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 below[1]:

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

a. [high] → ø / __ [high]
[-str] [+str]

b. *$V_{[high, -stressed]}$ $V_{[high, -stressed]}$

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

a. [+front] → [+front]
(tí.ta)(tà.ta) (tí.ti) (tà.ta)

b. ALIGN-R, [+high], Ft

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.-beaht.ti	veah.ke.hea-hp.pi	-beahtti	-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 dialets 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 $Level_0$. 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 $Level_3$, $Level_2$ gridmark represents primary stress, and $Level_1$ gridmark(s) represent secondary stress. If, on the other hand, $Level_2$ has no gridmarks, it would be gridmarks on $Level_1$ 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 stress[3]: a syllable can have no stress, secondary stress, or primary stress. Therefore, English would have gridmarks on $Level_1$ and $Level_2$, and no gridmarks on $Level_3$ (for the dialects that do not distinguish between secondary and tertiary stress); $Level_2$ gridmarks would be interpreted as primary stress, and $Level_2$ 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)

***LEVEL$_2$ GRIDMARK** There must not be a gridmark on $Level_2$

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:

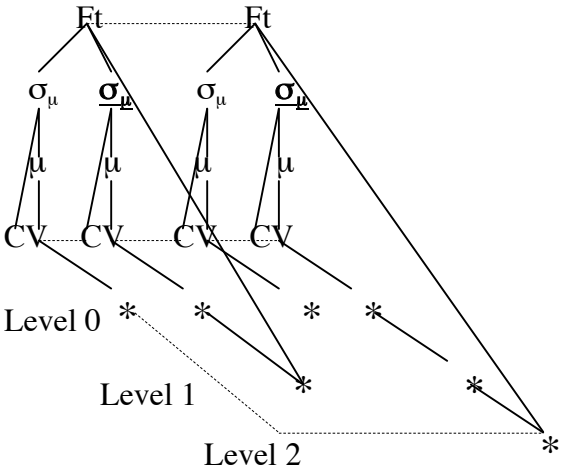
(7) ***Prominence Hierarchy***

…*LEVEL$_5$ GRIDM >> *LEVEL$_4$ GRIDM >> *LEVEL$_3$ GRIDM >> *LEVEL$_2$ GRIDM

It is difficult to say whether we have a constraint that bans Level$_1$ 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 Projections[4]:***



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. ALIGN-{L,R}(FT, $GRID_n$)
∀ $Level_n$ gridmark ∃ a {L, R} foot edge such that it is aligned with the gridmark.

b. ALIGN-{L,R}($GRID_n$, FT)
∀ {L, R} foot edge ∃ a $Level_n$ 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 ***LEVEL$_2$ 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 *Level$_2$Grid outranks a Prominence Alignment constraint of the second type, i.e. ALIGN-L (FT, GRID$_n$):

Tableau 1

/σ σ σ σ σ/	*Level$_2$Grid	ALIGN-L (FT, GRID$_n$)
☞ a. (σσ)(σσ)(σ́)		**
b. (σ̀σ)(σ̀σ)(σ́)	*!	

Tableau 2

/σ σ σ σ/	*Level$_2$Grid	ALIGN-L (FT, GRID$_n$)
☞ a. (σσ)(σ́σ)		*
b. (σ̀σ)(σ́σ)	*!	

The ranking of the *Level$_2$Grid 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 *Level$_2$Grid 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, Maŋs̯i

Lapse (results in misalignment, feet without prominence)
ex. Maŋs̯i

Faithfulness constraints to underlying prominence (results in misalignment)
ex. borrowings into Maŋs̯i, 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 Level_2Grid 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.