefixes surface as single consonants with vowel-initial roots, and ‘borrow’ the vowel features from the stems that are consonant-initial⁹:

(28)

- | | | | |
|----|-------------|----------------------|-----------------|
| a. | /nA/-/ulsi/ | [nulsɪ] | ‘the/a summit’ |
| | /nA/-/mbi/ | [nɪ ^m bɪ] | ‘the water’ |
| | /nA/-/yit/ | [niyɪt] | ‘the/a louse’ |
| | /nA/-/yom/ | [noyom] | ‘the/a disease’ |
| | /nA/-/lan/ | [nalan] | ‘the/a fly’ |

⁹ The underlying forms of the prefixes, with a capitalized vowel, are the ones François (2000), among others, gives to distinguish these prefixes from non-alternating ones. Essentially, these underlying forms indicate that there is some diacritic feature [variable] on the vowels of these prefixes. I preserve this notation in the forms in (28), but argue that the underlying forms of these prefixes are set up incorrectly, and discuss the underlying forms of varying prefixes that do not need to refer to a diacritic specification later in this section.

/nA/-/sim/	[nisim]	‘the money’
/nA/-/k ^w o/	[no ^k p ^w o]	‘the/a pig’
/nA/-/puj/	[nuvuj]	‘the/a volcano’
/nA/-/wis/	[niwis]	‘the/an owl’
/nA/-/k ^w ti/	[ni ^k p ^w ti]	‘the/a head’
/nA/-/lit/	[nilit]	‘the/a pudding’
/nA/-/k ^w et/	[ne ^k p ^w et]	‘the/a taro’
/nA/-/hij/	[nihij]	‘the/a bone’
/nA/-/ye/	[neye]	‘the/a fish hook’
/nA/-/kumaj/	[nukumaj]	‘the/a sweet potato’
/nA/-/dokta/	[no ⁿ dokta]	‘the/a doctor’
b. /pE/-/ju/	[vuju]	‘two’
/pE/-/pet/	[vevet]	‘four’
/pE/-/pih/	[vivi ^h]	‘how many’

The prefixes in Mwoṭlap are divided into ‘shifting’ and ‘non-shifting’ in traditional terminology, i.e. those that harmonize to the first vowel of the stem and those that do not. Among the non-shifting prefixes is the following 3rd person singular prefix *ni-*:

(29)

ni-in	‘he/she/it drinks’
ni-et	‘he/she/it sees’
ni-van	‘he/she/it goes’
ni-ye ⁿ	‘he/she/it eats’
ni-k ^w uŋ	‘it becomes night’
ni-siseg	‘he/she/it plays’
ni-vijtitit	‘he/she/it fights’
ni-vap	‘he/she/it says’

As we can observe, the roots in the data above contain four different vowels, but the 3rd singular prefix that is concatenated with all of these roots stays *ni-* no matter what vowel follows it in the root. In addition, the prefix does not show up without its vowel when it is concatenated with a root that is vowel-initial (29a). The same pattern can be detected with one of the Locative prefixes, *-a*, a nominal prefix *na-*, and prefix *le-* (that is considered Locative in the sources, but is glossed as ‘in’ as opposed to ‘at’): the above prefixes keep their quality regardless of what root follows it:

(30)

a. Locative prefix *a-* (shows up mostly with place names):

a-pnɔlap	‘at Vanua Lava’
a-ɣɔ	‘at Gaua’
a- ^ŋ m ^w ew	‘at Maewo’
a- ^ŋ m ^w sin	‘at Mosina’
a- ^ŋ m ^w ot	‘at Mota’

b. Nominal article¹⁰ *na-*

na-naw	‘the sea’
na-hij	‘the bone’
na-ɣe	‘the fish hook’
na-s ^ŋ m ^w al	‘the rain’
na- ^k p ^w o	‘the pig’
na-he-k	‘my name’
na-lit	‘the pudding’
na-ɣmel	‘men’s house’
na-wis	‘owl’
na-lo	‘the sun’
na- ^ŋ dokta	‘the doctor’
na-pnɔ	‘the country, island’

c. Locative prefix *le-*

le-naw	‘in the sea’
le-s ^ŋ m ^w al	‘in the rain’
le-he-k	‘in my name’
le-ɣmel	‘in the men’s house’
le-lo	‘in the sun’
le-pnɔ	‘in the country’
le-lit	‘in the pudding’

It is unclear, at least synchronically, why there are two sets of prefixes in the language (the harmonizing ones and the non-harmonizing ones), but it is possible that, historically, the non-harmonizing prefixes used to be prepositions. Assuming that prepositions can in some cases at least be not a part of a prosodic word, those prepositions were outside the

¹⁰ This prefix is glossed as ‘nominal article’ in François (2000) and Kasarhérou (1962), but it is unclear what the function of the prefix is. It is, however, obviously distinct from the harmonizing prefix that is glossed as definite/indefinite determiner here.

domain of stress assignment and vowel elisions that followed. It is not true, however, that we can analyze these prefixes as prepositions synchronically: the difference between prefixes, on the one hand, and prepositions and clitics, on the other hand, are clearly visible from the presence or absence of root-internal epenthesis:

(31)

a.	/le/-/pnu/	le-pnu	‘in the country’
	/le/-/mtiy/	le-mtiy	‘in the coconut’
b.	/ne/-/pnu/	ne-vunu	‘of the country’
	/ne/-/mtiy/	ne-mitiy	‘of the coconut’

The examples in (31a) show that one of the Locative prefixes *le-*, as part of the prosodic word, syllabifies together with the first consonant of the roots, thus creating two CVC syllables in each case. The examples in (31b), on the other hand, show that *ne-* is not part of the prosodic word since the prefix cannot syllabify with the first consonant of the root and break up an ungrammatical complex onset. The onset consequently has to be resolved through epenthesis.

The prefixes listed in (30) above, therefore, cannot be analyzed as prepositions that are outside the prosodic word synchronically. Descriptively, we have three types of prefix-like morphemes in the language, varying, non-varying, and clitic-like. Below is a summary of the morphemes mentioned in this chapter, with their meanings and the types of stems they attach to:

(32)

	Morpheme	Function	Attaches to
varying	nA- bE-	determiner ('a'/'the') indicates purpose ('for')	nouns
	mE- nE- tE-	perfect stative future	verbs, adjectives, some nouns
	tE-	Ablative	locatives
	vE-	numeralizer	numbers
non- varying	a- na- le-	Locative 'at' definite determiner Locative 'in'	nouns
clitic	ne	Genitive 'of'	nouns

In fact, there seems to be no phonological or morphosyntactic property that would separate harmonizing prefixes from non-harmonizing ones, as far as I can see. Since the explanation that the non-harmonizing prefixes do not harmonize because of some predictable property seems to be untenable, we are left with the conclusion that the prefixes in the language are divided by having different underlying representations. One of the restrictions on the vowel harmony that concerns us in this section, therefore, is what the underlying forms of alternating vs. non-alternating prefixes are. Proceeding on our hypothesis that the alternating prefixes used to be (and still are synchronically) parts of phonological words, it stands to reason to suggest that the prefixes would be tonic or non-tonic, depending on the length of the following root. The non-alternating prefixes, on the other hand, are diachronically not parts of phonological word (former prepositions). The alternating prefixes, therefore, would surface in Pre-Mwotlap as either (for the definite/indefinite determiner prefix) a single consonant [n], when stress fell on the first syllable of the root, or as [na], when stress fell on the second syllable of the root, and, consequently, on the vowel of the prefix. Because of this distribution in Pre-Mwotlap, I propose that alternating prefixes have two allomorphs, one that is a single consonant, and the other with a vowel following that consonant:

(33)

Definite/Indefinite Determiner	/n-/ ~ /na-/
Purpose ‘for’	/b-/ ~ /be-/
Perfect	/m-/ ~ /me-/
Stative	/n-/ ~ /ne-/
Future	/t-/ ~ /te-/
Numeralizer	/v-/ ~ /ve-/
Ablative	/t-/ ~ /te-/

Below are examples with some of the varying suffixes attached to the root /^kp^wuŋ/ ‘night’:

(34)

a.	bare root:	^k p ^w uŋ	‘night’
	/na/ ~ /n/-/ ^k p ^w uŋ/	nU- ^k p ^w uŋ	‘night’ (definite/indefinite)
	/be/ ~ /b/-/ ^k p ^w uŋ/	bU- ^k p ^w uŋ	‘night’ (purpose)
	/ne/ ~ /n/-/ ^k p ^w uŋ/	nU- ^k p ^w uŋ	‘night’ (stative)
	/me/ ~ /m/-/ ^k p ^w uŋ/	mU- ^k p ^w uŋ	‘night’ (perfect)
b.	bare root:	momjij	‘cold’
	/na/ ~ /n/-/momjij/	no-momjij	‘cold’ (definite/indefinite)
	/be/ ~ /b/-/momjij/	bo-momjij	‘cold’ (purpose)
	/ne/ ~ /n/-/momjij/	no-momjij	‘cold’ (stative)
	/me/ ~ /m/-/momjij/	mo-momjij	‘cold’ (perfect)
c.	bare root:	ⁿ dim ⁿ dim	‘think’
	/na/ ~ /n/-/ ⁿ dim ⁿ dim/	nI- ⁿ dim ⁿ dim	‘think’ (definite/indefinite)
	/be/ ~ /b/-/ ⁿ dim ⁿ dim/	bI- ⁿ dim ⁿ dim	‘think’ (purpose)
	/ne/ ~ /n/-/ ⁿ dim ⁿ dim/	nI- ⁿ dim ⁿ dim	‘think’ (stative)
	/me/ ~ /m/-/ ⁿ dim ⁿ dim/	mI- ⁿ dim ⁿ dim	‘think’ (perfect)

Underlying representations of non-varying prefixes would have just single allomorph each, e.g. /le-/ for the Locative prefix with the meaning ‘at’.

With the underlying forms of varying prefixes as we have determined them in (33) above, the analysis of the ‘vowel shifting’ becomes much clearer: first, there is no diacritic property that sets ‘shifting’ prefixes apart from ‘non-shifting’ ones; the difference between the two types is the difference (synchronically) between having two allomorphs or one. Secondly, the ‘shifting’ itself would be analyzed as allomorph selection with epenthesis and vowel harmony. Note that the two phenomena, ‘vowel shifting’ and

epenthesis in roots, previously analyzed as separate processes, are reduced to one phenomenon, epenthesis with vowel harmony determining the quality of the epenthetic vowel, under the present analysis. Vowel harmony, therefore, is a DEP-violating harmony, in that only epenthetic vowels harmonize with the first vowel of the root, regardless of whether the epenthetic vowel is root-internal or not. Vowels that are underlyingly specified for vocalic features do not alternate to harmonize with the root-internal vowel, hence neither non-initial root vowels nor vowels in non-varying prefixes surface as harmonic (no IDENT-violating harmony).

The question we have to ask ourselves now, however, is why have two allomorphs for varying prefixes, one with a single consonant and one with a consonant and a (specific!) vowel. Apart from historical reasons, we have seen no indication so far that varying prefixes surface with anything but a vowel harmonic with the first vowel of the root. The situation, however, is more difficult, since there are roots where these prefixes surface with non-harmonic vowels. Consider the following data with the varying Stative prefix:

(35)

- | | | | |
|----|---------------------|------------------------|---------------------|
| a. | bare root: | /dʒɪ/ | ‘wait’ |
| | /ne/ ~ /n/-/dʒɪ/ | me-dʒɪ (*mɪ-dʒɪ) | ‘wait’ (stative) |
| b. | bare root: | /twojɪy/ | ‘easy’ |
| | /ne/ ~ /n/-/twojɪy/ | ne-twojɪy (*no-twojɪy) | ‘is easy’ (stative) |
| c. | bare root: | /hjo/ | ‘long’ |
| | /ne/ ~ /n/-/hjo/ | ne-hjo (*no-hjo) | ‘is long’ (stative) |

Note that the forms in (35) above show up with disharmonic prefix vowel [e], even though the Stative prefix is among the varying prefixes. In fact, with certain roots, none of the varying prefixes surface with a harmonic vowel:

(36)

- | | | | |
|----|---------------------|-----------|------------------------------|
| a. | bare root: | /mgumgu/ | ‘work’ |
| | /na/ ~ /n/-/mgumgu/ | na-mgumgu | ‘work’ (definite/indefinite) |
| | /be/ ~ /b/-/mgumgu/ | be-mgumgu | ‘work’ (purpose) |
| | /ne/ ~ /n/-/mgumgu/ | ne-mgumgu | ‘work’ (stative) |
| | /me/ ~ /m/-/mgumgu/ | me-mgumgu | ‘work’ (perfect) |

b.	bare root:	/mtimtij/	‘sleep’
	/na/ ~ /n/-/mtimtij/	na-mtimtij	‘sleep’ (definite/indefinite)
	/be/ ~ /b/-/mtimtij/	be-mtimtij	‘sleep’ (purpose)
	/ne/ ~ /n/-/mtimtij/	ne-mtimtij	‘sleep’ (stative)
	/me/ ~ /m/-/mtimtij/	me-mtimtij	‘sleep’ (perfect)
c.	bare root:	/mjus/	‘want’
	/na/ ~ /n/-/mjus/	na-mjus	‘want’ (definite/indefinite)
	/be/ ~ /b/-/mjus/	be-mjus	‘want’ (purpose)
	/ne/ ~ /n/-/mjus/	ne-mjus	‘want’ (stative)
	/me/ ~ /m/-/mjus/	me-mjus	‘want’ (perfect)
d.	bare root:	/blekat/	‘play cards’
	/na/ ~ /n/-/blekat/	na-blekat	‘play cards’ (definite/indefinite)
	/be/ ~ /b/-/blekat/	be-blekat	‘play cards’ (purpose)
	/ne/ ~ /n/-/blekat/	ne-blekat	‘play cards’ (stative)
	/me/ ~ /m/-/blekat/	me-blekat	‘play cards’ (perfect)

Note that all the roots concatenated with the varying prefixes above start with two consonants¹¹, instead of one consonant in roots that cause the vowels in varying prefixes to harmonize. Below are more examples with the varying prefixes /be-/~/b-/ ‘for’ (Purpose) and /na-/ ~ /n-/ (Definite/Indefinite determiner) that attach to nouns:

(37)

a.	/ghuw/	guhūw		‘rat’
	/be~/~/b~/-/ghuw/	be-ghūw	*bū-ghūw	‘for the rat’

¹¹ There are a few roots in Mwotlap that contradict this generalization, because even though they start with a single consonant, they do not cause varying prefixes to surface with harmonic vowels. Historically, however, there is something particular about these exceptional roots: they used to be reduplicated, and left with geminates after the unstressed vowels between identical consonants had been lost (Kasarhérou (1962)), for example:

Pre-Mwotlap	Mwotlap	Gloss
lolo > llo	lo	‘sun’
rereŋa > rreŋ	jeŋ	‘turmeric’
sasa > sse	se	‘name’

Synchronically, we either have to say that the roots are exceptional when it comes to vowel harmony, or have underlying representations that start with two consonants, one of which is not audible because of lack of length contrast in consonants.

b.	$/^k p^w l i s m e n /$ $/b e / \sim / b / - / ^k p^w l i s m e n /$	$^k p^w i l i s m e n$ $b e - ^k p^w l i s m e n$	$* b i - ^k p^w l i s m e n$	‘policeman’ ‘for the policeman’
c.	$/t^k p^w e /$ $/n a / \sim / n / - / t^k p^w e /$	$t^k e p w e$ $n a - t^k p^w e$	$* n e - t^k p^w e$	‘bell’ ‘a/the bell’
d.	$/n j e /$ $/n a / \sim / n / - / n j e /$	$n e j e$ $n a - n j e$	$* n a - n j e$	‘blood’ ‘blood/the blood’

Both the Purpose prefix (37 a, b) and the Definite/Indefinite determiner prefix (37 c, d) show up with their respective non-harmonic vowels [e] and [a], even though the prefixes do harmonize with the first vowel of roots that do not start with two consonants.

Recalling our discussion of the stress evolution in Mwotlap, we can see how the root-initial double vs. singular consonant distinction can play a role: when prefixed to single-consonant roots (38a), prefixes can be parsed into a moraic binary foot with the first syllable of the root; when, on the other hand, these prefixes are attached to a root that starts with two consonants (38b), the first consonant of the root is syllabified into the coda of the word-initial syllable, so the prefix and the initial root of the consonant comprise a singular bimoraic foot:

(38)

a.	$/m e / \sim / m / - / v i j t i t i t /$ $/t e / \sim / t / - / m o m j i j /$	$(m i - v i j)(t i t i t)^{12}$ $(t o - m o m)(j i j)$	‘fight’ (perfect) ‘cold’ (future)
b.	$/b e / \sim / b / - / g h u w /$ $/n a / \sim / n / - / ^k p^w l i s m e n /$	$(b e - g)(h u w)$ $(n a - ^k p^w)(l i s)(m e n)$	‘for the rat’ ‘a/the policeman’

In (38a), where the prefix is footed with the first syllable of the root, the vowel of the varying prefix shows up as harmonic with the second vowel in the same foot. In (39b), on the other hand, the vowel of the prefix is parsed, together with the first consonant of the root, into a separate foot, and does not harmonize with the vowel outside the foot. It seems clear, therefore, that there is a **prosodic restriction** on the vowel harmony: the target must be in the same foot as the trigger. Otherwise, the vowel-final allomorph is

¹² Footing might or might not be persistent, it is only the initial foot that affects vowel harmony/allomorph selection in the language.

selected, and a vowel that has underlying specifications does not change them on the surface (no IDENT violations). While François (2000) is forced to say that two consonants is a ‘blocking boundary’ and a single consonant is not, we can analyze the phenomenon as being restricted by the **domain** of a bimoraic foot.

Our alternative analysis, therefore, takes into account several factors: the foot structure of the language; allomorph selection; and whether or not there is a single-consonant allomorph of a prefix (varying vs. non-varying prefixes). Below is an account of the pattern with the varying prefix /na-/~/n-/ (definite/indefinite determiner):

Tableau 1

/na~/n/-/k ^w ʊŋ/ ‘the/a night’	*COMPONS	IDENT [±high] [±front] [±round] [±ATR]	AGREE (V[±high] FT) [±front] [±round] [±ATR]	DEP _(v)
☞ a. (nʊ-k ^w ʊŋ)				*
b. (n-k ^w ʊŋ)	*!			
c. (na-k ^w ʊŋ)			*!	
d. (nʊ-k ^w ʊŋ)		*!		

There are two constraints in the tableau above that cannot be violated: a markedness constraint against complex onsets, and a faithfulness constraint that bans any vocalic features that are changed from the output to input. The two constraints are unranked with respect to each other. Candidate (b) fatally violates one of these constraints, *COMPONS, and is eliminated. Candidate (c), that has the longer allomorph of the prefix, violates the AGREE constraint that requires that all vowels within a foot agree with respect to all vocalic features. Candidate (d), though identical to candidate (a) on the surface, is a candidate that also chooses the longer allomorph of the prefix, but changes the quality of the prefix vowel to agree with the root-initial vowel within the same foot, thus violating the IDENT constraint. The remaining candidate (a), which appears with the shorter allomorph of the prefix and epenthesis, violates only the DEP_(v) constraint, but none of the others, therefore emerging as the winning candidate.

Let us now contrast the situation above, where the root starts with a single consonant, with the situation, where the same Definite/Indefinite prefix /na-/~/n/ is concatenated with a root that has two initial consonants in the underlying representation:

Tableau 2

/na-/~/n/-/ᵏpʷlismen/ 'a/the policeman'	*COMPONS	IDENT [±high] [±front] [±round] [±ATR]	AGREE (V[±high] FT) [±front] [±round] [±ATR]	DEP _(V)
☞ a. (na-ᵏpʷ)(lis)(men)				
b. (n-ᵏpʷ)(lis)(men)	*!			
c. (ni-ᵏpʷ)(lis)(men)				*!
d. (ni-ᵏpʷ)(lis)(men)		*!		

The tableau 3 above models how the longer allomorph of the Definite/Indefinite prefix is selected when the prefix is footed separately from the initial vowel of the root. Candidate (b) with the short allomorph and no epenthesis violates the highest-ranking *COMPONS constraint; candidate (d), which chooses the longer allomorph of the prefix but surfaces with a vowel different from the underlying specifications of the prefix vowel, fatally violates the IDENT constraint. The remaining two candidates, (a) and (c), surface with different allomorphs: (c) has the shorter allomorph of the prefix, with epenthetic [i]; candidate (a), on the other hand, chooses the longer allomorph /na-/. Neither candidate (a) nor candidate (c) violate any of the three higher-ranking constraints, but candidate (c) has an epenthetic vowel that candidate (a) does not. It is the DEP_(V) constraint, therefore, that is responsible for the choice of the candidate (a) in this situation: even though syllable structure and agreement of vowels within a foot are more important requirements, given the choice between a candidate with epenthesis and a candidate without, it is a candidate that is more faithful to the underlying representation that is chosen (candidate (a) in our example above).

Note how the model we have established accounts for cases where there is only one allomorph of the prefix (i.e. concatenation with so-called 'non-shifting' prefixes):

Tableau 3

/le/-/naw/ 'in the sea'	*COMPONS	IDENT [\pm high] [\pm front] [\pm round] [\pm ATR]	AGREE (V [\pm high] FT) [\pm front] [\pm round] [\pm ATR]	DEP _(V)
☞ a. (le-naw)			*	
b. (l-naw)	*!			
d. (la-naw)		*!		

When the prefix is of the non-varying type, i.e. has only one allomorph that ends in a vowel under the present analysis, there is no need for epenthesis as the prefix is vowel-final. Candidate (b) in tableau 3 above is ruled out by the *COMPONS constraint since it surfaces without the vowel of the prefix. In fact, this candidate could also be ruled out by a MAX_(segment) constraint that does not seem to be violated anywhere in the language. Candidate (d), even though it has the surface correspondent of the underlying vowel in the prefix, fatally violates the IDENT constraint, because the features of the vowel on the surface do not correspond to the features of the underlying vowel. Hence, candidate (a), despite its prefix vowel being disharmonic with the vowel in the same foot, is optimal here.

To summarize, there are several factors that determine vowel quality of prefix vowels in Mwoṭlap:

(39)

- a. Absence or presence of a consonant-only allomorph of a given prefix;
- b. Syllable structure that excludes complex onsets;
- c. Stronger prohibition (= higher-ranking constraint) against changing features specifications than adding features to an epenthetic vowel;
- d. Quality of the initial vowel of the root; and finally
- e. **Domain** of vowel harmony that is a **bimoraic foot**, where coda consonants contribute to weight.

Note that the role of prosody here is to restrict, or limit the domain of a phenomenon, total vowel harmony in the case under discussion, rather than to trigger vowel harmony, or add a condition on the trigger of vowel harmony, as in cases we discussed previously in this chapter. Note also that the prosodic condition on the vowel harmony in Mwotlap cannot be stress, since stress is always on the ultimate syllable synchronically, so the triggering vowel may or may not be stressed, depending on how many syllables a root has. There is, therefore, binary foot structure, with which stress does not coincide, and the effect of the foot structure on the segmental alternations in the language is to **restrict the domain** of the alternation.

It is also important to note that all the prefixes in the language are footed to account for the pattern of vowel harmony. The harmony shows us that there is at least one bimoraic foot at the left edge of a Phonological Word. Recall that stress, on the other hand, is always word-final, i.e. its assignment is due to a constraint that aligns prominence with the right edge of a Phonological Word, creating a misalignment of stress and foot boundaries, either if footing is not persistent, or if there is an unparsed final syllable, as in the example below:

Tableau 4

/be/ ~ /b-/mgumgu/ 'work' (purpose)	ALIGN-R ($\acute{\sigma}$, PWD)	ALIGN-L ¹³ (GRID ₂ , FT)
☞ a. (be-m)(gum)gú		*
b. (bé-m)(gum)gu	*!	

If, on the other hand, footing is persistent in the language **and** degenerate feet are allowed, it is the second type of Prominence Alignment constraint, the one that requires that a foot edge must be aligned with prominence, that is violated by the optimal candidate:

¹³ I chose ALIGN-L as a Prominence Alignment constraint here more for historical reasons, since the language used to have trochaic pattern rather than because it is possible to show that the foot type of trochee synchronically. ALIGN-R would be equally violated by the optimal candidate.

Tableau 5

/be/ ~ /b-/mgumgu/ 'work' (purpose)	ALIGN-R ($\acute{\sigma}$, PWD)	ALIGN-L ¹⁴ (FT, GRID ₂)
☞ a. (be-m)(gum)(gú)		**
b. (bé-m)(gum)(gu)	*!*	

Mwotlap vowel harmony, therefore, shows us that there is at least one bimoraic foot at the left edge of the word, but stress assignment is not matching the foot structure, due to the ALIGN-R ($\acute{\sigma}$, PWD) constraint outranking one of the Prominence Alignment constraints.

4.3 Case Study: Kera Vowel Sonority Distribution and [\pm high] Vowel Harmony

Kera, an East Chadic language of Afroasiatic language family, has several types of harmony, some of which must be accounted for with reference to foot structure. There are four overlapping types of vowel harmony:

(40)

- a. Complete harmony that applies within roots only; final light syllables are not subject to complete harmony;
- b. Between root and affix, there is height harmony;
- c. Rounding harmony that is triggered by suffixes with the vowel [u] and affects only the high central vowel [i]; and
- d. Fronting harmony that affects central vowels.

4.3.1 Relevant Basics

Kera is very unusual in that it apparently has no detectable stress¹⁵ (Pearce (2003)); vowel harmony patterns in the language, however, require reference to foot structure, namely to

¹⁴ See previous footnote.

¹⁵ It is difficult to evaluate what this statement really means: it could mean that no prominence detected impressionistically or instrumentally, or it could mean that speakers are unable to pick out more prominent

bimoraic feet. Evidence for postulating foot structure, apart from [±front] harmony to be discussed momentarily, comes from phonotactics involving three non-high vowels [ɛ, a, ɔ]. The lower-sonority vowels [e, ə, o] are found only in a particular metrical environment that can only be defined as a trough syllable of an iambic foot.

The Kera vowel inventory is listed below:

(41)

i	i	u
ɛ/e	ɔ/o	
a/ə		

Vowel length is phonemic in the language, and each of the short vowels has a long counterpart, with the same set of features as short vowels, as is illustrated by the minimal pairs below:

(42)

cere ‘libation’	cɛ:rɛ ‘rip open’
ɖere ‘gathering fruit’	ɖɛ:rɛ ‘pour liquid’
hame ‘eat’	ha:mɛ ‘bend metal’
hole ‘skin of animal’	ho:lɛ ‘rewarm’
ɖɛ ‘go’ (imperfective)	ɖɛ: ‘go’ (perfective)
diri ‘in them’	di:ri ‘with them’
duru ‘in him’	du:ru ‘with him’
dɪri ‘in her’	dɪ:ri ‘with her’
kəsaw ‘sauce’	ka:saw ‘millet’

There are no diphthongs in Kera. The three non-high vowels have alternates: ɛ/e, a/ə, ɔ/o. According to Pearce’s (2003) analysis, in each case, the second vowel differs from the first with respect to specification for the [ATR] feature, but they also differ in sonority, the [-ATR] vowels being more sonorous than the [+ATR] ones. I see the distribution of non-high vowels as one marking the position of accent, rather than [ATR] alternations.

syllable(s). I will maintain that accent in Kera has vowel sonority as phonetic correlate, rather than duration or pitch.

4.3.2 Non-high Vowel Sonority Distribution

Pearce (2003) finds the following distribution of vowels correlating with particular types of syllable sequences:

(43) In CVCV or CVCVC

- | | | | |
|----|-----------|-------|-----------|
| a. | [i] [i] | midɪ | ‘miracle’ |
| | [i̠] [i̠] | kikiw | ‘flies’ |
| | [u] [u] | tukur | ‘plate’ |
| b. | [e] [ɛ] | bege | ‘cattle’ |
| | [ə] [a] | kəram | ‘women’ |
| | [o] [ɔ] | solɔj | ‘money’ |

Note that in words with two open syllables or an open syllable followed by a closed syllable we either see only two identical high vowels (43a), or two vowels differing only in sonority if the vowels are non-high (43b). In the latter case, it is the second vowel in the sequence that has to be of higher sonority: sequences like CɛCe(C), CaCə(C), and CɔCo(C) are prohibited.

In trisyllabic (or trimoraic) words, however, the situation is different:

(44) In CVCV(C).CV

- | | | | |
|----|----------------|-------------------------|-----------------|
| a. | [i̠] [i̠] [a] | gidiwa | ‘stick’ |
| | [i] [i] [u] | a-tifinku ¹⁶ | ‘aubergine’ |
| | [ə] [a:] [ɔ] | gəda:mɔ | ‘horse’ |
| | [a:] [a] [ɔ] | ba:sajmɔ | ‘(sp. of) bird’ |
| | [i̠] [i̠] [i] | a-minili | ‘chameleon’ |
| | [a:] [ɛ] ka:dɛ | | ‘hair’ |
| | [a] [ɔ] kaskɔ | | ‘bird’ |
| b. | [a:] [a] | sa:ma | ‘rope’ |
| | [ɛ] [ɛ] | lɛntɛ | ‘lost’ |
| | [a:] [a] [a] | ka:lajna | ‘regret’ |
| | [o] [ɔ] [ɔ] | mɔlɔrɔ | ‘saliva’ |

¹⁶ Prefix *a-*, which obligatorily appears with some nouns, is not parsed into feet, and is not subject to sonority alternations or vowel harmony.

As we can see, the ‘stray’ final light syllable might, as in (44a), or might not (44b) be harmonic with the vowels that precede it in the root. We might consider that harmonic vowels in (44b) are simply accidental. However, it seems that there is another interesting property of final light syllables: they are always of higher sonority, i.e. the same vowels that are allowed in heads of feet, but disallowed in feet’s troughs. A distribution like that suggests that the final syllables footed by themselves are accented.

Below are more examples of sonority distribution that can be seen in underived (at least synchronically) roots consisting of up to four syllables:

(45)

a. monosyllabic

(kaw)	‘milk’
(si)	‘cow’
(ja:)	‘friend’
(ka:)	‘people’
(ca:)	‘poor’

b. bisyllabic

(cəwa)	‘sun’
(ka:)(saw)	‘millet’
(dəmal)	‘drum’
(beɛ)	‘love’
(tosɔ)	‘sore’

c. trisyllabic

(kətar)(taw)	‘boats’
(sa:)(təraw)	‘cat’
(gɔdər)(məj)	‘leach’
(ta:)(məka)	‘sheep’
(kesər)(dɛŋ)	‘traditional skirt’

d. quadrisyllabic

(gədar)(gəɗaw)	‘granaries’
(tiwir)(nini)	‘electric fish’

If prominence and foot structure of the language match, sonority distribution shows us the binary iambic left-to-right foot structure, in addition to the location of prominence in

the language. It appears that the choice between higher-sonority and lower-sonority non-high vowels is subject to sonority constraints on stressed vowels: accented vowels have to be of higher sonority than their respective unaccented counterparts. I believe that the distribution of non-high vowels in the language, therefore, is a consequence of the relative sonority of stressed vowels, rather than the assignment of the feature $[\pm\text{ATR}]$ *per se*¹⁷. If the position of prominence and foot structure of the language are perfectly aligned, the distribution of non-high vowels also gives us the inventory of possible feet in Kera:

(46)

LH	CV.CV: or CV.CVC	(dəmal) ‘drum’
H	CV: or CVC	(ka:)(saw) ‘millet’
LL	CV.CV	(beɛ) ‘love’
L	CV	(sa:)(ma) ‘rope’

The $[\pm\text{ATR}]$ distribution, or, rather, sonority of non-high vowels distribution, though a static generalization in Kera, is, I believe, the basis of sonority considerations in allomorph selection in Maŋsi and Shipibo, which we discuss in the following chapter in detail.

With the foot inventory and foot structure principles established, we now turn to vowel harmony alternations that show influence of the foot structure.

4.3.3 Fronting Harmony

There are two types of fronting harmony in Kera. In **Type 1**, suffixes containing a high vowel cause fronting and/or rounding of the high central vowel [ɨ] within the Prosodic Word:

(47)

/ci:r/-/i/	ci:ri	‘your (f) head’
/ci:r/-/u/	cu:ru	‘his head’

¹⁷ Pearce (2006) also proposes an analysis in these terms observing that the open vowels are c. 20 ms. longer than the closed ones.

Type 2 harmony is more interesting for the purposes of this dissertation: suffixes containing any front vowel, e.g. Imperfective /-ε/ (48a and 49a) and the 2nd person possessive feminine /-i/¹⁸ (48b and 49b), cause central vowels [i, a] **in the same foot** to front:

(48)

a.	/bal/-/ε/	(be ε)	‘love’ (Imperf)
	/biŋ/-/ε/	(biŋi)	‘open’ (Imperf)
	/i s/-/ε/	(ʔisi)	‘sit down’ (Imperf)
	/fal/-/ε/	(fe ε)	‘find’ (Imperf)
	/wi t/-/ε/	(witi)	‘hit’ (Imperf)
	/ham/-/ε/	(heme ε)	‘eat’ (Imperf)
b.	/mar/-/i/	(miri)	‘your (f) wife’
	/di r/-/i/	(diri)	‘your (f) eye’
	/ba r/-/i/	(biri)	‘your (f) father, master’

If, however, the front vowel of the suffix is footed separately from the root vowel, fronting does not apply:

(49)

a.	/vi:g/-/ε/	(vi:)(gi)	*(vi:)(gi)	‘empty’ (Imperf)
	/ba:d/-/ε/	(ba:)(dε)	*(be:) dε	‘wash’ (Imperf)
	/i sk/-/ε/	(ʔis)(ki)	*(ʔis)(ki)	‘understand’ (Imperf)
	/ha:m/-/ε/	(ha:)(mε)	*(he:)(mε)	‘mend metal’ (Imperf)
b.	/ka:s/-/i/ ¹⁹	(ki:)(si) ²⁰	*(ki:)(si)	‘your (f) hand’
	/da:r/-/i/	(di:)(ri)	*(di:)(ri)	‘your (f) friend’
	/na:r/-/i/	(ni:)(ri)	*(ni:)(ri)	‘your (f) aunt’
	/gigi:r/-/i/	(gigi:)(ri)	*(gigi:)(ri)	‘your (f) knee’
	/nawr/-/i/	(niw)(ri)	*(niw)(ri)	‘your (f) sister’
	/tarm/-/i/	(tir)(mi)	*(tir)(mi)	‘your (f) heart’

¹⁸ Used only with inalienable nouns, it seems, or nouns that can be interpreted as such.

¹⁹ cf.

/ka:s/-/u/	ki:su	‘his hand’
/ka:s/-/a/	ka:sa	‘her hand’

²⁰ Raising in this root is due to another type of vowel harmony, [±high], that is not restricted by foot structure.

The fronting harmony in Kera, therefore, is clearly dependent on foot boundaries: whereas most vowel harmony systems have the Prosodic Word as a domain, the fronting harmony in the language has foot as its domain. Given the distribution of non-high vowel pairs *ɛ/e*, *ɔ/o*, and *a/ə*, which we take as marking prominent vs. non-prominent syllables, we conclude that foot boundaries and position of prominence coincide in Kera, with prominence assigned to the rightmost syllable of a foot.

4.4 Case Study: Ibibio Verbs

There are three phenomena in Ibibio that are of interest to us in this dissertations: vowel distribution; voiceless stop lenition; and finally, verbal suffixation.

Ibibio is spoken in Akwa Ibom State in the Niger-Delta region of Nigeria. Essien (2001) puts the number of speakers at 4 million. Greenberg (1963) classifies Ibibio under the Benue-Congo branch of the Niger-Congo family. It is subclassified as a Lower-Cross language of the Cross-River subfamily.

The data in this case study is from Akinlabi and Urua (2002), Essien (1990), and Kaufman (1968). Ibibio itself has a fair amount of dialect variation. The dialect Akinlabi and Urua (2002) discuss is the Uruan dialect, as spoken in Mbaya, about eight miles from Uyo, the location of the state headquarters.

4.4.1 Relevant Basics

In Ibibio, monosyllabic verb roots may take one of three shapes: they may be CVVC, CVC, or just CV²¹:

(50)

- | | | | | | | |
|----|------|-------------|------|-----------|-----|-----------------------|
| a. | waak | ‘tear’ | deep | ‘scratch’ | kɔŋ | ‘hang up (a dress)’ |
| b. | wat | ‘paddle’ | dep | ‘buy’ | kɔŋ | ‘knock (on the head)’ |
| c. | wa | ‘sacrifice’ | se | ‘look’ | kpɔ | ‘carry’ |

²¹ here and throughout, tones are omitted

Each of the items above may be used in isolation (i.e. without any affix), as, for example, in imperatives.

Aside from the monosyllabic verb roots above, Ibibio also has synchronically underived disyllabic verbs, which can take the form of CVCCV (51a), CVVCV (51b), or CVCV (51c):

(51)

a.	dappa	‘dream’ (verb)
	damma	‘be mad’
	dɔkkɔ	‘tell’
	temme	‘explain’
b.	faaŋa	‘argue’
	yɔɔŋɔ	‘plaster a wall (surface)’
	yeeme	‘wilt’
	daara	‘rinse’
c.	saŋa	‘walk’
	kɔŋɔ	‘choke’
	feye	‘run’
	bɔyɔ	‘overtake’
	kere	‘think’
	sara	‘comb’

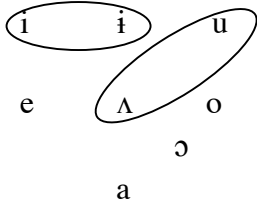
Note that in disyllabic roots, when the first syllable is closed, it is closed by the first part of a geminate. All the vowels in roots are harmonic.

With this background, we turn to specific alternations in Ibibio verbs. We will first consider the distribution of vowels in the language.

4.4.2 Vowel Distribution

Below is the vowel system of Ibibio, with allophones circled:

(63)



The high vowels [i] and [u] have centralized allophones [i̠] and [ʌ]. According to Akinlabi and Urua (2002) and Essien (1990), [i̠] is also lower than [i], and, of course [ʌ] is lower than [u]. It seems, therefore, that the alternations of the high vowels could be interpreted as alternations driven by sonority considerations, central lower vowels [i̠] and [ʌ] being more sonorous than high [i] and [u], respectively. The alternations, consequently, are very similar to the ones in Kera, discussed in the previous section, and also possibly indicate prominence, about which we have no information available otherwise.

In disyllabic CVCV roots, the lower central vowels appear in the first syllable, and the high vowels, or non-alternating vowels, in the second syllable:

(64)

- | | | | | | |
|----|------|----------------|----|------|--------------|
| a. | niye | ‘tickle’ | b. | tʌnɔ | ‘discipline’ |
| | bime | ‘scramble for’ | | tʌnɔ | ‘chastise’ |
| | tire | ‘stop’ | | | |
| | sine | ‘put on dress’ | | | |

Similarly, when the Agentless Passive/Reflexive suffix is added to CVC roots, the initial vowel of the resulting form has the higher sonority allophone of [i] and [u], while the second vowel does not:

(65)

a.	/dip/-/kV/	diβe	‘hide oneself’
	/jit/-/kV/	jire	‘be fastened/fasten on oneself’
	/bit/-/kV/	bire	‘spread oneself’
	/sin/-/kV/	sine	‘put dress on (or by) oneself’
b.	/fuk/-/kV/	fΛγo	‘cover oneself’
	/kuk/-/kV/	kΛγo	‘be shut’
	/dut/-/kV/	dΛrɔ	‘drag oneself’
	/mum/-/kV/	mΛmɔ	‘catch oneself’
	/kup/-/kV/	kΛβo	‘be covered’

CVC roots in isolation also have the more sonorous [i] and [Λ], and never the less sonorous [ɪ] and [u]:

(66)

a.	/dip/	dip	‘hide’
	/jit/	jit	‘fasten’
	/bit/	bit	‘spread’
	/sin/	sin	‘put on (dress)’
b.	/fuk/	fΛk	‘cover’
	/kuk/	kΛk	‘shut (door)’
	/dut/	dΛt	‘drag’
	/mum/	mΛm	‘catch’
	/kup/	kΛp	‘cover (with lid)’

Roots of the form CVVC, which are shortened to CVC when the Agentless Passive/Reflexive suffix is added, must also contain only [i] and [Λ], and cannot surface with [ɪ] or [u]:

(67)

a.	siit	‘seal/block an opening’	sire	‘be sealed/blocked’
	fiik	‘press down’	fiye	‘be piled up’
	fiip	‘suck’	fiβe	‘have an object stick out of the mouth’

b.	wuuk	‘drive something in’	wΛγɔ	‘be driven in’
	buuk	‘bury’	bΛγɔ	‘be buried’

Given the facts in (64 – 67) above, it is reasonable to say that the more sonorous vowels appear in initial position of a (disyllabic or bimoraic) foot, and the less sonorous [i] and [u] appear otherwise. The only counterexamples to this generalization Ibibio presents are CVV or CVVC roots, i.e. high long vowels do not lower or centralize even in word-initial position:

(68)

a. Negative forms

/siit/-/kV/	...siire	‘not sealing an opening’
/fiik/-/kV/	...fiɪye	‘not pressing down’
/fiip/-/kV/	...fiiβe	‘not sucking’
/wuuk/-/kV/	...wuuγɔ	‘not driving something in’
/buuk/-/kV/	...buuγɔ	‘not burying’

b. Reversive forms

/siit/-/kV/	sitte	‘unseal/unblock an opening’
/wuuk/-/kV/	wakkɔ	‘driving something out’

In (68a), where the Prosodic Word-initial syllable contains a long vowel, the high vowels appear without lowering/centralization, while when the underlying long vowel is shortened due to some suffixation conditions to be discussed shortly, only more sonorous [i] and [Λ] appear. If, indeed, the alternation of sonority between the vowels indicates the position of prominence, we can argue that long vowel are not only more sonorous than their short counterparts, but are also more sonorous than short lower/centralized more sonorous alternates [i] and [Λ]. The prominent position, hence, is the initial syllable of a Prosodic Word.²²

²² Prosodic Word excludes some verbal prefixes.

Another interesting property of Ibibio vowels can be seen if we consider verbal suffixation: certain (homophonous) suffixes in the language consist of an underlying /k/ followed by a copy of the root vowel:

(69)

se	‘look’	n-see-ye	‘I am not looking’
nɔ	‘give’	n-nɔɔ-ye	‘I am not giving’
do	‘be’ (copula)	n-doo-ye	‘I am not giving’
da	‘stand’	n-daa-ya	‘I am not standing’

The same Negative suffix, however, appears with either [e] after root [i]/[i] or [ɔ] after root [u]/[ʌ] (see, for example, (68a) above). Outside roots, therefore, the vowels are neutralized to central vowels, possibly indicating that only prominent vowels, that are root-initial vowels, can appear with their underlying [+high] feature. If the alternation between [i, u] and [i, ɔ], respectively, indicated the foot structure rather than prominence, we would expect at least some suffix vowels (foot-initial or foot-final) to appear as (variants of) high vowels. It appears, therefore, that, similar to Kera vowel alternations, the high vowels mark the location of prominence (the initial syllable of a Prosodic Word), rather than foot structure. With this hypothesis in mind, we will now discuss voiceless stop lenition, which is analyzed as foot structure-dependent in Akinlabi and Urua (2002).

4.4.3 Voiceless Stop Lenition

The following consonants occur in Ibibio in Prosodic Word-initial position (Urua (2000)):

(70)

p	t	k	kp
b	d		
m	n	ɲ	ŋ
f	s		
w	j		

Syllable-finally, the set of consonants above is reduced:

(71)

p t k
m n ŋ

As we can see, the syllable-final consonants are reduced to stops (oral or nasal), and to labials, coronals and dorsals.

Ibibio also shows voiceless stop lenition, where [p t k] lenite to [β r ɣ] respectively, but the lenition is prosodically restricted: weakening does not apply Prosodic Word-initially:

(72)

a. Prosodic Word-internal

dip	‘hide’	/dip/-/kV/	[diβe] _{PWD}	‘hide oneself’
wet	‘write’	/wet/-/kV/	[were] _{PWD}	‘be written’
fΛk	‘cover’	/fuk/-/kV/	[fΛɣɔ] _{PWD}	‘cover oneself’

b. Prosodic Word-initial

/u/-/taŋ/	u-[taŋ] _{PWD}	*[uraŋ] _{PWD}	‘plaiting’
/u/-/kup/	u-[kΛp] _{PWD}	*[uɣΛp] _{PWD}	‘covering’

The failure of lenition in (72b) above is due to the fact that the Ibibio nominalizing prefix /u-/ lies outside the Prosodic Word domain. Within a root, the generalization holds:

(73)

/topo/	[toβo] _{PWD}	*[topo] _{PWD}	‘make an order’
/sata/	[sara] _{PWD}	*[sata] _{PWD}	‘comb’
/feke/	[feye] _{PWD}	*[feke] _{PWD}	‘run’

Note that if our hypothesis that the initial syllable, whether heavy or light, of the Prosodic word is the prominent one, we can formulate the lenition condition as prominence dependent: a voiceless stop lenites after a prominent syllable. One apparent counterexample to lenition would show up with geminate voiceless stops that do not lenite despite following the initial syllable:

(74)

kΛp	‘hear’	i-[kΛp-pɔ] _{PWD}	‘he/she is not hearing’
jet	‘wash’	i-[jet-te] _{PWD}	‘he/she is not washing’
bot	‘mould’	i-[bot-to] _{PWD}	‘he/she is not molding’
dat	‘take/pick up’	i-[dat-ta] _{PWD}	‘he/she is not taking/picking up’
kɔk	‘vomit’	i-[kɔk-kɔ] _{PWD}	‘he/she is not vomiting’

Geminates in the language do not lenite, even though they follow Prosodic Word-initial syllables. This counterexample, however, just seems to be an instance of ‘geminate inalterability’ (see Kirchner (2000) and references therein) and the voiceless stops do not lenite just by virtue of being geminates.

Even though Akinlabi and Urua (2002) consider the lenition of voiceless stops as restricted to onsets of troughs of trochaic feet, rather than to consonants following prominent syllables, such an analysis would have to consider trochaic feet of the form (HL) not only possible, but **optimal** with certain types of verb forms, as Akinlabi and Urua (2002) claim. Only under their analysis of foot structure in the language the ‘trough of a foot’ environment for voiceless stops is sustainable. In the next subsection, I argue that such an analysis is misguided, and that even though an uneven trochee is a possible foot form in Ibibio, it is never the optimal one. The environment of voiceless consonant lenition, consequently, is better defined with reference to prominence rather than foot structure.

4.4.4 Verbal Suffixation

Essien (1990) refers to Ibibio morphemes that mark verb negation, reversion or action, and relativization as verbal extensions. These morphemes are homophonous, and have the underlying form /kV/, where the vowel of the suffix is a copy of the root vowel, with exceptions mentioned above.

When the Negative suffix is concatenated with a root of the form /CVC/, the consonant of the suffix is fully assimilated to the last consonant of the root, and the root itself is unchanged:

(75)

dep	‘buy’	i-dep-pe	‘he/she is not buying’
kʌp	‘hear’	i-kʌp-po	‘he/she is not hearing’
yet	‘wash’	i-yet-te	‘he/she is not washing’
bot	‘mould’	i-bot-to	‘he/she is not moulding’
dat	‘take/pick up’	i-dat-ta	‘he/she is not taking/picking up’
ɲek	‘shake’	i-ɲek-ke	‘he/she is not shaking’
kɔk	‘vomit’	i-kɔk-kɔ	‘he/she is not vomiting’
dom	‘bite’	n-dom-mo	‘I am not biting’
nam	‘do/perform’	n-nam-ma	‘I am not performing’
bon	‘father a child’	m-bon-no	‘I am not fathering a child’
saŋ	‘go’	n-saŋ-ŋa	‘I am not going’
kɔŋ	‘knock’	ŋ-kɔŋ-ŋɔ	‘I am not knocking’

As is evident from the forms above, the Negative suffix surfaces with the same consonant as the final consonant of a CVC root, and with the vowel of the root as well. Person prefixes have to be added to form the negative form, but they do not seem to affect the shape of the root + suffix complex. In fact, person and other prefixes in Ibibio are not a part of prosodic structure of the roots. The same pattern can be observed with CVC roots with the Reversive suffix. This suffix is homophonous with the negative one, but its distribution is restricted to less roots. The Reversive forms do not need a prefix to be well-formed:

(76)

kɔp	‘lock (door)’	kɔp-pɔ	‘unlock’
sɔt	‘squat’	sɔt-tɔ	‘move from squatting position’
tem	‘cook’	tem-me	‘remove cooked food from fire’
bjom	‘carry load on head’	bjom-mo	‘remove load from the head’

After CV verb roots, the Negative suffix takes the form of a dorsal continuant [ɣ] and a vowel identical to the preceding vowel, but the /CV/ roots now become CVV:

(77)

se	‘look’	n-see-ɣe	‘I am not looking’
nɔ	‘give’	n-nɔɔ-ɣɔ	‘I am not giving’
do	‘be’ (copula)	n-doo-ɣo	‘I am not giving’
da	‘stand’	n-daa-ɣa	‘I am not standing’

According to our generalization in the previous subsection, [ɣ] is the reflex of lenited underlying /k/, with lenition appearing after the prominent Prosodic Word-initial syllable.

After CVVC roots, there is a distinction between the Negative and Reversive forms. The Negative takes the form of a vowel identical to the preceding vowel, while the reversive takes the form of a CV as in the CVC roots, but the CVVC root is not shortened to CVC:

(78)

a. Negative forms

faak	‘wedge between two objects’	...faa-ɣa	‘...not wedged’
kwɔŋ	‘hand on hook’	...kwɔ-ŋɔ	‘...not hanging on hook’
ɲɔɔn	‘crawl’	...ɲɔɔ-nɔ	‘...not crawling’
weem	‘flowing’	...wee-me	‘...not flowing’
koot	‘read/call’	...koo-ro	‘...not reading/calling’
deep	‘scratch’	...dee-βe	‘...not scratching’

b. Reversive forms

faak	‘wedge between two objects’	fak-ka	‘remove wedged object’
kwɔŋ	‘hang on hook’	kwɔŋ-ŋɔ	‘remove from hook’

Finally, the negative suffix takes the form [ke], without the lenition of the underlying voiceless stop of the suffix after disyllabic verbs, no matter the segmental melody of the verb. Consider the negated forms of disyllabic verbs below:

(79)

a. /CVCCV/ roots

dappa	‘dream’ (verb)	...dappa-ke	‘...not dreaming’
damma	‘be mad’	...damma-ke	‘...not being mad’
dɔkkɔ	‘tell’	...dɔkkɔ-ke	‘...not telling’

b. /CVCV/ roots

/topo/	‘make an order’	...toβo	‘...not making an order’
/sata/	‘comb’	...sara	‘...not combing’
/feke/	‘run’	...feye	‘...not running’
/saŋa/	‘walk’	...saŋa-ke	‘...not walking’
/kɔŋɔ/	‘choke’	...kɔŋɔ-ke	‘...not choking’

Yet another suffix that has a similar effect on roots is the Relative suffix. Below are examples with CVC (80a), CV (80b) and CVVC (80c) roots:

(80)

a.	dep	‘buy’	dep-pe	‘one who has bought’
	wat	‘drive’	wat-ta	‘one who has driven’
	wot	‘kill’	wot-to	‘one who has killed’
	tem	‘cook’	...tem-me	‘...which is cooking’
	bom	‘break’	...bom-mo	‘...who has broken’
b.	ma	‘love’	maa-ya	‘one who loves’
	bo	‘say’	...boo-yo	‘...who is saying’
	kpe	‘judge a case’	...kpee-ye	‘...who is judging’
c.	waak	‘tear’	...waa-ya	‘...which is torn’
	kpeep	‘teach’	...kpee-βe	‘...who is teaching’
	koot	‘read’	...koo-ro	‘...who is reading’
	kɔɔŋ	‘hang on hook’	...kɔɔ-ŋɔ	‘...which is hung’
	soon	‘mock’	...soo-no	‘who is mocking’
	weem	‘flowing’	...wee-me	‘which is flowing’

As the data above shows, the Relative suffix behaves more like the Negative than the Reversive suffix with respect to treatment of CVVC roots: the first consonant of the suffix is deleted, and the final consonant of the root is syllabified into the onset of the final syllable.

There are two generalizations to be made from the patterns of Negative/Reversive suffixation: first, the input root form to the Negative/Reversive suffixation has to have one of the following shapes:

(81)

a.	CVCCV	HL
b.	CVCV	LL
c.	CVV	H
d.	CVC	H

Leaving the shape in (80a) aside for a moment, the three remaining shapes above pattern together. It stands to reason to hypothesize that codas are moraic in the language, so CVC syllables are heavy, and trimoraic syllables are not allowed in derived roots.

The second generalization that we can make from the Negative/Reversive suffixation is that in order to reach one of the desired prosodic targets, different roots are manipulated in different ways; in one instance, with roots of the shape CVVC, *-ke* negative suffix behaves differently from the reversive suffix with respect to its effect on the roots: while both inflectional stems surface as bimoraic (heavy) syllable, CVV or CVC, the results are achieved in disparate ways.

Akinlabi and Urua (2002) propose that the root + inflectional suffix complex (a constituent they dubb ‘inflectional stem’) has a templatic target of its own; the target is a **disyllabic unbalanced** foot, and the relevant templatic constraint is stated as follows:

- (82) Inflectional Stem = [σμμ σμ] (INFLST) (A&U 2002:127)
The Inflectional Stem is a heavy-light trochee

According to Akinlabi and Urua (2002)’s analysis, ideally, the right edge of this trochaic foot is aligned with the right edge of the inflectional affix; the left edge of the foot is aligned with the left edge of the root; and the inflectional stem matches the template.

I believe this analysis to be undesirable because, first, there is a constituent ‘inflectional stem’ that is different from Prosodic Word; secondly, the template for the constituent is defined not only as a foot, but a foot containing particular types of syllables; and finally, the template identifies as optimal an uneven trochaic foot, where the first syllable has to be heavy, whereas this type of trochee has repeatedly been shown to be the least optimal, if at all possible (see Hayes (1989), (1995), McCarthy and Prince (1986), (1996)).

An alternative analysis I propose here is based on the notion of Minimal Word, a requirement that disallows (content) words of less-than-a-foot size. I propose that the type of suffixation we have been discussing has the Minimal Stem requirement, i.e. the

suffixes in question are subcategorized to attach to stem of (minimally) a foot. The requirement can be enforced by Alignment constraints that make the foot edges correspond to the right and left edges of the root, respectively, and Foot Binariness_(μ) minimum constraint that would disallow degenerate feet.

Abstracting away from particular changes to roots for each of the suffixes we have discussed above, we can analyze the Ibibio suffixation as a phenomenon where the suffixes have to be attached to Minimal Stem, regardless of the underlying shape of the root. Hence, even though a heavy-light trochee is a possible foot type in Ibibio, as in formations with the underlying /CVCCV/ roots, e.g. ...(*damma*)-*ke* ‘...not being mad’, this foot shape is definitely not the target shape, but rather arises as a result of subcategorization and the Alignment and Binariness constraints mentioned above.

While the suffixes we have mentioned above subcategorize for stems with a particular prosodic shape (moraic trochee), this is not true for all verbal suffixation in Ibibio. We will now turn to the suffixation that creates “reflexive” or the “agentless passive” forms of verbs (i.e. verbs with suppressed external argument according to Essien (1990) or Urua (1990)). Below we see the suffixed forms of CVC (83a) and CVVC (83b) roots:

(83)

a.	jat	‘wear a hat’	jara	‘wear a hat on oneself’
	dot	‘place on top of’	doro	‘place on top of oneself/be on top’
	wet	‘write’	were	‘be written’
	kɔp	‘lock’	kɔβɔ	‘be locked’
	bot	‘create/mold’	boro	‘be shaped’
	man	‘give birth’	mana	‘be born’
	bɔp	‘tie’	bɔβɔ	‘tie on oneself’
	tat	‘loosen’	tara	‘be loosened’
	dɔŋ	‘put in’	dɔŋɔ	‘be put in’
	waŋ	‘wrap around’	waŋa	‘be wrapped around/wrap around oneself’
	fɔp	‘roast’	fɔβɔ	‘be roasted’
b.	dɔɔn	‘talk smoothly’	dɔnɔ	‘be smooth’
	kɔk	‘stack’	kɔɔɔ	‘be stacked’
	beek	‘remove corn’	beye	‘be removed (of corn)’
	waak	‘tear’	waya	‘be torn to pieces’
	kɔŋ	‘hang’	kɔŋɔ	‘be hung/hang on oneself’

The Agentless Passive forms of CV verbs have a different mechanism of formation: high-tone prefixation is required, and the root remains unchanged. Since there is not enough data to determine how the prefixation and the suffixation methods can be related to foot structure of the language, I will not discuss the prefixation method here.

As we can see, the data in (83) above shows that roots that are underlyingly larger than /CV/ get shortened to CV when subject to this type of suffixation. In other words, the whole derived Prosodic Word has to be a bimoraic foot, and there is no subcategorization for any particular shape of the stem. I believe that this type of suffixation provides additional support to the proposal that a heavy-light trochee is not a target shape in Ibibio: there is shortening of the underlyingly long vowels in (83b), creating a light-light trochee. We saw that shortening of the root vowel is one of the mechanisms to arrive at a target root shape, so an even trochee emerges whenever possible. In fact, the only type of uneven trochee that we saw would be with the underlying /CVCCV/ roots, where a syllable cannot be deleted even to achieve the desirable form of bimoraic trochee. It is unfortunate that there are no examples of concatenation of such roots with the Agentless Passive/Reflexive suffix, since the prediction under the present analysis would be that the suffixed forms surface as (CVC)(CV-CV), with two even feet that the suffixed form is parsed into.

The difference between the two types of suffixation, therefore, boils down to subcategorization: type one suffixation, with the Negative, Relative and Reversive suffixes has a subcategorization requirement, where the suffixes have to be concatenated with a stem that is minimally a (bimoraic) foot, whereas the type two suffixation, with the Agentless Passive/Reflexive suffix does not have such a requirement. The latter type of suffixation also shows that there is a requirement on the whole Prosodic Word to be footed. Note that it is not necessary to say that the first type of suffixation does not have the requirement on the whole Prosodic Word to be parsed into feet, just that the subcategorization requirement on the root shape supercedes the constraint on exhaustive parsing of the Prosodic Word.

To summarize, we discussed several phenomena that are related to prosody in Ibibio: the distribution of high vowels that indicates the position of the prominent syllable (Prosodic Word-initial); voiceless stop lenition that applies to onsets of post-tonic syllables; and finally, the two types of suffixation that help us define the foot structure in the language.

Since the voiceless stop lenition, previously analyzed as depending on foot structure, is recast here as sensitivity to prominence, it is not surprising that lenition in Ibibio shows signs of prominence-driven alternation, at least in that it is triggered by prosody rather than restricted by it and in that the alternation produces allophones like [β], [ɾ], and [ɣ] that are not present in the underlying inventory of the language.

4.5 Local Conclusions

In sum, there appear to be several points of typological dissimilarity between segmental alternations that are dependent on prominence and the ones that depend on foot structure of a language:

(84)

Prominence-dependent alternations	Foot structure-dependent alternations
triggered by position of prominence	restricted by foot structure
can produce allophonic alternates	produce contrastive alternates
optional in whether the alternation occurs; optional alternates	obligatory alternations; no optionality in reflexes of alternations
strictly local, segment-to-segment adjacency plays an important part	locality only in terms of position of the target within the structural unit (foot)

While none of the typological differences between the two types of alternations are exceptionless, the tendencies do exist in languages. This fact suggests that the notion of unbounded feet is not tenable, as cases of segmental alternation do not single out any such constituent in the same way they mark bounded feet.

We will take up the exceptionality of the typological differences outlined above and how they should be viewed in the context of synchronic grammar in the conclusions to this thesis. In the next chapter we will deal with cases of prosody/morphology interaction as it relates to segmental alternations.

In the case studies we have presented in this dissertation, there is no segmental alternation that depends on an unbounded foot when prominence assignment relies on different constraints. A hypothetical case below illustrates what such a language would look like:

(85) A non-existing language (schematic)

/melinə/-/daru/-/to/-/le/	mélinə-(dara-ta-la)
/ate/-/daru/-/to/-/le/	áte-da(ru-tu-lu)
/ri/-/daru/-/to/-/le/	rí-daru-(to-lo)
/porameni/-/daru/-/to/-/le/	pórame(ni-diri-ti-li)

The language above has uniformly initial stress and total vowel harmony that is triggered by the unbounded-foot initial syllable, where all the vocalic features are spread from the fourth vowel in the word throughout unbounded foot. In essence, the pattern is similar to vowel harmony in Mwotlap, where vowels within a foot harmonize, except in the hypothetical pattern in (85), the foot would have to be unbounded. Such a pattern, to the best of my knowledge, does not exist, which leads us to conclude that the notion of ‘unbounded foot’ is not part of grammar and should therefore be abandoned.

CHAPTER 5

MORPHOLOGY/PROSODY INTERFACE

5.1 Introduction

At issue in this chapter is the nature of interaction between prosody and certain types of allomorphy. Allomorphy that is rooted in segmental alternations like the ones we discuss in this thesis, gives support to the main proposal of this dissertation concerning the relationship between stress and foot structure.

It is well known that there are types of allomorphy that depend on phonology rather than on morphosyntactic information or arbitrary classes in the lexicon. The most commonly cited example, of course, is English *an* ~ *a* allomorphy of the indefinite determiner. Even though the phonology of the language in general does not include an [n] deletion or an [n] insertion requirement, the indefinite determiner appears as either *an* (if the following word begins with a vowel), or *a* if the following word begins with a consonant¹.

In Italian, there are (at least) two suppletive allomorphs for the prefix that negates an adjective, *s-* and *in-* (Scalise 1984), whose distribution depends on segmental phonology. The *s-* allomorph attaches to stems beginning in a consonant, as in:

(1)

fortunato 'lucky'
s-fortunato 'unlucky'

However, *s-* does not attach to vowel-initial adjectives², in which case the allomorph *in-* is used, as in:

¹ This rule is subject to lexical exceptions and dialectal and stylistic variation.

² It is curious to note that this distribution does not seem to be governed by Output Optimization, since the reverse would be expected, i.e. the *s-* allomorph attaching to vowel-initial adjectives creating an onset, and not attaching to the consonant-initial stems, because of the resulting complex coda.

(2)

utile 'useful'
*s-utile 'not useful'
in-utile 'not useful'

The allomorph *s-* is also never concatenated with adjectives whose initial segment cannot be preceded by *s-* by normal phonotactic rules of the language, i.e. the prefix allomorph that seems to be the preferred one for negative adjectives is blocked from attaching to stems when the result is unacceptable by regular phonology of Italian:

(3)

giusto 'right'
*sgiusto 'not right'
ingiusto 'not right'

All kinds of phonological environments can serve as conditioning allomorphy, and prosodic information is no exception. In English, to take another well-known example, the suffix */-ful/* that turns nouns into adjectives only attaches to stems ending in stressed syllables; and it also cannot attach to stems ending in */v f/*, presumably following regular phonotactics of the language (Siegel 1974: 164-174, Brown 1958, Chapin 1970).

Similarly, in Dutch (Booij & Lieber 1993), there are two allomorphs of the suffix that turns nouns into adjectives, *-isch* and *-ief*. The allomorph *-ief* is selected when the final syllable is stressed in the underived base and ends in *-ie*, while the other allomorph, *-isch*, is chosen elsewhere.

Another Dutch adjectivizing suffix, *-ig*, according to Trommelen & Zonneveld (1989) and Kager (1996) only attaches to stems ending in stressed syllables and may cause both blocking and stress shift.

The German deverbal adjectivizing suffix *-ei ~ -erei* surfaces with the allomorph *-erei* if the stem ends in a stressed syllable, while *-ei* is concatenated with stems ending in an unstressed final syllable (Hargus 1993, Hall 1990). For examples of this and other examples of German affixation that depend on the position of stress, see Hall (1990).

Examples where it is foot structure rather than stress that is responsible for allomorphy are somewhat more difficult to find, but they exist nevertheless. In chapter 2, we mentioned a case of foot structure-conditioned allomorphy in Northern Sámi (Saami, Lapp, Lappish) described and analyzed in Dolbey (1997), repeated here for convenience:

(4)

	jearra- ‘ask’	veahkehea- ‘help’	‘even’	‘odd’
1du	je:r.re.-∅	veah.ke.he:-t.ne	∅	-tne
2du	jear.ra.-beht.ti	veah.ke.heh-pi	-behtti	-hppi
2pl	jear.ra.-beh.tet	veah.ke.he:-h.pet	-behtet	-hpet
3pl pret	je:r.re.-∅	veah.ke.he:-d.je	∅	-d.je

As Dolbey (1997) argues, the allomorphy in all cases in (4) above is sensitive to the foot structure of the language (trochaic, quantity-insensitive, first foot is aligned with the left edge of a Prosodic Word). If the stem contains an even number of syllables, an allomorph that creates a fully footed word is attached, i.e. an allomorph with either no phonological material (1st person dual and 3rd person preterite forms), or with two syllables that create a foot by themselves (2nd dual and 2nd plural forms of the verb *jearra-* ‘ask’). If, on the other hand, a stem contains an odd number of syllables, as the stem *veahkehea-* ‘help’, monosyllabic allomorphs are the ones that attach to such stems (*-tne* for 1st person dual forms; *-hppi* for 2nd person dual; *-hpet* for 2nd person plural; and *-dje* for the 3rd person plural forms), all of which result, once again, in forms fully parsed into disyllabic feet. Note that the position of the stress does not play a part in the allomorph selection under question, since the stress in this Sámi language always falls on the initial syllable, without any secondary stress reported.

Hargus (1993) and Bergsland (1976) mention another example of allomorphy in Northern Sámi that depends on the foot structure of the stem, though not on the complete/incomplete parsing on the resulting form, since the allomorphs in this case are both disyllabic. The Illative plural suffix has two allomorphs, *-ide* and *-ida*. The allomorph of the suffix that has a higher (and hence less sonorous) vowel, *-ide*, attaches

when stem has an even number of syllables, and the allomorph that has the low vowel, *-ida*, is selected when stem has an odd number of syllables. Therefore, even though the resulting forms might not be completely parsed into binary feet, as in a case where an the disyllabic allomorph *-ida* is concatenated with a stem that has an odd number of syllables, the driving force of this allomorphy still seems to be output optimization, since the second syllable of the allomorph in this case ends up being parsed into a degenerate (monosyllabic) foot by itself, and its more sonorous vowel in the strong (head) position in a foot. On the other hand, when the allomorph *-ide* is selected as the one to attach to a stem with an even number of syllables, the suffix constitutes its own foot, with the second syllable containing a less sonorous [e] parsed into the weak second part of a trochaic foot.

Probably the most renowned example of the foot structure-sensitive allomorphy is found in Estonian, and is discussed in Prince (1980), Mürk (1991), and most recently in Kager (1995) and Blevins (2004). In Estonian, both nominal and verbal inflections have allomorphy that depends on the foot structure of the language.

In the nominal domain, Kager (1995) brings up the Partitive plural and Genitive plural suffixes that have more than one underlying form, and the choice between allomorphs is made on the basis of foot structure. The Partitive plural alternates between *-it* and *-sit*, and genitive plural, between *-te* and *-tte*. When suffixed to the stem *paraja-* ‘clock, watch’, the allomorph *-it* is selected for the Partitive plural form, and the allomorph *-tte* is selected over *-te* for the Genitive plural³. Blevins (2004) gives examples of similar distribution for the Adessive allomorphs *-tetta* ~ *-ttetta*, without providing an analysis for this alternation, since his paper is primarily concerned with generating the distribution computationally⁴.

³ The stems given as underlying here are so-called Genitive stems, that are used for most of the case inflection; however, other stems (usually with different grades of consonants and/or vowels) exist for almost all the nouns mentioned here. For more see, for example, Kask (1966) or Viitso (1998).

⁴ My sincerest thanks go to Andres Kivimäe (p.c.) who was kind enough to go over the Estonian examples with me, provide additional examples and glosses where they are missing in Kager (1995), as well as to clarify some points of pronunciation where they differ from orthography.

(5)				
(a)	/paraja-/ + /-it/ ~ /-sit/ /paraja-/ + /-te/ ~ /-tte/ /paraja-/ + /-tetta/ ~ /-ttetta/	párajà-it párajà-tte párajà-ttetta	*párajà-sit * párajà-te * párajà-tetta	‘clock, watch’ Part pl ‘clock, watch’ Gen pl ‘clock, watch’ Ades pl
(b)	/raamattu/ + /-it/ ~ /-sit/ /raamattu/ + /-te/ ~ /-tte/ /raamattu/ + /-tetta/ ~ /-ttetta/	ráamattù-it ráamattù-tte ráamattù-ttetta	* ráamattù-sit * ráamattù-te * ráamattù-tetta	‘book’ Part pl ‘book’ Gen pl ‘book’ Ades pl
(c)	/sisalikku/ + /-it/ ~ /-sit/ /sisalikku/ + /-te/ ~ /-tte/ /sisalikku/ + /-tetta/ ~ /-ttetta/	sísalikku-sit sísalikku-te sísalikku-tètta	*sísalikku-it * sísalikku-tte * sísalikku-ttètta	‘lizard’ Part pl ‘lizard’ Gen pl ‘lizard’ Ades pl
(d)	/telefoni/ + /-it/ ~ /-sit/ /telefoni/ + /-te/ ~ /-tte/ /telefoni/ + /-tetta/ ~ /-ttetta/	télefòni-sit télefòni-te télefòni-tètta	* télefòni-it * télefòni-tte * télefòni-ttètta	‘telephone’ Part pl ‘telephone’ Gen pl ‘telephone’ Ades pl
(e)	/pesa/ + /-it/ ~ /-sit/ /pesa/ + /-te/ ~ /-tte/ /pesa/ + /-tetta/ ~ /-ttetta/	pésa-sit pésa-te pésa-tètta	* pésa-it *pésa-tte * pésa-ttètta	‘nest’ Part pl ‘nest’ Gen pl ‘nest’ Ades pl
(f)	/mäge/ + /it/ ~ /-sit/ /mäge/ + /-te/ ~ /-tte/ /mäge/ + /-tetta/ ~ /-ttetta/	máge-sit máge-te máge-tètta	*máge-it *máge-tte * máge-ttètta	‘mountain’ Part pl ‘mountain’ Gen pl ‘mountain’ Ades pl
(g)	/kone/ + /-it/ ~ /-sit/ /kone/ + /-te/ ~ /-tte/ /kone/ + /-tetta/ ~ /-ttetta/	kóne-sit kóne-te kóne-tètta	* kóne-it * kóne-tte * kóne-ttètta	‘speech’ Part pl ‘speech’ Gen pl ‘speech’ Ades pl

Kager’s (1995) analysis of the distribution of the allomorphs relies on a TETU effect, where the right edge of the stem is ideally aligned with the right edge of a disyllabic foot (as in stems with an even number of syllables); in this case, the final syllable of the stem does not need any material from the suffix to conform to the TETU requirement. In cases where the stem cannot be parsed into binary feet by itself (i.e. stems with an odd number of syllables), the final CV syllable of such a stem requires some minimal segmental material from the suffix to form a binary foot that is just minimally misaligned with the right edge of the stem. That is precisely the reason why trisyllabic stems take allomorphs that either begin with a geminate (in Adessive and Genitive plural), or with a vowel (in

Partitive plural)⁵. The bottom line of Kager’s analysis remains that the allomorphy in Estonian is conditioned by the foot structure of the language.

As is illustrated above, Estonian and Northern Sámi present an almost identical pattern: the choice of an allomorph depends on the footing of the stem. In Estonian, however, the evidence of persistent footing in the language is not only the allomorphy, but stress marking as well, as each foot is marked by initial stress. In Northern Sámi, on the other hand, though we also have to postulate persistent left-aligned footing, there is no secondary stress, and feet that are not word-initial surface without prominence. In other words, the two languages (with respect to this kind of allomorph selection) differ only in whether or not the foot structure is marked with stress. The choice of an allomorph that is at the end of the word depends on binary footing throughout the word, but that footing is unmarked with stress. Thus, according to our scheme, it is the constraint on secondary stress (*LEV₂GRID) that is ranked higher than Prominence Alignment constraint in Northern Sámi that accounts for the difference between this language and Estonian:

Tableau 1

/jearra/-/behtet/ ~ / hpet/ ‘ask’ (2pl)	ALIGN-L (FT, PWD)	*LEV ₂ GRID	ALIGN-L (LEV _n GRID, FT)
☞ a. (jéarra)-(behtet)			*
b. (jéarra)-(bèhtet)		*!	

As Tableau 1 above illustrates, it is the ban on Level₂ gridmarks that outranks the Prominence Alignment constraint and is thus responsible for feet not marked by prominence. The constraint that aligns feet with the left edge of the Prosodic Word (as well as constraints like FTBIN and PARSE) is inactive here, as both of our candidates satisfy it. The losing candidate (b) is eliminated by the *LEV₂ GRID constraint, since it shows secondary stress on the second foot, allowing for Level₂ gridmark, and candidate (a) wins despite it violating the constraint that requires that there are gridmarks aligned with the left edge of a foot. Estonian, of course, will have a similar set of constraints accounting for its prosody, but the *LEV₂ GRID constraint will be outranked by the

⁵ For analysis of stems containing overlong syllables, and for a formal analysis outlined here, see Kager (1994, 1995).

ALIGN-L (LEV_nGRID, FT) constraint, causing all the feet to have a prominent syllable, i.e. having no mismatch between footing and prominence placement.

It is precisely the sensitivity of morphology to prosody, in one way or another, that we address in the case studies in this chapter. However, the cases that we are concerned with here are somewhat more puzzling than the examples given in the present introduction, since they show what I argue is disparity between the stress pattern and the foot structure.

We start with the case of another Uralic language, Maŋsi (Vogul), particularly with the Upper Loz'va dialect of the language. There are several phenomena that are of interest to us in this chapter: the pattern of stress placement, and two types of allomorphy that I analyze as sensitive to foot structure.

First, I show that the stress pattern in the language is trochaic, where the primary stress goes to the first syllable, and secondary stress is assigned to all subsequent odd syllables. It is shown with a multitude of examples that stress placement does not take into account the weight of syllables. The only restriction to this pattern is that final syllables are never stressed in the language. It is also demonstrated that some borrowings have exceptional stress patterns, though not even borrowed words are allowed to be stressed on the last syllable.

Having established that the stress pattern is weight-insensitive, we proceed to the description and partial analysis of two types of relevant allomorphy the language has. In this subsection, we will deal with several types of Maŋsi morphemes; I summarize some of their properties in the table below:

Table 1

Examples of affixes	<i>-t</i> (Locative singular); <i>-nəl</i> (Ablative); <i>-təl</i> (Instrum); <i>-k^wε</i> (diminutive), <i>-paal</i> (diminutive); <i>-axt</i> (intransitive); <i>-lt</i> (inchoative)	<i>-t/-ət</i> (Loc pl); <i>-ɣ/-iɣ/-jiɣ</i> (Translative sg); possessive <i>-ɣel-aɣel-jaye</i> ; possessive <i>-ε/-te</i> ; possessive <i>-aɣanəl/-ɣanəl</i>	possessive <i>-n/-nən/-an/-anən</i> ; possessive <i>-w/-uw/-anuw/-nuw</i>	Denominal adjective-forming <i>-p/-pa</i>	Participial <i>-n/-nε/-nə</i>
Properties of affixes					
Has allomorphs	no	yes	yes	yes	yes
Depends on syllable structure	–	yes	yes	no	yes
Depends on foot structure	–	no	yes	yes	yes
Depends on sonority	–	no	no	no	yes

As can be seen from the Table 1 above, Vogul has a number of affixes with different properties. There are affixes with no allomorphs, and hence no dependency on syllable or foot structure, or sonority. Secondly, there are affixes that have allomorphs, the distribution of which depends on syllable structure, but not on foot structure or sonority. The third type of affixes has allomorphs with the distribution dependent on foot structure, but not on syllable structure or sonority. Finally, there is at least one suffix in the language with the distribution of allomorphs dependent on syllable structure, foot structure (though not exactly in the same way the other types of affixes do, see below), and, finally on the relative sonority of the vowel in the suffix itself. We will explore all the types of allomorphy dependent on foot structure in some detail, as well as in conjunction with the stress facts. We will show that while stress seems to be weight-insensitive (which, under the current prevailing view should mean that parsing into feet should be weight-insensitive), all the types of foot structure-dependent allomorphy in the language indicates that footing must be weight-sensitive in order to predict the correct allomorph selection.

The second case study I am concerned with in this chapter is the case of a Panoan language Shipibo. I first discuss, however briefly⁶, the stress pattern of the language, and show that heavy syllables attract stress in the language. Therefore, under the standard theory, the footing in the language must be weight-sensitive. The patterns of allomorphy that I turn to next, however, contradict this theory, as in order to predict the correct allomorph for suffixes the distribution of which depends on foot structure we have to parse words into binary and, crucially, syllabic weight-insensitive feet. We will discuss three suffixes that show this pattern: a suffix meaning ‘again’ (repetitive) with two allomorphs *-riba-* and *-ribi-* and Ergative suffix *-n-/-nin* that, in addition to the rhythmic distribution of its allomorphs comes with its own underlying accent. The distribution of the allomorphs of both suffixes clearly shows that the foot structure required to predict the correct outputs needs to be weight-insensitive, contrary to what is suggested by the stress pattern of the language.

Thus, in both case studies included in this chapter, we find incongruity between the foot structure needed to predict stress patterns and foot structure needed to predict correct allomorphs. Among other things, the case studies provide support to the hypothesis we entertain in this dissertation, namely that foot structure is a phenomenon quite separate from prominence (stress), and the fact that the two coincide in more cases than not needs to be modeled by Alignment constraints.

5.2 Case Study: Mañsi (Vogul)

5.2.1 Preliminary Remarks

Mañsi, or Vogul, is a Uralic Ob-Ugric language spoken in Northwestern Siberia. The dialect I describe in this dissertation is one of Northern Mañsi dialects, specifically Upper Lozva dialect. It presumably differs somewhat from the more standard Sosva dialect (Rombandejeva (1973, 1993), Murphy (1968), Balandin and Vakhrusheva (1957), Keresztes (1998), *inter alia*), but since I do not have access to Sosva dialect speakers, I am not sure how extensive the dialectal differences are, and I will not address them here.

⁶ For a more detailed analysis, the reader is referred to Elías-Ulloa (2005).

The data presented here were collected during field trips of summer 2004 and January 2005, seven speakers total were interviewed, all but one of whom were Maŋsi-Russian bilinguals. The judgements of the speakers were in general very consistent, and all inconsistencies are noted below.

The dialect of Vogul under discussion has both short and long variants of four vowels (a, o, u, i), long [ee] and its short counterpart [ɛ], and schwa that can only be short. Within roots, the occurrence of long vowels is limited to initial syllables, though long vowels can appear in suffixes and second parts of compounds. Schwa cannot appear in the initial syllable. The long front vowels are very rare, though they do occur word-initially. I have found no suffixes that contain either long [ee] or long [ii].

Since we will be discussing foot structure, among other things, in this section, it should be mentioned that the language does not have free morphemes that only have a short vowel and no consonant. Thus, the syllable shapes CVC, VC, CVV are permitted (the latter is rare), but no free morphemes of the shapes V or CV are found. This distribution seems to suggest some sort of minimal word requirement, but since (i) there is no evidence that I am aware of that would suggest that coda consonants contribute to weight and (ii) there are no synchronic alternations in the shapes of the roots when they are concatenated with other morphemes, I will consider this distribution of syllable shapes a diachronic residue and not an active requirement in the contemporary language.

Finally, a note should be made on a very common type of allomorphy in the language, where there are two variants of certain suffixes, one vowel-initial and one consonant-initial. The allomorph that starts with a vowel attaches to the stems that end in consonants, and the allomorphs with a consonant attach to vowel-final stems. These are cases of genuine phonologically driven allomorphy (both allomorphs are underlying) rather than cases of epenthesis or deletion: suffixes that do not have two allomorphs are freely attached to the stems without triggering epenthesis in cases where a consonant-final stem is concatenated with a consonant-initial suffix.

- (6)
- | | | |
|---|------------|---|
| <p>(a) Locative singular -t</p> <p>loox-t ‘bay’ (Loc)
 wiiʎt-t ‘face’ (Loc)
 oos-t ‘sheep’ (Loc)
 pos-t ‘light’ (Loc)
 at-t ‘smell’ (Loc)
 lus-t ‘meadow’ (Loc)
 piʂ-t ‘trick’ (Loc)
 saayrap-t ‘axe’ (Loc)
 ʎaaxxal-t ‘message’ (Loc)
 juuntəp-t ‘needle’ (Loc)</p> | <p>cf.</p> | <p>(b) plural -t/-ət</p> <p>loox-ət ‘bays’
 wiiʎt-ət ‘faces’
 oos-ət ‘sheep’
 pos-ət ‘lights’
 at-ət ‘smells’
 lus-ət ‘meadows’
 piʂ-ət ‘tricks’
 saayrap-ət ‘axes’
 ʎaaxxal-ət ‘messages’
 juuntəp-ət ‘needles’</p> |
|---|------------|---|

The Locative singular suffix that has only one allomorph, *-t*, is attached to consonant-final stems in (6a) without epenthesis. In contrast, the plural suffix with two allomorphs, *-t* and *-ət*, when concatenated with consonant-final stems in (6b), uses the vowel-initial allomorph *-ət*.

Another piece of evidence that suggests that this phenomenon is genuine phonologically driven allomorphy is that the vowel-initial allomorphs of different morphemes have different vowels, rather than a ‘default’ vowel that would have been more consistent with epenthesis. In addition to the suffix-initial *-ə* that was illustrated above, an allomorph may start with *-i* in (7a) below, and *-a* in (7b) below:

- (7) a. **Root + Translative case suffix -y/-iy/-jüy⁷**
- | | |
|---|--|
| <p>tootap-iy ‘chest’ (Trans)
 soojəm-iy ‘brook’ (Trans)
 at-iy ‘smell’ (Trans)
 poc-iy ‘drip’ (Trans)
 ceent-iy ‘hat’ (Trans)
 luw-iy ‘horse’ (Trans)</p> | <p>waata-y ‘bank’ (Trans)
 ala-y ‘roof’ (Trans)
 okka-y ‘young tame raindeer’ (Trans)
 nee-y ‘woman’ (Trans)
 paassa-y ‘mitten’ (Trans)
 jaa-y ‘river’ (Trans)</p> |
|---|--|


⁷ The last variant of the Translative suffix (*-jüy*) is used to break up a hiatus of identical vowels, i.e. if the stem ends in *i-*.

b. *Possessive suffix* *ye/-aye/-jaye*⁸

pun-aye ‘his/her/its two feathers’	aŋa-ye ‘his/her/its two heaps’
luw-aye ‘his/her/its two horses’	oma-ye ‘his/her/its two female relatives’
woot-aye ‘his/her/its two winds’	paassa-ye ‘his/her/its two mittens’
oos-aye ‘his/her/its two sheep’	nee-ye ‘his/her/its two women’
pos-aye ‘his/her/its two lights’	jaa-ye ‘his/her/its two rivers’
kaat-aye ‘his/her/its two hands’	ala-ye ‘his/her/its two roofs’

It seems reasonable to conclude that the alternations in the suffixes above is a result of allomorphy that is driven by syllable structure requirements, rather than epenthesis and/or deletion, and should be handled along the lines of Kager (1995), attributing the alternations to the emergence of the unmarked allomorph:

Tableau 2

/at/-iɥ/~ɥ/ ‘smell’ (Trans)	DEP (VOWEL)	MAX (CONS)	NoCODA
 a. at-iɥ			*
b. a-ɥ		*!	*
c. atə-ɥ	*!		*
d. at-ɥ			**!

In the tableau above, the root for ‘smell’ *at-* is combined with a Translative case marker. Candidate (b) selects the consonant allomorph while deleting the last consonant of the root, and is ruled out by the MAX (CONS) constraint. Candidate (c) augments the stem by epenthesis of schwa⁹ and, again, takes the consonant-initial allomorph; it is ruled out by the DEP constraint. The remaining relevant candidates, the forms in (a) and (d), is the choice between the forms with the short allomorph and the longer vowel-initial allomorph. Candidate (d) has two violations of the NoCODA constraint, while candidate (a) is the fully faithful stem and selects the vowel-initial allomorph, making this candidate optimal.

⁸ The last allomorph (-jaye) is used after stems ending in -e.

⁹ or any other vowel

In contrast, for a suffix that does not have more than one allomorph available, both epenthesis and deletion are prohibited:

Tableau 3

/at/-t/ ‘smell’ (Loc)	DEP (VOWEL)	MAX (CONS)	NOCODA
☞ a. at-t			**
b. at-ət	*!		
c. a-t		*!	

Under the present analysis, candidate (b) is eliminated by the DEP constraint, since it has a vowel that is not present in the input. Candidate (c) violates the MAX constraint because of the vowel that is present in the input but not in the output. Candidate (a), though it has multiple violations of the NOCODA constraint is, therefore, the optimal candidate where there is no alternative allomorph.

With the above information in mind, we will proceed to discuss foot-sensitive alternations in the language. We will first discuss the Vogul stress pattern, and then go over a type of allomorphy that illuminates the prosodic structure of the language.

5.2.2 Stress¹⁰

The stress facts of Maṅṣi are fairly straightforward, but considered in conjunction with certain morphological alternations we will address in the following subsection of this chapter, are quite important; that is why we will go over them in some detail. The primary stress in the language is invariably on the first syllable of the word, with the exception of some borrowings the discussion of which we will put aside for the moment.

Below are some examples of nouns in the Nominative case (zero inflection) with the possessive suffix *-tɛ/-ɛ* (3rd person singular possessor, singular possessed). The

¹⁰ Here and throughout, primary stress is marked with an acute, and secondary stress with the grave mark. Note that in the long vowels, even though the stress is marked on the first part of the vowel, it is done for convenience and does not indicate different stress levels of the two parts of a long vowel.

allomorphy of the suffix depends on the last segment of the stem it is concatenated with: the consonant-initial allomorph is used with vowel-final stems, and the vowel-initial allomorph with consonant-final stems, thus exhibiting a case of phonologically driven allomorphy of the kind discussed and analyzed in Kager (1995), among others.

In examples in (a), the stems are monosyllabic, and the resulting possessive forms are disyllabic, with primary stress assigned invariably to the initial syllable. Secondary stress is absent in these forms. In the data in (b), the same affix is added to disyllabic roots, and the resulting trisyllabic possessive forms similarly exhibit initial primary stress and lack of secondary stress.

(8)

- a. sám-ε ‘his/her/its eye’
 séεηk^w-ε ‘his/her/its fog’
 wíiλt-ε ‘his/her/its face’
 xáar-ε ‘his/her/its ox’
 át-ε ‘his/her/its smell’
 póc-ε ‘his/her/its drip’
 jáa-te ‘his/her/its river’
 née-te ‘his/her/its woman’
 máa-te ‘his/her/its land, earth’
- b. sáaγrap-ε ‘his/her/its axe’
 ηéeləm-ε ‘his/her/its tongue’
 λάaxxal-ε ‘his/her/its message’
 óoηəγ-ε ‘his/her/its aunt’
 mówiηt-ε ‘his/her/its laughter’
 τόotap-ε ‘his/her/its chest’
 ták^wəs-ε ‘his/her/its autemn’
 sákka-te ‘his/her/its sugar’
 múuηi-te ‘his/her/its egg’
 páassa-te ‘his/her/its mitten’
 kúrskate ‘his/her/its jug’
 áηa-te ‘his/her/its heap’
 óma-te ‘his/her/its mother’
 áki-te ‘his/her/its uncle’

Vogul, to the best of my knowledge, does not have native trisyllabic underived stems. However, compounding is a fairly productive form of word-formation in the language, and the compounds can be concatenated with the same inflections non-compounded stems can. In (9a), the two stems with their respective stress assignments are shown, and in (9b), the resulting trisyllabic compounds are concatenated with the same 3rd person possessive suffix we saw above. In contrast with the previous data, however, we see that there is secondary stress on the third syllable of the forms in (9b):

(9)

a.
káat ‘hand’ + pátta ‘base’

náajəŋ ‘fiery’ + xáap ‘boat’

jániŋ ‘big’ + úuj ‘animal’

púwl-əŋ ‘to bathe’ (PARTPRES) + kól ‘house’

jáa ‘river’ + wáata ‘bank’

b.

káatpattà-tə ‘his/her/its palm (of the hand)’

náajəŋxàp-ε ‘his/her/its steamship’

jániŋùuj-ε ‘his/her/its elk’

púwləŋkòl-ε ‘his/her/its bathhouse’

jáawaatà-tə ‘his/her/its river bank’

There are several generalizations of note about the data above. First, the language has secondary stress that is assigned to alternate odd syllables, except the last syllable that is never stressed. Secondly, and this will become a point of interest as we discuss Vogul morphological processes in the next subsection, the stress assignment is not weight-sensitive: the secondary stress is assigned to the third syllable in the forms in (9b), regardless of whether the first syllable is light, as in forms with short initial vowels *jániŋùuj-ε* ‘his/her/its elk’ or *púwləŋkòl-ε* ‘his/her/its bathhouse’, or heavy, as in forms *káatpattà-tə* ‘his/her/its palm (of the hand)’, *náajəŋxàp-ε* ‘his/her/its steamship’ and *jáawaatà-tə* ‘his/her/its river bank’.

The same effect can be seen with the forms where stems combined with the 3rd person singular possessive suffix are concatenated with the Ablative suffix *-nəl*. In forms in (10a), where the resulting words are trisyllabic (1 syllable root + 1 syllable possessive suffix + 1 syllable Ablative suffix), the only stressed syllable is the initial one. In forms in (10b), in contrast, that are quadrisyllabic, secondary stress is assigned to the third

syllable, which is the syllable of the possessive suffix. Note, again, that the weight of the first syllable is disregarded with respect to stress assignment.

(10) **root+possessive+Ablative suffix -nəl**

- a. sám-ε-nəl ‘his/her/its eye’(Abl)
 jóor-ε-nəl ‘his/her/its strength’(Abl)
 wíiλt-ε-nəl ‘his/her/its face’(Abl)
 áat-ε-nəl ‘his/her/its hair’(Abl)
 át-ε-nəl ‘his/her/its smell’(Abl)
 póç-ε-nəl ‘his/her/its drip’(Abl)
 jáa-tε-nəl ‘his/her/its river’(Abl)
 née-tε-nəl ‘his/her/its woman’(Abl)
 máa-tε-nəl ‘his/her/its land, earth’(Abl)
- b. sáayrap-è-nəl ‘his/her/its axe’(Abl)
 ηéeləm-è-nəl ‘his/her/its tongue’ (Abl)
 λάaxxal-è-nəl ‘his/her/its message’(Abl)
 óoηəγ-è-nəl ‘his/her/its aunt’(Abl)
 mówiηt-è-nəl ‘his/her/its laughter’(Abl)
 τόotap-è-nəl ‘his/her/its chest’ (Abl)
 ták^wəs-è-nəl ‘his/her/its autemmn’(Abl)
 sákka-tè-nəl ‘his/her/its sugar’(Abl)
 múuηi-tè-nəl ‘his/her/its egg’(Abl)
 páassa-tè-nəl ‘his/her/its mitten’(Abl)
 kúrsk-a-tè-nəl ‘his/her/its jug’(Abl)
 áηa-tè-nəl ‘his/her/its heap’(Abl)
 óma-tè-nəl ‘his/her/its mother’(Abl)
 áki-tè-nəl ‘his/her/its uncle’(Abl)

Another possessive suffix *-ayanəl/-yanəl* (3rd person dual possessor, plural possessed), which has either two or three syllables, illustrates the same pattern: the main stress is on the first syllable, and the secondary stress is assigned to odd syllables except the final syllable, regardless of the weight. In the forms in (11b), the Ablative suffix *-nəl*, added on top of the possessive suffix, provides forms up to six syllables long. In these forms, the secondary stress is assigned to the third and fifth syllable. Note that the fifth syllable

in the five-syllable long forms does not receive secondary stress, presumably because of a non-finality condition.

(11)

a. Root + possessive -aɣənəl/-ɣənəl	b. + Ablative -nəl
sám-aɣənəl ¹¹ ‘their (du) eyes’	sám-aɣənəl-nəl ‘their (du) eyes’(Abl)
wíiɫt-aɣənəl ‘their (du) faces’	wíiɫt-aɣənəl-nəl ‘their (du) faces’(Abl)
áat-aɣənəl ‘their (du) hairs’	áat-aɣənəl-nəl ‘their (du) hairs’(Abl)
át-aɣənəl ‘their (du) smells’	át-aɣənəl-nəl ‘their (du) smells’(Abl)
póc-aɣənəl ‘their (du) drips’	póc-aɣənəl-nəl ‘their (du) drips’(Abl)
jáa-ɣənəl ‘their (du) rivers’	jáa-ɣənəl-nəl ‘their (du) rivers’(Abl)
née-ɣənəl ‘their (du) women’	née-ɣənəl-nəl ‘their (du) women’(Abl)
máa-ɣənəl ‘their (du) lands’	máa-ɣənəl-nəl ‘their (du) lands’(Abl)
sáaɣrap-aɣənəl ‘their (du) axes’	sáaɣrap-aɣənəl-nəl ‘their (du) axes’(Abl)
ɳéeləm-aɣənəl ‘their (du) tongues’	ɳéeləm-aɣənəl-nəl ‘their (du) tongues’ (Abl)
láaxxal-aɣənəl ‘their (du) messages’	láaxxal-aɣənəl-nəl ‘their (du) messages’ (Abl)
óoɳɣ-aɣənəl ‘their (du) aunts’	óoɳɣ-aɣənəl-nəl ‘their (du) aunts’(Abl)
tóotap-aɣənəl ‘their (du) chests’	tóotap-aɣənəl-nəl ‘their (du) chests’(Abl)
ták ^w əs-aɣənəl ‘their (du) autemns’	ták ^w əs-aɣənəl-nəl ‘their (du) autemns’ (Abl)
sákka-ɣənəl ‘their (du) sugars’	sákka-ɣənəl-nəl ‘their (du) sugars’(Abl)
múuɳi-ɣənəl ‘their (du) eggs’	múuɳi-ɣənəl-nəl ‘their (du) eggs’(Abl)
páassa-ɣənəl ‘their (du) mittens’	páassa-ɣənəl-nəl ‘their (du) mittens’(Abl)
kúrska-ɣənəl ‘their (du) jugs’	kúrska-ɣənəl-nəl ‘their (du) jugs’(Abl)
áɳa-ɣənəl ‘their (du) heaps’	áɳa-ɣənəl-nəl ‘their (du) heaps’(Abl)
áki-ɣənəl ‘their (du) uncles’	áki-ɣənəl-nəl ‘their (du) uncles’(Abl)

Vogul has a number of productive diminutive affixes, some of which have either affectionate or slightly pejorative¹² overtones. Below we see two of these diminutive suffixes, *-k^wε* and *-paal*, the latter of which also brings in pejorative meaning. For our

¹¹ This form was rejected by two of the speakers I worked with; they could not offer an alternative form, and it appears that there can be some paradigmatic gaps in the system, especially with dual forms. The rest of the speakers, however, had no difficulties producing this form, though commented that it was difficult to imagine a situation where one would refer to ‘eyes that belonged to two people’

¹² It is unusual for a diminutive suffix to have a pejorative meaning, but all seven speakers I interviewed agreed that it is the case with several diminutive suffixes in Vogul

purposes, these two suffixes are appropriate for illustrating and confirming that the stress assignment in the language is weight insensitive, as the first of these suffixes contains a short, and the second a long vowel. Since both of these suffixes are very productive, they can, in most cases, be attached to almost any noun.

(12)

a. root-DIM-3RD DU POSS-INSTR

jór-k^wε-γàⁿəl-təl ‘their (du) traces’
 súp-k^wε-γàⁿəl-təl ‘their (du) shirts’
 tín-k^wε-γàⁿəl-təl ‘their (du) prices’
 xúm-k^wε-γàⁿəl-təl ‘their (du) boys’
 pún-k^wε-γàⁿəl-təl ‘their (du) feathers’
 pós-k^wε-γàⁿəl-təl ‘their (du) lights’
 pál-k^wε-γàⁿəl-təl ‘their (du) ears’
 át-k^wε-γàⁿəl-təl ‘their (du) smells’
 lúw-k^wε-γàⁿəl-təl ‘their (du) horses’
 lús-k^wε-γàⁿəl-təl ‘their (du) meadows’
 píʃ-k^wε-γàⁿəl-təl ‘their (du) tricks’

b. root-DIM-3RD DU POSS-INSTR

jór-paal-àγanə̀l-təl ‘their (du) traces’
 súp-paal-àγanə̀l-təl ‘their (du) shirts’
 tín-paal-àγanə̀l-təl ‘their (du) prices’
 xúm-paal-àγanə̀l-təl ‘their (du) boys’
 pún-paal-àγanə̀l-təl ‘their (du) feathers’
 pós-paal-àγanə̀l-təl ‘their (du) lights’
 pál-paal-àγanə̀l-təl ‘their (du) ears’
 át-paal-àγanə̀l-təl ‘their (du) smells’
 lúw-paal-àγanə̀l-təl ‘their (du) horses’
 lús-paal-àγanə̀l-təl ‘their (du) meadows’
 píʃ-paal-àγanə̀l-təl ‘their (du) tricks’

The first observation we can make is that, even though the diminutive *-k^wε* in (12a) contains a short vowel and the diminutive *-paal* in (12b) a long vowel, the secondary stress is assigned to the following (third) syllable in both cases, regardless of syllable weight. The data in (12b) gives us further evidence that stress assignment in the language is weight-insensitive: weight-sensitive stress assignment would give us forms like **pún-pàal-aγàⁿəl-təl* for ‘their (du) feathers’ or **lúw-pàal-aγàⁿəl-təl* for ‘their (du) horses’, all of which are ungrammatical in Vogul.

Despite appearances, I maintain that the foot structure in the language is binary on the moraic level, while prominence assignment does not always correspond to it, because of constraints on rhythm, i.e. CLASH and LAPSE:

Tableau 4

/saayrap/-/paal/-/w~uw~anuw~nuw/ 'my axes' (dim)	LAPSE	CLASH	ALIGN-L (LEV _n GRID, FT)
☞ a. (sáay)rap-(pàa)(l-anuw)			*
b. (sáay)rap-(pàa)(l-ànuw)		*!	
c. (sáay)rap-(paa)(l-ànuw)	*!		*

Since both LAPSE and CLASH (which are unranked with respect to each other here) operate on the syllabic level, we can see how the ranking in the tableau above creates an illusion of syllabic footing: prominence is assigned to alternate syllables, regardless of their weight. Of course, if we consider a word that consists of only light syllables, there is no competition between the Prominence Alignment constraint, on the one hand, and the CLASH and LAPSE constraints, on the other hand:

Tableau 5

/puwləŋ/-/kol/-/w~uw~anuw~nuw/ 'my bathhouses'	LAPSE	CLASH	ALIGN-L (LEV _n GRID, FT)
☞ a. (púwləŋ)(kòl-uw)			
b. (púwləŋ)(kol-uw)	*!*		
c. (puwləŋ)(kol-ùw) ¹³			*!*

Here, the footing is actually binary on the syllabic, as well as the moraic level, hence footing actually coincides with the prominence assignment. There is really no relevant constraint with respect to which a candidate with either CLASH or LAPSE violation would be better than candidate (a). Were it not for data with heavy syllables and unviolated FTBIN(μ), we could not have established the ranking between the footing constraints and Prominence Alignment.

To conclude, barring some examples with borrowed words that we turn to next, we have accounted for the mismatch between stress assignment and foot constituency in Maŋsi: the illusion that the two notions do not interact is due to the fact that the language allows no violations of LAPSE or CLASH, and that these rhythmic constraints outrank the

¹³ This candidate is independently excluded by WDFIN constraint, which is unranked with respect to CLASH and LAPSE, but outranks the prominence alignment constraint.

Prominence Alignment constraint so that it is only in words with only light syllables that prominence uniformly surfaces on the heads of trochaic feet.

As a final observation about the stress assignment pattern in the language, we should mention that there are a few exceptions to the stress pattern we have just described. Several borrowings, especially recent ones, exhibit a different stress pattern, usually keeping the stress position of the source language:

(13)

pirkáta	from Russian	brigáda ¹⁴ ‘brigade’
esórma	from Iranian	sórma ‘shame’
soráŋa	from Russian	sobráníje ‘meeting’
pulkúwni	from Russian	polkóvnik ‘colonel’
ruupáta	from Russian	rabóta ‘work’
kiníka	from Russian	kníga ‘book’
ɛʃkóla	from Russian	ʃkóla ‘school’

Interestingly enough, however, borrowings that have final stress in the source language do not keep the final stress in Vogul, but the stress is shifted onto the penultimate syllable:

(14)

a.	káalaʃ	from Russian	kalátʃ ‘bun’
	kúrpa	from Russian	krupá ¹⁵ ‘grain’
	túrpa	from Russian	trubá ‘pipe’
	žúurnal	from Russian	žurnál ‘magazine’
	swésta	from Russian	zvezdá ‘star’
b.	istákan	from Russian	stakán ‘glass’
	kenélal	from Russian	generál ‘general’
	kaatálok	from Russian	katalóg ‘catalogue’
	liimónat	from Russian	limonád ‘lemonade’
	sekrétar	from Russian	sekretár ^j ‘secretary’
	iʃwéʃa	from Russian	svetʃá ‘candle’

¹⁴ with metathesis

¹⁵ with metathesis

It is obvious that Maᅇsi has adopted borrowed words to fit its native phonotactics (metathesis, epenthesis, devoicing and deletion are all common adaptations), but there is also something about borrowings that does not correspond to native phonology: stress assignment. While in (14a) we see initial primary stress, which corresponds to the language's native pattern, the examples in (14b) diverge from the regular every-odd-syllable stress placement in native Maᅇsi words.

It is probable that the source language's prominence location influenced how the words were adapted into Maᅇsi. Acknowledging this influence by no means signifies that underlying forms of in Maᅇsi are equal to (surface or underlying) forms of source language. For example, since we see prominence assignment pattern that differs from that of native Maᅇsi words, we should consider that there is something different in the underlying forms of Maᅇsi borrowed forms. However, as we can see from the data in (14), stress in Maᅇsi forms does not correspond to the source language's stress placement, either.

The challenge here is to determine what the underlying forms of borrowed words in Maᅇsi are. For the reasons we just stated, underlying forms cannot be equivalent to the source languages' forms. One question that arises is about the forms in (14): it is clear that the borrowed words can be different from native forms in that they have an accented syllable underlyingly, but it is unclear whether it is the last syllable that is underlyingly accented (corresponding to the source language's surface accent) and the WordFinality constraint makes the Maᅇsi surface forms have penultimate accent, or is it that the underlying forms themselves have penultimate accent. I believe this question can be answered if we consider derived forms of these words:

(15)

səkrétar-təl	‘helper, servant’ (Instr)	*sékretàr-təl
iswéʒa-təl	‘candle, lightbulb’ (Instr)	*iswéʒà-təl
kaatálok-təl	‘ledger, records’ (Instr)	*káatalòk-təl
istákan-təl	‘see-through glass’ (Instr)	*ístakàn-təl
iswésta-təl	‘famous person’ (Instr)	*iswèstà-təl

The examples above show us that the underlying forms of the words in (14b) have the penultimate syllable underlyingly accented, rather than ultimate syllables, since the roots do not surface with final stress (would be penultimate in derived forms in (15)), but rather the penults of the roots are stressed. I propose, therefore, that the underlying forms of the words in (14b) have penultimate syllables accented underlyingly. The underlyingly accented penult appears to be responsible for the abnormal (for Maṅsi) prominence in some of the borrowed words. In other words, there is a constraint on keeping lexical accent that outranks our regular Prominence Alignment constraint:

Tableau 6

\uparrow */iswèsta/ ‘famous person’	MAX (LEV _n GRID)	LAPSE	CLASH	ALIGN-L (LEV _n GRID, FT)
☞ a. (iswés)ta				*
b. (iswès)ta	*!			
c. (iswès)ta			*!	*

The tableau above illustrates how lexical prominence can overwrite the Prominence Alignment requirements. Candidate (b) is eliminated by the MAX (LEV_nGRID) constraint.¹⁶ Candidate (c), while incurring no violations of MAX (LEV_nGRID) since it keeps the underlying accent, also has prominence assigned to the foot-initial (and word-initial) syllable, which makes it resemble stress pattern of words that are not underlyingly accented, but violates CLASH. Candidate (a), therefore, even though its stress is ‘exceptionally’ not word-initial, is the optimal candidate here.

¹⁶ I also assume that, since the underlying accent is associated with the particular syllable, candidates that do not delete but reassociate the gridmark are also banned.

To summarize this subsection, we have discussed the particulars of stress assignment in the language: primary stress is always assigned to the initial syllable, regardless of syllable weight. Secondary stress is assigned to the odd-numbered syllables, and the language appears to be quantity-insensitive. The only cases where primary stress is not initial are the cases of borrowings. Finally, there are no forms, either native or borrowed, with final stress.

We will now turn to cases of prosody-conditioned allomorphy, and consider it in conjunction with the stress facts we have just established.

5.2.3 Prosody-sensitive Allomorphy

In this subsection, we will investigate two types of allomorphy in Vogul, and will show that both types of allomorphy discussed are sensitive to foot structure. We will also demonstrate that in order to predict the correct distribution of allomorphs we have to parse Vogul words into moraic feet, contrary to what the stress pattern indicates.

5.2.3.1 Allomorphy Type 1

Vogul has several suffixes that exhibit allomorphy similar to the allomorphy found in Estonian (Kager (1995), Mürk (1991)) and Sámi (Dolbey (1997)). The distribution of allomorphs is determined by the resulting footing.

One of the suffixes that exhibit this type of allomorphy is the 2nd person possessive suffix *-n/-nən/-an/-anən* (2nd person singular possessor, plural possessed). The allomorphs with initial vowels (*-an* and *-anən*) are attached to stems that end in consonants, and the consonant-initial allomorphs (*-n* and *-nən*) are attached to stems that end in vowels. However, whether one of the vowel-initial allomorphs or another is chosen, or which one of the consonant-initial allomorphs is chosen, depends on the prosodic structure of the stem.

In (16a) and (16b) below, we can observe the suffix concatenated with monosyllabic, consonant-final stems. Since the stems are consonant-final, the choice of the suffix allomorph is between *-an* and *-anən*, while *-n* and *-nən* are excluded by syllable structure requirements. In (16a), where the vowels of the roots are short, the shorter version of the suffix is chosen. In (16b), on the other hand, all the roots have long vowels, and they are invariably concatenated with the longer allomorph:

(16) *Possessive suffix 2nd person singular, plural possession -n/-nən/-an/-anən*

- | | |
|--|---|
| <p>a. luw-an ‘your (sg) horses’
 at-an ‘your (sg) smells’
 sam-an ‘your (sg) eyes’
 tal-an ‘your (sg) laps’
 jor-an ‘your (sg) traces’
 put-an ‘your (sg) ice-crusts’
 sup-an ‘your (sg) shirts’
 tin-an ‘your (sg) prices’
 pun-an ‘your (sg) feathers’
 pos-an ‘your (sg) lights’
 kaŋk-an ‘your (sg) elder brothers’
 pal-an ‘your (sg) ears’
 lus-an ‘your (sg) meadows’
 piŋ-an ‘your (sg) tricks’
 sun-an ‘your (sg) sleds’
 k^wol-an ‘your (sg) dwellings’</p> | <p>b. aaŋt-anən ‘your (sg) horns’
 ŋaar-anən ‘your (sg) swamps’
 joowt-anən ‘your (sg) bows’
 oos-anən ‘your (sg) goats’
 eet-anən ‘your (sg) nights’
 piiγ-anən ‘your (sg) boys, sons’
 xaar-anən ‘your (sg) oxen’
 xuul-anən ‘your (sg) fish’
 xaaʎ-anən ‘your (sg) birch trees’
 oos-anən ‘your (sg) sheep’
 uus-anən ‘your (sg) cities’
 saam-anən ‘your (sg) corners’
 taal-anən ‘your (sg) winters; years’
 joor-anən ‘your (sg) strengths’
 puut-anən ‘your (sg) cauldrons’
 loox-anən ‘your (sg) bays’</p> |
|--|---|

Note that the only variable between (16a) and (16b) is the length of the root vowel, the rest of the conditions being the same: the syllables are closed, and all the roots are monosyllabic. It stands to reason, therefore, to hypothesize that the allomorphy is weight-sensitive: the resulting form of root + possessive allomorph is optimally footed exhaustively, when there is an allomorph available to satisfy the condition.

As we mentioned in the previous subsection, Maŋŋsi does not have roots that are codaless, monosyllabic and contain a short vowel (i.e. roots of the form CV) In (16c), however, we

see monosyllabic roots that have long vowels and no coda. The allomorph of the possessive suffix that is chosen here is *-n*: since the roots end in a vowel, it is one of the consonant-initial allomorphs that is chosen, and the short allomorph would make the resulting form parsed into a foot, under the analysis that the footing is weight-sensitive. The stems in (16d) are trisyllabic and end in a consonant, so the allomorph chosen has to be vowel-initial. Between the two possible vowel-initial allomorphs, the monosyllabic one is selected, again allowing for exhaustive binary footing.

- | | | | |
|----|--|----|--|
| c. | jaa-n ‘your (sg) rivers’
maa-n ‘your (sg) lands’
nee-n ‘your (sg) women’
ʃaa-n ‘your (sg) teas’ | d. | istakan-an ‘your (sg) glasses’
kənɛlɔl-an ‘your (sg) generals’
sɛkrɛtar-an ‘your (sg) secretaries’
puwɫəŋkol-an ‘your (sg)
bathhouses’ |
|----|--|----|--|

The stems in both (16e) and (16f) are disyllabic and contain only light syllables, but in (16e) they are vowel-final, and in (16f) consonant-final. Thus, the shortest allomorph (*-n*) is chosen for the forms in (16e), making up a binary foot, and the longest allomorph (*-anən*) is concatenated with the stems in (16f), which makes for two binary feet.

- | | | | |
|----|--|----|---|
| e. | sakka-n ‘your (sg) pieces of sugar’
ala-n ‘your (sg) roofs’
okka-n ‘your (sg) young tame reindeer’
simri-n ‘your (sg) perches’
kurska-n ‘your (sg) jugs’
aŋa-n ‘your (sg) heaps’
raʃi-n ‘your (sg) pieces of silk clothing’
pici-n ‘your (sg) nests’
oma-n ‘your (sg) female relatives’
aki-n ‘your (sg) uncles’
pupa-n ‘your (sg) bears’
ŋuli-n ‘your (sg) pitchpines’ | f. | kossəm-anən ‘your (sg) birch-bark
basket’
pasan-anən ‘your (sg) table’
tak ^w əs-anən ‘your (sg) autumn’
apiɣ-anən ‘your (sg) grandson’
tuɕʂaŋ-anən ‘your (sg) sewing-bag
made of reindeer hide’
ʃaxəl-anən ‘your (sg) pile’
ulas-anən ‘your (sg) chair’
ŋaɣir-anən ‘your (sg) saddles’
isnas-anən ‘your (sg) windows’
turap-anən ‘your (sg) storms’
oxsar-anən ‘your (sg) foxes’ |
|----|--|----|---|

Examples below further illustrate the same pattern: the roots in (16g) contain a heavy syllable followed by a light syllable that is closed. The allomorph chosen for these forms, therefore, has to be vowel-initial. Given that the roots themselves have one binary

(moraic) foot and an unparsed syllable, the monosyllabic allomorph is added to comprise the second foot.

- | | |
|--|--|
| <p>g. saayrap-an ‘your (sg) axes’
 ɲeeləm-an ‘your (sg) tongues’
 neepak-an ‘your (sg) books’
 ʎaaxxal-an ‘your (sg) messages’
 tootap-an ‘your (sg) chests’
 ʎoomwoj-an ‘your (sg) gnats’
 soojəm-an ‘your (sg) brooks’
 aax^wtas-an ‘your (sg) stones’
 ooŋəy-an ‘your (sg) aunts’
 keeŋən-an ‘your (sg) buttons’
 juuntəp-an ‘your (sg) needles’
 aaməʂ-an ‘your (sg) riddles’
 xootal-an ‘your (sg) days’
 k^waaliy-an ‘your (sg) ropes’
 toorəm-an ‘your (sg) skies’</p> | <p>h. muuŋi-nən ‘your (sg) eggs’
 aarpi-nən ‘your (sg) fish-fences’
 iici-nən ‘your (sg) evenings’
 aawi-nən ‘your (sg) doors’
 oopa-nən ‘your (sg) paternal
 grandfathers’
 aayi-nən ‘your (sg) girls,
 daughters’
 saali-nən ‘your (sg) reindeer’
 eek^wa-nən ‘your (sg) women’
 oojka-nən ‘your (sg) old men’
 puutə-nən ‘your (sg) pots’
 paassa-nən ‘your (sg) mittens’
 poora-nən ‘your (sg) floats, rafts’
 waata-nən ‘your (sg) shores’</p> |
|--|--|

In contrast, the roots in (16h) have the final syllable open, though they also consist of a heavy syllable followed by a light syllable. In this case, a consonant-initial allomorph is added, and it also makes up the second foot of the resulting possessive form.

Note that it is crucial for the footing to be quantity-sensitive to predict the right form of the allomorph for this possessive suffix. Quantity-insensitive footing would predict the wrong results for forms containing heavy syllables, for example:

- (17)
- | | |
|---|---|
| <p>a.
 *(keeŋə)(n-anən) ‘your (sg) buttons’
 *(juuntə)(p-anən) ‘your (sg) needles’
 *(aamə)(ʂ-anən) ‘your (sg) riddles’</p> | <p>b.
 *(eek^wa-n) ‘your (sg) women’
 *(oojka-n) ‘your (sg) old men’
 *(puutə-n) ‘your (sg) pots’</p> |
|---|---|

As we can see above, quantity-insensitive parsing predicts the wrong allomorph selection: the forms in (17a) would have the disyllabic allomorph instead of a monosyllabic one that actually appears, and the forms in (17b) should have the shortest

possessive allomorph (-*n*), while they actually show up with the allomorph *-nən* (see (16h) above).

Similarly, we get the wrong predictions with monosyllabic roots with long vowels under the syllabic parsing analysis:

(18)

- *(eet-an) ‘your (sg) nights’
- *(piiγ-an) ‘your (sg) boys, sons’
- *(xaar-an) ‘your (sg) oxen’
- *(xuul-an) ‘your (sg) fish’
- *(xaaʕ-an) ‘your (sg) birch trees’

The allomorph that should be attached to the forms above is the disyllabic allomorph that would comprise the second foot (see (17a) above). However, if the first syllable with the long vowel is treated as just an incomplete foot, we predict the wrong forms above with the monosyllabic possessive allomorph *-an*.

It is clear that the allomorphy is sensitive to the foot structure of the language. The requirement that is important for choosing one of the four allomorphs here is a requirement that all syllables must be parsed into feet, and it is combined with the requirement for Binariness, crucially, on the moraic level.

Another suffix that behaves in a similar way is another possessive suffix *-w/-uw/-anuw/-nuw*. It is the suffix that has 1st singular possessor and plural possessed (“my nouns” scheme). If the suffix is concatenated with a stem that ends in a vowel, one of the two consonant-initial allomorphs is attached. If, on the other hand, the suffix is attached to a stem that ends in a consonant, the allomorph of this possessive suffix attached is either *-uw* or *-anuw*, i.e. one of the two vowel-initial allomorphs:

(19)

- | | |
|-----------------------------------|-------------------------------|
| (a) (nee-w) ‘my female relatives’ | (b) (sup-uw) ‘my shirts’ |
| (jaa-w) ‘my rivers’ | (tin-uw) ‘my prices’ |
| (ʃaa-w) ‘my teas’ | (kaŋk-uw) ‘my elder brothers’ |
| (maa-w) ‘my lands’ | (pun-uw) ‘my feathers’ |

(22)

- | | | | |
|----|---|----|---|
| a. | paassa-nuw ‘my mittens’
muuŋi-nuw ‘my eggs’
aarpi-nuw ‘my fish-fences’
iici-nuw ‘my evenings’
aawi-nuw ‘my doors’
eek ^w a-nuw ‘my women’
waata-nuw ‘my shores’
saali-nuw ‘my reindeer’
oojka-nuw ‘my old men’
puutə-nuw ‘my pots’
poora-nuw ‘my floats, rafts’
aayi-nuw ‘my girls, daughters’ | b. | ʎaaxxal-uw ‘my messages’
jaarmak-uw ‘my pieces of silk’
ooŋəγ-uw ‘my aunts’
tootap-uw ‘my chests’
keeŋən-uw ‘my buttons’
xootal-uw ‘my days’
ʎoomwoj-uw ‘my gnats’
saayrap-uw ‘my axes’
soojəm-uw ‘my brooks’
toorəm-uw ‘my skies’
ŋeeləm-uw ‘my tongues’
k ^w aaliγ-uw ‘my ropes’ |
|----|---|----|---|

Both the stems in (22a) and in (22b) take monosyllabic allomorphs that create binary moraic feet in each case; the only difference between the allomorphs is whether or not they are consonant-initial. Notably, again, the only parsing that would predict the right allomorphs selection is binary parsing on the moraic level.

The foot structure-dependent allomorph selection can be further illustrated with longer stems that are created by compounding:

(23)

- | | |
|---|---|
| kaat ‘hand’ + patta ‘base’ | (kaat)(patta-w) ‘my palms (of the hands)’ |
| naajəŋ ‘fiery’ + xaap ‘boat’ | (naa)(jəŋxa)(p-anuw) ‘my steamships’ |
| janiγ ‘big’ + uuγ ‘animal’ | (jani)(γuu)(j-anuw) ‘my elks’ |
| puwl-əŋ ‘to bathe’ (PARTPRES) + kol ‘house’ | (puwləŋ)(kol-uw) ‘my bathhouses’ |
| jaa ‘river’ + waata ‘bank’ | (jaa)(waa)(ta-nuw) ‘my river banks’ |

The foot structure in (23) above shows the basis for the allomorph selection: the compound *(kaat)(patta-w)* ‘my palms (of the hands)’ has two bimoraic feet in the stem and thus selects the shortest single consonant allomorph. The compound for ‘steamship’ *(naa)(jəŋxa)(p-anuw)* similarly contains two feet, but since the stem is consonant-final, the allomorph has to start with a vowel, and the longest allomorph for the possessive

suffix is attached to the stem, creating the third foot. The third compound, *(jani)(yuu)(j-anuw)* ‘elk’, exhibits exactly the same pattern. The compound *(puwləŋ)(kol-uw)* ‘bathhouse’, on the other hand, constitutes one complete foot and has a stray syllable. The allomorph *-uw*, therefore, is attached to complete the second foot. The situation is similar with the compound *(jaa)(waa)(ta-nuw)* ‘river bank’: two moraic feet are complete in the stem, but a stray syllable is left over, calling for a monosyllabic allomorph *-nuw*. All of the allomorphs are distributed to insure that the resulting forms can be parsed completely into binary moraic feet.

To emphasize the fact that the parsing into feet has to be on the moraic level, rather than on the syllabic level as it appears for the stress assignment pattern, consider the following forms with the diminutive suffix *-paal* that we saw in the previous subsection:

(24)

- | | |
|--|--|
| <p>a. jor-paal-anuw ‘my traces’ (dim)
 sup-paal-anuw ‘my shirts’ (dim)
 xum-paal-anuw ‘my men’ (dim)
 pun-paal-anuw ‘my feathers’ (dim)
 pal-paal-anuw ‘my ears’ (dim)
 luw-paal-anuw ‘my horses’ (dim)
 lus-paal-anuw ‘my meadows’ (dim)
 piş-paal-anuw ‘my tricks’ (dim)</p> | <p>b. saam-paal-anuw ‘my corners’ (dim)
 keent-paal-anuw ‘my caps’ (dim)
 puut-paal-anuw ‘my cauldrons’ (dim)
 jaa-paal-anuw ‘my rivers’ (dim)
 xuul-paal-anuw ‘my fish’ (dim)
 nee-paal-anuw ‘my women’ (dim)
 uus-paal-anuw ‘my cities’ (dim)
 leey-paal-anuw ‘my tails’ (dim)</p> |
|--|--|

As we can see, the diminutive suffix *-paal* is concatenated with both short-vowel stems and long-vowel stems alike, since there is only one allomorph of this suffix, and, as is the case with the Locative singular suffix *-t* above, there is no deletion or epenthesis allowed to optimize the syllable structure on the morpheme boundaries.

The possessive suffix, on the other hand, has four different allomorphs, as we saw before. Only two of the four possible allomorphs are relevant here, however: since the diminutive suffix *-paal* ends in a consonant, the possessive allomorph has to be one of the vowel-initial allomorphs (i.e. either *-uw* or *-anuw*). As the data above shows, however, only the longer, i.e. disyllabic allomorph, is selected for both forms in (24a) and (24b), regardless of the number of syllables or moras preceding the possessive suffix. The conclusion we

can draw, therefore, is that the allomorph selection treats the preceding diminutive suffix *-paal* as footed by itself, again indicating weight sensitivity.

An alternative explanation, of course, could be that since both the roots in (24a) and in (24b) above are monosyllabic, differing only in the length of the root vowel, the root together with the diminutive suffix comprise only one foot, which would mean that that foot has to be followed by the disyllabic allomorph of the possessive suffix to form a second foot. In other words, whether the footing is quantity-sensitive (as in *(puut)-(paa)(l-anuw)* ‘my cauldrons’ (dim)), or quantity-insensitive (as in *(puut-paa)(l-anuw)* ‘my cauldrons’ (dim)), the same allomorph of the possessive suffix (*-anuw*) is predicted to be selected. However, if we consider the forms below, this alternative explanation can be easily discarded:

(25)

a.	b.
(okka)-(paa)(l-anuw) ‘my young tame reindeer’ (dim)	* (okka)-(paal-uw)
(kossəm)-(paa)(l-anuw) ‘my birch-bark baskets’ (dim)	* (kossəm)-(paal-uw)
(simri)-(paa)(l-anuw) ‘my perches’ (dim)	* (simri)-(paal-uw)
(kurska)-(paa)(l-anuw) ‘my jugs’ (dim)	* (kurska)-(paal-uw)
(aŋa)-(paa)(l-anuw) ‘my heaps’ (dim)	* (aŋa)-(paal-uw)
(pici)-(paa)(l-anuw) ‘my nests’ (dim)	* (pici)-(paal-uw)
(aki)-(paa)(l-anuw) ‘my uncles’ (dim)	* (aki)-(paal-uw)
(tak ^w əs)-(paa)(l-anuw) ‘my autemns’ (dim)	* (tak ^w əs)-(paal-uw)
(ala)-(paa)(l-anuw) ‘my roofs’ (dim)	* (ala)-(paal-uw)
(isnas)-(paa)(l-anuw) ‘my windows’ (dim)	* (isnas)-(paal-uw)

In the data in (25) above, the disyllabic roots of the shape (C)VCV(C) are footed together, and the next foot is formed by the diminutive suffix *-paal*. The allomorph of the possessive suffix, therefore, has to form another foot, and this is the reason why the disyllabic allomorph is selected. In (25b), on the other hand, under quantity-insensitive footing, the diminutive suffix cannot be footed by itself to form a binary foot; hence the possessive allomorph that should be selected is disyllabic allomorph *-uw*. Clearly, the quantity-insensitive analysis predicts the wrong form of the allomorph.

A similar case can be made when we consider disyllabic stems the first syllable of which contains a long vowel. If the footing that predicts the allomorph selection is quantity-insensitive, then the allomorph selected for stems like that should be *-uw*, since all the roots are concatenated with the consonant-final diminutive *-paal* suffix. If, on the other hand, the footing is quantity-sensitive, the possessive allomorph selected in this case should once again be *-anuw*, i.e. the allomorph that attaches to stems that end in a consonant and forms another foot by itself. We can see from the data below that it is that disyllabic allomorph *-anuw* that is selected to attach to stems like that:

(26)

a.	b.
(saaŷ)rap-(paa)(l-anuw) ‘my axes’	*(saaŷrap)-(paal-uw)
(muu)ŋi-(paa)(l-anuw) ‘my eggs’	*(muuŋi)-(paal-uw)
(paas)sa-(paa)(l-anuw) ‘my mittens’	*(paassa)-(paal-uw)
(ʎaax)xal-(paa)(l-anuw) ‘my messages’	*(ʎaaxxal)-(paal-uw)
(soo)jəm-(paa)(l-anuw) ‘my brooks’	*(soojəm)-(paal-uw)
(oo)ŋəŷ-(paa)(l-anuw) ‘my aunts’	*(ooŋəŷ)-(paal-uw)
(ii)ci-(paa)(l-anuw) ‘my evenings’	*(iici)-(paal-uw)
(kee)ŋən-(paa)(l-anuw) ‘my buttons’	*(keeŋən)-(paal-uw)
(juun)təp-(paa)(l-anuw) ‘my needles’	*(juuntəp)-(paal-uw)
(aa)məŷ-(paa)(l-anuw) ‘my riddles’	*(aaməŷ)-(paal-uw)
(k ^w aa)liŷ-(paa)(l-anuw) ‘my ropes’	*(k ^w aaliŷ)-(paal-uw)
(aa)wi-(paa)(l-anuw) ‘my doors’	*(aawi)-(paal-uw)
(aax ^w)tas-(paa)(l-anuw) ‘my stones’	*(aax ^w tas)-(paal-uw)
(ʎoom)woj-(paa)(l-anuw) ‘my gnats’	*(ʎoomwoj)-(paal-uw)
(nee)pak-(paa)(l-anuw) ‘my books’	*(neepak)-(paal-uw)
(aa)ŷi-(paa)(l-anuw) ‘my girls, daughters’	*(aaŷi)-(paal-uw)
(saa)li-(paa)(l-anuw) ‘my reindeer’	*(saali)-(paal-uw)
(puu)tə-(paa)(l-anuw) ‘my pots’	*(puutə)-(paal-uw)
(poo)ra-(paa)(l-anuw) ‘my float, rafts’	*(poora)-(paal-uw)

In (26b) above we demonstrate that with quantity-insensitive footing we would get allomorph selection that is ungrammatical, despite the fact that the language appeared to be quantity-insensitive for the purposes of stress assignment pattern (see the previous subsection).

In fact, none of prosody-sensitive allomorph selection in the language treats the language as quantity-insensitive, to the best of my knowledge.

We have given illustrations with two possessive suffixes (2nd person singular possessor with plural possessed and 1st person singular possessor with plural possessed), where each of the suffixes has four allomorphs (*-n/-nən/-an/-anən*) for the former suffix and *-w/-uw/-anuw/-nuw* for the latter one). Another type of prosody-sensitive allomorphy in the language is allomorphy where only two allomorphs are available underlyingly, without the option to select a vowel-initial or consonant-initial allomorph, regardless of whether a consonant or a vowel ends the stem preceding the allomorph. One of these suffixes is an adjective-forming suffix that attaches to nominal stems. The allomorphs of this suffix are *-p* and *-pa*¹⁷. Regardless of whether the suffix is concatenated with a consonant-final or vowel-final stem, there is no “repair strategy” for the syllable structure:

(27)

a.			
put ‘ice-crust’	(put-pa) ‘covered with thin ice’		*(put-p)
tin ‘price’	(tin-pa) ‘expensive’		*(tin-p)
xum ‘man’	(xum-pa) ‘human’ (adj)		*(xum-p)
pos ‘light’	(pos-pa) ‘light’ (adj)		*(pos-p)
at ‘smell’	(at-pa) ‘smelly, stinky’		*(at-p)
poc ‘drip’	(poc-pa) ‘drippy’		*(poc-p)
piş ‘trick’	(piş-pa) ‘deceitful’		*(piş-p)
şuŋ ‘wealth’	(şuŋ-pa) ‘wealthy’		*(şuŋ-p)
b.			
uus ‘city’	(uus-p) ‘urban’		*(uus-pa)
seeŋk ^w ‘fog’	(seeŋk ^w -p) ‘foggy’		*(seeŋk ^w -pa)
joor ‘strength’	(joor-p) ‘strong-minded’		*(joor-pa)
naaj ‘fire’	(naaj-p) ‘hot, fiery’		*(naaj-pa)
suup ‘mouth’	(suup-p) ‘loud-mouthed’		*(suup-pa)

¹⁷ One of my informants uses not the prosodically-restricted allomorphs *-p/-pa* but rather syllable structure allomorphs *-əp/-pə*. The rest of the speakers accepted it as an extremely colloquial version. One of the comments was that it sounded ‘young’ and possibly brought over from some neighboring dialect of Vogul. It also seems to be true that this suffix is not entirely productive, as we encountered quite a few nominal stems that cannot be concatenated with this suffix but rather take a more productive suffix *-ŋ/-əŋ*. For several stems, the suffixes seem to be used interchangeably.

woot ‘wind’	(woot-p) ‘windy’	*(woot-pa)
jaa ‘river’	(jaa-p) ‘runny’	*(jaa-pa)
eet ‘night’	(eet-p) ‘very dark, night-dark’	*(eet-pa)

In the data in (27a) above, we have monosyllabic stems with short vowels. When adjectivized, these stems are concatenated with the longer allomorph *-pa*, which forms a complete binary foot. Note that the roots are consonant-final, and yet they take a consonant-initial allomorph, creating consonant cluster, presumably because there is no vowel-initial allomorph available, and constraints against epenthesis or deletion override the requirements on syllable structure. The forms with the shorter allomorph *-p* are ungrammatical with these roots.

In contrast, the forms in (27b) are also monosyllabic, but they are all of the (C)VV(C) shape, i.e. containing a long vowel. These roots take the short allomorph *-p*, still forming a complete moraic binary foot. Again, no vowel-initial allomorph seems to be available, so some of the adjectives end up with complex codas. The alternative forms with the longer allomorph *-pa* are ungrammatical, as, under the moraic footing, they would form either a ternary foot, or a binary foot followed by a degenerate monomoraic foot.

In a similar fashion, disyllabic roots of the form (C)VCV(C) only take the short allomorph of the suffix and are ungrammatical with the longer version. Even if a root ends in a consonant, there is neither deletion nor insertion to accommodate the less marked syllable structure:

(28)

sakka ‘sugar’	(sakka-p) ‘too sweet, sugary’	*(sakka-pa)
mowiŋt ‘laughter’	(mowiŋt-p) ‘ridiculous, laughable’	*(mowiŋt-pa)
pici ‘nest’	(pici-p) ‘cosy’	*(pici-pa)
oma ‘mother’	(oma-p) ‘maternal’	*(oma-pa)
tak ^w əs ‘autumn’	(tak ^w əs-p) ‘sad, unhappy, moody’	*(tak ^w əs-pa)
şaxəl ‘pile’	(şaxəl-p) ‘piling’	*(şaxəl-pa)
koləs ‘grain’	(koləs-p) ‘grainy, distorted’	*(koləs-pa)

Note that in one case, the adjective meaning ‘ridiculous, laughable’ *mowiŋt-p*, there is a triconsonantal coda created by the addition of the allomorph of the adjectivizing suffix, yet, since there is no vowel-initial allomorph of this suffix available underlyingly, and both epenthesis and deletion are prohibited, it is the one-consonant allomorph that is selected. Even though the addition of the other allomorph of this suffix would not create a triconsonantal coda, that allomorph is discarded since its addition would create either a ternary or a degenerate foot, or an unparsed syllable.

Similarly, roots with a long vowel followed by a short vowel in the second syllable, always take the longer allomorph of the adjectivizing suffix, so the resulting form consists of two binary moraic feet:

(29)

a.	b.	c.
ŋeeləm ‘tongue’	(ŋee)(ləm-pa) ‘linguistic; polyglot’	*(ŋeeləm-p)
λaaxxal ‘message’	(λaax)(xal-pa) ‘informative’	*(λaaxxal-p)
jaarmak ‘silk’	(jaar)(mak-pa) ‘silky’	*(jaarmak-p)
iici ‘evening’	(ii)(ci-pa) ‘evening’ (adj)	*(iici-p)
toorəm ‘sky’	(too)(rəm-pa) ‘heavenly; divine’	*(toorəm-p)
juuntəp ‘needle’	(juun)(təp-pa) ‘sharp’	*(juuntəp-p)
aaməʂ ‘riddle’	(aa)(məʂ-pa) ‘puzzling’	*(aaməʂ-p)
xootal ‘sun, day’	(xoo)(tal-pa) ‘day-time’ (adj)	*(xootal-p)
aax ^w tas ‘stone’	(aax ^w)(tas-pa) ‘heavy, stone-like’	*(aax ^w tas-p)
neepak ‘book’	(nee)(pak-pa) ‘well-read, bookish’	*(neepak-p)
eek ^w a ‘woman’	(ee)(k ^w a-pa) ‘feminine’	*(eek ^w a-p)

The adjectives in (29b) that are formed from the corresponding nouns in (29a) all take the longer allomorph *-pa*, clearly treating syllables with long vowels as heavy. The ungrammatical forms in (29c) show that with weight-insensitive footing we would predict that the short allomorph *-p* should be attached. Crucially, that prediction is not borne out. There are several other suffixes in Vogul that behave in a similar fashion, attaching an allomorph that would complete a foot.

5.2.3.2 Allomorphy Type 2

A similar, albeit different, phenomenon can be found in verbal formation of Vogul. The participial suffix *-n/-nɛ/-nə* with the meaning “(the one) V-ing,” which attaches to verbal stems, has the distribution of allomorphs that is also tied to prosodic structure of the language.

The single-consonant allomorph *-n* attaches to any stem that ends in a vowel or a single consonant:

- | | | | |
|------|------------------|---------------------------|-------------------|
| (30) | a. | b. | c. |
| | ju-n ‘coming’ | min-n ‘going’ | xol-n ‘stopping’ |
| | li-n ‘throwing’ | xil-n ‘digging’ | mat-n ‘aging’ |
| | wi-n ‘taking’ | xuj-n ‘sleeping/dreaming’ | tot-n ‘bringing’ |
| | mi-n ‘giving’ | al-n ‘killing’ | mas-n ‘dressing’ |
| | tee-n ‘eating’ | pin-n ‘placing’ | kis-n ‘whistling’ |
| | waa-n ‘sleeping’ | pur-n ‘biting’ | |

The language has very few (only the six listed above in (30a)) verbal roots ending in a vowel, and the ones that have a short vowel (‘coming’, ‘throwing’, ‘taking’, and ‘giving’) also have consonant-final allomorphs of the roots. Since the consonant-final allomorphs of these roots are not used with the suffix in question, we will not discuss them here. As is evident in (30b), monosyllabic verbal roots that end in a single consonant are also concatenated with the shortest allomorph (*-n*), despite the fact that the resulting form has a complex coda, marked both universally and in Vogul (see distribution of allomorphs that does not depend on prosody above). The reason for such allomorph distribution is outside the scope of this chapter.

Similarly, the same allomorph *-n* is concatenated with polysyllabic roots, as well as with monosyllabic roots of the form (C)VVC, regardless of the number of syllables or vowels preceding it:

- (31) a. xool-n ‘dying’
 waar-n ‘making’
 xuuʎ-n ‘leaving’
 ool-n ‘living’
 neey-n ‘tying, to binding’
 toos-n ‘drying’
 joom-n ‘going, striding’
 keet-n ‘sending’
 waat-n ‘picking’
 naat-n ‘floating’
 ʎuuʎ-n ‘standing’
 noox-n ‘flying up’
 k^waal-n ‘standing up’
- b. sawal-n ‘suffering’
 moyal-n ‘laughing, smiling’
 tayat-n ‘hanging’
 pokap-n ‘bursting’
 tinal-n ‘selling’
 xariy-n ‘extinguishing’

As the data above illustrates, the same shortest allomorph of the suffix is attached to roots with two vowels in them, either monosyllabic, as in (31a), or disyllabic, as in (31b) above.

The other two allomorphs (either *-nɛ* or *-nə*) are attached to stems that end in two consonants, presumably to reduce a potential tri-consonantal coda¹⁸. Some of the verbs below are derived.

- (32) a. xiwl-nə ‘rowing’
 joxt-nə ‘arriving’
 xopl-nə ‘knocking, beating’
 unl-nə ‘sitting’
 patt-nə ‘dropping’
 xans-nə ‘writing’
 xajɳ-nə ‘knowing’
 xanl-nə ‘gluing’
- b. xaareɣt-nə ‘crackling, squeaking’
 xaajtiyɣt-nə ‘running around’
 roonxuwl-nə ‘yelling’
 paajt-axt-nə ‘cooking’ (intr)¹⁹
 jeek^wə-lt-nə ‘beginning to dance’²⁰
 laawə-lt-nə ‘mentioning’
 xaajtə-ml-nə ‘startting to write’²¹
 puuwə-mt-nə ‘seizing’²²

¹⁸ If, indeed, the reduction of a potential complex coda is (one of the) reasons to attach a CV allomorph, it is unclear why a monoconsonantal allomorph *-n* is attached to roots ending in two consonants instead of a CV allomorph that would have been more beneficial, leaving a one-consonant coda. While I am pointing this problem out, I leave it outside the scope of this dissertation.

¹⁹ -axt- intransitive suffix

²⁰ -lt- inchoative and causative suffix

²¹ inchoative

²² -mt- momentaneous

One of the two CV allomorphs (allomorph *-nə*) is attached to both the verbal stems in (a) and in (b) in the data above. The stems in (32a) are all monosyllabic and contain a short vowel, whereas the stems in (32b) have two syllables, but one of the vowels is long. All of the stems end in two consonants. Under a moraic analysis, all of the examples in (32a) consist of a single foot, the first part of which is the verbal stem, and the second the allomorph *-nə* of the participial suffix. Similarly, in (32b), the first syllable of the stem, containing a long vowel, is footed by itself. The second syllable of the stem with the short vowel is footed together with the suffix. Just as in (32a), the whole word is parsed into binary moraic feet. Note that under a syllabic analysis, the occurrence of the allomorph with the schwa (as opposed to the allomorph with the full vowel) becomes unpredictable:

(33)

- | | |
|--|---|
| <p>a.</p> <p>(xiwl-nə) ‘rowing’</p> <p>(joxl-nə) ‘arriving’</p> <p>(xopl-nə) ‘knocking, beating’</p> <p>(unl-nə) ‘sitting’</p> <p>(patt-nə) ‘dropping’</p> <p>(xans-nə) ‘writing’</p> <p>(xanɣ-nə) ‘knowing’</p> <p>(xanl-nə) ‘gluing’</p> | <p>b.</p> <p>(xaareɣt)-(nə) ‘crackling, squeaking’</p> <p>(xaajtiɣt)-(nə) ‘running around’</p> <p>(roonxuwl)-(nə) ‘yelling’</p> <p>(paajt-axt)-(nə) ‘cooking’ (intr)</p> <p>(jeek^wə-lt)-(nə) ‘beginning to dance’</p> <p>(laawə-lt)-(nə) ‘mentioning’</p> <p>(xaajtə-ml)-(nə) ‘starting to write’</p> <p>(puuwə-mt)-(nə) ‘seizing’</p> |
|--|---|

The syllabic parsing above places the allomorph *-nə* as the second part of the foot in one case, in (33a), but as the initial part of the second foot in (33b). The syllabic analysis of the data, therefore, cannot explain the distribution of the allomorphs of this suffix, despite the fact that stress placement pattern in the language is quantity-insensitive.

We will next look at monosyllabic stems that contain long vowels and end in two consonants. Since the stems end in two consonants, it is either the *-nɛ*, or the *-nə* allomorph that should attach to the stem.

(34)

- | | |
|-------------------------------------|--|
| a. | b. |
| eery-nε ‘singing’ | alişl-nε ‘fishing’ |
| saanl-nε ‘ringing’ | potərt-nε ‘speaking’ |
| keenγ-nε ‘roaring’ | lowiŋt-nε ‘reading, counting’ |
| xaajt-nε ‘running’ | kitiy-l-nε ‘asking (a question)’ |
| moorm-nε ‘wrinkling, to folding’ | xarışt-nε ‘teaching, inquiring’ |
| uunl-nε ‘sitting’ | wojant-nε ‘defending’ |
| rooŋx-nε ‘shouting’ | janiγ-m-nε ‘growing, becoming big’ ²³ |
| uunt-nε ‘occupying (place)’ | mina-nt-nε ‘going along’ |
| saayr-nε ‘cutting’ | xoram-l-nε ‘decorating’ ²⁴ |
| aaŋx ^w -nε ‘pulling out’ | tıŋşaŋ-l-nε ‘lassoing’ ²⁵ |
| λuuŋş-nε ‘weeping’ | samə-ltt-nε ‘noticing’ ²⁶ |
| oox-t-nε ‘tar’ ²⁷ | ojə-lt-nε ‘putting to sleep’ |

In contrast with the previous set of data, all the verbal stems in the data in (34) above are concatenated with the allomorph *-nε* (with the full vowel). Under moraic analysis, the verbal stems in (34a) (either the roots alone, or roots with suffixes preceding the participial suffix), comprises a full bimoraic foot, and the participial suffix itself starts a second (degenerate) foot. Similarly, in (34b), the stems contain two vowels (two syllables with a short vowel each) and hence are also footed together, with the participial suffix outside the bimoraic foot.

Again, under a quantity-insensitive footing consistent with stress assignment, the distribution of the allomorphs is impossible to predict:

(35)

- | | |
|----------------------|--------------------------------------|
| a. | b. |
| (eery-nε) ‘singing’ | (alişl)-(nε) ‘fishing’ |
| (saanl-nε) ‘ringing’ | (potərt)-(nε) ‘speaking’ |
| (keenγ-nε) ‘roaring’ | (lowiŋt)-(nε) ‘reading, counting’ |
| (xaajt-nε) ‘running’ | (kitiy-l)-(nε) ‘asking (a question)’ |

²³ *-m-* is a suffix with the meaning ‘become X’; from *janiγ* ‘big’

²⁴ *-l-* is a transitive verbalizer, from *xoram* ‘decoration’

²⁵ see previous footnote

²⁶ *-ltt-* is a transitive verbalizer, from *sam* ‘eye’

²⁷ *-t-* is a suffix with the meaning ‘provide with X’; from *oox* ‘tar’

(moorm-nε) ‘wrinkling, folding’	(xapɪst)-(nε) ‘teaching, to inquiring’
(uunl-nε) ‘sitting’	(wojant)-(nε) ‘defending’
(rooŋx-nε) ‘shouting’	(janiɣ-m)-(nε) ‘growing, becoming big’
(uunt-nε) ‘occupying (place)’	(mina-nt)-(nε) ‘going along’
(saayɾ-nε) ‘cutting’	(xoram-l)-(nε) ‘decorating’
(aapɣ ^w -nε) ‘pulling out’	(tiŋʂaŋ-l)-(nε) ‘lassoing’
(λuuɲʂ-nε) ‘weeping’	(samə-ltt)-(nε) ‘noticing’
(oox-t-nε) ‘tarring’	(ojə-lt)-(nε) ‘putting to sleep’

As we can see from the examples above, forms in (35a) are parsed into a single syllabic foot, with the participial suffix comprising the second part of a foot. Forms in (35b), on the other hand, are footed differently: the stems, all of which contain two light syllables, are footed into binary syllabic feet, whereas the suffix starts another foot. Yet, both in the forms in (35a) and in (35b), the same allomorph of the participial suffix is chosen.

The explanation of the distribution of the two CV allomorphs of the participial suffix, it appears, lies in the sonority of the vowel of the suffix and the foot structure of the language that allomorphy requires. The allomorph *-nə*, with the schwa vowel that is the least sonorous, is selected when the suffix can be footed as the second (weak) part of a binary moraic foot. The other CV allomorph, *-nε*, appears when it is footed by itself, as the first, and the only, part of the second foot, putting the relatively more sonorous vowel [ε] into the strong position within a foot.

This pattern can be easily modelled within Optimality Theory utilizing a scale of constraints introduced in Kenstowicz (1994), and with de Lacy’s (2004, 2006) stringent constraints for foot margins (see Chapter 2 for definitions of these constraints).

This is a scale of constraints that insures that the most undesirable peak of a foot is a schwa, followed by a constraint prohibiting high vowels [i] and [u] from being prominent and so on. By the same reasoning, a constraint like *M/a will be defined as “vowel [a] must not be the peak of a syllable occupying the weak part (margin) of a foot”, with the vowel sonority scale reversed:

(36) Margin Prominence for Metrical Foot

- *M/a
- *M/a, ε •ɔ
- *M/a, ε •ɔ, e •o
- *M/a, ε •ɔ, e •o, i•u
- *M/a, ε •ɔ, e •o, i•u, i
- *M/a, ε •ɔ, e •o, i•u, i, ə

To account for the second type of allomorphy in Vogul discussed above, the distribution of the participial suffix allomorphs *-nə* and *-nε*²⁸, we will need two of the constraints specified in the stringency hierarchy:

- (37)
- a. *M/a, ε •ɔ, e •o, i•u, i, ə
 - b. *M/a, ε •ɔ

Other FT-FORM constraints that are not outranked by any other constraint in the language would insure that the type of feet we are dealing with is trochee. The BINARITY_μ constraint requires that all feet must be binary on the moraic level.

Tableau 3

/xopl/-nε/~nə/	FT-FORM (trochee)	FTBIN _μ	*M/a, ε •ɔ	*M/a, ε •ɔ, e •o, i•u, i, ə
s w a. (xopl-nε)			*!	*
s w b. (xopl-nə)				*
w s c. (xopl-nε)	*!			
w s d. (xopl-nə)	*!			
s s e. (xopl)-(nε)		**!		

²⁸ The single-consonant allomorph *-n* is disregarded here for reasons stated previously in this chapter.

As can be seen from the Tableau 3 above, the first two constraints (FTFORM and BINARITY) are not ranked with respect to each other; they outrank all the other constraints in the tableau. The only candidate that does not have binary footing is candidate (e) that is parsed into two monomoraic feet. This candidate is eliminated by the BINARITY violations, even though its suffix vowel ([ɛ]) is in the strong position of the foot, since the suffix is parsed into its own monomoraic foot, and thus does **not** violate the *M/a, ɛ •ɔ constraint. Candidates (c) and (d) are eliminated by the FTFORM constraint, since they are iambs and not trochees. The choice of optimal candidate, therefore, is limited to candidates (a) and (b), which minimally differ with respect to with of the two CV allomorphs the stem is concatenated with. The candidate (a) has the monosyllabic stem concatenated with the allomorph with the full vowel [ɛ]. The candidate (b), on the other hand, has the suffix with the schwa attached to it. The candidate (b) is optimal.

What the tableau above illustrates, therefore, is the generalization about the distribution of different sonority vowels within feet: the reduced schwa allomorph is chosen for the weak position within a foot.

5.2.4 Summary

Note again that the parsing that would correctly predict the distribution of the CV allomorphs must be moraic, i.e. quantity-sensitive. It seems clear, therefore, that there is a contradiction exhibited in the language between the weight-insensitivity that stress pattern suggests and weight-sensitive parsing needed to predict both forms of allomorphy:

(38)

<p>a. Moraic parsing (saay)rap-(paa)(l-anuw) ‘my axes’ (muu)ŋi-(paa)(l-anuw) ‘my eggs’ (paas)sa-(paa)(l-anuw) ‘my mittens’ (laax)xal-(paa)(l-anuw) ‘my messages’ (soo)jəm-(paa)(l-anuw) ‘my brooks’ (oo)ŋəy-(paa)(l-anuw) ‘my aunts’</p>	<p>b. Syllabic parsing *(saayrap)-(paal-uw) *(muuŋi)-(paal-uw) *(paassa)-(paal-uw) *(laaxxal)-(paal-uw) *(soojəm)-(paal-uw) *(ooŋəy)-(paal-uw)</p>
---	---

(ii)ci-(paa)(l-anuw) ‘my evenings’	*(iici)-(paal-uw)
(kee)ηən-(paa)(l-anuw) ‘my buttons’	*(keeηən)-(paal-uw)
(juun)təp-(paa)(l-anuw) ‘my needles’	*(juuntəp)-(paal-uw)

As we can see from the data above, repeated from (26) previously given in this chapter, it is only the moraic (weight-sensitive) parsing in (38a) that correctly predicts the shape of the possessive allomorph, whereas the syllabic parsing in (38b) gives us the wrong predictions. The parsing for predicting the correct stress pattern, on the other hand, must be weight-insensitive, as can be see below:

(39)

a. Syllabic parsing	b. Moraic parsing
(sáayrap)-(pàal-a)(nuw) ‘my axes’	*(sáay)rap-(pàa)(l-ànuw)
(múuηi)-(pàal-a)(nuw) ‘my eggs’	*(múu)ηi-(pàa)(l-ànuw)
(páassa)-(pàal-a)(nuw) ‘my mittens’	*(páas)sa-(pàa)(l-ànuw)
(láaxxal)-(pàal-a)(nuw) ‘my messages’	*(láax)xal-(pàa)(l-ànuw)
(sóojəm)-(pàal-a)(nuw) ‘my brooks’	*(sóo)jəm-(pàa)(l-ànuw)
(óoηəy)-(pàal-a)(nuw) ‘my aunts’	*(óo)ηəy-(pàa)(l-ànuw)
(iici)-(pàal-a)(nuw) ‘my evenings’	*(ii)ci-(pàa)(l-ànuw)
(kéeηən)-(pàal-a)(nuw) ‘my buttons’	*(kée)ηən-(pàa)(l-ànuw)
(júuntəp)-(pàal-a)(nuw) ‘my needles’	*(júun)təp-(pàa)(l-ànuw)

The examples in (39a) are parsed into trochaic weight-insensitive (syllabic) feet²⁹, giving us the correct stress pattern, without the secondary stress assigned to the penultimate syllable. The parsing in (39b), on the other hand, is weight-sensitive, and would therefore assign secondary stress to the penultimate syllable. Moreover, if we allow a monomoraic degenerate foot for the syllable “trapped” between the first heavy syllable and the third heavy syllable, we would get an additional ungrammatical secondary stress assigned to the second syllable in the words in (39b) above. It seems clear, therefore, that the stress pattern in the language takes into consideration syllables regardless of their weight, rather than moras.

²⁹ Whether or not we parse the last syllable here into a degenerate foot does not matter, as ultimate syllables never receive stress in the language.

To summarize this section, we have discovered a discrepancy between weight-insensitivity of the stress pattern in Vogul and the clearly weight-sensitive foot parsing required for both types of prosody-sensitive allomorphy.

Having the patterns of Vogul described above in mind, we now turn to somewhat similar pattern in an unrelated language, Shipibo (Panoan family), which presents some significant minimal differences with the Vogul pattern.

5.3 Case Study: Shipibo³⁰ (North-Central Panoan)

5.3.1 Preliminary Remarks

Shipibo is one of Panoan languages, spoken in Peru. Its close relatives are Huariapano and Capanahua, discussed in Chapter 4. According to Pozzi-Escot (1998), Shipibo has about sixteen thousand speakers.

Shipibo presents a pattern that looks like the mirror image to the Vogul case, in that while its stress assignment is sensitive to weight, rhythmic alternations in the language clearly depend on syllabic parsing. We will argue that the parsing in the language is indeed syllabic, whereas stress is pulled onto heavy syllables by the WEIGHT-TO-STRESS constraint that outrank the Prominence Alignment constraint requiring that stress be aligned with the left edge of a syllabic foot.

Shipibo has four short vowels: /i, i, u, a/, and the following consonants: /p, t, k, β, s, ʃ, ʂ, ts, tʃ, r, m, n, w, j, h/. Onsets and codas are optional in the language. Both complex codas and complex onsets are disallowed. Furthermore, only nasals and sibilants can be codas. Stress in the language is realized as high pitch.

Monosyllabic underived nouns always have a long vowel and can also have a coda consonant. Example: [hii] ‘hair’, or [tʃii] ‘fire’. Long vowels are not found anywhere else

³⁰ All the data in this section comes from Elías-Ulloa (1999, 2000, 2001), and partially from Lauriault (1948). My sincerest thanks to José Elías-Ulloa for allowing me access to all his manuscripts and field work data.

in the system (Elías-Ulloa (1999, 2003). This restriction suggests some kind of Minimal Word requirement, with consonants not contributing to weight, since there are no underived nouns of the form CVC. However, just as in the case with Vogul we discussed previously, there are no synchronic alternations indicating that the long vowel in the words like [hii] does not shorten when suffixes are added:

- (40)
- | | | |
|-----|-----------|---------------|
| (a) | tʃii | ‘fire’ |
| (b) | tʃii-ki | ‘in the fire’ |
| | fire-LOC | |
| (c) | tʃii-ris | ‘only fire’ |
| | fire-only | |

Furthermore, we will see evidence that consonants can be moraic and attract stress in certain configurations. I will, therefore, consider the fact that no underived monosyllabic word in Shipibo has a short vowel an epiphenomenon synchronically³¹.

5.3.2 Stress

In words with only open short syllables, main stress is assigned to the first syllable in the word, regardless of the number of syllables:

(41) (Data from Elías-Ulloa (2000))

- | | |
|---------|----------|
| ú.ta | ‘mother’ |
| βá.ki | ‘child’ |
| á.ta.pa | ‘hen’ |

When suffixes (of a certain type, see below) are added to a root consisting of CV syllables only, like the root *á.ta.pa* ‘hen’, main stress remains on the first syllable:

³¹ See Elías-Ulloa (2003) for a different analysis that recognizes the Minimal Word restriction as synchronically active constraint in the language and utilizes Output-Output constraints to account for the lack of shortening (or lack of lengthening if the underlying representation has a short vowel) when roots like [hii] ‘hair’ are concatenated with other morphemes.

- (42)
- | | | |
|-----|--------------------------------|-------------------|
| (a) | á.ta.pa.-βu
hen-PL | ‘hens’ |
| (b) | á.ta.pa.-ra
hen-EVID | ‘hen, evidently’ |
| (c) | á.ta.pa.-βu.-ra
hen-PL-EVID | ‘hens, evidently’ |

If, however, the second syllable of the root is a closed syllable, and the first is a CV syllable, the main stress in Shipibo words is shifted onto the second, closed syllable:

- (43)
- | | |
|---------------|--------------------|
| βis.βi | ‘kind of wasp’ |
| tʃa.rás | ‘catalan’ (a bird) |
| si.nín.βi.ris | ‘same, equal’ |

Such a pattern suggests, first, that consonants in the language do contribute to weight, and second, that the language, or at least its stress assignment pattern is weight-sensitive.

It is worth mentioning that main stress is restricted to the first two syllables of a word, regardless of shape or weight of syllables following. For example:

- (44)
- | | | |
|---------------|-----------------|-----------------|
| sá.pi.ton | ‘(sp. of) fish’ | * sa.pi.tón |
| si.nín.βi.ris | ‘same, equal’ | * si.nín.βi.rís |

The examples above illustrate the generalization we have made previously: the main stress is assigned to the first syllable if both the first and the second syllables are light, and to the second syllable, if the second syllable is heavy. Therefore, it appears that (i) stress in the language is weight-sensitive, and (ii) it is assigned within the initial two-syllable window.

Given allomorphy patterns we discuss in the next subsection, we have to conclude that, despite the sensitivity to weight, Shipibo words are parsed into syllabic feet. This case, therefore, shows us how WEIGHT-TO-STRESS principle can affect the stress assignment

without affecting foot structure, as is shown by segmental allomorphy. Shipibo's foot dependent segmental alternation proves that the footing in this language is constant and drives the stress assignment, with the exception of WEIGHT-TO-STRESS effect:

Tableau 4

/tʃaras-ra / 'catalan, evidently'	ALIGN-L (FT, PWD)	W-t-S	ALIGN-L (LEV _n GRID, FT)
☞ a. (tʃarás)-ra			*
b. (tʃáras)-ra		*!	
c. tʃa(rás)-ra	*!		
d. tʃa(rás-ra)	*!		

As the Tableau above illustrates, both the constraint on feet alignment and WEIGHT-TO-STRESS principle outrank the stress alignment constraint. Candidates (c) and (d) violate the foot-alignment constraint, even though they have the stress assigned correctly to the heavy syllable and aligned to the left edge of the foot. In fact, the only difference between the two losing candidates is that candidate (c) violates the FTBIN_(o) constraint, and candidate (d) does not. Since neither of these candidates is optimal, we cannot rank the BINARITY constraint with respect to other constraint, thus we do not include it in the Tableau 6 above. Candidate (b), while its footing is correct, is stressed on the light syllable that is followed by a heavy unstressed one and therefore violates the WEIGHT-TO-STRESS principle. Since WEIGHT-TO-STRESS also outranks the constraint that requires that prominence be aligned with the left edge of a foot, candidate (b) is eliminated as well. Consequently, even though candidate (a) violates the stress alignment constraint, it is chosen as optimal due to no violations of the higher-ranking constraints.

To summarize, WEIGHT-TO-STRESS constraint is shown to be another constraint that can influence stress assignment without any effect on the foot structure that is shown by the segmental alternation between the allomorphs.

Secondary stress is not reported to occur in the language; however, there are words with certain suffixes that do surface with secondary stress. Elías-Ulloa (2003) recognizes two types of suffixes, prosodic (type I) and non-prosodic (type II). The first type of suffixes

shows up with the secondary stress on its first syllable. Elías-Ulloa (2003) suggests that so-called prosodic suffixes start their own foot and thus have another stress assigned. Since this thesis is arguing for certain separation between footing and stress location, I will remain more cautious and say that all we know is that these suffixes (Type I) have a lexical stress in the lexicon, stress that shows up on the surface, presumably because of some sort of MAX(stress) constraint. Thus, rather than proposing that the appearance of secondary stress points to footing that starts when these suffixes are attached, I am leaving the issue unresolved, and argue that in Shipibo the main indication of parsing into feet is allomorphy that we will be discussing in the next subsection. Below we see some of the suffixes that do come with their own stress mark (45a), and some that do not cause Shipibo words surface with secondary stress (45b):

- (45)
- | | |
|---|---|
| <p>(a) Type I suffixes</p> <p>/-ʃú.ku/ diminutive</p> <p>/-rún.ki/ reportative</p> <p>/-nín/ ergative</p> | <p>(b) Type II suffixes</p> <p>/-a/, /-ki/, /-ai/ finished action
indicative, indicative-interrogative,
interrogative</p> <p>/-βu/ plural</p> <p>/-ra/ evidential</p> |
|---|---|

Below is a paradigm of the word /a.ta.pa/ ‘hen’ with different types of suffixes added. The data in (46a-c) show that certain suffixes (type II) do not carry secondary stress even if the word has four or more syllables. (46d-f) show that some suffixes (type I) introduce secondary stress. More than one secondary stress is possible, depending on how many type I suffixes are added to the word (46g). The example in (46h) shows a word with type II suffix and a Type I suffix. Secondary stress is only seen in the Type I suffix. Finally, the example in (46i) shows that compounds have secondary stress on the second root.

(46) Paradigm *atapa* ‘hen’ + suffixes

- | | |
|---|---------------------------------------|
| <p>(a) á.ta.pa.-βu
hen-PL</p> <p>(b) á.ta.pa.-ra
hen-EVID</p> | <p>‘hens’</p> <p>‘hen, evidently’</p> |
|---|---------------------------------------|

- (c) á.ta.pa.-β̥.ra ‘hens, evidently’
 hen-PL-EVID
- (d) á.ta.pa.-n̄in ‘hen’ (Ergative)
 hen-ERG
- (e) á.ta.pa.-r̄un.ki ‘hen, reportedly’
 hen-REP
- (f) á.ta.pa.-f̄u.ku ‘little hen’
 hen-DIM
- (g) á.ta.pa.-f̄u.ku.-r̄un.ki ‘little hen, reportedly’
 hen-DIM-REP
- (h) á.ta.pa.-β̥r̄un.ki ‘hens, reportedly’
 hen-PL-REP
- (i) á.ta.pa.-β̄i.ni ‘rooster’
 hen-male

It seems reasonable, therefore, to suggest that the suffixes that cause a word to surface with secondary stress have underlying prominence. This prominence must be realized on the surface, even though the language in general bans secondary stress:

Tableau 5

/atapa/-/f̄uku/ ‘little hen’	MAX (LEV _n GRID)	* LEV ₂ GRID	ALIGN-L (LEV _n GRID, FT)
☞ a. (á.ta.)(pa.-f̄u.)ku		*	**
b. (á.ta.)(pa.-fu.)ku	*!		**

Even though both candidates in the tableau above violate the Prominence Alignment constraint twice (the ‘additional’ secondary stress in candidate (a) is not foot-initial), candidate (b) is eliminated by the MAX (LEV_nGRID) constraint: its underlying gridmark does not appear on the surface. Candidate (a) emerges as a winner.

Note that this analysis predicts that the foot structure of the language is not changed by the underlying prominence, just like it is not changed by the Weight-To-Stress requirement.

To summarize, all the Shipibo data presented in this subsection illustrates that the stress assignment pattern in the language is weight-sensitive, with some instances of secondary stress attributed to lexical stress appearing on the surface as secondary stress. There is no evidence presented by the stress pattern that footing is persistent throughout the word, as there is no secondary stress assigned, except, again, the morphology-based stress. Further complications of Shipibo stress assignment do not contradict our conclusion that the stress assignment in the language is quantity-sensitive, and is analyzed in further detail in Elías-Ulloa (2003, 2005).

With this background, we now turn to another prosody-sensitive phenomenon in Shipibo, allomorphy that depends on rhythmic structure of words in the language.

5.3.3 Rhythmic Allomorphy

According to Elías-Ulloa (2003, 2005), and Lauriault (1948), among others, Shipibo has at least two types of allomorphy that depend on the rhythmic shape of the stems that precede them. In one case, one of the vowels in a disyllabic suffix alternates between [i] and [a]; in the other case, the suffix attaches different allomorphs, either a consonant, or a whole syllable. The choice of one of the two allomorphs of this suffix also relies on the rhythmic composition of the stem.

5.3.3.1 The *-riba-* ~ *-ribi-* Allomorphy

To the best of my knowledge, it was Lauriault (1948) who first noticed the existence of a rhythmic alternation in Shipibo. According to Lauriault, the suffix that means ‘again’ has two allomorphs, *-ribi-* and *-riba-*, depending on the number of vowels that precede it. After an even number of vowels the allomorph *-riba-* occurs, and after an odd number of vowels the allomorph *-ribi-* surfaces, as in examples below:

(47) Suffix *riba* ~ *ribi* alternations (from Lauriault 1948); the suffix is underlined

- (a) a-riba-ki 'did it again'
do-again-PAST
- (b) pi-riba-ki 'ate again'
eat-again-PAST
- (c) ka-riba-ki 'went again'
go-again-PAST

As we can see from the data in (47a-c) above, when the suffix is attached to a monosyllabic (C)V root, the allomorph that is attached is the allomorph with the more sonorous vowel [a] (*-riba-*). The same holds when the suffix is attached to a stem with three (C)V syllables:

- (d) a-ma-ri-siba-ki 'merely made him do it again'³²
do-CAUS-merely-again-PAST
- (e) a-pari-riba-ki 'did it first again'
do-immediately-again-PAST
- (f) yomitso-riba-ki 'stole again'
steal-again-PAST
- (g) ka-yama-riba-ki 'did not go again'
go-NEG-again-PAST

While there are no examples available to me where the suffix is concatenated with five or seven syllables, it seems reasonable to analyze the alternation between the allomorphs of this suffix as one dependent on the suffix's position in the foot of any given form: when the second syllable of the suffix starts a foot, the allomorph surfaces as *riba*, with left-aligned binary feet.

This generalization is supported by the data when the suffix attaches to stems that contain an even number of (C)V syllables:

³² The underlying form is /a-ma-ris-riba-ki/ (Lauriault (1948:23)). It appears that assimilation takes place between an adjacent /sr/ sequence with /s/ surfacing.

- (48)
- | | | |
|-----|---|-------------------------------------|
| (a) | a-ma- ribi -ki
do-CAUS-again-PAST | ‘made him/her do it again’ |
| (b) | yono- ribi -ki
command-again-PAST | ‘commanded again’ |
| (c) | ka-ma- ribi -ki
go-CAUS-again-PAST | ‘made him/her to go again’ |
| (d) | baki- ribi -ra
child-again-EVID | ‘again the child’ |
| (e) | jaka-pari- ribi -ki
sit down-immediately-again-PAST | ‘he sat down again and immediately’ |

In examples (48a-d), the suffix is attached to two (C)V syllables, thus starting a new foot. In these cases, the suffix’s second syllable is the second part of a foot comprised completely of the disyllabic suffix. The allomorph that surfaces, therefore, is the allomorph with the less sonorous vowel [i] (*-ribi-*). Similarly, in example in (48e), the suffix is concatenated with a stem with four (C)V syllables, i.e. with a stem that contains two complete feet. The suffix, once again, starts its own foot, and its second syllable is in the weak position of the foot, surfacing as *-ribi-*.

So far, all the roots we have looked at had only open syllables, with or without an onset. Given that stress in the language is quantity-sensitive, i.e. is attracted to closed syllables, as we discussed in the previous subsection, we would expect closed syllables of stems to render different results than the stems that contain open syllables only. However, the following data shows us that this prediction is incorrect:

- (49)
- | | |
|--|--|
| (a) Syllabic parsing of CVC syllables | (b) Moraic parsing of CVC syllables |
| (mísko)-(ribi)-ra
cramp-again-EVID
‘again the cramp, evidently’ | *(mís)(ko- ri)(ba -ra) |

(his-ri)(ba-ki)
see-again-PAST
'saw again'

*(his)-(ribi)-ki

Despite what the stress pattern of the language suggests, moraic parsing of closed syllables renders the incorrect result for the distribution of the allomorphs of the suffix under question. In the examples in (49a), the closed syllables are parsed as light, and this parsing renders the correct result for the distribution of the allomorphs.

In the first example, *mísko-ribi-ra* 'again the cramp, evidently', the root consists of a closed syllable followed by an open one. Under the syllabic parsing, the suffix *-riba-/-ribi-* starts the second foot, where both syllables of the suffix are footed together, thus surfacing with the allomorph *-ribi-*, since the second syllable is parsed as the second (weak) part of a foot. Moraic parsing, on the other hand, foots the first syllable of the root as a binary moraic foot by itself, and the second syllable of the root is parsed together with the first syllable of the suffix. The second syllable of the suffix, therefore, should start its own foot and occupy the first (strong) position in it; given this parsing the allomorph that should surface here is **-riba-*, with a more sonorous vowel in the second syllable. This prediction is clearly incorrect.

In the second example, on the other hand, *his-riba-ki* 'saw again', the root completely consists of a closed syllable. If, as in (49b), it is footed by itself comprising a binary moraic foot, the suffix should start its own foot, and the second syllable would be parsed into the second (weak) part of the foot, thus the word should surface with the allomorph **-ribi-*. If, on the other hand, we follow syllabic parsing as in (49a), the root is footed together with the first syllable of the suffix, and the second syllable of the suffix is parsed into the first part of the second foot, and occupies the strong position in that foot. This syllabic parsing gives the correct prediction that the *-riba-* allomorph shows up in this form.

It appears, therefore, that we are faced with a dilemma similar to the one we pointed out when we investigated the Vogul stress and allomorph selection: the stress pattern

suggests that words are parsed into moraic feet, while allomorph selection is only predictable from syllabic parsing. The difference with Vogul case is that, in Vogul, it was the allomorph selection that required moraic parsing, while stress insensitive to syllable weight.

5.3.3.2 Ergative suffix *-n/-nin* Rhythmic Alternations

A similar pattern is presented by another Shipibo suffix, the ergative suffix *-nin/-n*. This ergative suffix also alternates: it surfaces as *-n* when added to a noun with an even number of syllables but as *-nin* when added to a noun with an odd number of syllables³³.

(50)

- | | | |
|-----|------------------|-------------------------------------|
| (a) | (βá.ki) | ‘child’ |
| | (βa.kí-n) | ‘child (ergative)’ (Lauriault 1993) |
| (b) | (tái) | ‘foot’ |
| | (ta.í-n) | ‘foot’ (ergative) |
| (c) | (á.ta).pa | ‘hen’ |
| | (á.ta.)(pa.-nĭn) | ‘hen’ (ergative) (Lauriault 1993) |

In the examples in (50a) and (50b) above, both roots have two vowels. In the case of (50b), Lauriault (1993) syllabifies the two vowels of the root into different syllables. In both (50a) and (50b), therefore, the roots comprise disyllabic feet, and thus receive the shorter allomorph *-n* that shifts the stress to the second syllable (confirming that stress is weight-sensitive), but not adding any material that would not fit into the same disyllabic foot.

In contrast, the example in (50c) has a root that consists of three open syllables. The first two syllables of the root are parsed together, while the third syllable is parsed together with the ergative suffix. The allomorph of the ergative suffix that is added is, consequently, the longer of the two, *-nin*. Notice, also, that the ergative suffix is one of the Type I suffixes that bring in their lexical stress. The hypothesis we operate under is

³³ A similar alternation for the ergative suffix is found in Capanahua (Loos 1978:159-61)

that this allomorphy is triggered by a requirement to parse the whole form into binary feet (see Saami, Estonian and Vogul, previously discussed in this thesis). The parsing for the form in (c), therefore, predicts the correct allomorph of the suffix added to the root *atapa* ‘hen’; however, it also suggests that while certain suffixes (Type I) have lexical stress that shows up as secondary stress on the surface, it does NOT come with its own footing, but is rather parsed into the second part of the final foot, leaving the whole form in (50c) parsed into two disyllabic feet.

(d) *ʃin.ka* ‘(sp. of) parrot’
 (ʃin.ká-n) ‘(sp. of) parrot’ (ergative) (Loriot 1993:389)

(e) **(ʃin.)(ka-n̄in)*

Looking at the form in (50d) above, we can easily conclude that this type of allomorphy also indicates that the rhythmic alternations are weight-insensitive, i.e. closed syllables are parsed the same way light syllables are parsed. In the form above, the whole root *ʃin.ka* ‘(species of) parrot’ is parsed into a binary syllabic foot, thus the ergative allomorph added is the shorter one, *-n*, that is parsed into the same foot without adding another syllable.

An interesting exception to this pattern is presented by stems that end in consonants. When such a stem is concatenated with the ergative suffix, an epenthetic vowel is inserted between the consonant of the root and the consonant of the short allomorph *-n*:

(51)
 wi.táʃ ‘leg’
 wi.ta.ʃ-ín ‘leg’ (ergative)
 **wi.táʃ-n* (without epenthesis)
 **wi.tá-n* (without epenthesis, with deletion of the last consonant of the stem)

As we mentioned previously, the language does not have complex codas anywhere. It seems that this constraint is ranked high in the language, and outranks constraints that

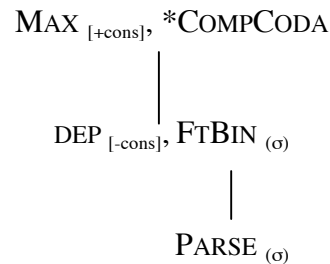
require all syllables in a Prosodic Word to be parsed into binary feet:

Tableau 6

/witaʃ/-n/~nin/	MAX _[+cons]	*COMPCODA	DEP _[-cons]	FTBIN _(σ)	PARSE _(σ)
☞ a. (wi.ta.)ʃ-in			*		*
b. (wi.tá.ʃ-n)		*!			
c. (wi.tá.-n)	*!				
d. (wí.ta.)(ʃ-ĩn)			*	*!	

What the pattern illustrated in the tableau above shows is that while both consonant deletion and complex codas are forbidden in the language, the violations of DEP_[-cons] and exhaustive parsing are less costly in the language. The comparison between candidate (a) and candidate (d) shows that binary syllabic parsing is more important than parsing all syllables into feet, as the winning candidate (a) leaves the last closed syllable unparsed. This subpart of the Shipibo grammar is illustrated in the following:

(52)



In concluding this subsection, we should emphasize again that while the stress pattern in the language indicates that the language is quantity-sensitive, both types of allomorphy require syllabic parsing into binary feet, with closed syllables never parsed into feet by themselves. What the rhythmic allomorphy shows us, therefore, is that the footing in the language is required to be quantity-insensitive, and forbids degenerate footing preferring to leave the third closed syllable unparsed.

5.4 Local Conclusions

The main theoretical claim of this thesis is that stress and foot structure are separate, though mutually dependent linguistic notions, and their interrelation must be regulated by a set of constraints. This chapter, in particular, discusses how the difference between stress and foot structure can be demonstrated in some cases of allomorphy selection. The conclusions we can draw from the case studies presented in this chapter show that the main premise of this dissertation can be maintained and reinforced by investigating certain types of interaction between prosody and allomorphy.

In the two cases we discussed, all types of allomorphy under consideration are shown to be foot structure-dependent, though in slightly different ways. However, stress appears to be also sensitive to rhythm in both case studies. The main puzzle comes from the fact that stress assignment pattern and allomorphy selection patterns do not appear to use the same foot structure.

In two of our case studies in this chapter we have shown, in particular, that sensitivity to syllable weight can be different for stress and allomorph selection. In Vogul, the stress placement pattern is clearly weight-insensitive, and ostensibly relies on binary syllabic feet to assign both primary and secondary stress. Both types of allomorphy discussed above, on the other hand, clearly demonstrate that the language **must** be sensitive to syllable weight and **must** form binary moraic feet in order to predict the distribution of all of the allomorphs that depend on prosody. The case study proves that the allomorphy selection cannot simply rely on the stress pattern of the language, since the same allomorphs can appear before or after a stressed syllable, and we simply get ungrammatical forms if we try to use stress positions as environments for allomorph distribution. Moreover, we clearly cannot rely on the foot structure that is apparently shown by the rhythmic stress assignment pattern.

Similarly, the Shipibo case study deals with the mismatch of stress and allomorph distribution. In contrast to Vogul, however, there is only primary stress in Shipibo, and it

is clearly weight-sensitive: it is easy to demonstrate that heavy syllables attract stress. Secondary stress is missing in Shipibo, except for some very interesting suffixes that seem to carry a stress of their own that appears as secondary on the surface. The question we asked there is whether it is foot structure that is prespecified in the underlying representations of those suffixes, or prominence, and if it is possible to answer this question with support of empirical data. It turns out that allomorphy selection in Shipibo, which itself clearly relies on foot structure of the language, could provide us with an answer to this question. Allomorph selection that treats the language as quantity-insensitive, shows us that the exceptional suffixes must be prespecified for some sort of prominence in the lexicon, but definitely not any element of foot structure, as such a prespecification would render Shipibo allomorph selection unpredictable. In a sense, the Shipibo case is a mirror image to the Vogul case, in that Vogul stress is weight-insensitive, while allomorphy indicates moraic binary feet, whereas Shipibo stress depends on syllable weight, and its prosody-sensitive allomorphy depends on quantity-insensitive binary footing.

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 Summary

In the preceding chapters, I have presented analyses of interaction of prominence and foot structure based on patterns of prosody-dependent segmental alternations, with special attention to mismatches between prominence assignment and foot assignment principles.

Detailed case studies of several cases of prosody-sensitive segmental alternations, as well as a survey of such phenomena mentioned in the literature were the empirical basis for this study.

I have had three main goals in this dissertation. First, I have offered an empirically motivated proposal that constituency and prominence have to be separate entities in the grammar, since some segmental alternations cannot be accounted for without reference to foot boundaries, while others require reference to prominence.

My second goal, especially in Chapters 3 and 4, was to investigate whether foot structure and prominence influence the same types of segmental alternations the same way. I have found that, even though both prosodic entities affect the same range of segmental phenomena (vowel harmony and consonant fortition/lenition are the most frequently affected alternations), there are slight differences in the way prominence-dependent, on the one hand, and foot structure-dependent phenomena, on the other hand, are influenced. These typological generalizations should be useful both to those who accept and those who have reservations about the formal proposal developed in this work.

Developing the formal proposal of representation of prominence and foot structure and their interaction has been my third goal: based on the empirical data that prosody-sensitive alternations provide, I have proposed that the relationship between foot structure and prominence should be mediated by violable constraints relating the two entities.

6.2 Typological Conclusions

Typologically, segmental alternations affected by prominence and those affected by foot structure have a lot in common: the phenomena most frequently influenced by prosody are all types of vowel harmony and lenition and fortition of consonants.

However, there appear to be several points of typological dissimilarity between segmental alternations that are dependent on prominence and the ones that depend on foot structure of a language:

Table 1

Alternations analyzed with reference to prominence	Alternations analyzed with reference to foot structure
Caused by position of prominence (the alternating segment is followed or preceded by a stressed vowel, or is itself a stressed vowel)	Phenomenon is caused by a more general requirement (e.g. all intervocalic consonants are lenis), but restricted by foot structure (foot-initial consonants do not lenite)
Can produce non-contrastive alternates	Produce contrastive alternates
Optional, can occur at one register or rate of speech, but not the other	Obligatory, occur at any rate of speech and register no optionality in reflexes of alternations
Can produce optional alternates (e.g. [t] can optionally alternate with either [d] or [ð])	Alternates are not optional (e.g. [t] can only alternate with [d])

Both the typological similarities and the dissimilarities can be understood if we accept the following two premises: (a) prominence has phonetic correlates, while foot boundaries do not; and (b) all the alternations we have discussed started out as dependent on prominence.

If all the alternations that are influenced by prosody were originally prominence-dependent, it stands to reason that the same types of phenomena (vowel harmony and distribution of lenis and fortis consonants in particular) would still be sensitive to prosody. Since prominence is actually *audible* to speakers, segmental alternations that accompany them can just be another (optional) cue for speakers to determine the position

of stress, much like flapping and aspiration works in American English. If, however, prominence assignment pattern is changed, the segmental alternation can either disappear, or become contrastive and serve as evidence for speakers to determine the foot structure of the language. Foot-dependent alternations, therefore, are diachronically the older ones that utilized the grammatical notion of foot.

6.3 Theoretical Conclusions

As any other theory, it will have to undergo changes as more facts are looked at. There are reasons for optimism that the proposed theory of how prominence and foot structure interact is a step in the right direction.

First, the theoretical proposal is fairly straightforward: prominence and foot structure are separate entities in the grammar; prominence is represented by gridmarks on an autosegmental tier, while foot structure **is not built on the gridmarks**, but is a function of syllables grouped into higher-level constituents; the relationship between prominence and foot boundaries is mediated by violable constraints.

Furthermore, the proposal utilizes many of the previously motivated constraints that relate stress to constituents such as Phonological Word or morpheme edges. The new group of constraints, which I call **Prominence Alignment** constraints, regulates the relationship between prominence and foot structure. There are only two types of Prominence Alignment constraints, the first of which requires that there be a foot edge for every mark on the metrical grid, and the second type requires that for every foot edge there be a gridmark:

- (1)
- a. $\text{ALIGN-}\{L,R\}(\text{FT}, \text{GRID}_n)$
 $\forall \text{Level}_n \text{ gridmark } \exists \text{ a } \{L, R\} \text{ foot edge such that it is aligned with the gridmark.}$
 - b. $\text{ALIGN-}\{L,R\}(\text{GRID}_n, \text{FT})$
 $\forall \{L, R\} \text{ foot edge } \exists \text{ a Level}_n \text{ gridmark such that it is aligned with that edge.}$

Mismatches between foot structure and prominence assignment in a given language are caused, under the present theory, when one of the constraints that refer to prominence but

not to foot structure outranks a Prominence Alignment constraint. The factorial typology generated by such ranking is substantiated by the case studies throughout this dissertation.

Finally, since the Prominence Alignment constraints are violable and rerankable, we have to answer the question of what our model predicts if constraints like WEIGHT-TO-STRESS or MAX(Grid) outrank constraints on footing instead of constraints on Prominence Alignment. In such cases, we should not expect any misalignment between foot structure and prominence, but the footing should deviate from a “perfect” required by footing constraints. Koniag Aluutiq provides an example of ranking like this.

Koniag Aluutiq has binary rhythm, and assigns the prominence to the even syllables. Foot-initial consonants show tensing:

- (2) a. (tu.qús.)(kə.ŋá:.)qa
 ‘the one I am killing’
 b. (méχ.)(ta.qán)¹
 ‘if she fetches water’

There are certain suffixes (Leer’s (1985) ‘post-bases’) that are sometimes called ‘accent-advancing’ in their description. In short, these suffixes show up with stress on their second syllable.

(3)²

- a. /-sinaq-/ Augmentative, ‘big N’

(paá.)ja	‘pie’	
(paá.)(ja-á)	‘my pie’	
(paá.)ja.-(si.ná:.)q-a	‘my big pie’	* (paá.)(ja.-si.)(ná.q-a)

- b. /-ŋinaŋ-/ ‘not until, only when’

(án.)ci	‘go out’	
(án.)ci-(ŋiná:.)-(quá)	‘not until I go out’	* (án.)(ci-ŋí:.)naŋ-(quá)

¹ Initial CVC syllables are heavy in Aluutiq.

² Morpheme breaks are mine, though easily inferred from Leer’s (1985) descriptions.

The segmental alternation, tensing, shows us how words are parsed into feet, and that when a suffix with inherent prominence is concatenated with a stem that is not completely parsed into feet by itself, the unparsed material from the stem is unparsed on the surface, in violation of the Parse(σ , Ft) constraint:

Tableau 1

* /paaja/-/sinaq/-/a/ 'my big pie'	ALIGN-R (Lev _n Grid, Ft)	MAX(Grid)	PARSE(σ , Ft)
☞ a.(paá.)ja.-(si.ná:.)q-a			**
b.(paá.)(ja.-sí.)(na.q-á:)		*!	
c.(paá.)(ja.-si.)(ná.q-a)	*!		

The winning candidate (a) does not have any violations of the Prominence Alignment constraint (all its gridmarks are aligned with the right edge of a foot, or MAX(Grid) violations (the underlying gridmark shows up on the surface), and even though it violates lower-ranking footing constraint PARSE(σ , Ft), it still emerges as optimal.

The example above shows us that reranking Prominence Alignment constraints with respect to constraint(s) on footing does not overgenerate patterns that exist languages, but rather accounts for cases where there is no mismatch between prominence assignment and foot parsing.

I conclude, therefore, that the model developed in this dissertation generates all types of interaction between foot structure and prominence attested and does not generate unattested patterns.

6.4 Issues for Further Investigation

This thesis leaves quite a few issues that call for further investigation, ways in which the theory can be extended. The most obvious one is the question of how segmental alternation can inform us on metrical constituency beyond Phonological Word. Following work of Selkirk (1984, 1986) and Truckenbrodt (1995, 1999, 2007), among others, we can explore what segmental alternations tell us about interaction between phonological and syntactic domains.

Another significant area of research I have not touched on, apart from the cursory discussion of Alutiiq (diachronically) and Huariapano in Chapter 4, is quantitative segmental alternations (and not the qualitative ones I have concentrated on in this work).

Finally, more work on phonetic and psycholinguistic aspects of prosody-dependent alternations promises to be interesting.

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APPENDIX: Apparent Counterexamples to Consonant Gradation Analysis

One of the main claims of this thesis is that foot structure and prominence are distinct notions. In Nganasan, we claim, consonant gradation depends on, and therefore marks, the rhythmic organization of the language, i.e. foot structure, while stress is assigned independently.

There are, however, examples in the language, which seem to contradict the claim that consonant gradation is intervocalic lenition that is constrained by the foot structure of the language. These ostensible counterexamples can be grouped into three types: strong grade where we expect to find a weak grade (1a); weak grade where we expect to find a strong one (1b); and, finally, an unexpected reflex of consonant gradation (1c):

(1)

a.	(le)(hua)	*(le)(bua)	‘board’ Nom sg non-poss
	(turku)-(tu)	*(turku)-(đu)	‘his/her/its lakes (pl)’
	(nil)(hie)-(ti)	*(nil)(hie)-(đi)	‘his/her/its slopes (pl)’
	(nilu)-(tu)	*(nilu)-(đu)	‘his/her/its life’
	(nerbi)-(ti)	*(nerbi)-(đi)	‘his/her/its wool’
	(ŋamsu)-(tu)	*(ŋamsu)-(đu)	‘his/her/its meat’
b.	(kađar)	*(katar)	‘light’
	(häjir)	*(häsir)	‘fish hook’
	(ŋuđa-ʔ)	*(ŋuta-ʔ)	‘berries’ (Nom pl)
	(ɲini)-(ᵐtəni)	*(ɲini)-(tənu)	‘older brother’ (Loc)
	(cimi)-(ᵐtənu)	*(cimi)-(tənu)	‘tooth’ (Loc)
	(səmu)-(ᵐtənu)	*(səmu)-(tənu)	‘hat’ (Loc)
	(jemɲi)-(ᵐtəni)	*(jemɲi)-(təni)	‘salary’ (Loc)
c.	(ci ⁿ de-ʔ)	*(ci ⁿ te-ʔ)	‘hill’ (Nom pl)
	(le)(^m bua-ʔ)	*(le)(bua-ʔ)	‘board’ (Nom pl)
	(ho ⁿ ge-ʔ)	*(ho ⁿ ke-ʔ)	‘handle’ (Nom pl)
	(kaɟu) ~ (kaɟu-ŋ)	*(kasu) ~ (kasu-ŋ)	‘bark’ (Gen sg)
	(iɟi) ~ (iɟi-ŋ)	*(içi) ~ (içi-ŋ)	‘father’ (Gen sg)
	(jäđe) ~ (jäđeŋ)	*(jäte) ~ (jäteŋ)	‘stone’ (Gen sg)
	(ŋubu)-(ᵐdi)	*(ŋuhu)-(ti)	‘mitten’ (Lat sg)
	(cebi)-(ᵐdi)	*(cehi)-(ti)	‘nail’ (Lat sg)
	(kiđa)-(ᵐdi)	*(kita)-(ti)	‘cup’ (Lat sg)

Some of the examples we see above we have already explained: for example, we know that a voiceless obstruent can be a weak grade of the gradation alternation, hence a word like ‘board’ (*le*)(*hua*) has alternation between [ʰh] and [h], and we observe the correct (weak) grade when the consonant is foot-initial. Other apparent counterexamples in (1a-c), however, are due to a number of factors that we have to discuss in order to prove the validity of the foot structure, we claim is marked by consonant gradation.

Below are examples of the alternations between strong and weak grades the reflexes of which are, in most cases, identical to the grade alternations we have previously discussed:

(2)

a.

Nom.sg.	Nom.pl.	Gloss
kuhu	kubuʔ	‘skin, hide’
basa	baʃaʔ	‘iron’
ke ⁿ te	ke ⁿ deʔ	‘sledge’
ŋuta	ŋuðaʔ	‘berry’
məku	məgaʔ	‘back’
ʃakə	ʃagüʔ	‘twin’

b.

kaðar	katarəʔ	‘light’
he ⁿ ʃir	he ⁿ sirəʔ	‘shaman’s drum’
biʔ	biðiʔ	‘water’
tuj	tuuʔ	‘fire’
ŋoj	ŋuəʔ	‘foot’
huəʔ	hiəʃiʔ	‘fur overcoat’
ciʃar	cisareʔ	‘benefit’
häjir	häsiŋeʔ	‘fish-hook’
ho ⁿ ʃir	ho ⁿ ʃireʔ	‘edge, side’

In (2a) Nominative singular forms and (2b) Nominative plural forms above, the word-internal consonants are in their strong grade, as expected, when they are foot-internal. A problem, however, arises when we look at the Nominative plural forms in (2a). From

these data we can see that the only difference between the forms in the Nominative plural and in the Nominative singular is that the Nominative plural ending is a glottal stop, while the Nominative singular ending is zero. It seems clear that the ‘extra’ consonant of the plural effects the consonant gradation: the plural forms in (2a) all have their foot-internal consonants in their ‘weak’ grades, contrary to what we predict with the condition on the distribution of weak grades we previously. The same difficulty is apparent in (2b): Nominative singular forms of the words for ‘light’ and ‘benefit’ have the weak grades of, respectively, *t/ð* and *s/f* alternations.

When the plural ending (glottal stop) is added to the basic consonant-final forms in (2b), it causes vowel epenthesis between the last consonant of the stem and glottal stop, since the language does not tolerate complex codas. The final syllable of the plural forms, therefore, is always closed, regardless of whether a stem ends in a vowel (as in (2a)) or in a consonant (as in (2b)).

The fact that a syllable is closed seems to affect gradation: the onset of a closed syllable is always ‘weak’ (except word-initial and postconsonantal onsets), and an open syllable’s onset is either weak or strong, depending on the position in a foot.

The above generalization, however, is not true for onsets that appear after another consonant (a coda of the previous syllable), and word-initially:

(3)

a. Nominative, possessive, 3rd person pl. possessor, sg. possessed suffix **-tuŋ/-ðuŋ**

tər-tuŋ ‘their hair’ (cf. kuhuðuŋ ‘their skin’, stem /kuHu-/)

ŋoj-tuŋ ‘their foot’

kaðar-tuŋ ‘their light’

hoⁿjir-tuŋ ‘their edge, side’

tuj-tuŋ ‘their fire’

b. tujça ‘come’, Verbal Adverb

hoⁿjir ‘edge, side’

tər ‘hair’

baŋ ‘dog’

baarpə ‘master, chief’

The data in (3a) shows that, while the first consonant of the suffix is a gradating consonant and is an onset of a closed syllable, it surfaces in its strong grade after another consonant. Another position in which the grade of consonants is not regulated by the condition on closed syllables (or their position within a foot) is the word-initial position. All of the word-initial consonants in (3b) are onsets of closed syllables, but the grade of the consonants can be either strong, as in words for ‘come’, ‘edge, side’ and ‘hair’, or weak, as in the words for ‘dog’ and ‘master, chief’. The word-initial position, therefore, is the only position where we need to prespecify the grade of the consonants in the inputs, the same conclusion we reached in the discussion of foot-marking consonant gradation, henceforth Rhythmic Gradation (RG).

The type of gradation we have been discussing here, therefore, is very similar to RG: all the gradation alternations happen intervocalically (due to the set of LENITION constraints under the present analysis), voicing of a consonant can be prespecified in the input for word-initial consonants and only there; postconsonantal consonants receive the default strong grade. The only difference, it seems, RG and Closed Syllable Condition (CSC) is only in the constituent the weak grades can be aligned with; in case of RG that depends on foot structure, the foot is the relevant constituent, and in case of CSC, this constituent is a closed syllable.

Given the degree of similarities, one might suspect that RG and CSC are, in fact, the same phenomenon and CVC can constitute a foot by itself. However, there are two facts that argue against such an analysis: first, closed syllables are always footed together with another syllable (except if CVC is the ultimate syllable within a word, footed into a degenerate foot):

(4)

a.	(tər-rə)(gī-tī)	*(tər)-(rəkī)-(ðī)	‘similar to his/her/its hair’
	(ŋoj-rə)(gī-tī)	*(ŋoj)-(rəkī)-(ðī)	‘similar to his/her/its foot’
	(tuj-rə)(gī-tī)	*(tuj)-(rəkī)-(ðī)	‘similar to his/her/its fire’
	(baŋ-rə)(gī-tī)	*(baŋ)-(rəkī)-(ðī)	‘similar to his/her/its dog’

- b. (kaðar)-(rəkī)-(ðī) *(ka)(ðar-rə)(gī-tī) ‘similar to his/her/its light’
 (häjir)-(rəkī)-(ðī) *(hä)(jir-rə)(gī-tī) ‘similar to his/her/its fish hook’

The examples in (4a) show that initial CVC syllables are always footed with a syllable following it, creating a binary foot. If CVCs were footed by themselves like CVV syllables are, we would observe different reflexes of RG in the similative and the 3rd person singular possessive suffix.

(4b) further shows that the footing of CVCs as light is not due to any sort of Foot Form constraints that might allow a (CVC.CV) as a good, or nearly ideal, trochee, but ban a (CV.CVC) trochee as maximally disharmonic. The data in (4b) indicate that it is not the case here, since the closed syllable is not footed with the following syllable, but rather with the preceding one. All the data in (4) shows that closed syllables are footed exactly as CV syllables are, i.e. CVCs are **light** syllables, and their onsets may or may not be foot-initial, in contrast with CVV syllables, the onsets of which are always foot-initial.

Another argument against analyzing CSC and RG as the same phenomenon is that some of the reflexes of the two differ. In particular, the ‘weak’ reflexes of prenasalized obstruents, which are lenited with the loss of prenasalization for RG, are lenited with voicing without the loss of prenasalization for the CSC:

(5)

strong grade	^h h	ⁿ t	^h k	ⁿ s	^h ç
RG weak grade	h	t	k	s	ç
CSC weak grade	^m b	ⁿ d	^h g	^h j	^h j

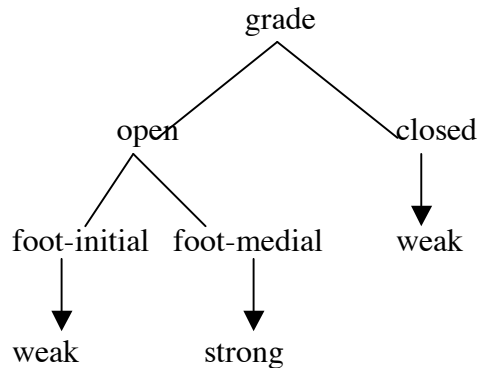
Onsets of closed syllables weak-grade reflexes of voiceless prenasalized consonants are voiced prenasalized consonants. In other words, lenition still takes place, but the result of it is simply voicing distribution.

Given the two significant differences between RG and CSC we are concluding here that the two are synchronically different. While RG marks the foot structure of the language just as we have been maintaining, CSC stands on its own, accounting for a lot of apparent

counterexamples to RG we mentioned in (1). The similarities between the two phenomena should probably be attributed to the historical development of the language that used to regard closed syllables as heavy, and thus allowing them to pattern with CVV syllables, and not CV syllables as the case is in the contemporary language.

Some of the apparent counterexamples to our generalization about consonant gradation in Ngunyan are, therefore, explained: the language has two similar but distinct types of consonant alternations, that differ in terms of a) whether they depend on foot structure (RG) or syllable structure (CSC); and b) the weak reflexes of prenasalized obstruents. The following diagram summarizes the appearance of appropriate weak and strong grades depending on the type of syllable and position within a binary foot:

(6)



The gradating consonants (obstruents) that appear in the onsets of open syllables are only allowed to surface as their respective weak counterparts if they are both foot-initial and intervocalic, thus marking the foot structure of the language.

Another ostensible counterexample to the generalizations about Ngunyan consonant gradation we have formulated in this dissertation comes from the existence of so-called latent (or ‘ghost’) segments. Immediately above, we saw how a consonant, added to a word and creating a closed syllable, affects the grade of the onset of this syllable, causing a series of voicing alternations. Now we turn to a set of alternations that is very similar

to the one above, with an additional complication: a consonant that closes the final syllable does not appear on the surface.

Below are the cases of alternations between Nominative and Genitive singular:

(7)

a.

Nom. sg.	Gen.sg.	Gloss
kasu	kaʃu	‘bark’
içi	iʃi	‘father’
ʃühü	ʃübü	‘sledge’
ɲuhu	ɲubu	‘mitten’
cehi	cebi	‘nail’
kita	kiða	‘cup’
ʃütü	ʃüðü	‘hand’
ʃäte	ʃäðe	‘stone’
ki ⁿ te	ki ⁿ de	‘smoke’
mī ⁿ tī	mī ⁿ dī	‘load’
ci ⁿ te	ci ⁿ de	‘hill’
lehua	le ^m bua	‘board’
ho ⁿ ke	ho ⁿ ge	‘handle’

b.

ciʃar	cisare	‘benefit’
hāʃir	häsire	‘fish-hook’
ho ⁿ ʃir	ho ⁿ çire	‘edge, side’
kaðar	katara	‘light’
he ⁿ ʃir	he ⁿ sīra	‘shaman’s drum’
bīʔ	bīðī	‘water’
tuj	tuu	‘fire’
ɲoj	ɲuə	‘foot’
huəʔ	hiəʃi	‘fur overcoat’

What is notable in (7a) above, is that the only difference between Nominative singular and Genitive singular forms is in the voicing of the stem-internal alternating consonant.

As we have established in the previously, one of the conditions on voicing distribution is the CSC. It stands to reason, consequently, to hypothesize that Genitive singular ending is a ‘ghost’, an underlying consonant that does not appear on the surface. The underlying

form of the Genitive singular of the word for ‘nail’, for that reason, is /cehiC/, with C being the ‘ghost’-consonantal Genitive ending. The form surfaces as *cebi* since its last syllable is closed by a latent segment.

The hypothesis that there is a latent segment that affects syllable structure is sustained if we look at the set of forms in (7b). The stems of these words are consonant-final, the addition of the ‘ghost’ consonant causes vowel epenthesis between the last consonant of the stem and the ‘ghost’. As the latent segment, together with the epenthetic vowel, changes the syllable structure of the words, thus determining the voicing of the consonants involved. In the word for ‘light’, for example, the underlying Nominative singular is /kaTar/, which surfaces as *kaðar*, with the gradating consonant in its weak grade, since it is in the onset of a closed syllable. Genitive singular underlying form for this word, on the other hand, is /kaTarC/. Since the *rC* codas (complex codas) are banned in the language in general, there is a vowel epenthesis¹ between [r] and the ‘ghost’ consonant. The resulting form we get is *katarəʔ*. The last syllable of the word is closed by the ‘ghost’, but since [r] is a non-alternating consonant, its voicing is not affected. The second consonant of the word, on the other hand, is one of the gradating consonants. Since the ‘ghost’ ending together with the vowel epenthesis cause the second syllable to be open and foot-medial, [t] is not subject to the condition on onsets of closed syllables, and surfaces in its strong grade according to the prosodic conditions we ascertained for RG.

The hypothesis that Genitive singular and other forms with the same properties have a ‘ghost’ consonant as an ending is supported by some diachronic and synchronic stylistic variation facts. Indeed, it is reported that historically the Genitive singular ending was [ŋ].² For the purposes of voicing, however, it is sufficient to say at this point in the

¹ The quality of the epenthetic vowel depends on properties of the stem (sometimes, lexical properties), as well as on the quality of the latent segment itself.

² Helimsky (1995) and others report that Genitive singular forms with [ŋ] at the end appear in folklore and in the ‘speech of older speakers’. Interestingly enough, I also heard speakers (all three of them in their 30s) pronounce these forms with a nasal as an ending when they were trying to speak ‘correctly’. Common were explanations such as ‘it is really *kitaŋ*, but you just cannot bother to pronounce it in rapid speech’.

discussion that the Genitive singular ending is an abstract consonant, leaving the question of its featural content to be below.

The properties of latent consonants that influence gradation are also evident in the set of Accusative case forms, which in their non-possessive paradigm³ are identical to the Genitive singular forms:

(6)

a.

Nom. sg.	Acc.sg.	Gloss
kasu	kaʃu	‘bark’
içi	iʃi	‘father’
ʃühü	ʃübü	‘sledge’
ɳuhu	ɳubu	‘mitten’
cehi	cebi	‘nail’
kita	kiða	‘cup’

etc.

b.

ciʃar	cisare	‘benefit’
häʃir	häsiŕe	‘fish-hook’
ho ^h ʃir	ho ^h ʃire	‘edge, side’
kaðar	katarə	‘light’
he ^h ʃir	he ^h siŕə	‘shaman’s drum’
bīʔ	bīðī	‘water’

etc.

Since the forms of (6) are identical to the forms in (7), we will propose the same analysis as above. Accusative singular ending is an underlying latent consonant, which closes the last syllable of vowel-final stems ((7a) and (6a)), and causes epenthesis between the last consonant of consonant-final stems and the ‘ghost’ in (7b) and (6b) because of the prohibition on complex codas. Syllabic and prosodic structure resulting from adding the

³ Historically, there is a difference between non-possessive Genitive singular forms and Accusative singular forms: while the former used to have *engma* as the case ending, the ending of Accusative was [m]. We will talk about how this difference is manifested synchronically in the section on nasals.

‘ghost’ consonant, is responsible for the grades of alternating consonants, and thus cannot be viewed as a counterexample to RG.

Nganasan also has suffixes that contain both surface and latent consonants. Such morphemes also appear to offer counterexamples to our generalization about RG, and should therefore be addressed here. One of the relevant examples is Elative singular non-possessive suffix.

(7) *Elative singular marker surfaces as -kətə/-gətə*

a.

kuhu-gətə ‘skin’
 le^hhe-gətə ‘eagle’
 turku-gətə ‘lake’
 kaⁿta-gətə ‘sledge’
 kita-gətə ‘cup’
 ŋuhu-gətə ‘mitten’

b.

bakunu-gətə ‘salmon’	*bakunu-kəðə
kəəli-gətə ‘tear’	*kəəli-kəðə
nī-gətə ‘wife’	*nī-kəðə
tīrimi-gətə ‘caviar’	*tīrimi-kəðə
baarpə-gətə ‘master, chief’	*baarpə-kəðə

Elative singular suffix shows up with the weak grade of the first consonant of the suffix ([g]), and the strong grade of the second consonant ([t]) in (7a). It seems that the appearance of weak grades in these words is in accordance RG, as weak grades are foot-initial, and strong grades are foot-internal. In (7b), on the other hand, the suffix should show up with quite the opposite grades, as in the starred column: the first consonant of the suffix is foot-internal in these forms, and the second consonant is foot-initial.

In fact, the only forms where the Elative singular suffix surfaces with the strong grade of the [k/g] alternation of the first consonant are the forms where the stems are consonant-final:

(8)

tər-kətə ‘fur’
hoðür-kətə ‘letter’
häjir-kətə ‘fish-hook’
tuj-kətə ‘fire’

Among other things, the forms in (8) show us that the suffix’s consonants (at least, the first consonant of the suffix) is of gradating variety, and should conform to the gradation conditions we have established.

There are two points about the suffix that are ostensibly problematic for the present analysis: the weak grade of the suffix-initial consonant in (7b), and strong grade of the second consonant of the suffix in (7b) and (8). To solve these problems I will propose that the suffix contains a ‘ghost’ consonant that influences its syllabic and prosodic structure, and, consequently, the grades of the consonants. Thus, the underlying form of the suffix is /-KəCTə/⁴.

This proposal solves both of the problems we have identified: the suffix-initial consonant shows up as voiced in (7a) and in (7b) as the onset of a syllable that is closed by the ‘ghost’. The initial consonant of the suffix shows up voiceless in (8), where the onset of the closed syllable immediately follows another consonant, the last consonant of the stem.

The second problem is solved by the same proposal that the suffix contains a latent consonant. Since the latent segment appears right before the last consonant of the suffix, it not only closes the previous syllable, but makes /T/ surface in its strong grade [t], regardless of its prosodic and syllabic position.

To summarize, we have seen several case endings that either consist entirely of latent segments (as in Genitive and Accusative singular), or contain a latent segment as well as

⁴ An alternative analysis of the gradation in this suffix would be to suggest that it comes with its special footing from the lexicon, so that it always has to be footed by itself. A form that shows that this explanation is incorrect is the following: *bakunugətəⁿtu*, where the two syllables of the Elative suffix must be footed separately to get the right grade (strong, with prenasalization) of the possessive suffix /-NTU/

other non-latent segments, as in Elative singular. Latent consonants, without (usually) showing up at the surface, influence prosodic and syllabic structure of Nganasan words and, as a result, RG.

In addition to having ‘ghost’ consonants as case endings, Nganasan also possesses some stems that appear problematic for the present analysis of RG. These stems, though surfacing as vowel-final, appear to behave as consonant-final instead:

(9)

a.

bəðua-sa ‘grow up’ (suffix *-ja/-ji/-sa/-ça/-si/-çi* Verbal Adverb)

jügu-sa ‘get lost’ (suffix *-ja/-ji/-sa/-ça/-si/-çi* Verbal Adverb)

b.

koðu ‘snowstorm’ (Nominative singular)

koðu-tu ‘his/her/its snowstorm’ (Nominative possessive, 3rd person singular possessor, singular possessed, suffix *-tu/ti/ðu/ði*)

ðöru ‘cry’ (Nominative singular)

ðöru-tu ‘his/her/its cry’ (Nominative possessive, 3rd person singular possessor, singular possessed, suffix *-tu/ti/ðu/ði*)

seju ‘shot’ (Nominative singular)

seju-tu ‘his/her/its shot’ (Nominative possessive, 3rd person singular possessor, singular possessed, suffix *-tu/ti/ðu/ði*)

nilu ‘life’ (Nominative singular)

nilu-tu ‘his/her/its life’ (Nominative possessive, 3rd person singular possessor, singular possessed, suffix *-tu/ti/ðu/ði*)

The two verbs in (9a) are vowel-final on the surface, but the Verbal Adverb suffix *-ja/-ji/-sa/-ça/-si/-çi* that should appear with the weak grade [j], instead shows up with the strong-grade [s]. Moreover, the last consonant of the stem of the word for ‘get lost’ *jügu-sa* is weak, though it is foot-internal and apparently starts an open syllable.

We encounter the same problem with the words in (9b): the possessive suffix should surface with the weak grade of the consonant, as it is foot-initial and seems to start an

open syllable in all of the nouns above. Instead, it invariably surfaces with the strong grade [t]. In addition, the last consonants of the stems for ‘snowstorm’ and ‘shot’ are weak contrary to the restriction on appearance of weak grades which can appear only aligned to the left edge of a foot.

All the stems above in (9), therefore, should have a final latent consonant that determines the strong grade of the first consonant of the suffix. The suffix-initial consonant, following that logic, appears postconsonantly, and is not relevant for either RG or CSC. Furthermore, the ‘ghost’ consonant closes the last syllable of all of the stems in (9), thus making the onsets show up as voiced due to CSC.

Again, as with the case of Genitive and Accusative ‘ghosts’, all of the stems in (9) used to have [ŋ] as a stem-final consonant. We will postpone discussion of featural content of these and other ‘ghost’ consonants until later in this appendix. At this point, however, we have to note that there is at least the root node that has to be present underlyingly in specification of ghosts. Within the contemporary metrical theory it is the root node that mediates between segmental features and higher prosodic structure (Clements 1985, Sagey 1986 *inter alia*).

At the present point in the analysis, we should discuss several properties of nasals in Nganasan that are relevant to RG, and, again, need to be accounted for to sustain our claim about Nganasan foot structure that is marked by consonant gradation. First, we will discuss latent ‘ghost’ nasals and nasal degemination that changes prosodic structure of words. Next, we will discuss the structure of prenasalized obstruents and how they function in RG and CSC; and lastly, we will introduce a phenomenon of nasal harmony, traditionally called Nunnation that blocks RG in certain environments.

Recall now that some of case endings in Nganasan are ‘ghosts’ as we previously established. Genitive singular and Accusative singular non-possessive endings do not show up on the surface, though they do influence gradation. Possessive paradigm in Nganasan is built onto the non-possessive one, so, for example, a Genitive singular possessive form would have the following structure:

(10)

[[[stem]Gen sg suffix]possessive suffix]

For example, Genitive singular 3rd person possessives (3rd person singular possessor, singular possessed) show up with the ‘ghost’ Genitive singular ending closing the last syllable of stems, and 3rd person singular possessive suffix /-TU/ following the ‘ghost’:

(11) *Genitive singular 3rd person possessives*

Underlying Form	Surface Form	Gloss
/kuHu-C-TU/	kubutu	‘his/her/its skin’
/kaSu-C-TU/	kaʃutu	‘his/her/its bark’
/jüHü-C-TU/	jübütu	‘his/her/its sledge’
/kiTa-C-TU/	kiðatu	‘his/her/its cup’
/ciSar-C-TU/	cisarətu	‘his/her/its benefit’
/kaTar-C-TU/	katarətu	‘his/her/its light’

The latent consonant (marked ‘C’ in the underlying forms above), though it does not show up on the surface, closes the last syllable of the stems in the words in (11), with schwa epenthesis in the last two words. The onsets of resulting closed syllables have voiced consonants in accordance to the CSC: [b] in *kubutu* and *jübütu*, [ʃ] in *kaʃutu*, and [ð] in *kiðatu*. Open syllables of the stems of the last two words (consonant-final stems) have strong onsets, since the gradating consonants are foot-internal. The ‘ghost’ consonants, thus, behave just like any other consonant with regard to prosody and gradation. Consider, however, the same words in Genitive singular 1st person possessives (1st person singular possessor, singular possessed) with suffix /nə/:

(12) *Genitive singular 1st person possessives*

Underlying Form	Surface Form	Gloss
/kuHu-C-nə/	kuhunə	‘my skin’
/kaSu-C-nə/	kasunə	‘my bark’
/jüHü-C-nə/	jühünə	‘my sledge’
/kiTa-C-nə/	kitanə	‘my cup’
/ciSar-C-nə/	cisarənə	‘my benefit’
/kaTar-C-nə/	katarənə	‘my light’

Even though the 1st person possessives are also built onto the stems + Genitive singular ‘ghost’ ending, the ‘ghost’ is only visible in schwa epenthesis in the last two words of (12), where bare roots are consonant-final. The surprising fact about the forms above is that the ‘ghost’ does not appear to close the last syllable of the stems, and the gradating onsets of these syllables are voiceless. The same is true of the 1st person Accusatives:

(13) *1st person singular Accusative possessives (1st person singular possessor, Accusative singular possessed), suffix /-nə/*

Underlying Form	Surface Form	Gloss
/kuHu-C-nə/	kuhumə	‘my skin’
/kaSu-C-nə/	kasumə	‘my bark’
/jüHü-C-nə/	jühümə	‘my sledge’
/kiTa-C-nə/	kitamə	‘my cup’
/ciSar-C-nə/	cisarəmə	‘my benefit’
/kaTar-C-nə/	katarəmə	‘my light’

Putting aside momentarily the difference in the suffixal consonant ([n] in the Genitive and [m] in the Accusative possessives), the forms in (13) are identical to the Genitive forms in (12), that is, the ‘ghost’ does not close the last syllable of the stem, onsets of which are voiceless. The answer, clearly, lies in the 1st person possessive suffix, as all the other singular Genitive and Accusative possessive forms (2nd and 3rd persons) show the effect of ‘ghosts’ on the stem consonants, as do non-possessive forms that we discussed in the previous section. As 1st person singular possessive suffix /-nə/ is the only one of the singular possessive suffixes starting with a nasal, it gets rid of the ‘ghost’ case ending. It appears that, true to their historical selves, the ‘ghost’ case endings are also nasals, and are subject to **nasal degemination** when the situation of two nasals coming together arises. It is not sufficient, therefore, to prespecify the Genitive and Accusative latent case endings as merely [+consonantal] in the input, they must be specified as [+nasal] as well.

Let us now turn to the difference between the surface realization of the same 1st person singular possessive suffix /-nə/ in Genitive and Accusative forms. The suffix invariably

appears as [-nə] in the Genitive (12) and as [-mə] in the Accusative (13). While we have already determined that our ‘ghost’ endings, both Genitive and Accusative, are nasals, it seems necessary to specify the Accusative nasal for place of articulation as well: while the Genitive case ending ‘ghost’ is underspecified for place, the Accusative ‘ghost’ is labial. Thus, the difference in Genitive and Accusative 1st person possessive forms is explained: the suffixal nasal in Accusative possessive forms adopts the place of articulation of the Accusative case ‘ghost’ ending. The underlying specification of nasals will have to be as follows:

(14)

Genitive singular case ending is $\left[\begin{array}{l} +\text{consonantal} \\ +\text{nasal} \end{array} \right]$

Accusative singular case ending is $\left[\begin{array}{l} +\text{consonantal} \\ +\text{nasal} \\ +\text{labial} \end{array} \right]$

Specifying the ‘ghost’ case endings with labial place of articulation for the Accusative ‘ghost’ and leaving the Genitive nasal underspecified for place has consequences for consonant gradation that goes beyond nasal degemination and resulting prosodic structure. The Genitive singular ‘ghost’ nasal ending combined with a possessive suffix that starts with a dental stop, such as possessive endings of the 2nd person singular /-Tə/ and 3rd person singular /-TU/, constitutes a gradating prenasalized stop. This resulting complex segment appears in its weak grade [t] when aligned with the left edge of a foot as predicted by our analysis of RG:

(15) *Genitive singular possessives, 3rd person singular (3rd person singular possessor, Genitive singular possessed)*

Underlying Form	Surface Form	Gloss
/kuHu-N-Tu/	kubutu	‘his/her/its skin’
/kaSu-N-Tu/	kaʃutu	‘his/her/its bark’
/jüHü-N-Tu/	ʃübütu	‘his/her/its sledge’
/kiTa-N-Tu/	kiðatu	‘his/her/its cup’
/tər-N-Tu/	tərətu	‘his/her/its hair’
/jäTe-N-Tu/	jädətu	‘his/her/its stone’
/jüTü-N-Tu/	ʃüðütu	‘his/her/its hand’
/hoNKe-N-Tu/	ho ^ŋ getu	‘his/her/its handle’

The nasal ‘ghost’ of Genitive singular ending, therefore, as a prenasalized obstruent, gradates to the weak-grade [t] when it is foot-initial (15), and stays strong as [ʔt] when it is foot-internal (16):

(16) *Genitive singular possessives, 3rd person singular (3rd person singular possessor, Genitive singular possessee)*

Underlying Form	Surface Form	Gloss
/ciSar-N-TU/	cisarə ⁿ tu	‘his/her/its benefit’
/kaTar-N-TU/	katarə ⁿ tu	‘his/her/its light’
/kəəlī-N-TU/	kəəlī ⁿ tī	‘his/her/its tear’
/cīṽpSinəTə-N-TU/	cīṽpsinəðə ⁿ tu	‘his/her/its wrist’
/çieʃə-N-TU/	çieʃə ⁿ tu	‘his/her/its tongue’
/hīaʃə-N-TU/	hīaʃə ⁿ tī	‘his/her/its thumb’
/baarpə-N-TU/	baarpə ⁿ tu	‘his/her/its master’

Foot internal position, therefore, is the only position in the language, where the Genitive nasal ‘ghost’ shows up on the surface. When it is foot-initial, as in (12), it surfaces as a weak-grade obstruent (the weak reflex of *ʔ/t* alternation, where strong grade has prenasalization that is lost in weak grades). The presence of this nasal, as a result, is crucial in Genitive singular possessive forms: the weak reflex of the suffix /-TU/ without it is [ðu], as in Nominative singular 3rd person possessive forms we discussed previously.

The fact that Accusative singular ‘ghost’ ending is specified for the feature [labial] has consequences for gradation other than nasal degemination and resulting syllable structure. Since this latent nasal is labial, it cannot compose a gradating prenasalized consonant, and is treated, as a result, as a sonorant closing the previous syllable, but not a nasal part of the complex segment:

(14) *Accusative singular possessives, 3rd person singular (3rd person singular possessor, Accusative singular possessed)*

a.	Underlying Form	Surface Form	Gloss
	/kuHu-m-Tu/	kubumtu	‘his/her/its skin’
	/kaSu-m-Tu/	kaʃumtu	‘his/her/its bark’
	/ʃüHü-m-Tu/	ʃübümtu	‘his/her/its sledge’
	/kiTa-m-Tu/	kiðamtu	‘his/her/its cup’
	/tər-m-Tu/	tərəmtu	‘his/her/its hair’
	/jäTe-m-Tu/	jädəmtu	‘his/her/its stone’
	/ʃüTü-m-Tu/	ʃüðümtu	‘his/her/its hand’
	/hoNKe-m-Tu/	hoŋgemtu	‘his/her/its handle’
b.			
	/ciSar-m-Tu/	cisarəmtu	‘his/her/its benefit’
	/kaTar-m-Tu/	katarəmtu	‘his/her/its light’
	/kəəli-m-Ti/	kəəlimtī	‘his/her/its tear’
	/cīipSinəTə-m-Ti/	cīipsinəðəmtu	‘his/her/its wrist’
	/çiəʃə-m-Ti/	çiəʃəmtu	‘his/her/its tongue’
	/hiəʃə-m-Ti/	hiəʃəmtī	‘his/her/its thumb’
	/baarpə-m-Tu/	baarpəmtu	‘his/her/its master’

It is clear from the forms above, that [t] of the possessive suffix is treated as a postconsonantal consonant, and thus surfaces in its strong grade, regardless of its position with respect to foot edges: in (14a) it is foot-initial, and in (14b) it is foot-internal. In contrast with the Genitive possessive forms in (13), the Accusative ‘ghost’ is always seen on the surface when it is not word final.

The nasal and place specifications of the Genitive and Accusative ‘ghost’ case endings, therefore, influence RG and CSC in several ways: their nasality triggers nasal degemination and neither of the case endings have any bearing on grades of the

consonants of the stems; underspecified for place nasal Genitive case ending, comprising a prenasalized gradating consonant, surfaces with weak or strong grade depending on prosodic position; labial nasal Accusative case ending acts simply as a consonant closing the last syllable of the stem, and shows up on the surface before any possessive ending that starts with a non-nasal.

Quite a different situation is encountered with the Elative singular case ending, where we also posited a latent consonant, so the underlying form of the suffix looks like /-KəCTə/, with the ‘ghost’ consonant C closing the first syllable of the suffix. This ‘ghost’ consonant, though it determines syllable structure of the Elative singular forms, does not appear on the surface anywhere in the language, as opposed to nasal latent segments of Genitive and Accusative case endings:

(15) *Elative singular non-possessives*

	Underlying Form	Surface Form	Gloss
a.	/kuHu-KəCTə/	kuhu-gətə (*kuhu-gə ⁿ tə)	‘skin’
	/leNHē-KəCTə/	le ⁿ he-gətə (*le ⁿ he-gə ⁿ tə)	‘eagle’
	/turKu-KəCTə/	turku-gətə (*turku-gə ⁿ tə)	‘lake’
	/kaNTa-KəCTə/	ka ⁿ ta-gətə (*ka ⁿ ta-gə ⁿ tə)	‘sledge’
	/kita-KəCTə/	kita-gətə (*kita-gə ⁿ tə)	‘cup’
	/ŋuHu-KəCTə/	ŋuhu-gətə (*ŋuhu-gə ⁿ tə)	‘mitten’
	/hoTür -KəCTə/	hoðür-kətə (*hoðür-kə ⁿ tə)	‘letter’
	/häSir-KəCTə/	häjir-kətə (*häjir-kə ⁿ tə)	‘fish-hook’
b.	/baKunu-KəCTə/	bakunu-gətə	‘salmon’
	/kəəli-KəCTə/	kəəli-gətə	‘tear’
	/ni-KəCTə/	ni-gətə	‘wife’
	/tīrimi-KəCTə/	tīrimi-gətə	‘caviar’
	/baarpə-KəCTə/	baarpə-gətə	‘master’
	/tər-KəCTə/	tər-kətə	‘fur’
	/tuj-KəCTə/	tuj-kətə	‘fire’

While the forms in (15b) do not have the ‘ghost’ surfacing as prenasalization on the following consonant, it is not the result of RG: the ‘ghost’ is invisible on the surface even

when it is foot-internal, as in (15b). The latent segment in this suffix, therefore, is specified underlyingly only as [+consonantal].

So far, therefore, we have encountered three types of latent consonants: the ‘ghost’ in the Elative singular ending that is prespecified only for [consonantal] feature; Genitive singular ‘ghost’ ending that is specified as a nasal underlyingly, and Accusative singular ending, that has to be specified as labial nasal in the underlying form. Next, we will further discuss the structure of nasal ghosts and their effect on RG and CSC.

According to the present analysis of consonant gradation in Nganasan, consonant alternations are caused by the requirement of intervocalic Lenition, combined with restrictions on alignment of weak grades of consonants. The grades of consonants that are not intervocalic are determined either by their underlying specification (word-initial consonants), default voicing (postconsonantal consonants), or coda requirements (no voiced obstruents in codas). We have also seen that an obstruent preceded by a homorganic nasal, or underspecified for place nasal ‘ghost’, behaves as prenasalized consonant, that is, as a singular segment, rather than a consonant cluster:

(16) *Non-possessive nouns*

Nominative singular	Nominative plural	Gloss
he ^ŋ jir	he ⁿ sirəʔ	‘shaman’s drum’
ho ^ŋ jir	ho ⁿ çireʔ	‘edge, side’
ki ⁿ te	ki ⁿ deʔ	‘smoke’
mī ⁿ tī	mī ⁿ dīʔ	‘load’
ci ⁿ te	ci ⁿ deʔ	‘hill’
ho ^ŋ ke	ho ^ŋ geʔ	‘handle’
etc.		

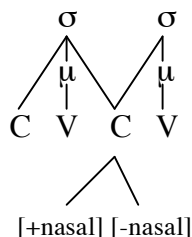
The prenasalized consonants in each of the above cases are intervocalic, and are thus subject to intervocalic lenition. The voiced prenasalized consonants are onsets of closed syllables. In cases where prenasalized consonants are foot-initial, prenasalized consonants are also subject to Lenition, though the weak grade reflects a segment simplification rather than voicing as in cases with CSC:

(17) *Genitive singular 2nd person possessives (2nd person singular possessor, Genitive singular possessed)*

Underlying Form	Surface Form	Gloss
/kuHu-N-Tə/	kubutə	‘your (sing) skin’
/kaSu-N-Tə/	kaʃutə	‘your (sing) bark’
/jüHü-N-Tə/	jübütə	‘your (sing) sledge’
/kiTa-N-Tə/	kiðatə	‘your (sing) cup’
/tər-N-Tə/	tərətə	‘your (sing) hair’
/jäTe-N-Tə/	jäðetə	‘your (sing) stone’
/jüTü-N-Tə/	jüðütə	‘your (sing) hand’
etc.		

Recall, however, that the same Genitive case nasal ‘ghost’ ending that comprises the nasal part of prenasalized consonants in (17) above also serves to close the last syllable of the stems, which is evidenced by voiced variants of the stem-final alternating obstruents: [b] in *kubutə*, [ð] in *kiðatə* etc. Nasals, therefore, seem to play dual role in the words in (17): not only are they a part of (onset) prenasalized consonant, they are also codas of preceding syllables. Nasals in these positions, therefore, appear to be **ambisyllabic**. However, in order to be subject to RG and CSC, the nasals must be intervocalic, i.e. lack a root node of their own. Since it is the root node that is generally taken to be syllabified (see, for example, Zoll (1998)), it appears that prenasalized obstruents have the structure in (18), where the root node of a prenasalized obstruent is syllabified as a coda of a preceding, and an onset of the following syllable:

(18)



It appears that a nasal that takes on the place features of the following obstruent, creating a prenasalized consonant, also affects the host obstruent such that the root node

of the obstruent is syllabified in a geminate-like way (without contribution to weight to the preceding syllables, simply because coda consonants are not moraic in the language). Because the prenasalized obstruent closes the preceding syllable, the onset of this syllable appears voiced according to the CSC. Prenasalized consonant itself is intervocalic, and is thus subject to RG as well as CSC.

It is necessary to note that latent consonants in the cases we have been discussing differ from full segments in the language only minimally: to get the correct prosodic and syllable structure on the surface, the root nodes of the ‘ghosts’ have to appear on surface as well. I will therefore suggest that latent segments are not pronounced due to their lack of an essential feature not only in the underlying representation but in the surface representation as well: the ‘ghost’ nasals can come underspecified for place as we have seen above. On the surface, they are either linked to a host obstruent (see structure in (18)), in which case they are pronounced as prenasalization, or they are dropped in pronunciation. It seems that phonetics cannot supply the feature [place] for the consonants that lack it on the surface, and cannot read a placeless segment off the surface phonological representation. Previous analyses of deletion along the same lines include the analysis of deletion of nasals in Axininca Campa where the nasals subject to deletion are argued to be underspecified for [place] feature (Spring 1993).

There is a situation in the language, however, in which a prenasalized consonant shows up strong (keeping its input prenasalization) despite being foot-initial and intervocalic, thus presenting another apparent counterexample to RG and our claim about the rhythmic organization of the language.

Recall that according to RG, prenasalized consonants appear in their weak grade (without the nasal component) when they are intervocalic and aligned with the left edge of a foot:

(19)

- a. Locative singular non-possessives (suffix /-NTənU/)

Underlying Form	Surface Form	Gloss
/SaTu-NTənU/	(saðu)(tənu)	‘clay’
/KuHu-NTənU/	(kubu)(tənu)	‘skin’
/jäTe-NTənU/	(jäðe)(təni)	‘stone’
/jüHü-NTənU/	(jübü)(tənu)	‘sledge’
/KiTa-NTənU/	(kiða)(təni)	‘cup’

- b. Present tense of verbs, 3rd person singular (suffix /-NTU/)

Underlying Form	Surface Form	Gloss
/KuNTa-NTU/	(ku ⁿ da)(tu)	‘he/she/it sleeps’
/KoNTu-NTU/	(ko ⁿ du)(tu)	‘he/she/it carries’
/KoTu-NTU/	(koðu)(tu)	‘he/she/it kills’
/HoTə-NTU/	(hoðə)(tu)	‘he/she/it writes’
/biTirnäNTi-NTU/	(biðir)(nä ⁿ di)(ti)	‘he/she/it is thirsty’

In (19) above, both the Locative singular suffix /-NTənU/ in (a) and present tense 3rd person singular suffix /-NTU/ of the verbs in (b) start with a prenasalized obstruent, that shows up in its weak grade (without the prenasalization) in all the forms above, as it is foot-initial.

The same suffixes, however, fail to appear with the weak grade of their prenasalized consonants in the same prosodic positions in the following forms:

(20)

- a. Locative singular non-possessives (suffix /-NTənU/)

Underlying Form	Surface Form	Gloss
/dimi-NTənU/	(dimi)(ⁿ təni)	‘glue’
/binī-NTənU/	(binī)(ⁿ təni)	‘rope’
/jini-NTənU/	(jini)(ⁿ təni)	‘older brother’
/cimi-NTənU/	(cimi)(ⁿ təni)	‘tooth’
/səmu-NTənU/	(səmu)(ⁿ tənu)	‘hat’
/jempri-NTənU/	(jempri)(ⁿ təni)	‘salary’

- b. Present tense of verbs, 3rd person singular (suffix /-NTU/)

Underlying Form	Surface Form	Gloss
/konĩ-NTU/	(konĩ) ^{(n)ti}	‘he/she/it goes’
/tana- NTU/	(tan ^u a) ^{(n)tu}	‘he/she/it is accustomed’
/niã-NTU/	(niã) ^{(n)tu}	‘he/she/it saves up’
/kəməu-NTU/	(kə)(məu) ^{(n)tu}	‘he/she/it wrestles’
/ləŋi-NTU/	(ləŋi) ^{(n)ti}	‘he/she/it burns’ (intr.)
/kəmə-NTU/	(kəmə) ^{(n)tu}	‘he/she/it catches’
/ŋam-NTU/	(ŋamə) ^{(n)tu}	‘he/she/it eats’
/hiŋ-NTU/	(hiŋi) ^{(n)ti}	‘he/she/it cooks’

RG predicts that the first prenasalized consonant of the suffixes must appear in its weak grade [t] in all of the words in (20) above, as the consonant in question is always intervocalic and left-aligned with a foot, our two basic conditions for weak grade distribution. The nasal component of the prenasalized consonant, however, remains intact, the consonant thus appearing in the strong grade. The reason for it seems to be the quality of the consonant of the syllable preceding the suffix: while all the words in (19) have a non-nasal as the last consonant of the stem, the onset of the stem-final syllable of the forms in (20) is invariably nasal.

This phenomenon, traditionally called Nunnation, appears to be a type of nasal harmony that requires nasalization on a consonant that follows a nasal. Note, that the ‘target’ consonant and the ‘trigger’ consonant can be separated by one or more vowels, but any non-nasal consonant blocks the effect of Nunnation:

(21)

a.	/leNHe-NTU/	le ^m betu (*le ^m be ⁿ tu)	‘eagle’
	/kaNTa-NTU/	ka ⁿ datu (*ka ⁿ da ⁿ tu)	‘sledge’
	/hoNKe-NTU/	ho ^ŋ getu (*ho ^ŋ ge ⁿ tu)	‘handle’
	/leNHua-NTU/	le ^m buatu (*le ^m bua ⁿ tu)	‘board’
	/miNTi-NTU/	mi ⁿ di ⁿ ti (*mi ⁿ di ⁿ ti)	‘load’
	/kiNTe-NTU/	ki ⁿ deti (ki ⁿ de ⁿ ti)	‘smoke’

b.	/məKu-NTU/	məgutu (*məgu ⁿ tu)	‘spine’
	/ŋuHu-NTU/	ŋubutu (*ŋubu ⁿ tu)	‘mitten’
	/ŋerbī-NTU/	ŋerbīti (*ŋerbī ⁿ ti)	‘wool’
	/ŋamsu-NTU/	ŋamsutu (*ŋamsu ⁿ tu)	‘meat’
	/ŋilhie-NTU/	ŋilhietī (*ŋilhie ⁿ ti)	‘slope’
	/ŋarmü-NTU/	ŋarmütü (*ŋarmü ⁿ tü)	‘north wind’

As the data in (21) illustrate, neither prenasalization on the last consonant of the stem, as in (a), nor a nasal that does not directly precede the possible Nunnation target, as in (b), can influence the nasality of the suffixal consonant. In (21a) Nunnation is stopped from applying by the ‘host’ obstruent of the prenasalization that is between the nasal component and the suffixal consonant. In (21b), similarly, a nasal of the stem cannot support the nasalization on the suffixal consonant since there is (at least) one non-nasal in between. Nunnation, therefore, is a constraint that requires nasalization on a consonant immediately following a nasal. This requirement, however, is overridden when there is no nasalization in the input to harmonize:

(22) *Nominative singular 3rd person possessives (3rd person singular possessor, Nominative singular possessee)*

Underlying Form	Surface Form	Gloss
/nī-TU/	nīti (*nī ⁿ ti)	‘his/her/its wife’
/bīnī-TU/	bīnīđi (*bīnī ⁿ ti)	‘his/her/its rope’
/ŋinī-TU/	ŋinīđi (*ŋinī ⁿ ti)	‘his/her/its older brother’
/cimi-TU/	cimiđi (*cimi ⁿ ti)	‘his/her/its tooth’
/bakunu-TU/	bakunutu (bakunu ⁿ tu)	‘his/her/its salmon’
/tīrimi-TU/	tīrimiti (*tīrimi ⁿ ti)	‘his/her/its caviar’
/dimi-TU/	dimiđu (*dimi ⁿ tu)	‘his/her/its glue’

As the forms above evidence, Nunnation is prevented from introducing nasalization to the consonant following a nasal when nasalization is not present in the input. Our analysis of consonant gradation, therefore, must include two constraints, in addition to the ones we formulated in the previously:

(23)

NUNNATION *C_[+nasal] (V) C_[-nasal] A nasal consonant must be followed by another nasal

DEP_[+nasal] All nasals of the output must have a correspondent in the input

With the addition of these two constraints, our analysis of RG with reflexes involving prenasalized consonants would look like is illustrated in the following tableau:

Tableau 1

	DEP _[+nasal]	NUNNATION	ALIGN WEAK	LENITION
/dimi-NTənU/ 'glue'-Loc.sg.				
☞ a.(dimi)(ⁿ tenī)				*
b.(dimi)(tenī)		*!		
/taa-NTənU/ 'deer'-Loc.sg				
☞ a. (taa)(tənu)				
b. (taa)(ⁿ tənu)				*!
/dimi-TU/ 'glue'-Nom.sg, 3 rd possessive				
☞ a.(dimi)(ðī)		*		
b.(dimi)(ⁿ tī)	*!			*

According to the tableau above, DEP has to be ranked above NUNNATION (to prevent insertion of nasalization that is not in the input), which in turn has to be ranked above LENITION, for prenasalized consonants to be possible intervocalically.

In the upper part of the Tableau 1, the DEP constraint is inactive: there is a nasal in the input /dimi-NTənU/, so both of the candidates pass the constraint. Candidate (b) has a violation of the NUNNATION constraint that is fatal: the candidate's suffixal consonant [t] has no prenasalization on it, though the consonant that precedes it is nasal [m]. Even though candidate (a) has a violation of lower-ranked LENITION constraint due to the complex prenasalized segment intervocalically, it is still the optimal candidate.

The middle part of the tableau shows that NUNNATION has no effect on the inputs with a prenasalization but no nasal in the preceding syllable intervocalically. Since both DEP and NUNNATION constraints are inactive in this case, the decision is passed down to the ALIGNMENT and LENITION constraints. Both of the candidates satisfy the ALIGNMENT constraint, as candidate (a) has its weak-grade [t] aligned with the left edge of a foot, and candidate (b) has no weak grade to be aligned. Candidate (b), however, goes out on the LENITION constraint because of its strong-grade prenasalized consonant, leaving candidate (a) the winner.

The lower part of the Tableau 1 illustrates how our analysis works for a word with the last nasal consonant of the stem but no nasal in the input of the suffix. In this case, candidate (b) that has the prenasalized strong grade [ʰt], fatally violates DEP constraint, though satisfying NUNNATION constraint by introducing prenasalization that is not present in the input. Candidate (a), on the other hand, violates NUNNATION due to the lack of harmonious nasalization on the suffix consonant, but it is still a winner: DEP is crucially ranked higher than NUNNATION.

The analysis above shows that Nunnation, a particular kind of nasal harmony, serves to **block Rhythmic Gradation** where the latter would have otherwise forced a weak (without prenasalization) grade of the alternation. Nunnation itself, however, is possible only when its conditions (nasals in two subsequent syllables) are met in the input, and is blocked by a higher-ranking DEP constraint when such a nasal does not appear underlyingly.

At this point, we have accounted for all apparent counterexamples to our claim that RG reflexes mark foot structure of the language: CSC, presence of latent segments, and a type of nasal harmony interact with RG, but do not invalidate the original claim about foot structure of Nganasan.