DISTINCTIVENESS, COERCION AND SONORITY: A UNIFIED THEORY OF WEIGHT

by

Bruce Timothy Morén

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland at College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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Advisory Committee:

Professor Linda Lombardi, Chair/Advisor
Professor Laura Benua
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ABSTRACT

Title of dissertation: DISTINCTIVENESS, COERCION AND SONORITY: A UNIFIED THEORY OF WEIGHT

Bruce Timothy Morén, Doctor of Philosophy, 1999

Dissertation directed by: Professor Linda Lombardi
Department of Linguistics

The two main goals of this dissertation are:

1) to examine and review the nature and patterns of segment weight, including: inventories, processes, and dependencies; and
2) to provide a simple and economical account for the observed descriptive generalizations within the framework of Optimality Theory and Moraic Theory.

A thorough inspection of data from a large number of languages leads to the conclusion that a unified theory and mechanism of moraicity across segment types (i.e. both consonants and vowels) is warranted. This work provides such a unified theory.

Chapter 1 reviews evidence for different degrees of weight, presents the syllable representations assumed throughout this work, and demonstrates that there are two sources of weight – coerced and distinctive. Coerced weight is a restriction on surface moraicity in some phonological context (e.g. weight by position and foot binarity), and is subject to distributional restrictions based on sonority. In contrast,

distinctive weight is an underlying moraicity reflected in a surface contrast (e.g. geminate versus non-geminate intervocalic consonants), and is not bounded by sonority.

Chapter 2 is a brief review of Optimality Theory and Correspondence Theory, and discusses the factorial rankings (permutations) of three types of constraints:

1) General moraic markedness constraints against moraic segments of different types – ranked in a universal hierarchy based on sonority;
2) Coercive moraic markedness constraints; and
3) Faithfulness constraints on underlying moraic affiliation with segments of different sonorities.

Chapter 3 uses data from a number of languages to show that the descriptive generalizations discussed in chapter 1 emerge naturally as the result of constraint interactions.

Chapter 4 expands on chapter 3, and provides in-depth case studies of segment moraicity and other phenomena in Hawaiian, Modern Standard Italian, Kashmiri, two Hungarian dialects, two Icelandic dialects, and Metropolitan New York English. This chapter gives detailed descriptions of different weight patterns; reveals that the constraints proposed in this work can be integrated into more complete grammars; and shows that different dialects can arise from a minimal re-ranking of constraints.

Chapter 5 is a repository for discussions of miscellaneous issues, as well as the general conclusions.

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DEDICATION

To my mother, Barbara Louise Tellefsen,

for teaching me that all things are possible – in spite of the odds

ACKNOWLEDGMENTS

It has been my good fortune to have Linda Lombardi, Paul Smolensky, Laura Benua, Amy Weinberg, and Rose-Marie Oster as members of my committee. Each of these people has provided invaluable encouragement, support, insights and enthusiasm not only throughout the preparation of this dissertation, but also through my graduate studies.

I am particularly indebted to Linda Lombardi, my advisor, for encouraging me to delve into the mysteries of phonology despite my initial apprehension. From her, I have learned to love abstraction, formalism AND data. She has shown me a world of linguistic analysis derived from simple and well-grounded tools, and her consistency and formidable knowledge of both data and theory have led me directly to this point.

Anyone who has worked with Paul Smolensky must understand how truly fortunate I feel to have had the honor of working with him. I appreciate his sharp intellect and approachable demeanor, his mental prowess and personal charm (qualities too rarely found together). I thank him for being an incredible role model, and for his amazingly haiku-like way of making a seemingly difficult concept clear.

Laura Benua has many qualities that I admire and hope to emulate. I believe that the most important thing she has taught me is to challenge my own and others' assumptions. She has also encouraged me to stretch my imagination to look for the seeds of an analysis, and then to carefully reign in to a more reasoned and reasonable solution.

I thank Amy Weinberg for her continued support and encouragement after my defection from syntax to phonology. She has always shown an interest in my work, and her unique perspective has certainly led to insights I would otherwise not have made.

Rose-Marie Oster has instilled in me an appreciation of all things Scandinavian, and has awakened in me a love of the traditions and language of my Swedish heritage. She is an outstanding teacher and a truly kind and generous person.

I would also like to thank the other faculty members at the University of Maryland at College Park with whom I have had the pleasure to work. Over the years they have become dear colleagues, and I will sorely miss having daily contact with them. David Lightfoot has instilled in me an appreciation of the relationship among diachronic change, language acquisition, and dialect difference. He has also helped me to see beyond the formalism du jour to the important language issues beyond. Norbert Hornstein and Juan Uriagereka have impressed me with their incredible grasp of syntactic data and the facility with which they manipulate the tools of analysis. I have certainly benefited greatly from their instruction and attention. Although no longer at the University of Maryland, I owe quite a bit of my love of linguistics to David Lebeaux. It was his encouragement and kind remarks regarding my early work that gave me the courage to pursue graduate school. Finally, I must thank all the syntacticians for their infinite patience as I challenged almost every bit of English data ever presented to my non-standard (non-human?) grammar.

What can one say to show appreciation for classmates? My friends Juan Carlos Castillo, Haruka Fukazawa, Patricia Hironymous, Viola Miglio, Frida Morelli, Julien

Mussolino, Akemi Matsuya, Mits Ota (Georgetown infiltrator), Tuomo Neuvonen, and Caro Struijke have each enriched my life in ways they cannot imagine. We learned together, laughed together, pulled our hair out together, and inspected pencil points at dangerously close range together. For my closest friends, the Funologists, I am completely without words to describe my deepest regard, affection, and respect. It seems that this is a case where silent mutual understanding is the optimal candidate…

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Finally, without the consistent love and devotion of my family, I would not have made it to this point. I am indebted to my parents Roger and Barbara, my grandparents Cora, Bernice, and Carl, and my sister Leigh-Ann for molding me into the person that I am, and for teaching me that love and life are of paramount importance – all else is icing. I am especially grateful to my partner David Kidd, who encouraged me to follow my dreams and to study linguistics despite the many pressures to pursue a more practical profession. He has been unflinchingly understanding and supportive through three degrees and many incomprehensible mini-lectures on garden path sentences, parasitic gaps, prosody, and other arcane linguistic topics. I owe him much more than I can ever possibly repay.

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Chapter 1 Syllable Weight - Descriptive Generalizations

1.1 Introduction

There are two main goals of this dissertation. The first is to make a descriptive contribution by providing an in-depth review of segment moraicity patterns, including: segment weight inventories, segment weight processes, and segment weight dependencies covering both well-known and lesser-known systems. The second goal is make contribution to phonological theory by providing a system to explain the observed descriptive generalizations using as economical and elegant system as possible.

I demonstrate that segment weight comes in two varieties: coerced and distinctive. Coerced weight arises from minimal or maximal weight requirements, whereas distinctive weight is an underlying moraicity reflected in a surface contrast. An example of coerced weight would be weight by position, where coda consonants are required to be moraic, or foot binarity, where prosodic feet are required to be bimoraic. Distinctive weight is found for vowels in languages with phonemic long/short vowels and for consonants in languages with a phonemic gemination. These two types of weight are referred to in the literature implicitly, but not explicitly.

In fact, many discussions either refer to only one or the other, or they simply conflate weight phenomena. I will show that coerced and distinctive weight ought not be thought of monolithically, nor should they be thought of as absolutely separate. Instead, I will show that they are separate but related phenomena with different patterns that fall naturally out of the interactions of constraints proposed herein. The basic generalizations regarding these two types of weight are that there is an implicational relationship between coerced weight and sonority, a la Zec (1988, 1995), that does not exist for distinctive weight. Rather, the distribution of distinctive weight is free.

I will show that the implicational relationship between sonority and moraicity follows from the interaction between "coercive" moraic markedness constraints, e.g. weight by position, and a reformulated and expanded universal moraic markedness hierarchy of the Zec (1995) sort. Further, the free distribution of distinctive weight follows from the interaction between a set of fully re-rankable moraic faithfulness constraints and the universal moraic markedness hierarchy.

Once the descriptive generalizations have been examined in adequate detail, it becomes clear that consonant and vowel moraic patterns are remarkably parallel. This is something not explored in the literature. Both consonants and vowels display coerced, as well as distinctive, patterns. Further, the implicational relationship between sonority and moraicity for coerced weight is seen within each of the consonant and vowel classes, as well as across the two classes. Likewise, the free distribution of distinctive moraicity is seen across segment classes.

These striking parallels lead to the conclusion that consonant and vowel moraicity should not be looked at as different phenomena subject to completely unrelated principles. Instead, they lead to the conclusion that a unified theory is not only preferred, but necessary. I propose a unified theory that puts to rest the notion that consonant and vowel moraicity are two separate phenomena. Further, I show that constraints such as NOLONGVOWEL and *GEMINATE are not only counterproductive, but they inherently deny the facts and propagate a dichotomy where none exists.

The general outline of the dissertation is as follows: Chapter 1 provides the introduction and descriptive generalizations regarding syllable weight and segment moraicity. Chapter two gives an overview of Optimality Theory (OT) (Prince and Smolensky 1993) and Correspondence Theory (McCarthy and Prince 1995), and discusses the relationship between typology and OT. It also provides a discussion of the major constraints proposed and used in this work, and the typology developed by the factorial ranking of these constraints. Chapter three illustrates examples of the coerced weight and distinctive weight patterns found cross-linguistically, thus providing data from a wide variety of languages to support the analysis of segment weight proposed here to unify the weight systems of vowels and consonants. Chapter four provides in-depth case studies of the weight patterns of Hawaiian, Hungarian, Icelandic, Italian, Kashmiri, and Metropolitan New York English. This shows not only that the mechanism proposed in this work provides an analysis of quite different weight systems in widely different languages, but that the proposed system integrates well into the larger phonological system. Finally, chapter five discusses several theoretical considerations, and provides the general conclusion.

1.1.1 What is syllable weight?

Traditionally, syllables have been separated into two classes - heavy and light. This dichotomy has been justified by the patterns these two types of syllables exhibit with respect to a variety of phonological and morphological phenomena - including stress, tone, and pitch. In this thesis, I will concentrate on the correlation between weight and stress.

Many languages have systems of word stress that are predictable from the surface syllabification of vowels and consonants. This was noted as early as the 1930's by Jakobsen (1931) and Trubetzkoy (1939). To illustrate predictable stress based on syllabification, let us begin with the well-known example of Cairene Arabic (description and examples from Kenstowicz, 1994). Note that unless otherwise specified, stressed vowels are indicated with an acute accent, and boundaries separating syllables are indicated with periods.

Given the following trisyllabic words from Cairene Arabic, it is clear that stress falls on the penultimate syllable if it:

(a) contains a long vowel (CVV) (see (1a)),

(b) contains a short vowel followed by a geminate (long) consonant (CVG) (see (1b)), or

(c) contains a short vowel followed by a consonant cluster (CVCC) (see (1c)).

(1) a. [ga.ríi.da] 'newspaper'

[fa.káa.ha] 'humor'

b. [bi.síl.la] 'green peas'

[ẓa.kít.ta] 'jacket'

c. [fa.súl.ya] 'green beans'

[ga.wán.ti] 'gloves'

However, if the penult contains a short vowel only (CV), then the antepenultimate syllable is stressed (see (2)).

(2) a. [ʕí.na.ba] 'a grape'

[ʕá.ra.bi] 'Arabic'

[ẓáḷaṭa] 'stone'

This distribution of stress is completely predictable based on the syllable structure. Stress is as far left in trisyllabic words as possible, but is attracted to penultimate syllables that meet certain structural criteria. Traditionally, the syllables attracting stress are called "heavy", and those that do not attract stress are called "light". In the case of Egyptian Arabic, light syllables are those that are CV in shape, and heavy syllables are either CVV or CVC (‘C’ stands for a generic consonant, and ‘V’ stands for a generic vowel). Other languages that assign stress based on syllable weight include: Huastesco (Larsen & Pike 1949), Kashmiri (chapter 4), and Khalkha Mongolian (Bosson 1964).

Not only is the distinction between light and heavy syllables used by some languages to assign stress, but some languages enforce a minimal or maximal weight requirement on certain syllables. For example, stressed penultimate syllables in Modern Standard Italian must be heavy (3a-c). Light stressed penults are prohibited, as shown in (3d).

(3)	a.	[kár.ne]	*carne*	'meat'
		[pás.ta]	*pasta*	'pasta'
	b.	[nón.no]	*nonno*	'grandfather'
		[gát.to]	*gatto*	'cat'
	c.	[káa.sa]	*casa*	'house'
		[víi.le]	*vile*	'villian'
	d.	*[ká.sa]		

As was the case for Cairene Arabic, light syllables in Modern Standard Italian are open syllables containing short vowels, and heavy syllables are either open syllables containing long vowels (CVV) or syllables ending in a consonant (CVC). This will be explored further in chapter 4 – case study of Italian.

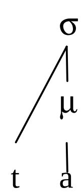
Other languages which place weight requirements on certain syllables include Hawaiian (chapter 4), Hungarian (chapter 4), Icelandic (chapter 4) and some English dialects (chapter 4).

1.1.2 Moraic Theory

As early as Jakobsen (1931) and Trubetzkoy (1939), the dichotomy of light and heavy syllables displayed by some languages was accounted for via the notion of the "mora". Under Moraic Theory (McCawly 1968; Hyman 1985; McCarthy and Prince 1986; Hayes 1989; etc.), light syllables are said to have a single mora (weight unit), and heavy syllables are said to have two. Using the representations proposed by McCarthy and Prince (1986), (4) shows that light open syllables contain a single mora, whereas, the three heavy syllables in (5) contain two morae.

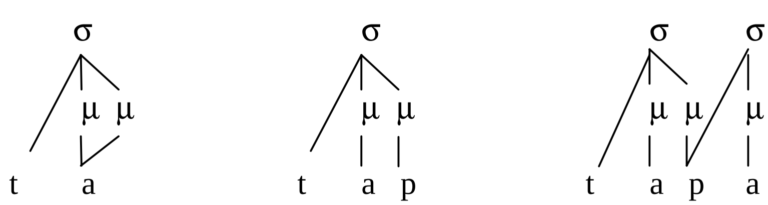
(4) Light (CV)

a. [ta]



(5) Heavy (CVV, CVC)

a. [taa] b. [tap][1] c. [tap.pa]



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[1] Depending on the language, this structure may be transcribed as [tapp]; for example, Hungarian.

Note that I, like McCarthy and Prince, assume that onsets are associated directly to the syllable and not to the following mora. This representation has been used to explain the robust differences between pre- and post-nuclear segments with regard to weight phenomena. Since onsets rarely, if ever, contribute to syllable weight, they are thought to be non-moraic. One way of capturing the lack of onset weight is to associate the onset directly with the syllable node. In addition, the general program espoused in this work will make use of the idea that segments are non-moraic unless forced to be moraic for some reason. Programmatically, this supports the assertion that onsets are typically non-moraic. Although this is not the only logical possibility, it is convenient and I assume it here.

1.1.3 Superheavy and Extra-light Syllables

Having established a representational way to distinguish between light and heavy syllables, there are two questions to be asked:

Can syllables contain more than two morae?

Can syllables be mora-less?

In addition to languages which oppose light and heavy syllables, i.e. monomoraic and bimoraic syllables, there are also languages which seem to show evidence of a third degree of weight - superheavy syllables. Superheavy, or hypercharacterized, syllables contain three morae. The question of the existence of trimoraic syllables has received a good deal of attention in the past fifteen years. Some literature claims that there is a bimoraic upper bound on syllable weight (McCarthy and Prince 1986; Steriade 1991; Sprouse 1996; Shaw 1996), and that cases that seem to require trimoraic syllables can be analyzed as either just bimoraic or bimoraic with an extra element (e.g. degenerate syllable). Others, such as McCarthy (1979), Aoun (1979), and Hayes (1989), argue that trimoraic syllables best account for at least some cases of over-length phenomena. I will assume that superheavy (trimoraic) syllables are not universally banned although they are marked. The main reason for this choice is that trimoraic syllables straightforwardly account for the assignment of Kashmiri stress given in chapter 4. In addition, there is new phonetic evidence that trimoraic syllables may be necessary in Hindi (Broselow et al 1997). It is important to note that the OT framework assumed here allows for the marked but non-universal ban of trimoraic syllables to be formalized in a straightforward way. This is one advantage of OT over previous frameworks that either allowed trimoraic syllables without being able to restrict their occurrence in a non-ad hoc manner or disallowed trimoraic syllables completely.

One well-known example of a three-way weight distribution is Hindi. According to Kelkar (1968), Hindi word stress falls on the heaviest syllable of a word. If there is a superheavy syllable (CVVC, CVCC), it is stressed regardless of there it occurs in the word.

(6)	[ʃóox.Ja.baa.nii]	'talkative'
	[mu.sal.máan]	'Muslim'

In the absence of a superheavy syllable, a heavy (CVV, CVC) syllable is stressed – again, regardless of position.

(7) [ru.pi.áa] 'rupee'

If a word consists of only light syllables, the rightmost non-final syllable is stressed.

(8) [sa.mí.ti] 'committee'

In the case of more than one syllable of the same weight, the rightmost non-final syllable of the heaviest class is stressed.

(9) a. Light

[sa.mí.ti] 'committee'

b. Heavy

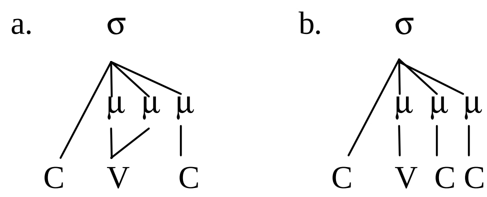
[kaa.ríi.ga.rii] 'craftsmanship'

c. Superheavy

[aas.máan.Jaah] 'highly placed'

Based on this data, the inventory of syllable weight for Hindi can be expanded from the traditional light/heavy dichotomy of (4) and (5), to include the trimoraic superheavy syllables in (10).

(10) Superheavy (CVVC, CVCC)



On the other hand, the evidence for the existence of syllables with nuclear segments not dominated by a mora is unclear at best. Hyman (1985) claims that the behavior of Slavic yer-vowels and “reduced” vowels in Chuvash give evidence of non-moraic syllables. He suggests that syllables containing full vowels in Chuvash are monomoraic, but syllables containing the “reduced” vowels are non-moraic. This could explain the fact that stress falls on the last full vowel of a word, and ignores the “reduced” vowels.

It has also been claimed that some languages (e.g. German – Fery 1999) have extra-light syllables, and that some languages have over-short vowels (e.g. Georgian, Lungchow, Ostyak, Yurak – Maddieson 1984). One possible interpretation of over-short vowels and extra-light syllables is that they are not associated with morae.

Although trimoraic syllables will be made use of in the analysis of Kashmiri in chapter 4, non-moraic syllables will not be discussed further. Until I do a more detailed examination of non-moraic syllables, I remain agnostic about their existence. However, the system proposed in this thesis predicts their occurrence. If they are prohibited universally, then some undominated constraint may be at work[2].

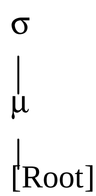
[2] Or GEN may be prohibited from producing syllables without morae.

1.1.4 Summary

The assumption made here is that weight is defined as relative moraic content. A mora is a prosodic unit between the segmental and syllabic tiers. There are at least three degrees of weight, although not all are found in every language, and other degrees may exist. Throughout the rest of this thesis, I will assume the following representations of mono-, bi-, and trimoraic syllables.

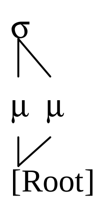
(11) Light[3]

a.

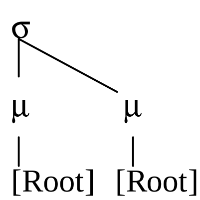


(12) Heavy

a.

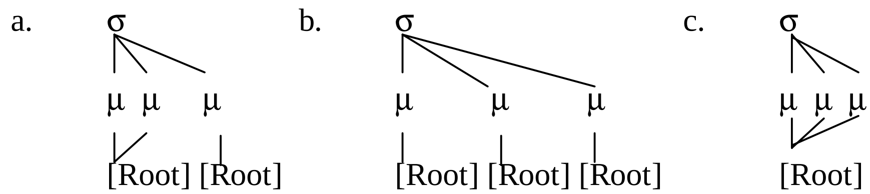


b.



[3] The representations of light closed syllables will be added in section 1.2.

(13) Superheavy



1.2 Two Sources of Weight – Coerced and Distinctive

When discussing syllable weight phenomena, one must be careful to distinguish between the two sources of weight – coerced and distinctive. Although the literature does not make overt reference to these two sources, the distinction is there implicitly. Coerced weight results from a restriction on surface moraicity in some phonological context. Some examples of coerced weight phenomena are: weight by position (the requirement that coda consonants be moraic), minimal word (prosodic words must be minimally bimoraic), and stress to weight (stressed syllables must be minimally bimoraic). On the other hand, distinctive weight results from an underlying moraic specification that is reflected in a surface contrast. For example, geminate intervocalic consonants in some languages contrast with non-geminate intervocalic consonants. Within the moraic framework assumed here for geminate consonants (Hayes 1989), intervocalic consonants that surface as non-moraic are underlyingly non-moraic, while contrasting intervocalic geminates surface as moraic because they are underlyingly moraic.

As will be shown throughout this work, not only is there a dichotomy between these two sources of weight, but the generalizations and patterns relevant to each are quite different. In addition, this dichotomy is shown to effect both vowels and consonants is strikingly parallel ways – thus unifying the two classes with respect to weight. Further, the patterns and their differences, as well as the unification of vowel and consonant weight patterns, will result naturally from constraint interactions.

1.2.1 Coerced Weight

Both consonants and vowels can receive weight due to coercion – sometimes from the same source, and sometimes from different sources. First I will discuss coerced consonant weight based on the work of Zec (1988, 1995), thus setting the stage for the extension of her work into the class of vowels. In chapters 2 and 3, I will show that the parallels found in the patterns of vowel and consonant coerced weight is the result of a unified set of constraints and similar constraint interactions. The analysis of Kashmiri given in chapter 4 demonstrates that constraint interactions can conspire to allow coda consonants to be moraic only in stressed syllables.

In her groundbreaking work on the relationship between sonority and prosodic structure, Zec (1988, 1995) explores coerced consonant weight generalizations – specifically, as they relate to sonority. Basically, she claims that there is an implicational relationship between sonority and moraicity. If a language has a moraic consonant of one sonority, then more sonorous consonants will also be moraic. Further, there are three basic language types, those without moraic consonants, those with only more sonorous moraic consonants, and those with moraic consonants of all sonorities. (14) shows languages of these three types discussed by Zec (1995:89). One can see that if a language has moraic obstruents, then it also has moraic sonorants.

(14)	Sets of Moraic Segments	Languages
	a. vowels	Khalkha Mongolian, Yidiɲ
	b. vowels, all sonorants	Lithuanian, Tiv
	c. vowels, sonorants, obstruents	English[4], Latin, Arabic dialects

Although Zec claims that only stricture features can play a role in determining moraic class behavior within sonorant and obstruent classes, there is evidence that aspiration and voicing play a role in the moraic hierarchies of some languages. In Icelandic, all segments except the least sonorous (aspirated stops) can be moraic in the coda of a stressed syllable (Morén and Miglio 1998). This restriction is absolute in that aspirated stops are never moraic. When underlyingly aspirated stops are forced into a moraic position, preaspiration results as the repair strategy. This case will be analyzed in more detail in chapter 4.

A second case of the least sonorous segment in a language not surfacing as moraic comes from Metropolitan New York English. As I show in Morén 1996, 1997, all consonants except the voiceless stops can be moraic following the low front vowel. This case will also be analyzed in more detail in chapter 4. Combined with the Icelandic data, Metropolitan New York English strongly suggests that Zec's claim that only stricture features play a role in the moraic hierarchy of consonants is incorrect. Both aspiration and voicing seem to play a role in determining moraic segments in some languages.

[4] Except in those contexts that I discuss in Morén (1996, 1997).

To summarize, there is a relationship between sonority and moraicity (Zec 1988, 1995). This relationship can be formalized in the following:

(15) If α is moraic under coercion, then β is moraic under coercion if β is more sonorous than α.

Expanding on Zec (1995), the following sets of moraic segments are found in the following languages.

(16)	Sets of Moraic Segments	Languages
	Vowels	Khalkha Mongolian, Yidiɲ (Zec 1995)
	Vowels + Glides	Gumbaynggir (Sherer 1994)
	Vowels + Non-glottal Sonorants	Kwakwala (Zec 1988)
	Vowels + All Sonorants	Lithuanian, Tiv (Zec 1995)
	Vowels + All Consonants except Plain Stops	Metropolitan New York English (Morén 1996, 1996)
	Vowels + All Consonants except Aspirated Stops	Icelandic (Morén & Miglio 1998)
	All Segments	Latin, Arabic dialects, Aklan, Koya, Imdlawn Tashlhiyt Berber (Zec 1988, 1995)

Although Zec only discusses the differences among consonants with respect to moraicity, I will now expand her system and show that the same patterns are found within the class of vowels – only in slightly different form.

Just as with the consonants, vowel systems seem to fall into three main categories with respect to sonority and coercion[5]. For ease of exposition, since most vowels are in nuclear position and must have at least one mora, when talking about coerced moraicity here, I will be referring to vowels that are forced to be long (bimoraic). The three main categories are 1) no vowels are forced to be bimoraic in some environment, 2) only the more sonorous vowels are forced to be bimoraic in some environment, and 3) all vowels are forced to be bimoraic in some environment. This is an expansion of Zec's work on sonority and consonant moraicity to the class of vowels, and shows that vowel and consonant moraicity under coercion are parallel.

(17)

	Sets of Coerced Bimoraic Vowels	Languages
a.	None	Cayuvava, Chaha, Hua, Mazateco
b.	Low	American English dialects, Russian dialects, Chinese dialects
c.	Low + Mid	Russian dialects, Chinese dialects
d.	All	Hawaiian, Icelandic, Italian

[5] Chapter 3 will show that this is not universal, and is violated under specific conditions.

The first type of language is one in which no vowels are coerced to long. Languages of this type include Cayuvava (Key 1961), and Chaha (Leslau 1997). For example, Cayuvava has only light syllables - i.e. monomoraic vowels. The following are from Key (1961).

(18)	a.	[ki.hi.be.re]	'I ran'
	b.	[i.ki.ta.pa.re.re.pe.ha]	'the water is clean'
	c.	[ma.ra.ha.ha.e.i.ki]	‘their blankets’

The second language type is one in which all vowels are susceptible to lengthening processes. Many languages have vowel systems of this type, including Choctaw (Nicklas 1975), Hixkaryana (Derbyshire 1979), Hungarian (chapter 4), Icelandic (chapter 4), and Modern Standard Italian (chapter 4). For example, stressed monosyllables in Hawaiian must be heavy, (19a-e)[6]. Light stressed monosyllables are prohibited, as shown in (19f-h).

[6] See chapter 4 for a detailed analysis. Although Hawaiian has distinctive vowel weight in general, this distinctiveness is sometimes over-ridden by coerced weight requirements.

(19) a. [íi] 'to say'

b. [ée] 'different'

c. [páa] 'fence'

d. [kóo] 'sugar cane'

e. [kúu] 'upright'

f. *[í]

g. *[pá]

h. *[kó]

The third type of language is one in which more sonorous vowels are forced to lengthen in some environment, but less sonorous vowels are not. For example, all vowels in Standard American English have distinctive length[7] except the low back vowel which must always surface as long.

(20) a. [bíit] *beat*

b. [bít] *bit*

c. [béet] *bait*

d. [bét] *bet*

e. [bɔ́ɔt] *bought*

f. *[bɔ́t]

[7] Abstracting away from the concurrent tense/lax distinction.

As I explain in Morén 1997, this is due to the combination of a requirement (common among Germanic languages) that forces stressed syllables to be bimoraic and the preference in this dialect to lengthen the low back vowel than to have a moraic consonant. A similar phenomenon is found in Metropolitan New York English, and will be addressed in detail in chapter 4.

1.2.2 Coerced Weight Summary

Cross-linguistically, both consonants and vowels are subject to coerced moraicity. Further, coerced weight for both natural classes seems to follow sonority. Zec (1988) demonstrates the relationship between sonority and consonant moraicity in coerced environments, and in the previous section, I have given brief examples of the relationship between sonority and vowel moraicity. The main point is that the treatment of coerced weight within both classes of segments is remarkably parallel. This unification will be explained in chapter 2 and demonstrated in chapter 3 as resulting from similar interactions among similar moraic markedness constraints.

1.2.3 Distinctive Weight

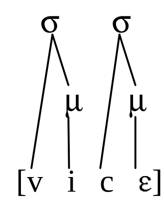
Just as in the case of coerced weight, both consonants and vowels can have distinctive weight. This is well established in the literature. Usually, however, distinctive vowel weight and consonant weight are thought of as different phenomena – distinctive vowel length and distinctive consonant gemination. First I will discuss distinctive consonant weight, and show that unlike coerced consonant weight, distinctive consonant weight is not closely tied to sonority. Second, I will show that distinctive vowel weight is also not tied to sonority. Thus, consonants and vowels will again be shown to have striking similarities – this time with respect to distinctive weight. In chapters 2 and 3, I will show that the parallels found in the patterns of vowel and consonant distinctive weight is the result of a unified set of constraints and similar constraint interactions.

Some languages have distinctive weight for intervocalic consonants, in which case, they are said to have intervocalic geminates (e.g. Finnish (Harms 1964), Hindi (Kelkar 1968), Ilokano (Hayes and Abad 1989), Japanese (Yoshida 1990), Modern Standard Italian – chapter 4). Some languages also have a weight distinction in post-vocalic word final positions (e.g. Hungarian – chapter 4, Icelandic – chapter 4)). Before we embark on a discussion of the generalizations regarding distinctive consonant weight, let me first make clear the representations that I assume for both medial and final "geminates".

First, medial geminates arise from an underlyingly moraic consonant that surfaces as ambisyllabic[8]. This is in contrast with an underlyingly non-moraic medial consonant that surfaces as either an onset or a coda. The following two examples from Standard Literary Hungarian show an underlyingly non-moraic intervocalic consonant surfacing as an onset (21), while an underlyingly moraic intervocalic consonant surfaces as moraic and ambisyllabic (22) – representations from Hayes (1989).

[8] This is in opposition to coerced gemination that is a different phenomenon and falls under the coerced weight category.

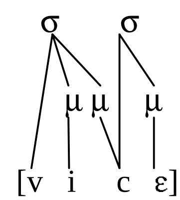
(21) *vice* ‘janitor’

/vicɛ/ → 

[vi.cɛ]

(22) *vicce* ‘his joke’

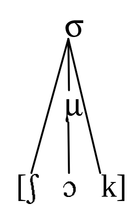
μ

/vi cɛ/ → 

[vic.cɛ]

Likewise, languages that have a word-final consonant weight distinction, sometimes referred to as final geminates, have the following representations.

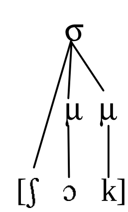
(23) *sok* ‘much’

/ʃɔk/ → 

[ʃɔk]

(24) *sokk* ‘shock’

μ

/ʃɔk/ → 

[ʃɔkk]

Note that what I am assuming here as a “geminate” is an underlyingly moraic consonant that surfaces as moraic in contrast with an underlyingly nonmoraic consonant in the same environment that surfaces as nonmoraic. Although intervocalic geminates are ambisyllabic (due to the pressure for syllables to have onsets), ambisyllabicity is not a necessary component of geminates as seen in the case of final geminates.

Having established the representations for both medial and final geminate consonants, let us now move on to the patterns of distinctive consonant and vowel weight.

Many people have tried to make generalizations regarding the distribution of geminates of varying sonorities. However, these generalizations are tenuous at best, and by no means absolute. Given the above discussion regarding segment moraicity in coercive environments, one could hypothesize that distinctive weight would also follow the sonority scale. Predictions of this hypothesis would be:

1. A synchronic tendency in geminate inventories toward higher-sonority geminates, not lower-sonority geminates.

    - According to Jaeger (1978), of the 72 languages with geminates that she surveyed, nine had only sonorant geminates. Gumperz and Naim (1960) claim that Hindi-Urdu has geminates of all consonants except the least sonorant – aspirated stops. Newman (1997) claims that Hausa only has lexical geminates that are nasal or liquids.

2. A diachronic loss of less-sonorous geminates prior to a loss of more-sonorous geminates.

    - Holt (1997, 1998) claims that there was a progressive loss of geminates in Late Spoken Latin and Proto-Romance that "…mirrors the sonority hierarchy" (Holt 1998:2). First obstruent geminates were lost (proto-Romance), then sonorant geminates were lost (10^{th}-11^{th} c.).

However, although there are cases where more-sonorous geminates are preferred to less-sonorous geminates, the <u>overall tendency</u> of geminate patterns is toward the less sonorous. This is the opposite of that predicted by a sonority-based approach to weight.

1. Some languages have distinctively moraic obstruents, but not distinctively moraic sonorants (Jaeger 1978; Taylor 1985; Nichols 1997; Anderson 1997):

    - Chechen, Iraqw, Lak, Ojibwa, Nez Perce, Tarascan, Totonac

2. Some languages have distinctively moraic nasals, but not distinctively moraic liquids:

    - Educated Colloquial Hungarian (Vago 1992), and 16 out of 72 languages with geminates surveyed by Jaeger (1978).

3. There are many languages that prefer less-sonorous obstruent geminates to more-sonorant obstruent geminates (Jaeger 1978; Taylor 1985):

    - Lak, Nez Perce, Ocaina, Ojibwa, Totonac, and Yakut have voiceless geminates but no voiced geminates.
    - Finnish, Kurdish, Ocaina, Somali, Songhai, Telugu, Totonac, and Wolof have stop geminates, but no fricative geminates.

To summarize, distinctive consonant weight is taken to be fairly free as far as which types of segments can participate in the distinction, as shown in (25). In chapter 3, I show that constraint interactions yield the fairly free distribution of geminate consonants.

(25) Languages, Consonant Classes and Distinctive Weight (simplified)

Obstruent	Sonorant	Languange	Reference
Yes	Yes	Balochi	Elfenbein 1997
		Brahui	Elfenbein 1997
		Gujarati	Mistry 1997
		Hungarian	Chapter 4
		Modern Standard Italian	Chapter 4
No	Yes	Hausa	Newman 1997
Yes	No	Chechen	Nichols 1997
		Lak	Anderson 1997
No	No	Burushaski	Anderson 1997
		Chaha	Leslau 1997
		Hawaiian	Chapter 4
		Khalkha Mongolian	Bosson 1964

The distribution of distinctive vowel length is very similar to that of distinctive consonant weight. As (26) shows, there are languages with no distinctive vowel weight; languages with distinctive vowel weight for more sonorous segments, but not less sonorous segments; languages with distinctive weight for less sonorous vowels, but not for more sonorous vowels; and languages with distinctive weight for all vowels.

(26) Languages, Vowel Classes and Distinctive Weight (simplified)

High	Low	Languange	Reference
Yes	Yes	Hawaiian	Chapter 4
		Hungarian	Chapter 4
		Khalkha Mongolian	Bosson 1964
		Dagbani	Maddieson 1984
		Chipewyan	Maddieson 1984
No	Yes	Khasi	Maddieson 1984
Yes	No	Atayal	Maddieson 1984, Crothers 1978
No	No	Icelandic	Chapter 4
		Modern Standard Italian	Chapter 4
		Spanish	Harris 1983

1.2.4 Distinctive Weight Summary

Cross-linguistically, both consonants and vowels may have distinctive moraicity. Further, distinctive weight for both natural classes does not seem to follow sonority. There are many cases in which sonority and distinctive moraicity are at odds. The main point is that the treatment of distinctive weight within both classes of segments is remarkably parallel. This unification will be explained in chapter 3 as resulting from similar interactions among similar moraic markedness constraints.

1.3 Summary of Weight Descriptive Generalizations

Weight has been defined as the relative moraic content of segments and syllables. Syllables with more morae are “heavier” than those with fewer morae. Relative weight is relevant in some languages on purely inventory grounds – e.g. long/short vowels and heavy/light consonants. Other languages show reflexes of weight in the assignment of prosodic and prosodically sensitive structures such as stress, tone and accent.

Segments can range in moraic content from non-moraic to trimoraic depending on the language, the segment and the phonological context. There are two basic sources for weight. Coerced weight results from a condition on surface moraicity. Segments are forced to have a minimum moraic content in some environment. This type of weight seems to follow the sonority sequence, as discussed by Zec (1988, 1995) for consonants and expanded here for vowels. Distinctive weight is an underlying moraicity that is contrastive on the surface. Languages can contrast at least non-moraic, moraic, and bimoraic vowels; and non-moraic and moraic consonants. Distinctive weight does not follow the sonority sequence.

Chapter 2 Optimality Theory, Typology and Constraints

2.1 Optimality Theory and Typology

Prince and Smolensky (1993) proposed that Universal Grammar is a set of violable constraints of various types. As originally conceived, the set of constraints is universal, and languages differ only in the particular ranking of these constraints. The architecture of the system is schematized in (1). An input string is submitted to GEN, which modifies the string in any number of ways to produce a set of possible output candidates. This candidate set is evaluated by the language particular constraint ranking to yield the most harmonic candidate. The most harmonic candidate with respect to the constraint ranking is optimal and surfaces as the output.

(1)

	GEN				EVAL	
/input string/ →		→	candidate 1	→	constraint 1	→ [output string]
			candidate 2		constraint 2	
			candidate 3		constraint 3	
			candidate n		constraint n	

One major advantage of Optimality Theory (OT) over traditional rule-based theories is the typological predictions intrinsic to the architecture. Since constraints are universal and re-rankable, the factorial ranking of the constraints potentially yields all possible grammars.

We can illustrate this system of factorial typology using the following three abstract constraints: $, %, &. Since there are three constraints, the number of possible permutations is 3!, or six. The six possible rankings of $, %, and & are given in (2).

(2)
a. $ >> %>> &
b. $ >> &>> %
c. %>> $ >> &
d. %>> &>> $
e. &>> $ >> %
f. &>> %>> $

These six rankings potentially correspond to six different language types. Of course, some rankings may result in identical optimal candidates, and others may not appear by sheer accident or because they are occulted by some other constraint interaction.

Given the inherent typological nature of OT, the attempt made in this work is not to fully exhaust the possible constraint rankings of all constraints, nor even to show a language of each possible permutation of the constraints under investigation. Both of those tasks are much too ambitious. However, an attempt is made to explore each major prediction of factorial ranking of the constraints used here, as well as to show that constraint interactions provide a unified typology of weight and weight interactions across segment types. That is, vowel weight and consonant weight need not be viewed as different systems subject to completely different constraints. Rather, the generalizations regarding segment moraicity are fairly uniform across both classes.

2.2 Constraints

There are three major constraint types to be used in the following typology:

1. General moraic markedness constraints – structural markedness constraints against moraic segments.
2. Coercive moraic markedness constraints – require minimal or maximal moraicity within a given context.
3. Moraic faithfulness constraints – require corresponding input and output segments to be associated with the same number of morae.

2.2.1 General Moraic Markedness Constraints and Sonority

The general moraic markedness constraints are simply co-occurrence constraints against morae affiliated with different classes of segments. Zec (1988) originally proposed these constraints as pre-OT filters. Later, I reformulated them within the OT framework (Morén 1996, et seq.). The generic constraint of this type is given in (3).

(3) ***MORA[SEG]** – Do not associate a mora with a particular type of segment.

However, this single constraint is actually a family of constraints relative to different natural classes of segments and ranked in a universal moraic markedness hierarchy based on sonority.

(4) Simplified Universal Markedness Hierarchy

*MORA[STOP] >> *MORA[CONT] >> *MORA[SON] >> *MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

There are two things to note about the hierarchy in (4). First, the constraints are relative to different natural classes of segments, not necessarily to different features. Therefore, the description in the square brackets refers to a segment class, not a feature. This simply means that if there are two constraints, *MORA[STOP] and *MORA[VOICEDSTOP], a segment that is both voiced and a stop violates only the constraint specific to the class of voiced stops, not the constraint specific to plain stops. Second, this hierarchy is similar in nature to Prince and Smolensky's (1993) peak and margin hierarchies. In fact, it seems to be intermediate between the two. The peak hierarchy is relevant to prosodically prominent positions – syllable peaks, while the margin hierarchy is relevant to prosodically less prominent positions – syllable margins. Moraic segments are in peak position when nuclear, and margin position when non-nuclear.

There are two ways in which this family of constraints differs from the OT moraic markedness hierarchy that Zec (1995) proposes. First, the constraints proposed here are negative markedness constraints. That is, they penalize segments that are associated with morae. In contrast, Zec (1995) proposed a set of positive markedness constraints that penalize segments that are not associated with morae. As will be shown in chapter 5, the positive markedness constraints make incorrect predictions, while the negative moraic markedness constraints make exactly the correct predictions. Second, the constraints proposed here are articulated for the full range of segment types. This includes vowels as well as consonants. The advantage of this is two-fold. First, there is no a priori reason to exclude vowels from the universal moraic markedness hierarchy. Second, including vowels in the universal moraic markedness hierarchy allows for the natural unification of the consonant and vowel weight patterns discussed in chapter 1. This will be demonstrated in chapter 3.

A second departure from Zec's original formulation of the universal moraic markedness hierarchy is in the formulation of the sonority hierarchy relevant to moraic consonants. Zec (1988) claims that only stricture features (including [glottal]) play a role in the relationship between sonority and moraicity, and that other laryngeal features (specifically voicing) do not play a role in consonant moraicity patterns. However, as was briefly mentioned in chapter 1, and will be addressed in more detail in chapter 4, there is evidence from Icelandic and Metropolitan New York English that aspiration and voicing are important for moraicity in those languages, respectively. In addition, once the universal moraic markedness hierarchy is evoked to help explain distinctive consonant weight distributions, it becomes clear that both laryngeal features and continuance play important roles in the geminate inventories of some languages. A further advantage of including laryngeal features in the moraic markedness hierarchy is that [glottal] need not be unconventionally classified as stricture.

(5) Simplified Universal Markedness Hierarchy

*MORA[ASPSTOP] >> *MORA[PLAINSTOP] >> *MORA[VOICEDSTOP] >>
*MORA[PLAINCONT] >> *MORA[VOICEDCONT] >> *MORA[NASAL] >>
*MORA[LIQ] >> *MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

A third innovation made here regarding these general moraic markedness constraints is that they subsume the NOLONGVOWEL and NOGEMINATE constraints proposed in the literature. Not only can neither NOLONGVOWEL nor NOGEMINATE fully explain all cross-linguistic weight patterns, as chapter 5 will show, but they completely miss the intuition promoted here that the parallels seen in the moraic patterns across the classes of consonants and vowels are not accidental.

2.2.2 Coercive Moraic Markedness Constraints

There are a variety of constraints found in the literature that force minimal or maximal moraicity in some environment. These constraints seem to fall into two separate classes: those that are specific to a particular segment type and those that are not. Examples of former are given in (6) and (7).

(6) **WEIGHTBYPOSITION (WBYP) –** Coda consonants must surface as moraic (based on Hayes 1989)

(7) ***WORD-FINALLONGVOWEL (*LONGV]#) –** Word-final long vowels are prohibited (based on Buckley 1998)

The first constraint is specific to consonants and enforces a minimal consonant moraicity in coda position. The second constraint is specific to vowels and enforces a maximal vowel moraicity in word-final position.

Examples of constraints not specific to segment type are given in (8) and (9).

(8) **FOOTBINARITY (FTBIN) –** Prosodic feet must be binary under syllabic or moraic analysis (McCarthy and Prince 1993)

(9) **STRESSTOWEIGHT (STOW) –** Prominent syllables must be heavy – i.e. “stressed syllables must be heavy” (based on Prince 1990)

Both of these constraints enforce minimal moraicity, but neither specifies the type of segment that must be moraic to meet the requirement.

As will been seen in chapter 3, the dichotomy between those coercive moraic markedness constraints specific to segment types and those that are general is important because the former obscure the parallels between vowel and consonant weight patterns. Thus it is understandable that previous research overlooked the similarity between the distribution of these two natural classes.

Before moving on to a brief discussion of the moraic faithfulness constraints to be used, I must point out that the coercive moraic markedness constraints may sometimes be referred to as the following composite constraint for ease of exposition and demonstration purposes:

(10) **“BEMORAIC” –** shorthand for any constraint or set of constraints that force moraicity in some environment.

This is not meant to be a serious contender for universal status. Rather, it is an expositional device used when discussing the typological reflexes of ranking a coercive moraic markedness constraint with respect to the universal moraic markedness hierarchy and/or moraic faithfulness constraints. It may also be used when the actual constraints for a particular analysis add further complications not important to the discussion, and simplification of the facts is in order to demonstrate the relevant phenomenon or pattern.

2.2.3 Correspondence Theory and Moraic Faithfulness Constraints

The third type of constraint to be used in the factorial typology proposed in this work are moraic faithfulness constraints. I propose a set of constraints against adding moraic associations that are not there underlying, and a set of constraints against deleting moraic associations that are there underlying. Before moving on to the actual constraints/constraint families proposed, it seems germane to give a brief background on Correspondence Theory.

In studying reduplicative morphology, McCarthy and Prince (1995) expand on the containment conception of faithfulness constraints proposed by Prince and Smolensky (1993). They observe that the identity relationship between the base and the reduplicant is similar in several ways to the faithfulness relationship between the input and output. In an attempt to bridge the gap between these (and other) otherwise separate phenomena, McCarthy and Prince developed a general theory of correspondence between various relationships (input-output, base-reduplicant, etc.). This correspondence relation is formalized as follows:

(11) Correspondence (adapted from McCarthy and Prince 1995:262)

Given two strings S_1 and S_2, correspondence is a relation R from the elements of S_1 to those of S_2. Segments α (an element of S_1) and β (an element of S_2) are referred to as correspondents of one another when $\alpha R \beta$.

Under this theory, outputs and reduplicants are evaluated in correspondence with related inputs and bases, respectively. However, it is important that correspondence is not absolute, since it is regulated via violable faithfulness constraints. There are two types of faithfulness constraints on moraic associations that will be investigated in this work[9]. There are several names and formulations of these constraints in the literature (e.g. Archangeli and Pulleyblank 1993; and Itô, Mester, and Padgett 1995). For example, McCarthy (1995) proposes the constraints in (12) and (13). (12) translates into a constraint against losing associations between segments and morae that were there underlyingly. (13) translates into a constraint against adding associations between segments and morae that were not there underlyingly.

[9] Although MAX-MORA and DEP-MORA are also needed, the present work focuses on faithfulness to association.

(12) **No-Flop-Mora** – let μ^i be morae, ζ_j be segments, S_k phonological representations,

$S_1\ R\ S_2$,

μ^1 and ζ_1 are elements of S_1,

μ^2 and ζ_2 are elements of S_2,

$\mu^1\ R\ \mu^2$, and

$\zeta_1\ R\ \zeta_2$,

if μ^1 is associated with ζ_1,

then μ^2 is associated with ζ_2.

(13) **No-Spread-Mora** – let μ^i be morae, ζ_j be segments, S_k phonological representations,

$S_1\ \mathscr{R}\ S_2$,

μ^1 and ζ_1 are elements of S_1,

μ^2 and ζ_2 are elements of S_2,

$\mu^1\ \mathscr{R}\ \mu^2$, and

$\zeta_1\ \mathscr{R}\ \zeta_2$,

if μ^2 is associated with ζ_2,

then μ^1 is associated with ζ_1.

I have proposed similar constraints under the names of IDENT$_{IO}$MORA[SEG] and IDENT$_{OI}$MORA[SEG] in my work on Icelandic (Morén 1997, Morén and Miglio 1998) and Hungarian (Morén 1999).

Presently, I propose a hybrid of the constraints I have proposed in the past and those of McCarthy. They incorporate the formalism of McCarthy's constraints, but allow for the specification of sonority classes of segments relevant to the universal moraic markedness hierarchy.

(14) **MAXLINK-MORA[SEG]** – let ζ_j be segments, S_k phonological representations,

S_1 *R* S_2,

ζ_1 is an element of S_1,

ζ_2 is an element of S_2,

ζ_1 *R* ζ_2, and

ζ_2 belongs to a specific sonority class of segments,

if ζ_1 is associated with a mora,

then ζ_2 is associated with a mora.

(15) **DEPLINK-MORA[SEG]** – let ζ_j be segments, S_k phonological representations,

S_1 *R* S_2,

ζ_1 is an element of S_1,

ζ_2 is an element of S_2,

ζ_1 *R* ζ_2, and

ζ_1 belongs to a specific sonority class of segments,

if $\zeta_2$is associated with a mora,

then ζ_1 is associated with a mora.

In essence, the first constraint ensures that morae are not added to a class of segments if they were not there underlyingly. The second ensures that underlying morae are not deleted from a class of segments. The reformulation is necessary to account for the full range and unification of weight patterns. Note that these reformulations have further implications for faithfulness. As will be seen in chapter 4 in the analysis of Icelandic, faithfulness constraints relevant to feature/segment affiliations must also be able to specify the source or recipient segment class.

The faithfulness constraints are evaluated as shown in (16) and (17). In both tableaux, the competing candidates are segmentally identical. Candidate (a) is non-moraic, and candidate (b) is moraic. The tableaux differ in the moraic content of the input segment. In (16), the input is non-moraic, and in (17) the input is moraic.

(16)

/ V /	DEPLINK-MORA[V]	MAXLINK-MORA[V]
a. ☞ V	✓	✓
b. μ V	*	✓

Candidate (a) in tableau (16) does not violate either of these constraints. It neither adds a moraic association that was not there underlyingly, not does it delete a moraic association that was there underlyingly. Candidate (b) violates the constraint against adding a moraic association.

(17)

μ / V /	DEPLINK-MORA[V]	MAXLINK-MORA[V]
a. V	✓	*
b. ☞ μ V	✓	✓

Candidate (b) in tableau (17) does not violate either of these constraints. It neither adds a moraic association that was not there underlyingly, not does it delete a moraic association that was there underlyingly. Candidate (a), on the other hand, violates the constraint against deleting moraic associations.

2.2.4 MAXLINK and DEPLINK versus MAX and DEP

Before moving on to the ways in which the constraints discussed in this chapter interact and yield different weight patterns, let me briefly mention the difference between the faithfulness constraints on moraic associations proposed here and other faithfulness constraints on morae themselves.

In addition to faithfulness constraints ensuring that the underlying weight of segments is maintained on the surface, there must also be constraints ensuring that the same number of morae appear in the output as were there in the input. There must be a constraint against adding a mora to a string that was not there underlyingly, and one against deleting a mora from a string.

(18) **MAX-MORA –** Every mora in S_1 has a correspondent in S_2.

(19) **DEP-MORA –** Every mora in S_2 has a correspondent in S_1.

At first glance, it might appear as if the faithfulness constraints on morae and the faithfulness constraints on moraic associations yield the same result, thus are redundant. This is suggested by tableaux (20) and (21).

(20)

/ V /	DEPLINK-MORA[V]	DEP-MORA
a. ☞ V	✓	✓
b. μ V	*	*

Candidate (b) in tableau (20) violates both faithfulness constraints, while candidate (a) violates neither.

(21)

μ / V /	MAXLINK-MORA[V]	MAX-MORA
a. V	*	*
b. ☞ μ V	✓	✓

Candidate (a) in tableau (21) violates both faithfulness constraints, while candidate (b) violates neither.

However, there are three circumstances under which these constraints make different predictions regarding the optimal candidate – segmental epenthesis, segmental deletion, and re-association of morae.

Since the MAXLINK-MORA and DEPLINK-MORA constraints regulate moraic affiliations between segments that are in correspondence, if a segment in the input or output does not have a correspondent in the output or input, respectively, then the faithfulness constraints on associations are not relevant. Therefore, it is the faithfulness constraints on the morae that ensure their faithful parsing. This is demonstrated in (22) for segmental epenthesis, and (23) for segmental deletion.

(22) Segmental epenthesis

/ /	DEPLINK-MORA[V]	DEP-MORA
a. ☞ V	✓	✓
b. μ V	✓	*

Neither of the candidates in (22) violate the DEPLINK-MORA constraint, however, candidate (b) violates the DEP-MORA constraint. This tableau predicts that in the absence of an active constraint forcing an epenthetic segment to be moraic, it will surface as non-moraic. This suggests that claims that epenthetic vowels in some languages are non-moraic may be a logical conclusion of factorial constraint ranking.

As tableau (23) shows, it is the MAX-MORA constraint that can force morae to remain on the surface even if the underlying sponsor segment is deleted on the surface.

(23) Segmental deletion

μ μ / VC/	MAXLINK-MORA[C]	MAX-MORA
a. μ V	✓	*
b. μ μ ☞ V	✓	✓

Neither of the candidates in (23) violates the MAXLINK-MORA constraint, however, candidate (a) violates the MAX-MORA constraint. One consequence of these constraints is the prediction of compensatory lengthening if constraints against re-association of the mora are not active.

Finally, neither MAX-MORA nor DEP-MORA alone can prevent morae from arbitrarily changing moraic associations on the surface, as shown in (24).

(24)

μ / V C/	DEPLINK-MORA[C]	MAXLINK-MORA[V]	DEP-MORA	MAX-MORA
a. VC	✓	*	✓	*
b. μ ☞ VC	✓	✓	✓	✓
c. μ VC	*	*	✓	✓

Candidate (a) violates both MAX constraints because not only is the mora lost on the surface, but the association is also disrupted. Candidate (c) violates the constraints ensuring that underlying morae are associated with the same segment on the surface. The faithful candidate, by definition, violates none of the faithfulness constraints. Note, however, that without the DEPLINK-MORA and MAXLINK-MORA constraints, either candidate (b) or (c) is optimal.

To summarize, the MAXLINK-MORA, DEPLINK-MORA, MAX-MORA, and DEP-MORA constraints are functionally similar in some contexts, but are quite distinct in others. The association constraints ensure that associations do not change; however, they are insufficient in cases of segmental epenthesis or deletion. Likewise, faithfulness to underlying morae ensures that morae may surface regardless of input (or output) association. This allows for compensatory lengthening, for example. However, they are insufficient to prevent morae from moving from one segment to another.

The implications of the MAX-MORA and DEP-MORA constraints are worthy of a full investigation. However, in this work, I will concentrate on the constraints that ensure faithfulness to affiliations between segments and morae, and leave the other faithfulness constraints for future research.

2.3 Constraint Interactions and Weight Patterns

The interactions between the three types of moraic constraints outlined in sections 2.2.1, 2.2.2, and 2.2.3 produce a typology of syllable weight. Recall from chapter 1 that there is a dichotomy of weight sources – coerced weight and distinctive weight. Also recall that both vowels and consonants are subject to each type of weight. I claim that the interaction between the universal moraic markedness hierarchy and the coercive moraic markedness constraints yields the coercive patterns described in section 1.2.1. In addition, I claim that the interaction between the universal moraic markedness hierarchy and the moraic association faithfulness constraints results in the distinctive weight patterns described in section 1.2.3. The unification of coerced and distinctive weight across vowel and consonant classes is derived here from the fact that the three moraic constraint types are relevant to both classes.

2.3.1 Factorial Ranking and "Pure" Coerced Weight

Without the interference of moraic faithfulness constraints (they are ranked sufficiently low to not be visible), and examining the relationship between the *MORA[SEG] and coercive moraic markedness constraints, there is a strong correlation between moraicity and sonority[10]. This lack of active moraic faithfulness constraints results in what I call "pure" coerced weight.

The total number of rankings in "pure" coerced weight systems is equal to the factorial of the sum of the number of universal moraic markedness hierarchy constraints (n) and the number of coercive moraic markedness constraints (x) quantity divided by the factorial of the number of universal moraic markedness hierarchy constraints (n): $(n+x)!/n!$ – this is the same as $((n+1)(n+2)\ldots(n+x))/n!$. It is important

[10] However, as will be shown in chapter 3, coercive moraic markedness constraints relative to different segment types can be ranked to countermand this "universal".

to note that freely re-ranking (n+x) constraints over-generates by a factor of n! for a fixed subhierarchy of n. This is why (n+x)! must be divided by n!.

If all the general moraic markedness constraints are ranked together with respect to a single coercive moraic markedness constraint, let us say "BEMORAIC", the effect is that of a single constraint, *MORA[SEG]. There are only two patterns that result from a total of 2 possible rankings (1+1)!/1!: no coerced weight, or coerced weight.

(25) No Coerced Weight

a. *MORA[SEG] >> "BEMORAIC"

(26) Coerced Weight

a. "BEMORAIC" >> *MORA[SEG]

This is equivalent to saying that there is no coerced weight if the coercive moraic markedness constraint is ranked below the entire moraic markedness hierarchy, and there is coerced weight for all segments if it is ranked above the entire hierarchy.

Given the bifurcation of the general moraic markedness constraints and a coercive moraic markedness constraint, in addition to maintaining the universal moraic markedness hierarchy (*MORA[SEG1] >> *MORA[SEG2]), there are (2+1)!/2! permutations – i.e. a total of three possible rankings. The result is there are three patterns.

(27) No coerced weight for either segment

a. *MORA[SEG1] >> *MORA[SEG2] >> "BEMORAIC"

(28) Coerced weight for more sonorous segments only

a. *MORA[SEG1] >> "BEMORAIC" >> *MORA[SEG2]

(29) Coerced weight for all segments

a. "BEMORAIC" >> *MORA[SEG1] >> *MORA[SEG2]

Notice, however, that these three rankings are simply a combination of two instantiations of the previous binary system.

(30) No coerced weight for either segment

a. *MORA[SEG1] >> "BEMORAIC", and

b. *MORA[SEG2] >> "BEMORAIC"

(31) Coerced weight for more sonorous segments only

a. *MORA[SEG1] >> "BEMORAIC", and

b. "BEMORAIC" >> *MORA[SEG2]

(32) Coerced weight for all segments

a. "BEMORAIC" >> *MORA[SEG1], and

b. "BEMORAIC" >> *MORA[SEG2]

Dividing the general moraic markedness hierarchy further increases the number of possible permutations.[11] However, due to the universal nature of the moraic markedness hierarchy, only one of three patterns is found in any particular language – no segments are forced to be moraic, all segments are forced to be moraic, or the more sonorous segments are forced to be moraic. In other words, all segments more sonorous than π must be moraic, where π is a parameter fixed by the ranking. Various languages of these types will be shown in chapter 3.

2.3.2 Factorial Ranking and "Pure" Distinctive Weight

Without the interference of coercive moraic markedness constraints, and examining the relationship between the *MORA[SEG], MAXLINK-MORA[SEG] and DEPLINK-MORA[SEG] constraints, DEPLINK-MORA[SEG] does not show a visible effect. This is because there is no coerced weight forcing an underlyingly non-moraic segment to become moraic, and all candidates with moraic segments also incur violations of the general moraic markedness constraint. Therefore, there are only two patterns that result from a total of 6 possible rankings (3!): no distinctive weight, or distinctive weight.

[11] Three constraints from the universal moraic markedness hierarchy and a single coercive moraic markedness constraint = (3+1)!/3! = four rankings. Four constraints from the universal moraic markedness hierarchy and a single coercive moraic markedness constraint = (4+1)!/4! = five rankings, etc.

(33) No Distinctive Weight from *MORA[SEG] >> MAXLINK-MORA[SEG]

a. *MORA[SEG] >> MAXLINK-MORA[SEG] >> DEPLINK-MORA[SEG], or

b. *MORA[SEG] >> DEPLINK-MORA[SEG] >> MAXLINK-MORA[SEG], or

c. DEPLINK-MORA[SEG] >> *MORA[SEG] >> MAXLINK-MORA[SEG]

(34) Distinctive Weight from MAXLINK-MORA[SEG] >> *MORA[SEG]

a. MAXLINK-MORA[SEG] >> *MORA[SEG] >> DEPLINK-MORA[SEG], or

b. MAXLINK-MORA[SEG] >> DEPLINK-MORA[SEG] >> *MORA[SEG], or

c. DEPLINK-MORA[SEG] >> MAXLINK-MORA[SEG] >> *MORA[SEG]

The total number of rankings in “pure” distinctive weight systems is equal to the factorial of three times the number of universal moraic markedness hierarchy constraints (n) quantity divided by the factorial of the number of universal moraic markedness hierarchy constraints (n): (3n)!/n!. In this case, 3n is equivalent to (n+x) where “x” is 2n because each “n” general moraic markedness constraint has two corresponding faithfulness constraints – one of the MAXLINKMORA[SEG] variety and one of the DEPLINKMORA[SEG] variety. As in the “pure” coerced systems, (3n)! overgenerates by a factor of n! for a fixed subhierarchy of n.

However, since DEPLINK-MORA[SEG] is irrelevant for this type of system, the total number of relevant rankings is equal to the factorial of two times the number of universal moraic markedness hierarchy constraints (n) quantity divided by the factorial of the number of universal moraic markedness hierarchy constraints (n): (2n)!/n!

With two moraic markedness constraints and four corresponding faithfulness constraints, and maintaining the universal moraic markedness hierarchy (*MORA[SEG1] >> *MORA[SEG2]), there are 6!/2! permutations – a 360 possible rankings. However, DEPLINK-MORA[SEG1] and DEPLINK-MORA[SEG2] do not have an impact, so there are only 4!/2! relevant permutations – 12 relevant rankings. These 12 rankings result in only 4 patterns. In other words, the number of distinct patterns is equal to 2^n – for each segment type (n), there are two ranking classes (*MORA[SEG] >> MAXLINKMORA[SEG] and MAXLINKMORA[SEG] >> *MORA[SEG]).

(35) No distinctive weight for either segment

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2]

(36) Distinctive weight for SEG1 only

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2]

(37) Distinctive weight for SEG2 only

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2]

(38) Distinctive weight for both segments

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2]

With three general moraic markedness constraints and corresponding six faithfulness constraints, and maintaining the universal moraic markedness hierarchy (*MORA[SEG1] >> *MORA[SEG2] >> *MORA[SEG3]), there are 9!/3! permutations – 60480 possible rankings. However, DEPLINK-MORA[SEG1], DEPLINK-MORA[SEG2] and DEPLINK-MORA[SEG3] do not have an impact, so there are only 6!/3! Relevant permutations = 120 relevant rankings. These 120 rankings result in only 8 patterns.

(39) No distinctive weight for any segment

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG3] >> MAXLINK-MORA[SEG3]

(40) Distinctive weight for SEG1 only

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG3] >> MAXLINK-MORA[SEG3]

(41) Distinctive weight for SEG2 only

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. *MORA[SEG3] >> MAXLINK-MORA[SEG3]

(42) Distinctive weight for SEG3 only

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. MAXLINK-MORA[SEG3] >> *MORA[SEG3]

(43) Distinctive weight for SEG1 and SEG2 only

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. *MORA[SEG3] >> MAXLINK-MORA[SEG3]

(44) Distinctive weight for SEG1 and SEG3 only

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. MAXLINK-MORA[SEG3] >> *MORA[SEG3]

(45) Distinctive weight for SEG2 and SEG3 only

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. MAXLINK-MORA[SEG3] >> *MORA[SEG3]

(46) Distinctive weight for all segments

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. MAXLINK-MORA[SEG3] >> *MORA[SEG3]

Regardless of the number of moraic markedness and faithfulness constraints, the net result is that there are three meta-patterns: no distinctive weight in any segment, distinctive weight for some segments but not others (unrestricted in class affiliation), distinctive weight for all segments. I will illustrate this result in chapter 3.

2.3.3 Interactions between Distinctive and Coerced Weight

Given a coercive moraic markedness constraint, a general moraic markedness constraint, and the corresponding moraic faithfulness constraints, there are a total of 4! permutations. These 24 rankings yield only 3 patterns.

(47) No Moraic Segments

a. *MORA[SEG] >> MAXLINK-MORA[SEG], and

b. *MORA[SEG] or DEPLINK-MORA[SEG] >> "BEMORAIC"

(48) Distinctive Weight

a. MAXLINK-MORA[SEG] >> *MORA[SEG], and

b. *MORA[SEG] or DEPLINK-MORA[SEG] >> "BEMORAIC"

(49) All Segments are Moraic

a. "BEMORAIC" >> *MORA[SEG], DEPLINK-MORA[SEG]

b. MAXLINK-MORA[SEG] has no effect

Given a "BeMoraic" constraint, two general moraic markedness constraints in a universal ranking (*MORA[SEG1] >> *MORA[SEG2]) and the corresponding moraic faithfulness constraints, there are a total of 7!/2!=2520 permutations. These yield 9 patterns.

(50) No Moraic Segments

a. MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG1] or DEPLINK-MORA[SEG1] >> "BEMORAIC", and

d. *MORA[SEG2] or DEPLINK-MORA[SEG2] >> "BEMORAIC"

(51) Distinctive Weight for All Segments

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. *MORA[SEG1] or DEPLINK-MORA[SEG1] >> “BEMORAIC”, and

d. *MORA[SEG2] or DEPLINK-MORA[SEG2] >> “BEMORAIC”

(52) All Segments are Moraic

a. “BEMORAIC” >> *MORA[SEG1], DEPLINK-MORA[SEG1], *MORA[SEG2], DEPLINK-MORA[SEG2]

b. MAXLINK-MORA[SEG1] and MAXLINK-MORA[SEG2] have no effect

(53) Distinctive Weight for SEG1, SEG2 is Non-moraic

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG1] OR DEPLINK-MORA[SEG1] >> “BEMORAIC”, and

d. *MORA[SEG2] OR DEPLINK-MORA[SEG2] >> “BEMORAIC”

(54) Distinctive Weight for SEG1, SEG2 is Moraic

a. MAXLINK-MORA[SEG1] >> *MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG1] or DEPLINK-MORA[SEG1] >> “BEMORAIC”, and

d. “BEMORAIC” >> *MORA[SEG2], DEPLINK-MORA[SEG2]

(55) SEG1 is Non-moraic, Distinctive Weight for SEG2

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. *MORA[SEG1] or DEPLINK-MORA[SEG1] >> "BEMORAIC", and

d. *MORA[SEG2] or DEPLINK-MORA[SEG2] >> "BEMORAIC"

(56) SEG1 is Moraic, Distinctive Weight for SEG2

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. MAXLINK-MORA[SEG2] >> *MORA[SEG2], and

c. "BEMORAIC" >> *MORA[SEG1], DEPLINK-MORA[SEG1], and

d. DEPLINK-MORA[SEG2] >> "BEMORAIC"

(57) SEG1 is Moraic, SEG2 is Non-moraic

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. "BEMORAIC" >> *MORA[SEG1], DEPLINK-MORA[SEG1], and

d. DEPLINK-MORA[SEG2] >> "BEMORAIC"

(58) SEG1 is Non-moraic, SEG2 is Moraic

a. *MORA[SEG1] >> MAXLINK-MORA[SEG1], and

b. *MORA[SEG2] >> MAXLINK-MORA[SEG2], and

c. *MORA[SEG1] or DEPLINK-MORA[SEG1] >> "BEMORAIC", and

d. "BEMORAIC" >> *MORA[SEG2], DEPLINK-MORA[SEG2]

Note that of the above 9 patterns, all but three obey the predictions made by the universal moraic markedness hierarchy. In 6/9 patterns, if a less sonorous segment is moraic in some environment, then a more sonorous segment is moraic in that environment. The three exceptions are the fourth, the eighth and the last patterns. In the fourth pattern, a less sonorous segment has distinctive weight, but a more sonorous segment is always non-moraic. In the eighth pattern, a less sonorous segment is forced to be moraic, but a more sonorous segment is forced to be non-moraic. In the last pattern, a less sonorous segment is forced to be moraic, but a more sonorous segment has distinctive weight in that environment. The point is that a universally ranked moraic markedness hierarchy accurately captures the generalizations in both "pure" coerced weight systems and weight systems that contain both coerced and distinctive patterns. However, the universal moraic markedness hierarchy does not make any predictions regarding "pure" distinctive weight systems. In addition, distinctive weight can contravene expected coerced weight patterns in a proportionally low number of cases.

2.4 Summary

It is quite obvious that the above discussion does not address every possible ranking of all the constraints, nor does it address every pattern that could surface. However, it does provide a representative example of several of the core patterns predicted by the factorial re-ranking of these particular constraint types. The three main goals of this chapter were to provide:

- A basic summary of Optimality Theory and its relevance to language typology;
- Summaries and definitions of the three major constraint types used in this work; and
- A primer on the types of weight patterns resulting from the factorial ranking of the general moraic markedness constraints, the coercive moraic markedness constraints, and the faithfulness constraints on moraic associations.

Chapter 3 Segment Weight Typology

3.1 Introduction

There are three major patterns to be described in this chapter, and these patterns will be shown to emerge from an interaction of the markedness and faithfulness constraints introduced in chapter 2. Not only will these patterns be explained, but it will be shown that a unification of the patterns of vowel and consonant moraicity is both possible and desirable. First, I will discuss the patterns found for coerced weight. Second, I will discuss the patterns found for distinctive weight. Finally, I will discuss the interactions between these two types of weight.

3.2 Coerced Weight

Recall from chapter 1 that both vowels and consonants are susceptible to coerced weight depending on the language, the sonority of the segment, and the particular phonological environment. For example, Hungarian high vowels neutralize to long in open monosyllables, but low vowels maintain distinctive weight in this environment (chapter 4). Similarly, Lithuanian sonorants always surface as moraic in coda position, but obstruents surface as non-moraic in this environment (Zec 1988). Also recall that Zec (1988) claims that moraicity is closely bound to sonority, and that if a segment of one sonority is forced to be moraic in some environment, then more sonorous segments should be moraic in that environment. This was given in chapter 1, repeated here as (1).

(1) if α is moraic under coercion, then β is moraic under coercion if β is more sonorous than α.[12]

This implicational relationship between sonority and moraicity is easily captured by ranking coercive markedness constraints with respect to the universal markedness hierarchy proposed by Zec (1995). A simplified version of the hierarchy introduced in the previous chapter is given in (2). Throughout this work, I collapse the full hierarchy, ignoring finer-grained details, when the full hierarchy is not important for the discussion.

(2) *MORA[OBS] >> *MORA[CONT] >> *MORA[SON] >>
*MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

Ranking coercive markedness constraints with respect to this hierarchy yields the implicational relationship between sonority and moraicity. First I will discuss the relationship between moraicity and the vowel hierarchy, then I will discuss moraicity and the consonant hierarchy, and then I will show that the relationship between vowel and consonant weight follows from the same system of constraint ranking. What will emerge is a unification of the consonant and the vowel patterns with respect to each other, and an inherent asymmetry in the behavior of consonants with respect to vowels.

[12] As will be discussed, this is subject to other phonotactic restrictions, and violable.

3.2.1 Coerced Vowel Length

As already noted in chapter 1, some languages have only short vowels, some languages neutralize the more sonorous vowels to long in some environment, and some languages neutralize all vowels to long in some environment. This is readily explained if we rank the relevant coercive constraint with respect to the markedness hierarchy given in (3).

(3) *MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

Using a generic coercive markedness constraint, "BEMORAIC", the possible rankings are schematized in (4), and the factorial rankings given in (5).

(4) >> *MORA[HIGH] >> >> *MORA[MID] >> >> *MORA[LOW] >>

"BEMORAIC"

(5) a. *MORA[HIGH] >> *MORA[MID] >> *MORA[LOW] >> "BEMORAIC"

b. *MORA[HIGH] >> *MORA[MID] >> "BEMORAIC" >> *MORA[LOW]

c. *MORA[HIGH] >> "BEMORAIC" >> *MORA[MID] >> *MORA[LOW]

d. "BEMORAIC" >> *MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

With the ranking in (5a), the coercive markedness constraint is ranked below the hierarchy. This results in no coerced moraicity of any vowel. The ranking in (5b) results in coerced moraicity of low vowels, but not of mid or high vowels. The ranking in (5c) yields coerced moraicity for all vowels but high vowels. Finally, the ranking in (5d) results in coerced weight in all vowels.

3.2.1.1 No Coerced Vowel Length

The first type of language is one in which there are no long vowels. I will make the assumption that all nuclear vowels are forced to have at least one mora by some undominated constraint in the following discussion. Languages of this type are Amharic (Leslau 1997), Chaha (Leslau 1997), Gujarati (Mistry 1997), Tatar (Comrie 1997). The following example are from Cayuvava which has only monomoraic vowels. Examples from Key (1961):

(6)	a.	[é.ɲe]	‘tail’
	b.	[ki.hí.be.re]	'I ran'
	c.	[ʃá.ka.he]	‘stomach’

To give a concrete constraint ranking, let us rank the generic coercive moraic markedness constraint lower than the vowel markedness hierarchy to show how Cayuvava stressed syllables can surface with monomoraic vowels.

The tableaux in (7) and (8) show that an input with a short vowel in the input surfaces with a short vowel, while the tableaux in (9) and (10) demonstrate that even an input with an underlying long vowel surfaces as short given this ranking. Note that only the syllables that receive surface stress are evaluated in the following tableaux.

(7)

μ /kihibere/ 'I ran'	*MORA[HIGH]	DEPLINK-MORA[HIGH]	"BEMORAIC"
a. ☞ μ ki.hí.be.re	*		*
b. μμ ki.hí. be.re	**!	*!	

Either the constraint against moraic high vowels or the constraint against adding morae to high vowels must be ranked above the coercive moraic markedness constraint. Candidate (b) fatally violates both of these higher-ranked constraints once more than candidate (a). The optimal candidate violates the coercive moraic markedness constraint once more than candidate (b), but this violation is low enough ranked to not matter to the outcome. Although the losing candidate also violates the constraint against adding morae (DEPMORA), this violation is not addressed here (see discussion in section 2.2.4).

The tableau in (8) shows the same result for low vowels.

(8)

μ /ʃakahe/ 'stomach'	*MORA[LOW]	DEPLINK-MORA[LOW]	"BEMORAIC"
a. ☞ μ ʃá.ka.he	*		*
b. μμ ʃá. ka.he	**!	*!	

Both (9) and (10) show that underlyingly bimoraic vowels shorten in Cayuvava due to the markedness constraint against moraic vowels ranked above both the faithfulness constraint requiring that underlying moraicity be reflected on the surface and the coercive moraic markedness constraint. It is the latter that is most germane to the discussion of coerced weight here. In both tableaux, candidate (b) fatally violates the higher-ranked general moraic markedness constraint once more than candidate (a). Although the losing candidates also violate the constraint against deleting morae (MAXMORA), this violation is not addressed here (see discussion in section 2.2.4).

(9)

μμ /kihi bere/ 'I ran'	*MORA[HIGH]	MAXLINK-MORA[HIGH]	"BEMORAIC"
a. ☞ μ ki.hi.be.re	*	*	*
b. μμ ki.hi. be.re	**!		

(10)

μμ /ʃa kahe/ 'stomach'	*MORA[LOW]	MAXLINK-MORA[LOW]	"BEMORAIC"
a. ☞ μ ʃá.ka.he	*	*	*
b. μμ ʃá. ka.he	**!		

3.2.1.2 Coerced Length for All Vowels

With the "BeMoraic" type of constraint ranked above the vowel hierarchy, as in (5d), all vowels are forced to lengthen in some environment. A very straightforward example of this type of language is Modern Standard Italian. In Modern Standard Italian, stressed penultimate syllables must be bimoraic on the surface. If the penultimate vowel is followed by a single consonant, then the stressed vowel lengthens to meet this requirement. This generalization is true regardless of the quality of the vowel, as (11) shows.

(11)	a.	/vile/	→	[víi.le]	*vile*	'mean'
	b.	/nono/	→	[nóo.no]	*nono*	'ninth'
	c.	/kasa/	→	[káa.sa]	*casa*	'house'

Although the actual analysis of this phenomenon is more complicated than that presented here, and will be addressed in detail in chapter 4, it is sufficient for now to simply say that the "BEMORAIC" constraint is ranked above the moraic markedness hierarchy to drive Italian vowel lengthening.

Tableaux (12) and (13) illustrate that underlyingly short vowels lengthen in stressed open penults in Modern Standard Italian. Although candidate (b) violates both of the lower-ranked constraints once more than candidate (a), it is still optimal because candidate (a) does not satisfy the higher-ranked constraint requiring bimoraic stressed penults.

(12)

μ /vi le/ 'mean'	"BEMORAIC"	*MORA[HIGH]	DEPLINK-MORA[HIGH]
a. μ ví.le	*!	*	
b. ☞ μμ ví.le		**	*

(13)

μ /ka sa/ 'house'	"BEMORAIC"	*MORA[LOW]	DEPLINK-MORA[LOW]
a. μ ká.sa	*!	*	
b. ☞ μμ ká .sa		**	*

Tableaux (14) and (15) show that underlyingly long vowels surface as long. The difference between these two tableaux and the previous two is that DEPLINK-MORA[VOC] is not relevant since no vowel is lengthening.

(14)

μμ /vi le/ 'mean'	"BEMORAIC"	*MORA[HIGH]	DEPLINK-MORA[HIGH]
a. μ ví.le	*!	*	
b. ☞ μμ ví.le		**	

(15)

μμ /ká sa/ 'house'	"BEMORAIC"	*MORA[LOW]	DEPLINK-MORA[LOW]
a. μ ká .sa	*!	*	
b. ☞ μμ ká .sa		**	

The net result is that with an undominated coercive moraic constraint, it does not matter what the underlying moraic content of the vowel is, it will always surface as long.

3.2.1.3 Coerced More-sonorous Vowel Length

With the "BeMoraic" type of constraint ranked between the vowel markedness constraints, as in (5b) and (5c), more sonorous vowels are forced to lengthen but less sonorous vowels are not. An example of this type of language is Russian. According to Katherine Crosswhite (p.c.), Russian does not have distinctive vowel length. Instead, long vowels are found as the result of stress in some dialects. Standard Russian does not lengthen any stressed vowels, however, other dialects lengthen all non-high vowels and still other dialects lengthen only the low vowels. I will not provide data and tableau here, but rather leave the Russian vowel system for future research.

3.2.2 Summary of Coerced Vowel Length

Ranking coercive moraic markedness constraints with respect to the moraic markedness hierarchy for vowels yields three types of languages. One type language has no coerced weight for vowels. This results from ranking the coercive constraint below the markedness hierarchy. The second type of language has coerced weight for all vowels in some context. The example given was vowel lengthening in open stressed penults in Modern Standard Italian. This pattern results from ranking the coercive markedness constraint above the moraic markedness hierarchy for vowels. The third type of language has coerced length for the more sonorous vowels (low vowels in this case), but does not force the less sonorous vowels to lengthen. Russian is a language of this type. This pattern results from ranking the coercive markedness constraint between moraic markedness constraints.

3.2.3 Coerced Consonant Weight

As already noted in chapter 1, some languages have only non-moraic consonants, some languages force the more sonorous consonants to be moraic in some environment, and some languages force all consonants to be moraic in some environment. This is readily explained if we rank the relevant coercive weight constraint with respect to the markedness hierarchy. Given the simplified hierarchy in (16), we will examine and compare the relative behavior of the obstruents and sonorants.

(16) *MORA[OBS] >> *MORA[SON]

Using the “BEMORAIC” coercive markedness constraint as an example, the possible rankings are schematized in (17), and the factorial rankings given in (16).

(17) >> *MORA[OBS] >> >> *MORA[SON] >>

“BEMORAIC”

(18) a. *MORA[OBS] >> *MORA[SON] >> “BEMORAIC”

b. *MORA[OBS] >> “BEMORAIC” >> *MORA[SON]

c. “BEMORAIC” >> *MORA[OBS] >> *MORA[SON]

With the ranking in (18a), the coercive markedness constraint is ranked below the hierarchy. This results in no coerced weight for coda consonants. The ranking in (18b) results in coerced moraic sonorant codas, but not coerced moraic obstruent codas. Finally, the ranking in (18c) results in coerced moraic codas of all consonant types. This implicational relationship between sonority and moraicity does not hold for distinctive geminates because of the intervention of faithfulness constraints to be discussed in section 3.3.

3.2.3.1 No Coerced Consonant Weight

The first type of language is one in which there are no coerced moraic coda consonants. A language of this type is Khalkha Mongolian, which has only non-moraic consonants. The basic description of the facts comes from a combination of Bosson (1964) and Walker (1995).

In Khalkha Mongolian, main stress placement is completely predictable and dependent on syllable weight. In words containing only short vowels and no diphthongs, stress is on the initial syllable.

(19)	a.	[á.xa]	'brother'
	b.	[xá.da]	'mountain'

However, stress is weight sensitive and retracts from the initial syllable to the rightmost non-final syllable containing a long vowel or diphthong.

(20)	a.	[do.lóo.du.gaar]	'seventh'
	b.	[áa.ruul]	'dry cheese curds'
	c.	[da.lae.gáa.raa]	'by one's own sea'

What is important for our purpose here is that coda consonants do not add weight to syllables. That is, closed syllables are no heavier than their open counterparts. Closed syllables containing a single short vowel are treated the same by the stress system as plain open syllables containing single short vowels (21). Likewise, closed syllables containing long vowels or diphthongs are treated the same as open syllables containing these nuclei types.

(21) a. [bae.gúu.lag.dax] *[bae.guu.lág.dax] ‘to be organized’

b. [úit.gar.tae] *[uit.gár.tae] ‘sad’

As tableaux (22) and (23) demonstrate, with the constraint ranking in (18a), coda consonants surface as non-moraic in Khalkha Mongolian regardless of the underlying moraic status.

(22) Evaluated only over the penultimate syllable

	/baeguulagdax/ ‘to be organized’	*MORA[OBS]	“BEMORAIC”
a. ☞	σ μ bae.gúu.l a g.dax		*
b.	σ μ μ bae.guu.l á g.dax	*!	

Candidate (a) is optimal because although it violates the coercive markedness constraint requiring coda consonants to be moraic, candidate (b) violates the higher-ranked general markedness constraint against moraic obstruents.

(23) Evaluated only over the penultimate syllable

/uitgartae/ 'sad'	*MORA[SON]	"BEMORAIC"
a. ☞ σ μ úit.g a r.tae		*
b. σ μ μ uit.g á r.tae	*!	

Candidate (a) is optimal. The competing candidate (b) fatally violates the constraint against moraic sonorant consonants.

3.2.3.2 Coerced Weight for All Consonants

With a "BEMORAIC"[13] type of constraint ranked above the consonant moraic markedness hierarchy, as in (18c), all coda consonants are force to be moraic in some environment. A very straightforward example of this type of language is Cairene Arabic. The description and examples are from Kenstowicz (1994). In this language, stress is completely predictable from surface syllabification and syllable weight. In trisyllabic words, stress falls on the antepenult if all syllables are open and contain short vowels.

[13] The "BEMORAIC" constraint in this case is WEIGHTBYPOSITION.

(24)	a.	[ʕí.na.ba]	'a grape'
	b.	[ʕá.ra.bi]	'Arabic'
	c.	[z̩á.l̩a.t̩a]	'stone'

If either the penult or the antepenult are heavy, then stress is on the penult.

(25)	a.	[ga.ríi.da]	‘newspaper’
	b.	[fa.súl.ya]	‘green beans’
	c.	[t̩a.r̩áb.lus]	‘Tripoli’

(26)	a.	[qaa.hí.ra]	‘Cairo’
	b.	[fal.sá.fa]	‘philosophy’
	c.	[mak.tá.ba]	‘library’
	d.	[bus̩.t̩á.gi]	‘mailman’

As (25b,c) and (26b,c,d) show, heavy syllables can be closed by sonorants or obstruents. Tableaux (27) and (28) demonstrate that with the coercive moraic markedness constraint ranked above the moraic markedness hierarchy, all coda consonants surface as moraic.

(27)

/maktaba/ 'library'	"BEMORAIC"	*MORA[OBS]
a. σ μ m á k .ta.ba	*!	
b. ☞ σ μ μ m a k .tá.ba		*

(28)

/falsafa/ 'philosophy'	"BEMORAIC"	*MORA[SON]
a. σ μ f á l .sa.fa	*!	
b. ☞ σ μ μ f a l .sá.fa		*

In both of the above tableaux, candidate (a) fatally violates the constraint requiring coda consonants to be moraic. Although candidate (b) violates the constraint against moraic segments, it is still optimal because the coercive moraic markedness constraint takes precedence.

3.2.3.3 Coerced More-sonorous Consonant Weight

With a "BEMORAIC" constraint ranked between the consonant markedness constraints, as in (18b), sonorant codas are forced to be moraic, but obstruent codas are not. An example of this type of language is Lithuanian[14]. Zec (1988) has argued that only sonorants may be moraic in coda position in Lithuanian, despite the fact that all consonants may close syllables. One piece of evidence that she uses to support her assertion is that sonorant codas are not licit following long vowels; however, obstruent codas are. We can interpret these facts as a competition between a restriction on maximal syllable weight (29), the moraic markedness hierarchy, and the need to have coda consonants count for weight.

(29) ***TRIMORA –** Trimoraic syllables are prohibited.

As tableaux (30) and (31) show, with "BEMORAIC"[15] ranked between the consonant moraic markedness constraints for obstruents and sonorants, only sonorants surface as moraic.

[14] Struijke (1997) makes this same claim for Dutch.

[15] The "BEMORAIC" constraint in this case is WEIGHTBYPOSITION.

(30) Only the first syllable is evaluated

μμ / tu pti/ 'to perch'	*TRIMORA	*MORA[OBS]	"BEMORAIC"	MAXLINK-MORA[VOC]
a. ☞ σ μμ t u p.ti			*	
b. σ μμμ tu p.ti	*!	*!		
c. σ μμ t u p.ti		*!		*

Candidate (b) violates the two highly ranked constraints against trimoraic syllables and moraic obstruents. Therefore, it is sub-optimal. Candidate (c) violates the constraint against moraic obstruents and the faithfulness constraint to underlying vowel length. It is the violation of the constraint against moraic obstruents that is fatal. Candidate (a) violates the constraint requiring coda consonants to be moraic, but since the other candidates violate higher-ranked constraints, it is optimal.

(31) Only the first syllable is evaluated

μμ /ka rti/ 'to hang'	*TRIMORA	"BEMORAIC"	*MORA[SON]	MAXLINK-MORA[VOC]
a. σ μμ k a r.ti		*!		
b. σ μμμ k a r.ti	*!		*	
c. ☞ σ μμ k a r .ti			*	*

This tableau differs from (30) in that it evaluates the moraicity of sonorant codas. Here we see that the constraint against trimoraic syllables and the coercive moraic markedness constraint must be ranked above both the constraint against moraic sonorants and the constraint against shortening vowels. Candidate (a) fatally violates the constraint requiring moraic codas. Candidate (b) fatally violates the constraint against trimoraic syllables.

3.2.4 Summary of Coerced Consonant Weight

Ranking coercive moraic markedness constraints with respect to the moraic markedness hierarchy on consonants yields three types of languages. One type of language has no coerced consonant weight – for example, Khalkha Mongolian. This results from ranking the coercive constraint below the markedness hierarchy.

(32) *MORA[OBS] >> *MORA[SON] >> "BEMORAIC"

The second type of language has coerced weight for all consonants in some context – for example, Cairene Arabic. This pattern results from ranking the coercive markedness constraint above the moraic markedness hierarchy for consonants.

(33) "BEMORAIC" >> *MORA[OBS] >> *MORA[SON]

The third type of language has coerced weight for the more sonorous consonants, but does not force the less sonorous consonants to be moraic – for example, Lithuanian. This pattern results from ranking the coercive markedness constraint between the moraic markedness constraints.

(34) *MORA[OBS] >> "BEMORAIC" >> *MORA[SON]

3.2.5 Coerced Consonant and Vowel Weight

In sections 3.2.1 and 3.2.3, we examined the behavior of segments within the natural classes of vowels and consonants with respect to coerced moraicity. It was shown that the two systems are parallel in that there is a relationship between sonority and moraicity. If one segment of a given class is forced to be moraic in some environment, then more sonorous segments in that class will also be moraic in that environment. This parallel distribution is accounted for by a unified set of constraints. In this section, the implicational relationship between sonority and moraicity is shown to also be relevant between the classes of consonants and vowels, thus unifying completely the coercive weight system. However, an asymmetry is discovered when vowels and consonants compete for moraicity in the same token environment. I will show that this asymmetry is the direct result of constraint interaction.

As already noted, neutralization of vowel length is explained by the relative ranking of coercive moraicity constraints with the markedness constraints against moraic vowels. (35a) yields neutralization to short, while (35b) yields neutralization to long. Recall that *MORA[VOC] and *MORA[CON] are only shorthand for a more complete hierarchy. They are used here simply to setup a dichotomy between the natural classes of vowels and consonants.

(35) a. *MORA[VOC] >> "BEMORAIC"

b. "BEMORAIC" >> *MORA[VOC]

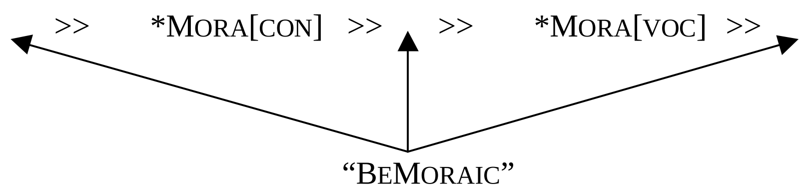
Likewise, consonants are neutralized to non-moraic by ranking the moraic markedness hierarchy above the coercive markedness constraints (36a); and neutralization to moraic by ranking the hierarchy below the coercive markedness constraints (36b).

(36) a. *MORA[CON] >> "BEMORAIC"

b. "BEMORAIC" >> *MORA[CON]

Using the same reasoning, we can also account for the implicational relationship there seems to be between consonant moraicity and vowel length schematized in (37).

(37)



(38) a. *MORA[CON] >> *MORA[VOC] >> "BEMORAIC"

b. *MORA[CON] >> "BEMORAIC" >> *MORA[VOC]

c. "BEMORAIC" >> *MORA[CON] >> *MORA[VOC]

The ranking in (38a) has already been discussed. Basically, it results in no coerced moraicity of any vowel or any consonant. The ranking in (38b) has also been discussed, and results in coerced moraicity for all vowels, but not for consonants. The new case is the one with the ranking in (38c). This ranking potentially results in coerced weight in all segments in some context.

There is a difficulty, however, in evaluating this comparison of consonants and vowels in a single environment. In the cases discussed in the previous two sections, there was never an environment in which the two types of segments under discussion were competing for the same mora at the same time. Either a high and low vowel were compared in parallel environments, or an obstruent and a sonorant were compared in parallel environments. However, note that in the present situation any environment in which a vowel and a consonant can be compared will necessarily have both (e.g. [VC]). Therefore, the two segment types will compete within the same form for a mora forced by a coercive markedness constraint that does not specify segment type. The prediction made by the universal markedness hierarchy in this competitive context is that the vowel will always lengthen rather than the consonant becoming moraic. This is illustrated in the following tableau. Recall that I am only discussing “pure” coercive weight, meaning that faithfulness constraints on underlying moraicity are ranked low.

(39)

μ /CVC/	“BEMORAIC”	*MORA[CON]	*MORA[VOC]
a. σ μ C V C	*!		*
b. σ μ μ C V C		*!	*
c. ☞ σ μμ C V C			**

Candidate (a) fails because it violates the highly-ranked constraint that requires the monosyllable to be minimally bimoraic. Candidate (b) fails because it violates the constraint against moraic consonants. Despite the fact that candidate (c) has one more violation of the constraint against moraic vowels than the other two candidate, it is optimal because the other candidates fatally violate higher-ranked constraints.

This asymmetry in segment weight, due to the nature of the constraint interaction and basic syllabification, harkens back a well-known generalization of Trubetzkoy (1939). Trubetzkoy asserted that if a language has heavy CVC syllables, it will also have heavy CVV syllables. Zec (1988) claims to derive this generalization from the implicational relationship between sonority and moraicity, and at first glance, (39) seems to support this claim. However, upon closer inspection, (39) says something quite different. It really shows that given a coercive weight constraint that does not specify the target of the weight requirement (e.g. FOOTBINARITY), vowels will lengthen.

In contrast, if a coercive moraic markedness constraint specifies that the target of the weight requirement is a consonant (e.g. WEIGHTBYPOSITION), then consonants can be forced to be moraic despite the universal moraic markedness hierarchy. This is shown in (40).

(40)

μ /CVC/	WBYP	*MORA[CON]	*MORA[VOC]
a. σ μ C V C	*!		*
b. ☞ σ μ μ C V C		*	*
c. σ μμ C V C	*!		**

Candidates (a) and (c) both lose due to violations of the constraint requiring coda consonants to be moraic. Candidate (b) wins despite the violation of the consonant moraic markedness constraint.

Given just the constraints used in tableau (40), it is possible to imagine a language with heavy closed syllables, but no long vowels. With WBYP ranked above the consonant moraic markedness constraint, and all "non-segment specific" moraic markedness constraints ranked below the entire moraic markedness constraints, consonants are forced to be moraic and vowels are always short. This would be a clear violation of Trubetzkoy's generalization. As it turns out, there are such exceptions to Trubetzkoy's "universal" – for example, Ilokano (Morén forthcoming).

For now, I will demonstrate that a general coercive moraic markedness constraint can force a language to lengthen vowels not consonants. In many iambic languages, there is a condition that stressed syllables be heavy. If this requirement is not met via underlying weight, then iambic lengthening takes place. One such language is Choctaw (Lombardi and McCarthy 1991; Buckley 1998). In Choctaw, open stressed syllables necessarily contain long vowels, as shown in (41).[16] All examples are from Nicklas (1975). Foot structure is represented with parentheses.

[16] Except final syllables that never contain long vowels in open syllables. This is easily explained with the constraint against final long vowels used for Hungarian and Italian in chapter 4.

(41) a. [(ha.bíi).na] 's/he receives a present'

b. [(pi.sáa).li] 'I see'

c. [(t͡ʃi.píi).sa] 's/he sees you'

The forms in (42), without iambic lengthening, are illicit.

(42) a. *[(ha.bí).na]

b. *[(pi.sá).li]

c. *[(t͡ʃi.pí).sa]

Tableau (43) shows that with a coercive moraic markedness constraint ranked above the constraint against moraic vowels, vowels lengthen in stressed syllables.

(43) Only the stressed syllable is evaluated

μ /ha.bi.na/ 's/he receives a present'	"BEMORAIC"	*MORA[VOC]
a. σ μ ha. b í .na	*!	*
b. ☞ σ μ μ ha. b í .na		**

Candidate (a) fatally violates the constraint that requires stressed syllables to be heavy. Although candidate (b) has one more violation of the constraint against moraic vowels, the competing candidate violates the higher-ranked constraint.

Note that in addition to the optimal candidate (b) in which vowel lengthening occurs, and the sub-optimal candidate (a) that surfaces with a short vowel, there is yet another possibility – a candidate in which the following consonant becomes moraic, [ha.bín.na]. (44) shows that this candidate cannot be optimal because the universal markedness hierarchy dictates that it is always better to add a mora to a vowel than to a consonant.

(44)

μ /ha.bi.na/ ‘s/he receives a present’	“BEMORAIC”	*MORA[CON]	*MORA[VOC]
a. σ μ ha. b í .na	*!		*
b. ☞ σ μ μ ha. b í .na			**
c. σ μ μ ha. b í n a		*!	*

Section 3.4 and chapter 4 will show that despite this prediction implicit in the universal markedness hierarchy coerced consonant gemination is possible under two conditions: first, under the influence of moraic faithfulness constraints; and second,

under the influence of a higher-ranked constraint prohibiting vowel lengthening in a given context.

3.2.6 Summary of Coercive Weight Patterns

(45) >> *MORA[OBS] >> >>*MORA[SON] >> >> *MORA[HIGH] >> >> *MORA[LOW] >>

"BEMORAIC"

(45) schematizes some of the possible constraint rankings between a coercive moraic markedness constraint and the universal moraic markedness hierarchy. We have seen that given coercive constraints specific to segment type, there is symmetry between the coerced weight of vowels and consonants depending on whether the coercive constraint is ranked above, below, or between the moraic markedness constraints for the specified segment type. However, we have also seen that an asymmetry arises when the segmental scope of the coercive markedness constraint is not specified. In this case, since consonants and vowels will always compete for the coerced mora when a consonant is present in a given environment, the vowel will always receive the mora and the consonant cannot be moraic under coercion.

3.3 Distinctive Weight

Recall from chapter 1 that both vowels and consonants can have distinctive weight depending on the language, the quality of the segment, and the particular phonological environment. For example, Khalkha Mongolian has distinctive length for all vowels in all contexts, but consonants are never moraic. Conversely, Modern Standard Italian has distinctive length for all consonants, but vowel length is completely predictable from the context. Some languages have distinctive length for only some of the vowel inventory, for example Persian (Windfuhr 1997), while some languages have distinctive weight for only some of the consonant inventory, for example Chechen (Nichols 1997).

Also recall that although Zec (1988) claims that moraicity is closely bound to sonority, this relationship does not seem to hold for distinctive moraicity. As was shown in the survey of geminate consonants in chapter 1, some languages have distinctive weight for only more sonorous segments, for example Hausa (Newman 1997), while others have distinctive weight for only less sonorous segments, for example Chechen (Nichols 1997). In this section, I will discuss the constraint interactions responsible for the observed cross-linguistic patterns of distinctive moraicity.

I propose that distinctive weight patterns result from the ranking of a class of faithfulness constraints with respect to the universal markedness hierarchy. I will argue that the relatively free distribution of distinctive weight (the fact that it does not follow sonority) is a direct consequence of the fact that the faithfulness constraints are relative to different sonority classes of segments and the fact that they can freely re-rank with respect to each other and the universal moraic markedness hierarchy.

3.3.1 Distinctiveness of Vowel Length

Let us begin with the basic patterns of distinctive vowel length found in the world's languages. For ease of exposition, the following discussion will focus on the tripartition of high, mid and low vowels. The following chart summarizes the relevant patterns:

(46) Languages and Vowel Classes with Distinctive Length

HIGH	**MID**	**LOW**	**Languages**	**Reference**
yes	yes	yes	Hawaiian Hungarian Khalkha Mongolian	Chapter 4 Chapter 4 Svantesson 1994
no	yes	yes	Afgani Persian	Windfuhr 1997
no	no	yes	Irani Persian	Windfuhr 1997
yes	no	yes	Baloch, Brahui	Elfenbein 1997
yes	yes	no	Standard American English Metropolitan New York English	Moulton 1990 and Morén 1997 Chapter 4
yes	no	no	Atayal	Crothers 1978[17]
no	yes	no	(accidental gap)	
no	no	no	Icelandic Italian Gujarati Chechen	Chapter 4 Chapter 4 Mistry 1997 Nichols 1997

From table (46), we can conclude that vowel length distinctions are fairly free in distribution, and that sonority does not seem to play a significant role. There are languages with distinctive length for less sonorous vowels, but not more sonorous

[17] Original source – Egerod 1966.

vowels, and there are languages with distinctive length for more sonorous vowels, but not less sonorous vowels. The one language type not found in the table, but predicted to exist has distinctive weight only for the mid vowels. I claim that the gap here is merely accidental.[18]

3.3.1.1 No Distinctive Vowel Length

To account for languages that do not have distinctive length in any vowel, we must rank the moraic markedness constraint for each type of vowel above the corresponding vowel weight faithfulness constraint. The generic faithfulness constraints from chapter 2 are repeated in short form in (47) and (48) for convenience.

(47) **DEPLINK-MORA[SEG] –** "Do not add morae to segments."

(48) **MAXLINK-MORA[SEG] –** "Do not delete morae from segments."

[18] In fact, I may have inadvertently, but systematically, disregarded languages of this type in an effort to not confuse a length distinction with a tense/lax distinction. Given the common occurrence of concurrent quantity and quality differences among vowels with length differences, it is possible that some languages that have been described as having a seven vowel system with a tensing distinction in the mid vowels (e.g. [i, u, e, ɛ, o, ɔ, a]) may actually have a length distinction (e.g. [i, u, ee, ɛ, oo, ɔ, a] or [i, u, ee, e, oo, o, a]).

Recall from chapter 2 that without an active coercive moraic markedness constraint, the constraint in (47) does not show a visible effect. Only the relative ranking of the MAXLINK-MORA[SEG] constraints and the universal moraic markedness constraints yield different language types.

To account for a language without distinctive length for any vowel, the general moraic markedness constraints must outrank the faithfulness constraint against deleting underlying morae from vowels.

(49) a. *MORA[HIGH] >> MAXLINK-MORA[HIGH]

b. *MORA[MID] >> MAXLINK-MORA[MID]

c. *MORA[LOW] >> MAXLINK-MORA[LOW]

An example of a language that has these constraint rankings is Gujarati. Gujarati, an Indo-Aryan language spoken in India has only short vowels. All examples are from Mistry (1997).

(50)	a.	[mil]	‘textile factory’
	b.	[cu.ri]	‘crushed’
	c.	[mel]	‘put down’
	d.	[co.ri]	‘theft’
	e.	[mal]	‘luggage’
	f.	[ca.ri]	‘was grazed’

Long vowels are prohibited.

(51) a. *[miil]

b. *[cuu.ri]

c. *[meel]

d. *[coo.ri]

e. *[maal]

f. *[caa.ri]

Since there is no contrast between long and short vowels in any environment, we must ensure that either a long or a short vowel in the underlying form surfaces as short. This is to satisfy the condition proposed by Prince and Smolensky (1993) called Richness of the Base. Richness of the Base states that there are no restrictions on the lexicon, and that the grammar (constraint ranking) must ensure that a lack of contrast is manifested on the surface regardless of the input. In the case of non-distinctive vowel length, either a long or a short vowel in the input will surface as short in Gujarati.

Tableaux (52) and (53) show that with the constraint ranking in (49a), either a long or short high vowel in the input will surface as short in Gujarati syllables. In (52), a short vowel in the input surfaces as short straightforwardly due to the moraic markedness constraint. Note that the markedness constraints are gradient so that a long vowel receives two marks while a short vowel receives only one.

(52) Only the initial syllable is evaluated

μ /c u ri/ ‘crushed’	*MORA[HIGH]	MAXLINK-MORA[HIGH]
a. ☞ σ μ c u .ri	*	
b. σ μμ c u .ri	**!	

Candidate (a) violates the constraint against moraic high vowels one less time than candidate (b). Therefore, it is optimal. The faithfulness constraint does not apply because no underlying morae are being lost. Although not shown, DEPLINK-MORA[HIGH] is also violated once more for candidate (b) than for candidate (a) because it has added a mora to a vowel that was not here underlyingly.

Tableau (53) demonstrates that the faithfulness constraint must be lower ranked than the markedness constraint to ensure that underlyingly long vowels surface as short.

(53) Only the initial syllable is evaluated

μμ /c u ri/ ‘crushed’	*MORA[HIGH]	MAXLINK-MORA[HIGH]
a. ☞ σ μ c u .ri	*	*
b. σ μμ c u .ri	**!	

Although candidate (a) violates the faithfulness constraint once more than candidate (b) because it has shortened an underlyingly long vowel, the additional violation of the higher-ranked markedness constraint that candidate (b) incurs makes (a) optimal. Although not shown, MAX-MORA is also violated by candidate (a) because an underlying mora is deleted.

Similarly, tableaux (54) and (55) demonstrate that low vowels also surface as short regardless of their underlying moraic content.

(54) Only the initial syllable is evaluated

μ /c a ri/ 'was grazed'	*MORA[LOW]	MAXLINK-MORA[LOW]
σ μ a. ☞ c a .ri	*	
σ μμ b. c a .ri	**!	

(55) Only the initial syllable is evaluated

μμ /c a ri/ 'was grazed'	*MORA[LOW]	MAXLINK-MORA[LOW]
σ μ a. ☞ c a .ri	*	*
σ μμ b. c a .ri	**!	

To summarize, ranking the moraic markedness constraints on vowels above the relevant moraic association faithfulness constraints, vowel length is non-distinctive. All vowels will be short unless forced to lengthen as the result of coercion. Combining the universal moraic markedness hierarchy with the faithfulness constraints on underlying moraicity, the following hierarchy yields non-distinctive vowel length:

(56) Non-distinctive vowel length

*MORA[HIGH]	
*MORA[MID]	MAXLINK-MORA[HIGH]
*MORA[LOW]	MAXLINK-MORA[MID]
	MAXLINK-MORA[LOW]

The core ranking is:

(57) Non-distinctive vowel length

*MORA[VOC]

MAXLINK-MORA[VOC]

3.3.1.2 Distinctive Vowel Length for All Vowels

The second type of vowel length pattern to be discussed is one in which all vowels have distinctive length. The constraint ranking resulting in this type of language has faithfulness constraints against deleting underlying morae from any vowel ranked above the universal moraic markedness hierarchy constraint for the each type of vowel. Khalkha Mongolian is a language in which all vowels have distinctive length.

In Khalkha Mongolian, all vowels can appear as either long or short in any syllable.

(58)	a.	[áxa]	‘brother’
	b.	[áa.ruul]	‘dry cheese curds’
	c.	[do.lóo.du.gaar]	‘seventh’
	d.	[u.laan.báa.ta.raas]	‘ulaanbaatar’ (ablative)

Not only is vowel length unpredictable in its occurrence, but it can cause a difference in meaning. (59a-d) shows minimal pairs differing only in vowel length.

(59)	a.	[ter]	‘pillow’
	b.	[teer]	‘above’
	c.	[tá.rax]	‘to press’
	d.	[táa.rax]	‘to feel cold’

To ensure that all vowels that are underlyingly short remain short on the surface and all vowels that are underlyingly long remain long on the surface, the constraint rankings in (60) must hold. Just as in the previous subsection, only high and low vowels are evaluated for ease of exposition.

(60) a. MAXLINK-MORA[HIGH] >> *MORA[HIGH]

b. MAXLINK-MORA[MID] >> *MORA[MID]

c. MAXLINK-MORA[LOW] >> *MORA[LOW]

As the tableaux in (61) and (62) show, a short high vowel in the input surfaces as short and long high vowel surfaces as long.

(61)

μ l i mb ‘flute’	MAXLINK-MORA[HIGH]	*MORA[HIGH]
σ μ a. ☞ l i mb		*
σ μμ b. l i mb		**!

Candidate (b) fatally violates the markedness constraint against moraic high vowels once more than candidate (a). Therefore, candidate (a) is optimal.

(62)

μμ t u xt ‘historical’	MAXLINK-MORA[HIGH]	*MORA[HIGH]
σ μ a. t u x t	*!	*
σ μμ b. ☞ t u x t		**

Although candidate (b) violates the markedness constraint once more than candidate (a) does, it is optimal because candidate (a) violates the higher-ranked constraint against shortening underlyingly long high vowels.

Similarly, tableaux (63) and (64) demonstrate that faithfulness ranked above markedness gives rise to distinctive low vowel length.

(63)

μ a rd 'people'	MAXLINK-MORA[LOW]	*MORA[LOW]
a. ☞ σ μ a r d		*
b. σ μμ a r d		**!

Candidate (b) fatally violates the markedness constraint against moraic low vowels once more than candidate (a). Therefore, candidate (a) is optimal.

(64)

μμ a rc 'curds'	MAXLINK-MORA[LOW]	*MORA[LOW]
a. σ μ a r c	*!	*
b. ☞ σ μμ a r c		**

Although candidate (b) violates the markedness constraint once more than candidate (a) does, it is optimal because candidate (a) violates the higher-ranked constraint against shortening underlyingly long low vowels.

To summarize, ranking the moraic markedness constraints on vowels below the relevant moraic association faithfulness constraints, vowel length is distinctive. All underlyingly short and long vowels will surface as short or long, respectively. Combining the universal markedness hierarchy with the faithfulness constraints, the following hierarchy yields distinctive vowel length:

(65) Distinctive vowel length

MAXLINK-MORA[HIGH]

MAXLINK-MORA[MID] *MORA[HIGH]

MAXLINK-MORA[LOW] *MORA[MID]

*MORA[LOW]

The core ranking is:

(66) Distinctive vowel length

MAXLINK-MORA[VOC]

*MORA[VOC]

3.3.1.3 Distinctive Length for Less-sonorous Vowels Only

The third type of vowel length pattern to be discussed is one in which the less-sonorous vowels have distinctive length but more-sonorous vowels do not. The constraint ranking resulting in this type of language has vowel length faithfulness for less-sonorous vowels ranked above the moraic markedness constraints for those vowels, and vowel length faithfulness for more-sonorous vowels ranked below the moraic markedness constraints for those vowels.

(67) a. MAXLINK-MORA[HIGH] >> *MORA[HIGH]

b. *MORA[MID] >> MAXLINK-MORA[MID]

c. *MORA[LOW] >> MAXLINK-MORA[LOW]

Although there are a number of languages that fall into this category, the difficulty is that most of the languages neutralize the more-sonorous vowels to long. For example, Standard American English has distinctive length for the high and mid vowels, but the low back vowel only surfaces as long. Likewise, Brahui and Baloch have distinctive length for high (and low) vowels, but the mid vowels always surface as long. In these cases, there is a complication to the analysis that requires the interaction of the constraints under discussion with a coercive moraic markedness constraint.

The only language I have found that is claimed to have distinctive length for the high vowels, but only short low and mid vowels is Atayal. According to Crothers (1978), Atayal has the vowel system shown in (68).

(68)

ii i	u uu
ɛ	ɔ
a	

Although Crothers does not give any words from this language, it is easy to surmise what the relevant forms might look like.

(69) a. [Ci.CV]

b. [Cii.CV]

c. [Cɛ.CV]

d. [Cɔ.CV]

e. [Ca.CV]

f. *[Cɛɛ.CV]

g. *[Cɔɔ.CV]

h. *[Caa.CV]

As the tableaux in (70) and (71) show, a short high vowel in the input surfaces as short and long high vowel surfaces as long with the ranking in (67a).

(70) Only the initial syllable is evaluated

μ C i CV	MAXLINK-MORA[HIGH]	*MORA[HIGH]
a. ☞ σ μ C i CV		*
b. σ μμ C i CV		**!

Candidate (b) fatally violates the markedness constraint against moraic high vowels once more than candidate (a). Therefore, candidate (a) is optimal.

(71) Only the initial syllable is evaluated

μμ C i CV	MAXLINK-MORA[HIGH]	*MORA[HIGH]
a. σ μ C i CV	*!	*
b. ☞ σ μμ C i CV		**

Although candidate (b) violates the markedness constraint once more than candidate (a) does, it is optimal because candidate (a) violates the higher-ranked constraint against shortening underlyingly long high vowels.

In contrast, tableaux (72) and (73) demonstrate that low vowels surface as short regardless of their underlying moraic content.

(72) Only the initial syllable is evaluated

μ C a CV	*MORA[LOW]	MAXLINK-MORA[LOW]
a. ☞ σ μ C a CV	*	
b. σ μμ C a CV	**!	

(73) Only the initial syllable is evaluated

μμ C a CV	*MORA[LOW]	MAXLINK-MORA[LOW]
a. ☞ σ μ C a CV	*	*
b. σ μμ C a CV	**!	

Although candidate (a) violates the faithfulness constraint, candidate (b) fatally violates the higher-ranked markedness constraint once more than (a).

To summarize, ranking the moraic markedness constraint on less-sonorous vowels below the relevant moraic association faithfulness constraints results in distinctive length for those vowels. Ranking the faithfulness constraint relevant to more-sonorous vowels below the moraic markedness hierarchy yields non-distinctive length for those vowels. In the case of Atayal, a higher-ranked coercive markedness constraint forces low and mid vowels to neutralize to short on the surface.

(74) Non-distinctive low and mid vowel length and distinctive high vowel length

MAXLINK-MORA[HIGH]

*MORA[HIGH]

*MORA[MID]

*MORA[LOW]　　MAXLINK-MORA[MID]

MAXLINK-MORA[LOW]

It is important to note that faithfulness constraints relativized to different vowel (segment) types are needed to get this result. A single faithfulness constraint predicts sonority-based generalizations that are simply not true.

3.3.1.4 Distinctive Length for More-sonorous Vowels Only

The final type of distinctive vowel length language to be addressed here is one in which more-sonorous vowels have distinctive length, but less-sonorous vowels do not – essentially, the opposite pattern than that seen in the case of Atayal. By now, the analysis of this type of language should be self-evident. Ranking faithfulness to more-sonorous vowel length above the appropriate vowel moraic markedness constraint will result in distinctive length for those vowels, while the opposite ranking of the less-sonorous vowel constraints results in non-distinctive less-sonorous vowel length. One language of this type is Irani Persian.

In Irani Persian, all vowels are short except the low vowel that has distinctive length. All data is from Windfuhr (1997). (75) shows minimal pairs differentiated only by the length of the low vowel.

(75) a. [kam] 'little'

b. [kaam] 'desire'

c. [kar] 'deaf'

d. [kaar] 'work'

(76) provides some examples of short high and mid vowels.

(76) a. [pul] 'money'

b. [pol] 'bridge'

c. [ki] 'who'

d. [ke] 'that'

e. *[puul]

f. *[kee]

To ensure that high and mid vowels are always short, the markedness constraints against moraic high and mid vowels must be ranked above the faithfulness constraint requiring that underlyingly long high and mid vowels surface as such. These rankings are given in (77).

(77) a. *MORA[HIGH] >> MAXLINK-MORA[HIGH]

b. *MORA[MID] >> MAXLINK-MORA[MID]

In contrast, to ensure that underlyingly long low vowels surface as long, the faithfulness constraint on underlying moraicity for low vowels must be ranked above the markedness constraint against moraic low vowels.

(78) a. MAXLINK-MORA[LOW] >> *MORA[LOW]

Tableaux (79) and (80) show that underlyingly long high and mid vowels surface as short.

(79)

μ μ ki ‘who’	*MORA[HIGH]	*MAXLINK-MORA[HIGH]
a. ☞ σ μ k i	*	*
b. σ μμ k i	**!	

(80)

μ μ ke ‘that’	*MORA[MID]	*MAXLINK-MORA[MD]
a. ☞ σ μ k e	*	*
b. σ μμ k e	**!	

In both tableaux, candidate (b) fatally violates the higher-ranked constraint against moraic vowels once more than candidate (a) does.

In contrast, tableaux (81) and (82) demonstrate that underlyingly long and short low vowels surface as such because faithfulness outranks markedness.

(81)

μ μ kam 'desire'	MAXLINK-MORA[LOW]	*MORA[LOW]
a. σ μ k a m	*!	*
b. ☞ σ μμ k a m		**

(82)

μ ka m 'little'	MAXLINK-MORA[LOW]	*MORA[LOW]
a. ☞ σ μ k a m		*
b. σ μμ k a m		**!

To summarize, ranking the moraic markedness constraint on more-sonorous vowels below the relevant moraic association faithfulness constraints results in distinctive length for those vowels. Ranking the faithfulness constraint relevant to less-sonorous vowels below the moraic markedness hierarchy yields non-distinctive length for those vowels.

(83) Non-distinctive high and mid vowel length and distinctive low vowel length

*MORA[HIGH]

MAXLINK-MORA[LOW] *MORA[MID] MAXLINK-MORA[HIGH]

*MORA[LOW] MAXLINK-MORA[MID]

3.3.2 Distinctiveness of Consonant Weight

In the following section, I will show that consonant weight distinctiveness patterns are not only parallel to those just seen for vowel length, but that similar constraint rankings yield these parallel systems.

Let us begin with the basic patterns of distinctive consonant weight found in the world’s languages. The following chart summarizes some of the relevant patterns:

(84) Languages, Consonant Classes, and Distinctive Weight

STOP	**CONT**	**SON**	**Languages**	**References**
yes	yes	yes	Hungarian Modern Standard Italian Baloch Brahui Gajarati	Chapter 4 Chapter 4 Elfenbein 1997 Elfenbein 1997 Mistry 1997
no	yes	yes	(accidental gap)	
no	no	yes	Hausa	Newman 1997
yes	no	yes	Kurdish	McCarus 1997
yes	yes	no	Chechen Lak	Nichols 1997 Anderson 1997
yes	no	no	(accidental gap)	
no	yes	no	Tartar	Comrie 1997
no	no	no	Khalkha Mongolian Hawaiian Burushaski Chaha	Svantesson 1994 Chapter 4 Anderson 1997 Leslau 1997

From the chart we can conclude that consonant weight distinctions are fairly free in distribution, and that sonority does not seem to play a role. For ease of exposition, the following discussion will focus on the dichotomy between more and less sonorous consonants, and will not exhaust all possible patterns. As in the vowel patterns, moraic faithfulness constraints relativized to different consonant (segment) types are needed to get this result. A single faithfulness constraint predicts sonority-based generalizations that are simply not true.

3.3.2.1 No Distinctive Consonant Weight

To account for languages that do not have distinctive weight for any consonant, we must rank the moraic markedness hierarchy above the consonant weight faithfulness constraints relevant to each type of consonant. The relevant constraint rankings are given in (85).

(85) a. *MORA[STOP] >> MAXLINK-MORA[STOP]

b. *MORA[CONT] >> MAXLINK-MORA[CONT]

c. *MORA[SON] >> MAXLINK-MORA[SON]

An example of a language that has these constraint rankings is Khalkha Mongolian. As discussed in chapter 1, Khalkha Mongolian has coda consonants, but these codas do not count for weight in the stress system. This includes a lack of heavy geminate consonants. Intervocalic consonants always surface as onsets.

(86)	a.	[ja.la]	‘fly’
	b.	[sa.xəl]	‘beard’
	c.	[a.dω]	‘horse’
	d.	*[jal.la]	
	e.	*[sax.xəl]	
	f.	*[ad.dω]	

Since there is no contrast between long and short consonants in this language, we must ensure that either a moraic or a non-moraic consonant in the input surfaces as non-moraic in the output. This is to satisfy Richness of the Base (Prince and Smolensky 1993). Tableau (87) shows that with the constraint ranking in (85a), an underlyingly moraic stop in the input will surface as non-moraic. Note that only those constraints and structures relevant to consonant moraicity are shown.

(87)

μ /adω/ 'horse'	*MORA[STOP]	MAXLINK-MORA[STOP]
a. ☞ σ σ μ μ a d ω		*
b. σ σ μ μ μ a d ω	*!	

Although candidate (a) violates the faithfulness constraint by losing the underlying mora from the consonant, candidate (b) fatally violates the higher-ranked constraint against moraic stops.

Similarly, (88) demonstrates that intervocalic sonorants surface as non-moraic even if underlying moraic.

(88)

μ /jala/ 'fly'	*Mora[son]	MaxLink-Mora[son]
a. ☞ σ σ μ μ j a l a		*
b. σ σ μ μ μ j a l a	*!	

Although candidate (a) violates the faithfulness constraint by losing the underlying mora from the consonant, candidate (b) fatally violates the higher-ranked constraint against moraic sonorants.

To summarize, ranking the moraic markedness constraints on consonants above the relevant moraic association faithfulness constraints, consonant weight is non-distinctive. Combining the universal markedness hierarchy with the faithfulness constraints, the following hierarchy yields non-distinctive consonant weight:

(89) Non-distinctive consonant weight

*Mora[stop]

*Mora[cont] MaxLink-Mora[stop]

*Mora[son] MaxLink-Mora[cont]

MaxLink-Mora[son]

The core ranking is:

(90) Non-distinctive consonant weight

*MORA[CON]
|
MAXLINK-MORA[CON]

3.3.2.2 Distinctive Consonant Weight for All Consonants

The second type of distinctive consonant weight pattern to be discussed is one in which all consonants have distinctive weight. The constraint ranking resulting in this type of language has moraicity faithfulness constraints for all consonants ranked above the corresponding moraic markedness constraints for consonants. Gujarati is a language of this type.

In Gujarati, all consonants can appear as either long or short intervocalically (Mistry 1997). (91) and (92) give examples of words containing short and long consonants, respectively.

(91)	a.	[pa.kũ]	‘ripe’
	b.	[pi.ʃe]	‘will drink’
	c.	[sa.me]	‘in front of’

(92) a. [sik.ko] ‘coin’

b. [kis.so] ‘episode’

c. [d^hum.məs] ‘mist’

To ensure that all intervocalic consonants that are underlyingly moraic remain so on the surface, the constraint against deleting underlying consonant morae must be ranked above the constraint against moraic consonants. The constraint rankings are given in (93).

(93) a. MAXLINK-MORA[STOP] >> *MORA[STOP]

b. MAXLINK-MORA[CONT] >> *MORA[CONT]

c. MAXLINK-MORA[SON] >> *MORA[SON]

As tableaux (94) and (95) demonstrate, underlyingly moraic and non-moraic intervocalic stops surface as moraic and non-moraic, respectively.

(94)

μ /siko/ ‘coin’	MAXLINK-MORA[STOP]	*MORA[STOP]
a. σ σ μ μ s i k o	*!	
b. ☞ σ σ μ μ μ s i k o		*

Candidate (a) fatally violates the faithfulness constraint ensuring that underlying morae associated with a stop surface associated with the stop. Candidate (b) only violates the lower-ranked moraic markedness constraint.

As (95) shows, underlyingly non-moraic intervocalic stops surface as non-moraic.

(95)

/pakũ / ‘ripe’	MAXLINK-MORA[STOP]	*MORA[STOP]
a. ☞ σ σ μ μ p a k ũ		
b. σ σ μ μ μ p a k ũ		*!

Candidate (a) is optimal because it does not violate either of these constraints, while candidate (b) violates the moraic markedness constraint.

Likewise, tableaux (96) and (97) demonstrate that faithfulness ranked above markedness gives rise to distinctive sonorant weight. The tableaux are evaluated identically to (94) and (95).

(96)

μ /bəne / ‘both’	MAXLINK-MORA[SON]	*MORA[SON]
a. σ σ μ μ b ə n e	*!	
b. ☞ σ σ μ μ μ b ə n e		*

(97)

/bəne / ‘may happen’	MAXLINK-MORA[SON]	*MORA[SON]
a. ☞ σ σ μ μ b ə n e		
b. σ σ μ μ μ b ə n e		*!

To summarize, ranking the moraic markedness constraints on consonants below the relevant moraic association faithfulness constraints, consonant weight is distinctive. All underlyingly short and long consonants will surface as short or long, respectively. Combining the universal markedness hierarchy with the faithfulness constraints, the following hierarchy yields distinctive consonant weight:

(98) Distinctive consonant weight

MAXLINK-MORA[STOP]

MAXLINK-MORA[FRIC] *MORA[STOP]

MAXLINK-MORA[SON] *MORA[FRIC]

*MORA[SON]

The core ranking is:

(99) Distinctive consonant weight

MAXLINK-MORA[CON]

*MORA[CON]

3.3.2.3 Distinctive Weight for Less-sonorous Consonants Only

The third type of distinctive consonant weight pattern to be discussed is one in which the less-sonorous consonants have distinctive weight but more-sonorous consonants do not. The constraint ranking resulting in this type of language has consonant moraicity faithfulness for less-sonorous consonants ranked above the corresponding moraic markedness constraint, and consonant moraic faithfulness for more-sonorous consonants ranked below the appropriate moraic markedness constraint.

In Chechen, a Caucasus language, plain non-palatal stops and fricatives have distinctive intervocalic length. Sonorant intervocalic geminates result only from morphological (e.g. focus) gemination (Nichols 1997). Although she does not give examples of morphologically simplex words with intervocalic geminate consonants, the generalizations she gives are clear.

(100) a. [lät.ta] ‘stand-pres.’

b. [le.ta] ‘stick to-pres.’

c. [CV.nV]

d. *[CVn.nV]

If we assume that the faithfulness constraint on stop moraicity is higher-ranked than the moraic markedness constraint for stops, then the distribution of stop geminates follows. As (101) demonstrates, underlyingly moraic intervocalic stops surface as moraic.

(101)

μ /läta/ ‘stand-pres.’	MAXLINK-MORA[STOP]	*MORA[STOP]
a. σ σ μ μ l ä t a	*!	
b. ☞ σ σ μ μ μ l ä t a		*

Candidate (a) fatally violates the moraic faithfulness constraint.

On the contrary, tableau (102) demonstrates that faithfulness ranked below markedness gives rise to underlyingly moraic sonorants surfacing as non-moraic.

(102)

μ /läna/ (hypothetical)	*Mora[son]	MaxLink-Mora[son]
a. ☞ σ σ μ μ l ä n a		*
b. σ σ μ μ μ l ä n a	*!	

Candidate (b) fatally violates the markedness constraint against moraic sonorants.

To summarize, ranking the moraic markedness constraint on obstruents below the relevant moraic association faithfulness constraint results in distinctive obstruent weight. Ranking the faithfulness constraint relevant to sonorants below the moraic markedness hierarchy yields sonorant neutralization.

(103) Non-distinctive sonorant weight and distinctive obstruent weight

MaxLink-Mora[stop]

MaxLink-Mora[cont] *Mora[stop]

*Mora[cont]

*Mora[son]

MaxLink-Mora[son]

As further support for the claim that distinctive consonant moraicity does not follow the sonority sequence, let us divide the moraic markedness hierarchy relevant to the consonants in one more way. Within the class of obstruents, there are languages that allow geminate voiceless stops, but not geminate voiced stops. To find a language of this type, we need only examine Japanese.

Within the Japanese stop class, only voiceless stops can be geminates in the native vocabulary. Long voiced stops are prohibited (Itô and Mester 1995, Fukazawa 1999).

(104)	a.	[yuk.kuri]	‘slowly’
	b.	*[yug.guri]	
	c.	[kat.ta]	‘buy – past’
	d.	*[kad.da]	
	e.	[mot.to]	‘more’
	f.	*[mod.do]	

In this subsection, I will show that the same system used to analyze the difference between obstruents and sonorants (and vowels of different heights for that matter) will also work to explain the distinctive weight facts for voiced and voiceless stops in Japanese. This analysis, in conjunction with the evidence from Icelandic and Metropolitan New York English given in chapter 4, will support my assertion that Zec’s (1988) claim that laryngeal features do not play a role in the moraic markedness hierarchy is incorrect.

Recall that the universal moraic markedness hierarchy by itself implicitly predicts that if obstruent geminates are found, then sonorant geminates will also be found. Without the intervention of moraic faithfulness constraints, this should be the case. However, as we have seen above, re-rankable faithfulness constraints allow for the implicational relationship between sonority and moraicity to be circumvented. Thus, Chechen can have geminate obstruents, but not geminate sonorants. Also implied by the universal moraic markedness hierarchy is that if voiceless stops are found as geminates, then voiced stops should also be found as geminates[19]. However, Japanese falsifies this prediction by allowing voiceless stop geminates, but not voiced stop geminates. The constraint rankings needed to account for the dichotomous behavior of stop geminates in Japanese are given in (105).

(105) a. MAXLINK-MORA[PLAIN STOP] >> *MORA[PLAIN STOP]

b. *MORA[VOICED STOP] >> MAXLINK-MORA[VOICED STOP]

Tableaux (106) and (107) demonstrate that an underlyingly moraic voiceless stop surfaces as moraic, while an underlyingly moraic voiced stop cannot given the rankings in (105).

[19]As originally conceived by Zec (1988) this implication does not hold because she denies the relevance of voicing to the sonority scale for moraicity. However, as will be discussed in chapter 4, there is evidence from both Icelandic and Metropolitan New York English that laryngeal features are relevant to the universal moraic markedness hierarchy in coerced weight contexts.

(106)

μ /moto/ 'more'	MAXLINK-MORA [PLAIN STOP]	*MORA[PLAIN STOP]
a. σ σ μ μ mo t o	*!	
b. ☞ σ σ μ μ μ mo t o		*

In tableau (106), candidate (a) fatally violates the faithfulness constraint on underlying moraic associations to voiceless stops.

(107)

μ /modo/	*MORA[VOICEDSTOP]	MAXLINK-MORA[VOICEDSTOP]
a. ☞ σ σ μ μ mo d o		*
b. σ σ μ μ μ mo d o	*!	

Candidate (a) is optimal despite its violation of the faithfulness constraint. Candidate (b), with the illicit geminate voiced stop violates the higher-ranked constraint against moraic voiced stops.

To summarize, ranking the moraic markedness constraint on voiceless stops below the relevant moraic association faithfulness constraint results in distinctive weight for voiceless stops. Ranking the faithfulness constraint relevant to voiced stops below the moraic markedness hierarchy yields voiced stop neutralization.

(108) Non-distinctive sonorant weight and distinctive obstruent weight

MAXLINK-MORA[PLAINSTOP]

*MORA[PLAINSTOP]

*MORA[VOICEDSTOP]

MAXLINK-MORA[VOICEDSTOP]

3.3.2.4 Distinctive Weight for More-sonorous Consonants Only

The final type of distinctive consonant weight language to be addressed here is one in which sonorants have distinctive weight, but obstruents do not – essentially, the opposite pattern than that seen in the case of Chechen. By now, the analysis of this type of language should be self-evident. Ranking faithfulness to sonorant moraicity above the sonorant moraic markedness constraint will result in distinctive weight for sonorants, while the opposite ranking of the obstruent constraints results in non-distinctive obstruent weight. The rankings are given in (109).

(109) a. MAXLINK-MORA[SON] >> *MORA[SON]

b. *MORA[OBS] >> MAXLINK-MORA[OBS]

A language with this distribution of distinctive consonant weight is Hausa (Newman 1997).

In the Hausa non-derived native vocabulary, only intervocalic geminate nasals and liquids are common. Other non-derived geminates are found, but are extremely rare[20]. (110) gives some examples of geminate sonorants and non-geminate obstruents (high tone is unmarked, low tone is marked with a grave accent).

(110)	a.	[dan.nèe]	'suppress'	
	b.	[han.nuu]	'hand'	(versus [ha.nuu] 'frankincense tree')
	c.	[tal.lee]	'soup pot'	
	d.	[dà.gà]	'from'	
	e.	[kuu.kàa]	'baobab tree'	

As (111) demonstrates, underlyingly moraic intervocalic sonorants surface as moraic with the constraint ranking in (109a).

(111) Only the consonant moraicity is evaluated

μ /ha nuu/ 'hand'	MAXLINK-MORA[SON]	*MORA[SON]
a. σ σ μ μμ h a n u	*!	
b. ☞ σ σ μ μ μμ h a n u		*

---

[20] Geminate consonants of all sonorities are commonly found in morphologically derived forms.

Candidate (a) fatally violates the moraic faithfulness constraint.

On the contrary, tableau (112) demonstrates that faithfulness ranked below markedness gives rise to underlyingly moraic obstruents surfacing as non-moraic.

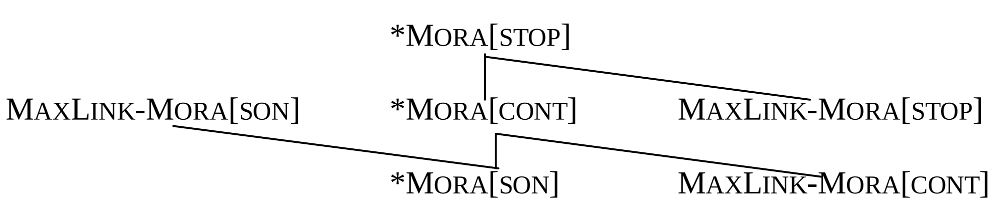
(112)

μ /dàgà/ ‘from’	*MORA[OBS]	MAXLINK-MORA[OBS]
a. ☞ σ σ μ μ d à g à		*
b. σ σ μ μ μ d à g à	*!	

Candidate (b) fatally violates the markedness constraint against moraic obstruents.

To summarize, ranking the moraic markedness constraint on obstruents above the relevant moraic association faithfulness constraint results in non-distinctive obstruent weight. Ranking the faithfulness constraint relevant to sonorants above the moraic markedness hierarchy yields distinctive sonorant weight.

(113) Non-distinctive obstruent weight and distinctive sonorant weight



3.3.3 Distinctive Consonant and Vowel Weight

So far, we have examined the patterns of distinctive moraicity within the class of vowels and the class of consonants, have seen that the same patterns exist in both realms, and have seen that the same type of constraint interactions yield the attested patterns. In essence, distinctive weight has been unified for both consonants and vowels. There is, however, one more piece of the puzzle to be examined. We must ensure that the same system of constraint interactions will account for the patterns of distinctive weight when comparing across consonant and vowel classes. As will be seen below, not only are the patterns identical to those seen within the vowel and consonant classes, but the same constraints produce these patterns.

Let us begin with the basic patterns of distinctive weight found when comparing cross-linguistic consonant and vowel inventories. The following table summarizes the relevant patterns:

(114) Languages, Segment Classes, and Distinctive Weight

CON	**VOC**	**Languages**	**References**
yes	yes	Baloch Brahui Hungarian Oromo	Elfenbein 1997 Elfenbein 1997 Chapter 4 Lloret 1997
yes	no	Icelandic Ilokano Modern Standard Italian	Chapter 4 Morén forthcoming Chapter 4
no	yes	Burushaski Khalkha Mongolian Hawaiian	Anderson 1997 Svantesson 1994 Chapter 4
no	no	Chaha	Leslau 1997

From the chart we can conclude that segment weight distinctions are fairly free in distribution, and that sonority does not seem to play a role. The constraint rankings resulting in these four types of languages are:

(115) No distinctive weight

a. *MORA[CON] >> MAXLINK-MORA[CON]

b. *MORA[VOC] >> MAXLINK-MORA[VOC]

(116) Distinctive weight for both consonants and vowels

a. MAXLINK-MORA[CON] >> *MORA[CON]

b. MAXLINK-MORA[VOC] >> *MORA[VOC]

(117) Distinctive weight for consonants, but not vowels

a. MAXLINK-MORA[CON] >> *MORA[CON]

b. *MORA[VOC] >> MAXLINK-MORA[VOC]

(118) Distinctive weight for vowels, but not consonants

a. *MORA[CON] >> MAXLINK-MORA[CON]

b. MAXLINK-MORA[VOC] >> *MORA[VOC]

One final note before moving on to the interactions possible when combining coerced and distinctive weight systems – recall from section 3.2.5 that in coerced weight systems there was an asymmetry between coerced weight within the consonant and vowel classes and coerced weight across classes. Within each class, the implicational relationship between moraicity and sonority was evident, but a language could force less-sonorous segments to be moraic. This was accomplished by a combination of constraints specific to segment types (e.g. WBYP is relevant only to consonants) and the fact that the segments being compared were never found to actually compete within a given form. However, when comparing vowel and consonant coerced moraicity using constraints not specific to segment type, vowels were seen to always lengthen. When in direct competition, the universal markedness hierarchy dictates that the more sonorous segment will receive the coerced mora.

This asymmetry does not apply when moraic faithfulness constraints come into play. First, the faithfulness constraints are necessarily segment-type specific; and second, the freely re-rankable nature of the faithfulness constraints allows for a symmetrical pattern to emerge in the distinctive weight realm.

3.3.4 Summary of Distinctive Weight Patterns

Unlike the coercive moraicity situation, which follows the sonority sequence, distinctive moraicity is free to disregard the sonority sequence. This is a direct result of the nature of the constraints and interactions. Since moraic faithfulness constraints are relative to different segment types and are freely re-rankable with respect to each other and the universal moraic markedness hierarchy, they allow violations of the implicational relationship between moraicity and sonority inherent in the universal markedness hierarchy.

3.4 Interactions between Coerced and Distinctive Weight

In this section, I will briefly explore the complex interactions between the coerced and distinctive weight systems. Due to the inherent complexity of these systems, it is not feasible to examine an example of each predicted pattern. However, I will give brief examples of some the predictions, and will address other complicated interactions in chapter 4.

Just as in the previous sections, there are three segmental domains to be observed. First I will describe languages with distinctive length for vowels of differing sonorities but also coerced weight for at least some of the vowels. Second I will describe languages with distinctive weight for consonants of differing sonorities but also coercive weight for at least some of the consonants. Finally, I will examine languages that have distinctive moraicity for both vowels and consonants, and will explore how these languages differ in segment neutralization under coerced weight requirements. As will be made clear, just as within the coercive and distinctive weight systems, the patterns across systems are predicted to show striking parallels. These parallels will emerge naturally out of the system of constraint interactions proposed here.

3.4.1 Distinctive Vowel Length Neutralization

Within languages that display distinctive vowel length for all vowels in the inventory, there are four patterns that emerge when coercive moraicity constraints come into play[21]. These patterns are summarized in the following table.

(119) Distinctive Vowel Length, Segment Classes, and Coerced Weight

HIGH	LOW	Languages
dist.	dist.	No neutralization in some environment
dist.	neutr.	Metropolitan New York English æ-neutralization before voiceless stops
neutr.	dist.	Hungarian stressed open monosyllables
neutr.	neutr.	Hawaiian stressed open monosyllables

As seen in (119), there are four basic patterns of vowel length neutralizations within languages with distinctive vowel length for the relevant vowels. One pattern has no neutralization in a given environment, and results from the vowel length faithfulness constraints on all vowels being ranked above the coercive markedness constraint. An example of this type is a language that has distinctive vowel length that carries over even to open stressed monosyllables (an environment commonly subject to

[21] I restrict the discussion to the dichotomy of high and low vowels for ease of exposition. Adding mid vowels to the discussion adds further complexity but not additional insights.

the minimal word condition). The relevant constraint ranking for this language would be similar to that in (120).

(120) Distinctive vowel length not subject to minimal word requirements

MAXLINK-MORA[HIGH]

*MORA[HIGH] MAXLINK-MORA[LOW]

*MORA[LOW]

FOOTBINARITY

This is a fairly uninteresting case of a lack of neutralization, therefore I will not discuss it further. Instead, let us move on to some more interesting cases.

A second pattern of vowel length neutralization in distinctive vowel length languages is one in which all vowels neutralize to either long or short in a given environment despite the usual distinctive length. I will briefly discuss one case of this type showing neutralization of underlyingly short vowels to long to meet a minimal word requirement.

As will be seen in more detail in chapter 4, Hawaiian has distinctive vowel length, as shown in the examples in (121).

(121)	a.	[na.na]	'to plait'
	b.	[naa.na]	'by him'
	c.	[na.naa]	'to snarl'
	d.	[naa.naa]	'to look (at)'

However, there is one environment in which this distinction is lost. As (122) shows, short vowels are prohibited in open monosyllables.

(122) a. [ii] 'to say'

b. [ee] 'different'

c. [paa] 'fence'

d. [koo] 'sugar cane'

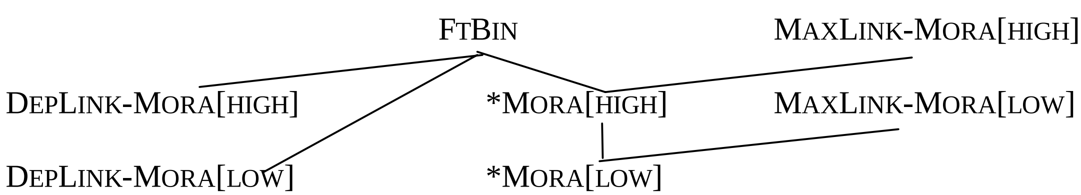
e. [kuu] 'upright'

b. *[CV]

This is a simple case of a minimal word condition that requires that prosodic words be minimally bimoraic. If we assume the constraint in (123), and that it is ranked above both the vowel moraic markedness constraints and the faithfulness constraints against adding morae to vowels, as in (124), then the Hawaiian vowel length pattern is fully explained.

(123) **FootBinarity (FtBin) –** Prosodic feet must be binary at either the syllabic or moraic level. (Prince and Smolensky 1993)

(124) Distinctive vowel length subject to minimal word requirements



Tableaux (125) and (126) show that underlyingly monomoraic high vowels are forced to lengthen despite usually having distinctive length.

(125)

μ /ku/ ‘upright’	FtBin	*Mora[high]	DepLink-Mora[high]
a. σ μ ku	*!	*	
b. ☞ σ μμ ku		**	*

In tableau (125), although candidate (b) violates both the moraic markedness constraint and the faithfulness constraint against adding a mora to a high vowel once more than candidate (a) does, it is still optimal because candidate (a) fatally violates the higher-ranked constraint against non-binary prosodic feet.

Tableau (126) is identical to (125) except that the vowel is low.

(126)

μ /pa/ ‘fence’	FtBin	*Mora[low]	DepLink-Mora[low]
a. σ μ pa	*!	*	
b. ☞ σ μμ pa		**	*

The third type of distinctive vowel length language that undergoes length neutralization is one in which only the high vowels neutralize. A language of this type is Standard Literary Hungarian. Although chapter 4 will provide a more detailed analysis of this language, the core generalizations and analysis are provided here.

In Hungarian, all vowels have distinctive length, as seen in (127).[22] However, there are several environments in which vowels of different qualities neutralize to either long or short depending on both the vowel and the environment (Nádasdy 1985, Morén 1998b). One such neutralization is discussed and analyzed below.

(127) Phonological Length Grouping of Hungarian Vowels

	Front	Back
High	ii/i üü/ ü	uu/u
Mid	öö/œ	oo/ɔ
Low	ee/ɛ	aa/ɑ

As we have already seen, distinctive length results from ranking the faithfulness constraints against deleting underlying morae from segments above the moraic markedness constraints for the different vowel types. The rankings needed for

[22] The pairing of long and short vowels is supported by morphologically conditioned alternations. The classification of [ee] and [ɛ] as low vowels is well-supported by the phonological patterns of the language.

Hungarian high and low vowels are given in (128), and (129) shows how these rankings are evaluated for underlyingly long vowels.

(128) a. MaxLink-Mora[high] >> *Mora[high]

b. MaxLink-Mora[low] >> *Mora[low]

(129)

	μμ μμ /a ru/ 'having a price'	MaxLink-Mora[high]	*Mora [high]	MaxLink-Mora[low]	*Mora [low]
a.	σ σ μ μ a r u [a.ru]	*!	*	*	*
b.	σ σ μ μμ a r u [a.ruu]		**	*!	*
c.	σ σ μμ μ a r u [aa.ru]	*!	*		**
d. ☞	σ σ μμ μμ a r u [aa.ruu]		**		**

In tableau (129), candidates (a) and (c) fatally violate the faithfulness constraint against removing morae from high vowels. Candidate (b) fatally violates the constraint against removing morae from low vowels. The completely faithful candidate, (d), is optimal.

Despite this distinctive length, short high vowels are prohibited in open monosyllables, as shown in (130), but low vowels maintain distinctive length in this environment, as shown in (131).

(130)	a.	[buu] ‘melancholy’	*[bu]
	b.	[füü] ‘grass’	*[fü]
	c.	[fii] ‘phi’	*[fi]

(131)	a.	[faa]	‘FA in music’	[fɑ]	‘tree’
	b.	[lee]	‘juice’	[lɛ]	‘down’

Just as in the case of Hawaiian, this high vowel neutralization is driven by a minimal word requirement, and results from the constraint requiring that phonological feet be minimally bimoraic (FTBIN) ranked above both a high vowel length faithfulness constraint and the markedness constraint against moraic high vowels.

(132)

μ /bu/ ‘meloncholy’	FTBIN	*MORA[HIGH]	DEPLINK-MORA[HIGH]
a. σ μ b u	*!		
b. ☞ σ μμ b u		*	*

In (132), it is better to lengthen the high vowel than it is to have a monomoraic prosodic foot.

Distinctive length for low vowels in this environment results from the faithfulness constraint against adding a mora to a low vowel being ranked above the constraint requiring foot binarity. Note that the markedness constraint against moraic low vowels must be ranked below the foot binarity constraint because of the universal moraic markedness hierarchy and transitivity: FTBIN>>*MORA[HIGH]>>*MORA[LOW].

(133)

μ /fɑ/ 'tree'	DEPLINK-MORA[LOW]	FTBIN
a. ☞ σ μ f ɑ		*
b. σ μμ f a	*!	

In (133), it is worse to add a mora to a low vowel than it is to have a monomoraic prosodic foot.

The resulting constraint ranking is:

(134) Distinctive high vowel length subject to minimal word requirements

DEPLINK-MORA[LOW]

FTBIN

DEPLINK-MORA[HIGH] MAXLINK-MORA[HIGH]

*MORA[HIGH] MAXLINK-MORA[LOW]

*MORA[LOW]

The fourth type of distinctive vowel length neutralization is one in which high vowels maintain a length distinction in some environment, but low vowels are seen to neutralize. Essentially, a language of this type is the opposite of the Hungarian case. Metropolitan New York English is a language that falls into this category. [23]

Metropolitan New York English has a fairly complicated vowel length system. What is important for the present discussion is that the non-low vowels have distinctive length in most (non-derived) environments, and the low front vowel has distinctive length in several environments but not in monosyllables closed by voiceless stops. In monosyllables closed by voiceless stops, the low front vowel must be long. This is in contrast with high vowels which have distinctive length monosyllables closed by any consonant. The distribution of the low front vowel is common referred to as "æ-tensing" in the literature (Ferguson 1972, Kahn 1976, Payne 1980, Labov 1981, Dunlap 1987, Benua 1995, Morén 1996, 1997).

[23] Keep in mind that a detailed analysis of this language is given in chapter 4, and that the analysis presented here is incomplete. However, the basic patterns do support the typological prediction that this fourth type of vowel neutralization language exists.

As stated above, high vowels in this dialect have distinctive length in monosyllables closed by all consonants, as shown in (135).

(135)	a.	[biit] beat		[bit]	bit
	b.	[biin] bean		[bin]	bin

In contrast, the low front vowel has distinctive length in monosyllables only if they are closed by consonants more sonorous than voiceless stops. (136) shows both long and short low front vowels in closed monosyllables, including minimal pairs. (137) shows that the vowel must be long if the coda consonant is a voiceless stop.

(136)	a.	[kææn]	can – verb	[kæn]	can – noun
	b.	[hææv]	have	[hæv]	halve
	c.	[hææd]	had		
	d.			[bæd]	bad

(137)	a.	[kææt]	cat	*[kæt]
	b.	[bææk]	back	*[bæk]

To ensure that the non-low and low front vowels have distinctive length in at least some contexts, the moraic faithfulness constraints on the respective vowels must be ranked higher than the moraic markedness constraints on those vowels. These rankings are given in (138).

(138) a. MAXLINK-MORA[NON-LOW] >> *MORA[NON-LOW]

b. MAXLINK-MORA[LOWFRONT] >> *MORA[LOWFRONT]

However, all vowels in open monosyllables neutralize to long, as shown in (139). This should not be surprising since many languages have either a minimal word requirement, a requirement that word-final vowels be long, or a requirement that stressed syllables be heavy.

(139) a.	[bii]	*bee*	*[bi]
b.	[dææ]	*dad* – truncated	*[dæ]
c.	[kææ]	*Caroline* – truncated	*[kæ]

Although the full analysis will be given in chapter 4, it is sufficient for now to invoke the "BEMORAIC" constraint to ensure coerced bimoraicity of all vowels in open monosyllables. Therefore, ranking "BEMORAIC" above the constraints against adding a mora to a high vowel and against moraic high vowels results in lengthening in open syllables. This is shown in (140) for high vowels and (141) for low front vowels.

(140)

μ /bi/ *bee*	"BEMORAIC"	*MORA [NON-LOW]	DEPLINK-MORA[NON-LOW]
a. σ μ b i	*!	*	
b. ☞ σ μμ b i		**	*

In tableau (140), the faithful candidate fatally violates the constraint requiring a minimal moraic content. Candidate (b) is optimal despite the extra violations for the markedness constraint against moraic non-low vowels and the faithfulness constraint against adding morae to non-low vowels.

(141)

μ /dæ/ *dad* - truncated	"BEMORAIC"	*MORA [LOWFRONT]	DEPLINK-MORA [LOWFRONT]
a. σ μ d æ	*!	*	
b. ☞ σ μμ d æ		**	*

In tableau (141), the low front vowel patterns like the non-low vowels in open monosyllables.

So far, the analysis of these two vowel classes is the same. However, as mentioned above, the difference in distinctive length between the high vowels and the low front vowels is that the high vowels show distinctive length in closed monosyllables, while the low front vowels neutralize to long in monosyllables closed by voiceless stops. This distribution is readily explained if we rank the vowel length faithfulness constraints not only with respect to the moraic markedness hierarchy for vowels, but also with respect to the rest of the moraic hierarchy. As (142) and (143) show, if the high vowel faithfulness constraint against adding a mora to a high vowel is ranked above the entire moraic markedness hierarchy, then all consonants following underlyingly short high vowels are forced to be moraic by “BeMoraic”.

(142)

μ /b i t/ *bit*	“BeMoraic”	DepLink-Mora[non-low]	*Mora [plain stop]	*Mora [son]
a. σ μ b i t	*!			
b. σ μμ b i t		*!		
c. ☞ σ μ μ b i t			*	

Candidate (c) in tableau (142) is optimal despite the violation of the constraint against moraic voiceless stops because the other two candidates violate higher-ranked constraints. Candidate (a) fatally violations the constraint requiring prosodic feet to be bimoraic, and candidate (b) fatally violates the constraint against adding morae to non-low vowels.

(143)

μ /b i n/ *bin*	"BEMORAIC"	DEPLINK-MORA[HIGH]	*MORA [PLAIN STOP]	*MORA [SON]
a. σ μ b i n	*!			
b. σ μμ b i n		*!		
c. ☞ σ μ μ b i n				*

The evaluation of tableau (143) is identical to that of (142), except that the winning candidate violates the constraint against moraic sonorants.

In contrast, ranking the faithfulness constraint on low front vowel length between the moraic markedness constraints on voiceless stops and the rest of the consonants yields distinctive length for low front vowels only when followed by segments more sonorous than voiceless stops, as shown in (144). Before voiceless stops, a combination of the voiceless stop moraic markedness constraint and the constraint ensuring bimoraicity forces the low front vowel to neutralize to long, as shown in (145).

(144)

μ /k æ n/ *can*-noun	"BEMORAIC"	*MORA [PLAIN STOP]	DEPLINK-MORA [LOWFRONT]	*MORA [SON]
a. σ μ k æ n	*!			
b. σ μμ k æ n			*!	
c. ☞ σ μ μ k æ n				*

In tableau (144), candidate (a) fatally violates the minimal weight condition, and candidate (b) fatally violates the constraint against adding a mora to a low front vowel. The winning candidate violates only the low-ranked constraint against moraic sonorants.

(145)

μ /k æ t/ *cat*	"BEMORAIC"	*MORA [PLAIN STOP]	DEPLINK-MORA [LOWFRONT]	*MORA [SON]
a. σ μ k æ t	*!			
b. ☞ σ μμ k æ t			*	
c. σ μ μ k æ t		*!		

As tableau (145) shows, it is more costly to have a moraic voiceless stop or to have a monomoraic monosyllable than it is to add a mora to a low front vowel.

To summarize, non-low vowels in Metropolitan New York English have distinctive length in monosyllables closed by any consonant. To meet a minimal weight requirement, consonants are forced to be moraic because vowel length faithfulness outranks the moraic markedness hierarchy. In contrast, the low front vowel has distinctive length in monosyllables only if they are closed by consonants more sonorous than the voiceless stops. Low front vowels neutralize to long before voiceless stops because the moraic markedness constraint for voiceless stops is ranked above the faithfulness constraint on low front vowel length. To meet the minimal weight requirement, low front vowels are forced to lengthen. The constraint ranking is given in (146).

(146) Metropolitan New York high and low front vowel length ranking

"BeMoraic"

DepLink-Mora[lowfront] DepLink-Mora[non-low]

*Mora[plain stop]

*Mora[son] MaxLink-Mora[non-low]

*Mora[non-low] MaxLink-Mora[lowfront]

*Mora[lowfront]

The importance of this pattern is two-fold. First, it exemplifies the fourth type of distinctive vowel length system in which high vowel length is distinctive in some neutralization context, but normally distinctive low vowel length neutralizes to long. This is the opposite of the pattern seen for Hungarian. The second important aspect of this vowel system is that it demonstrates that voicing plays a role in the universal moraic markedness hierarchy. Since *[bæk] is prohibited, but [bæg] is not, this implies the ranking in (147).

(147) *MORA[PLAIN STOP] >> *MORA[VOICED STOP]

This point will be returned to in chapter 4 in the full analysis of Metropolitan New York English.

3.4.2 Distinctive Consonant Weight Neutralization

As shown in (148), there are four basic patterns of consonant weight neutralizations predicted for languages with distinctive consonant weight for all relevant consonants. These patterns parallel those just discussed for vowel length.

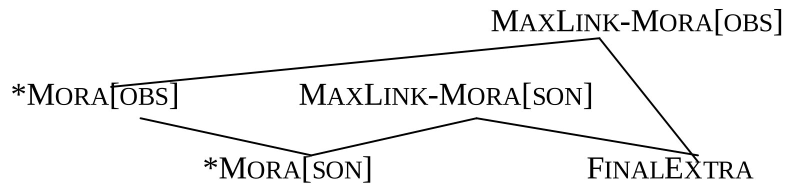
(148) Distinctive Consonant Weight Languages, Segment Classes, and Coerced Weight

OBS	**SON**	**Languages**
dist.	dist.	Italian intervocalic geminates
dist.	neutr.	Italian geminates in clusters
neutr.	dist.	Ponapean final geminates
neutr.	neutr.	Modern Standard Italian *Raddoppiamento Sintattico*, Northern Scandinavian consonant gemination following open stressed syllables

As in the cases of neutralization of distinctive vowel length, all consonant weight can be neutralized in some environment, only the more sonorous consonants can neutralize, only the less sonorous consonants can neutralize, or no consonants neutralize.

One pattern has no neutralization in a given environment, and results from the consonant length faithfulness constraints on all consonants being ranked above the coercive markedness hierarchy. An example of this type is a language that has distinctive consonant weight that carries over even to word final position (an environment sometimes subject to a word final extrametricality). The relevant constraint ranking for this language would be similar to that in (149).

(149) Distinctive consonant weight not subject to final extrametricality



Since this is an uninteresting case of a lack of neutralization, I will not discuss it further. Instead, let us move on to some more interesting cases.

A second pattern of consonant weight neutralization in distinctive consonant weight languages is one in which all consonants neutralize to either moraic or non-moraic in a given environment despite the fact that consonant weight is usually distinctive. I will briefly discuss one case of this type which shows neutralization of all consonants to moraic in the codas of stressed syllables.

In Modern Standard Italian, the initial consonants of words following stressed word-final vowels become geminate if the two words are within a specific syntactic phrase (Nespor and Vogel 1986). This is in spite of the fact that Modern Standard Italian has distinctive consonant weight. A more detailed analysis is given in the case study of Modern Standard Italian in chapter 4, however, a simplified analysis is presented here to demonstrate this second consonant neutralization pattern.

Modern Standard Italian has non-distinctive vowel length and distinctive consonant weight. Intervocalic consonants surface as either moraic or not depending on the underlying weight. Moreover, vowels in open stressed penults are forced to be long because the final syllable is extrametrical and Italian has a condition requiring that prosodic feet be bimoraic.

(150)	a.	[(víi).le]	*vile*	'mean'
	b.	[(víl).le]	*ville*	'villas'
	c.	[(káa).sa]	*casa*	'house'
	d.	[(kás).sa]	*cassa*	'case'
	e.	[(nóo).no]	*nono*	'ninth'
	f.	[(nón).no]	*nonno*	'grandfather'

We know that consonant weight is distinctive here, not vowel length, because is pre-penultimate positions, geminate consonants are quite common, but long vowels are prohibited.

(151)	a.	[mé.di.ko]	*medico*	'doctor'	*[mée.di.ko]
	b.	[mét.te.re]	*mettere*	'to put'	
	c.	[dif.f í.t͡ʃi.le]	*difficile*	'difficult'	

The fact that underlyingly moraic consonants surface as moraic in all positions, but bimoraic vowels surface only under coercion is the result of the following constraint rankings.

(152) a. MAXLINK-MORA[CON] >> *MORA[CON]

b. FTBIN >> *MORA[VOC] >> MAXLINK-MORA[VOC]

Since the vowels in open penults lengthen rather than the following consonants becoming geminate is a product of the universal moraic markedness hierarchy. As (153) shows, the fact that the vowel moraic markedness constraints are ranked below the consonant moraic markedness constraints forces the vowel to lengthen in response to a higher-ranked coercive weight constraint.

(153)

μ μ /mi te/ 'mild'	FTBIN	*MORA[CON]	*MORA[VOC]
a. (σ́) σ μ μ m i t e	*!		
b. ☞ (σ́) σ μμ μ m i t e			*
c. (σ́) σ μ μ μ m i t e		*!	

Candidates (a) and (c) fatally violate the higher-ranked constraints against monomoraic feet and moraic consonants.

In the case of exceptional final stress, final vowels do not surface as long. This is despite the imperative to have a binary foot. To account for short vowels in final stressed open syllables, a constraint against word-final long vowels must be ranked above the constraint requiring foot binarity.

(154)

µ µ /v i r t u/ 'virtue'	*FINALLONGV	FTBIN
σ (σ́) µ µ µ a. ☞ v i r t u		*
σ (σ́) µ µ µµ b. v i r t u	*!	

Candidate (b) fatally violates the constraint against final long vowels. Although candidate (a) violates the constraint against non-binary feet, this violation is not fatal.

Finally, *Raddoppiamento Sintatico* is the result of the imperative to have binary prosodic feet, but no word-final long vowels. Although consonants typically do not become moraic if they were underlyingly non-moraic in Modern Standard Italian, they can be forced to be moraic if adjacent to a stressed word-final vowel.

(155)

(σ́) (σ́) σ µ µ µ µ [t e] + [f r e d o]	*FINALLONGV	FTBIN	*MORA[CON]
(σ́) (σ́) σ µ µ µ µ a. t e f r e d o		*!	
(σ́) (σ́) σ µ µ µ µ µ b. t e f r e d o	*!		
(σ́) (σ́) σ µ µ µ µ µ c. ☞ t e f r e d o			*

Candidate (b) loses because it has a word-final long vowel. Candidate (a) loses because it has a mono-moraic foot. Although candidate (c) violates the constraints against moraic consonants, this violation is not fatal in this environment although it is fatal in stressed penultimate syllables.

In the above discussion of Modern Standard Italian, I showed that normally distinctive consonant weight can be neutralized. All consonants are subject to *Raddoppiamento Sintatico* effects, so this language shows us the second interactive weight pattern.

The third type of distinctive consonant weight language that undergoes weight neutralization is one in which only obstruent weight neutralizes in some context but sonorant weight remains distinctive. Ponapean may be a language of this type[24]. In Ponapean, both sonorants and obstruents are found in medial position as shown in (156). All data are from Rehg and Sohl (1981).

(156)	a.	*urenna*	'lobster'
	b.	*lallal*	'to speak incessantly'
	c.	*rerrer*	'to be trembling'
	d.	*nappa*	'Chinese cabbage'
	e.	*kakko*	'putting on airs'
	f.	*kiassi*	'catcher'

[24] There are complications, such as morphological restrictions on obstruent geminates, that require further research and are not discussed here.

In final position, sonorant geminates are found, (157), but not obstruent geminates. Obstruents are found in final position only as singletons or in homorganic nasal-obstruent clusters, (158).

(157)	a.	*mall*	'clearing, in a forest'
	b.	*kull*	'roach'
	c.	*lemmw*	'afraid of ghosts'
	d.	*rommw*	'calm'
	e.	**oss*	
	f.	**madd*	
	g.	**epp*	

(158)	a.	*onop*	'to prepare'
	b.	*malek*	'chicken'
	c.	*os*	'to sprout'
	d.	*kens*	'yaws'
	e.	*mand*	'tame'
	f.	*emp*	'coconut crab'

To maintain medial obstruent and sonorant geminates, the faithfulness constraints to both obstruent and sonorant moraicity must be ranked above the markedness constraints against moraic obstruents and sonorants, respectively.

(159) a. MAXLINK-MORA[OBS] >> *MORA[OBS]

b. MAXLINK-MORA[SON] >> *MORA[SON]

To maintain final sonorant geminates, the faithfulness constraint on underlying sonorant moraicity must outrank a markedness constraint against final consonant moraicity.

(160) ***WORDFINALMORA** (***μ]#**) **–** The word-final segment must not be associated with a mora (in the spirit of Hung 1994).

(161) a. MAXLINK-MORA[SON] >> *μ]#

But, to ensure that final obstruents are not geminates at the end of the word, the ranking in (162) must hold.

(162) a. *μ]# >> MAXLINK-MORA[OBS]

Combining the above rankings with the universal moraic markedness hierarchy, (163) emerges and accounts for the distribution of geminates in Ponapean.

(163) MAXLINK-MORA[SON]
|
*μ]#
|
MAXLINK-MORA[OBS]
|
*MORA[OBS]
|
*MORA[SON]

The fourth type of distinctive vowel length neutralization is one in which obstruents maintain a weight distinction in some environment, but sonorants are seen to neutralize. Essentially, a language of this type is the opposite of the previous case. Modern Standard Italian is a language that falls into this category.

As already mentioned above, Modern Standard Italian has distinctive consonant weight for all intervocalic consonants. This was captured by the constraint rankings in (164).

(164) a. MAXLINK-MORA[OBS] >> *MORA[OBS]

b. MAXLINK-MORA[SON] >> *MORA[SON]

There is, however, an asymmetry in the treatment of distinctive consonant weight in this language. As (165) shows, obstruent consonants can also be distinctively moraic following a vowel and preceding consonants with which they can normally form onset clusters, (166).

(165)	a.	[at.tríi.to]	*attrito*	‘abrasion’
	b.	[láb.bro]	*labbro*	‘lip’
	c.	[púb.bli.ko]	*pubblico*	‘public’

(166)	a.	[a.tro.fii.a]	*atrofia*	‘atrophy’
	b.	[líi.bro]	*libro*	‘book’
	c.	[blát.ta]	*blatta*	‘cockroach’

However, since sonorants can never be the initial segment in an onset cluster, they cannot appear as medial geminates if they are not intervocalic, (167).

(167)	a.	*[non.nro]
	b.	*[kar.rno]

They may only appear as non-geminate onsets (168a), intervocalic geminates (168b), or non-geminate codas (168c,d).

(168)	a.	[nóo.no]	*nono*	‘ninth’
	b.	[nón.no]	*nonno*	‘grandfather’
	c.	[kón.to]	*conto*	‘bill/check’
	d.	[kár.ne]	*carne*	‘meat’

Because there is a minimal weight requirement on stressed penultimate syllables in this language (discussed briefly above), we know that sonorants in the codas of stressed penults are moraic because otherwise the preceding vowel would be long. Thus, we can conclude that although obstruent weight is distinctive between a vowel and a consonant of the right type, sonorant weight is never distinctive in this environment.

3.4.3 Distinctive Consonant Weight and Vowel Length Neutralization

Finally, there are potentially four patterns that emerge when coercive moraicity constraints come into play within languages that display distinctive moraicity for both vowels and consonants. These patterns are summarized in the following chart.

(169) Distinctive Consonant and Vowel Weight Languages, Segment Classes, and Coerced Weight

CON	**VOC**	**Languages**
dist.	dist.	No neutralization in some environment
dist.	neutr.	Languages with vowel lengthening, not gemination in some environment
neutr.	dist.	Languages with gemination, not vowel lengthening in some environment
neutr.	neutr.	Languages with a loss of long vowels and geminates in some environment – perhaps no heavy unstressed syllables?

I leave a full exploration of these patterns for future research. For now, I simply mention the predictions that arise from factorial ranking of coercive moraic markedness constraints in languages that have both a vowel length and a consonant weight distinction.

3.5 Summary

In this chapter, have shown the interaction of the universal moraic markedness hierarchy with coercive moraic markedness constraints and moraic faithfulness constraints. Basically, there are three major weight patterns: coerced, distinctive, and a combination of coerced and distinctive.

Coerced weight is the result of ranking constraints that require a minimal moraic content above some part of the universal moraic markedness hierarchy. This type of interaction results in an implicational relationship between moraicity and sonority, and was the type explored by Zec (1988, 1995). I have expanded Zec's work to both within the class of vowels and across vowel and consonant classes. Further, I have shown that vowel and consonant weight patterns are either symmetrical or asymmetrical with respect to each depending on the nature of the coercive moraic markedness constraint. If vowels and consonants are examined when coercive constraints relative to each class are involved, then the two classes show symmetrical behavior. However, if the coercive moraic markedness constraint does not specify the target segment type, then vowels typically lengthen to satisfy the markedness constraint.

Distinctive weight is fairly free in distribution. There is no implicational relationship between sonority and distinctive moraicity. As with coerced moraicity, there are parallels in the behavior of consonants and vowels within the domain of distinctive moraicity that result from constraint interactions.

I also discussed the interactions between distinctive and coercive moraicity. The most important consequence of the freely re-rankable faithfulness constraints on coerced moraicity is that they can countermand the implicational relationship inherent in the interaction between coercive moraic markedness and the universal moraic markedness hierarchy, as was shown in the case of Hungarian vowels.

Chapter 4 Case Studies

In this chapter, I will provide detailed analyses of the moraic patterns of several languages: Hawaiian, Modern Standard Italian, two Hungarian dialects, Icelandic, and Metropolitan New York English. The goal of this chapter is four-fold:

- to provide descriptions of some well-known and not so well-known weight phenomena;
- to show how the constraints proposed in chapter 2 can provide analyses of moraic patterns that range from fairly simple (e.g. Hawaiian) to quite complex (e.g. Metropolitan New York English);
- to show how the constraints proposed here can be integrated into a more complete phonological system to provide a coherent grammar (e.g. Icelandic); and
- to show how different dialects can arise from a minimal re-ranking of constraints (e.g. Hungarian and Icelandic).

4.1 Hawaiian Syllable Weight

Hawaiian has a fairly simple syllable weight pattern. It has distinctive vowel length in most environments, but has coerced vowel length in stressed open monosyllables. Further, there is neither distinctive nor coerced consonant weight. This illustrates a language type predicted in chapter 3 in which there is a difference between segment types with respect to distinctive weight. It also demonstrates that interactions can occur between distinctive and coerced weight within a class of segments.

4.1.1 Data

In Hawaiian, as described by Elbert and Pukui (1979), there is ample evidence that vowel length is distinctive, but consonant weight is not. In fact, other than in stressed monosyllables that must be minimally bimoraic, as shown in (1), vowel length is distinctive in any position in a word, regardless of stress (2).

(1)	a.	[íi]	'to say'
	b.	[ée]	'different'
	c.	[páa]	'fence'
	d.	[kóo]	'sugar cane'
	e.	[kúu]	'upright'
	f.	*[CV]	

(2)	a.	[na.na]	'to plait'
	b.	[naa.na]	'by him'
	c.	[na.naa]	'to snarl'
	d.	[naa.naa]	'to look (at)'

In addition, since coda consonants are prohibited in this language absolutely, consonants are never moraic.

4.1.2 Analysis

Following chapter 2, the core syllable weight distribution of Hawaiian can be analyzed as the interaction of faithfulness constraints on underlyingly moraic content with markedness constraints against moraic segments. The faithfulness constraints, (3) and (4), are given in summarized form here for convenience:

(3) **MAXLINK-MORA[SEG] –** "Do not delete an underlying mora from a segment."

(4) **DEPLINK-MORA[SEG] –** "Do not add a mora to a segment that it did not have underlyingly."

Recall that these constraints are actually shorthand for two families of constraints relativized to different segments. In the case of Hawaiian, they must be relativized minimally to the natural classes of consonants, (5) and (6), and vowels, (7) and (8), since vowel length and consonant weight are treated differently by the grammar.

(5) **MAXLINK-MORA[CON] –** "Do not delete an underlying mora from a consonant."

(6) **DEPLINK-MORA[CON] –** "Do not add a mora to a consonant that it did not have underlyingly."

(7) **MAXLINK-MORA[VOC] –** "Do not delete an underlying mora from a vowel."

(8) **DEPLINK-MORA[VOC] –** "Do not add a mora to a vowel that it did not have underlyingly."

The general moraic markedness constraint is given in (9).

(9) ***MORA[SEG] -** "Do not associate a mora with a particular segment".

Recall that this is really a constraint family relative to different segment types. Since Hawaiian only differentiates between the natural classes of consonants and vowels, and not within each of these classes, only two shorthand constraints need to be shown here, (10) and (11).

(10) ***MORA[CON] -** "Do not associate a mora with a consonant."

(11) ***MORA[VOC] -** "Do not associate a mora with a vowel."

Assuming that most long vowels in Hawaiian are the result of an underlyingly bimoraic vowel that surfaces as bimoraic, the faithfulness constraint against deleting underlying morae from vowels must rank above the constraint forbidding moraic vowels. As (13) shows, all long vowels in the input surface as long. Since Hawaiian does not allow non-moraic syllables, I assume an undominated constraint that ensures that all syllables are minimally mono-moraic, (12). Candidates without moraic nuclei are not considered.

(12) **SYLL[MORA] –** “A syllable must be minimally mono-moraic”

(13)

μμ μ /ma la/ 'garden'	MAXLINK-MORA[VOC]	*MORA[VOC]
σ σ μ μ a. m a l a	*!	**
σ σ μ μ μ b. ☞ m a l a		***

Candidate (a) fatally violates the moraic faithfulness constraint by shortening an underlyingly long vowel. Candidate (b) violates the markedness constraint once more than candidate (a) because it has one more mora, but this constraint is lower-ranked, so candidate (b) is optimal.

The tableau in (14) shows that underlying short vowels do not lengthen in polysyllables. A non-moraic consonant in the input will surface as a non-moraic onset straightforwardly. Without a dominant coercive moraic markedness constraint to force a vowel to lengthen, either the general moraic markedness constraint or the faithfulness constraint against adding morae to underlyingly short vowels prevent lengthening.

(14)

μ μ /ma la / 'ache'	DEPLINK-MORA[VOC]	*MORA[VOC]
σ σ μ μ a. ☞ m a l a		**
σ σ μ μ μ b. m a l a	*!	***!

In contrast with the evaluation of (13), candidate (b) in (14) fatally violates the faithfulness constraint because it has lengthened an underlyingly short vowel. It also violates the general moraic markedness constraint once more than candidate (a).

The fact that stressed monosyllables must surface with long vowels is the result of a highly ranked constraint requiring that feet be binary at either the syllabic or moraic level.

(15) **FOOTBINARITY** (**FTBIN**) - Feet must be binary at either the mora or syllable level.

Ranked above both the moraic faithfulness constraint and the general moraic markedness constraint, underlyingly short vowels in open syllables surface as long.

(16)

μ /pa/ 'fence'	FtBin	*Mora[voc]	DepLink-Mora[voc]
a. σ μ p a	*!	*	
b. ☞ σ μ μ p a		**	*

In tableau (16), candidate (b) violates both MaxLink-Mora[voc] and *Mora[voc] once more than candidate (a). However, since candidate (a) violates the higher-ranked constraint ensuring that prosodic feet be binary, candidate (b) is still optimal.

As discussed by Itô (1986) and Zec (1988), a constraint against codas in a language is different from one against geminates since many languages that lack non-geminate codas do allow geminates. Therefore, although the constraint against codas is highly ranked in Hawaiian, this does not automatically suffice as the prohibition against geminates. I propose that geminates are at least partially illicit because the markedness constraint against moraic segments is ranked above the faithfulness constraint on the underlying moraicity of consonants, as shown in (17).

(17)

μ μ μ /ma l a/ 'ache'	*MORA[CON]	MAXLINK-MORA[CON]
σ σ μ μ a. ☞ m a l a		*
σ σ μ μ μ b. m a l a	*!	

By having a geminate consonant on the surface, candidate (b) fatally violates the constraint against moraic consonants. Although candidate (a) has deleted an underlying mora from an input consonant, thus violating the faithfulness constraint, this violation is preferred to having a surface moraic consonant.

4.1.3 Summary

Hawaiian has a fairly straightforward system of syllable weight. Normally distinctive vowel length is neutralized in stressed open monosyllables due to a condition requiring feet to be bimoraic (minimal word condition). Consonant weight is never distinctive. All consonants are non-moraic. I have shown that this distribution of segment moraicity is due to the interaction of general moraic markedness constraints with faithfulness constraints on underlying moraic associations and a coercive moraic markedness constraint.

The constraint ranking that results in Hawaiian vowel length is:

(18) MAXLINK-MORA[VOC] FTBIN

*MORA[VOC] DEPLINK-MORA[CON]

The lack of geminates is due, in part, to the ranking in (19).

(19) *MORA[CON]

MAXLINK-MORA[CON]

The relative ranking of DEPLINK-MORA[CON] is indeterminate.

4.2 Italian Syllable Weight and Stress Assignment

The purpose of this section is twofold. First, I review the syllable weight and stress patterns of Modern Standard Italian in environments. Second, I provide an account of these patterns, and show that Italian has one of the more complicated interactions between the constraint types proposed in chapter 2. Consonant weight is distinctive medially; however, this distinction is neutralized in two environments – in non-geminate coda positions (weight by position), and in the *Raddoppiamento Sintattico* (syntactic doubling) environment. In contrast to the distinctive nature of consonant weight, vowel weight is non-distinctive, and vowels generally surface as short. However, vowels lengthen in one environment (stressed open penults), and they shorten unexpectedly in another environment (stressed word-final open syllables).

The layout of this section is as follows: First, a description of the data is given. Second, a brief description of the constraints proposed in chapter 2 relevant to the Italian data presented here, and an analysis of distinctive weight. Third is an analysis of penultimate vowel lengthening, including a preliminary account of Italian stress assignment. Fourth is an analysis of coda consonant weight neutralization, as well as weight sensitive stress assignment. Fifth, an analysis of three types of exceptional stress is given. The sixth section is an analysis of *Raddopiamento Sintattico*, followed by a summary.

4.2.1 Data - Vowel Length, Consonant Weight, and Syllabification

As shown in Vogel (1982, and references cited therein), vowel length in Modern Standard Italian is non-distinctive. The distribution of long and short vowels is completely predictable. Long vowels are found only in stressed open penults, while all other vowels are short regardless of stress or syllable closure. (20) shows that stressed open penults contain long vowels, and (20d) shows that medial clusters of rising sonority are syllabified as onsets.

(20)	a.	[víi.le]	*vile*	'mean'
	b.	[káa.sa]	*casa*	'house'
	c.	[nóo.no]	*nono*	'ninth'
	d.	[páa.dre]	*padre*	'father'

(21) shows that stressed penults closed by the first half of a geminate contain short vowels. (21e) shows that medial clusters of rising sonority can also contain geminates.

(21)	a.	[víl.le]	*ville*	'villas'
	b.	[kás.sa]	*cassa*	'case'
	c.	[nón.no]	*nonno*	'grandfather'
	d.	[gát.to]	*gatto*	'cat'
	e.	[láb.bro]	*labbro*	'lip'

(22) demonstrates that stressed penults closed by a sonorant contain a short vowel.[25] In contrast with (20d), the examples in (22) show that medial clusters of falling sonority syllabify heterosyllabically.

[25][s] also closes a non-final syllable followed by another consonant in medial position. The exceptional behavior of 'sC' clusters is well-known, and will not be addressed here. See Morelli (forthcoming) for current work in this area.

(22)	a.	[kón.to]	*conto*	'bill/check'
	b.	[kár.ne]	*carne*	'meat'
	c.	[ál.to]	*alto*	'high'

(23) shows that stressed antepenults contain only short vowels, whether open (a-c), closed by a geminate (d, e), or closed by a sonorant non-geminate (f).

(23)	a.	[fá.ci.le]	*facile*	'easy'
	b.	[má.ni.ka]	*manica*	'sleeve'
	c.	[mé.di.ko]	*medico*	'doctor'
	d.	[mét.te.re]	*mettere*'to put'	
	e.	[púb.bli.co]	*pubblico*	'public'
	f.	[mán.dor.lo]	*mandorlo*	'almond tree'

Stressed pre-antepenults are attested in the language, however, only under strict morphological conditions – in the third person plural present indicative and subjunctive forms of first conjugation verbs. Pre-antepenults contain only short vowels, as shown in (24). The corresponding singular present verb form is given in (25).

(24)	a.	[dú.bi.ta.no]	*dubitano*	'doubt' - indicative
	b.	[dú.bi.ti.no]	*dubitino*	'doubt' – subjunctive

(25)	a.	[dú.bi.to]	*dubito*	'doubt' 1st pers. sing. pres.

Since this exceptional stress pattern is morphologically restricted and the stressed syllable is identical to that found in the singular present verb forms, I assume that there is some output-output correspondence explanation (Benua 1996). However, since pre-antepenultimate stress falls outside regular stress assignment, which is normally restricted to one of the final three syllables, and is beyond the scope of this thesis, I will not account for it here.

(26) shows that stressed final syllables contain only short vowels.

(26)	a.	[cit.tá]	*città*	'city'
	b.	[vir.tú]	*virtù*	'virtue'
	c.	[pe.ró]	*però*	'however'

4.2.2 Analysis

4.2.2.1 Core Syllable Weight

In the above discussion, it was shown that vowel length is non-distinctive, but consonant weight is distinctive in Modern Standard Italian. Vowels are short everywhere except in stressed open penults (long stressed penults will be discussed in section 4.2.2.2), and medial consonants can be either geminate or non-geminate. Following chapter 2, this core syllable weight distribution can be analyzed as the interaction of faithfulness constraints on underlyingly moraic content with markedness constraints against moraic segments. The faithfulness constraints, (27) and (28), are given in summarized form here for convenience:

(27) **MAXLINK-MORA[SEG] –** "Do not delete an underlying mora from a segment."

(28) **DEPLINK-MORA[SEG] –** "Do not add a mora to a segment that it did not have underlyingly."

Recall that these constraints are actually shorthand for two families of constraints relativized to different segments. In the case of Italian, they must be relativized minimally to the natural classes of consonants, (29) and (30), and vowels, (31) and (32), since vowel length and consonant weight are treated differently by the grammar.

(29) **MAXLINK-MORA[CON] –** "Do not delete an underlying mora from a consonant."

(30) **DEPLINK-MORA[CON] –** "Do not add a mora to a consonant that it did not have underlyingly."

(31) **MAXLINK-MORA[VOC] –** "Do not delete an underlying mora from a vowel."

(32) **DEPLINK-MORA[VOC] –** "Do not add a mora to a vowel that it did not have underlyingly."

The general moraic markedness constraint is given in (33).

(33) ***MORA[SEG] -** "Do not associate a mora with a particular segment".

Recall that this is really a constraint family relative to different segment types. Since Italian only differentiates between the natural classes of consonants and vowels, and not within each of these classes, only two encapsulated constraints need to be shown here, (34) and (35).

(34) ***MORA[CON] -** "Do not associate a mora with a consonant."

(35) ***MORA[VOC] -** "Do not associate a mora with a vowel."

Assuming that geminates in Italian are the result of an underlyingly moraic consonant that surfaces as moraic, the faithfulness constraint against deleting underlying morae from consonants must rank about the constraint forbidding moraic consonants. This is shown in (36). Only the consonant mora is evaluated.

(36)

μ /metere/ ‘to put’	MAXLINK-MORA[CON]	*MORA[CON]
σ σ σ μ μ μ a. m e t e r e	*!	
σ σ σ μ μ μ μ b.☞ m e t e r e		*

Despite the fact that candidate (b) violates the markedness constraint once more than candidate (a), it is still optimal because candidate (a) fatally violates the higher-ranked faithfulness constraint against deleting underlying morae from consonants.

A non-moraic intervocalic consonant in the input will surface as non-moraic straightforwardly, as shown in tableau (37). Since there is no imperative to moraify the consonant, either the general moraic markedness constraint or the faithfulness constraint against adding morae to consonants will rule out a moraic intervocalic consonant.

(37)

/manika/ ‘sleeve’	DEPLINK-MORA[CON]	*MORA[CON]
σ σ σ μ μ μ a. ☞ m a n i k a		
σ σ σ μ μ μ μ b. m a n i k a	*!	*!

Candidate (b) violates both constraints once more than candidate (a), therefore it loses. It violates the consonant faithfulness constraint because it adds a mora to a consonant that was not there underlyingly, and it violates the markedness constraint for that added mora.

Recall that vowel length is non-distinctive. All non-penultimate vowels surface as short. To account for this, MAXLINK-MORA[VOC] be ranked below the markedness constraint. Tableau (38) shows that with a long non-penultimate vowel in the input, the vowel surfaces as short. Note that I assume that long vowels are bimoraic in the input. However, monomoraic vowels may either be underlying non-moraic or monomoraic since Italian does not contrast these two vowel types in nuclear position. I will assume underlyingly monomoraic vowels just for convenience.

(38)

μμ μ μ /m a n i k a/ 'sleeve'	*MORA[VOC]	MAXLINK-MORA[VOC]
σ σ σ μ μ μ a. ☞ m a n i k a	***	*
σ σ σ μ μ μ μ b. m a n i k a	****!	

Although candidate (a) violates the vowel faithfulness constraint by shortening an underlyingly long vowel, it is still optimal because candidate (b) incurs one more violation of the higher-ranked markedness constraint by having a long vowel.

Without a higher-ranked constraint forcing non-penultimate vowels to lengthen, the relative ranking of *MORA[VOC] and DEPLINKMORA[VOC] is unimportant. This is shown in (39).

(39)

μ μ μ /m a n i k a/ ‘sleeve’	*MORA[VOC]	DEPLINK-MORA[VOC]
σ σ σ μ μ μ a. ☞ m a n i k a	***	
σ σ σ μ μ μ μ b. m a n i k a	****!	*!

To summarize, distinctive consonant weight results from ranking MAXLINK-MORA[CON] above *MORA[CON], and non-distinctive vowel length results from ranking *MORA[VOC] above MAXLINK-MORA[VOC]. The relative ranking of the DEPLINK-MORA constraints is indeterminate. Keeping in mind the universal moraic markedness hierarchy, the following constraint ranking results:

(40) MAXLINK-MORA[CON]
*MORA[CON]
*MORA[VOC]
MAXLINK-MORA[VOC]

4.2.2.2 Penultimate Stress and Vowel Lengthening

Recall that stress is always found within the three syllable window at the end of a word (except morphologically driven stress which is not accounted for here). From this, we can conclude that stress falls on the right-most foot. This stress placement can be explained via a constraint aligning the head foot of a prosodic word to the right edge of the prosodic word ranked above a constraint aligning the head foot to the other edge of the prosodic word.

(41) **ALIGNHEAD-EDGE** (**ALIGNHD-E**) **–** Align the head foot of a prosodic word to an edge of that prosodic word (McCarthy and Prince (1993) - an alignment translation of Prince and Smolensky's (1993) EDGEMOST(pk; L/R;word) constraint family).

As (42) shows, with ALIGNHD-R(ight) ranked above ALIGNHD-L(eft), given a choice between stressing a final or non-final foot, the final foot is always stressed.

(42)

	ALIGNHD-R	ALIGNHD-L
a. ☞ [FF'**F**]$_{PRWD}$		*
b. [F'**F**F]$_{PRWD}$	*!	*
c. ['**F**FF]$_{PRWD}$	*!	

Candidate (b) violates both of these constraints. Candidate (c) violates only the high-ranked constraint, and candidate (a) violates only the lower-ranked constraint. Therefore, candidate (a) is more harmonic.

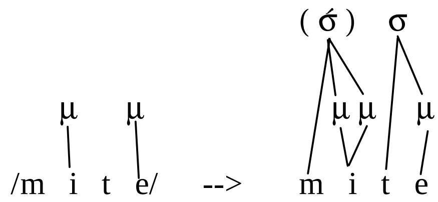
As discussed above, and shown here in (43), vowels in stressed penultimate open syllables must be long.

(43)	a.	[míi.te]	*mite*	'mild'
	b.	[nóo.me]	*nome*	'name'

This is readily explained using a combination of final syllable extrametricality and the requirements that feet be binary and aligned to the right edge of the word. Given an input composed of two open syllables, and no stress marked, stress falls on the penult. The final syllable is extrametrical (unfooted), and the penult is a foot by itself. To maintain the condition that feet be binary at either the moraic or the syllabic level, a monosyllabic foot must surface as bimoraic.

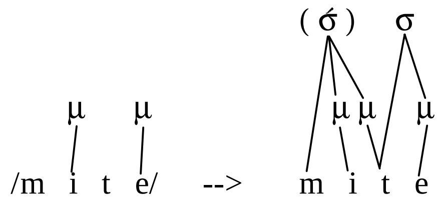
Disregarding the possibility of epenthesis or deletion which never occur in this environment in Italian, there are two possible repair strategies for ensuring that the binary minimal weight requirement is met. One is to lengthen the vowel (the actual choice made in this environment in Modern Standard Italian, as shown in (44)), and another is to geminate the following consonant (English, Morén 1996, et seq.; Ancient Greek, Steriade, 1982), as shown in (45).

(44) a.



[míi.te]

(45) a.



[mít.te]

As tableau (48) demonstrates, with a constraint requiring final syllables to be unfooted, as (46), and a constraint requiring that feet be binary, as (47), both of these options are possible. It is up to some other constraint to decide whether candidate (a) or (b) will be optimal in a particular language.

(46) **FINALSYLLABLEEXTRAMETRICALITY** (**FINALSYLLEXTRA**) **–** "Do not foot the final syllable." Based on Hung's (1994:65) "σ → <σ>/ __]PhonWd" which is based on Hayes (1991) and Crowhurst (1992).

(47) **FOOTBINARITY** (**FTBIN**) **–** Feet must be binary at either the mora or syllable level (Prince and Smolensky 1993)

(48)

μ μ /mi te/	FTBIN	FINALSYLLEXTRA
(σ́ σ) μ μ a. m i t e		*!
(σ́) σ μ μ b. m i t e	*!	
(σ́) σ μμ μ c. ☞ m i t e		
(σ́) σ μ μ μ d. ☞ m i t e		

Candidate (a) fatally violates the constraint requiring the final syllable to be unfooted. Candidate (b) fatally violates the constraint requiring that feet be binary. Candidates (c) and (d) are equally harmonic with respect to these two constraints because both have binary feet and unfooted final syllables.

To ensure that the vowel lengthens and the consonant does not become a geminate, we need only make use of the universal moraic markedness hierarchy. As (49) demonstrates, with the constraint against moraic consonants ranked above the constraint against moraic vowels, the vowel lengthens under coercion.

(49)

μ μ /mi te/ 'mild'	FTBIN	FINALSYLLEXTRA	*MORA[CON]	*MORA[VOC]
a. (σ́ σ) μ μ m i t e		*!		
b. (σ́) σ μ μ m i t e	*!			
c. ☞ (σ́) σ μμ μ m i t e				*
d. (σ́) σ μ μ μ m i t e			*!	

In tableau (49), candidate (c) wins over candidate (d) because of the universal moraic markedness hierarchy. Candidate (d) violates the higher-ranked constraint against moraic consonants, while candidate (c) violates the lower-ranked constraint against moraic vowels.

Finally, to ensure that the final syllable is not footed despite the imperative to build feet from the right edge of the word, the constraint requiring final syllable extrametricality must outrank the alignment constraint, as shown in (50).

(50)

μ μ /mi te/ 'mild'	FinalSyllExtra	AlignFt-R
a. (σ́ σ) μ μ m i t e	*!	
b. ☞ (σ́) σ μ μ μ m i t e		*

Tableau (50) shows that it is worse to foot the final syllable, candidate (a), than it is to not alight the foot with the right edge of the prosodic word, candidate (b).

To summarize, Modern Standard Italian stressed penultimate vowels in open syllables lengthen to maintain binary feet, final syllable extrametricality, and underlying consonant moraicity.

(51) FtBin, FinalSyllExtra, *Mora[con] >> *Mora[voc]

In addition, although feet try to align to the right edge of the word, the final syllable is unfooted due to (52).

(52) FinalSyllExtra >> AlignFt-R

4.2.2.3 Antepenultimate Stress

In the case of antepenultimate stressed open syllables, the final syllable is extrametrical, and the penult and antepenult form a disyllabic foot. Therefore, no vowel lengthening is required, as shown in tableau (53).

(53)

μ μ μ /ma ni ka/ 'sleeve'	FINALSYLLEXTRA	*MORA[VOC]	DEPLINK-MORA[VOC]
a. σ (σ́ σ) μ μ μ m a n i k a	*!	***	
b. ☞ (σ́ σ) σ μ μ μ m a n i k a		***	
c. (σ́ σ) σ μ μ μ μ m a n i k a		****!	*!

Candidate (c), with a lengthened stressed antepenultimate vowel, incurs one more violation of both the markedness constraint against moraic segments and the faithfulness constraint on underlying vowel length than the other two candidates. Since candidates (a) and (b) differ only in foot structure, and candidate (b) satisfies the final extrametricality constraint, it is optimal.

4.2.2.4 Weight by Position

Another issue to be explained is the fact that non-geminate codas must surface as moraic[26]. Recall that non-geminate codas can be found in stressed penults, as described in section 4.2.1. Since the vowel is not long in this environment, the coda consonant must be moraic to satisfy the binary foot requirement. This is a case of coerced consonant weight.

(54)	a.	[kón.to]	*conto*	'bill/check'
	b.	[kár.ne]	*carne*	'meat'
	c.	[ál.to]	*alto*	'high'
	d.	*[kóon.to]		

To force codas to surface as moraic, there must be an active constraint requiring codas to be heavy. Following a long line of literature based on Hayes (1989), I use the following constraint:

(55) **WEIGHTBYPOSITION** (**WBYP**) **–** Coda consonants must surface as moraic.

Since non-geminate codas must surface as heavy whether or not underlyingly moraic, WBYP must outrank both the general moraic markedness constraint on consonants and

[26] This is true in at least closed stressed final and penultimate syllables where moraic content is visible. However, the moraic status of closed pre-penultimate syllables is indeterminate since there are no diagnostics to determine the relative weight.

the faithfulness constraint on underlyingly consonant weight[27]. Assuming that the penult must be bimoraic, WBYP forces an underlyingly moraic consonant to remain moraic if it is ranked above the general moraic markedness constraint. This is demonstrated in (56).

(56)

μ μ μ /kon to/ 'bill/check'	WBYP	*MORA[CON]
a. (σ́) σ μμ μ k o n t o	*!	
b. ☞ (σ́) σ μ μ μ k o n t o		*

Candidate (a) fatally violates the WBYP constraint because it has a coda which is not moraic. Candidate (b) is optimal, even though it has a moraic consonant.

As the tableau in (57) shows, WBYP must be ranked above both *MORA[CON] and the DEPLINK-MORA[CON] constraints to ensure that underlyingly non-moraic consonants surface as moraic in strictly coda position.

[27]An observation to make here is that the sonorant must syllabify as a coda because otherwise it would form an onset cluster which violates a well-formedness condition that onset clusters rise in sonority. Since this issue is beyond the scope of this thesis, it will not be addressed here. See Hironymous (1999) for proposals on deriving this effect via a universal hierarchy of alignment constraints requiring different segment types to be aligned with the left edge of the syllable.

(57)

μ μ /kon to/ 'bill/check'	WBYP	*MORA[CON]	DEPLINK-MORA[CON]
a. (σ́) σ μμ μ k o n t o	*!		
b. ☞ (σ́) σ μ μ μ k o n t o		*	*

Candidate (a) fatally violates the WBYP constraint because it has a coda which is not moraic. Candidate (b) is optimal, even though it adds a mora to an underlyingly non-moraic consonant.

4.2.2.5 Weight Sensitivity

In words of more than two syllables, closed penults are usually stressed (exceptions will be discussed in section 4.2.2.6).

(58)	a.	[kom.mén.to]	*commento*	'comment'
	b.	[de.si.nén.za]	*desinenza*	'end of a word'
	c.	[dif.fe.rén.te]	*differente*	'different'

To guarantee that the bimoraic penult is stressed, not the disyllabic combination of the antepenult and penult, a constraint is needed to ensure that feet are maximally bimoraic.

(59) ***TRIMORAICFOOT** (***TRIMORAFT**) **–** Prosodic feet should be maximally bimoraic.[28]

With the constraint requiring codas to be moraic ranked above the consonant weight faithfulness constraint, and the constraint against trimoraic feet, the heavy penult must be footed by itself – therefore is stressed. The relative ranking of *TRIMORAFT and WBYP will be resolved in next section.

(60)

μ μ μ μ μ /d i f e r ente/ ‘different’	WBYP	*TRIMORAFT	*MORA[CON]
σ (σ́ σ) σ μ μ μ μ μ a. d i f e r e n t e	*!		*
σ (σ́ σ) σ μ μ μ μ μ μ b. d i f e r e n t e		*!	**
σ (σ σ́) σ μ μ μ μ μ μ c. d i f e r e n t e		*!	**
σ σ (σ́) σ μ μ μ μ μ μ d. ☞ d i f e r e n t e			**

[28] Note that this constraint is similar, but not identical, to the *TRIMORA constraint on syllables used in section 3.2.3.3 for Lithuanian. Although the two constraints both penalize trimoraic prosodic structures, the prosodic structures targeted by the two constraints are different.

Candidate (a) fatally violates the constraint requiring codas to be moraic. Candidates (b) and (c) violate both the constraint against trimoraic feet (fatally) and the constraint against moraic consonants. Candidate (d) is optimal because it violates only the lowest-ranked constraint against moraic consonants.

4.2.2.6 Exceptional Stress

There are three cases in which stress is assigned lexically, or unpredictably, in Modern Standard Italian. The first is when an open penultimate syllable is stressed in words containing more than two syllables.

(61)	a.	[bra.vúu.ra]	*bravura*	'skill'

This is exceptional because the penult is stressed and the vowel lengthened even though there is an antepenult available to receive stress. Section 4.2.2.3 discusses the canonical stressing of antepenults when penults are open.

The second exception to canonical stress assignment is when the final syllable is stressed.

(62)	a.	[vir.tú]	*virtù*	'virtue'

This is exceptional because there are relatively few simplex words in this language which have final stress, and stress is typically predicted to be on either the penult or the antepenult. Final syllable extrametricality predicts that final syllables should not be stressed, as discussed in section 4.2.2.2.

The third exception is when an antepenultimate syllable is stressed even when there is a closed penultimate syllable.

(63) a. [mán.dor.la] *mandorla* ‘almond’

This is exceptional because the antepenult is stressed even though there is a closed penult. As discussed in section 4.2.2.5, closed penults typically attract stress.

Recall that given an open penult, antepenultimate stress is predictable due to a combination of final syllable extrametricality and moraic markedness. I propose that in the case of exceptional penultimate stress, the open penult is marked with underlying stress, as shown in (64).

(64) a. /b r a v ú r a/ *bravura* 'skill'

To ensure that underlying stress surfaces despite the imperative to not lengthen vowels (recall that feet must be binary), a faithfulness constraint on underlying stress, (65), must be ranked above the moraic markedness constraint, as shown in (66).

(65) **FAITHSTRESS** - Maintain stress affiliation[29].

[29] This is obviously shorthand for a more articulated constraint or set of constraints that conspire to maintain underlying stress affiliation. It is not meant as a serious contender for universal status as currently formulated.

(66)

μ μ μ /b r a v ú r a/ ‘skill’	FAITHSTRESS	FTBIN	*MORA[VOC]
σ (σ́) σ μ μ μ a. b r a v u r a		*!	***
σ (σ́) σ μ μμ μ b. ☞ b r a v u r a			****
(σ́ σ) σ μ μ μ c. b r a v u r a	*!		***

Candidate (a) fatally violates the constraint requiring binary feet. Candidate (c) fatally violate the faithfulness constraint on underlying stress assignment. Although candidate (b) incurs one more markedness violation than either of the competing candidates, it is optimal because the other two candidates fatally violate higher-ranked constraints.[30]

The second case of exceptional stress is that of final stress. To ensure that underlying stress assignment is preserved in spite of a constraint requiring extrametrical final syllables, faithfulness to underlying stress must outrank FINALSYLLEXTRA, as shown in (67).

[30] A fourth candidate in which the penult and antepenult form an iambic bimoraic foot is not evaluated because I assume a highly ranked constraint requiring that Italian prosodic feet be left-headed.

(67)

μ μ /v i r t ú/ 'virtue'	FAITHSTRESS	FINALSYLLEXTRA
σ (σ́) μ μ μ a. ☞ v i r t u		*
(σ́) σ μ μ μ b. v i r t u	*!	
(σ́ σ) μ μ μ c. v i r t u	*!	*

Candidate (c) violates both of these constraints, however, it is the faithfulness constraint which is fatal. Candidate (b) also fatally violates the faithfulness constraint. Candidate (a) is optimal even though it violates the constraint requiring extrametricality.

Since the final stressed vowel does not lengthen, a constraint prohibiting long vowels in final position must outrank the constraint requiring binary feet.

(68) ***WORD-FINALLONGVOWEL** (***FINALLONGV**) **–** Word-final long vowels are prohibited.

(69)

μ μ /v i r t u/ 'virtue'	*FINALLONGV	FTBIN
σ (σ́) μ μ μ a. ☞ v i r t u		*
σ (σ́) μ μ μμ b. v i r t u	*!	

Finally, since FTBIN does not force a violation of underlying stress assignment, stress faithfulness must be higher-ranked.

(70)

μ μ /v i r t u/	FAITHSTRESS	FTBIN
σ (σ́) μ μ μ a. ☞ v i r t u		*
(σ́) σ μ μ μ b. v i r t u	*!	

The third example of lexical stress assignment is when an antepenult is stressed even though there is a closed penult. As section 4.2.2.2 demonstrated, closed penults predictably attract stress due to a combination of weight by position and a markedness constraint against trimoraic feet. I propose that exceptional antepenultimate stress follows from ranking both *TRIMORAFT and FAITHSTRESS above WBYP and assuming underlying stress on the antepenult. This forces the antepenult and penult to surface as a bimoraic/disyllabic foot, as shown in (71).

(71)

μ μ μ / m a n d o r l a/	*TRIMORAFT	FAITHSTRESS	WBYP
a. (σ́ σ) σ μ μ μ μ μ m a n d o r l a	*!		
b. σ (σ́) σ μ μ μ μ μ m a n d o r l a		*!	
c. ☞ (σ́ σ) σ μ μ μ m a n d o r l a			**

Candidate (a) is faithful to underlying stress, and it has moraic codas, but it fatally violates the constraint against trimoraic feet. Candidate (b) also has moraic codas, thus satisfying the lowest-ranked constraint, however, it violates stress faithfulness. Note that it is the head foot alignment constraint, not shown, which forces stress to right-most foot (the penult) in candidate (b), thereby defeating lexical stress in this candidate. Candidate (a) satisfies both *TRIMORAFT and stress faithfulness (as well as FTBIN, not shown here), therefore it is optimal.

With this constraint ranking, it is impossible for main stress in underived environments to ever fall forward of the antepenult if the constraint requiring that the head foot of the prosodic word be the rightmost foot is also ranked above faithfulness to underlying stress placement. Any underlying stress contrived to achieve pre-antepenultimate stress will not surface unmodified and will result in either antepenultimate or penultimate stress depending on the surface footing of these two syllables.

4.2.4 *Raddoppiamento Sintattico* (Syntactic Doubling)

The analysis given above suggests at least part of an account for the phenomenon known (somewhat misleadingly) as *Raddoppiamento Sintattico*. This is a phenomenon by which a word with a final stressed open syllable triggers gemination of the onset of the following word if the two are contained within a phonological phrase (Nespor and Vogel, 1986). In this paper, I will not attempt to provide a motivation for, or account of, the mechanism that selects what syntactic constituents trigger *Raddoppiamento Sintattico*. Instead, I will show that given the proper motivation, the consonant gemination follows straightforwardly from the stress and weight system of Modern Standard Italian established above. Further, this particular phenomenon gives evidence of the ability of coercive moraic markedness constraints to override distinctive moraicity.

As (72) shows, if a word with a final stressed vowel joins with a consonant-initial word, the consonant geminates.

(72)	a.	[té] + [fréd.do]	→	[téf.fréd.do]	*tè freddo*	'cold tea'
	b.	[vá] + [vía]	→	[váv.vía]	*va via*	'go away'
	c.	[é] + [kár.lo]	→	[ék.kár.lo]	*e Carlo*	'and Carlo'

Neither unstressed monosyllables nor unstressed final syllables trigger gemination, as seen in (73).

(73)	a.	[tór.re] + [grán.de]	→	[tór.re.grán.de]	*torre grande*	'great tower'
	b.	[la] + [káa.sa]	→	[la.káa.sa]	*la casa*	'the house'

Recall that feet in Italian are binary, unless word final and composed of an open syllable. This restriction is the result of the ranking in (74).

(74) *FINALLONGV >> FTBIN

In addition, stressed penultimate vowels in open syllables lengthen in part because of the ranking in (75).

(75) FTBIN, *MORA[CON] >> *MORA[VOC]

During the discussion motivating (74), we did not have evidence with which to rank *MORA[CON] with respect to FTBIN. However, (76) shows that consonant gemination is the logical conclusion to the need to not lengthen final vowels, yet maintain a binary foot, if FTBIN is ranked above *MORA[CON].

(76)

(σ́) (σ́) σ μ μ μ μ [t e] + [f r e d o]	*FINALLONGV	FTBIN	*MORA[CON]
a. (σ́) (σ́) σ μ μ μ μ t e f r e d o		*!	
b. (σ́) (σ́) σ μ μ μ μ μ t e f r e d o	*!		
c. ☞ (σ́) (σ́) σ μ μ μ μ μ t e f r e d o			*

Candidate (a) fatally violates the constraint requiring a binary foot because the initial foot is both monomoraic and monosyllabic. Candidate (b) is bimoraic, but it fatally violates the higher-ranked constraint against word-final long vowels. Candidate (c) violates the consonant weight faithfulness constraint because an underlyingly non-moraic consonant surfaces as moraic. However, it is still optimal because the other candidates violate higher-ranked constraints.

4.2.5 Summary

The fact that Modern Standard Italian has distinctive medial consonant weight, but no distinctive vowel length results from the constraint ranking in (77). This is an example of the constraint rankings in sections 2.3.2 and 3.3.2 that yield distinctive weight for a less-sonorous segment and non-distinctive weight for a more-sonorous segment. It also shows that distinctive moraicity is not dependent on sonority the way that coerced moraicity is.

(77) MaxLink-Mora[con]
|
*Mora[con]
|
*Mora[voc]
|
MaxLink-Mora[voc]

The neutralization of consonants in non-geminate coda position to moraic is the result of (78). This ranking shows the influence of coerced moraicity on normally distinctive weight.

(78) WbyP >> DepLink-Mora[con], *Mora[con]

Stressed penultimate vowels in open syllables lengthen because of (79). As discussed in section 3.3.2, the influence of coercive moraic markedness constraints that do not specify the target of the weight requirement results in the moraification of a higher-sonority segment. In this case, the stressed vowel lengthens rather than the following consonant becoming moraic.

(79) FtBin, FinalSyllExtra, *Mora[con] >> *Mora[voc]

Exceptionally stressed final vowels in open syllables are short as a result of (80).

(80) FAITHSTRESS, *FINALLONGV >> FINALSYLLEXTRA, FTBIN

Finally, R*addoppiamento Sintattico* is the result of (81). Here we see that a higher-ranked coercive moraic markedness constraint, in this a constraint ensuring maximal moraicity of a certain segment in a particular environment, can contravene the result predicted for the interaction of coercive moraic markedness constraints not specifying segment type and the universal moraic markedness hierarchy. The constraint requiring foot binarity ranked above the moraic markedness hierarchy predicts that vowels will lengthen to meet the requirement. This is the case for stressed open penults. However, the higher-ranked constraint forbidding final long vowels forces consonants to be moraic to satisfy the foot binarity requirement.

(81) *FINALLONGV >> FTBIN >> *MORA[CON]

4.3 Kashmiri Syllable Weight and Stress Assignment

Kashmiri, a Dardic Indo-Aryan language spoken in the Kashmir province of India, shows an interesting relationship between vowel length, consonant weight, and stress assignment. In this section, I will show how the constraints and constraint interactions proposed in chapter 2 can be used to provide not only an analysis of the core syllable weight of Kashmiri, but also an analysis of the previously puzzling distribution of stress in this language. Besides the empirical importance of demonstrating yet another language type predicted by factorial ranking of moraic constraints, an added theoretical point is that I demonstrate that closed syllables may vary in weight depending on surface stress assignment. This is in line with the work of Kager (1989), Hayes (1995), Rice (1996), and Broselow et al (1998), but in contrast with many other theories of weight that treat consonant weight for a particular segment in a given syllabic position as static within a given language.

I will demonstrate that the complex distributions of moraic segments in Kashmiri are the result of the interaction of a limited number of general constraints. In addition, I show that re-ranking these constraints cannot lead to an unattested and intuitively unexpected interaction between stress and weight.

The section is organized as follows. Section 4.3.1 is a brief review of the constraints and typology proposed in chapter 2. In section 4.3.1.1, I describe the data. In section 4.3.2, an analysis of the observed facts is provided, and in section 4.3.3, some theoretical issues are discussed.

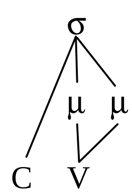
4.3.1 Background and Data

As reviewed in chapter 1, the equivalence of syllables containing long vowels (CVV) and closed syllables (CVC), as opposed to open syllables containing short vowels (CV), is found in many languages under a variety of circumstances, including stress assignment. Traditionally, this has been seen as a difference in syllable weight. CVV and CVC are heavy, and CV is light. It has also been shown that in languages with a CV/CVV distinction, CVC syllables do not always pattern with CVV, but may count as light and pattern with CV (e.g. Zec 1988).

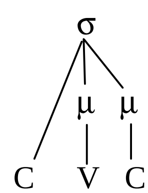
Under Moraic Theory (Hyman 1985; Prince 1976, 1983; Hayes 1989, etc.), the equivalence of CVV and CVC has been captured via bimoraicity. A long vowel has two moraic positions associated with a single vowel root node. A heavy closed syllable has one mora associated with the vowel and another mora associated with the coda consonant.

(82) Heavy syllables

a. [CVV]



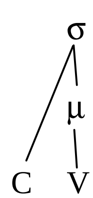
b. [CVC]



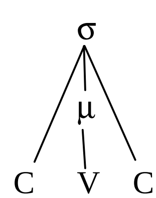
In contrast, in languages where closed syllables pattern with CV, both of these syllables are monomoraic.

(83) Light syllables

a. [CV]



b. [CVC]



Zec (1988) demonstrates that not only do CVC syllables pattern as either light or heavy, but CVC can act as light or heavy within the same language depending on the quality of the coda consonant. In some languages, a CVC with a higher sonority coda patterns with CVV, while a CVC with a lower sonority coda patterns with CV. For example, Lithuanian CVO (O = obstruent) is light, and CVS (S = sonorant) is heavy (Zec 1988).

In contrast with most previous theories where consonant weight is constant for a particular segment in a given syllabic position within a language as a whole, I will show that CVC syllables can vary in weight within a language depending on whether or not they are stressed. I propose that in Kashmiri, CVV and CV are always heavy and light, respectively. However, CVC is heavy only if it is the best potentially stressable syllable in the word, otherwise it is light. The conclusion that consonant weight is variable comes from the surface stress pattern of the language, and this variable weight is the result of constraint interactions.

4.3.1.1 Distinctive Weight

The examples in (84), (85), (86), and (87) show that Kashmiri, like its cousin Hindi, has both long and short vowels. All examples come from Kachru (1973) and Bhatt (1989).

(84) Short vowels only

a.	[bá.tɨ]	‘food/cooked rice’
b.	[p^{h}í.ki.ri]	'understand'
c.	[kú.ni.vi.zi]	‘sometime’
d.	[á.ni.ga.tɨ]	‘darkness’

(85) Long and short vowels

a.	[ə́ə.nɨ]	'mirror'
b.	[kí.taab]	'book'
c.	[báa.sun]	'to seem'
d.	[mɔ.kɨ.láa.vun]	'to finish'
e.	[báa.laa.dər]	'balcony'

(86) Long vowels only

a.	[dée.vəə.lii]	'the Hindu festival of lights'
b.	[kə́ə.pʰii]	'enough'
c.	[áa.raam]	'rest'

(87) Minimal pairs

a.	[bal]	'strength'
b.	[baal]	'forehead'
c.	[tɨr]	'a piece of rag'
d.	[tɨɨr]	'cold'
e.	[mar]	'die'
f.	[maar]	'beat'

However, the status of geminate intervocalic consonants is less clear. Although Bhatt (1989) cites one unglossed example of a long consonant, (88), Kachru (1973) does not cite a single long consonant in the over 700 pages of “Introduction to Spoken Kashmiri”.

(88) a. [mu.kád.di.ma] no gloss (Bhatt 1989)

In addition, although Kachru does discuss vowel length as an important feature of Kashmiri, there is no mention of long consonants. Since Kashmiri speakers are heavily exposed to neighboring languages that have geminate consonants, it is possible that Bhatt’s citation was mistakenly included from another language. Since the overwhelming evidence available at this time supports a Kashmiri without geminate consonants, that is the assumption made here.

Given that long vowels do not consistently appear in any one syllable in a word, and there are abundant minimal pairs differing only in vowel length, I assume that vowel weight is phonologically distinctive. Further, given that geminates are extremely limited in this language, if they exist at all, I assume that consonant weight is non-distinctive.

4.3.1.2 Stress and Representations

As (89) shows, in disyllabic words, the final syllable is never stressed, regardless of weight.

(89)	a.	[ə́ə.nɨ]	‘mirror’
	b.	[kí.taab]	‘book’
	c.	[báa.sun]	‘to seem’
	d.	[kə́ə.p^{h}ii]	‘enough’

However, in words of more than two syllables, stress is determined by syllable weight. In words containing long vowels, the leftmost non-final long vowel is stressed.

(90)	a.	[mɔ.kɨ.láa.vun]	‘to finish’
	b.	[báa.laa.dər]	‘balcony’
	c.	[dée.vəə.lii]	‘the Hindu festival of lights’
	d.	[kə́ə.p^{h}ii]	‘enough’
	e.	[vah.ráa.vun]	‘to spread’

In the absence of a long vowel, the leftmost non-final closed syllable is stressed.

(91)	a.	[gí.dun]	‘to play’
	b.	[ʃo.kɨ́r.vaar]	‘Friday’
	c.	[yə́m.bɨr.zal]	‘narcissus’

Note that the attraction of stress to closed syllables parallels the pattern seen with long vowels. Thus, we can conclude that stressed closed syllables are heavy.

Non-final closed syllables containing long vowels (superheavy) are stressed in preference to all other syllables.

(92) a. [boo.dées.var] 'Lord'

Finally, stress is assigned to the initial syllable if all non-final syllables are light.

(93) a. [p^{h}í.ki.ri] ‘understand’

b. [kú.ni.vi.zi] ‘sometime’

c. [á.ni.ga.tɨ] ‘darkness’

d. [ná.kɨ.voor] ‘nostril’

The conclusion to be drawn from these data is that main stress in Kashmiri is as far left in a word as possible. However, it is weight sensitive, and retracts to the left-most heaviest syllable of the word (excluding final syllables).

The most puzzling aspect of the interaction between stress and syllable weight in this language is that given the choice of stressing a non-final long vowel or non-final closed syllable within a single word, the long vowel is always stressed - even if it is to the right of a closed syllable.

(94) a. [vah.ráa.vun] ‘to spread’

b. [vuʃ.náa.vun] ‘to warm’

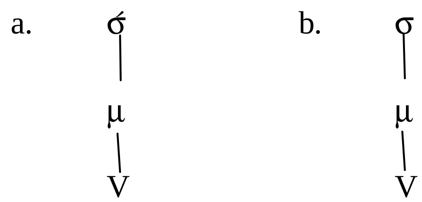
c. [pʰam.váa.rɨ] ‘fountains’

d. [dar.váa.zɨ] ‘door’

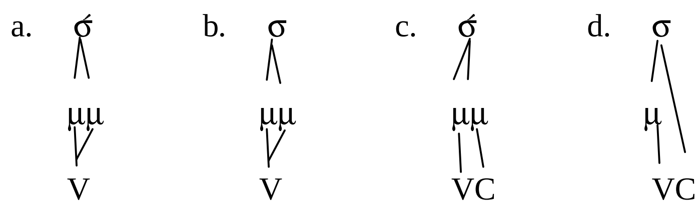
This is a puzzle given standard assumptions about syllable weight. Under the standard version of moraic theory assumed here, superheavy syllables are trimoraic, heavy syllables are bimoraic, and light syllables are monomoraic. Since it is obvious that both long vowels and closed syllables are heavy (they both attract stress), why are long vowels preferentially stressed?

The answer proposed here is that despite surface appearances, weight is responsible for all cases of non-initial stress in Kashmiri. The intuition is that the inherent bimoraicity of long vowels (compare (82a) and (83a)) is the driving force behind stress attraction, but the ability of closed syllable weight to be variable across languages (compare (82b) and (83b)) allows for heavy closed syllables only when they are stressed on the surface. In contrast with many languages that treat syllables closed by particular segment types as always heavy or always light, Kashmiri closed syllable weight is variable and dependent on surface stress. This variability is the result of constraint interaction.

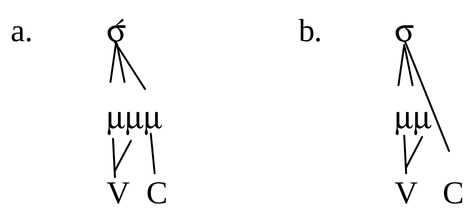
The surface representations proposed here for Kashmiri light and heavy stressed and unstressed syllable rhymes are shown in (95) and (96). In (95), both stressed and unstressed syllables containing simple rhymes are monomoraic.

(95) 

In (96a) and (96b), both stressed and unstressed long vowels are bimoraic. In (96c), a stressed closed syllable is bimoraic. However, in (96d), an unstressed closed syllable is monomoraic.

(96) 

Finally, the representations assumed for stressed and unstressed superheavy syllables is given in (97).

(97) 

4.3.2 Analysis

I claim in chapter 2 that the core syllable weight of any language is the result of ranking faithfulness constraints on underlying moraic content relative to markedness constraints on segment moraicity. The generic faithfulness constraints were given in (14) and (15) of chapter 2. Recall, however, that these constraints are actually shorthand for two families of constraints relativized to different segments. In the case of Kashmiri, they must be relativized minimally to the natural classes of consonants, (98) and (99), and vowels, (100) and (101), since vowel length and consonant weight are treated differently by the grammar. However, weight is uniform within each class.

(98) **MAXLINK-MORA[CON] –** "Do not delete an underlying mora from a consonant."

(99) **DEPLINK-MORA[CON] –** "Do not add a mora to a consonant that it did not have underlyingly."

(100) **MAXLINK-MORA[VOC] –** "Do not delete an underlying mora from a vowel."

(101) **DEPLINK-MORA[VOC] –** "Do not add a mora to a vowel that it did not have underlyingly."

The general moraic markedness constraint, must also be relativized to the natural classes of consonants and vowels.[31]

[31] This is only a notational convenience, as I assume that all general moraic markedness constraints are universal.

(102) ***MORA[CON]** - “Do not associate a mora with a consonant.”

(103) ***MORA[VOC]** - “Do not associate a mora with a vowel.”

In the following sections, I will show that the distribution of Kashmiri vowel and consonant moraicity, as well as the complex stress pattern, results quite naturally from the interaction of the general moraic markedness constraints, the moraic faithfulness constraints, and coercive moraic markedness constraints (to be introduced).

4.3.2.1 Distinctive Vowel Weight

Recall from section 4.3.1.1 that vowel length is distinctive in Kashmiri. Using the constraints proposed in chapter 2, and reviewed in the previous section, distinctive moraicity is analyzed as the ranking a faithfulness constraint on underlying moraic content over a markedness constraint against moraic segments. To account for the distinctive vowel length, faithfulness to underlying vowel length must outrank markedness, as shown in (104) and (105). In (104), an underlyingly long vowel in the initial syllable surfaces as long.[32]

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[32] I am assuming an undominated constraint that requires syllable peaks to be minimally monomoraic – thereby forcing at least one violation of the markedness constraint. This constraint is not discussed here.

(104)

μμ μ /ə n ɨ/ ‘mirror’	MAXLINK-MORA[VOC]	* MORA[VOC]
σ σ μ μ a. ə n ɨ	*!	**
σ σ μμ μ b. ☞ ə n ɨ		***

Despite the fact that the initial syllable of candidate (b) violates the markedness constraint twice (once per mora), as opposed to the one violation of candidate (a), it is still optimal. Candidate (a) violates the higher-ranked faithfulness constraint by shortening an underlyingly long vowel.

With an input containing a short vowel in the initial syllable, that vowel will surface as short straightforwardly, as shown in (105). Without some higher-ranked coercive moraic markedness constraint to force a vowel to lengthen, either the general moraic markedness constraint or the faithfulness constraint against adding a mora that was not there underlyingly will ensure that underlyingly short vowels remain short.

(105)

μ μ /ba tɨ/ 'food'	DEPLINK-MORA[VOC]	* MORA[VOC]
a. ☞ σ σ μ μ b a t ɨ		**
b. σ σ μμ μ b a t ɨ	*!	***!

Tableau (106) shows that by ranking the faithfulness constraint against deleting underlying consonant weight below the consonant moraic markedness constraint, underlyingly moraic intervocalic consonants surface as non-moraic onsets.

(106)

μμ μ /ba tɨ/ 'food'	*MORA[CON]	MAXLINK-MORA[CON]
a. ☞ σ σ μ μ b a t ɨ		*
b. σ σ μ μ μ b a t ɨ	*!	

Distinctive vowel length and non-distinctive consonant weight are thus captured by the rankings in (107) and (108). The DEPLINK-MORA constraint rankings are indeterminate, so are not shown.

(107) MAXLINK-MORA[VOC] >> *MORA[VOC]

(108) *MORA[CON] >> MAXLINK-MORA[CON]

4.3.2.2 Stress

Recall that in the absence of a non-final long vowel or closed syllable, stress is initial. This can be explained by ranking a constraint aligning the head syllable of a prosodic word to the left edge of the prosodic word above a constraint aligning the head syllable to the right edge of the prosodic word.

(109) **ALIGNHEAD-EDGE** - Align the head syllable of a prosodic word to an edge of that prosodic word (McCarthy and Prince (1993) - an alignment translation of Prince and Smolensky's (1993) EDGEMOST(pk; L/R; word) constraint).

As (110) shows, with ALIGNHD-L(eft) ranked above ALIGNHD-R(ight), given a choice between stressing the initial or a non-initial syllable, stress falls on the initial.

(110)

/p^hikiri/ ‘understand’	ALIGNHD-L	ALIGNHD-R
a. ☞ p^hí.ki.ri		**
b. p^hi.kí.ri	*!	*
c. p^hi.ki.rí	*!*	

Candidate (b) violates both of these constraints because neither the leftmost nor the rightmost syllable is stressed. Candidate (c) violates only the higher-ranked constraint, and candidate (a) violates only the lower-ranked constraint. Therefore, candidate (a) is optimal.

<u>Weight Sensitivity</u>

Recall that a non-final long vowel attracts stress away from the initial syllable. This was shown above and is due to the ranking of a constraint requiring heavy syllables to be stressed above the alignment constraint, as demonstrated in (112).

(111) **WEIGHT-TO-STRESS PRINCIPLE (WSP)** - Heavy syllables are prominent - i.e. "heavy syllables must be stressed" (Prince and Smolensky (1993), based on Prince (1990)).

(112)

/gilaasɨ/ 'cherries'	WSP	ALIGNHD-L
a. ☞ gi.láa.sɨ		*
b. gí.laa.sɨ	*!	

The tableau in (112) shows that although candidate (b) has initial stress, thus satisfying alignment, it violates WSP because the heavy syllable is not stressed. Since WSP is higher ranked, candidate (b) loses to candidate (a) which does not violate this constraint, although it does violate the lower-ranked alignment constraint.

We must also account for the fact that underlyingly long vowels do not shorten to satisfy both WSP and left alignment. By surfacing as short, an underlyingly long vowel could circumvent WSP, and a candidate consisting of only short vowels would surface with initial stress. To prevent this from happening, the faithfulness constraint on vowel length is ranked higher than both of the other constraints. In (113), vowels maintain distinctive length and the leftmost long vowel is stressed. There is no argument yet to rank MAXLINK-MORA[VOC] with respect to WSP.

(113)

μ μμ μ / g i l a s ɨ / 'cherries'	MAXLINK-MORA[VOC]	WSP	ALIGNHD-L
σ σ́ σ μ μμ μ a. ☞ g i l a s ɨ			*
σ́ σ σ μ μμ μ b. g i l a s ɨ		*!	
σ́ σ σ μ μ μ c. g i l a s ɨ	*!		

However, (114) shows that not only must faithfulness to underlying vowel morae be higher ranked than alignment, it must also dominate WSP. In cases where there is more than one non-final long vowel, the leftmost long vowel is stressed, and the others remain long.

(114)

μμ μμ μ / sa ma ni / 'luggage'	MAXLINK-MORA[VOC]	WSP	ALIGNHD-L
σ́ σ σ μμ μμ μ a. ☞ s a m a n i		*	
σ σ́ σ μμ μμ μ b. s a m a n i		*	*!
σ́ σ σ μμ μ μ c. s a m a n i	*!		
σ σ́ σ μ μμ μ d. s a m a n i	*!		*

Candidates (c) and (d) both shorten the unstressed long vowel, thus violating the highest-ranked constraint. Candidate (b) violates alignment in addition to WSP. Candidate (a) violates only WSP, therefore is optimal. Note that it is the lower-ranked alignment constraint that, although dominated, is still active, and forces the leftmost of the long vowels to be stressed.[33] Also note that if the faithfulness constraint did not dominate WSP, candidate (c) would win.

Non-Finality

The fact that the final syllable of a polysyllabic word is never stressed follows from an undominated constraint. Recall that although long vowels typically attract

[33] I am assuming that there is an undominated constraint (not shown) that allows only one main stress per prosodic word. Therefore, only one of the long vowels can bear stress.

stress away from short vowels, final long vowels are never stressed – even if they are preceded by only light syllables. To account for this, WSP must be dominated by a constraint against stressed final syllables, as shown in (116).

(115) **NONFINALITY** (**NONFINAL**) **-** No head of a prosodic word is final in the prosodic word (Prince and Smolensky (1993)).

(116)

μ μμ /a t͡ʃʰa/ ‘all right’	NONFINAL	WSP
a. σ σ́ μ μμ a t͡ʃʰ a	*!	
b. ☞ σ́ σ μ μμ a t͡ʃʰ a		*

The partial constraint ranking motivated in this section is:

(117) NONFINAL, MAXLINK-MORA[VOC] >> WSP >> ALIGNHD-L >> ALIGNHD-R

ALIGNHD-L ranked above ALIGNHD-R results in leftward-aligned stress. Undominated NONFINAL results in an absolute prohibition on final stress. WSP ranked above ALIGNHD-L results in the retraction of stress from initial position to heavy syllables. MAXLINK-MORA[VOC] ranked above WSP results in distinctive vowel length in both stressed and unstressed positions.

4.3.2.3 Closed Syllables

As discussed above, shown in above and repeated here as (118), if there are no long vowels, but there are closed syllables, then the leftmost non-final closed syllable is stressed.

(118)	a.	[gí.dun]	'to play'
	b.	[So.kɨ́r.vaar]	'Friday'
	c.	[yə́m.bɨr.zal]	'narcissus'

Since the closed syllables attract stress from the initial syllable the same way that long vowels do, we can hypothesize that stressed closed syllables are bimoraic. Rightward stress retraction is then captured with the constraint ranking already established, as shown in (119).

(119)

/ ʃokɨrvaar/ ‘Friday’	WSP	ALIGNHD-L
σ́ σ σ μ μμ μμ a. ʃ o k ɨ r v a r	**!	
σ σ́ σ μ μμ μμ b. ☞ ʃ o k ɨ r v a r	*	*

However, since consonant weight is non-distinctive, there must be some way to ensure that closed syllables can attract stress away from the initial syllable regardless of the underlying moraicity of the consonant[34]. To force coda consonants to surface as moraic, there must be an active coercive moraic markedness constraint requiring codas to be heavy.

(120) **WEIGHT BY POSITION** (**WBYP**) - Coda consonants must surface as moraic (Based on Hayes (1989)).

Since the coda consonant surfaces with a mora that it may not have had underlyingly, WBYP must outrank both the faithfulness constraint against adding morae to consonants and the general moraic markedness constraint against moraic consonants,

[34] This is consistent with Richness of the Base (Prince and Smolensky 1993).

as shown in (121). The moraic status of the final consonant is not addressed here, but will be addressed in the next section.

(121)

μ μ μμ /ʃo kɨr var/ 'Friday'	WBYP	*MORA[CON]	DEPLINK-MORA[CON]
a. σ́ σ σ μ μ μμ ʃ o k ɨ r v a r	**!		
b. ☞ σ σ́ σ μ μμ μμ ʃ o k ɨ r v a r	*	*	*

To ensure that the coda surfaces as heavy, despite the imperative to have initial stress, WBYP must also be ranked higher than the alignment constraint. (122) shows that with WBYP ranked above ALIGNHD-L, underlyingly non-moraic codas become moraic to bear stress. Recall that WSP >> ALIGNHD-L (see (119)) ensures that heavy syllables attract stress from the initial position.

(122)

μ μ μμ /ʃo kɨr var/ ‘Friday’	WBYP	ALIGNHD-L
a. σ́ σ σ μ μ μμ ʃ o k ɨ r v a r	**!	
b. ☞ σ σ́ σ μ μμ μμ ʃ o k ɨ r v a r	*	*

To summarize the results of this section: WBYP >> *MORA[CON], DEPLINK-MORA[CON], and ALIGNHD-L results in codas surfacing as moraic, and WSP and WBYP >> ALIGNHD-L results in closed syllables receiving stress.

4.3.2.4 Heavy Syllable Interactions

Recall that the interesting aspect of the Kashmiri stress pattern is that with an input containing a closed syllable positioned to the left of the leftmost non-final long vowel, the long vowel is stressed. This is unexpected since one would expect the leftmost heavy syllable to be stressed regardless of the segmental content of that syllable. I will show that with the correct constraint ranking, we get the effect that a closed syllable is only heavy and stressed if it is the best potential stressable syllable in a word.

In the absence of a non-final long vowel, a single closed syllable is forced to be heavy by WBYP ranked higher than the constraint against moraic consonants, the faithfulness constraint prohibiting adding morae to consonants, and the constraint requiring initial stress. If WBYP were undominated, all closed syllables would be heavy, and there would be no weight difference between closed syllables and syllables containing long vowels. In such a situation, the leftmost long vowel or closed syllable would be stressed. However, in Kashmiri, long vowels <u>ARE</u> stressed over closed syllables, therefore, some constraint must dominate WBYP. With WSP ranked above WBYP, we get the correct distribution.

As (123) shows, an input with an underlyingly non-moraic coda consonant surfaces as non-moraic when in proximity to a non-final long vowel because surfacing as moraic would cause a violation of WSP.

(123)

μ μμ μ /darva zɨ]/ 'door'	MAXLINK-MORA[VOC]	WSP	WBYP	ALIGNHD-L
σ σ́ σ μ μμ μ a. ☞ d a r v a z ɨ			*	*
σ́ σ σ μ μ μμ μ b. d a r v a z ɨ		*!		
σ σ́ σ μ μ μμ μ c. d a r v a z ɨ		*!		*
σ́ σ σ μ μ μ μ d. d a r v a z ɨ	*!			

In candidate (b), the long vowel violates WSP, and in candidate (c), the closed syllable violates WSP. To avoid a violation of WSP, either the long vowel could shorten, or the coda consonant could be non-moraic. However, shortening the vowel is prevented by MAXLINK-MORA[VOC] >> WSP (see (114)) as shown in candidate (d). Since candidate (a) satisfies both higher-ranked constraints, it wins at the expense of violating WbyP.

Since consonant moraicity is non-distinctive, the same candidate surfaces even if the input contains an underlyingly moraic consonant.

<u>The preference for stressing long vowels over closed syllables is now revealed to be the result of a constraint interaction which forces coda consonants to surface as non-moraic in the presence of long vowels.</u>

To summarize, it is better to have a non-moraic coda consonant than it is to shorten a vowel. WSP ranked above WBYP prevents a coda from surfacing as moraic if there is a non-final long vowel in the word. WSP and WBYP are functionally similar in that they can both coerce consonant moraicity, but they are different in that WSP forces consonant non-moraicity in some environments, and WBYP forces consonant moraicity in some environments.

The constraint rankings developed thus far are shown in (124) and (125).[35]

(124) NONFINAL, MAXLINK-MORA[VOC] >> WSP >> WBYP >> DEPLINK-MORA[CON], *MORA[CON], ALIGNHD-L

[35] DEPLINK-MORA[VOC] is excluded here because there is no evidence to rank it with respect to the other constraints.

(125) MAXLINK-MORA[VOC] >> *MORA[VOC]

A further result of the constraint ranking in (124) is that not only do unstressed closed syllables surface as light in the proximity of a long vowel, but if more than one closed syllable is found in a single word, only the leftmost will be heavy. All others will be light. To demonstrate this, tableau (126) illustrates the evaluation of a set of likely candidates given an input with two underlyingly moraic codas. The constraint ranking predicts that the leftmost closed syllable surfaces as bimoraic and stressed, while the second closed syllable surfaces as monomoraic. To keep the following large tableau as small as possible, full syllable representations are not given. Instead, syllable boundaries are indicated using '.', and moraic associations are indicated using superscript morae.

(126)

/yəmbɨrzal/ 'narcissus'	WSP	WBYP	*MORA[CON]	ALIGNHD-L
a. yə́$^{\mu}$m.bɨ$^{\mu}$r.za$^{\mu}$l		***!		
b. yə$^{\mu}$m.b ɨ́$^{\mu}$r.za$^{\mu}$l		***!		*
c. yə$^{\mu}$m.bɨ́$^{\mu}$r$^{\mu}$.za$^{\mu}$l		**	*	*!
d. ☞ yə́$^{\mu}$m$^{\mu}$.bɨ$^{\mu}$r.za$^{\mu}$l		**	*	
e. yə́$^{\mu}$m.bɨ$^{\mu}$r$^{\mu}$.za$^{\mu}$l	*!	**	*	
f. yə$^{\mu}$m$^{\mu}$.bɨ́$^{\mu}$r.za$^{\mu}$l	*!	**	*	*
g. yə$^{\mu}$m$^{\mu}$.bɨ́$^{\mu}$r$^{\mu}$.za$^{\mu}$l	*!	*	**	*
h. yə́$^{\mu}$m$^{\mu}$.bɨ$^{\mu}$r$^{\mu}$.za$^{\mu}$l	*!	*	**	

Candidates (e) through (h) violate the highest-ranked WSP because each has an unstressed heavy syllable. The remaining candidates all violate WBYP, but (a) and (b) incur one more violation than (c) and (d). Of these two remaining candidates, (c) violates the imperative to have stress as far left in the word as possible. Therefore, (d) is the winning candidate.

4.3.2.5 Summary of the Analysis of Kashmiri

We have seen a straightforward account of Kashmiri in which stressed closed syllables are bimoraic and unstressed closed syllables are monomoraic. This results from an interaction of several constraints that not only yields the overall stress pattern of the language, but also accounts for general vowel length and consonant weight distributions.

Following chapters 2 and 3, the general distinctiveness of vowel length and non-distinctiveness of consonant weight is captured by appropriately ranking the moraic faithfulness constraints with moraic markedness constraints.

(127) MAXLINK-MORA[VOC] >> *MORA[VOC]

(128) *MORA[CON] >> MAXLINK-MORA[CON]

The weight sensitive leftward alignment of stress with a proviso that stress not be on the final syllable is captured by ranking constraints proposed by Prince and Smolensky (1993) and McCarthy and Prince (1993).

(129) NONFINAL >> WSP >> ALIGNHD-L >> ALIGNHD-R

The preference for stressed long vowels over stressed closed syllables is the logical result of constraint interaction. The constraint ranking in (130) allows unstressed long vowels to remain long, but forces unstressed closed syllables to be light.

(130) MAXLINK-MORA[VOC] >> WSP >> WBYP >> *MORA[C], DEPLINK-MORA[CON]

4.3.3 Theoretical Issues

There are two theoretical issues addressed in this section. The first is a discussion of the difference between two constraints proposed by Prince and Smolensky (1993) to ensure that heavy syllables are preferred as stressed syllables. The second is a discussion of how the constraints used in the analysis of Kashmiri to preferentially stress long vowels over closed syllables cannot be re-ranked to yield the opposite (unattested) result – closed syllables preferentially stressed over long vowels.

4.3.3.1 Peak Prominence

It is important to point out that until section 4.3.2.4, the constraint in (131) could have been substituted for WSP. This constraint says that there is a preference for stressing syllables such that stressed super-heavy syllables are better than stressed heavy syllables, which in turn are better than stressed light syllables.

(131) **PEAK-PROMINENCE** (**PK-PROM**) - Peak (x) is more harmonic than Peak (y) if |x| > |y|. Where |μμμ| > |μμ| > |μ|. (Prince and Smolensky (1993), based on McCarthy and Prince (1986), and using the prominence scale of Hayes (1991).)

For example, the tableau in (113) could be replaced with (132).

(132)

μ μμ μ / g i l a s ɨ / 'cherries'	MAXLINK-MORA [VOC]	PK-PROM	ALIGNHD-L
σ σ́ σ μ μμ μ a. ☞ g i l a s ɨ			*
σ́ σ σ μ μμ μ b. g i l a s ɨ		*!	
σ́ σ σ μ μ μ c. g i l a s ɨ	*!		

Here candidate (b) violates PK-PROM because a short vowel is assigned the peak position instead of an available long vowel.

However, in comparing (123) with (133), it is clear that PK-PROM by itself makes the wrong predictions if comparing two syllables of equal prominence. Since PK-PROM is satisfied as long as one of the heaviest syllables is stressed, the non-peak status of the other syllables in unimportant. This leaves the lower ranked ALIGNHD-L to choose between candidates (b) and (c). The result is that the left-most heavy syllable is stressed regardless of its segmental content. In (133), a closed syllable is incorrectly stressed when there is an available non-final long vowel.

(133)

μ μμ μ /darva zɨ]/ 'door'	MAXLINK-MORA [VOC]	PK-PROM	WBYP	ALIGNHD-L
σ σ́ σ μ μμ μ a. ☜ d a r v a z ɨ			*!	*
σ́ σ σ μ μ μμ μ b. ☛ d a r v a z ɨ				
σ σ́ σ μμ μμ μ c. d a r v a z ɨ				*!
σ́ σ σ μ μ μ μ d. d a r v a z ɨ	*!			

This is important because it shows that although PK-PROM and WSP functionally overlap in some ways, they are functionally distinct in others.

This is not to say that PK-PROM plays no role in the phonology of Kashmiri. On the contrary, there is evidence from the preferential stressing of superheavy syllables over heavy syllables that Kashmiri needs PK-PROM in addition to WSP.

(134) a. [boo.dées.var] 'Lord'

WSP is not sufficient for this case because it does not distinguish between bimoraic and trimoraic syllables. Therefore, the constraint ranking argued for thus far will incorrectly yield an output with initial stress if a heavy syllable containing a long vowel is to the left of a superheavy syllable, as shown in (135). Moraicity is indicated by superscript morae.

(135)

/bo$^{\mu\mu}$de$^{\mu\mu}$sva$^{\mu}$r/	WSP	WBYP	*MORA[CON]	ALIGNHD-L
a. bo$^{\mu\mu}$.dé$^{\mu\mu}$s.va$^{\mu}$r	*	*!		*
b. bó$^{\mu\mu}$.de$^{\mu\mu}$s.va$^{\mu}$r	*	*!		
c. ☜ bo$^{\mu\mu}$.dé$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	*!
d. ☛ bó$^{\mu\mu}$.de$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	

Candidates (a) and (b) are not optimal because they both violate the constraint requiring coda consonants to be moraic. It is the low-ranking constraint requiring that stress be aligned with the left edge of the prosodic word that rules out candidate (c). This leaves candidate (d) as optimal. However, the solid hand indicates that this is an incorrect result. Candidate (c), with the reversed hand, actually surfaces in this language.

However, if we include PK-PROM in the constraint hierarchy, and rank it above ALIGNHD-L, then the superheavy syllable will receive stress, as shown in (136).

(136)

/bo$^{\mu\mu}$de$^{\mu\mu}$sva$^{\mu}$r/	WSP	WBYP	*MORA[CON]	PK-PROM	ALIGNHD-L
a. bo$^{\mu\mu}$.dé$^{\mu\mu}$s.va$^{\mu}$r	*	*!			*
b. bó$^{\mu\mu}$.de$^{\mu\mu}$s.va$^{\mu}$r	*	*!			
☞ c. bo$^{\mu\mu}$.dé$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*		*
d. bó$^{\mu\mu}$.de$^{\mu\mu}$s$^{\mu}$.va$^{\mu}$r	*		*	*!	

Candidate (d) is now ruled out because the heaviest syllable is not most prominent. Candidate (c) is optimal.

This demonstrates that WSP and PK-PROM are separate constraints that perform different functions. While WSP ensures that all heavy syllables are stressed when possible, PK-PROM ensures that at least one of the heaviest syllables is stressed. Both of these constraints are necessary to account for the distribution of stress in Kashmiri.

4.3.3.2 Unattested Stress Patterns[36]

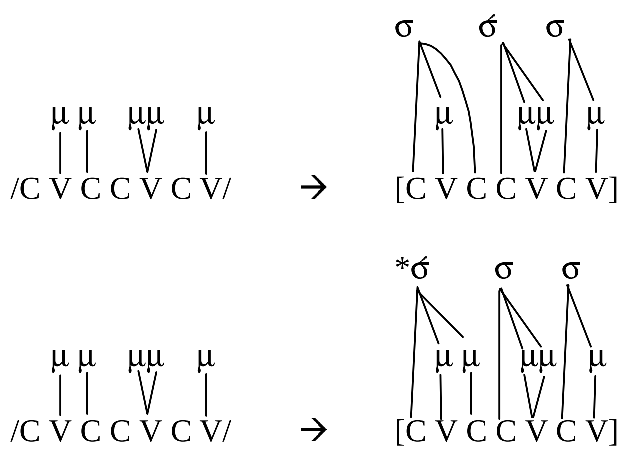
In the analysis of Kashmiri, it was shown that the assignment of stress preferentially to long vowels rather than closed syllables stems from a constraint ranking that forces unstressed coda consonants to be non-moraic. Is it not possible, then, to re-rank these same constraints for the opposite result? That is, can closed syllables be preferentially stressed over long vowels, while maintaining the vowel

[36] Thanks to Amy Weinberg and Norbert Hornstein for interesting discussions regarding the material in this section.

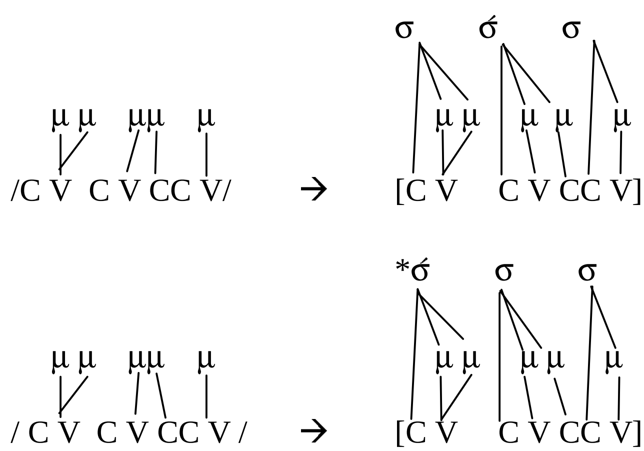
length on the surface? The answer is that they cannot because of a subset relation between the marks incurred by the relevant competing candidates.

To be more concrete, (137a) and (137b) illustrate the pattern seen in Kashmiri, and (138a) and (138b) illustrate the hypothetical pattern. Recall that crucial to this comparison is that stress retracts from the initial syllable.

(137) a. b.



(138) a. b.



In Kashmiri, stress is able to retract from the initial syllable to the long vowel because the constraint ranking allows the initial syllable to surface as light, yet still remain closed, as in (137a). However, it is impossible for the constraints to be re-ranked such that stress retracts from canonically left-aligned position to a closed syllable while maintaining a long vowel on the surface, as in (138a). This is because the long vowel is necessarily bimoraic, therefore it is always heavy, and always available to be the leftmost stressed syllable.

The key to the absolute prohibition of the unattested pattern is in examining the subset relationship of marks incurred by the competing output candidates. As (139) and (140) show, maintaining the left-alignment of stress and distinctive vowel length, there is no constraint ranking which will result in candidates (a) or (b) being optimal. Candidates with stressed closed syllables always have one more mark than candidates with stressed long vowels, therefore long vowels are always preferentially stressed. In tableau (139), WSP takes precedence over WBYP, and candidate (d) surfaces (as is the case for Kashmiri).

(139)

/$CV^{\mu\mu}CV^{\mu}C^{\mu}CV^{\mu}$/	WSP	WBYP	ALIGNHD-L
a. $CV^{\mu\mu}.C\acute{V}^{\mu}C^{\mu}.CV^{\mu}$	*!		*
b. $CV^{\mu\mu}.C\acute{V}^{\mu}C.CV^{\mu}$	*!	*	*
c. $C\acute{V}^{\mu\mu}.CV^{\mu}C^{\mu}.CV^{\mu}$	*!		
d. ☞ $C\acute{V}^{\mu\mu}.CV^{\mu}C.CV^{\mu}$		*	

Tableau (140) shows that if WBYP takes precedence over WSP, candidate (c) will surface. Candidates (b) and (d) violate the highest ranked constraint by not having moraic coda consonants. Although both candidates (a) and (c) violate WSP, candidate (a) incurs an additional violation by not having left-aligned stress. Therefore, candidate (c) has a subset of the violations of candidate (a) and is always more harmonic.

(140)

/CV^{μμ}CV^{μ}C^{μ}CV^{μ}/	WBYP	WSP	ALIGNHD-L
a. CV^{μμ}.CV́^{μ}C^{μ}.CV^{μ}		*	*!
b. CV^{μμ}.CV́^{μ}C.CV^{μ}	*!	*	*
c. ☞ CV́^{μμ}.CV^{μ}C^{μ}.CV^{μ}		*	
d. CV́^{μμ}.CV^{μ}C.CV^{μ}	*!		

In both tableaux (139) and (140), candidate (d) occults candidate (b) and candidate (c) occults candidate (a). Both of the occulting candidates have stressed long vowels, and both of the occulted candidates have stressed closed syllables. Therefore, the candidates with the stressed long vowels are always better outputs than the candidates with the stressed closed syllables.

Given that the hypothesized weight/stress pattern is unattested, it is a welcome result that the constraints proposed for the odd weight/stress pattern of Kashmiri will not yield such a system.

4.3.4 Summary

The main purpose of this case study of Kashmiri was to show that just because there is evidence in a language that some closed syllables are heavy, that does not necessitate all closed syllables being heavy. Counter to many previous theories where consonant weight is constant for a particular segment in a given syllabic position within a language as a whole, I demonstrated that CVC syllables in Kashmiri vary in weight depending on surface stress. In doing this, I offered an analysis of Kashmiri vowel length, consonant weight, and stress assignment; and showed that seemingly complex distributions of moraic segments can be handled by the interaction of a limited number of general constraints. In support of chapter 2, vowel length and consonant weight are analyzed as interactions of various general and coercive moraic markedness constraints and faithfulness constraints on underlying moraic content. Finally, I demonstrated that constraints needed to explain the somewhat odd distribution of weight and stress in Kashmiri cannot be re-ranked to result in a unattested weight-sensitive stress pattern.

4.4 Moraicity in Two Hungarian Dialects

In this case study, I will provide an analysis of Hungarian syllable weight that not only accounts for the basic generalizations of the language, but also derives dialect differences as the result of minimally different constraint rankings. The theoretical importance of this work is two-fold. First, the analysis of Hungarian will show that a sonority approach to segment weight (Zec 1988, 1995) is not sufficient to explain all weight distributions. Rather, faithfulness constraints can interact with the moraic markedness hierarchy to induce violations of the sonority/weight implicational relationship. This supports the claims made in chapter 3. Second, a comparison of word-medial and word-final geminates in Hungarian supports the claims of Morén (1997c) and Morén and Miglio (1998) regarding the nature of faithfulness constraints on moraicity. Not only must faithfulness constraints on the association between morae and segments be relativized to different segment types, but they also come in two flavors – one against adding an association that was not there underlyingly, and one against deleting an association that was there underlyingly.

4.4.1 Description and Data (Standard Literary Hungarian[37])

Hungarian, a Finno-Ugric language, has a very complicated system of syllable weight as described by Nádasdy (1985) and Vago (1992). In general, both vowel length and consonant weight are distinctive. However, the length of some vowels is neutralized to either short or long depending on both the vowel and the environment. Similarly, the weight of consonants is neutralized to either moraic or non-moraic depending on the consonant and the environment. There also seems to be a great deal of variation/instability in the distinctive moraic status for some of the vowels and some of the consonants across dialects. For example, high vowels have distinctive length word-finally in Standard Literary Hungarian, but they neutralize to short in Educated Colloquial Hungarian. Likewise, although Standard Literary Hungarian has distinctive

[37] Standard Literary Hungarian is the more conservative of the two dialects discussed here - its pronunciation follows most closely the orthography.

consonant weight for most consonants in specific environments, Educated Colloquial dialects disprefer geminate sonorants (especially the non-nasals).

<u>Description of Vowels</u>

The articulatory properties of the Hungarian vowels are shown in (141), as described by Nádasdy (1985). The phonetic symbols have been modified slightly to incorporate a tense/lax distinction in the mid and low vowels that he describes but does not include in his transcription system. As will be seen in section 4.4.2.1, this tense/lax distinction is vital to the analysis of vowel length.

(141) Articulatory Properties of Hungarian Vowels

	Front	Central	Back
high	ii i üü ü		u uu
mid-high	ee öö œ		ɔ oo
mid-low	ɛ		α
low		aa	

As pointed out by Nádasdy, the vowels can be grouped phonologically slightly differently than they are phonetically. This is apparent when comparing the “features” used in (141) and (142). Note that each vowel comes in a length pair, with the high vowels displaying only a quantity difference and the mid and low vowels displaying both quality and quantity differences.

(142) Phonological Grouping of Hungarian Vowels

	Front	Back
high	ii/i üü/ü	uu/u
mid	öö/œ	oo/ɔ
low	ee/ɛ	aa/ɑ

The pairing of long and short vowels, especially those that are qualitatively different, is supported by morphologically conditioned alternations. (143) shows vowel shortening as the result of plural formation.

(143)	a.	[hiid] *híd*	→	[hidɑk]	*hidak*	'bridges'
	b.	[kuut] *kút*	→	[kutɑk]	*kutak*	'wells'
	c.	[tüüz] *tüz*	→	[tüzɛk]	*tüzek*	'fires'
	d.	[loo] *ló*	→	[lɔvɑk]	*lovak*	'horses'
	e.	[t͡ʃöö] *csö*	→	[t͡ʃɔvɛk]	*csövek*	'tubes'
	f.	[keez] *kéz*	→	[kɛzɛk]	*kezek*	'hands'
	g.	[ɲaar] *nyár*	→	[ɲɑrɑk]	*nyarak*	'summers'

The somewhat unconventional classification of [ee] and [ɛ] as low vowels is also well supported by the phonological patterns of the language. Not only do these vowels alternate with the low back vowels in the harmony system (see Nádasdy (1985) for discussion), but as will be seen below, they also pattern as low with respect to the pattern of distinctive length.

Description of Consonants

Hungarian consonant inventory is given in (144), and according to Nádasdy all consonants can be found as either long or short[38].

(144) Hungarian Consonant Inventory

	labials		alveolars		palatals		velars		glottals
stops	p	b	t	d	c	ɟ	k	g	
fricatives	f	v	s	z	ʃ	ʒ			h
affricates			t^s	d^z	t͡ʃ	d͡ʒ			
nasals	m		n		ɲ		ŋ		
liquids					r, l				
glides					y				

(145) Short and Long Consonants (Nádasdy 1985:242)

a.	[baa.ɲ ɑ]	*bánya*	'a mine'	[baaɲ.ɲɑ]	*bánja*	'he minds'
b.	[hɑ.lɔtt]	*halott*	'dead'	[hɑl.lɔtt]	*hallott*	'heard'
c.	[vi.cɛ]	*vice*	'janitor'	[vic.cɛ]	*vicce*	'his joke'
d.	[hɑ.yɑm]	*hajam*	'my hair'	[hɑy.yɑm]	*halljam*	'I hear+imp.'
e.	[ʃɔk]	*sok*	'much'	[ʃɔkk]	*sokk*	'shock'

38 [d^z] and [d͡ʒ] are rare in Hungarian, and are the result of voicing assimilation from an adjacent voiced consonant. Since geminates (long consonants) are not found in clusters in this language, it is doubtful that these phones can be long.

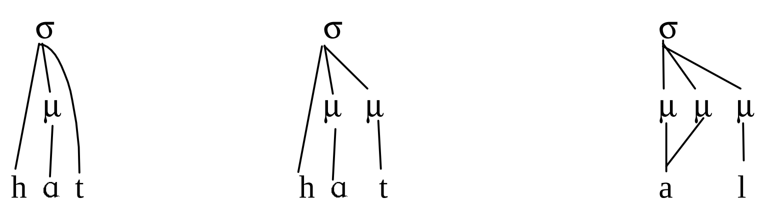
<u>Syllable Weight</u>

Not only are vowel length and consonant weight distinctive, but superheavy syllables containing both are common.

(146)	a.	[aall]	*áll*	'stand'	-vs-	[aal]	*ál*	'false'
	b.	[eepp]	*épp*	'just/exactly'	-vs-	[eep]	*ép*	'intact'

Using the representations proposed by McCarthy & Prince (1986), the Hungarian light, heavy, and superheavy syllables are shown in (147). Note that the representations in (147a) and (147b) illustrate the structures I am assuming for the final geminate consonant distinction seen on the surface in Hungarian. Section 4.4.2.3 will demonstrate that these representations are the result of constraint interactions needed to account not only for final geminates, but also the inventory of medial and final consonant clusters.

(147) a. Light b. Heavy c. Superheavy



<u>Vowel Length Neutralization</u>

In the data examined thus far, there is no difference in the behavior of Standard Literary Hungarian and Educated Colloquial Hungarian. However, in the following cases of neutralization, there is a split in the dialects.

The low vowels show distinctive vowel length in all environments in both dialects, including in open monosyllables, as shown in (148). However, short high vowels are prohibited in this environment in Educated Colloquial Hungarian, as seen in (149).

(148) Standard Literary and Educated Colloquial Hungarian

a.	[faa]	*fá*	'FA in music'	[fɑ]	*fa*	'tree'
b.	[lee]	*lé*	'juice'	[lɛ]	*le*	'down'

(149) Educated Colloquial Hungarian

a.	[buu]	*bú*	'melancholy'	*[bu]
b.	[füü]	*fű*	'grass'	*[fü]
c.	[fii]	*fí*	'phi'	*[fi]

In contrast, long high vowels must surface as short in final position of polysyllabic words (150) in the Educated Colloquial dialect. Again, low vowels display distinctive length in this environment (151).

(150)	a.	[aa.ru] *áru* 'merchandise'			*[aa.ruu]	*árú*
					('having a price'- only SLH)	
(151)	a.	[mɛl.lee] *mellé* 'next to'			[mɛllɛ]	*melle* 'his breast'

In both Standard Literary Hungarian and Educated Colloquial Hungarian, the mid vowels only surface as long in both open monosyllables and open final syllables.

(152)	a.	[loo]	*ló*	'horse'	*[lɔ]
	b.	[t͡ʃöö]	*cso*	'tube'	*[t͡ʃœ]
	c.	[tuu.roo]	*túró*	'cheese'	*[tuu.rɔ]
	d.	[tɛk.nöö]	*tekno*	'trough'	*[tɛk.nœ]

The chart in (153) summarizes the distribution of the vowels in the two dialects under investigation. The shaded areas indicate neutralization.

(153) Distribution of Vowels

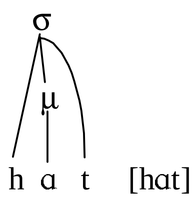
	Height	Tensing differ.	Non-final		Final			
					Monosyllable		Polysyllable	
			SLH	ECH	SLH	ECH	SLH	ECH
[ii/i,uu/u,üü/ü]	high	no	dist.	dist.	dist.	long	dist.	short
[öö/œ,oo/ɔ]	mid	yes	dist.	dist.	long	long	long	long
[ee/ɛ,aa/ɑ]	low	yes	dist.	dist.	dist.	dist.	dist.	dist.

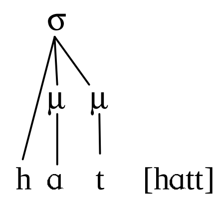
Section 4.4.2.1 will show that mid vowel lengthening is the result of a prohibition against lax final vowels. This prohibition is in conflict with another constraint against long final vowels which motivates high vowel shortening.

<u>Consonant Weight Neutralization</u>

The neutralization of consonant weight is a little more complicated. I claim that non-final codas must be moraic, and final consonants are non-moraic unless post-vocalic and underlyingly moraic. This is best seen in the absolute prohibition of more than one non-final coda consonant. As discussed above, intervocalic consonant weight is distinctive for all consonants, that is, all consonants can be geminate or singleton in intervocalic position. In addition, post-vocalic final consonant weight is also distinctive for all consonants (i.e. final geminate versus singleton). Final non-geminate/geminate representations are repeated in (154a) and (154b), respectively.

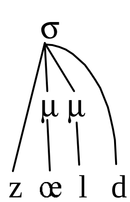
(154) a. Non-geminate final consonant b. Geminate final consonant





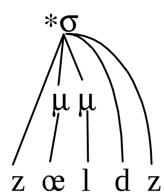
Foreshadowing the analysis to follow below, I propose that all final consonants are non-moraic unless underlyingly moraic. This allows single final consonants to escape the weight by position requirement that applies to all other coda consonants. Support for this claim comes from the fact that coda clusters are allowed only in word-final position, and then only with clusters of maximally two consonants. One straightforward interpretation of these facts is that the final consonant is non-moraic and the post-vocalic consonant is moraic (subject to weight by position). The proposed representation is given in (155).

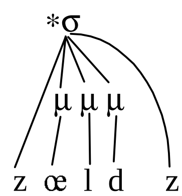
(155) a.



Three consonant clusters are prohibited because no more than one consonant can be either final (therefore non-moraic) or moraic.

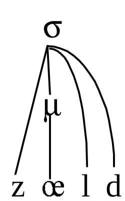
(156) a. b.

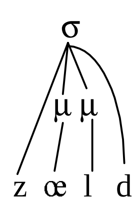


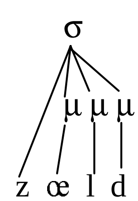


We also know that the weight of the two final consonants is neutralized because unlike in single final codas, which show a weight distinction, there is no such distinction in clusters. Although there are forms such as *zöld* ([zœld]), there are no contrasting forms such as *zölld* ([zœlld]) or *zöldd* ([zœldd])[39]. Since there is no contrast in the weight of final consonants in clusters, the output must have one of three possible representations:

(157) a. b. c.







The representation in (157c) is not viable for two reasons. First, there is no principled (unstipulated) way to enforce moraicity of the final consonant in this form, and yet not enforce moraicity in the case of *hat*. As will be shown in section 4.4.2.3, single final

[39] These forms actually surface as the result of imperative formation – not accounted for here because morpheme-relative faithfulness constraints (Urbanczyk 1995, 1996) needed to account for these forms are far afield of the present work.

consonants must be non-moraic unless underlyingly moraic. Faithfulness to the underlying moraicity overrides the imperative to be non-moraic in final position. Since final consonants in consonant clusters do not participate in a weight distinction, we do not have the luxury of specifying all final consonants in these clusters as underlyingly moraic due to richness of the base. Thus, I propose that the final coda consonant in clusters is non-moraic on the surface regardless of underlying weight.

The second reason that (157c) is not viable is closely allied with the evidence against (157a). Although consonant clusters are licit in final position, they are illicit in medial positions. As (158) shows, if normally licit final coda clusters are forced medially due to morpheme concatenation, epenthesis occurs to ensure that the cluster does not surface as such.

(158)	a.	/fɛst + ni/	→	[fɛs.tɛ.ni]	*[fɛst.ni]	'paint-infinite'

(159) shows that single consonants do not elicit epenthesis.

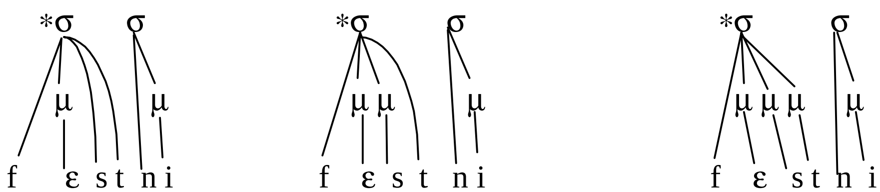
(159)	a.	/üt + ni/	→	[üt.ni]	'hit-infinitive'
	b.	/vaar + ni/	→	[vaar.ni]	'wait-infinitive'

One possible reason for epenthesis in (158) is some condition against biconsonantal medial coda sequences or against triconsonantal sequences. However, by itself, either of these conditions is merely a restatement of the descriptive fact and does not provide any insight into the overall distribution of segments in Hungarian.

Instead, the proposal I make here provides a less ad hoc explanation. I propose that medial coda clusters are prohibited because non-final codas must be moraic by weight by position, and sequences of two moraic consonants are prohibited[40]. Since non-moraicity is available to final codas in clusters, but not to medial codas in clusters, final clusters arise but medial coda clusters do not. Note that this proposal unifies the lack of medial coda clusters and the lack of triconsonantal final clusters. Thus, (157b) is the representation of a form of CVCC, and none of the forms in (160) are licit.

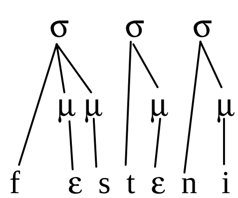
[40] Adjacent moraic consonants may be prohibited, despite the general acceptance of superheavy syllables, due to some type of OCP constraint.

(160) a. b. c.



Coupled with the word-final consonant weight distinction, and the non-distinctive weight of final consonants in clusters, the following representation provides a coherent syllabification of underlying medial coda clusters. Epenthesis is favored over adjacent moraic consonants and non-final weightless codas.

(161) a.



The analysis to follow provides a straightforward translation of this descriptive analysis into OT constraint interactions.

Thus far, the distribution of moraic consonants is the same for both Standard Literary and Educated Colloquial Hungarian. All non-final codas are moraic in both dialects. However, the two dialects differ in the treatment of geminates. In Standard Literary Hungarian, all underlyingly moraic consonants surface as moraic. In contrast, Educated Colloquial Hungarian disprefers sonorant geminates (Nádasdy 1985). Depending on the subdialect and morphological environment, the sonorants tend to only surface as onsets[41]. (162a) shows non-moraic final single codas in both dialects. (162b-d) show final and medial geminates surfacing in Standard Literary Hungarian, but not in Educated Colloquial Hungarian.

(162)

			SLH	ECH
a.	*szál*	'thread'	[saal]	[saal]
b.	*váll*	'shoulder'	[vaall]	[vaal]
c.	*kommuna*	'commune'	[kɔm.mu.nɑ]	[kɔ.mu.nɑ]
d.	*korrigál*	'to correct'	[kɔr.ri.gaal]	[kɔ.ri.gaal]

The chart in (163) summarizes the distribution of consonant weight in the two dialects under investigation. The shaded areas indicate non-distinctive weight.

(163)

	Inter-vocalic		Post-vocalic final		Post-vocalic in cluster		Post-consonant in cluster	
	SLH	ECH	SLH	ECH	SLH	ECH	SLH	ECH
Obstruents	dist.	dist.	dist.	dist.	mora	mora	no mora	no mora
Sonorants	dist.	no mora	dist	no mora	mora	mora	no mora	no mora

[41] Vago (1992) claims that sonorant degemination induces compensatory lengthening of the preceding short vowel. However compensatory lengthening is not a necessary result of degemination in all dialects (Nádasdy 1985). To avoid the additional complication of compensatory lengthening, I analyze the Nádasdy (1985) dialect.

Section 4.4.2.3 will show that consonant weight neutralization in clusters is due to an interaction of two conditions – weight by position and final segment non-moraicity. In contrast, neutralization of underlyingly moraic sonorants in the Educated Colloquial dialect is due to an interaction between the imperative to maintain an underlying moraic specification on sonorants and constraints that penalize moraic sonorants on the surface.

4.4.2 Analysis

4.4.2.1 Vowel Length

<u>High Vowels</u>

Recall that in all positions in Standard Literary Hungarian, and in medial positions in Educated Colloquial Hungarian, high vowels show distinctive length. However, they must be short in word-final position in Educated Colloquial Hungarian, unless in an open monosyllable. Using the constraints proposed in chapter 2, the distinctive length of high vowels is the result of ranking a faithfulness constraint on underlying vowel moraicity (164) above a markedness constraint against moraic high vowels (165).

(164) **MAXLINK-MORA[HIGH] –**"Do not delink underlying morae from high vowels."

(165) ***MORA[HIGH] –** A high vowel should not be affiliated with a mora.

As (166) shows, ranking the faithfulness constraint for high vowel length above the markedness constraint ensures that underlyingly long vowels surface as long in word-medial position. This applies to both dialects under investigation. (Note that only the high vowel length is evaluated in this tableau – the mid vowel will be evaluated below.)

(166) Distinctive High Vowel Length in Both Dialects

μμ μμ /tu r o/	MAXLINK-MORA[HIGH]	*MORA[HIGH]
a. σ σ μ μμ t u r o	*!	*
b. ☞ σ σ μμ μμ t u r o		**

Candidate (a) violates the moraic faithfulness constraint by shortening the high vowel. This violation is fatal because candidate (b) does not violate this constraint.

Without a higher-ranked constraint forcing high medial vowels to lengthen, either the moraic markedness constraint in (167), or the moraic faithfulness constraint in (168) will ensure that high vowels do not lengthen. This is illustrated in tableau (168).

(167) **DEPLINK-MORA[HIGH] –**"Do not add a mora to a high vowel."

(168)

μ μ /vi c ɛ/	DEPLINK-MORA[HIGH]	*MORA[HIGH]
a. ☞ σ σ μ μ v i c ɛ		*
b. σ σ μ μ μ v i c ɛ	*!	**!

Candidate (b) does worse than candidate (a) on both constraints.

However, in Educated Colloquial Hungarian, the high vowels neutralize to long in stressed open monosyllables. This is explained by a coercive weight markedness constraint requiring that prosodic feet be binary (see (169)) ranked above both the moraic markedness constraint and the high vowel faithfulness against adding morae, as shown in (170). Note that either a long or a short vowel may be in the input because of Richness of the Base (Prince and Smolensky 1993). Only the short vowel possibility is shown here.

(169) **FOOTBINARITY (FTBIN) –** Prosodic feet must be binary at either the moraic or syllable level.

(170) Educated Colloquial Hungarian High Vowel Neutralization to Long

μ /bü/ 'meloncholy'	FTBIN	*MORA[HIGH]	DEPLINK-MORA[HIGH]
a. σ μ b ü	*!	*	
b. ☞ σ μ μ b ü		**	*

Candidate (a) fatally violates the constraint requiring that prosodic feet be bimoraic. Although candidate (b) violates both the constraint against moraic high vowels and the constraint against adding morae to high vowels once more than candidate (a), these are not fatal violations because these constraints are lower-ranked.

In Standard Literary Hungarian, the constraint requiring foot binarity must be ranked lower than either the moraic faithfulness constraint or the markedness constraint because high vowels do not length in open monosyllables.

(171) Standard Literary Hungarian Distinctive High Vowel Length

μ /bü/	*MORA[HIGH]	DEPLINK-MORA[HIGH]	FTBIN
a. ☞ σ μ b ü	*		*
b. σ μ μ b ü	**!	*!	

Since high vowels are only short in unstressed final position in Educated Colloquial Hungarian, there must be a constraint prohibiting them from being long in that position. Since there are a number of languages that prohibit long vowels word-finally (Buckley 1998), the following constraint is proposed:

(172) ***FINALLONGV** – Word-final long vowels are prohibited[42].

With this constraint ranked higher than the faithfulness constraint for high vowels, high vowels surface as short in unstressed final position.

(173) Educated Colloquial Hungarian High Vowel Neutralization to Short

μμ μμ / a r u / 'having a price'	*FINALLONGV	MAXLINK-MORA[HIGH]
a. ☞ σ σ μ μ μ a r u		*
b. σ σ μ μ μμ a r u	*!	

[42] Buckley (1998) has convincing arguments for the need for such a constraint. Not all languages that exhibit a restriction against long final vowels do so under constraints on foot structure. As discussed in section 4.2, Modern Standard Italian is one such language which normally prefers stressed penultimate or final syllables to be bimoraic, but not if the stressed final is open.

Candidate (b) fatally violates the constraint against final long vowels. The moraic faithfulness constraint is lower-ranked, so the violation of it that candidate (a) incurs by shortening the vowel is not fatal.

Again, the length of high vowels is distinctive in Standard Literary Hungarian in this same environment, so the constraint against word-final long vowels must be ranked below vowel length faithfulness.

(174) Standard Literary Hungarian Distinctive High Vowel Length

μμ μμ / a r u / 'having a price'	MAXLINK-MORA[HIGH]	*FINALLONGV
a. σ σ μ μ μ a r u	*!	
b. ☞ σ σ μ μ μμ a r u		*

However, since high vowels do neutralize to long in stressed open monosyllables in Educated Colloquial Hungarian, the constraint requiring binary feet must be ranked above the final vowel markedness constraint in that dialect.

(175) Educated Colloquial Hungarian High Vowel Neutralization to Long

μ /bü/ 'meloncholy'	FTBIN	*FINAL LONGV
a. σ μ b ü	*!	
b. ☞ σ μ μ b ü		*

Summary: The constraint ranking in (176) was motivated for the distribution of high vowels in Educated Colloquial Hungarian. In contrast, the ranking in (177) was motivated for Standard Literary Hungarian.

(176) Constraint Ranking for Educated Colloquial Hungarian High Vowels

FTBIN

*FINALLONGV DEPLINK-MORA[HIGH]

MAXLINK-MORA[HIGH]

*MORA[HIGH]

(177) Constraint Ranking for Standard Literary Hungarian High Vowels

MAXLINK-MORA[HIGH]

*FINALLONGV *MORA[HIGH] DEPLINK-MORA[HIGH]

FTBIN

<u>Mid Vowels</u>

Mid vowels have distinctive length in non-final position in both dialects, so the faithfulness constraint against deleting underlying morae from mid vowels is ranked higher than the markedness constraint against moraic mid vowels.

(178) MAXLINK-MORA[MID] >> *MORA[MID]

However, both dialects also show mid vowel neutralization to long in word-final position. The lengthening in monosyllables can be handled via the ranking of FTBIN above the moraic markedness constraint and the faithfulness constraint against adding morae. However, this would not explain the lack of short mid vowels in unstressed final syllables. Since both of these neutralization environments are actually word-final, I propose a constraint against final lax vowels. Recall from section 4.4.1 that, unlike high vowel length pairs manifesting only a quantitative difference, mid vowels show both a length and tense/lax alternation.

(179) ***lax]$_{\#}$** - Word-final lax vowels are prohibited.[43]

As (180) demonstrates, ranking this constraint above the mid vowel moraic faithfulness and markedness constraints seems to cause the neutralization of final mid vowels to long.

[43] The effects of this constraint are seen in other languages - e.g. English disallows word-final lax mid and high vowels, as does Dutch (p.c. Caro Struijke).

(180) Mid Vowel Neutralization to Long in Both Dialects

μ /lɔ/ 'horse'	*lax]$_{\#}$	*MORA[MID]	DEPLINK-MORA[MID]
σ μ a. l ɔ	*!	*	
σ μ μ b. ☞ l o		**	*

Candidate (a) has a final lax vowel, therefore it fatally violates the highly-ranked constraint against final lax vowels. The extra violations of the two lower-ranked constraints are not fatal for candidate (b) because the competing candidate fatally violates the higher-ranked constraint.

However, there is a difficulty here in that it would seem better to simply change the lax short vowel into a tense short vowel. Thus, only feature faithfulness is violated, and moraic faithfulness is satisfied, as shown in (181).

(181) Mid Vowel Neutralization to Long in Both Dialects

μ /lɔ/ 'horse'	*lax]$_{\#}$	MAX[RTR]	*MORA[MID]	DEPLINK-MORA[MID]
σ μ a. l ɔ	*!		*	
σ μ μ b. ☜ l o		*	**!	*
σ μ c. ☛ l o		*	*	*

Candidate (c) is more harmonic than candidate (b) in this tableau because of the extra violation of the constraint against moraic mid vowels that (b) incurs. This result, however, is incorrect since candidate (b) actually surfaces in this language.

The problem is that Hungarian has, as do many languages with a vowel length distinction, a cooccurrance condition (parasitic dependency) between tensing and length. At least part of the vowel distribution requires that lax vowels be short and tense vowels be long. The motivation behind this correlation is fairly clear – it is much easier to perceive a difference between long and short vowels if there is also a qualitative difference between members of a pair. The difficulty is in formulating this requirement that if segments are different along one dimension (e.g. length), then they should also be different along another dimension (e.g. tensing), or vice versa. Since this topic is a problem for any account of vowels in a language which makes use of concurrent vowel quality and quantity differences, and is far beyond the scope of the present work, I will simply assume the constraint (182) is ranked high enough to ensure that tense vowels surface as long when appropriate.

(182) ***SHORT[tense] –** Tense vowels must be bimoraic.[44]

[44] This constraint (or type of constraint) may or may not be a contender for universal status. Here it is simply used as a "dummy" constraint to motivate the parasitic dependency between tense and bimoraicity in Hungarian. To my knowledge, there are no OT analyses at this time that can capture this dependency.

As (183) illustrates, with the constraint against final lax vowels ranked higher than *MORA[MID], final mid vowels always surface as long in the final open syllable of polysyllabics. Note that only the final syllable is evaluated.

(183) Mid Vowel Neutralization to Long in Both Dialects

μ /t ɛ k nœ/ 'trough'	*lax]$_{\#}$	*SHORT[tense]	*MORA [MID]	DEPLINK-MORA[MID]
σ μ a. t ɛ k n œ	*!		*	
σ μ μ b. ☞ t ɛ k n ö			**	*
σ μ c. t ɛ k n ö		*!	**	*

Candidate (a) cannot surface because it fatally violates the constraint against final lax vowels. Candidate (c) cannot surface because of its violation of the constraint requiring tense vowels to be long. Candidate (b) is optimal because it does not violate either of these constraints.

Finally, since the final mid vowels are long, the constraint against final lax vowels and the constraint ensuring that tense vowels are long are ranked above the constraint against final long vowels.

(184) Mid Vowel Neutralization to Long in Both Dialects

μ /t ɛ k nœ/ 'trough'	*lax]$_{\#}$	*SHORT[tense]	*FINALLONGV
a. σ μ t ɛ k n œ	*!		
b. ☞ σ μ μ t ɛ k n ö			*
c. σ μ t ɛ k n ö		*!	

The constraint ranking in (185) has been motivated thus far.

(185) *SHORT[tense] *lax]$_{\#}$ MAXLINK-MORA[MID]

DEPLINK-MORA[MID] *FINALLONGV *MORA[MID]

<u>Low Vowels</u>

Since low vowels retain a length distinction in all environments in both dialects, faithfulness against adding morae to these vowels must be ranked above the foot binarity constraint and the constraint requiring that lax vowels be long in final position. In addition, the faithfulness constraint against deleting underlying morae from low vowels must be ranked above the constraint against final long vowels.

(186) Distinctive Low Vowel Length in Both Dialects

μ /fɑ/ 'tree'	DEPLINK-MORA[LOW]	FTBIN
a. ☞ σ μ f ɑ		*
b. σ μ μ f a	*!	

In tableau (187), candidate (a) surfaces despite the violation of foot binarity because candidate (b) violates the higher-ranked constraint against adding morae to low vowels.

(187) Distinctive Low Vowel Length in Both Dialects

μ /lɛ/ 'down'	DEPLINK-MORA[LOW]	*lax]$_{\#}$
a. ☞ σ μ l ɛ		*
b. σ μ μ l e	*!	

In tableau (187), candidate (a) is optimal despite the violation of the constraint against final lax vowels because candidate (b) fatally violates the higher-ranked faithfulness constraint.

(188) Distinctive Low Vowel Length in Both Dialects

μμ /l e / 'juice'	MAXLINK-MORA[LOW]	*FINALLONGV
a. σ μ l ɛ	*!	
b. ☞ σ μ μ l e		*

In tableau (188), candidate (a) fatally violates the faithfulness constraint because it surfaces with a short vowel. Although candidate (b) violates the constraint against final long vowels, this violation is not fatal because (b) does not violate the higher-ranked faithfulness constraint.

The constraint rankings needed for low vowels in both dialects are:

(189) DEPLINK-MORA[MID] >> *lax]$_{\#}$, FTBIN

MAXLINK-MORA[MID] >> *FINALLONGV

4.4.2.2 Consequence

An interesting and important consequence of the constraint rankings needed for the different vowels is that it shows evidence of a violation of a well-known generalization about moraicity. According to Zec (1988, 1995), moraicity follows the sonority scale – if a segment of a certain sonority is forced to be moraic in some environment, then segments of higher sonority will necessarily be forced to be moraic in that environment. This is due to the relationship between the general markedness constraints against moraic segments and other markedness constraints forcing moraicity and was discussed in chapter 2. (190) provides a simplified universal moraic markedness hierarchy.

(190) *MORA[STOP] >> *MORA[CONT] >> *MORA[NASAL] >> *MORA[LIQ] >>
*MORA[HIGH] >> *MORA[MID] >> *MORA[LOW]

Without the influence of faithfulness constraints, since FTBIN is ranked above *MORA[HIGH] in Educated Colloquial Hungarian, low vowels should also only surface as long in open monosyllables. This is predicted implicitly by Zec (1988, 1995).

(191) FTBIN >>*MORA[HIGH] >> *MORA[LOW]

Tableau (192) demonstrates that markedness constraints alone make the wrong prediction for low vowels – they are forced to neutralize to long.

(192) Incorrect Low Vowel Neutralization Predicted by Markedness

μ /bü/	FTBIN	*MORA[HIGH]	*MORA[LOW]
a. σ μ bü	*!	*	
b. ☞ σ μμ bü		**	
μ /fα/			
c. ☜ σ μ fα	*!		*
d. ☛ σ μμ f a			**

In tableau (192), although the constraint requiring foot binarity correctly rules out the final short high vowel of candidate (a), it incorrectly rules out the short low vowel in candidate (c).

However, low vowels can violate the sonority-based implicational relationship because of a higher-ranked faithfulness constraint, as seen in the Hungarian length patterns. The ranking in (192), with low vowel faithfulness ranked above the constraint requiring foot binarity and high vowel faithfulness ranked below, the correct distribution arises, as shown in (194).

(193) DEPLINK-MORA[LOW] >> FTBIN >> DEPLINK-MORA[HIGH], *MORA[HIGH] >> *MORA[LOW]

(194) Correct Distinctive Low Vowel Length and High Vowel Neutralization

	μ /fα/	DEPLINK-MORA[LOW]	FtBin	DEPLINK-MORA[HIGH]	*MORA[HIGH]	*MORA[LOW]
a. ☞	σ μ fα		*			*
b.	σ μμ f a	*!				**
	μ /bü/					
c.	σ μ bü		*!		*	
d. ☞	σ μμ bü			*	**	

In tableau (194), foot binarity still correctly rules out candidate (c) which has a short final high vowel. However, the short low vowel is allowed to surface because of the higher-ranked faithfulness constraint against adding morae to low vowels.

Thus, there is evidence that an interaction between coerced weight and distinctive weight can conspire to violate the predictions of Zec. This was predicted in chapter 3.

4.4.2.3 Consonant Weight

Recall that obstruent geminates are attested in Hungarian both word-finally and word-medially in both dialects. In addition, sonorant geminates do not surface in some Educated Colloquial dialects although they do appear in the Standard Literary dialect.

Following the logic used for vowel length, this can be seen as the relative ranking of a faithfulness constraint on underlying consonant moraicity with the markedness constraint against moraic segments. In anticipation of comparing the different distributions of moraic obstruents and sonorants, the following two constraints from chapter 3 are given:

(195) **MAXLINK-MORA[OBS] –** "Do not delete underlying morae from obstruents."

(196) **MAXLINK-MORA[SON] –** "Do not delete underlying morae from sonorants."

As (197) shows, ranking the obstruent moraic faithfulness constraint above the markedness constraint against moraic obstruents ensures that underlyingly moraic obstruents surface as moraic in word-medial intervocalic position.

(197) Distinctive Obstruent Weight – Both Dialects

μ μ μ /v i c ɛ/ 'his joke'	MAXLINK-MORA[OBS]	*MORA[OBS]
a. σ σ μ μ v i c ɛ	*!	
b. ☞ σ σ μ μ μ v i c ɛ		*

In Standard Literary Hungarian the moraic faithfulness constraint on sonorants is ranked above the markedness constraint against moraic sonorants, as shown in (198).

(198) Distinctive Sonorant Weight – Standard Literary Hungarian

μ μ μ μ /k ɔ m u n α/ ‘commune’	MAXLINK-MORA[SON]	*MORA[SON]
σ σ σ μ μ μ a. k ɔ m u n α	*!	
σ σ σ μ μ μ μ b. ☞ k ɔ m u n α		*

In contrast, (199) shows that in Educated Literary Hungarian the markedness constraint against moraic sonorants is ranked above the moraic faithfulness for sonorants. This results in neutralization of underlyingly moraic sonorants in intervocalic position to non-moraic.

(199) Neutralization of Intervocalic Sonorant Weight – Educated Colloquial Hungarian

μ μ μ μ /k ɔ m u n α/ ‘commune’	*MORA[SON]	MAXLINK-MORA[SON]
σ σ σ μ μ μ a. ☞ k ɔ m u n α		*
σ σ σ μ μ μ μ b. k ɔ m u n α	*!	

Since underlyingly non-moraic intervocalic obstruents and sonorants in both dialects surface as non-moraic, either the moraic markedness constraints on both segments types or the faithfulness constraints against adding morae will prohibit adding morae.

(200) Underlyingly Non-moraic Consonants – Both Dialects

μ μ /v i c ε/ 'janitor'	*MORA[OBS]	DEPLINK-MORA[OBS]
σ σ μ μ a. ☞ v i c ε		
σ σ μ μ μ b. v i c ε	*!	*!
μ μ /k ɔ m ɑ/ 'chum'	*MORA[SON]	DEPLINK-MORA[SON]
σ σ μ μ c. ☞ k ɔ m ɑ		
σ σ μ μ μ d. k ɔ m ɑ	*!	*!

<u>Weight By Position</u>

Since consonant weight is not distinctive in medial non-geminate coda position, the faithfulness constraints against adding morae to consonants and the general moraic markedness constraints for consonants must be ranked lower than a constraint requiring codas to be moraic. This is the case for both obstruents and sonorants.

(201) **WEIGHTBYPOSITION (WBYP)** — Coda consonants must surface as moraic.

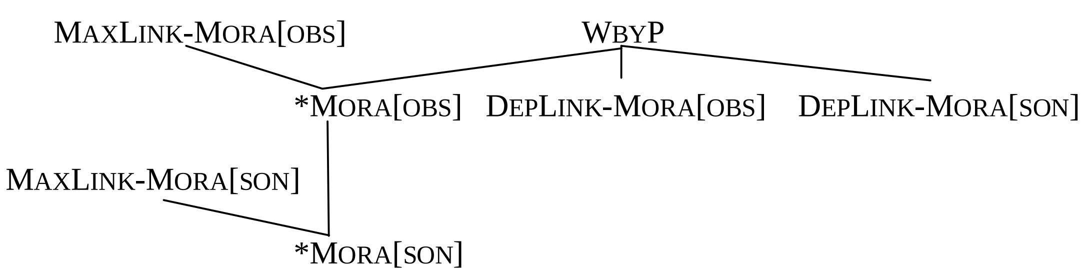
As (202) shows, underlyingly non-moraic coda obstruents surface as moraic[45].

(202) Coda Neutralization to Moraic

µ µµ /t ɛk nö/ 'trough'	WBYP	*MORA[OBS]	DEPLINK-MORA[OBS]
σ σ µ µµ a. t ɛ k n ö	*!		
σ σ µ µ µµ b. ☞ t ɛ k n ö		*	*

To summarize, the constraint rankings motivated thus far are:

(203) Standard Literary Hungarian



45 Recall that since there is no weight contrast, richness of the base requires that either an underlyingly moraic or non-moraic consonant will surface as moraic. Tableau (202) only shows a non-moraic input.

(204) Educated Colloquial Hungarian

MAXLINK-MORA[OBS] WBYP

*MORA[OBS] DEPLINK-MORA[OBS] DEPLINK-MORA[SON]

*MORA[SON]

MAXLINK-MORA[SON]

<ins>Final Non-moraic Consonants and Coda Clusters</ins>

In this subsection, I will show that the requirement that coda consonants be moraic is necessarily violated by some word-final consonants. By allowing WBYP to be violated at the edge of the word, but not word internally, not only will I show that final geminates emerge, but I also unify the word-final and word-medial coda cluster size restrictions.

The constraints used/assumed up until this point cannot result in distinctive consonant weight in word-final position. While underlyingly moraic single consonants are predicted to surface as geminates (moraic), as seen in (205), underlyingly non-moraic single consonants are wrongly predicted to gain a mora by WBYP, as shown in (206). (Only the relevant constraints are shown)

(205) Word-final Post-vocalic Moraic Consonant

μ μ /ʃ ɔ k/ 'shock'	WBYP	MAXLINK-MORA[OBS]	*MORA[OBS]
a. σ μ ʃ ɔ k	*!	*!	
b. ☞ σ μ μ ʃ ɔ k			*

Candidate (a) violates the constraint requiring that coda consonants be moraic, as well as the faithfulness constraint against losing underlying morae from obstruents. Candidate (b) violates only the lowest-ranked constraint, therefore it is optimal.

If the input final consonant is underlyingly non-moraic, then it should surface as non-moraic. Recall that Hungarian has distinctive gemination in final position. However, the constraint ranking motivated thus far predicts that the final consonant should surface as moraic, as shown in (206).

(206) Incorrectly Predicted Word-final Moraic Consonant

μ /ʃ ɔ k/ 'much'	WBYP	DEPLINK-MORA[OBS]	*MORA[OBS]
a. ☜ σ μ ʃ ɔ k	*!		
b. ☛ σ μ μ ʃ ɔ k		*	*

We know that candidate (a) with the non-moraic final consonant should win in tableau (206) because of the surface facts of the language.

With the constraint in (207) ranked above the constraint requiring that coda consonants be moraic, the candidate with the final non-moraic consonant is optimal. This is shown in (208).

(207) ***WORDFINALMORA (*μ]#) –** The word-final segment must not be associated with a mora (in the spirit of Hung 1994).

With the final non-moraic constraint ranked above WBYP, underlyingly non-moraic final consonants surface as non-moraic.

(208) Word-final Consonant Non-moraicity

μ /ʃ ɔ k/ ‘much’	*μ]#	WBYP
a. ☞ σ μ ʃ ɔ k		*
b. σ μ μ ʃ ɔ k	*!	

Because candidate (b) has a final moraic consonant it violates the constraint requiring final segment non-moraicity. This violation is fatal because candidate (a) satisfies this highly-ranked constraint.

As (209) shows, underlyingly moraic final post-vocalic consonants surface as moraic if the faithfulness constraint against deleting underlying morae from obstruents is ranked above the final non-moraicity constraint.

(209) Word-final Post-vocalic Moraic Consonant

μ μ /ʃ ɔ k/ ‘shock’	MAXLINK-MORA[OBS]	*μ]#	WBYP
σ μ a. ʃ ɔ k	*!		*
σ μ μ b. ☞ ʃ ɔ k		*	

Now most of the constraints and interactions necessary to account for the distribution of coda clusters are in place. Recall that in word final position, a maximum of two coda consonants is licit. Given an input with two post-vocalic final consonants, the final consonant will surface as non-moraic and the post-vocalic consonant will surface as moraic, regardless of their respective input moraic content. In (210), an input with a non-moraic final consonant and a non-moraic post-vocalic consonant surface as moraic followed by non-moraic.

(210)

μ /ɔ l t͡ʃ/ 'extinguish'	*μ]#	WBYP	*MORA[OBS]	*MORA[SON]
a. σ μ ɔ l t͡ʃ		**!		
b. ☞ σ μ μ ɔ l t͡ʃ		*		*
c. σ μ μ μ ɔ l t͡ʃ	*!		*	*

Candidate (c) violates the constraint requiring final non-moraicity. Candidate (a) fatally violates the constraint requiring coda consonants to be moraic because it violates this constraint once more than winning candidate (b).

Since MAXLINK-MORA[OBS] is ranked above the final non-moraicity constraint, geminates are predicted to surface in final clusters. However, this is an incorrect prediction. To ensure that underlyingly moraic final post-consonantal consonants surface as non-moraic, a constraint against adjacent moraic consonants must be ranked above the moraic faithfulness constraint. This is shown in (212).

(211) ***CON$^{\mu}$CON$^{\mu}$** – Two adjacent moraic consonants are prohibited[46].

[46] This constraint may be interpreted as an Obligatory Contour Principle (OCP) constraint against adjacent moraic consonants. Note that corresponding OCP(VOC$^{\mu}$) may militate against hiatus and diphthongs.

Note that a constraint against trimoraic structures is not sufficient for this case because trimoraic syllables containing long vowels and moraic consonants are quite common in this language (e.g. [a$^{\mu\mu}$l$^{\mu}$] *áll* 'stand' versus [a$^{\mu\mu}$l] *ál* 'false'). Therefore the constraint must be specific to two adjacent moraic consonants.

(212)

μ μ μ /ɔ l t͡ʃ/ 'extinguish'	*CON$^{\mu}$CON$^{\mu}$	MAXLINK-MORA[OBS]	*μ]#	WBYP
a. σ μ ɔ l t͡ʃ		*		**!
b. ☞ σ μ μ ɔ l t͡ʃ		*		*
c. σ μ μ μ ɔ l t͡ʃ	*!		*	

Since we have already established that consonant weight faithfulness must be ranked higher than the final non-moraicity constraint, without a constraint against adjacent moraic consonants, candidate (c) in tableau (212) would be optimal. However, it is candidate (b) which actually surfaces in this language, therefore the constraint against adjacent moraic consonants must be ranked above the moraic faithfulness constraint. Of the remaining candidates, (a) is suboptimal because it violates the constraint against non-moraic coda consonants once more than candidate (b).

Recall that in medial position, coda clusters are totally prohibited. This is because medial coda consonants do not have the possibility of being non-moraic because they are not at the word edge. To avoid either a sequence of two moraic consonants or a medial non-moraic coda, epenthesis occurs. The tableau in (214) shows that if the constraint against epenthesizing a vowel is lower ranked than weight by position, epenthesis results in medial position.

(213) **DEPV –** Do not add a vowel that was not there underlyingly.

(214)

μ μ /ɔ l t͡ʃ + ni/ 'extinguish-inf.'	*CON$^{\mu}$CON$^{\mu}$	*μ]#	WBYP	DEPV
a. ɔ l t͡ʃ ni		*	*!*	
b. ɔ l t͡ʃ ni		*	*!	
c. ɔ l t͡ʃ ni	*!	*		
d. ☞ ɔ l t͡ʃ ɔ ni		*		*

In tableau (214), candidate (c) fatally violates the constraint against adjacent moraic consonants. All candidates violate the constraint against final moraic segments because they all end in vowels in nuclear position (thus necessarily moraic).

Candidates (a) and (b) both fatally violate the constraint requiring coda consonants to be moraic. Although candidate (d) violates the constraint against adding a vowel that was not there underlyingly, it is optimal because this violation is low enough ranked.

(215) demonstrates that in final position, non-moraicity is available to avoid a violation of DEPV.

(215)

μ /ɔ l t͡ʃ ‘extinguish’	*CON$^{\mu}$CON$^{\mu}$	*μ]#	WBYP	DEPV
a. ɔ l t͡ʃ			**!	
b. ☞ ɔ l t͡ʃ			*	
c. ɔ l t͡ʃ	*!	*		
d. ɔ l t͡ʃ ɔ		*!		*

To summarize, the distribution of consonant weight in Hungarian is quite complex. In general, distinctive weight in obstruents is captured by

(216) MAXLINK-MORA[OBS] >> *MORA[OBS]

Distinctive sonorant moraicity in Standard Literary Hungarian is captured by (217), however, non-distinctive sonorant moraicity in Educated Colloquial Hungarian is captured by the reverse ranking in (218).

(217) MAXLINK-MORA[SON] >> *MORA[SON] (SLH)

(218) *MORA[SON] >> MAXLINK-MORA[SON] (ECH)

To ensure that non-final codas are neutralized to moraic,

(219) WBYP >> *MORA[OBS], DEPLINK-MORA[OBS]

(220) WBYP >> *MORA[SON], DEPLINK-MORA[SON]

To ensure that final underlyingly non-moraic codas surface as non-moraic,

(221) *μ]# >> WBYP

To ensure that final obstruent geminates surface as moraic in both dialects,

(222) MAXLINK-MORA[OBS] >> *μ]#

It is important to note that MAXLINK-MORA[OBS] >> *μ]# >> WBYP >> DEPLINK-MORA[OBS] shows that the two faithfulness functions (do not add a mora/do not delete a mora) cannot be included in a single constraint (e.g. IDENTMORA[OBS]) since they must be ranked separately.

To ensure that final sonorant geminates surface as moraic in Standard Literary Hungarian, but not Educated Colloquial Hungarian,

(223) MAXLINK-MORA[SON] >> *μ]# (SLH)

(224) *μ]# >> MAXLINK-MORA[SON] (ECH)

Finally, epenthesis takes place as a repair strategy to avoid either a medial non-moraic coda consonant or a sequence of two media moraic consonants. This is the result of ranking weight by position, final non-moraicity and a constraint against adjacent moraic consonants above a constraint against adding vowels that were not there underlyingly.

(225) $\text{CON}^{\mu}\,\text{CON}^{\mu}$, WBYP *μ]# >> DEPV

4.4.3 Summary

In this case study, I proposed an Optimality Theoretic analysis of core Hungarian segment moraicity in two major dialects. Hungarian weight phenomena, including distinctive vowel and consonant weight, and vowel and consonant weight neutralizations, are shown to be the result of constraint interactions. The differences between the Standard Literary and Educated Colloquial dialects in the treatment of vowels and consonants of varying feature specifications is due to minimal differences in the rankings of faithfulness constraints.

Related to the language-specific analysis, there are two major theoretical claims: First, the analysis of word-final geminates demonstrates that a symmetrical identity constraint on moraic associations, like that used in recent literature (Broselow, et al 1998; Keer 1999 - IDWT), as well as some of my previous work (e.g. Morén 1996, 1997 – IDENTMORA[SEG]) is not sufficient to account for all weight distributions found cross-linguistically. There is evidence from the behavior of word-medial and word-final geminates in languages like Hungarian that the two functions ensuring faithfulness to underlying moraic association (no adding and no deleting), must sometimes be ranked separately. This has potentially wide-reaching implications on other faithfulness constraints on associations (e.g. on features), and should be explored further.

Finally, the vowel length and consonant weight neutralization facts argue that a sonority-based approach to moraicity is not sufficient to account for the patterns of moraic segments. Moraic faithfulness constraints are necessary to force violations of Zec's (1988, 1995) prediction that if a segment of one sonority is moraic in some environment, then a more sonorous segment must be moraic in that environment.

4.5 Icelandic Phonology: A Unified Account

In this case study, I propose a unified account of several issues in Icelandic phonology[47]. I provide a review of the descriptive generalizations regarding syllabification, syllable weight, preaspiration, sonorant devoicing and stop deaspiration in Icelandic; and provide an Optimality Theoretic (Prince and Smolensky 1993) explanation of these phenomena. The advantage of this account is not only the unification of otherwise disparate phenomena, but also the demonstration that a minimal re-ranking of constraints captures the difference between the "northern" (*harðmæli*) and "southern" (*linmæli*) dialects.

Icelandic is investigated because it displays many weight-related phenomena that fit nicely into the framework developed here. Consonant weight is distinctive, yet neutralizes due to coercive weight requirements. Vowel length is non-distinctive and is subject to neutralization to either long or short depending on the context. Icelandic also provides evidence that laryngeal features play a role in the moraic markedness hierarchy, contra the claims of Zec 1988. Moreover, the analysis that follows shows how the constraints on moraicity can interact with various other constraints to form an integrated phonological system.

[47] This material was originally co-presented with Viola Miglio at the Xth Conference on Nordic Linguistics at Reykjavík, Iceland, June 1998. Viola was indispensable in working out the details of the analysis and for finding the appropriate data. However, I take full responsibility for all remaining errors.

4.5.1 Background Data[48]

This section provides a summary of the basic generalizations regarding several phonological phenomena found in Icelandic and addressed below.

4.5.1.1 Medial Syllabification

Unlike many other Germanic languages, Icelandic intervocalic consonant-consonant (CC) sequences typically syllabify heterosyllabically (Venneman 1972). This is shown in (226).

(226)	a.	[vél.ja]	*velja*	'choose'
	b.	[fák.na]	*fagna*	'celebrate'

The notable exception to this generalization is a stop followed by [r], [j], or [v]. When these sequences are found medially, the stop syllabifies as part of a complex onset, as shown in (227).

(227)	a.	[vö̋ö.kva]	*vökva*	'water'
	b.	[víi.tja]	*vitja*	'visit'

[48] I would also like to thank Óskar Holm Halldórsson for data and intuitions.

4.5.1.2 Syllable Weight and Stress

Much has been written about syllable weight, stress, and their interaction in Icelandic (e.g. Stefán Einarsson 1945; Kristján Árnason 1980). The following generalizations are well-established in the literature:

- Main stress is initial (except some prefixes, e.g. *all*-).
- Stressed syllables must be heavy (bimoraic).
- Vowel length is completely predictable, and long vowels are found only in open stressed syllables.
- Consonant weight is distinctive intervocalically and in post-vocalic final position. However, medial single coda consonants are always moraic, as are the initial consonants of coda clusters. All other non-geminate consonants are non-moraic.

4.5.1.3 Sonorant Devoicing

The patterns of Icelandic sonorant devoicing have been well-established in the literature (e.g. Höskuldur Þráinsson 1978, Kristján Árnason 1986). Aspiration is distinctive in sonorants only in initial position. Following Lombardi (1991), I assume that what are commonly referred to as voiceless sonorants are actually aspirated sonorants. However, since they are traditionally referred to as devoiced sonorants I will continue to call them by that conventional label.

(228)	a.	/rʰifa/	[r̥íi.va]	*hrífa*	‘rake’
	b.	/rifa/	[ríi.va]	*rífa*	‘tear’

In final coda clusters, all sonorants in all dialects devoice when adjacent to an underlyingly aspirated stop.[49] This is shown in (229).

(229)	a.	/mIntʰ/	[mín̥t]	*mynt*	‘coin’
	b.	/jamtʰ/	[jám̥t]	*jafnt*	
	c.	/vɛrkʰ/	[vɛ́r̥k]	v*erk*	‘work’

However, there is some dialect difference in which sonorants devoice in medial position. In all dialects, [r] devoices medially if followed by an underlyingly aspirated stop. This is shown in (230).

(230)	a.	/harpʰa/	[hár̥.pa]	*harpa*	‘harp’
	b.	/ɛrtʰa/	[ɛr̥.ta]	*erta*	‘tease’

The southern (*linmæli*) dialect devoices all sonorants in this environment, but the northern (*harðmæli*) dialect does not devoice nasals, as shown in (231).

[49] Except phrase-finally where there is a compulsory final aspiration. In which case, sonorant devoicing does not take place. I will not address phrase-final aspiration.

(231)	a.	/vant^{h}a/	[váņ̊.ta]	*vanta*	'to want' (southern dialect)
	b.	/vant^{h}a/	[ván.t^{h}a]	*vanta*	'to want' (northern dialect)

4.5.1.4 Stop Deaspiration

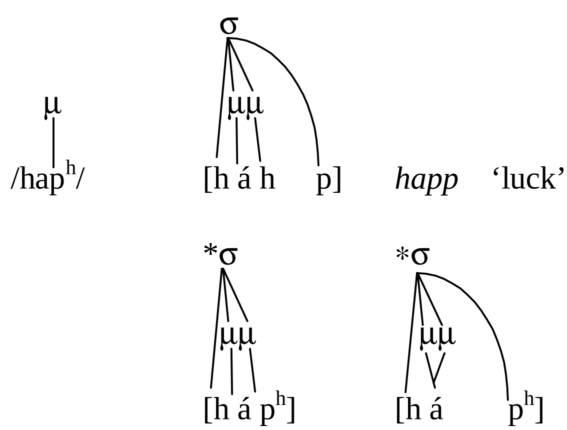
All dialects maintain distinctive stop aspiration in stressed syllables. However, the southern dialect does not support aspirated stops in unstressed syllables (Höskuldur Þráinsson 1978, Kristján Árnason 1986).

(232)	a.	/t^{h}ak^{h}a/	[t^{h}áa.ka]	*taka*	'to hold' (southern dialect)
	b.	/t^{h}ak^{h}a/	[t^{h}áa.k^{h}a]	*taka*	'to hold' (northern dialect)

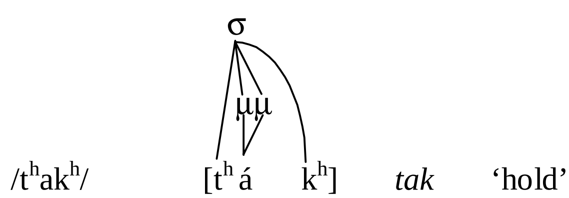
4.5.1.5 Preaspiration

A great deal has been written regarding preaspiration in Icelandic (e.g. Stefán Einarsson 1945, Magnús Pétursson 1972, Höskuldur Þráinsson 1978, Sigríður Sigurjónsdóttir 1989-90, Kristján Árnason 1986). The claim that I make here is that preaspiration occurs in three environments as a repair strategy to prevent an aspirated stop from surfacing in a moraic position. First, if an underlyingly moraic aspirated stop is both word-final and post-vocalic, then preaspiration occurs, as in (233a). If the stop is not moraic underlyingly, then it surfaces as an aspirated non-moraic consonant following a long vowel, as in (233b). Following the arguments in Höskuldur Þráinsson (1978), I assume that preaspiration is, in fact, the epenthesis of a root node to carry a dislodged aspiration feature. Note that explicit in this assumption is the claim that the [h] segment resulting from a preaspiration configuration in Icelandic has an aspiration feature specification. This is in line with previous literature that claims that [h] is specified for aspiration (e.g. Höskuldur Þráinsson 1978), but counter to Lombardi 1995.

(233) a.

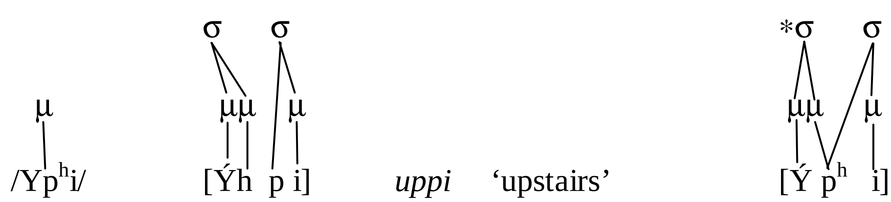


b.



The second situation triggering preaspiration is when an underlyingly moraic aspirated stop is intervocalic. This is shown in (234).

(234)



Finally, if an underlyingly aspirated stop is in a position where it would be syllabified as a moraic coda, then preaspiration occurs to prevent the stop from surfacing as both moraic and aspirated.

(235)

σ σ *σ σ

μμ μ μμ μ

/vat^{h}na/ [v áh t na] *vatna* ‘to water’ [v a t^{h}n a]

4.5.2 Analysis

4.5.2.1 Canonical Weight

I claim in chapter 2 that the core syllable weight of any language is the result of ranking faithfulness constraints on underlying moraic content relative to markedness constraints on segment moraicity. This has been demonstrated for numerous cases throughout this work.

Since there is a dichotomy of distinctive moraicity between the natural classes of consonants and vowels in Icelandic, the moraic faithfulness constraints must be relativized minimally to these classes in this language. The consonant constraints I propose are given in (236), and the vowel constraints are given in (237).

(236) a. **MAXLINK-MORA[CON] –** "Do not delink an underlying mora from a consonant."

b. **DEPLINK-MORA[CON] –** "Do not add a mora to a consonant that it did not have underlyingly."

(237) a. **MAXLINK-MORA[VOC] –** "Do not delink an underlying mora from a vowel."

b. **DEPLINK-MORA[VOC] –** "Do not add a mora to a vowel that it did not have underlyingly."

The general moraic markedness constraint must also be relativized to at least the natural classes of consonants and vowels. However, in anticipation of the following analysis of preaspiration, I propose that the general moraic markedness constraints for Icelandic consonants must be differentiated even further. Recall from the discussion in chapter 2 that the individual markedness constraints are universally ranked with respect to each other following the sonority scale for morae. A simplified markedness hierarchy is shown in (238). Note that the constraint on the least sonorous Icelandic segments, aspirated stops, is highest ranked. This follows the sonority scales of Selkirk (1984) and Levin (1985), as well as others.

(238) *MORA[ASPSTOP] >> *MORA[PLAINSTOP] >> *MORA[SON] >> *MORA[HIGH] >> *MORA[LOW]

Since the relevant splits in Icelandic will be between consonants and vowels on the one hand, and between aspirated stops and the rest of the consonants on the other hand, I propose the constraints (239) through (241). Note that (240) is just a convenient shorthand corresponding to a larger hierarchy.

(239) ***MORA[ASPSTOP] -** "An aspirated stop must not be associated with a mora."

(240) ***MORA[PLAINSTOP+] -** "A consonant more sonorous than a voiceless stop must not be associated with a mora ."

(241) ***MORA[VOC] -** "A vowel must not be associated with a mora."

<u>Distinctive Intervocalic Consonant Weight and Vowel Lengthening</u>

The overarching generalization about Icelandic syllable weight is that all stressed syllables are heavy. This generalization is never violated, and is due to an undominated constraint, such as that in (242).

(242) **STRESSTOWEIGHTPRINCIPLE (STOW) –** Stressed syllables must be heavy (bimoraic). (Jespersen 1909; Prince 1990; Prince and Smolensky 1993)

Keeping in mind the minimal weight requirement on stressed syllables (STOW), an underlyingly moraic intervocalic consonant surfaces as moraic because the faithfulness constraint against losing underlying associations between morae and consonants is ranked above the markedness constraint against moraic consonants. This is demonstrated in tableau (243). Note that I will not show underlying vowel moraicity unless it is germane to the discussion.

(243)

μ /ana/ *Anna*	STOW	MAXLINK-MORA[CON]	*MORA [PLAINSTOP+]
a. σ σ μ μ á n a [á.na]	*!	*!	
b. σ σ μμ μ á na [áa.na]		*!	
c. ☞ σ σ μμ μ á n a [án.na]			*

In tableau (243), candidate (a) fatally violates either the constraint requiring stressed syllables to be bimoraic or the faithfulness constraint against losing morae from consonants. Candidate (b) fatally violates the faithfulness constraint because the nasal is not associated with a mora. Although candidate (c) violates the constraint against having a mora associated with a consonant, this violation is low enough ranked to not be fatal.

In contrast, an underlying non-moraic intervocalic consonant surfaces as non-moraic following a long stressed vowel. The undominated constraint on stressed syllable weight forces the initial syllable to be bimoraic. Since the markedness constraint against moraic consonants outranks the markedness constraint against moraic vowels, the vowel lengthens in preference to adding a mora to the consonant. There is also a violation of DEPLINK-MORA[VOC], but this constraint is ranked low enough to never be active in Icelandic and will not be discussed further. This is shown in tableau (244).

(244)

/ana/ *ana*	STOW	*MORA [PLAINSTOP+]	*MORA[VOC]
a. σ σ μ μ á n a [á.na]	*!		**
b. ☞ σ σ μμ μ á na [áa.na]			***
c. σ σ μμ μ á n a [án.na]		*!	**

In tableau (244), candidate (a) is suboptimal because it violates the constraint requiring stressed syllables to be heavy. Candidate (c) is now ruled out because it has a moraic consonant. Candidate (b), with a long vowel, is optimal.

Medial Single Codas

There is no distinctive weight for medial codas. That is, there are no contrasts between moraic and non-moraic coda consonants. All medial codas surface as moraic because a constraint requiring moraic coda consonants, (245), is ranked above the consonant moraic markedness constraint, as shown in (246).

(245) **WEIGHTBYPOSITION (WBYP) –** Coda consonants must surface as moraic. (Hayes 1989)

(246)

/fakna/ *fagna*	STOW	WBYP	*MORA [PLAINSTOP+]
a. σ σ μ μ f á kna [fák.na]	*!	*!	
b. σ σ μμ μ f á kna [fáak.na]		*!	
c. ☞ σ σ μμ μ f á k na [fák.na]			*

Candidate (a) fatally violates both the constraint requiring heavy stressed syllables and the constraint requiring coda consonants to be moraic. Candidate (b) fatally violates the constraint requiring moraic codas consonants. Although candidate (c) violates the constraint against moraic coda consonants, this violation is not fatal.

Final Single Codas

In word-final position, single coda consonant weight is distinctive. Consonants surface as non-moraic if underlyingly non-moraic. This results from ranking the constraint in (247) above WBYP, as shown in (248).

(247) ***WordFinalMora (*μ]#)** – The word-final segment must not be associated with a mora (in the spirit of Hung 1994). (Used in a similar fashion for Hungarian in the previous case study.)

(248)

/man/ *man*	StoW	*μ]#	WbyP
a. ☞ σ μμ má n [máan]			*
b. σ μ μ má n [mánn]		*!	

Candidate (b) in tableau (248) is moraic, therefore it violates the final non-moraicity constraint. Although candidate (a) violates the constraint requiring moraic codas, it is still optimal.

However, final geminates are allowed. Therefore, consonant weight faithfulness must outrank the constraint against final moraic consonants, as shown in (249).

(249)

μ /man/ *mann*	StoW	MaxLink-Mora[con]	*μ]#	WbyP
a. σ μμ má n [máan]		*!		*
b. ☞ σ μ μ má n [mánn]			*	

In tableau (249), candidate (a) loses because it fatally violates the moraic faithfulness constraint because the coda nasal is underlyingly moraic.

Based on the above discussion, the constraint ranking that results in the syllable weight for all dialects of Icelandic is given in (250).

(250)

MaxLink-Mora[con]
|
*μ]#
|
WbyP
|
StoW   *Mora[plainstop+]
|
*Mora[voc]
|
MaxLink-Mora[voc]

MaxLink-Mora[voc] must be ranked below *Mora[voc] to ensure that vowel length is not distinctive. StoW and *Mora[plainstop+] ranked above *Mora[voc] force vowels to surface as long in open stressed syllables. WbyP ranked above *Mora[con] ensures that coda consonants are moraic. However, final single codas may surface as non-moraic because *μ]# is ranked above WbyP. Finally, underlyingly moraic final single codas surface as moraic despite the imperative to not be moraic in final position because MaxLink-Mora[con] is ranked above *μ]#.

4.5.2.2 Syllabification

Recall that stops followed by [r, j, v] form onset clusters. All other sequences are heterosyllabic. If we assume that [r, j, v] are the most sonorous of the Icelandic consonants[50], and the stops are the least sonorous segments, then we can invoke some instantiation of the sonority distance to derive proper syllabification.

(251) **SONORITYDISTANCE (SONDIST)**[51] - “Consonant sequences closer in sonority than [t,p,k,s] and [r,j,v] must syllabify heterosyllabically.”

This constraint must be ranked above *MORA[PLAINSTOP+] and WBYP.

Tableau (252) shows tautosyllabic syllabification, while tableaux (253) and (254) show heterosyllabic syllabification.

(252)

/mɛkra/ *megra*	SONDIST	*MORA [PLAINSTOP+]
a. ☞ σ σ μμ μ m ɛ́ kr a [mɛ́ɛ.kra]		
b. σ σ μμ μ mɛ́ k r a [mɛ́k.ra]		*!

Candidate (a) in tableau (252) does not violate either of these constraints. Since the competing candidate violates the markedness constraint against moraic consonants, it

[50] [v] is an approximant in Icelandic.

[51] This constraint is obviously shorthand for a more substantive constraint or set of constraints the exact formulation of which is beyond the scope of the present work.

loses. Note that candidate (b) satisfies sonority distance vacuously because it does not contain a cluster.

(253)

/fakna/ *fagna*	SONDIST	*MORA [plainstop+]
a. σ σ μμ μ f á k n a [fáa.kna]	*!	
b. ☞ σ σ μμ μ f á k n a [fák.na]		*

In tableau (253), candidate (a) fatally violates the sonority distance constraint. The winning candidate violates the lower-ranked constraint against moraic consonants.

(254)

/vak^{h}na/ *vakna*	SONDIST	WXP
a. σ σ μμ μ v á k^h n a [váa.k^{h}na]	*!	
b. ☞ σ σ μ μ μ v á h k n a [váhk.na]		*

The analysis of the preaspiration seen in candidate (b) will be presented below. However, for now, the constraint ranking necessary for syllabification in all dialects is given in (255).

(255) SONDIST
|
WBYP
|
*MORA[PLAINSTOP+]

4.5.2.3 Distinctive Aspiration in Stressed Syllables - all dialects

To maintain distinctive aspiration for both stops and sonorants in stressed syllables, a faithfulness constraint on underlying aspiration in stressed syllables, (256), must be ranked above the markedness constraints against aspirated segments, (257). The result of this ranking is shown in tableau (258) a stop and tableau (259) for a sonorant.

(256) **MAXASPσ́** (positional faithfulness[52]) – α is in S_1, β is in S_2, $\alpha\ R\ \beta$, α and β are segments. If α is [asp] and β is in a stressed syllable, then β is [asp]. "A correspondent in the output should maintain underlying aspiration if it surfaces in a stressed syllable."

(257) ***ASP[SEG]** (constraint family) – Aspirated segments are prohibited.

Since the pattern of distinctive aspiration is different for stressed and unstressed syllables, the constraint in (256) must be different from a general faithfulness

[52] See Beckman (1995) and Alderete (1995) for more on positional/prosodic faithfulness. Although I present the positional faithfulness constraint as a MAXLINK constraint to parallel MAXLINK-MORA, I will not pursue the possibility that featural faithfulness must come in both a MAXLINK and DEPLINK formulation.

constraint on aspiration. This will be demonstrated shortly. In addition, since the pattern of distinctive aspiration in non-initial position will be different depending on the quality of the segment, the constraint in (257) must be relative to different segment types. A single constraint against aspiration is not sufficient.

(258)

/tʰimI/ *tími*	MAXASPσ́	*ASP[STOP]
a. ☞ tʰíi.mI		*
b. tíi.mI	*!	

Tableau (258) shows that despite the imperative to no aspirate stops, stop aspiration is distinctive in stressed syllables because of the ranking of faithfulness over markedness. Candidate (b) is ruled out by the violation of faithfulness.

(259)

/rʰifa/ *hrífa*	MAXASPσ́	*ASP[SON]
a. ☞ rʰíi.va [r̥íi.va]		*
b. ríi.va	*!	

The evaluation of (259) is identical to that of (258), with the exception that the markedness constraint is on aspirated sonorants.

4.5.2.4 Unstressed Syllable Aspiration

In the southern dialect, stops in unstressed syllables surface without aspiration, but in the northern dialect, stop aspiration is distinctive in unstressed syllables. This is due to different relative rankings of the constraint against aspirated stops and the general faithfulness constraint on stop aspiration given in (260). Tableau (261) demonstrates neutralization in unstressed syllables in the southern dialect, and tableau (262) demonstrates the lack of neutralization in stressed syllables in this dialect.

(260) **MAXASP[STOP]**[53] **–** "An underlying aspiration from a stop should surface."

(261) Southern dialect stop deaspiration

/tʰakʰa/ *taka*	MAXASPσ́	*ASP[STOP]	MAXASP[STOP]
a. ☞ tʰáa.ka		*	*
b. tʰáa.kʰa		**!	

Candidate (b) in tableau (261) fatally violates the markedness constraint. Both candidates satisfy the constraint requiring faithfulness to aspiration in stressed syllables, and although candidate (a) violates the general faithfulness constraint requiring faithfulness to stop aspiration, it is still optimal.

[53] See Pater (1996) for more on featural faithfulness constraints specific to segment type, e.g. Ident[ObsVce] – Correspondent obstruents are identical in their specification for [voice] (Pater 1996:22).

As (262) shows, with the positional faithfulness constraint ranked above the markedness constraint, all underlyingly aspirated stops remain aspirated on the surface if they appear in a stressed syllable.

(262) Southern dialect stressed syllable stop aspiration

/tʰakʰ/ *tak*	MAXASPσ́	*ASP[STOP]	MAXASP[STOP]
a. tʰáak	*!	*	*
b. ☞ tʰáakʰ		**	

In candidate (a), the coda consonant has lost its aspiration, so it fatally violates the positional faithfulness constraint.

In contrast with the southern dialect, the northern dialect maintains distinctive aspiration on stops in unstressed syllables as well as in stressed syllables. To capture this, the general stop aspiration faithfulness constraint is ranked above the markedness constraint, as demonstrated in (263).

(263) Northern dialect distinctive stop aspiration

/tʰakʰa/ *taka*	MAXASPσ́	MAXASP[STOP]	*ASP[STOP]
a. tʰáa.ka		*!	*
b. ☞ tʰáa.kʰa			**

Candidate (a) fatally violates the constraint requiring that underlying stop aspiration surfaces.

4.5.2.5 Medial Sonorant Devoicing

All dialects devoice /r/ if followed by an underlyingly aspirated stop. This arises from *ASP[STOP], MAXASP[STOP] >> *ASP[r], as shown in (264). Note that the winning candidate must also violate (non-fatally) a faithfulness constraint against adding aspiration to an [r]. This constraint is not discussed and is assumed to be ranked lower than MAXASP[STOP].

(264) Southern dialect [r] devoicing

/harp^{h}a/ *harpa*	*ASP[STOP]	MAXASP[STOP]	*ASP[r]
a. hár$^{\mu}$.pa [hár.pa]		*!	
b. hár$^{\mu}$.p^{h}a [hár.p^{h}a]	*!		
c. ☞ hár$^{h\mu}$.pa [hár̥.pa]			*

(265) Northern dialect [r] devoicing

/harp^{h}a/ *harpa*	MAXASP[STOP]	*ASP[STOP]	*ASP[r]
a. hár$^{\mu}$.pa [hár.pa]	*!		
b. hár$^{\mu}$.p^{h}a [hár.p^{h}a]		*!	
c. ☞ hár$^{h\mu}$.pa [hár̥.pa]			*

The southern dialect actually aspirates all sonorants in this position, as shown in (266).

(266) Southern dialect nasal devoicing

/vant^{h}a/ *vanta*			*ASP[STOP]	MAXASP[STOP]	*ASP[n]
a.		van$^{\mu}$.ta [van.ta]	*!		
b.		van$^{\mu}$.t^{h}a [van.t^{h}a]		*!	
c.	☞	van$^{h\mu}$.ta [van̥.ta]			*

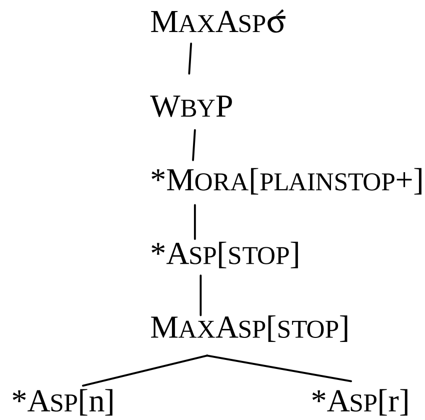
However, the northern dialect does not devoice [n].

(267) Northern dialect

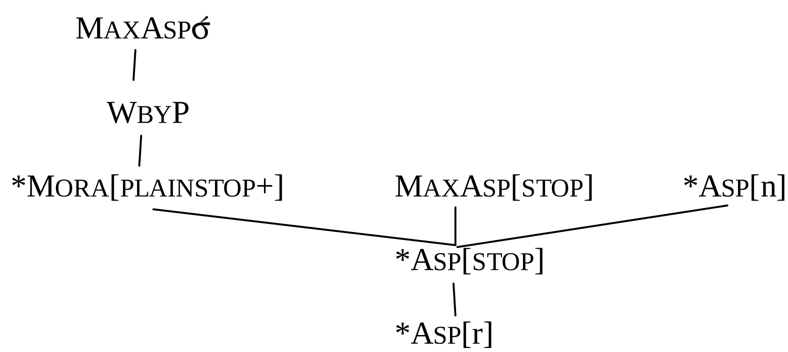
/vant^{h}a/ *vanta*			MAXASP[STOP]	*ASP[n]	*ASP[STOP]
a.		van$^{\mu}$.ta [van.ta]	*!		
b.	☞	van$^{\mu}$.t^{h}a [van.t^{h}a]			*
c.		van$^{h\mu}$.ta [van̥.ta]		*!	

To summarize, the constraint rankings in (268) and (269) were motivated for the patterns of aspiration (excluding preaspiration) in southern and the northern dialects, respectively. Note that the difference between dialects is in the relative ranking of the constraints on aspiration.

(268) Partial constraint ranking for the southern dialect



(269) Partial constraint ranking for the northern dialect



Before moving on to the analysis of preaspiration, I would like to clarify some issues regarding the faithfulness and markedness constraints on aspirated segments. First, the general faithfulness constraint must be relativized to different segment types. If we hypothesize that the aspiration markedness constraints are relative to different segment types, but the faithfulness constraint is only of the type MaxAsp, then the southern dialect pattern cannot be obtained.

To ensure that unstressed stops are neutralized to unaspirated in intervocalic position, *Asp[stop] must be ranked above MaxAsp. However, then nasal devoicing before medial aspirated stops must derive from having MAXASP ranked above *ASP[NAS]. The unfortunate and undesirable result of this ranking is that nasals (sonorants in general) are predicted to have distinctive aspiration in unstressed syllables. This is simply an incorrect prediction for Icelandic, where non-initial sonorants are only devoiced in response to the underlying aspiration of an adjacent stop.

The second issue in need of clarification is the question of segmentally relative markedness constraints. If there is a need for aspiration faithfulness constraints relative to different segment types, perhaps there is no need to also have aspiration markedness constraints relative to different segment types. Under this hypothesis, the southern dialect stop deaspiration in unstressed syllable must result from *ASP being ranked above MAXASP[STOP]. However, this immediately precludes the possibility of devoicing adjacent sonorants in this dialect because aspirated sonorants violate *ASP just as readily as aspirated stops do, so there is no advantage to aspirating the sonorant given just a constraint against aspiration.

To summarize, not only must the faithfulness constraints on aspiration specify the source segment type, but the markedness constraints must follow suit. Both expanded constraint families are necessary to account for the aspiration pattern of the southern Icelandic dialect.

4.5.2.6 Preaspiration

At this point, most of the relevant constraints accounting for all phenomena but preaspiration are in place. I claim that preaspiration results logically from ranking the moraic markedness constraint on the least-sonorous segment (aspirated stop) differently from the rest of the markedness constraints against moraic consonants. To be precise, *MORA[ASPSTOP] is ranked above WBYP.

Medial preaspiration before [n,l] results from: SONDIST, MAXASPσ́, and *MORA[ASPSTOP] >> WBYP, as shown in (270).

(270)

/vak^{h}na/ *vakna*	SONDIST	MAXASPσ́	*MORA [ASPSTOP]	WBYP
a. σ σ μμ μ v á k^{h}n a [váa.k^{h}na]	*!			
b. σ σ μμ μ v á k n a [vák.na]		*!		
c. σ σ μμ μ v á k^h n a [vák^h.na]			*!	
d. ☞ σ σ μμ μ v á h kn a [váhk.na]				*

Candidate (a) fatally violates the constraint requiring that a sequence of a stop followed by a nasal must be syllabified heterosyllabically. Candidate (b) fatally violates the constraint against losing underlying aspiration in stressed syllables. Candidate (c) fatally violates the constraint against moraic aspirated stops. This leaves candidate (d) as the optimal candidate. Note that this candidate violates the constraint requiring that coda consonants be moraic because the stop is in the coda, but not moraic. Although not shown, the three highly-ranked constraints must also outrank the faithfulness constraint against epenthesizing a consonantal root node, DEPC, since a root node is inserted for the [h].

Medial Preaspiration of Geminates

Preaspiration in medial geminates results from MAXLINK-MORA[CON], MAXASPσ́, *MORA[ASPSTOP] >> *MORA[CON], as shown in tableau (271).

(271)

μ /Yp^{h}I/ *uppi*	MAXLINK-MORA[CON]	MAXASPσ́	*MORA [ASPSTOP]	*MORA [CON]
a. σ σ μμ μ Ý p^h I [ÝY.p^{h}I]	*!			
b. σ σ μμ μ Ý p I [Ýp.pI]		*!		
c. σ σ μμ μ Ý p^h I [Ýp^h.p^{h}I]			*!	
d. ☞ σ σ μμ μ Ýhp I [Ýh.pI]				*

Candidates (b) and (c) violate the constraints against losing aspiration from segments in the stressed syllable and against moraic aspirated stops, respectively. Candidate (a) violates the constraint against losing the underlying moraic content of consonants. It is important to note that the moraic [h] can satisfy this constraint because it is in correspondence with the input aspirated stop.

There are two interesting theoretical consequences of this analysis. First, it makes use of the notion of fission, or "breaking", in which one segment in the input can have more than one corresponding segment in the output (a violation of INTEGRITY (McCarthy and Prince 1995)). Note that one possible consequence of this fission is that the [h] may not, in fact, incur a violation of DEPC. The reason for this is that the output segment has a corresponding segment in the input. Second, it makes use of the notion of "broad" input-output faithfulness as proposed by Struijke (1998) in which faithfulness to some property is satisfied if it surfaces at least once in the output. This mechanism is needed here because under the traditional definition of correspondence, the non-moraic stop in candidate (d) of tableau (271) violates the moraic faithfulness constraint even though the co-corresponding segment, [h], satisfies this constraint. If the stop did indeed elicit a violation of the faithfulness constraint, then preaspiration would not occur in this environment. I will not pursue either the notion of fission or "broad" faithfulness further.

Final Geminate Preaspiration

Tableau (272) shows that preaspiration of final geminates results from MAXLINK-MORA[CON] >> *μ]#, MAXASPσ́, *MORA[ASPSTOP] >> WBYP. Recall that each of these constraints, and rankings, except the markedness constraint against moraic aspirated stops was motivated to account for other phenomena in the language.

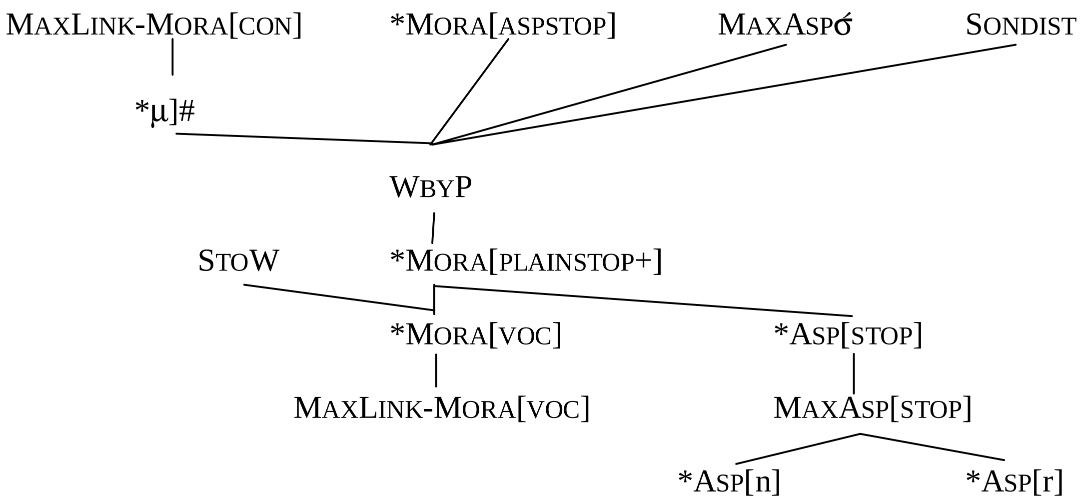
(272)

μ /hap^h/ *happ*	MAXLINK-MORA[C]	*μ]#	MAXASPσ́	*MORA [ASPSTOP]	WBYP
a. σ μμ h á p^h [háap^h]	*!				*
b. σ μμ h á p [háp]		*!	*!		
c. σ μμ h á p^h [háp^h]		*!		*!	
d. σ μμ h á p [háap]	*!		*		*
e. ☞ σ μμ h á h p [háhp]					*

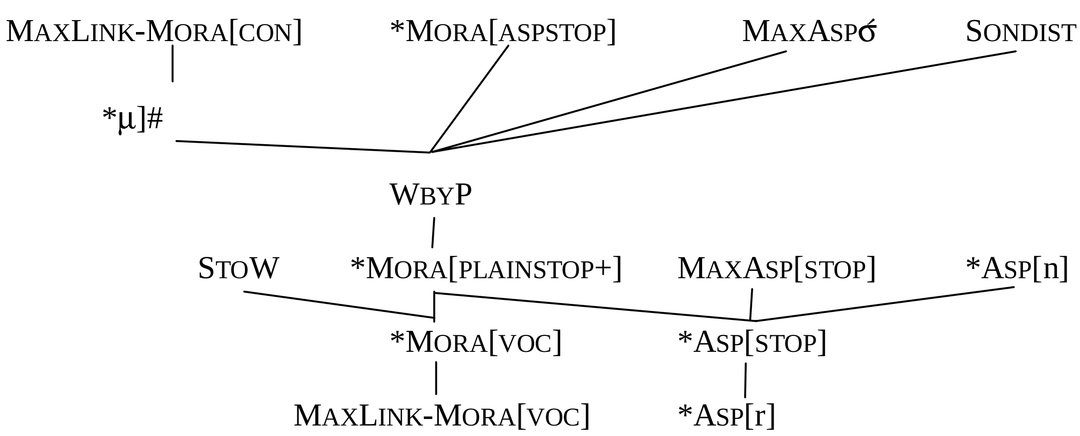
In tableau (272), candidates (a) and (d) fatally violate the constraint requiring faithfulness to underlying moraicity of consonants. Candidates (b) and (c) fatally violate several of the constraints ranked above WBYP. The optimal candidate is (e). Although this candidate violates the constraint requiring coda consonants to be moraic, this constraint violation is not fatal because the competing candidates violate even higher-ranked constraints.

(273) shows the complete constraint ranking motivated for the southern (*linmæli*) dialect, and (274) shows the complete ranking motivated for the northern (*harðmæli*) dialect.

(273) Southern Dialect Constraint Hierarchy



(274) Northern Dialect Constraint Hierarchy



4.5.3 Why No Moraic Aspirated Stops?

One advantage of this moraic analysis over an analysis that attempts to explain preaspiration in Icelandic as a condition against aspirated stops in coda position is that it provides a principled reason for why the aspirated stops have a different distribution from the rest of the consonants. The inability of aspirated stops to surface in moraic position (including geminates) follows from an expansion of Zec (1988) and the interactions among a general markedness constraint against moraic aspirated stops, coercive moraic markedness constraints and a faithfulness constraint on the underlying moraic content of aspirated stops.

Although a moraic analysis makes use of a well-established correlation between moraicity and sonority and ties together preaspiration in various environments, analyses that do not state the influence of moraicity on preaspiration must merely stipulate that the aspirated stops cannot be in coda position. This is especially significant considering the fact that coda conditions are typically employed for non-geminate codas, but geminates are many times immune. For example, Modern Standard Italian has a coda condition against stops. However, geminate stops are quite common.

The fact that the analysis of Icelandic preaspiration presented here not only makes use of the moraic hierarchy but also accounts for the odd behavior of "geminate" aspirated stops suggests that a moraic analysis of Icelandic preaspiration is superior to a coda condition analysis.

4.5.4 Summary

In this case study I have proposed a unified account of Icelandic syllabification, syllable weight, sonorant devoicing, and stop deaspiration. I present an analysis that derives preaspiration in a natural way from a combination of constraint rankings already required for the other phonological phenomena and an extension of the work of Zec (1988) on the relationship between sonority and moraicity. Preaspiration is shown to be a repair strategy to prevent aspirated stops from surfacing as moraic, while maintaining underlying (and coerced) consonant moraicity. Further, I demonstrate that the *linmæli* and *harðmæli* dialect differences regarding sonorant devoicing and stop deaspiration result from a minimal reranking of constraints.

4.6 Metropolitan New York English

Metropolitan New York English has a fairly complicated vowel and vowel length system. What makes things even more complicated is that the literature typically speaks of the various dialects found within the same geographical areas as monolithic. In turn, descriptions and analyses of the phonology tend to not adequately distinguish between dialects. The dialect I will describe and analyze here comes from the south shore of Staten Island, one of the five boroughs of New York City. This is the dialect that I speak, and I have gathered the data from family members. The generalizations discussed here and in chapter 3 were originally presented in Morén 1996 and 1997, as were similar analyses.

In accord with previous literature on Metropolitan New York English (Hubbell 1972, Moulton 1990), I claim that the Metropolitan New York phonological system can be analyzed as having a tripartition in the vowel inventory. In addition, I claim that the vowel system has a length distinction that is relevant for at least some aspects of the distribution of individual vowels. Although this language also has a tense/lax distinction, I will abstract away from the quality differences between long/short vowel pairs.

The non-low vowels have distinctive length in all (non-derived) environments. The low back vowels only surface as long. The third leg of the tripartitian, and the vowel that is important to this discussion, is the low front vowel. The low front vowel has distinctive length in several environments, including monosyllables closed by all consonants except the voiceless stops. In monosyllables closed by voiceless stops, the low front vowel must be long. This is in contrast with both the non-low vowels which have distinctive length in monosyllables closed by any consonant and the other low vowels which surface as only long in all environments. This distribution of the low front vowel is common referred to as "æ-tensing" in the literature. However, I claim that the term "æ-tensing" is something of a misnomer since, as will be seen below, the relevant generalization is length neutralization, not tensing.

There are two main reasons for including an analysis of Metropolitan New York English in this work. First, as mentioned above, the vowel system is quite complex on the surface. Some vowels have distinctive length, some vowels have distinctive length that is neutralized in specific environments, and some vowels only surface as long. From this perspective, Metropolitan New York English makes a fine candidate for exploring some of the systems predicted by factorial ranking of the constraint types discussed in chapter 2. Second, the distribution of the low front vowel provides evidence that voicing plays a role in the moraic markedness hierarchy. This is counter the claim of Zec (1988) that laryngeal features do not play a role in the sonority hierarchy for morae.

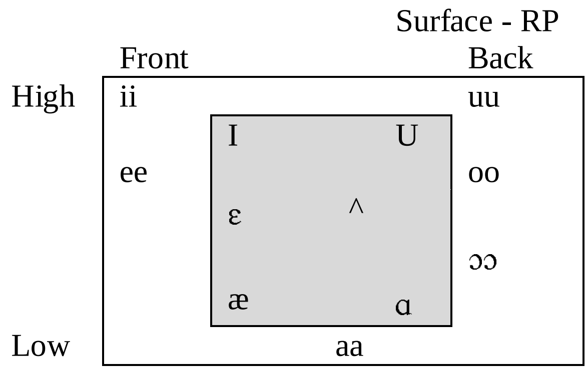
I begin by describing the vowel inventory of this language and providing a description of the distribution of each class. I then provide an analysis of each vowel class.

4.6.1 English Vowels (General)

Before exploring the intricacies of Metropolitan New York English vowels, it is germane to discuss English vowels in general. The standard pre-theoretic description of English vowels is that they come in two classes: checked and free.[54] In monosyllables, checked vowels are found only in closed syllables, while free vowels are found in both open and closed syllables. (275) shows the relative articulatory distribution (approximate) of checked (shaded box) and free vowels in the Received Pronunciation (RP) dialect of English. (276) shows relevant open and closed monosyllables containing free vowels, and (277) shows that checked vowels can occur only in closed monosyllables.

[54] I am only addressing stressed vowels, not unstressed vowels or syllabic consonants. I treat [^] as a full vowel, not a version of the phonetically similar reduced vowel (schwa).

(275)



(276) Free

a.	[bii]	bee	[biit]	beat	[biin]	bean
b.	[tuu]	too	[buut]	boot	[duun]	dune
c.	[bee]	bay	[beet]	bait	[been]	bane
d.	[boo]	bow	[boot]	boat	[boon]	bone
e.	[braa]	bra	[baaθ]	bath	[saam]	psalm
f.	[pɔɔ]	paw	[kɔɔt]	caught	[dɔɔn]	dawn

(277) Checked

a.	*[bI]	[bIt]	bit	[bIn]	bin
b.	*[pU]	[pUt]	put	[pUl]	pull
c.	*[bɛ]	[bɛt]	bet	[dɛn]	den
d.	*[b^]	[b^t]	but	[b^n]	bun
e.	*[bæ]	[bæt]	bat	[bæn]	ban
f.	*[bɑ]	[kɑt]	cot	[dɑn]	don

Abstracting away from tenseness and diphthongization, Chomsky and Halle (1968) conclude that at least some of the English vowels have distinctive length between phonetically-related checked and free vowels. So, the difference between "bid" and "bead" is one of vowel length. I propose that Chomsky and Halle are correct in their characterization of English as having a phonemic length distinction in some vowels. Henceforth, checked vowels will be referred to as short, and free vowels as long.

Following Giegerich's (1992) proposed taxonomy of the English vowels based on the free/checked dichotomy, but modifying his system to coincide with the proposal that the relevant distinction between English vowels is one of quantity (length), not quality, the feature specifications for RP vowels is (278). Henceforth, the transcription system for English vowels will reflect only the length opposition, but the standard IPA symbols will be displayed in parentheses where necessary for clarity[55].

(278)

Surface - RP

	Front		Back	
High	ii	i (I)	u (U)	uu
Mid	ee	e (ɛ)	o (^) ɔ (ɑ)	oo ɔɔ
Low		a (æ)	aa	

[55] It may be that the tense/lax dichotomy is also relevant for some phonological processes, however I do not explore those cases if they exist.

It is not particularly crucial to this work which phonological features are assumed for the vowels in (278). What is important is that each vowel is a member of a long/short pair, where the long vowels are represented as bimoraic and the short vowels as monomoraic. For concreteness, I assume the feature specifications in (278)[56].

4.6.2 New York English Vowels

Like RP, Metropolitan New York English has some vowels that have a length distinction, as shown in (279). This dialect also has a minimal word condition, like RP, such that only the long vowel of each pair are found in open monosyllables, as shown in (280).

(279) Distinctive length vowels

a.	[biit]	beet	[bit]	bit
b.	[biin]	bean	[bin]	bin
c.	[buut]	boot	[put]	put
d.	[puul]	pool	[pul]	pull
e.	[beet]	bait	[bet]	bet
f.	[peen]	pain	[pen]	pen
g.	[boot]	boat	[bot]	but
h.	[boon]	bone	[bon]	bun

[56] To avoid unnecessary controversy, I assume the most common feature specifications for English vowels here. However, the analysis of Metropolitan New York English to follow will assume that [ɔ] is a low back vowel because it patterns with [a], not [o].

(280)	a.	[bii]	bee	*[bi]
	b.	[tuu]	too	*[tu]
	c.	[bee]	bay	*[be]
	d.	[boo]	bow	*[bo]

However, in sharp contrast with the RP vowels shown in (279) above, which all come in long/short pairs (have distinctive length), Metropolitan New York English has two vowels which always surface as long. These are the lower-mid back and low back vowels.

(281)	a.	[pɔɔ]	paw	*[pɔ]
	b.	[kɔɔt]	caught	
	c.	[pɔɔnt͡ʃ]	paunch	
	d.	[braa]	bra	*[ba]
	e.	[kaat]	cot	
	f.	[faant]	font	

In addition to having vowels with distinctive length in closed syllables, and vowels that only surface as long in closed syllables, I claim that Metropolitan New York English also has a vowel that has either distinctive length or is only long depending on the quality of the following consonant. As (282) illustrates, the low front vowel only surfaces as long, as expected, in open monosyllables. This is consistent with the behavior of all the other vowels.

(282)	a.	[kææ]	Caroline-truncated
	b.	[dææ]	dad-truncated
	c.	[bææ]	the sound a sheep makes

In addition, the low front vowel has distinctive length before most consonants, as shown in (283). This is consistent with the behavior of the non-low vowels.

(283)	a.	[kæn]	can – noun
	b.	[kææn]	can – verb
	c.	[hæv]	halve
	d.	[hææv]	have
	e.	[kæd]	cad
	f.	[kææd]	C.A.D. (computer aided design)

However, the low front vowel only surfaces as long in syllables closed by voiceless stops, as shown in (284). This is inconsistent with the behavior of the non-low vowels, but is consistent with that of the other low vowels.

(284)	a.	[kææt]	cat	*[kæt]
	b.	[bææk]	back	*[bæk]
	c.	[tææp]	tap	*[tæp]
	d.	[bææt͡ʃ]	batch	*[bæt͡ʃ]

The distribution of the low front vowels in Metropolitan New York English has been both a puzzle and the topic of much research for decades (Ferguson 1972, Kahn 1976, Payne 1980, Labov 1981, Dunlap 1987, Benua 1995). All previous accounts have characterized it as a strictly allophonic alternation, where a lax vowel (what I call long) becomes tense (what I call short) in the environment preceding all consonants but voiceless stops – hence the label "æ-tensing"[57]. However, in characterizing the distribution in this way, I believe that they have missed an important point – the robust variability in the data.

Previous analyses have been unable to account for the extremely wide range of variation found in the data, including minimal pairs like those above in (283). Labov (1972) listed a variety of "exceptions" in which one vowel was expected but the other occurred or vice versa. There are two important things to note about the exceptions that Labov mentions. First, the variation is so widespread (by both types and tokens) that Labov actually restricts his analysis to monosyllables since they are much more

[57] I claim that the "tense" vowel is phonologically short and the "lax" vowel is phonologically long. This is the opposite of all previous analyses.

regular than polysyllables - although even monosyllables are quite variable. Second, the pattern of exceptions is asymmetrical – something not noted in previous accounts of the phenomenon. While it is possible to have a lax vowel followed by a tautosyllabic "tensing" consonant, as in (285a), and it is possible to have a tense vowel followed by an intervocalic "tensing"" consonant, as in (286b), it is <u>impossible</u> to have a tense vowel followed by an intervocalic voiceless stop, as in (287).

(285)	a.	[hææv]	have (unexpected under a "tensing" analysis)	
	b.	[hæv]	halve (expected under a "tensing" analysis)	
(286)	a.	[kææbIn]	cabin	
	b.	[wægIn]	wagon (unexpected under a "tensing" analysis)	
(287)	a.	[ræænId]	rapid	*[ræpId]
	b.	[pææltInt]	patent	*[pætInt]

I propose that what were considered "exceptions" by previous analyses are not exceptional at all. It is only by starting with the incorrect assumption that there is no distinctive length (distinctive tensing under the other analyses) that previous analyses have been forced to analyze the distribution as anything but regular. Taking a closer look at the data, I propose that the distribution of the low front vowel is actually a combination of distinctive and neutralized vowel length, similar to that found in the other Metropolitan New York English vowels. Specifically, the low front vowel has distinctive length that is neutralized when either there is no following consonant to fulfill a minimal weight requirement (e.g. in open monosyllables), or when the following consonant cannot support a mora (e.g. the least sonorous segments – voiceless stops). This analysis will follow naturally from the general mechanisms used throughout this work.

To summarize, Metropolitan New York English has three classes of vowels. The non-low vowels have a length distinction and almost always surface as long or short depending on the number of morae they have underlyingly. They show length neutralization only when they appear in open monosyllables, in which case they must surface as long. The low back vowels surface as long in all environments. Finally, the low front vowel has distinctive length before consonants more sonorous than voiceless stops, but is always long in open monosyllable and before voiceless stops. I will attribute these patterns to interactions between markedness and faithfulness constraints on the moraicity of consonants and vowels.

4.6.3 Analysis

Following the main theme of this work, there are three classes of moraic constraints needed for the Metropolitan New York English vowel pattern – general moraic markedness constraints, coercive moraic markedness constraints, and faithfulness constraints ensuring that underlying moraic associations are the same for corresponding segments.

In anticipation of the analysis to follow, I will relativize the general moraic markedness constraint, (288), with respect to five classes, as shown in (289).

(288) ***MORA[SEG] –** "Do not associate a mora with a particular segment"

As was the case of Icelandic, the moraic markedness constraints for consonants are split at the less-sonorous end of the scale. The least sonorous segments, the plain stops, are treated differently by the phonology than all other consonants as far as moraicity is concerned. For this reason, the constraint against moraic plain stops must be evoked. All other constraints against moraic consonants will be referred to in the shorthand constraint, *MORA[VOICEDSTOP+]. This constraint really represents the set of constraints against moraic segments more sonorous than plain stops.

(289) *MORA[PLAINSTOP]
|
*MORA[VOICEDSTOP+]
|
*MORA[NON-LOW]
|
*MORA[LOWFRONT]
|
*MORA[LOWBACK]

The coercive moraic markedness constraint has been used previously. It is given in (290). Note that a constraint requiring foot binarity (FTBIN) would work in monosyllabic cases, but not necessarily in the polysyllabic cases to be addressed below. Therefore, I use the constraint in (290) in anticipation of the polysyllabic cases.

(290) **STRESS-TO-WEIGHT PRINCIPLE (STOW) –** Stressed syllables must be heavy (bimoraic).

The generic moraic faithfulness constraints are those in (291) and (292). However, they will be relativized to the same natural classes as those of the general moraic markedness constraints.

(291) **MAXLINK-MORA[SEG] –** "Do not delete an underlying mora from a consonant."

(292) **DEPLINK-MORA[SEG] –** "Do not add a mora to a consonant that it did not have underlyingly."

4.6.3.1 Bimoraic Monosyllables

Since all stressed open monosyllables must contain long vowels, the constraint requiring that stressed syllables be heavy must be ranked above the general moraic marked constraints for all vowels, as well as above the faithfulness constraints against adding moraic associations to vowels. Tableaux (293) and (294) show that regardless of the moraic content of the input high vowel, only long vowels surface.

(293)

μ /bi/ bee	STOW	*MORA[NON-LOW]	DEPLINK-MORA [NON-LOW]
a. σ μ b i	*!	*	
b. ☞ σ μ μ b i		**	*

(294)

μμ /bi/ bee	STOW	*MORA[NON-LOW]	DEPLINK-MORA [NON-LOW]
a. σ μ b i	*!	*	
b. ☞ σ μ μ b i		**	

Candidate (b) is bimoraic in both tableaux, and although it violates the lower-ranked constraints more than candidate (a) does, it is still optimal because candidate (a) fatally violates the higher-ranked constraint requiring stressed syllables to be heavy.

Tableaux (295) through (298) show the same result for the other classes of vowels in Metropolitan New York English.

(295)

μ /bra/ bra	STOW	*MORA[LOWBACK]	DEPLINK-MORA [LOWBACK]
σ μ a. br a	*!	*	
σ μ μ b. ☞ b r a		**	*

(296)

μμ /bra/ bra	STOW	*MORA[LOWBACK]	DEPLINK-MORA [LOWBACK]
σ μ a. br a	*!	*	
σ μ μ b. ☞ b r a		**	

(297)

μ /dæ / dad-trunc.	STOW	*MORA[LOWFRONT]	DEPLINK-MORA [LOWFRONT]
σ μ a. d æ	*!	*	
σ μ μ b. ☞ d æ		**	*

(298)

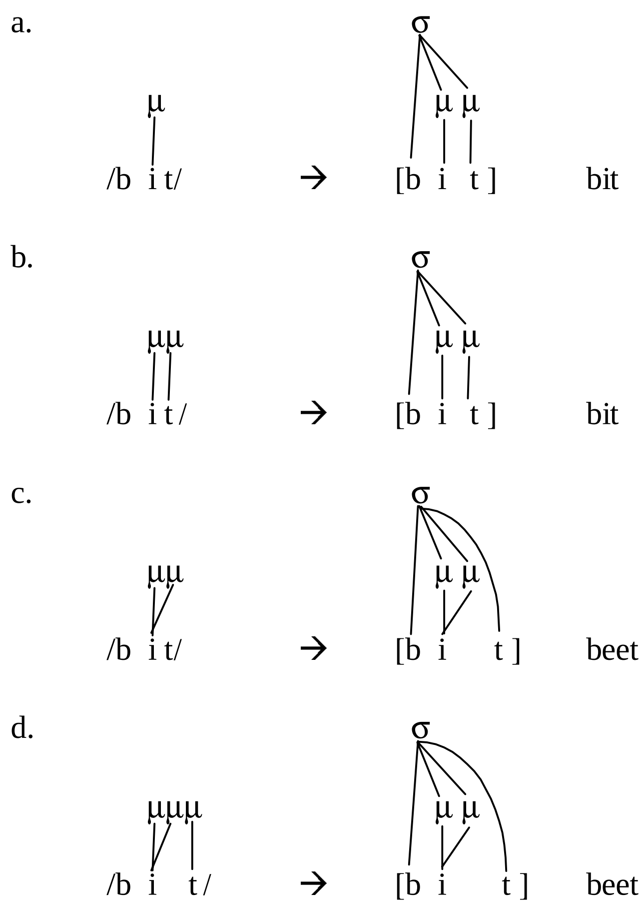
μμ /dæ / dad-trunc.	StoW	*Mora[lowfront]	DepLink-Mora [lowfront]
a. σ μ d æ	*!	*	
b. ☞ σ μ μ d æ		**	

4.6.3.2 Distinctive Non-Low Vowel Length in Closed Monosyllables

Recall that non-low vowels have distinctive length in closed monosyllables. Since stressed syllables must be bimoraic, if a closed syllable contains a short vowel, then the coda consonant must be moraic. (299) shows that high vowel length is distinctive in monosyllables closed by a single coda consonant, and that coda consonant moraicity is dependent on the length of the vowel[58]. The inputs in (299a) and (299b) both converge on the same output, as do the inputs in (299c) and (299d).

[58]Since the number of consonants in the coda makes no difference in the distribution of vowels in monosyllables, the analysis focuses on monosyllables without coda clusters.

(299)



In (299a), an input with a short vowel and a non-moraic coda surfaces with a short vowel and a moraic coda (recall that being completely faithful to the monomoraic input violates high-ranked STOW). This means that the faithfulness constraint against adding morae to non-low vowels must be higher-ranked than both the constraint against moraic consonants and the faithfulness constraint against adding morae to consonants. Note that since call consonants are treated equally following non-low vowels, a single constraint is shown in the following tableaux.

(300)

μ /b i t/ bit	STOW	DEPLINK-MORA [NON-LOW]	*MORA[CON]	DEPLINK-MORA [CON]
a. b i t	*!			
b. b i t		*!		
c. ☞ b i t			*	*

Candidate (a) fatally violates the constraint that requires all stressed syllables to be heavy. Candidate (b) loses because it violates the high-ranked faithfulness constraint by adding a mora to the vowel. The input vowel is monomoraic, but the vowel in candidate (b) is bimoraic. Although candidate (c) violates the markedness constraint against moraic consonants and the constraint against adding morae to consonants, the competing candidates fatally violate the higher-ranked constraints. This results in the moraicity of the consonant being subordinate to the length of the vowel.

In (299c), the vowel surfaces as long even though it is more marked to have two morae associated to a vowel then to have one. Tableau (301) shows that with the faithfulness constraint against deleting morae from vowels ranked higher than the markedness constraint against moraic vowels, long vowels surface.

(301)

μμ /b i t / beet	STOW	MAXLINK-MORA [NON-LOW]	*MORA[NON-LOW]
a. σ μ b i t	*!	*!	*
b. ☞ σ μμ b i t			**
c. σ μ μ b i t		*!	*

Candidate (a) fatally violates both the vowel faithfulness constraint and the minimal stressed syllable constraint. Candidate (b) only violates the vowel moraicity constraint.

Since there is no evidence of that consonant weight is distinctive in this language, I assume that the markedness constraint against moraic consonants is ranked higher than the faithfulness constraint against deleting morae from consonants. Thus, an input with both a long vowel and a moraic consonant will surface with a long vowel and a non-moraic consonant. This is shown in (302).

(302)

μμμ /b i t / beet	STOW	MAXLINK-MORA [NON-LOW]	*MORA[CON]	MAXLINK-MORA[CON]
a. σ μ b i t	*!	*!		*
b. ☞ σ μμ b i t				*
c. σ μ μ b i t		*!	*	
d. σ μμ μ b i t			*!	

If we do not differentiate the constraints against the different consonant classes, then (303) shows the constraint ranking motivated for non-low vowels in both open and closed monosyllables.

(303)

STOW

DEPLINK-MORA[NON-LOW]

DEPLINK-MORA[CON] *MORA[CON]

MAXLINK-MORA[CON]

MAXLINK-MORA[NON-LOW]

*MORA[NON-LOW]

4.6.3.3 Long Low Back Vowels in Closed Monosyllables

The fact that low back vowels are always long in closed monosyllables is easily derived by ranking the faithfulness constraint against adding morae to low back vowels below both the constraint against moraic consonants and the constraint against adding morae to consonants. This is demonstrated in (304), where an input with a short vowel and a non-moraic consonant surfaces with a long vowel and a non-moraic consonant.

(304)

μ /k a t/ cot	*MORA[CON]	DEPLINK-MORA[CON]	DEPLINK-MORA[LOWBACK]
a. ☞ σ μμ k a t			*
b. σ μ μ k a t	*!	*!	

Candidate (b) fatally violates either of the two highest-ranked constraints. It violates the moraic markedness constraint because it has a moraic consonant. It violates the consonant moraic faithfulness constraint because it adds a mora to a consonant that it did not have underlyingly. Although candidate (a) violates the faithfulness constraint against adding a mora to a low back vowel, this violation is not fatal because this constraint is ranked lower than one or both of the other constraints.

The ranking in (305) was motivated for low back vowel neutralization to long in closed monosyllables. Essentially, the consonant constraints penalize moraic consonants at the expense of forcing low back vowels to be bimoraic to meet the higher-ranked requirement that stressed syllables be bimoraic.

(305)

STOW

DEPLINK-MORA[CON] *MORA[CON]

DEPLINK-MORA[LOWBACK] *MORA[LOWBACK]

4.6.3.4 Distinctive LowFront Vowel Length in Closed Monosyllables

The fact that there are minimal pairs with the long and short low front vowels in closed monosyllables supports the claim that low front vowels have a length distinction. However, recall that this distinctive length only appears before consonants more sonorous than voiceless stops. Assuming that the length of these vowels is distinctive in this environment, the distinction can be captured in a way similar to that used for the non-high vowels. Specifically, the constraint against adding a mora to a vowel must be ranked higher than the constraints against moraic consonants more sonorous than voiceless stops. Tableaux (306) and (307) demonstrate that if the low front vowel is underlyingly short, it will surface as short, and the following consonant will be moraic, and if the vowel is underlyingly long, it will surface as long and the following consonant will be non-moraic.

(306)

μ /h æv/ halve	STOW	DEPLINK-MORA [LOWFRONT]	*MORA [VOICEDSTOP+]	DEPLINK-MORA [VOICEDSTOP+]
σ μ a. h æ v	*!			
σ μμ b. h æ v		*!		
σ μ μ c. ☞ h æ v			*	*

Candidate (b) loses because it fatally violates the vowel faithfulness constraint by lengthening the vowel. Even though candidate (a) has added a mora to the coda, the other candidate violates a higher-ranked constraint.

Tableau (307) shows that with a long vowel in the input, the output has a long vowel.

(307)

μμ /h æv/ have	STOW	MAXLINK-MORA [LOWFRONT]	*MORA [LOWFRONT]
σ μ a. h æ v	*!	*!	*
σ μμ b.☞ h æ v			**
σ μ μ c. h æ v		*!	*

Candidate (b) wins because it only violates the lower-ranked constraint.

The problem now is explaining the fact that the length contrast of low front vowels is neutralized before voiceless stops. Based on an extension of the work of Zec (1988), I claim that Metropolitan New York English shows a distinction in the moraicity of stops based on voicing, where moraic voiceless stops are more marked than more sonorous moraic segments. This distinction results in the non-distinctive length of the low front vowel before voiceless stops.

4.6.3.5 Long Low Back Vowels in Closed Monosyllables

Recall that previously we captured non-distinctive vowel length by ranking the constraint against moraic consonants above the constraint against adding morae to low back vowels. Assuming that Metropolitan New York English has distinctive vowel length in the low front vowels, we know that simply ranking all moraic markedness constraints above low front vowel faithfulness will not work. However, since the plain stops are the least sonorous segments in the Metropolitan New York English consonant inventory, we can make use of the universal moraic markedness hierarchy to rank the moraic markedness constraint on plain stops above the low front vowel faithfulness constraint and leave the faithfulness constraint ranked above the other moraic markedness constraints. This is shown in (308).

(308) *MORA[PLAINSTOP] >> DEPLINK-MORA[LOWFRONT]
>> *MORA[VOICEDSTOP+]

With this constraint ranking we get a length distinction before codas more sonorous than voiceless stops (see tableaux (306) and (307)), but we only get long vowels before voiceless stops, as seen in tableau (309). With a short vowel in the input, the vowel surfaces as long.

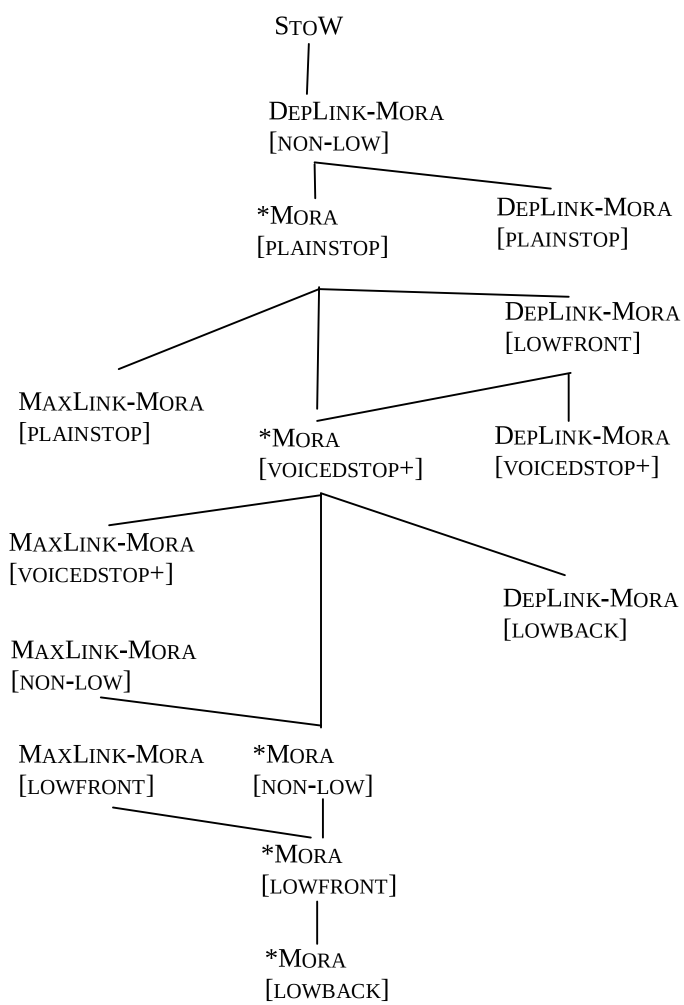
(309)

µ /k æ t / cat	*MORA [PLAINSTOP]	DEPLINK-MORA[PLAINSTOP]	DEPLINK-MORA[LOWFRONT]
σ µµ b. ☞ k æ t			*
σ µ µ c. k æ t	*!	*!	

Candidate (b) fatally violates either the constraint against having a moraic voiceless stop or the constraint against adding a mora to a voiceless stop. Candidate (a) violates the vowel faithfulness constraint because the output vowel has an additional mora, but that is optimal because the other candidate violates a higher-ranked constraint.

At first, the Metropolitan New York English low front vowel seems to show a puzzling distribution. There is evidence of distinctive length when the vowel is followed by consonants more sonorous than voiceless stops (minimal pairs, fairly random distribution, etc.), however, this distinction is neutralized before voiceless stops. I have analyzed these facts as resulting from an interleaving of the constraint requiring faithfulness to the underlying length of the low front vowel with a markedness hierarchy of constraints against moraic consonants. It is worse to have a moraic voiceless stop than it is to add a mora to a low front vowel. This result is perfectly consistent with the hypothesis that voicing plays a role in the universal moraic markedness hierarchy. Further, it shows that the behavior of the low front vowel can behave like the less-sonorous (non-low) vowels in some environments but like the more sonorous (low back) vowels in other environments. This analysis has provided a unified analysis of the distribution of all Metropolitan New York English vowels in both open and closed monosyllables. As (310) illustrates, the complete constraint hierarchy needed for the phenomena discussed above is quite complex.

(310)

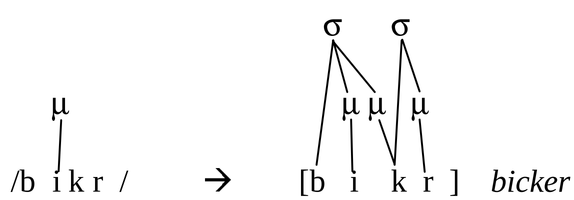


However, the various components this hierarchy are quite transparent and easily learnable. To ensure that all open stressed monosyllables surface as bimoraic, STOW must outrank all DEPLINK-MORA[VOC] and *MORA[VOC] constraints. Since consonant weight is never distinctive, all *MORA[CON] constraints must outrank their respective MAXLINK-MORA[CON] constraints. Since underlyingly long non-low and low front vowels always surface as long, MAXLINK-MORA[NON-LOW] and MAXLINK-MORA[LOWFRONT] must rank above *MORA[NON-LOW] AND *MORA[LOWFRONT], respectively. Since non-low vowels in closed monosyllables never lengthen to satisfy the requirement that stressed syllables be heavy, DEPLINK-MORA[NON-LOW] must outrank all the *MORA[CON] and DEPLINK-MORA[CON] constraints. Since an underlyingly short low front vowel always surfaces as long before a voiceless stop and as short before all other consonants, DEPLINK-MORA[LOWFRONT] must be ranked below *MORA[PLAINSTOP] and above all other *MORA[CON] constraints. Finally, since the low back vowels always surface as long in closed monosyllables, *MORA[LOWBACK] AND DEPLINK-MORA[LOWBACK] be lower-ranked than all the *MORA[CON] constraints.

4.6.3.6 Disyllables

Given the constraint ranking in (310), motivated by the distribution of morae in monosyllables, disyllables are evaluated straightforwardly. Moreover, the distribution of low front vowels in disyllables that was problematic for previous analyses of Metropolitan New York English is no longer a problem. The distribution of all vowels in closed syllables is exactly the same in stressed intervocalic position. The slightly unexpected result of this analysis is that consonants following short stressed vowels in this language must surface as derived geminates. That is, they are ambisyllabic and moraic to fulfill the condition that stressed syllables be bimoraic. (311) shows the result of inputs with non-low short vowels in the input followed by a non-moraic and a moraic consonant. The output of each input contains a short vowel followed by a moraic intervocalic consonant.

(311) a.



b.

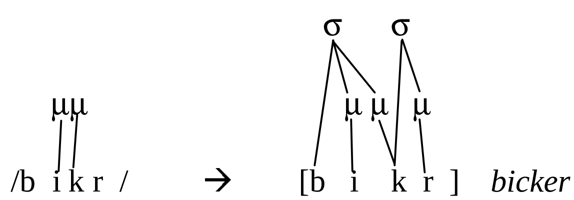


Tableau (312) shows that with a short vowel and a non-moraic consonant in the input, the optimal candidate has an ambisyllabic consonant. Since STOW is undominated, all potentially optimal candidates have bimoraic stressed syllables. Also, since *MORA[PLAINSTOP] is universally ranked above the constraints against moraic consonants appropriate to the language, other consonants will also surface as ambisyllabic in this environment (e.g. [ín.nr̩] inner).

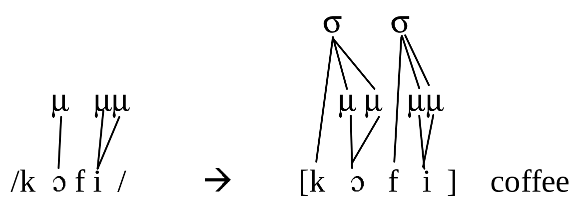
(312)

μ / b i k r / bicker	DEPLINK-MORA [NON-LOW]	* MORA [PLAINSTOP]
a. σ σ μμ μ b i k r	*!	
b. ☞ σ σ μ μ μ b i k r		*

Candidate (a) fatally violates the constraint against changing the mora association with the vowel because it has a long vowel in correspondence with a short vowel in the input. Therefore, candidate (b) is optimal even though it has added a mora to the following consonant.

The constraint ranking in (312) also produces only long low back vowels in stressed syllables in polysyllables. (313) illustrates that either a non-moraic or moraic consonant in the input surfaces as a non-moraic onset consonant following a low back vowel.

(313) a.



b.

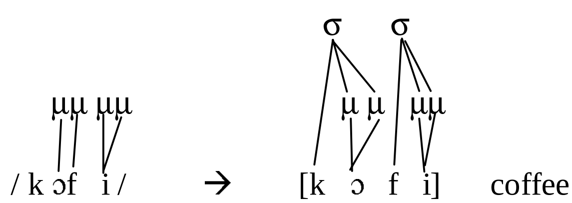


Tableau (314) shows that with a short vowel and a moraic consonant in the input, the optimal candidate has an long vowel and a non-moraic consonant. Since STOW is undominated, all candidates have bimoraic stressed syllables. Also, since all consonants behave similarly, I only present the analysis of a non-plain stop.

(314)

μμμμ / k ɔf i / coffee	*MORA [VOICESTOP+]	DEPLINK-MORA [LOWBACK]	* MORA [LOWBACK]
a. ☞ σ σ μμ μμ k ɔ f i		*	**
b. σ σ μ μ μμ k ɔ f i	*!		

Candidate (b) fatally violates the constraint against having a moraic consonant.

Further support for the above analysis comes from the distribution of low front vowels in disyllables. In disyllables, low front vowels in open stressed syllables followed by voiceless stops can only be of the long variety. However, if they are followed by consonants more sonorous than voiceless stops, then they can be either long or short.

(315)	<u>Only long</u>	<u>Long</u>	<u>Short</u>
	[rææ.pId] rapid	[kææ.bIn] cabin	[wæg.gIn] wagon
	[ræ.pId]/[ræp.pId]		

Under previous analyses, this fact went completely unexplained. However, under my analysis, the distribution of the low front vowels in disyllables follows from the analyses of the length phenomena in the other Metropolitan New York English vowels.

Tableaux (316) and (317) show that before consonants more sonorous than voiceless stops, the surface length of the vowel is determined by underlying length. If the vowel is underlyingly long, it will surface as long, and the following consonant will be non-moraic. If the vowel is underlyingly short, then it will surface as short, and the following consonant will become moraic and ambisyllabic (the evaluation of the vowel in the final syllable is unimportant). Notice that this mimics exactly the analysis of *beaker* and *bicker* presented above. Tableau (316) shows an underlyingly long vowel surfacing as long.

(316)

μμ μ / kæ bIn / cabin	MAXLINK-MORA [LOWFRONT]	*MORA [LOWFRONT]
σ σ μμ μ a. ☞ k æ b In		**
σ σ μ μ μ b. k æ b I n	*!	*

Candidate (b) loses because it fatally violates the faithfulness constraint requiring that underlyingly long low front vowels surface as long. Candidate (a) wins even though it has an additional violation of the markedness constraints against moraic low front vowels.

Tableau (317) shows the evaluation of the word *wagon*. This example was problematic for previous analyses because it contains an unexpected vowel. However, this tableau demonstrates that under the distinctive length hypothesis promoted here, a short vowel before a consonant more sonorous than a voiceless stop will surface as short.

(317)

μ μ / wæ gIn / wagon	DEPLINK-MORA [LOWFRONT]	*MORA [VOICEDSTOP+]
σ σ μμ μ a. w æ g In	*!	
σ σ μ μ μ b. ☞ w æ g I n		*

In tableau (317), an underlyingly short vowel in the input surfaces a short followed by a moraic ambisyllabic consonant. This is because candidate (a) fatally violates the constraint against adding morae to low front vowels. Candidate (b) does not violate this constraint, therefore is optimal.

In contrast with tableau (317), tableau (318) shows that with the constraint ranking in (310), it is impossible to have a short low front vowel followed by a voiceless stop regardless of underlying vowel length. This is because the length of this vowel is dependent on the inability of the following consonant to be moraic. In tableau (318), a short vowel surfaces as long.

(318)

μ μ / r æ pId / rapid	*MORA [PLAINSTOP]	DEPLINK-MORA [LOWFRONT]
σ σ μμ μ a. ☞ r æ p Id		*
σ σ μ μ μ b. r æ p I d	*!	

Although candidate (a) violates the constraint against adding a mora to a low front vowel, this violation is preferred to the violation incurred by candidate (b) of the markedness constraint against moraic plain stops.

4.6.4 Summary

In the above analysis, I showed that previous analyses of Metropolitan New York English æ-Tensing are inadequate because they assume that the phenomenon is strictly an allophonic alternation. By making that assumption, they have been unable to account for the extremely wide range of variation in the distribution of the low front vowel in both monosyllable and disyllables - including minimal pairs and a large number of "exceptions". My analysis combines distinctive length, non-distinctive length, and the inability of some consonants to be moraic in certain environments. Those cases that look like exceptions to previous analyses are simply the result of constraint interactions already needed for length phenomena in other Metropolitan New York English vowels. Two additional results of this analysis are that the sonority scale for morae should contain the feature [voice] since plain stops and voiced stops act differently as far as moraicity is concerned, and that low back vowels are more sonorous than low front vowels.

The immediate goal of this case study was to show that interleaving faithfulness constraints on mora associations and a universal Zec-like markedness hierarchy on mora associations straightforwardly accounts for the distribution of vowels in (at least) stressed monosyllables and penultimate syllables in monomorphemes in Metropolitan New York English. In doing this, I argued for a constraint ranking that results in three types of Metropolitan New York English vowels: distinctive-length vowels, non-distinctive-length vowels, and a hybrid vowel that has the characteristics of both. The phenomenon known as "æ-tensing" was described, and an analysis proposed that accounted for all the data without resorting to "exceptionality".

In addition, there are two broader goals of this case study. One was to show that re-ranking the members of the constraint families proposed in chapter 2 provides a mechanism for analyzing the dependency between vowel length and consonant moraicity in systems that require syllables to be heavy. The second was to show that even a fairly complicated ranking of constraints on moraicity can be easily derived from the input data.

4.7 Summary

In this chapter, I have discussed and analyzed weight phenomena from several languages. These languages are not only geographically and genetically diverse, but they also display a wide range of weight phenomena of varying complexities. However, despite the dissimilarities among the languages and phenomena, the system of constraint interactions that I have proposed handles all the data in a straightforward and unified way. The languages addressed in this chapter showed distinctive vowel length, distinctive consonant weight, coerced vowel length, coerced consonant weight, and sometimes a combination. Moreover, I have shown that:

1) the constraints I have proposed can be integrated into a larger phonological system to yield interactions between moraicity and other phenomena (e.g. Icelandic preaspiration);

2) moraic faithfulness constraints can sometimes be ranked to impede the implicational relationship between sonority and moraicity predicted by the coercive moraic markedness constraints and the universal moraic markedness hierarchy; and

3) the differences between two Hungarian and two Icelandic dialects are the result of minimal constraint re-ranking.

Chapter 5   Miscellaneous Issues and General Conclusions

The purpose of this chapter is to act as a repository for discussions of miscellaneous issues and to provide general conclusions. In the sections devoted to miscellaneous issues, I begin with a discussion of why I have chosen to go against the trend of positing constraints specifically prohibiting long vowels and/or geminate consonants. Recall that I have restricted the occurances of these segments via single or multiple violations of a single constraint hierarchy.

The second miscellaneous issue to be addressed regards recent literature suggesting that the moraic association patterns of (at least some) languages is tied to phonetic duration. Further, I show that the constraint against sharing morae proposed by Broselow, et al (1997) is readily incorporated into my constraint system.

The third miscellaneous issue pertains to the choice of negative moraic markedness constraints over positive moraic markedness constraints. I argue that not only are positive markedness constraints more difficult to formulate and to evaluate, but that they make odd predictions regarding unmarked syllable structure and syllable inventories.

The final issue that I address has to do with the Principle of Equal Weight for Codas proposed by Tranel (1991). I show that Tranel's principle does not need to be encoded as a separate constraint because it is the natural result of the interactions of constraints that I proposed in previous chapters. Further, I demonstrate that a weight pattern that Tranel does not discuss, but that my typology predicts, nonetheless obeys the Principle of Equal Weight for Codas.

5.1 No Need for *LONG-VOWEL and *GEMINATE Constraints

Much of the recent work on vowel length and/or geminate consonants within the OT framework makes use of two constraint types:

(1) ***LONGVOWEL** – "Avoid long vowels"; "Long vowels are disfavored" (Prince and Smolensky 1993, Rosenthall 1994, Sherer 1994, Benua 1995, Hammond 1997, Holt 1997, Keer 1999)

(2) ***GEMINATE** (or ***LONGCONSONANT**) – "Avoid long consonants"; "Long consonants are disfavored" (Holt 1997)

The constraint against long vowels is specific to a single vocalic root node associated with two morae. A monomoraic vowel does not violate this constraint. On the other hand, many of the constraints against geminates, for example Sherer's (1994) constraint, specify that the constraint is violated by a monomoraic consonant. This type of bifurcation makes the possibility of a unified approach to vowel length and consonant weight in both distinctive and coerced realms inherently more difficult. First, it automatically sets up a dichotomy of constraints which, at least on the surface, are not related in any obvious way. Second, it introduces two additional constraints (or constraint families) into the grammar to account for long segments, whereas I have shown that these segments can be handled via a single constraint family that also accounts for other weight phenomena. Further, I have demonstrated that the patterns of vowel and consonant weight are parallel (in both distinctive and coerced realms) in exactly those ways as to suggest that a unified theory of segment weight is warranted. The question to ask, then, is why have people argued that a single constraint/constraint family (e.g. *MORA[SEG]) is not sufficient to account for distinctive and coerced moraicity for both consonants and vowels? To answer this question, let me use Holt as an example and begin with a brief review of the relevant claims that he makes.

5.1.1 Holt (1997)

In his work on the evolution of vowel length and geminate consonants in the Romance languages, Holt (1997) foreshadows many of the intuitions which led to the present work. That is, he augments Zec's (1988, 1995) work on the sonority hierarchy and moraicity with faithfulness constraints against adding and deleting morae. For example, he provides the following tableaux as a demonstration of a constraint ranking that would yield both long and short vowels and consonants (Holt 1997:43-44):

(3)

/V_{μ}/	FAITH (MAX)	FAITH (DEP)	*C_{μ}	*$V_{\mu\mu}$
☞ [V_{μ}]				
[$V_{\mu\mu}$]		*!		*

(4)

/$V_{\mu\mu}$/	FAITH (MAX)	FAITH (DEP)	*C_{μ}	*$V_{\mu\mu}$
[V_{μ}]	*!			
☞ [$V_{\mu\mu}$]				*

(5)

/C/	FAITH (MAX)	FAITH (DEP)	$*C_\mu$	$*V_{\mu\mu}$
☞ [C]				
$[C_\mu]$		*!	*	

(6)

$/C_\mu/$	FAITH (MAX)	FAITH (DEP)	$*C_\mu$	$*V_{\mu\mu}$
[C]	*!			
☞ $[C_\mu]$			*	

Note that this system of evaluation is very similar to the system I am proposing. However, there are several important differences.

First, the faithfulness constraints that he gives are not relative to different segment types. Given that he decomposes the constraint against moraic consonants into Zec's universal moraic markedness hierarchy based on sonority, the result one expects from ranking a unitary faithfulness constraint with respect to the hierarchy is that languages should have an implicational relationship between sonority and geminate inventories. As I have shown in chapters 1 and 3, this prediction is incorrect. There are languages with obstruent geminates and not sonorant geminates, or nasal geminates and not liquid geminates, etc. I have claimed that faithfulness constraints must be relative to different sonority classes, and they must be fully re-rankable with respect to each other and the universal moraic markedness hierarchy.

Second, Holt conflates what I have separated as coerced and distinctive weight. In his (10), repeated below, he uses the moraic faithfulness constraint against losing underlying morae to derive the moraic segment inventories of English, Arabic dialects, Lithuanian, Tiv, Yidiɲ, and Khalkha Mongolian.

(7) Ranking of MAX in the sonority hierarchy for several languages: (Holt 1997:58)

MAX ↓ (above $*O_\mu$)	(English, Arabic dialects)
MAX ↓ (above $*N_\mu$)	(Lithuanian, Tiv)
MAX ↓ (above $*G_\mu$)	(Yidiɲ, Khalkha Mongolian)

$*O_\mu >> *N_\mu >> *L_\mu >> *G_\mu >> *V_\mu$

However, this system only accounts for geminate inventories, not the distribution of what I call coerced weight (phonologically derived weight). As I have shown in chapters 2, 3, and 4, ranking a moraic markedness constraint (e.g. FTBIN or WBYP), not moraic faithfulness constraints, with respect to the moraic markedness hierarchy yields the phonologically predictable weight that Holt wants to derive in (7) above.

It is unclear from his discussion if Holt assumes Richness of the Base (Prince and Smolensky 1993). If he does, then the mechanism in (7) will not work for coerced weight simply because the lack of a surface distinction requires that the grammar neutralize consonants to moraic in a coerced weight environment regardless of underlying moraicity. Faithfulness constraints could not force underlyingly non-moraic segments to become moraic. If, however, he does not subscribe to the Richness of the Base Hypothesis and believes that predictable weight is stored in the input, then it is possible that faithfulness will derive the desired effect. Such a system, however, would still predict that all languages with coerced weight produced by ranking moraic faithfulness constraints with respect to the moraic hierarchy would necessarily have a geminate distinction.

Although I agree with Holt's intuitions regarding the moraic hierarchy and the need for MAX-like and DEP-like constraints for morae, I disagree with his implementation. First, he only derives distinctive weight since coercive moraic markedness constraints are needed to derive predictable weight. Second, his system only predicts distinctive weight inventories that follow the sonority scale since his faithfulness constraints are not relative to different segment types. I have shown throughout this work that distinctive weight is not bound by sonority.

5.1.2 No *LONG-VOWEL Constraint

The next point of departure between my work and that of other recent work on weight in OT is in the question of the need for both a constraint against monomoraic vowels (*V_μ) and a constraint against bimoraic vowels (*LONG-VOWEL). I claim that a separate constraint against long vowels is unnecessary. Not only have I shown throughout this work that multiple violations of constraints against moraic vowels of different types is sufficient to explain vowel length inventories and phenomena, but that a single hierarchy makes exactly the correct predictions in coerced weight environments which do not specify the type of segment to receive a mora to meet the requirement. For example, many languages prefer to lengthen vowels rather than make consonants moraic in response to a minimal word condition or minimal foot requirement.

If it were the case that *LONG-VOWEL universally outranked the $*C_{\mu}$ constraints then this result is unexpected. If, on the other hand, it were the case that $*C_{\mu}$ universally outranked *LONG-VOWEL, then there would be no evidence for *LONG-VOWEL. Finally, if the constraints against long vowels and against moraic consonants are not universally ranked with respect to each other, then their factorial ranking should be carefully investigated to determine if unattested weight systems are predicted. Since the interactions among the universal moraic markedness hierarchy, moraic faithfulness constraints, and coercive moraic markedness constraints proposed in chapter 2 are sufficient to account for the quite diverse weight patterns that I addressed above, Occam's razor suggests that a third constraint or set of constraints against long vowels should be eliminated from the grammar.

The strongest argument that I have found in the literature for the insufficiency of a single hierarchy against moraic segments is the fact that there are languages with a consonant weight distinction, but no vowel length distinction. Given only those constraints used in, (3) through (6), (8) through (11) show that we cannot derive the desired, and attested, pattern – even if faithfulness is ranked high. The best we can achieve is moraic consonants only if there is already a bimoraic vowel and there is a highly-ranked constraint (not shown) against trimoraic vowels.

(8)

	$/V_{\mu}C/$	FAITH (MAX)	$*C_{\mu}$	FAITH (DEP)	$*V_{\mu}$
☞	$[V_{\mu}\ C]$				*
	$[V_{\mu\mu}\ C]$			*!	**
	$[V_{\mu}\ C_{\mu}]$		*!	*	*
	$[V_{\mu\mu}\ C_{\mu}]$		*!	**	**

(9)

	$/V_{\mu\mu}C/$	FAITH (MAX)	$*C_{\mu}$	FAITH (DEP)	$*V_{\mu}$
	$[V_{\mu}\ C]$	*!			*
☞	$[V_{\mu\mu}\ C]$				**
	$[V_{\mu}\ C_{\mu}]$		*!		*
	$[V_{\mu\mu}\ C_{\mu}]$		*!	*	**

(10)

	$/\ V_{\mu}C_{\mu}/$	FAITH (MAX)	$*C_{\mu}$	FAITH (DEP)	$*V_{\mu}$
	$[V_{\mu}\ C]$	*!			*
☞	$[V_{\mu\mu}\ C]$				**
	$[V_{\mu}\ C_{\mu}]$		*!		*
	$[V_{\mu\mu}\ C_{\mu}]$		*!	*	**

(11)

/ $V_{\mu\mu}C_{\mu}$/	FAITH (MAX)	*C_{μ}	FAITH (DEP)	*V_{μ}
[V_{μ} C]	**!			*
[$V_{\mu\mu}$ C]	*!			**
[V_{μ} C_{μ}]	*!	*		*
☞ [$V_{\mu\mu}$ C_{μ}]		*		**

Introducing a constraint against long vowels and ranking it above the Max-type of faithfulness will certainly solve this problem. However, the faithfulness constraints I propose in chapter 2 also eliminate this problem. If the moraic faithfulness constraints are on underlying affiliations, are relativized to different segment types, and are freely re-rankable, then the desired pattern emerges without the need for a *LONG-VOWEL constraint. This was demonstrated in Modern Standard Italian and Icelandic in chapter 4 (i.e. MAXLINK-MORA[CON] >> *MORA[CON] >> *MORA[VOC] >> MAXLINK-MORA[VOC]).

5.1.3 No *GEMINATE Constraint

Similar arguments can be made against a constraint banning geminates when there are already constraints against moraic consonants. First of all, geminate patterns follow straightforwardly from the constraints in chapter 2. This was shown in chapter 3 and chapter 4. Therefore, *GEMINATE is not needed, and Occam's razor demands that it be eliminated from the grammar. A more troublesome problem for a constraint against geminates is that it does not predict the variability and lack of absolute universals regarding geminate inventories. Holt acknowledges this fact and replaces the *LONG-CONSONANT constraint that he uses initially with the universal markedness hierarchy against moraic consonants. This is a move that is in line with my proposal.

There is, however, one other formulation of a *GEMINATE constraint that should be considered – namely, one against double-linking not against geminates proper. Since non-final geminates are segments associated with two prosodic positions, it is conceivable that a constraint against double-linking might work to prevent geminates in some languages. There are two major difficulties with this hypothesis. First, a no double-linking story has nothing to say about final geminates (or the lack thereof) if final geminates are simply an underlying moraicity reflected in a surface contrast – not a doubly-linked segment. In contrast, an analysis of geminates such as mine allows for medial and final geminates to be unified. Second, a single constraint against double-linking cannot account for the diversity of geminate inventories found cross-linguistically. A single constraint ranked with respect to the universal moraic markedness hierarchy, for example, predicts an implicational relationship between geminate segments and sonority. As was discussed in chapters 1 and 3, this is an incorrect prediction.

5.1.4 Summary

A universal moraic markedness hierarchy adequately articulated across both consonants and vowels can subsume both a constraint against long vowels and one against geminate consonants. Ranking the universal moraic markedness hierarchy with respect to both freely re-rankable moraic faithfulness constraints relativized to different segment classes and various coercive moraic markedness constraints gives exactly the desired patterns. Coerced segment weight follows the sonority sequence, but distinctive moraicity patterns are free.

5.2 Shared Morae and Phonetic Correlations (Broselow et al 1997)

Throughout this work, I have been implicitly assuming only representations in which morae are not shared by segments. Thus, I have assumed representations in which codas are moraic only if they have their own mora, otherwise they are attached to the syllable node directly, as shown in (12).

(12) a. Light Closed b. Heavy Closed

There is, however, evidence that some languages may allow morae to be shared among segments, for example the recent work by Broselow, et al (1997) on the relationship between phonology and phonetics in different weight systems. In investigating the phonetic differences in the duration of various rhyme constituents, they conclude that there is a correlation between segment duration and mora sharing. In languages like Hindi, in which there are phonological grounds for positing heavy closed syllables, there is also phonetic support for assuming the structure in (12b). They found that Hindi has no significant difference in duration between monomoraic vowels in open or closed syllables, or between bimoraic vowels in open or closed syllables. Similarly, the duration of consonants in closed syllables containing long or short vowels is not significantly different. That is, syllable shape has no effect on duration – long is always long and short is always short. This is depicted in (13).

(13) Statistical results for Hindi Speaker 1 (Broselow, et al 1998:53) (modified to indicate the relationship between segments and morae)

Vowel	μμ		μμμ		μ		μμ
Duration:	**V**	=	**V**C	>	**V**	=	**V**C
		$p=.91$		$p<.0001$		$p=.98$	
			μμμ		μμ		
Consonant duration:			V**C**	=	V**C**		
				$p=.54$			

This finding is consistent with the hypothesis that rhyme vowels and consonants have their own morae.

On the other hand, some languages without phonologically heavy closed syllables, such as Malayalam, seem to display phonetically variable vowel length depending on the presence or absence of a coda consonant.

(14) Statistical results for Malayalam Speaker 1 (Broselow, et al 1998:53) (modified to indicate the relationship between segments and morae)

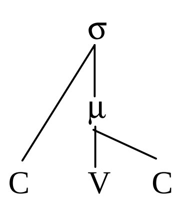
Vowel	μμ		μμ		μ		μ
Duration:	**V**	>	**V**C	>	**V**	>	**V**C
		p=.0001			p<.0001		p=.003

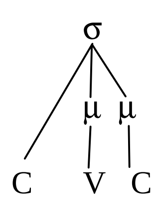
	μμ		μ
Consonant duration:	V**C**	=	V**C**
		p=.677	

This finding is consistent with the hypothesis that the vowels and coda consonants share morae since adding a coda consonant to a syllable reduces the duration of the vowel (whether phonologically long or short) relative to an open syllable containing the same vowel.

Broselow, et al claim that these phonetic data provide an argument in favor of the following two representations for closed syllables in Malayalam and Hindi:

(15) a. Malayalam Closed b. Hindi Closed





Further, they claim that the representation of a closed light syllable in (16a) does not predict the duration dependency in closed Malayalam syllables.

To derive these facts within an OT analysis, Broselow, et al propose several constraints, including a constraint against sharing morae and a constraint requiring parity between input and output segments and the number of morae associated with them. The former is given in (16) and the latter in (17).

(16) **NoSharedMora –** Morae should be linked to single segments (Broselow, et al 1998:65).

(17) **MoraFaith –** If the number of morae linked to S_1 = n, and S_1 *R* S_0, then the number of morae linked to S_0 = n (Broselow, et al 1998:65).

The faithfulness constraint is similar in nature to a symmetrical "identity" constraint of the McCarthy and Prince (1993) variety, and that I proposed in past work (Morén 1996, 1997). Basically, it penalizes both insertion and deletion of a moraic association. However, it differs from the constraints I propose in this work in two important ways. First, I have shown that a single symmetrical constraint is not adequate because there is evidence from languages like Hungarian and Icelandic that the two functions performed by the constraint must sometimes be ranked separately in the hierarchy. Second, I have relativized the MaxLink-Mora and DepLink-Mora faithfulness constraints to different segment types. This is needed to ensure the free distribution of distinctive vowel and consonant moraic patterns.

Although I am not convinced that there is an absolute match between phonetic duration and phonological length in all languages[59], it would be a straightforward move to incorporate the Broselow's constraint against mora sharing into my system – thus incorporating their correlation between duration and length for some languages. Although I will not provide complete analyses of the Hindi, Malayalam and Levantine Arabic cases that they discuss, I will give the backbone of what the analyses would look like given my constraints. Complete analyses are left to future research.

5.2.1 Hindi

Hindi syllables fall into three classes based on the ability to attract stress. Superheavy (trimoraic) syllables attract stress in preference to heavy (bimoraic) syllables, which in turn attract stress in preference to light (monomoraic) syllables. Superheavy syllables are CVVC and CVCC in shape. Heavy syllables are CVV and CVC in shape. Light syllables are all CV. Since coda consonants add weight to syllables, they have their own morae.

Since vowel length is unpredictable, the faithfulness constraints to input vowel morae must outrank the constraints against moraic vowels. Since all vowels are treated equally for our purposes, the constraints will be relativized to the class of vowels.

[59] In fact, my own preliminary phonetic work on Metropolitan New York æ-tensing suggests that phonological length and phonetic duration do not always correlate. The duration of the lax and tense low front vowels in this dialect is not significantly different in a given environment despite different phonological lengths.

(18) MAXLINK-MORA[VOC] >> *MORA[VOC]

Coda consonants in Hindi are necessarily moraic. The evidence for this is that closed syllables attract stress from edgemost open syllables containing short vowels. If coda consonants were allowed to surface as non-moraic, then closed syllables could be skipped over in favor of stress aligned with an edge of the stressing domain. This was discussed in the stress system of Kashmiri. To force codas to be moraic, the weight by position constraint must outrank the markedness constraint against moraic consonants, and a general economy constraint against unnecessary structure, as shown in (20). The economy constraint is defined in (19), and must be ranked below the constraint against sharing morae. Although the economy constraint is not particularly relevant in this case be, it will become important for the analysis of Malayalam to follow. Note that since I will draw close comparisons between the analyses of three languages, I follow the example of Broselow et al in using generic segments in the following tableaux.

(19) ***STRUC**[60] **–** prosodic structure is costly (Prince and Smolensky 1993).

[60] I use this general economy constraint here to avoid making a commitment regarding the actual constraint needed for the various languages being discussed. It is possible that a generic markedness constraint against morae (*MORA) is actually what is needed here.

(20)

μ /CVC/	WBYP	NOSHAREDMORA	*STRUC	*MORA[CON]
a. σ μ C VC	*!			
b. ☞ σ μ μ C VC			*	*
c. σ μ C VC		*!		*

In tableau (20), candidate (a) has a nonmoraic coda consonant. This is a fatal violation of the constraint requiring codas to be moraic since this constraint is highly-ranked. Candidate (c) fatally violates the constraint against sharing morae. Candidate (b) is optimal despite the violations of the economy constraint against structure and the constraint against moraic consonants because these constraints are lower-ranked. Note that although candidate (c) shares a mora between a vowel and a consonant, it does not violate WBYP because the consonant meets both criteria of the WBYP constraint – it is in coda position and it is moraic.

The summary of the partial hierarchy for Hindi is shown in (21).

(21)

WBYP NOSHAREDMORA

MAXLINK-MORA[VOC] *MORA[CON] *STRUC

*MORA[VOC]

This ranking will result in all coda consonants surfacing as moraic, even following long vowels, as shown in (22).

(22)

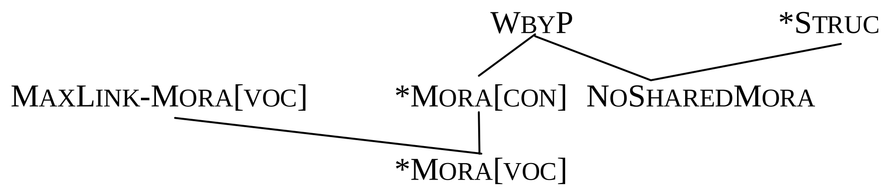
μμ /CVC/	WbyP	NoSharedMora	*Struc	*Mora[con]
a. σ μμ C V C	*!			
b. ☞ σ μμ μ C V C			*	*
c. σ μμ C V C		*!		*

Tableau (22) is evaluated in the same way that (20) was. The only difference is that the vowel is underlyingly long and it surfaces as long.

5.2.2 Malayalam

Malayalam has the same syllable types on the surface as Hindi. The difference between it and Hindi is in both the phonological consequence of codas on the stress system and the phonetic implementation of vowels in open and closed syllables. Unlike Hindi which has stress attraction to closed syllables, Malayalam closed syllables are not treated differently than their open counterparts by the phonology. Similarly, unlike Hindi which has fairly uniform vowel duration in both open and closed syllables, Malayalam vowels are shorter in closed syllables. As mentioned above, Broselow et al claim that these differences support the hypothesis that Hindi coda consonants do not share morae with the preceding vowels, while Malayalam coda consonants do. I can easily derive these effects by the ranking in (23) – simply re-ranking the economy constraint and the constraint against shared morae.

(23)



Tableaux (24) and (25) show that the constraint ranking in (23) yields the Malayalam pattern for both underlyingly short and underlyingly long vowels.

(24)

μ /CVC/	WBYP	*STRUC	NOSHAREDMORA	*MORA[CON]
a. σ μ C VC	*!			
b. σ μ μ C VC		*!		*
c. ☞ σ μ C VC			*	*

Candidate (a) fails because it violates the constraint requiring codas to be moraic. Candidate (b) fails because it has structure that it need not have. With the constraint against sharing morae ranked below the economy constraint, it becomes better to share a mora than to have more than one mora. This is the opposite of the Hindi case.

In tableau (25), consonants in coda position following long vowels also share the preceding mora with the vowel. Recall that vowel length is distinctive in Malayalam, therefore, vowel length faithfulness must outrank the constraint against moraic vowels. This is not shown.

(25)

μμ /CVC/	WBYP	*STRUC	NOSHAREDMORA	*MORA[CON]
a. σ μμ C V C	*!			
b. σ μμ μ C V C		*!		*
c. ☞ σ μμ C V C			*	*

To summarize, the difference between the Hindi and Malayalam weight systems is the relative ranking of two constraints: NOSHAREDMORA and *STRUC.

5.2.3 Levantine Arabic

There is one more weight/duration pattern discussed by Broselow et al that I would like to sketch an analysis of using my system with the addition of their constraint against mora sharing. Levantine Arabic has the same syllable inventory as both Hindi and Malayalam: CV, CVV, CVC, CVVC and CVCC. However, these syllables act differently both phonologically and phonetically in Levantine Arabic than then do in either of the other two languages. Phonologically, there is a dichotomy of weight such that there are light and heavy syllables. Light syllables are those that are open and contain a short vowel. All other syllables are heavy, including hypercharacterized syllables which are not treated by the phonology as superheavy. As pointed out by Broselow, et al, the duration of the vowels and consonants in this language reflect the phonological pattern, as shown in (26).

(26) Statistical results for Levantine (Jordanian) Speaker (Broselow, et al 1998:59) (modified to indicate the relationship between segments and morae)

Vowel	μμ		μμ		μ		μμ
Duration:	**V**	>	**V**C	>	**V**	=	**V**C
		$p=.0001$		$p<.0001$		$p=.94$	

	μμ		μμ
Consonant duration:	V**C**	$<$	V**C**
		$p=.0002$	

This finding is consistent with the hypothesis that the vowels and coda consonants do not share morae in closed syllables containing a short vowel, but do share morae in closed syllables containing a long vowel. As (27) and (28) show, the constraint ranking needed for Hindi will produce the correct pattern if we augment it with a highly-ranked constraint against trimoraic syllables. In Hindi, the constraint against trimoraic syllables is obviously lower-ranked.

(27)

μ /CVC/	WBYP	*TRIMORA SYLL	NOSHAREDMORA	*STRUC	*MORA[CON]
σ μ a. C VC	*!				
σ μ μ b. ☞ C VC				*	*
σ μ c. C VC			*!		*

As shown in (27), weight by postion is not violated in syllables closed by a single consonant in this language. This rules out candidate (a). If the vowel is short in the input, then it is worse to share a mora with the coda consonants than it is to have the added mora. Thus, candidate (b) is more harmonic than candidate (c).

In tableau (28), we see that a long vowel in the input yields not only a long vowel in the output, but also a coda consonant that shares its mora with the preceding vowel.

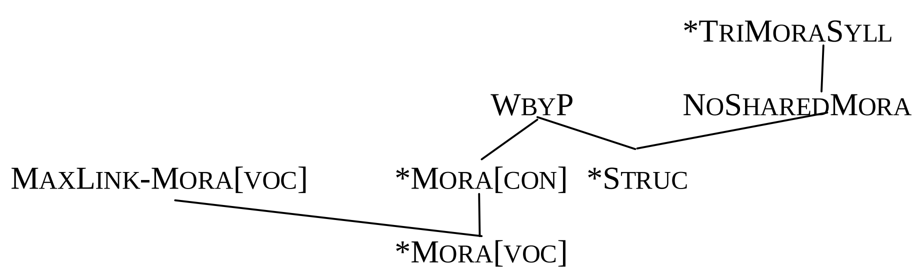
(28)

μμ /CVC/	WBYP	*TRIMORASYLL	NOSHAREDMORA	*STRUC	*MORA[CON]
a. σ μμ C V C	*!				
b. σ μμ μ C V C		*!		*	*
c. ☞ σ μμ C V C			*		*

A violation of the constraint against sharing morae that is fatal given a short vowel is non-fatal given a long vowel because of the higher-ranked constraint against trimoraic syllables. (a) is ruled out because the coda is nonmoraic. (b) is ruled out because the syllable is trimoraic. (c) wins because the shared mora violation is better than the nonmoraic coda violation or a trimoraic syllable violation.

The hierarchy for Levantine Arabic is given in (29).

(29)



5.2.4 Summary

The conclusion is that the mechanism I have proposed to account for consonant and vowel weight patterns is consistent with the results and overall analysis of Broselow et al. However, my analysis has the advantage of accounting for a broader weight typology. Obviously, much work is necessary to fully explore both the typological predictions of allowing shared morae and the intuitions of Broselow et al regarding correlations between phonological weight and phonetic duration in some languages. I leave these to future research.

5.3 Positive Versus Negative Moraic Markedness Constraints

Throughout this work, I have assumed a universal moraic markedness hierarchy composed of constraints against moraic associations (*MORA[SEG]). In chapter 2, I drew comparisons between the moraic hierarchy and the negatively formulated peak and margin hierarchies proposed by Prince and Smolensky (1993). However, the literature also includes mention of positive moraic markedness constraints that require more sonorous segments to be moraic (Zec 1995). In this section, I will review several reasons for favoring the negative moraic markedness constraint approach over the positive constraint approach.

5.3.1 Ease of Formulation and Evaluation

Negative moraic markedness constraints are symmetrical in nature. That is, violations are evaluated over two conditions – morae should not be associated with segments, (30a), and segments should not be associated with morae, (30b).

(30) *MORA[SEG] implies both:

a. A mora should not be affiliated with a segment

b. A segment should not be affiliated with a mora

No further conditions need be imposed. The evaluation of such a constraint is fairly transparent, and violations of both conditions require the presence and affiliation of two elements to be violated. Tableau (31) demonstrates the evaluation of three simple candidates given negative moraic markedness constraints in a universal ranking. Note that the constraint conditions are separated out to illustrate which condition is violated by which structure. In addition, the locus of each violation is indicated to show which structures violate the conditions.

(31)

/VC/	*MORA[CON] If μ, then *CON	 If CON, then *μ	*MORA[VOC] If μ, then *VOC	 If VOC, then *μ
a. VC				
b. μ VC			μ V	μ V
c. μμ VC	μ C	μ C	μ V	μ V
d. μ VC	μ C	μ C	μ V	μ V

In tableau (31), candidate (b) violates each condition of the constraint against moraic vowels. Each violation is caused by the presence of offending structure. Candidates (c) and (d) violate each condition of each markedness constraint. Again, each violation is relevant only to the presence of material. Since the last two candidates violate each of these constraints the same number of times, some other constraint or constraint interaction must decide between them (see section 5.2). The only candidate to violate neither of the constraints is (a). However, this candidate is presumably ruled out by constraints on minimal moraicity for prosodic structure. The prediction of this constraint evaluation is that if a syllable must be minimally monomoraic, the unmarked structure is one with a moraic vowel and a non-moraic consonant.

On the other hand, positive constraints can be evaluated in different ways depending on the exact formulation of the constraint. If the positive constraints are formulated symmetrically, as the negative constraints above are, then the evaluation is not particularly straightforward. The constraint conditions are given in (32), and tableau (33) demonstrates the effect of the positive moraic markedness hierarchy on a simple set of candidates.

(32) MORA[SEG] implies both:

a. A mora should be affiliated with a segment

b. A segment should be affiliated with a mora

(33)

/VC/	MORA[VOC] If μ, then VOC	 If VOC, then μ	MORA[CON] If μ, then CON	 If CON, then μ
a. VC		V		C
b. μ VC			μ V	C
c. μμ VC	μ C		μ V	
d. μ VC				

Candidate (a) violates only the second condition of each constraint. Note that it is the absence of material (a mora) that prompts the violation. Candidate (b) violates both conditions of the constraint requiring association between morae and consonants. Both violations are for the absence of material, however, each condition is violated for a different reason. The first condition is violated by the lack of a consonant associated with the mora. In contrast, the second condition is violated by the lack of a mora associated with the consonant. Candidate (c) violates only the first condition of each constraint.

An odd prediction of these positive moraic markedness constraints is the occurrence of a language in which all syllables must be closed by a consonant – a result that is obvious at odds with syllable theory (Prince and Smolensky 1993). As (34) shows, ranking a constraint against epenthesis below the positive moraic markedness hierarchy can yield epenthesis of a consonant. Moreover, although the epenthetic consonant can be either an onset or a coda, it must be moraic (assuming that GEN allows onsets to be associated with the following morae). This implies that a language that allows onsetless syllables could force all onsetless syllables to be closed.

(34)

/V/	MORA[VOC]	MORA[CON]	DEPC
a. μ V		*!	
b. ☞ μ VC			*

Candidate (a) violates the moraic consonant constraint because the mora is not associated with a consonant. Although candidate (b) violates the constraint against epenthesis, this violation is not fatal. This results in a language that allows onsetless syllables to force all onsetless syllables to have codas.

Tableau (35) shows that the negative moraic markedness hierarchy cannot force a optional-onset language to have a syllable inventory consisting only of closed syllables. In addition, it favors non-moraic onsets – thus supporting the proposals that onsets do not normally associate with morae.

(35)

/V/	*MORA[CON]	*MORA[VOC]	DEPC
a. ☞ μ V		*	
b. μ VC	*!	*	*

However, tableau (36) shows that epenthesis of a vowel is possible in response to the negative moraic markedness hierarchy. Note that vowel epenthesis of this type produces canonically well-formed open syllables, unlike the positive moraic markedness driven consonant epenthesis in (34).

(36)

/C/	*MORA[CON]	*MORA[VOC]	DEPV
a. μ C	*!		
b. μ VC	*!	*	*
c. ☞ μ C V		*	*

A potentially problematic prediction made by the negative moraic markedness hierarchy is the existence of non-moraic vowels. Since vowels are canonically syllable nuclei, therefore moraic, one might assume that constraints against moraic vowels are antithetical to their very nature. However, there is certainly evidence that vocalic segments can be non-moraic (e.g. glides – Rosenthal 1994), and there is the possibility that the canonical moraicity of vowels is due to a condition on minimal moraicity required by prosodic structures (e.g. "syllables must be moraic"). Therefore, constraints against moraic vowels do not necessarily contradict the standard assumption that vowels are normally moraic.

One potential way to "fix" the positive moraic markedness constraints is to formalize them using only the second condition (a vowel should be affiliated with a mora). However, this move does little to yield more reasonable inventories. Tableau (37) shows that heavy closed syllables can still emerge as unmarked.

(37)

/VC/	MORA[VOC] If VOC, then μ	MORA[CON] If CON, then μ
a. VC	V	C
b. VC (μ on V)		C
c. ☞ VC (μμ: μ on V, μ on C)		
d. ☞ VC (μ shared by V and C)		

5.3.2 Distinctive Moraicity

One more problem for the positive moraic markedness constraints when compared to negative moraic markedness constraints is the mechanism required to yield distinctive moraicity and the typological predictions of this mechanism for distinctive moraicity. Whereas negative constraints use the standard OT rankings of markedness above faithfulness to yield neutralization to less complex structure and faithfulness above markedness to yield a distinction, the positive constraints require that neutralization be to more complex structures. Tableaux (38) through (41) demonstrate the standard evaluation for the negative constraints in which consonants either neutralize to non-moraic or they have distinctive length.

(38) Neutralization to less complex

/C/	*MORA[CON]	MAXLINK-MORA[CON]	DEPLINK-MORA[CON]
a. ☞ C			
b. μ C	*!		*

(39) Neutralization to less complex

μ /C/	*MORA[CON]	MAXLINK-MORA[CON]	DEPLINK-MORA[CON]
a. ☞ C		*	
b. μ C	*!		

(40) Distinctive moraicity

/C/	MAXLINK-MORA[CON]	*MORA[CON]	DEPLINK-MORA[CON]
a. ☞ C			
b. μ C		*!	*

(41) Distinctive moraicity

μ /C/	MAXLINK-MORA[CON]	*MORA[CON]	DEPLINK-MORA[CON]
a. C	*!		
b. ☞ μ C		*	

In contrast, tableaux (42) through (45) demonstrate the unusual evaluation necessary for positive constraints. The predicted unmarked segment weight is moraic. Given this system, there is no way to force non-moraic consonants without the addition of another constraint.

(42) Neutralization to more complex

/C/	MORA[CON]	MAXLINK-MORA[CON]	DEPLINK-MORA[CON]
a. C	*!		
b. ☞ μ C			*

(43) Neutralization to more complex

μ /C/	MORA[CON]	MAXLINK-MORA[CON]	DEPLINK-MORA[CON]
a. C	*!	*	
b. ☞ μ C			

(44) Distinctive moraicity

/C/	DEPLINK-MORA[CON]	MORA[CON]	MAXLINK-MORA[CON]
a. ☞ C		*	
b. μ C	*!		

(45) Distinctive moraicity

μ | /C/	DEPLINK-MORA[CON]	MORA[CON]	MAXLINK-MORA[CON]
a. C		*!	*
b. ☞ μ | C			

According to negative moraic markedness constraints, the unmarked case is that in which segments are non-moraic. In contrast, the positive moraic markedness constraints predict that the unmarked case is that in which segments are moraic. Since there are languages without moraic segments of various types, the positive moraic markedness constraint hypothesis forces the addition of a constraint or set of constraints disallowing moraic segments.

5.3.3 Summary

At the very least, negative moraic markedness constraints are more easily formalized and evaluated, they provide a standard analysis of distinctiveness for moraicity when ranked with respect to faithfulness constraints, and they make no unusual syllable inventory predictions. In contrast, positive moraic markedness constraints are not as straightforwardly formulated or evaluated, they provide a non-standard analysis of distinctiveness for moraicity, and they make somewhat strange typological predictions.

5.4 Heavy Geminates and Light Codas (Tranel 1991)

One prediction of the typology I propose for syllable weight is that it allows syllables closed by underlyingly moraic consonants to count for weight, but syllables closed by underlyingly non-moraic consonants to not count for weight. Since many people automatically equate underlyingly moraicity with geminates and underlyingly non-moraic consonants with non-geminate codas, this looks like the pattern that Tranel (1991) claims does not exist due to what he calls the "Principle of Equal Weight for Codas".

(46) Principle of Equal Weight for Codas (Tranel 1991:293)

"Coda positions of geminate consonants behave in the same way as other coda consonants with respect to syllable weight."

However, upon closer inspection, it becomes clear that my system actually derives the Principle of Equal Weight for Codas and adds a needed refinement.

Essentially, Tranel meant to allow two types of weight systems with his principle while disallowing two other systems. One licit pattern, shown in row 1 of table (47), has distinctive intervocalic consonant moraicity where the geminate coda contributes to syllable weight, and non-geminate coda consonants that contribute to syllable weight (e.g. Hindi). A second licit pattern, shown in row 2 of table (47), has distinctive intervocalic consonant moraicity where the geminate coda does not contribute to syllable weight, and non-geminate coda consonants that do not contribute to syllable weight either (e.g. Malayalam). There are two patterns that Tranel wants to prohibit. The first illicit pattern, shown in row 3 of table (47), has distinctive intervocalic consonant moraicity where the geminate codas do not contribute to syllable weight, and non-geminate coda consonants that do contribute to syllable weight. The second illicit pattern, shown in row 4 of table (47), has distinctive intervocalic consonant moraicity where the geminate codas contribute to syllable weight, and non-geminate coda consonants that do not contribute to syllable weight. I will show that these patterns are universally prohibited as the direct result of interactions of the constraints I have proposed throughout this work.

(47)

	closed			intervocalic		
	light		heavy		light	heavy
	σ σ μ μ CVCCV	σ σ μ μ CVCCV	σ σ μμ μ CVCCV	σ σ μ μ CVCV	σ σ μ μ CVCV	σ σ μμ μ CV CV
1.			✓	✓		✓
2.		✓		✓	✓	
3.			✓	✓	✓	
4.		✓		✓		✓
5.	✓		✓	✓		✓

The first licit pattern (row 1) has distinctive intervocalic consonant moraicity and weight by position codas, where the coda consonants add to syllable weight (e.g. Hindi). To ensure that intervocalic consonant moraicity is distinctive, MaxLink-Mora[con] must outrank *Mora[con]. In addition, to ensure that codas add to syllable weight, WbyP must be ranked above *Mora[con], and NoSharedMora must rank above *Struc. The results of these rankings are shown in (48) for an underlyingly non-moraic intervocalic consonant and (49) for an underlyingly moraic intervocalic consonant.

(48)

/CVCV/	MaxLink-Mora[con]	*Mora[con]	NoSharedMora	*Struc
a. ☞ σ σ μ μ C VCV				
b. σ σ μ μ μ C VC V		*!		*
c. σ σ μ μ C VCV		*!	*!	

(49)

μ /CVCV/	MaxLink-Mora[con]	*Mora[con]	NoSharedMora	*Struc
a. σ σ μ μ C VCV	*!			
b. ☞ σ σ μ μ μ C VC V		*		*
c. σ σ μ μ C VCV		*	*!	

Tableaux (50) and (51) show that non-intervocalic coda consonants always surface as moraic regardless of the underlying moraic content.

(50)

/CVCCV/	WBYP	*MORA[CON]	NOSHAREDMORA	*STRUC
σ σ μ μ a. C VCCV	*!			
σ σ μ μ μ b. ☞ C VCC V		*		*
σ σ μ μ c. C VCCV		*	*!	

(51)

μ /CVCCV/	WBYP	*MORA[CON]	NOSHAREDMORA	*STRUC
σ σ μ μ a. C VCCV	*!			
σ σ μ μ μ b. ☞ C VCC V		*		*
σ σ μ μ c. C VCCV		*	*!	

To summarize, it is possible to rank the constraints such that all codas (including intervocalic geminates) add to the weight of syllables. Ranking MAXLINK-MORA[CON] above *MORA[CON] results in distinctive intervocalic consonant moraicity, and ranking WBYP above *MORA[CON] results in moraic coda consonants. It is the relative ranking of NOSHAREDMORA and *STRUC which determines if the coda consonants will count for weight or not.

The second licit pattern (row 2 of table (47)) has distinctive intervocalic consonant moraicity and weight by position codas. In addition, the coda consonants do not add to syllable weight (e.g. Malayalam). This pattern arises from the same rankings needed for the first pattern, the difference is that *STRUC must outrank NOSHAREDMORA.

(52)

μ /CVCV/	MAXLINK-MORA[CON]	*MORA[CON]	*STRUC	NOSHAREDMORA
σ σ μ μ a. ☞ C VCV				
σ σ μ μ μ b. C VC V		*!	*!	
σ σ μ μ c. C VCV		*!		*

(53)

μμ /CVCV/	MAXLINK-MORA[CON]	*MORA[CON]	*STRUC	NOSHAREDMORA
σ σ μ μ a. C VCV	*!			
σ σ μ μ μ b. C VC V		*	*!	
σ σ μ μ c. ☞ C VCV		*		*

(54)

/CVCCV/	WBYP	*MORA[CON]	*STRUC	NOSHAREDMORA
σ σ μ μ a. C VCCV	*!			
σ σ μ μ μ b. C VCC V		*	*!	
σ σ μ μ c. ☞ CVCCV		*		*

(55)

μ /CVCCV/	WBYP	*MORA[CON]	*STRUC	NOSHAREDMORA
σ σ μ μ a. C VCCV	*!			
σ σ μ μ μ b. C VCC V		*	*!	
σ σ μ μ c. ☞ CVCCV		*		*

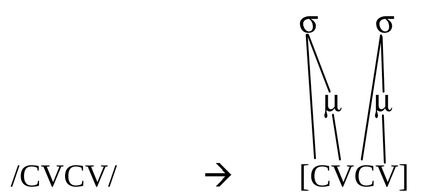
To summarize, it is possible to rank the constraints such that all codas are moraic, but they share morae with the preceding vowels, thus moraic codas do not add weight to syllables.

Note that it is the relative ranking of NOSHAREDMORA and *STRUC which determines if the coda consonants will count for weight or not. This is the key to deriving the impossibility of the patterns in row 3 and row 4 of table (47). Both of these patterns require the ranking of NOSHAREDMORA above *STRUC for some forms, but below *STRUC for other forms. Since both rankings cannot be found in a single grammar, the illicit patterns are absolutely prohibited, and Tranel's Principle of Equal Weight for Codas results.

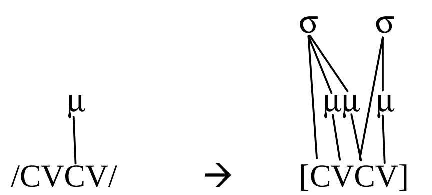
There is yet one more pattern that can result from ranking the constraints under discussion[61]. This is shown in row 5 of table (47), and is a pattern that Tranel does not address directly, but that his Principle of Equal Weight for Codas does not prohibit. This pattern has distinctive intervocalic consonant moraicity where ambisyllabic codas contribute to syllable weight, and non-ambisyllabic coda consonants that contribute to syllable weight or not depending on whether or not they are underlyingly moraic. (56) shows the underlying representations and corresponding outputs of this pattern.

[61] Logically, there are two additional patterns: the one addressed here and an additional one that is not addressed. The pattern not addressed has distinctive weight both intervocalically and in non-ambisyllabic codas, but none of the codas add to syllable weight. The reason this pattern is dismissed, is that there is no way to distinguish this pattern from the licit pattern in row 2 of table (47).

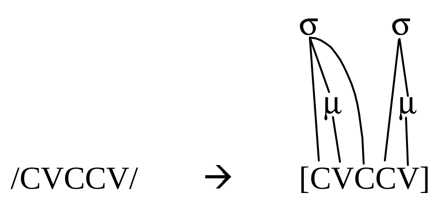
(56) a.



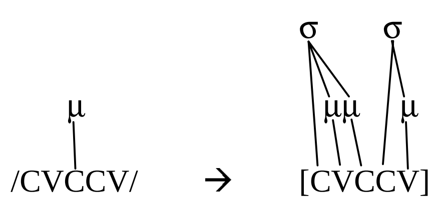
b.



c.



d.



Since this language type has a weight distinction for both ambisyllabic and non-ambisyllabic coda consonants, it does not violate Tranel's principle.

The following tableaux demonstrate that distinctive consonant weight can apply to both intervocalic consonants and consonants that surface in non-ambisyllabic coda position. Since I have established that NOSHAREDMORA ranked above *STRUC allows moraic codas to count for weight, I will not discuss the ranking of these constraints in the following tableaux.

(57) Distinctive Intervocalic Weight

μ /CV C V/	MaxLink-Mora[con]	*Mora[con]	WbyP
a. σ σ μ μ C V C V	*!		
b. ☞ σ σ μ μ μ C V C V		*	

(58) Distinctive Intervocalic Weight

/CV C V/	MaxLink-Mora[con]	*Mora[con]	WbyP
a. ☞ σ σ μ μ C V C V			
b. σ σ μ μ μ C V C V		*!	

(59) Distinctive Coda Weight

μ /CV CC V/	MaxLink-Mora[con]	*Mora[con]	WbyP
a. σ σ μ μ C V CC V	*!		*
b. ☞ σ σ μ μ μ C V C CV		*	

(60) Distinctive Coda Weight

/CV CC V/	MAXLINK-MORA[CON]	*MORA[CON]	WBYP
σ σ μ μ a. ☞ C V CC V			*
σ σ μ μ μ b. C V C CV		*!	

It is an empirical issue as to whether this type of language exists (as predicted above), or not. Although I have not found a language that has exactly the above pattern, there are cases that arise in which underlyingly moraic segments must surface as moraic whether intervocalically or in coda position, while underlyingly non-moraic segments surface as either non-moraic onsets or non-moraic codas. An example of this type of language is Modern Standard Swedish. The reason that Modern Standard Swedish does not display exactly the patterns above is two-fold. First all non-moraic intervocalic consonants and non-moraic coda consonants must be preceded by a long vowel. Second, the medial non-moraic codas seem to be found only in morphologically complex forms. Regardless, the surface pattern is basically that predicted above.

5.4.1 Modern Standard Swedish[62]

The Standard Swedish weight system is similar to that of Icelandic (see chapter 4). Main stress typically falls on the initial syllable, all stressed syllables must be bimoraic, and consonant weight, not vowel length, is distinctive. Therefore, underlyingly moraic intervocalic consonants surface as geminates, and underlyingly non-moraic intervocalic consonants surface as onsets following long vowels (if stressed) .

The data in (61) show distinctive intervocalic consonant moraicity and the data in (62) show a weight distinction in coda consonants (underlying consonant moraicity is indicated by a superscript mora).

(61)	a.	/lil$^{\mu}$a/	→	[líl.la]	*lilla*	'little'
	b.	/lila/	→	[líi.la]	*lila*	'purple'
	c.	/vek$^{\mu}$a/	→	[vék.ka]	*vecka*	'week'
	d.	/veke/	→	[vée.ke]	*veke*	'wick'

[62] I will not give a full analysis of this language, but leave that to future research.

(62)	a.	/vitna/	→	[víit.na]	*vitna*	'to whiten'
	b.	/vit$^{\mu}$na/	→	[vít.na]	*vittna*	'to witness'
	c.	/lysniŋ/	→	[lýys.nIŋ]	*lysning*	'bann'
	d.	/lys$^{\mu}$ na/	→	[lýs.na]	*lyssna*	'to listen'
	e.	/polska/	→	[póol.ska]	*polska*	'Polish'
	f.	/polka/	→	[pól.ka]	*polka*	'polka – a dance'
	g.	/svɛn$^{\mu}$ ska/	→	[svɛ́n.ska]	*svenska*	'Swedish'

Tableau (63) shows a geminate following a short vowel, and tableau (64) shows an onset following a long vowel (even if underlying short).

(63) Distinctive Intervocalic Weight

/l i l$^{\mu}$ a/ 'little'	STOW	MAXLINK-MORA[CON]	*MORA[CON]	*MORA[VOC]
a. σ σ / μ μ / l i l a	*!	*!		**
b. σ σ / μμ μ / l i l a		*!		***
c. ☞ σ σ / μ μ μ / l i l a			*	**

(64) Distinctive Intervocalic Weight

/ l i l a / 'purple'	STOW	MAXLINK-MORA[CON]	*MORA[CON]	*MORA[VOC]
σ σ μ μ a. l i l a	*!			**
σ σ μμ μ b. ☞ l i l a				***
σ σ μ μ μ c. l i l a			*!	**

Tableaux (65) and (66) demonstrate this same effect with closed stressed syllables.

(65) Distinctive Coda Weight

μ /svɛnska/ 'Swedish'	STOW	MAXLINK-MORA[CON]	*MORA[CON]	*MORA[VOC]
σ σ μ μ a. sv ɛ nsk a	*!	*!		**
σ σ μμ μ b. sv ɛ nsk a		*!		***
σ σ μ μ μ c. ☞ sv ɛ nsk a			*	**

(66) Distinctive Coda Weight

/p o lska/ ‘Polish’	StoW	MaxLink-Mora[con]	*Mora[con]	*Mora[voc]
a. σ σ μ μ p o l sk a	*!			**
b. ☞ σ σ μμ μ p o lsk a				***
c. σ σ μ μ μ p o l sk a			*!	**

5.4.2 Summary

From the above discussion, it should be clear that Tranel’s Principle of Equal Weight for Codas is a reflex of constraint interactions. This is a welcome result since it is preferable to derive a universal restriction on the grammar from the interaction of constraints already needed for other phenomena rather than stipulating it with a single rule or constraint.

The patterns that Tranel predicts to occur do so as the result of factorially ranking the constraints I have introduced in the previous chapters. The pattern that Tranel predicts to not occur is prohibited as the direct result of constraint interactions. Finally, a pattern that my typology predicts, but is not discussed by Tranel, nonetheless obeys the Principle of Equal Weight for Codas.

5.5 General Conclusions

There were three main goals of this dissertation. The first was to provide an in-depth, yet broad, look at the descriptive generalizations regarding segment weight and weight dependencies in both well-known and lesser-known weight systems. In accomplishing this goal, I provided a basic typology of moraicity that divides weight into two broad categories, coerced and distinctive, and I showed that the descriptive patterns are parallel across segment types. Moreover, I demonstrated that there are implications between sonority and moraicity inherent in coerced weight, but not distinctive weight.

The second goal was to develop an optimality theoretic mechanism to capture the observed descriptive generalizations. To accomplish this goal, I proposed an inventory of constraints and interactions among them that differentiates between the two sources of weight, unifies consonant and vowel moraicity, and easily accounts for the weight systems of several languages. In addition, I have exploited the intrinsically typological character of OT to show that factorial ranking of the constraints not only accounts for the observed data in a natural way, but also predicts the absence of some unattested patterns (e.g. non-geminate closed syllables that are heavier than geminate closed syllables). It is this inherently typological nature of OT that is one of the major advantages of this theory over previous theories.

The third goal was to propose an OT account for observed weight systems using as economical a system as possible. I believe I have done this by eliminating constraints against long vowels and geminates, and by only making use of constraints that are fairly uncomplicated, well-attested, and in many cases needed elsewhere in the phonology.

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