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# Words and Subwords: Phonology in a Piece-Based Syntactic Morphology

## Abstract

The goal of this dissertation is to take generalizations made in a variety of phonological and morphological theories and account for them in a piece-based syntactic theory of morphology. The theories discussed are Cyclic phonology, Lexical Phonology (and Stratal Optimality Theory), Prosodic Hierarchy Theories, and Syntactic Spell-Out Only theories. Phonological and morphological generalizations from these theories include the cyclic/non-cyclic distinction of phonological blocks and morphemes, "grammatical" words and phonological words (their equivalence and apparent mismatches), incorporation of clitics into word level phonology, morpheme-sensitive phonological processes, and the relationship between syntactic spell-out phases and phonological domains.

I present a framework within the theory of Distributed Morphology (Halle and Marantz 1993, et seq.) in which I account for these generalizations in several ways. I relate as much phonological structure to morphosyntactic structure as possible. However, there are several phonological phenomena which cannot be accounted for by syntactic structure alone. To account for these phenomena, I propose that the syntax feeds information in chunks to PF (cyclic spell-out) but that the morphology and phonology may operate on that information, creating mismatches between syntactic structure and phonological domains.

For the cyclic/non-cyclic distinction of phonology, there are mismatches between syntactic spell-out domains and phonological interactions at the subword level. I propose a "phonocyclic buffer" into which phonologically cyclic exponents are added and over which the cyclic phonology is calculated. This is illustrated with data from yer lowering and yer deletion in Slovak and Polish, English stress and derivational affixes, and Spanish depalatalization.

For the relationship between "grammatical" words and phonological/prosodic words, I propose an interface function relating morphosyntactic words (M-Words; non-minimal complex heads of the syntax) and phonological words. The basic relationship is illustrated with data from English voicing assimilation and German devoicing. I argue against two types of apparent mismatches between M-Words and phonological words, such as those proposed for Japanese "Aoyagi" prefixes, Vietnamese interleaving word order, Plains Cree polysynthetic verbs, and Spanish compounds. I find some of these apparent mismatches can be handled elsewhere in the phonological system, while others are examples of complex syntactic structure (but not of mismatches between syntactic and phonological structure). I also present an operation which can create phonological words out of non-M-Word configurations, dubbed Stray Terminal Grouping. This is illustrated with data from Bilua, Standard English, and African American Vernacular English.

Regarding the behavior of clitics (independent syntactic pieces which are phonological dependent on a host), I find that their behavior is not predetermined or memorized, but is dependent on the morphosyntactic context in which they are derived. I show cases from Turkish, Maltese, and Makassarese in which morphemes variably behave like clitics or affixes depending on their context. I argue that this variable behavior may be determined either by syntactic or morphological operations.

Finally, I investigate two types of morpheme-sensitive phonological processes, morphophonological rules and morpheme/morpheme readjustments, illustrated with data from Slavic derived imperfect raising, German umlaut, and Kashaya decrement and palatalization. I argue that these processes are underlyingly phonological in nature, but are activated by morphological diacritics. This activation can happen during two different stages of linearization; Morpheme/morpheme readjustments occur at the level of subword concatenation while

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The conclusion of this dissertation is that we can account for these phonological generalizations in a piece-based syntactic framework, but not by syntax alone. Rather, it must be a combination of syntactic, morphological, and phonological operations which combine to create the phonological output.

**Degree Type**

Dissertation

**Degree Name**

Doctor of Philosophy (PhD)

**Graduate Group**

Linguistics

**First Advisor**

David Embick

**Keywords**

Affix, Clitic, Morphology, Phonology, Word

**Subject Categories**

Linguistics

WORDS AND SUBWORDS:  
PHONOLOGY IN A PIECE-BASED SYNTACTIC MORPHOLOGY

Kobey Shwayder

A DISSERTATION

in

Linguistics

Presented to the Faculties of the University of Pennsylvania in Partial  
Fulfillment of the Requirements for the Degree of Doctor of Philosophy  
2015

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WORDS AND SUBWORDS:  
PHONOLOGY IN A PIECE-BASED SYNTACTIC MORPHOLOGY

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Kobey Adam Ergas Shwayder

# Acknowledgments

I owe many thanks to my advisor, David Embick. No matter how well or ill prepared I felt entering a meeting with Dave, I always left feeling that I was on the right track, that I was doing a good job, and that I had a specific set of tasks to accomplish for the next meeting. Dave is always quick to question an assertion, simplify an explanation, or clarify a problem. I have greatly enjoyed working with him over the past few years.

Thanks also to the other members of my committee, Eugene Buckley and Rolf Noyer, for feedback and advice on this and other projects. I have learned a lot from discussions with them both inside and outside the classroom.

Thanks to my colleagues in the linguistics department at Penn for creating an enjoyable environment. A special thanks to my cohort-mates, Meredith Tamminga, Hilary Prichard, Yong-cheol Lee, and Claire Crawford, who especially helped me through the first few years of grad school, and to regular F-MART attendees, who helped workshop many of the case studies presented in this dissertation. I also need to thank my coauthors on various projects: Brittany McLaughlin, Soohyun Kwon, and H. Akiva Bacovcin. They have helped me formulate my theories and brought interesting data to bear.

Thanks to everyone at Temple University Yongmudo Hapkido: Robert Brown, Sandy Hashima, Huy Tran, and all the students. Hapkido kept me healthy and sane during grad school and I enjoyed learning from you and teaching you.

Thanks to my friends Avery Schwenk, Colin Phillips, and Carolyn Orson. They are always an encouraging and supporting source of encouragement and support.

Thanks to my parents for their unconditional support in whatever endeavors I follow.

And special thanks, as always, to Mindy Snitow.

## ABSTRACT

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Kobey Shwayder

David Embick

The goal of this dissertation is to take generalizations made in a variety of phonological and morphological theories and account for them in a piece-based syntactic theory of morphology. The theories discussed are Cyclic phonology, Lexical Phonology (and Stratal Optimality Theory), Prosodic Hierarchy Theories, and Syntactic Spell-Out Only theories. Phonological and morphological generalizations from these theories include the cyclic/non-cyclic distinction of phonological blocks and morphemes, “grammatical” words and phonological words (their equivalence and apparent mismatches), incorporation of clitics into word level phonology, morpheme-sensitive phonological processes, and the relationship between syntactic spell-out phases and phonological domains.

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Finally, I investigate two types of morpheme-sensitive phonological processes, morphophonological rules and morpheme/morpheme readjustments, illustrated with data from Slavic derived imperfect raising, German umlaut, and Kashaya decrement and palatalization. I argue that these processes are underlyingly phonological in nature, but are activated by morphological diacritics. This activation can happen during two different stages of linearization; Morpheme/morpheme readjustments occur at the level of subword concatenation while morphophonological rules occur at the level of subword chaining. This division accounts for the difference in locality conditions between the two types of processes.

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# Contents

<b>Acknowledgments</b>	<b>iii</b>
<b>Abstract</b>	<b>iv</b>
<b>Contents</b>	<b>vi</b>
<b>List of Figures</b>	<b>xi</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background . . . . .	1
1.1.1 Piece-Based Syntactic Theory . . . . .	1
1.1.2 Phonological Generalizations . . . . .	3
1.1.3 Comparison points between theories . . . . .	6
1.2 Overview of Framework . . . . .	10
1.2.1 Quick Note: Rules and Constraints . . . . .	14
<b>2 The Subword Domain</b>	<b>15</b>
2.1 Overview . . . . .	15
2.2 Cyclicity and Yers in Slovak and Polish . . . . .	17
2.2.1 Cyclicity of Yer Vocalization, Non-cyclicity of Yer Deletion . . . . .	17
2.2.2 Piece-based approach . . . . .	24
2.2.3 Slavic Prefixes and Non-cyclic Morphemes . . . . .	29
2.2.4 Case Study Conclusion . . . . .	38

2.3	English Stress and Derivational Morphology . . . . .	39
2.3.1	Data and Background . . . . .	40
2.3.2	Possible approaches in a piece-based framework . . . . .	44
2.3.3	Implementation . . . . .	56
2.3.4	Discussion: Overwriting and Syntactic Spell-Out . . . . .	69
2.3.5	Case Study Conclusion . . . . .	72
2.4	Cyclicity and Spanish Depalatalization . . . . .	73
2.4.1	Background and Data . . . . .	73
2.4.2	Analysis . . . . .	77
2.4.3	Case Study Conclusion . . . . .	85
2.4.4	Aside: Syntactic spell-out domains . . . . .	86
2.5	Additional Discussions . . . . .	87
2.5.1	Blocking and Non-blocking Zeros . . . . .	87
2.5.2	Diacritics and assignment of randomness . . . . .	88
2.6	Chapter Conclusion . . . . .	90
<b>3</b>	<b>The Word Domain</b>	<b>91</b>
3.1	Overview . . . . .	91
3.2	Discussion: What is a word? . . . . .	93
3.3	The M-Word $\Rightarrow$ $\omega$ -Word Correspondence . . . . .	97
3.3.1	Restriction: Non-minimal M-Words . . . . .	99
3.4	M-Word $\Rightarrow$ $\omega$ -Word Basic Case Studies . . . . .	100
3.4.1	German syllable-final devoicing . . . . .	100
3.4.2	English $\omega$ -Level voicing assimilation . . . . .	104
3.4.3	Case Study Conclusions . . . . .	107
3.5	Discussion: $M \Rightarrow \omega$ Mismatches . . . . .	108
3.5.1	$M \Rightarrow 2\omega$ Mismatches . . . . .	109
3.5.2	$2M \Rightarrow \omega$ mismatches . . . . .	111
3.5.3	Summary of apparent mismatches . . . . .	113

3.6	Japanese Aoyagi Prefixes . . . . .	114
3.6.1	Background and Data . . . . .	114
3.6.2	New Data on Minor Phrases . . . . .	119
3.6.3	Analysis . . . . .	120
3.6.4	Case Study Conclusion . . . . .	123
3.7	Vietnamese Interleaved Words . . . . .	123
3.7.1	Background and Data . . . . .	123
3.7.2	Analysis . . . . .	129
3.7.3	Case Study Conclusion . . . . .	133
3.8	Plains Cree Polysynthetic Verbs . . . . .	134
3.8.1	Background . . . . .	134
3.8.2	Phonological Structure of Plains Cree Verbs . . . . .	135
3.8.3	Morphosyntax of the Plains Cree Verb . . . . .	140
3.8.4	Special Sandhi . . . . .	145
3.8.5	Conclusion . . . . .	147
3.9	Word-Level Recursion in Spanish Compounds . . . . .	148
3.9.1	Background and Data . . . . .	148
3.9.2	Analysis of Compounds . . . . .	152
3.9.3	Discussion . . . . .	156
3.9.4	Case Study Conclusion . . . . .	160
3.10	Stray Terminal Grouping . . . . .	160
3.10.1	Introduction . . . . .	160
3.10.2	Bilua . . . . .	162
3.10.3	Standard English Contraction . . . . .	166
3.10.4	AAVE copula contraction . . . . .	169
3.10.5	Conclusion . . . . .	174
3.10.6	Aside: Why do we need phonological words anyway? . . . . .	175
3.11	Discussion: Syntactic Phases . . . . .	176

3.12	Chapter Conclusion . . . . .	178
<b>4</b>	<b>The Clitic/Affix Distinction</b>	<b>180</b>
4.1	Overview . . . . .	180
4.2	Discussion: Theories of Cliticization and Affixation . . . . .	182
4.2.1	Analysis and predictions of each theory type . . . . .	185
4.2.2	Key Predictions/Summary of Theory Comparison . . . . .	191
4.3	Discussion: Leaning . . . . .	192
4.4	Turkish Stress . . . . .	196
4.4.1	Data . . . . .	196
4.4.2	Analysis . . . . .	202
4.4.3	Notes on previous analyses . . . . .	207
4.4.4	Aside: Clitic Group Phenomena . . . . .	208
4.4.5	Case Study Conclusions . . . . .	210
4.5	Local Dislocation . . . . .	210
4.5.1	Voice assimilation of the English possessive clitic . . . . .	212
4.6	Case Studies in Amphitopy . . . . .	214
4.6.1	Makassarese Suffixes, Clitics, and the Definite Determiner . . . . .	215
4.6.2	Maltese Subject Agreement and Object Clitics . . . . .	225
4.6.3	Discussion: Conditioning on Local Dislocation . . . . .	236
4.6.4	Case Study Summary and Conclusion . . . . .	237
4.7	Chapter Conclusion . . . . .	239
<b>5</b>	<b>Morpheme-Specific Phonological Rules</b>	<b>240</b>
5.1	Overview and Proposal . . . . .	240
5.2	Slavic Derived Imperfect Raising . . . . .	243
5.3	German Umlaut . . . . .	246
5.3.1	Morphophonological Umlaut with <i>-chen</i> and <i>-lein</i> . . . . .	248
5.3.2	Umlaut as Morpheme/Morpheme Readjustment . . . . .	248

5.3.3	Morphological or Phonological Locality . . . . .	251
5.3.4	Case Study Conclusions . . . . .	253
5.4	Kashaya Decrement and Palatalization . . . . .	253
5.4.1	The Decrement . . . . .	254
5.4.2	Plural Agent Palatalization . . . . .	257
5.4.3	Case Study Conclusion . . . . .	259
5.5	Chapter Conclusion . . . . .	260
<b>6</b>	<b>Conclusions</b>	<b>261</b>
6.1	Discussion: Typology of Domains for Phonological Processes . . . . .	261
6.2	Conclusion . . . . .	264

# List of Figures

2.1	Schematic of Lexical Phonology (adapted from Kiparsky 1982a and Kenstowicz 1994) . . . . .	41
2.2	Schematic of Stratal Optimality Theory (see Bermúdez-Otero 2003, 2013) . . . . .	41
3.1	Pitch track of <i>motodaijin</i> “former minister”. . . . .	119
3.2	Pitch track of <i>motodaijin no komon</i> “former minister’s advisor”. . . . .	120
3.3	Pitch track of <i>kokka no motodaijin</i> “nation’s former minister”. . . . .	120

# Chapter 1

## Introduction

The topic of this dissertation is the interface between morphology and phonology for units of word size and smaller. The goal is to take generalizations that have been made in a variety of phonological and morphological frameworks and account for them in a piece-based syntactic theory of morphology. In particular, I will deal with the morphological and phonological structure of words and subwords and the types of phonological processes applicable in those domains.

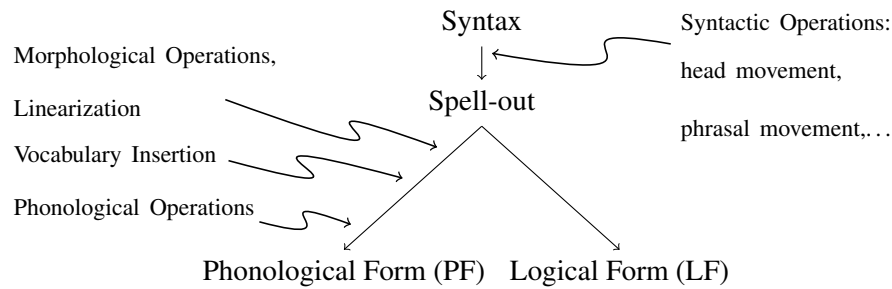
### 1.1 Background

#### 1.1.1 Piece-Based Syntactic Theory

The framework proposed here assumes a piece-based, syntactic theory of morphology, specifically Distributed Morphology (DM) (Halle and Marantz 1993, 1994, *et seq.*). The intuition behind DM and similar syntactic theories is that the interactions and relationships between pieces of the morphology are the same as pieces of the syntax. The proposal is that both are manipulated by the same module of the grammar, namely, the syntax.

This proposal, “Syntax All the Way Down”, is one of the core principles of DM. For the purposes of investigating the interactions of phonology and morphology, this principle means that the determination of the initial position of morphemes must be according to syntactic principles. The general architecture of DM is shown in (1):

(1) Architecture of Distributed Morphology



As shown in (1), after some syntactic operations, the “spell-out” operation sends the syntactic structure to be phonologized (at PF) and to be interpreted semantically (at LF). Spell-out is proposed to be interleaved with syntactic operations following the syntactic phase theory of Chomsky (2000, 2001), meaning that certain syntactic heads trigger spell-out. This effectively means that syntactic structure is sent to be processed at PF and LF one chunk at a time (see, e.g., Marantz 2007; Embick and Marantz 2008; Embick 2010a).

After the chunk of syntactic structure is spelled out, it changed from the hierarchical relationship structure to a linear relationship structure through the operation Linearization. Linearization is proposed to occur in two steps, one step which takes the hierarchical relations and generates a set of binary linear relationships between constituents and a second step which chains these binary pairs into longer strings of morphemes (Marantz 1984, 1988; Embick and Noyer 2001, 2007; Embick 2007b; Pak 2008).

After (or possibly also before) linearization, there are a variety of morphological operations which modify morphosyntactic structure. Although the core principle “Syntax All the Way Down” claims that morphemes are arranged by the syntax operations such as Fission, Fusion, Impoverishment, Morphological Merger and Local Dislocation have been proposed to modify the featural content of morphemes or change their relationships with each other after spell-out. (Halle and Marantz 1993; Marantz 1988; Bonet 1991; Halle 1997; Noyer 1997; Embick and Noyer 2001, *i.a.*).

The final step of morphological operations is Vocabulary Insertion. Vocabulary Insertion is the operation by which the morphemes are assigned exponents which match their semantic, syntactic and morphological features to a phonological form. The equation of semantic, syntactic and morphological features to a phonological form is stored in a Vocabulary Item.



This “Late Insertion” of phonological forms is one of the other core principles of DM. The assignment of phonological forms to morphosyntactic terminals is proposed to happen after syntactic calculations have applied (hence “late”), in contrast with “Early Insertion” theories in which a Lexicon is used to create phonological forms before syntactic operations.

Late Insertion is an important principle for the framework here because it means that the syntax operates without reference to phonological form. Syntactic operations are proposed to not be sensitive to phonological forms. Violations of this (which will be proposed) must be principled. For example, syntactic cyclic spell-out may operate in such a way that nodes internal to the current position have been spelled out, and thus their phonology is visible.

After Vocabulary Insertion, the phonological exponents of morphemes have been introduced and the derivation proceeds to the phonology, where these exponents interact. While much work has been done on the morphosyntactic and syntacticosemantic sides of DM, there is less work on the exact mechanics of the interaction of the structure with phonological domains (for a few proposals, see, Marvin 2002, 2013; Newell 2005, 2008). These mechanics will be investigated in this dissertation.

Before moving on, it is worth mentioning another important, although separate, hypothesis within the DM framework. This hypothesis is that morphosyntactic roots are not prespecified for a part of speech (such as noun, verb, or adjective). Rather uncategorized roots select (in the syntactic sense) for a *category defining head* which provides the necessary combinatoric mechanisms (syntactic and semantic features) to interact with the syntactic and semantic (Marantz 1997, 2007; Embick 1997, 2010a; Harley and Noyer 1998; Embick and Marantz 2008, *i.a.*). This hypothesis has been fruitful in the domains of allomorphy and allosemy, and it will also be helpful in the domain of phonological grouping (although it causes problems in a few places).

### **1.1.2 Phonological Generalizations**

Other theories of phonology and the interface with morphology make important generalizations about the types of processes, domains, and interactions that occur. Four theories in particular will be discussed here: Cyclic phonology, Lexical Phonology (and Stratal Optimality Theory), Prosodic Hierarchy Theory, and what I will term Syntactic Spell-Out Only Theories.

### 1.1.2.1 Cyclic Phonology

Chomsky and Halle (1968, *SPE*) and following work, make two important observations about the nature of phonological rules with respect to morphological structure and the creation of words. First, phonological rules apply in two ways, some rules (cyclic rules) apply iteratively to a word with the addition of (at least some) affixes while others (non-cyclic rules) only apply once after all affixes have been added to a word. Second, affixes come in two flavors; Cyclic affixes trigger the application of the cyclic rules after they are added but non-cyclic affixes do not trigger the cyclic phonology. These two claims are different in that the first, cyclic vs. non-cyclic phonology, proposes that there are two blocks of phonology which apply at different times in the derivation, while the second, cyclic vs. non-cyclic affixes, proposes that some morphological pieces are transparent or otherwise non-reactive with the cyclic phonology but all of them participate in the non-cyclic phonology.

For Chomsky and Halle, there is a direct path between the syntactic structure and the phonological structure. They posit an intermediate level of representation in grammar that is the surface syntactic structure. This surface structure is the output of the syntactic component and the input to the phonological component. The syntactic structure and the phonological structure “coincide to a very significant degree, but there are also certain discrepancies” indicating that there are other operations applying to the output of the syntax to convert it into a form able to be the input of the phonological component (Chomsky and Halle 1968, p. 9).

The main generalizations taken from Cyclic phonology are: (1) there are two blocks of phonological rules (cyclic/non-cyclic), (2) there are two types of affixes (cyclic/non-cyclic), and (3) there are adjustments made to the structure in between the syntactic structure and the phonological structure.

### 1.1.2.2 Stratal Theories

Following *SPE*, a set of theories, which I will term “Stratal Theories” proposed a different architecture of grammar in which the Lexicon, a special module for building words, contains levels or strata. These types of theories include Lexical Phonology (Kiparsky 1982a; Mohanan 1986; *et. seq.*), and its Optimality Theoretic progeny Stratal OT (Kiparsky 2000; Bermúdez-Otero in prep).

In these theories, the lexicon contains levels for each type of morpheme and each block of phonology. These levels provide a structure for the addition of morphemes and the phonology that accompanies them. Earlier work in Lexical Phonology posits any number of layers possible in the lexicon, while later work and Stratal OT claim that there are two layers within the lexicon, mirroring the cyclic/noncyclic phonology, which they call Stem and Word level.

The separation between lexicon and syntax in these theories, however, poses problems with what are termed “lexical clitics”, morphemes that are generated by the syntax but seem to interact with words at a lexical level (Nevis 1985; Halpern 1992). Nevertheless, there is a strong generalization made that the word as the unit of the lexicon is a generally important unit.

The generalizations made from level ordering theories are: (1) there appear to be some ordered ways in which morphemes are attached to a word which reflects its phonological domain, and (2) there is some unit called “word” which includes all affixes.

An additional prediction of these theories involves the number of domains for phonological application. In earlier versions of Lexical Phonology, there are any number of levels in the lexicon possible, predicting any number of domains. Later work and Stratal OT predict exactly three domains (Stem, Word, Phrase). Both of these predictions are problematic in that there seem to be more than three domain levels, but not a limitless or arbitrary number of domains. Rather, the domains of phonological application seem to be related to different morphosyntactic structures and PF domains, as is discussed below.

### **1.1.2.3 Prosodic Hierarchy Theory**

Prosodic Hierarchy Theories (Selkirk 1981, 1984; Nespor and Vogel 1986, *et seq.*) deal largely with phonological phenomena larger than the word. As such, they are claimed to be possibly coexistent with lexical theories such as Lexical Phonology. While the literature for the most part does not talk about their interaction, the two theories are said to exist in the same grammar space.

For the aspects of interest in this dissertation, Prosodic Hierarchy Theories make a set of generalizations about words and how words interact with clitics. we’ll be looking at the word level and the next higher level (in some accounts) the clitic group.

The claim is that there is a phonological unit, the Prosodic Word (PWd), which is built after the syntactic module of grammar. Words derived from the lexicon are automatically marked for being PWds, but functional heads of the syntax are not. These heads which do not have a prosodic unit must find a prosodic unit to attach to. In this way, the framework can account for a variety of phenomena involving clitics and their interaction (or non-interaction) with the phonology of the word level.

The generalizations taken from Prosodic Hierarchy Theories are: (1) Some phonological constituents must be built after the syntax, (2) content (lexical) words are somehow different from functional words with respect to their status as phonological units, and (3) clitics have a variety of behaviors with respect to their interaction with the PWd.

#### **1.1.2.4 Syntactic Spell-Out Only Theories**

Taking an entirely different approach, Syntactic Spell-Out Only Theories follow the piece-based syntactic framework of DM (or other similar frameworks) sketched out above. Taking the “Syntax All the Way Down” principle to the fullest extent, these theories claim that the only phonological domains are those that are defined by syntactic phases (Marantz 1997, 2001; Marvin 2002; Newell 2005; Lowenstamm 2010; Embick 2010a; *i.a.*, cf. also Lieber 1992).

In contrast with theories which propose a lexicon for creating words and processing the phonology of words and smaller units, Syntactic Spell-Out Only Theories use syntactic operations, such as cyclic spell-out, and restrictions, such as the Phase Impenetrability Condition, to account for a variety of phonological phenomena. However, as it does not seem to be true that all phonological domains can be explained by these syntactic definitions (see Pak 2008; Embick 2014; and argued here).

Nevertheless, the clear generalization is that there is some relationship between the syntactic spell-out domains and the phonological domains.

#### **1.1.3 Comparison points between theories**

The theories above differ on a variety of theoretical concepts which are not necessarily exclusive to one theory. Below, I give an overview of a few of these concepts which are important for the

framing of the theory I present here.

### **1.1.3.1 Direct or Indirect Reference**

The theoretical concept under discussion between Direct Reference and Indirect Reference theories is how the syntactic information is referenced by the phonology.

In Direct Reference theories, the phonology can refer directly to syntactic features to determine phonological behavior. Under the Direct Spell-Out Hypothesis, syntactic structures are built (possibly one phase at a time) and the phonology applies directly to the material that it is given (Pak 2008, p. 10). Theories following this hypothesis use the locality conditions imposed by the syntax to account for phonological locality. These theories include Syntactic Spell-Out Only theories.

However, the problem for Direct Reference is the observation that not all phonological constituents are syntactic constituents. That is, phonological constituency and syntactic constituency are non-isomorphic

Because of this observation, Indirect Reference theories, most notably, Prosodic Hierarchy Theories, propose an intermediate representation between syntactic structure and phonological structure, the Prosodic Hierarchy. The Indirect Reference Hypothesis states that phonological rules do not refer to syntactic structure but to a derived intermediate structure (Prosodic constituents) (Inkelas 1989).

This sort of theory can be either derivational or Optimality Theoretic. Derivational approaches extract information from the syntax by rule and convert various syntactic features into boundaries for prosodic constituents. OT models maintain constraints which cause correspondences between the syntactic structure and prosodic structure, often a single edge. (see, e.g., Selkirk 1986). These constraints can be overridden by higher ranking constraints, causing the mismatches we see on the surface.

However, newer research in Indirect Reference Theory argues against the single edge approach and for a “Match Theory” of reference which aligns both edges of a prosodic constituent with both edges of a syntactic constituent (see, e.g., Selkirk 2009). Following this theory, there is less of a schism between the two theory types because “Match Theory” essentially proposes a change of

notation from syntax to phonology without changing any of the boundaries.

Additionally, Pak (2008, p. 49ff.), reevaluates the arguments leveled against Direct Reference Theory, including the non-isomorphism, and argues that they can be accounted for in a piece-based syntactic morphology by referring to more than just syntactic constituents. Pak argues that other syntactic (and morphosyntactic) properties may be used for reference, such as spell-out phases.

The framework I present here is what I call a Modified Direct Reference theory. Following Pak (2008), I argue that the syntax directly feeds chunks of material to the phonology through the mechanism of syntactic spell-out but that the phonology processes those chunks in a sliding window (Pak's "holding bins") and is not necessarily beholden to the spell-out domains. The intuition is that the phonology receives a chunk of information from the syntax and processes it, but then may hold onto that processed piece (put it in a "bin") in order to combine it with subsequent chunks. In this sense, the integration of these "bins" of information is not related to the syntactic structure except for the fact that each piece is originally a syntactic chunk.

Additionally, although phonological rules apply directly to the spelled-out syntactic chunks, they may apply at different stages of PF (specifically, different stages of linearization), resulting in different sensitivities and locality conditions for different types of phonological processes.

### **1.1.3.2 Lexicon or No Lexicon**

The theoretical concept here is whether words are built in a special module of grammar, the Lexicon, or whether they are built through the mechanisms needed in another module (namely, the syntax).

Theories which argue for a lexicon (such as Lexical Phonology as well as other theories), do so for several reasons (Halle 1973; Siegel 1974; Aronoff 1976; Lieber 1980; Kiparsky 1982a; Anderson 1982; Baker 1988, *i.a.*). Some of these theories are syntactic theories which manipulate words as their atoms. Because it is easily noted that words themselves are not atomic, but have complex structure, there must be some other mechanism for creating words, which they term "the Lexicon". The difference between lexically derived objects (words) and syntactically derived objects (phrases) is supposed to be clear. The principles of word creation are supposed to differ from those of word

combination. Words are supposed to be able to have idiosyncrasies in their meaning and phonology while phrases are not.

Theories without a lexicon, in particular DM, which argues for a syntactic generation of words, argue against these differences between words and phrases (Lieber 1992; Halle and Marantz 1993; Marantz 1997, *i.a.*). They argue that there is no more idiosyncrasy among words than among phrases (e.g., idioms) and that the combinatorics of the pieces of words (morphemes) and the pieces of phrases (words) are the same. Additionally, interactions between words and phrases in which words and phrases alternate (“Word Phrase Blocking”) are difficult to account for in a theory with a lexicon separate from the syntax (Embick 2007b; Embick and Marantz 2008).

The framework presented here follows directly from work in DM, arguing that there is no lexicon and that the combination of morphemes is done in the same system as the combination of words.

### **1.1.3.3 Prespecification or Contextually Determined Behavior**

The theoretical concept at issue here is whether the phonological behavior of morphemes is prespecified (that is, stored in memory) or whether it results from some morphosyntactic or phonological context that the morpheme ends up in.

Prespecification theories make use of diacritics or lists which tell the relevant module how to handle a particular morpheme. Examples of this sort of analysis include the Level Ordering for morphemes of Lexical Phonology, which must be stored on some list of what level they apply at, as well as the behavior of clitics in Prosodic Hierarchy Theory, which must be stored knowing whether they are an affixal clitic or a free clitic.

Contextually Determined theories instead derive phonological behavior from the context. For example, Syntactic Spell-Out Only theories argue that morphemes are put in phonological groups based on what spell-out phase they happen to end up in. This phonological behavior is not stored as an inherent property.

The framework here uses both of these methods of determining phonological behavior at different places. Ideally, following as much of the syntactic principles of DM as possible, all phonological

behavior would be contextually determined (as is argued for in Syntactic Spell-Out Only theories). However, I will argue that there are some cases (such as the cyclic/non-cyclic morpheme distinction) which show no apparent difference in the morphosyntax between one behavior and another, and therefore are best handled as diacritic instructions to the phonological system.

## 1.2 Overview of Framework

The framework I present here is a piece-based syntactic morphological theory with no lexicon. Instead, morphemes are combined by the syntax and sent to the phonology at spell-out. This theory is a Modified Direct Reference theory in that syntactic spell-out domains and syntactic relationships are references for the phonological domains, but they are not the only way that the phonology may group constituents. I argue that much of the phonological behavior of morphemes is the contextually determined, but that some properties are best analyzed as diacritic instructions.

Of critical importance to the framework is a morphosyntactic object, called the *Morphosyntactic Word* (M-Word) which is defined as a maximal complex head (cf.  $H^{0max}$  of Chomsky 1995). The definition of M-Word and its subconstituent *subword* is given in (2):

- (2) Definitions of morphosyntactic objects (Embick and Noyer 2001)
- *Morphosyntactic Word* (M-Word):  
A (potentially complex) head not dominated by a further head-projection.
  - *Subword*: A terminal node of the syntax that is not an M-Word

Note that these are syntactically defined objects, not phonological objects. M-Words and subwords (or simply, morphemes) will be referred to throughout the analysis.

To introduce the framework, I will step through the derivational process on the PF side and note the morphological and phonological domains and processes of interest.

To start, this system follows a form of cyclic spell-out. Specifically, I will assume  $C_1$ -LIN, argued for by Embick (2010a), which states the complement of a syntactically cyclic head is spelled out when the next syntactically cyclic head is merged into the structure. The exact formulation of the



cyclic spell-out will not be of critical importance, but the framework does rely on the syntax passing information to the phonology in chunks.

The next step in the derivation (ignoring some morphological processes for the moment) is linearization. Embick (2007b) proposes that M-Words and subwords are of different ontological types in the calculation of linearized morphosyntactic structure such that M-Words are only linearized with respect to other M-Words while subwords are only linearized with respect to other subwords within their M-Word. As mentioned above, linearization is proposed to occur in two steps, one step which takes the hierarchical relations and generates a set of binary linear relationships between constituents and a second step which chains these binary pairs into longer strings of morphemes (Marantz 1984, 1988; Embick and Noyer 2001, 2007; Embick 2007b; Pak 2008). Following Pak (2008, p.14), that “morphemes internal to maximal complex heads (M-words) are linearized before M-words are linearized with respect to each other,” I propose that subwords undergo the same two linearization steps before M-Words do.

### (3) Linearization Steps

a, b, etc. are subwords; A, B, etc. are M-Words

- a. Subword Concatenation:  $a\oplus b$ ;  $b\oplus c$ ;  $c\oplus d$ ;  $d\oplus e$
- b. Subword Chaining:  $(a+b+c+d+e)$
- c. M-Word Concatenation:  $A\wedge B$ ;  $B\wedge C$ ;  $C\wedge D$ ;  $D\wedge E$
- d. M-Word Chaining:  $(A-B-C-D-E)$

Various phonological domains are defined, in part, by these different steps of linearization. Note that Pak (2008) covers the phrasal phonological domains associated with M-Word Concatenation and M-Word Chaining. Here, I will be concerned with the subword processes, as well as the interaction between subwords and their M-Word.

The first linearization step, Subword Concatenation, is when subwords are in binary relationships. I propose that this is the domain at which Morpheme/Morpheme Readjustments occur. Morpheme/Morpheme Readjustments are changes which have a morpheme-specific trigger and a morpheme-specific target. Because these readjustments are limited in scope to relationships between adjacent

morphemes, this stage nicely predicts their restrictions. These readjustments are discussed further in Chapter 5.

The next linearization step is Subword Chaining, when the subwords are combined together into a linear string. At this stage, I propose that there are two different phonological phenomena at play. The first is morphophonological rules, which are phonological rules with a morpheme-specific target or a morpheme-specific trigger, but not both (See Chapter 5). These rules are limited to phonological locality, so they potentially need to be able to see across many morphemes.

Also showing phonological locality (unsurprisingly) are cyclic phonological rules. Following Cyclic phonology, I propose that there is a block of phonological rules which may apply with the addition of every morpheme. Morphemes which carry diacritics to trigger the cyclic phonology are termed cyclic morphemes, those which do not are non-cyclic. I implement the interactions of cyclic and non-cyclic morphemes with the *phonocyclic buffer*. This is a phonological workspace into which exponents of morphemes may be added. The addition of phonological material into the phonocyclic buffer is the trigger for the cyclic phonology to run on the material within the buffer. Non-cyclic nodes are argued to not be integrated into the phonocyclic buffer. This accounts for two effects of non-cyclic morphemes: (1) they do not participate in the cyclic phonology, and (2) they block outer morphemes from participating in the cyclic phonology with morphemes internal to the non-cyclic morpheme.

Note that I argue that, while the syntax sends information in chunks, the phonology may hold onto that information longer than a particular syntactic cycle. I argue for this because of a particular violation of the Phase Impenetrability Constraint which is seen in the interaction of cyclic morphemes. This, and the discussion of the rest of the phonology of subwords is the subject of Chapter 2.

As I mentioned above, the M-Word/subword distinction is critical for the framework. This is because the M-Word structure is the signal to the Phonology that it has received all the material to build a phonological word. That is, when the phonology receives an M-Word structure from the syntax, it groups together all of the phonocyclic buffers and intervening non-cyclic morphemes that it has been holding onto and processes them all with what I term the  $\omega$ -Level phonology

(resulting in a  $\omega$ -Word). This block of phonology should be more-or-less equivalent to the non-cyclic phonology of Cyclic phonology, the word level phonology of stratal theories, and the PWD of Prosodic Hierarchy Theories.

Note that, while I argue that the trigger for the  $\omega$ -Level phonology is the M-Word, the M-Word is not the only place we see  $\omega$ -Word groupings. I argue that there is at least one other configuration of morphosyntactic nodes (“Stray Terminal Grouping”) that gets grouped together into a  $\omega$ -Word. The correspondence between M-Words and  $\omega$ -Words and the other ways to create  $\omega$ -Words are the topics of Chapter 3.

Finally, I note that the correspondence between M-Words and  $\omega$ -Words seems to only be applicable to non-minimal M-Words, that is, M-Words with more than a single syntactic head. On the other hand, Minimal M-Words behave as clitics. Following observations made in Prosodic Hierarchy Theory, I note that some clitics are incorporated into the  $\omega$ -Word of their host and some are not. I argue that clitic incorporation is implemented with the operation Local Dislocation and that it has the distinct property of causing a recursive application of the  $\omega$ -Level phonology. Clitics which are not incorporated simply “lean” onto their host, and must be incorporated with their host into a higher phonological group (which I will not fully discuss in this dissertation). The behavior of clitics (and the classic distinction between clitics and affixes) is the subject of Chapter 4.

The dissertation will proceed as follows:

- In Chapter 2, I discuss phonological phenomena associated with the subword level, namely cyclic/non-cyclic phonology. I argue that the distinction between cyclic and non-cyclic morphemes must be diacritic and not morphosyntactic. I implement phonological cyclicity with the phonocyclic buffer and argue that this is one domain where syntactic spell-out only cannot solve the problem of phonological domains.
- In Chapter 3, I discuss phonological phenomena associated with the word level, namely  $\omega$ -Level phonology and mismatches between “grammatical words” and phonological words. I argue that there is a direct correspondence between the morphosyntactic structure, the M-Word, and the  $\omega$ -Word, although the phonology also has at least one other way to create  $\omega$ -Words.

- In Chapter 4, I investigate the traditional distinction between clitics and affixes and argue that this is a contextually derived difference and not a diacritic or inherent feature of morphemes. I also present the morphological operation Local Dislocation and show its effect on both morphological and phonological structure.
- In Chapter 5, I look at morpheme-specific phonological rules. I argue that there are two classes of morpheme-specific rules, whose locality conditions and morphological sensitivities align with the subword concatenation and subword chaining steps of linearization.
- In Chapter 6, I present a discussion of the typology of phonological domains and their equivalent steps of morphological linearization. Following this, I present a summary and conclusion of the issues dealt with in this dissertation.

### **1.2.1 Quick Note: Rules and Constraints**

In this dissertation, I frame all phonological processes as ordered rules. However, I do not wish to claim that this framework only works with the ordered rule approach to phonology. Rather, the primary concern here is the interaction between the morphosyntax, morphological operations, and the domains of phonology. Given a well defined phonological domain, any particular phonological change under discussion could easily be redefined in terms of a constraint set rather than a list of ordered rules.

## Chapter 2

# The Subword Domain

### 2.1 Overview

In this chapter, I examine phonological phenomena that occur in the domain smaller than that of an entire word. Subword phonology includes those phonological blocks which are traditionally called “cyclic” or “stem-level” phonology in Cyclic or Stratal theories respectively. The phenomena under investigation in the domain of subword phonology are those changes that are triggered by the addition of an affix to a morphological structure, in comparison with what I will call Word level phonology, which does not apply until all affixes are included in the morphological form.

In the first case study on the “fleeting vowels,” or *yers*, of Slovak and Polish, I will motivate the need for two types of morphemes with respect to phonological behaviors. One type seems to trigger certain phonological changes while the other does not. This is, of course, not a new discovery, and, following *SPE* (Chomsky and Halle 1968), I will refer to these two classes as cyclic and non-cyclic morphemes. Cyclic morphemes trigger phonological changes which I will refer to as the “cyclic block of phonology” whereas non-cyclic morphemes do not. A different phonological block, the “non-cyclic block” or Word Level phonology applies after all the morphemes have been added. The exact nature of this Word Level block and how it is calculated is the topic of Chapter 3. In this chapter, I will simply assume that this phonology is run after all the relevant cyclic phonology applies.

Note that *SPE* and some following works refer directly to boundaries (notated + and #, for

example) placed between morphemes. The phonological processes are proposed to be sensitive to these boundaries, with cyclic phonology applying across a + boundary but not a # boundary, for example. The architecture here does not refer to these boundaries as real units, but instead follows Halle and Vergnaud (1987) in proposing that it is the morphological structure itself which is used in the calculation of the phonological structure. In contrast, Lexical Phonology (Kiparsky 1982a; Mohanan 1986; *et. seq.*), and its Optimality Theoretic progeny Stratal OT (Kiparsky 2000; Bermúdez-Otero in prep), set up their architecture of grammar to contain submodules for each type of morpheme and each block of phonology. A more detailed comparison of these solutions is presented with the second case study on English stress and derivational affixes (see also Scheer 2011 for a comprehensive comparison of the differences between the theories).

The basic mechanics proposed here for phonology for the subword domain involve morphophonological diacritics on exponents which indicate their cyclic or noncyclic status (a discussion of which is underlying and which is marked follows the case studies). Morphemes marked as cyclic trigger integration of their exponents into a phonological workspace I will call the *phonocyclic buffer*. The integration of new phonological material into the buffer triggers the cyclic phonology to apply to that buffer.<sup>1</sup> Noncyclic morphemes do not trigger the integration and remain outside the phonological buffer. The interaction of the buffer with noncyclic nodes is discussed in each of the case studies below, as they each show slightly different aspects of the system.

I concede that diacritic solutions in general are undesirable. It would be preferable if the difference between cyclic and noncyclic morphemes could be reflective of some principled semantic, syntactic, or morphological difference, but this does not seem to be the case. Further discussion on the theoretical aspects of this point is made in Section 2.3.2.2 in the case study on English. Additionally, one reason for the diacritic solution is the many ways of generalizing cyclic and noncyclic morphemes into classes. That is, Polish seems to have entirely cyclic suffixes and noncyclic prefixes, English seems to have mixes cyclic and noncyclic affixes of all types, and the final case study of this chapter, Spanish, has almost entirely noncyclic affixes with the exception of the theme vowels.

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<sup>1</sup>The default proposal I put forth here is that, in principle, the addition of new material to the buffer and the processing of the cyclic phonology of the buffer are different steps. An alternative view is that the application of cyclic phonology is how exponents are integrated in the buffer. These two views should result in the same output but make slightly different claims about the possibility of dividing the labor into different parts.

I posit that these divisions are the result of learners creating strategies for organizing an otherwise chaotic system. This is discussed further in Section 2.5.2.

A final discussion point brought up by the Spanish case study in comparison with the Slovak case study is the effect of exponents with null phonology. In Slovak it seems that exponents with null phonology have no effect on the system. Essentially they behave as if they are not there. In Spanish, however, the theme vowel node is critically cyclic and triggers depalatalization even if the theme vowel is phonologically null. A discussion of blocking and non-blocking morphemes, pruning, and phonological versus morphological zeros is discussed in Section 2.5.1.

## **2.2 Cyclicity and Yers in Slovak and Polish**

In this case study, the interaction of the vowel-zero alternation with morphological structure will motivate the need for two different types of morphemes, cyclic and noncyclic, and two different blocks of phonological process. One block applies with each addition of a cyclic morpheme and one applies once after all affixes have been added.

To handle this behavior, I will also introduce the phonocyclic buffer, a mechanism for calculating the domain of phonological application for cyclic rules. Cyclic morphemes are added to the buffer while noncyclic nodes are not. I posit that the integration of new material into the phonocyclic buffer triggers the application of the cyclic block of phonology. Because noncyclic nodes are not integrated into the buffer, the cyclic phonology does not apply to them.

### **2.2.1 Cyclicity of Yer Vocalization, Non-cyclicity of Yer Deletion**

Slavic languages famously have alternations between vowels and zero (see Lightner 1965; Gussmann 1980; Rubach 1984, 1986; Kenstowicz and Rubach 1987; Spencer 1986, *inter alia*). These alternations historically originate from reduced short vowels, called *yers*, which underwent a change called Havlík's Law which syncopated every other reduced short vowel in a word.

In older forms of Slavic, such as Old Czech and Old Polish, the calculation of which yers were deleted occurs at the level of the entire word (Scheer and Ziková 2010). That is, after all affixes are added, Havlík's Law applies deleting every other yer in a sequence of yers. However, the pattern of

syncope has been reanalyzed in modern Slavic languages as a subword process rather than a word level process. As an example here I will use Slovak, data from Rubach (1993).

To start, the alternation between yers and full vowels is not fully predictable in two senses. First, whether or not a word contains an alternating vowel is not predictable, as shown by minimal pairs in (4). For example, in (4a), looking at just the nom. sg. surface forms *šev* and *lev*, it is not predictable that the /e/ in *šev* alternates with  $\emptyset$ , as in the gen. sg. *švu*, while the /e/ in *lev* does not alternate (gen. sg. *leva*, \**lva*). Second, which surface vowel alternates with zero is unpredictable. Compare the /e/~ $\emptyset$  alternations in (4a-b) with the /o/~ $\emptyset$  alternations in (4c-d). Looking only at the gen. sg. forms of, for example, *švu* and *kotla*, it is impossible to predict that the vowel appearing in the nom. sg. is /e/ for *šev* but /o/ for *kotol*.<sup>2</sup>

(4) Alternating vs. non-alternating vowel minimal pairs in Slovak (Rubach 1993, p.139)

	Nom. sg.	Gen. sg.	Gloss
a.	<i>šev</i>	<i>šv+u</i>	"seam"
	<i>lev</i>	<i>lev+a</i>	"lion"
b.	<i>semester</i>	<i>semestr+a</i>	"semester"
	<i>jeseter</i>	<i>jeseter+a</i>	"sturgeon"
c.	<i>kotol</i>	<i>kotl+a</i>	"kettle"
	<i>atol</i>	<i>atol+u</i>	"atoll"
d.	<i>bahor</i>	<i>bahr+a</i>	"felly (= exterior rim of wheel)"
	<i>bachor</i>	<i>bachor+a</i>	"belly"

One of the generally accepted solutions to these unpredictable alternations is to posit a set of abstract underlying vowels that appear in some situations but disappear in others (e.g., Rubach 1984, 1986). I will adopt this solution here, and will use capital E and O here to represent underlying yers of front and back quality, respectively.<sup>3</sup>

The traditional analysis of the behavior of yers in Slovak (and Slavic in general) is that a yer

<sup>2</sup>Rubach (1993, p.140–149) argues that any (quality of) vowel of Slovak has the potential to behave as a yer. For simplicity of exposition and comparison to Polish below, I will limit the discussion to /e/ and /o/ alternations.

<sup>3</sup>For the purposes of exposition here, I use only E and O yers, although the Ä yer will play a role in the discussion below as well. Note that some researchers use I and U to represent the fact that these vowels are historically short high vowels. The notation difference does not affect the discussion here: Feel free to read I and U where E and O appear.



becomes a full vowel through the process of Lowering (Lightner 1965) or Vocalization (Kenstowicz and Rubach 1987; Rubach 1993) when there is another yer in the following syllable. I will use the term Vocalization here, formulated as a rule in (5), although the exact mechanics of the phonological process are not at issue here. Rather, it is the interaction with the morphological structure that will be discussed.

- (5) Yer Vocalization:  $\left\{ \begin{array}{c} \text{E} \\ \text{O} \end{array} \right\} \rightarrow \left\{ \begin{array}{c} /e/ \\ /o/ \end{array} \right\} / \_ C_0 \left\{ \begin{array}{c} \text{E} \\ \text{O} \end{array} \right\}$   
 "An underlying yer vocalizes (becomes a full vowel) when followed by a yer in the next syllable."

At some point in the derivation, unvocalized yers are deleted. This is formulated as a rule in (6), and results in the vowel~zero alternations seen on the surface.

- (6) Yer Deletion:  $\left\{ \begin{array}{c} \text{E} \\ \text{O} \end{array} \right\} \rightarrow \emptyset$   
 "Unvocalized yers are deleted."

Taking the minimal pair *šev~švu* and *lev~leva* from (4a) for example, we can derive the surface forms through the critical ordering of Yer Vocalization before Yer Deletion.<sup>4</sup>

(7) Example derivation with yers and full vowels

	Nom. Sg.	Gen. Sg.	Nom. Sg.	Gen. Sg.
UR	šEv+O	šEv+u	lev+O	lev+a
Yer Vocalization	šev+O	—	—	—
Yer Deletion	šev+_	š_v+u	lev+_	—
Output	šev	švu	lev	leva

Yer Vocalization and Yer Deletion are not just critically ordered with each other, but act differently with respect to morphophonological structure. Yer Vocalization applies after the addition of every suffix, while Yer Deletion must not apply until after all affixes are added. Following Rubach (1993), I will motivate the cyclicity of Yer Vocalization and then discuss noncyclicity and Yer Deletion below.

<sup>4</sup>Assuming here that the nom. sg. is /-O/, following previous work on Slovak and other Slavic languages.

To help motivate this distinction, we must use several other processes which Yer Vocalization and Yer Deletion interact with: Vowel Lengthening, Diphthongization, and Rhythm Law.

(8) Other vowel processes in Slovak (Rubach 1993)

- a. Vowel Lengthening:  $V \rightarrow \bar{V} / \_ C_0 \left\{ \begin{array}{l} E \\ O \end{array} \right\}$   
 "Lengthen a (vocalized) vowel before a yer in the following syllable"
- b. Rhythmic Law:  $\bar{V} \rightarrow \check{V} / \bar{V} C_0 \_$   
 "Shorten a long vowel when preceded by a long vowel in the previous syllable"
- c. Diphthongization:  $\left\{ \begin{array}{l} \bar{e} \\ \bar{o} \end{array} \right\} \rightarrow \left\{ \begin{array}{l} ie \\ uo \end{array} \right\}$   
 "Long mid vowels /e/, /o/ diphthongize to [ie], [uo]"

Examples of Vowel Lengthening and Diphthongization are shown in (9). Note that in Slovak, orthographic acute accent (e.g., <á>) is used to represent a long vowel and a circumflex accented *o* <ô> represents the diphthong [uo].

(9) Examples of Vowel Lengthening and Diphthongization (Rubach 1993, p.145)

Nom. Sg.	Gen. Pl.	Gloss
fabrik+a	fabrik+O →fabrík	"factory"
chat+a	chat+O →chát	"cottage"
čel+o	čel+O →čél →čiel	"forehead"
kol+o	kol+O →kól →kôl [kuol]	"circle"

Yers, once vocalized, behave like normal vowels and are subject to these vowel processes. The interaction of Yer Vocalization with Vowel Lengthening and Rhythmic Rule is exemplified by the minimal pair in (10):

(10) Interaction of Yer Vocalization with other processes (Rubach 1993, p.145)

Root UR	Nom. Sg.	Gen. Pl.	Gloss
vedEr	vedEr+o →vedro	vedEr+O →vedier	"bucket"
krídEl	krídEl+o →krídlo	krídEl+O →krídel (*krídiel)	"wing"

In (10), we see three different outcomes of underlying yers. In the nom. sg. of both forms, the yer is unvocalized and gets deleted. In the gen. pl. of "bucket", the yer in the root is vocalized to /e/ (due to the yer in the following syllable, the gen. pl. morpheme -O). Once it is a vocalized vowel, it is subject to lengthening and diphthongization like any other normal vowel. The result is that the surface form of the underlying E is [ie]. However, in the gen. pl. of "wing", the vowel length is removed via the Rhythmic Rule because the first vowel of the root is underlyingly long. That is, the root yer is vocalized to /e/ and lengthened due to the following yer. However, the intermediate form /krídél+O/, with two adjacent long vowels, is subject to the Rhythmic Rule which removes the length on the second long vowel resulting in /krídel+O/.<sup>5</sup> The surface form is a short /e/. These examples show that there is a critical ordering of Yer Vocalization before Vowel Lengthening before Rhythmic Rule.

However, if we try to impose a single application of phonological processes to Slovak words, we end up with an ordering paradox. Compare the orderings of phonological processes in (11) and (12). The two data points to be examined here are *stebiel* "stalk (gen. pl.)" and *čielec* "forehead (dim. gen. pl.)". In the first ordering (11), Yer Vocalization is ordered before Vowel Lengthening. This correctly derives *stebiel* but incorrectly generates *\*čielec*.

(11) Order 1: Yer Vocalization > Vowel Lengthening

	"stalk (gen. pl.)"	"forehead (dim. gen. pl.)"
UR	stebEl+O	čel+Ec+O
Yer Vocalization	stebelO	čelecO
Vowel Lengthening	stebéIO	čeléCO
Rhythmic Law	—	—
Diphthongization	stebielO	čeliecO
Yer Deletion	stebiel_	čeliec_
Output	stebiel	*čeliec (cf. čielec)

---

<sup>5</sup>The interaction of Vowel Lengthening and Rhythmic Rule results in many "Duke of York" derivations in which a short vowel is lengthened by Vowel Lengthening and then shortened by Rhythmic Rule. It may be possible to reformulate Vowel Lengthening to be sensitive to the previous syllable if it is desirable to avoid these types of derivations. This reformulated Vowel Lengthening will, however, have the same effect as the combination of the two rules. Since the exact formulation of the processes is not under discussion here, I will simply follow Rubach's formulation of the two processes.

Reversing the ordering, as shown in (12), leaves us with the opposite problem; This ordering correctly derives *čielec* but incorrectly generates *\*stiebel*.

(12) Order 2: Vowel Lengthening > Yer Vocalization

	"stalk (gen. pl.)"	"forehead (dim. gen. pl.)"
UR	stebEl+O	čel+Ec+O
Vowel Lengthening	stébElO	čélEcO
Yer Vocalization	stébelO	čélecO
Rhythmic Law	—	—
Diphthongization	stiebelO	čielecO
Yer Deletion	stiebel_	čielec_
Output	*stiebel	čielec

(cf. *stebiel*)

Of course, the main difference between these two example data points is that *stebiel* "stalk (gen. pl.)" has two underlying morphemes, the root and the inflection, while *čielec* "forehead (dim. gen. pl.)" has three: the root, the diminutive morpheme, and the inflection morpheme.

To solve this paradox, the cyclic phonology approach proposes that some phonological processes are applied repetitively as each morpheme is added while others are "non-cyclic" and are only applied once at the end of the derivation. Here, following Rubach (1993) we have Yer Vocalization, Vowel Lengthening, and Rhythmic Rule as cyclic rules and Diphthongization<sup>6</sup> and Yer Deletion as non-cyclic rules. The derivation in (13) shows how the cyclic application of these rules solves the paradox above.

(13) Derivation of *stebiel* and *čielec* with cyclic and non-cyclic phonology blocks

	"stalk (gen. pl.)"	"forehead (dim. gen. pl.)"
Full Morphology	stebEl+O	čel+Ec+O
Cycle 1 Input	stebEl+O	čel+Ec

<sup>6</sup>Rubach (1993) splits Diphthongization into two processes, a cyclic process which adds a mora and a [+high] feature and a non-cyclic process which spells out that mora and feature node. The motivation for this is the interaction with some other processes involving high vowels and glides. Because those other processes are not relevant to the discussion here, I place Diphthongization in the non-cyclic block for simplicity.

Yer Vocalization	stebelO	čelEc
Vowel Lengthening	stebéIO	čélEc
Rhythmic Law	—	—
<hr/>		
Cycle 2 Input		čélEc+O
Yer Vocalization		čélecO
Vowel Lengthening		čélécO
Rhythmic Law		čélecO
<hr/>		
Non-cyclic Input	stebéIO	čélecO
Diphthongization	stebielO	čielecO
Yer Deletion	stebiel_	čielec_
<hr/>		
Output	stebiel	čielec

Note that the application of Yer Vocalization, Vowel Lengthening, and Rhythmic Law must be applied to the addition of each morpheme separately in order to calculate the correct output (and not end up with the paradox of (11) or (12)). However, Yer Deletion cannot be calculated at the same time because, for example, the yer from Cycle 1 *čélEc* must persist through to Cycle 2 in order to be vocalized. That is, applying Yer Deletion at the addition of every morpheme generates the incorrect output, as shown in (14):

(14) Incorrect cyclic application of all rules

	"forehead (dim. gen. pl.)"
Full Morphology	čel+Ec+O
<hr/>	
Cycle 1 Input	čel+Ec
Yer Vocalization	—
Vowel Lengthening	čélEc
Rhythmic Law	—
Diphthongization	čielEc
Yer Deletion	čiel_c
<hr/>	
Cycle 2 Input	čiel_c+O

Yer Vocalization	—
Vowel Lengthening	—
Rhythmic Law	—
Diphthongization	—
Yer Deletion	čielc_
<hr/>	
Output	*čielc

The theory underlying Cyclic Phonology is that there are two blocks of phonological processes. One block of processes, the cyclic phonology, is directly related to morphological structure because it applies every time a morpheme is added to the structure (ignoring, for the moment, non-cyclic morphemes, to be discussed below). The other block, the non-cyclic phonology, is "not sensitive" to the morphology in that it applies only once at the end of the derivation.

### 2.2.2 Piece-based approach

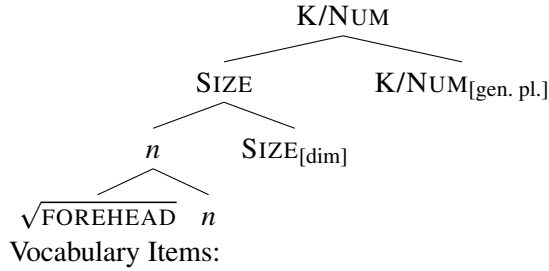
We saw above that there must be two different categories of phonological processes which are calculated at different points in a derivation. What does this mean for piece-based approach?

First, the nature of cyclic morphemes shows us that we must be able to execute some phonological calculation piece by piece. Second, there is some other phonological calculation which critically does not take place piecewise but waits until some endpoint to apply. In subsequent chapters, I will discuss how the non-cyclic phonology is perhaps not as insensitive to the morphology as portrayed here, but it is certainly true that it does not apply iteratively to each morpheme as the cyclic phonology block does. Setting aside this discussion of non-cyclic phonology for later, let us examine how to explain the cyclic phonology phenomenon in a piece-based framework.

For example, let's take a possible structure and vocabulary items for *čielec* "forehead (dim. gen. pl.)", shown in (15):

(15) Possible structure<sup>7</sup> and vocabulary items for *čielec* "forehead (dim. gen. sg.)"

<sup>7</sup>The exact labels on nodes are not important here. Furthermore, the ordering of *n* and the diminutive head could also be reversed, see, e.g., De Belder et al. (2009). The diminutive could be a lower head merged directly with the root before addition of the *n* head. This configuration would not change the morphophonology under discussion here, so it will not be addressed further.



- $\sqrt{\text{FOREHEAD}} \leftrightarrow /čel/$
- $n \leftrightarrow \emptyset$
- $n_{\text{dim}} \leftrightarrow /-Ec/$
- $K/NUM_{[\text{gen. pl.}]} \leftrightarrow /-O/$

The calculation of the cyclic phonology must be able to apply to the structure taking the addition of one node at a time. That is, in order to correctly derive the the output as in (13), some phonological calculation must be performed on /čel+Ec/ before it applies to /čelEc+O/.

I propose a simple algorithm to iterate through the morphological structure, gather phonological exponents and add them to a phonocyclic buffer.

- (16) Algorithm for calculating cyclic phonology. Traversing across linearized morphological structure left to right:
- a. Insert Vocabulary Item for morpheme
  - b. Integrate phonology into the phonocyclic buffer
  - c. If new material is integrated, perform phonological operations (cyclic phonology) on buffer

An explicit walk through the derivation of *čielec* is given in (17):<sup>8</sup>

- (17) Derivation of *čielec* "forehead (dim. gen. pl.)"

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{FOREHEAD}} - n - \text{SIZE}_{[\text{dim}]} - K/NUM_{[\text{gen. pl.}]}$   
 UR vocabulary items:  $/čel/ - \emptyset - /Ec/ - /O/$

<sup>8</sup>Here, I show all the morphemes linearized together, although work on the syntactic side of morphology suggests that the morphemes which are visible at any given time are a function of syntactic spell-out.

- |    |  |  |
|----|--|--|
| 2. | Integrate leftmost node                              | $\sqrt{\text{FOREHEAD}}$   |
|    | 2a. Vocabulary Insertion                             | /čel/  |
|    | 2b. Integrate into buffer                            | $\boxed{\text{čel}}$   |
| 3. | Integrate Next Node                                  | $\sqrt{\text{FOREHEAD} - n}$   |
|    | 3a. Vocabulary Insertion                             | $\boxed{\text{čel}} + \emptyset$   |
|    | 3b. Integrate into buffer                            | $\boxed{\text{čel}}$   |
|    | 3c. Cyclic Phonological Integration                  | (nothing to integrate)   |
| 4. | Integrate Next Node                                  | $\sqrt{\text{FOREHEAD} - n - \text{SIZE}_{[\text{dim}]}}$  |
|    | 4a. Vocabulary Insertion                             | $\boxed{\text{čel}} + /Ec/$  |
|    | 4b. Integrate into buffer                            | $\boxed{\text{čelEc}}$   |
|    | 4c. Cyclic Phonological Integration:                 |  |
|    | Cyclic Phonology Applies:                            | $\boxed{\text{čélEc}}$   |
|    | (Vowel Lengthening)                                  |  |
| 5. | Integrate Next Node                                  | $\sqrt{\text{FOREHEAD} - n - \text{SIZE}_{[\text{dim}]} - \text{K}/\text{NUM}_{[\text{gen. pl.]}}$ |
|    | 5a. Vocabulary Insertion                             | $\boxed{\text{čélEc/}} + /O/$  |
|    | 5b. Integrate into buffer                            | $\boxed{\text{čélEcO}}$  |
|    | 5c. Cyclic Phonological Integration:                 |  |
|    | Cyclic Phonology Applies:                            | $\boxed{\text{čélecO}}$  |
|    | (Yer Vocalization, Vowel Lengthening, Rhythmic Rule) |  |
|    | (Output after non-cyclic phonology:                  | čielec )   |

Integrating each exponent individually provides the same repetition of phonological rule application as seen in the Cyclic Phonology solution in (13). That is to say, this is a particular implementation of a cyclic phonology theory. The output here in (17) is the same as the stage in (13) before the non-cyclic phonology applies. This implementation makes some critically different predictions from Cyclic Phonology, however, with respect to the interaction of non-cyclic nodes. This will be discussed further in the next section.

One caveat on the derivation above is that we actually do not want a cycle of phonology to run



on the *n* head. Although it has no effect on the derivation of *čielec*, with a different root, such as our other example *stebiel* "stalk (gen. pl.)", running a cycle on the *n* head derives the wrong output. As shown in (18), if the cyclic phonology is run at the *n* head, it causes the yer in the root to lengthen the first root vowel, causing problems later in the derivation.

(18) Incorrect Derivation of \**stiebel* (cf. *stebiel* "stalk (gen. pl.)")

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{STALK}} - n - \text{K/NUM}_{[\text{gen. pl.}]}$   
 UR vocabulary items: /stebEl/ -  $\emptyset$  - /O/
  2. Add leftmost node to buffer  $\sqrt{\text{STALK}}$ 
    - 2a. Vocabulary Insertion /stebEl/
    - 2b. Integrate into buffer stebEl
  3. Cyclic Integration of Next Node  $\sqrt{\text{STALK}} - n$ 
    - 3a. Vocabulary Insertion stebEl +  $\emptyset$
    - 3b. Integrate into buffer stebEl
    - 3c. Cyclic Phonological Integration:
      - Cyclic Phonology Applies: stébEl ← Problematic!
      - (Vowel Lengthening)
  4. Cyclic Integration of Next Node  $\sqrt{\text{STALK}} - n - \text{K/NUM}_{[\text{gen. pl.}]}$ 
    - 4a. Vocabulary Insertion stébEl + /O/
    - 4b. Integrate into buffer stébElO
    - 4b. Cyclic Phonological Integration:
      - Cyclic Phonology Applies: stébelO
      - (Yer Vocalization, Vowel Lengthening, Rhythmic Rule)
- (Output after non-cyclic phonology: \**stiebel*, cf. *stebiel* )

In (18) Step 3, if the cyclic block of phonology is run, the yer in the root causes Vowel Lengthening to apply to the first root vowel. This causes Rhythmic Rule to apply at the cyclic phonology of Step 4, ultimately resulting in diphthongization of the first vowel instead of the second (\**stiebel* instead of *stebiel*).

There are a few possible solutions to this problem. One possibility is that only morphemes with overt exponents are able to call the cyclic phonology. This would make sense if the cyclic phonology is about integration of phonological material into a buffer. If there is no new material to add, there is no reason to run the phonology associated with the integration process.

While this strategy (explicit exponent = cyclic) may be a strategy that some languages or speakers employ, it does not seem to be universal. We will see below in the case study of Spanish in Section 2.4 that phonologically null exponents can trigger a pass of the cyclic phonology, even though they add no new material. A further discussion of this point is given in Section 2.5.1.

For Slovak, the nominal heads with null exponents must not trigger the cyclic phonology, as mentioned for *čielec* above. As such, the correct derivation of *stebiel* is given in (19)

(19) Derivation of *stebiel* "stalk (gen. pl.)"

- |    |                                      |  |
|----|--------------------------------------|--|
| 1. | Linearize Morphosyntactic Structure: | $\sqrt{\text{STALK}} - n - \text{K/NUM}_{[\text{gen. pl.}]}$                     |
|    | UR vocabulary items:                 | /stebEl/ - $\emptyset$ - /O/   |
| 2. | Add leftmost node to buffer          | $\sqrt{\text{STALK}}$  |
|    | 2a. Vocabulary Insertion             | /stebEl/   |
|    | 2b. Integrate into buffer            | <span style="border: 1px solid black; padding: 2px;">stebEl</span>               |
| 3. | Cyclic Integration of Next Node      | $\sqrt{\text{STALK}} - n$  |
|    | 3a. Vocabulary Insertion             | <span style="border: 1px solid black; padding: 2px;">stebEl</span> + $\emptyset$ |
|    | 3b. Integrate into buffer            | <span style="border: 1px solid black; padding: 2px;">stebEl</span>               |
|    | 3c. Cyclic Phonological Integration: | (nothing to integrate)   |
| 4. | Cyclic Integration of Next Node      | $\sqrt{\text{STALK}} - n - \text{K/NUM}_{[\text{gen. pl.}]}$                     |
|    | 4a. Vocabulary Insertion             | <span style="border: 1px solid black; padding: 2px;">stebEl</span> + /O/         |
|    | 4b. Integrate into buffer            | <span style="border: 1px solid black; padding: 2px;">stebElO</span>              |
|    | 4b. Cyclic Phonological Integration: |  |
|    | Yer Vocalization:                    | <span style="border: 1px solid black; padding: 2px;">stebelO</span>              |
|    | Vowel Lengthening:                   | <span style="border: 1px solid black; padding: 2px;">stebéIO</span>              |
|    | Rhythmic Law:                        | <span style="border: 1px solid black; padding: 2px;">stebéIO</span>              |
|    | Non-cyclic phonology:                |  |

Diphthongization:	stebielO
Yer Deletion:	stebiel_
Output:	stebiel

In this section I have motivated the distinction between two blocks of phonological processes, that which applies cyclically with each affix and that which applies once at the end. In the next section, I will introduce noncyclic nodes and how they interact with the phonocyclic buffer and the cyclic phonology.

### 2.2.3 Slavic Prefixes and Non-cyclic Morphemes

One of the interesting phenomena involving yers in Slavic languages is the behavior of verbal prefixes. Slavic has a set of verbal prefixes which productively attach to verbal roots to affect the meaning (see, e.g., Svenonius 2004 and sources cited therein). Many of these prefixes contain a yer, which is variably vocalized depending on the context. Examples of these prefixes in Slovak are given in (20):

(20) Yer alternations in prefixes (Rubach 1993, p.158)

Prefix UR	Deleted Yer	Vocalized Yer
odO	od+plat+i+t' "pay back"	odo+hr+a+t' "play back"
rozO	roz+plak+a+t' "weep"	rozo+dn+i+t' "to dawn"
podO	pod+pál+i+t' "burn"	podo+tk+nú+t' "mention"
zO	z+mraz+i+t' "freeze"	zo+sch+nú+t' "dry up"
vO	v+pad+nú+t' "fall into"	vo+pcha+t' "to stick"

These prefixes are cyclic in Slovak and behave precisely as expected if they are the leftmost morpheme.<sup>9</sup> That is, the yer in the prefix is vocalized if there is an underlying yer in the root regardless of the future fate of the yer in the root.

For example, take three different words involving the root *pÄn*:<sup>10</sup>

<sup>9</sup>The processing order could also start with the root and then add the prefix. Note that if the first integration step involves two exponents, it does not matter whether the root or the prefix is processed first, only that these two are processed together.

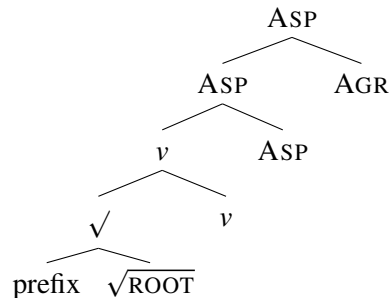
<sup>10</sup>Note here the Ä yer of Slovak behaves exactly like the other yers but has /ä/ as its vocalized form.

- (21) Yer behavior with the root  $p\ddot{A}n$ <sup>11</sup> (Rubach 1993, pp. 158–160)
- |                                   |                         |
|-----------------------------------|-------------------------|
| UR "undo"                         | odO+p $\ddot{A}n$       |
| Infinitive "to undo"              | odo+p $\ddot{a}+t'$     |
| 1sg Present "I undo"              | odo+pn+em               |
| 3pl Derived Imperfect "they undo" | odo+p $\acute{I}n+aj+ú$ |

Note that despite three different surface outcomes of the root yer ( $/\ddot{a}/$ ,  $\emptyset$ ,  $/i'/$ ), the yer in the prefix is always vocalized to  $/o/$ . Compare this with the deleted yer in this prefix with the root  $/plat/$  which has a full vowel  $odplatit'$  in (20).

This pattern falls out naturally if the prefix is a normal cyclic morpheme which attaches to the root low, structure shown in (22):

- (22) Structure of prefixed verb



The first cycle of phonology, then, integrates the prefix and the root into the buffer. At this point, no phonological processes have been applied to the root, so it has its underlying form  $/p\ddot{A}t/$ . Thus for all three forms in (21), the first cycle is shown in (23):

- (23) First pass of cyclic phonology on prefix  $/odO/$  and root  $/p\ddot{A}n/$

Cyclic Integration of Nodes	PREFIX - $\sqrt{\text{ROOT}}$
a. Vocabulary Insertion	$/odO/ + /p\ddot{A}n/$
b. Integrate into buffer	$odOp\ddot{A}n$
b. Cyclic Phonological Integration:	

<sup>11</sup>Two other phonological processes are at play in these examples: Nasal Deletion, which deletes a nasal consonant before another consonant, and Derived Imperfect Raising, which is a morphologically triggered rule which raises (and lengthens) yers to  $/i'/$  before the Derived Imperfect morpheme  $/aj/$ . See Section 5.2 on Derived Imperfect Raising. For further details, see Rubach (1993).

Cyclic Phonology Rules:

Yer Vocalization:

odopÄn

From that point, whether the yer in the root is vocalized, deleted, or raised, it does not affect the outcome of the yer in the prefix. Once vocalized, there is no mechanism for undoing the vocalization. Thus, in Slovak, it seems that the prefixes are unexceptional in their behavior as cyclic morphemes.

However, in Polish (Booij and Rubach 1984; Rubach 1984; Gussmann 1980, 2007; Rubach and Booij 1990), as well as most (if not all) other Slavic languages, the prefixes behave differently (Pesetsky 1979; Halle and Nevins 2009, see, e.g.,). Compare the same lexical items from Slovak in (21) with those from Polish:

- (24) Slovak and Polish prefix yer minimal pairs (Rubach 1993, pp. 159–160)
- |         |           |           |                                 |
|---------|-----------|-----------|---------------------------------|
|         | "to undo" | "I undo"  | "They undo" (Derived Imperfect) |
| Slovak: | odo+pä+t' | odo+pn+em | odo+pín+aj+ú                    |
| Polish: | od+piä+ć  | ode+pn+ę  | od+pin+aj+a                     |

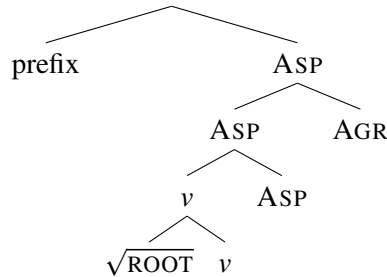
Note that the yer in the Polish prefix /odE/ is sensitive to the final outcome of the yer in the root. When the yer of the root is vocalized, as in *odpiäć*,<sup>12</sup> or raised, as in *odpinaja*,<sup>13</sup> the yer of the prefix is unvocalized and gets deleted. Only in the case where the yer of the root is unvocalized, as in *odep\_nę*, does the yer of the prefix surface vocalized.

In order for this to happen, the prefix must not be processed until after the other affixes. There are several possibilities as to why this might be the case. One possibility is that the prefixes attach higher in the morphosyntactic structure and the cyclic phonological processing happens from bottom up in the tree structure rather than from left to right in the linearized structure. Under this hypothesis, the Polish prefixed verb would have the structure in (25):

<sup>12</sup>This yer is also subject to lowering and nasalization resulting in the surface form /ä/.

<sup>13</sup>This yer is subject to Derived Imperfect raising, as in Slovak.

(25) High attachment of prefix



While this structure would solve the phonological problem, there is little motivation for it. Rather, the prefix seems to be very low, due to its idiosyncratic semantic interaction with the root (see, e.g., Babko-Malaya 1999; Svenonius 2004). The prefix must also be low enough in the structure to appear in participles and other verbal structures which do not contain higher heads. Additionally, the prefix-root interactions at every level except the phonology are practically identical in all Slavic languages. It would be strange, then, to posit that Slovak has low attaching prefixes while all the other languages have high attaching prefixes.

Another possibility is that languages can choose what order to process their exponents in. Booij and Rubach (1984), for example, propose that Polish prefixes are cyclic but are always processed after other cyclic morphemes. While this can derive the right form, without evidence of other sorts of this kind of "ordering by fiat", we would ideally like to derive the output through some principled mechanism (or at least, an arbitrary mechanism that is seen elsewhere).

Here, following Halle and Nevins (2009), I propose that Polish prefixes are diacritically labelled as non-cyclic (or vice-versa: that all suffixes are labelled as cyclic).<sup>14</sup> I will postpone the more complete discussion of a diacritic solution versus a structural solution for Section 2.3.2.2 below as part of the discussion of the English case study.

In the framework proposed here, the non-cyclic diacritic tells the mechanism that non-cyclic exponents are not added to the phonocyclic buffer being calculated during the cyclic phonology.

An example of this derivation is given in (26), with the non-cyclic diacritic notated as a superscript

<sup>14</sup>Note that in Halle and Nevins's (2009) analysis the prefixes are non-cyclic which for them means that the material is added to the phonological workspace but the cyclic phonology is not run. Yers in the prefix are prevented from lowering in later cycles through phonological strict cyclicity, which (by fiat) prevents changes which should have been made in a previous pass of the cyclic phonology. This is a different explanation than the one I propose here, where non-cyclicity means no interaction with the phonological workspace (the phonocyclic buffer). These two analyses, then, make substantially different predictions about the availability of non-cyclic exponents to later passes of cyclic phonology. Halle and Nevins predict that the material is available (although blocked by strict cyclicity). I predict that the material is not available (until the non-cyclic phonology).

"{nc}". Note that the rules employed here are following Rubach (1984).

(26) Derivation of Polish *odpiąć* with non-cyclic prefix

1. Linearize Morphosyntactic Structure:	prefix - $\sqrt{\text{ROOT}}$ - v - ASP <sub>[infin]</sub>
UR vocabulary items:	/odE/ <sup>{nc}</sup> - /p <sup>j</sup> en/ - $\emptyset$ - /ć/
2. Integration of leftmost node	prefix
2a. Vocabulary Insertion	/odE/ <sup>{nc}</sup>
	non-cyclic, no buffer integration
3. Integration of Next Node	prefix - $\sqrt{\text{ROOT}}$
3a. Vocabulary Insertion	/odE/ <sup>{nc}</sup> - /p <sup>j</sup> En/
3b. Add cyclic node to buffer	/odE/ <sup>{nc}</sup> - <span style="border: 1px solid black; padding: 2px;">/p<sup>j</sup>En/</span>
4. Integration of Next Node	prefix - $\sqrt{\text{ROOT}}$ - v
4a. Vocabulary Insertion	/odE/ <sup>{nc}</sup> - <span style="border: 1px solid black; padding: 2px;">/p<sup>j</sup>En/</span> + $\emptyset$
4b. Add cyclic node to buffer	/odE/ <sup>{nc}</sup> - <span style="border: 1px solid black; padding: 2px;">p<sup>j</sup>En + <math>\emptyset</math></span>
	No new material to integrate
5. Integration of Next Node	prefix - $\sqrt{\text{ROOT}}$ - v - ASP <sub>[infin]</sub>
5a. Vocabulary Insertion	/odE/ <sup>{nc}</sup> - <span style="border: 1px solid black; padding: 2px;">/p<sup>j</sup>En/</span> + /ć/
5b. Add cyclic node to buffer	/odE/ <sup>{nc}</sup> - <span style="border: 1px solid black; padding: 2px;">p<sup>j</sup>En + ć</span>
	Cyclic Phonology Rules:
	Prenasal Vowel Shift: <sup>15</sup> <span style="border: 1px solid black; padding: 2px;">p<sup>j</sup>an + ć</span>
	Nasal Deletion: <sup>15</sup> <span style="border: 1px solid black; padding: 2px;">p<sup>j</sup>a + ć</span>
Input to non-cyclic phonology:	/odE/+p <sup>j</sup> ać/
Non-cyclic Yer Vocalization:	—
Non-cyclic Yer Deletion:	od_p <sup>j</sup> ać
Output after non-cyclic phonology:	odp <sup>j</sup> ać (orthographic <odpiąć>)

In (26), the non-cyclic prefix is examined in Step 2, but because it is marked as non-cyclic, it is not added to the buffer. This removes it from any of the cyclic phonology calculation which are

<sup>15</sup>See Rubach (1984) for further discussion of the rules, their motivation and their ordering.

applied to the material in the buffer. When it comes time to apply the non-cyclic phonology, the buffer is irrelevant, its contents are simply linearized next to the rest of the phonological material for the purposes of the application of the non-cyclic phonological block. This plays a role in the derivation of *odepnę* in (27), in which the yer of the prefix is vocalized non-cyclically.

(27) Derivation of Polish *odepnę* with non-cyclic prefix

1.	Linearize Morphosyntactic Structure: UR vocabulary items:	prefix - $\sqrt{\text{ROOT}} - \nu - \text{T} - \text{AGR}_{[1 \text{ sg.}]}$ $/\text{odE}/^{\{\text{nc}\}} - /p^j\text{En}/ - \emptyset - \emptyset - /ɛ/$
2.	Integration of leftmost node 2a. Vocabulary Insertion	prefix $/\text{odE}/^{\{\text{nc}\}}$  non-cyclic, no buffer integration
3.	Integration of Next Node 3a. Vocabulary Insertion 3b. Add cyclic node to buffer	prefix - $\sqrt{\text{ROOT}}$ $/\text{odE}/^{\{\text{nc}\}} - /p^j\text{En}/$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{/p^j\text{En}/}$
4.	Integration of Next Node 4a. Vocabulary Insertion 4b. Add cyclic node to buffer	prefix - $\sqrt{\text{ROOT}} - \nu$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{/p^j\text{En}/} + \emptyset$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{p^j\text{En} + \emptyset}$  No new material to integrate
5.	Integration of Next Node 5a. Vocabulary Insertion 5b. Add cyclic node to buffer	prefix - $\sqrt{\text{ROOT}} - \nu - \text{T}$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{/p^j\text{En}/} + \emptyset$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{p^j\text{En} + \emptyset}$  No new material to integrate
6.	Integration of Next Node 6a. Vocabulary Insertion 6b. Add cyclic node to buffer	prefix - $\sqrt{\text{ROOT}} - \nu - \text{T} - \text{AGR}_{[1 \text{ sg.}]}$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{/p^j\text{En}/} + /ɛ/$ $/\text{odE}/^{\{\text{nc}\}} - \boxed{p^j\text{En} + ɛ}$
	Cyclic Phonology Rules:	— (no relevant changes) <sup>16</sup>
	Input to non-cyclic phonology:	$/\text{odE}/+/p^j\text{En}ɛ/$

<sup>16</sup>Prenasal Vowel Shift and Nasal Deletion only apply when the nasal segment is in the syllable coda (Rubach 1984). Because the agreement morpheme is a vowel here, the /n/ is syllabified in the onset and these processes do not apply.



Non-cyclic Yer Vocalization:	odep <sup>j</sup> Ene
Non-cyclic Yer Deletion:	odep <sup>j</sup> _ne
Non-cyclic Depalatalization: <sup>17</sup>	odepne
Output after non-cyclic phonology:	odepne

Note that we need to introduce an additional application of Yer Vocalization in the non-cyclic component. If this non-cyclic Yer Vocalization rule were not present, the yer of the non-cyclic prefix would never get a chance to vocalize due to its non-cyclic status.

I have just posited that non-cyclic morphemes do not get integrated into the phonocyclic buffer, and, because of that, do not participate in the cyclic phonology. However, there must be some point at which the non-cyclic morphemes are integrated so that the entire word can be processed by the non-cyclic phonology.

### 2.2.3.1 Integration of Non-cyclic Morphemes

In the Slavic cases here the non-cyclic morphemes are prefixes, but in the English case study to be presented in Section 2.3, there seem to be cyclic and non-cyclic morphemes interspersed with each other (for example, *environ-ment<sup>(nc)</sup>-al<sup>+</sup>-ly<sup>(nc)</sup>*). How does the buffer respond to this?

Using Slavic, we can show that non-cyclicality is not just a pass on the cyclic block of rules. That is, it is not the case that non-cyclic morphemes are added to the phonocyclic buffer but block or otherwise fail to trigger the application of cyclic phonology. Rather, non-cyclic morphemes are critically non-interactive with the buffer, meaning that they are not included in any of the calculations of the cyclic phonology. Additionally, as will be shown in English in Section 2.3, they seem to block the interaction of cyclic morphemes with the buffer if they are linearly intervening.

For example, if we look at past tense of prefixed verbs in Polish, there the first (overt) morpheme following the prefix and root is the ASP head. The exponent of this head here is /t/, which does not contain a yer. If the prefix were integrated into the phonocyclic buffer when this ASP head was calculated, we would expect an interaction of the yers of the prefix and root cyclically rather than

<sup>17</sup>Palatalized labials lose their palatalization when not followed by a syllable nucleus, see Gussmann (2007, p. 41).

non-cyclically, as we actually see in the data.

(28) Polish Prefixal Verb Past Tense Data (Booij and Rubach 1984)

rozsechł “he dried”

Exponents: rozE<sup>{nc}</sup>- sEch -∅ -ł -O

Morphemes: prefix root v ASP AGR<sub>[3.sg.M.]</sub>

If the prefix were simply added to the phonocyclic buffer but the cyclic phonological calculation was not processed during that step, we derive the incorrect interaction of yers, as shown in (29):

(29) Incorrect derivation using integration of non-cyclic prefix

1. Linearize Morphosyntactic Structure: prefix -  $\sqrt{\text{ROOT}}$  - v - ASP - AGR<sub>[3.sg.M.]</sub>  
 UR vocabulary items: /rozE/<sup>{nc}</sup> - /sEch/ - ∅ - /ł/ - /O/
2. Integration of Prefix and Root prefix -  $\sqrt{\text{ROOT}}$ 
  - 2a. Vocabulary Insertion /rozE/<sup>{nc}</sup> - /sEch/
  - 2b. Add nodes to buffer rozEsEch
  - 2c. — No cyclic phonology because of {nc} diacritic
3. Integration of Next Node prefix -  $\sqrt{\text{ROOT}}$  - v
  - 3a. Vocabulary Insertion rozEsEch + ∅
  - 3b. Add node to buffer rozEsEch
  - No new material to integrate
4. Integration of Next Node prefix -  $\sqrt{\text{ROOT}}$  - v - ASP
  - 4a. Vocabulary Insertion rozEsEch + /ł/
  - 4b. Add node to buffer rozEsEchł
  - 4c. Cyclic Phonology Rules:
 

Yer Vowering: rozesEchł ← Problematic!
6. Integration of Next Node prefix -  $\sqrt{\text{ROOT}}$  - v - ASP - AGR<sub>[3 masc. sg.]</sub>
  - 5a. Vocabulary Insertion rozEsEchł + /O/
  - 5b. Add node to buffer rozEsEchłO
  - 5c. Cyclic Phonology Rules:
 

Yer Vocalization: rozesechłO

Input to non-cyclic phonology: /rozesechŃO/  
 Non-cyclic Yer Deletion: rozesechŃ\_  
 Output after non-cyclic phonology: \*rozesechŃ (cf. rozsechŃ)

The integration of the prefix into the phonocyclic buffer in Step 2 of (29) results in the vocalization of the prefix's yer during the cyclic phonology block of Step 3. This is problematic because the correct form has the yer of the prefix deleted rather than vocalized.

Instead, it must be the case that the non-cyclic morphemes are held outside the phonocyclic buffer throughout the entire cyclic part of the derivation. The buffer and the non-cyclic morphemes are only integrated together when the calculation of the non-cyclic phonology begins. The correct derivation is shown in (30):

(30) Correct derivation using non-integration of non-cyclic prefix

1. Linearize Morphosyntactic Structure: prefix -  $\sqrt{\text{ROOT}}$  - *v* - ASP - AGR<sub>[3.sg.M.]</sub>  
 UR vocabulary items: /rozE/<sup>{nc}</sup> - /sEch/ -  $\emptyset$  - /Ń/ - /O/
2. Integration of Prefix and Root  $\text{prefix} - \sqrt{\text{ROOT}}$ 
  - 2a. Vocabulary Insertion /rozE/<sup>{nc}</sup> + sEch
  - 2b. — No integration because of {nc} diacritic
3. Integration of Next Node  $\text{prefix} - \sqrt{\text{ROOT}} - v$ 
  - 3a. Vocabulary Insertion /rozE/<sup>{nc}</sup> + sEch +  $\emptyset$
  - 3b. Add node to buffer /rozE/<sup>{nc}</sup> + sEch

No new material to integrate
4. Integration of Next Node  $\text{prefix} - \sqrt{\text{ROOT}} - v - \text{ASP}$ 
  - 4a. Vocabulary Insertion /rozE/<sup>{nc}</sup> + sEch + /Ń/
  - 4b. Add node to buffer /rozE/<sup>{nc}</sup> + sEchŃ
  - 4c. Cyclic Phonology Rules: (no changes made)
6. Integration of Next Node  $\text{prefix} - \sqrt{\text{ROOT}} - v - \text{ASP} - \text{AGR}_{[3.sg.M.]}$ 
  - 5a. Vocabulary Insertion /rozE/<sup>{nc}</sup> + sEchŃ + /O/
  - 5b. Add node to buffer /rozE/<sup>{nc}</sup> + sEchŃO

### 5c. Cyclic Phonology Rules:

Yer Vocalization:	sechŃO
Input to non-cyclic phonology:	/rozE/ + /sechŃO/
Non-cyclic Yer Vocalization:	—
Non-cyclic Yer Deletion:	roz_sechŃ_
Output after non-cyclic phonology:	rozsechŃ

As shown in the comparison between (29) and (30), it is critical that the prefix is held outside the phonocyclic buffer and not integrated in order to correctly derive the surface behavior of the yers. It is interesting to note, however, that even though the prefix is hierarchically intervening between the root and the suffixes, as shown in the tree in (22), the suffixes and root still interact with each other in the phonocyclic buffer. I propose that the interaction and participation with the phonocyclic buffer is based purely on linear adjacency and not hierarchical relationships. This follows from the calculation of phonology being after the linearization of the morphosyntactic structure.

We will return to this issue of linear adjacency and the phonocyclic buffer in the discussion of English in Section 2.3 where we will see some linear interleaving of cyclic and non-cyclic affixes and explore how they interact with each other and with the phonocyclic buffer.

Another crucial comparison to mention is that other implementations of Cyclic Phonology (such as Halle and Nevins 2009) propose that non-cyclic nodes available to the workspace of the cyclic phonology but (i) do not trigger a pass of the cyclic phonology when they are added to the structure and (ii) are protected by “strict cyclicity” in subsequent cycles. As I showed in (29), the integration of non-cyclic material into a cyclic workspace (here “buffer”) is problematic without “strict cyclicity”, but it is also unclear what exactly “strict cyclicity” is. It is not clear why in such a system the non-cyclic phonology is able to modify information that the cyclic phonology cannot.

#### 2.2.4 Case Study Conclusion

In this case study, I motivated the need for two different types of phonological blocks (cyclic and noncyclic) by comparing the behavior of the processes of Yer Lowering and Yer Deletion in

Slovak. Further comparison of Slovak with Polish also motivated the fact that there are two types of morphemes, those which are integrated into the phonocyclic buffer and undergo cyclic phonology and those that are not integrated into the phonocyclic buffer. I presented the difference between the two types of morphemes as a diacritic difference, although this was not motivated. This will be discussed in more depth in Section

Another point of interest which needs to be mentioned here is the class division between cyclic and non-cyclic morphemes. In Polish, the two morphemes align along the same classes as prefixes and suffixes. All suffixes are cyclic and all prefixes are non-cyclic. It is tempting, then to present a solution which takes advantage of the prefix/suffix (or left/right) asymmetry in order to account for the phonological behavior. However, in the following case studies we will see that the division between cyclic and non-cyclic falls along other lines in other languages; Spanish seems to employ a strategy of having only non-cyclic morphemes with the exception of theme vowels, and English seems to have a relatively random distribution of cyclic and non-cyclic morphemes (at least for the synchronic speaker). This point will be taken up again in the discussion in Section 2.5.2.

A further discussion of yers and their interaction with the morphophonological process of Derived Imperfect Raising is given in Section 5.2.

### **2.3 English Stress and Derivational Morphology**

In this section, we will discuss the analysis of cyclic phonology in a piece-based framework as introduced in Section 2.2. Here, however, the discussion will focus on English derivational affixes which is interesting because both prefixes and suffixes arbitrarily show cyclic and non-cyclic behavior. This behavior will call for a discussion of the interaction of the phonocyclic buffer with non-cyclic morphemes. We will see that there seems to be some ability to overwrite phonological changes or designations within the phonocyclic buffer. That is, in Section 2.2 we saw a phonological process applying iteratively with each morpheme, but this process never modified or overwrote a change from a previous cycle. With cyclic stress in English, we see a case of overwriting in the change from, for example, *átom* to *atómic* to *àtomícity*. While we must allow for some mechanism to allow overwriting with cyclic morphemes (at least to some extent, see the discussion in Section 2.3.4),

overwriting never occurs across non-cyclic morphemes. In order to explain the lack of overwriting across non-cyclic morphemes, I propose that there is a separate phonocyclic buffer for each group of adjacent cyclic morphemes, discussed in Section 2.3.3.2.

I will also reexamine the issue of alternatives to the cyclic/noncyclic diacritics. We will consider some morphosyntactic explanations in Section 2.3.2.1, but ultimately these solutions are not viable in that they disrupt the generalizations that the morphosyntactic system makes about the syntax and semantics of forms and do not sufficiently explain the data in a way that calls for this sort of alteration of the morphosyntax.

However, there is quite a bit of previous literature on English stress. I will start with a discussion of this literature and the generalizations made therein. The discussion of other accounts of the data in other frameworks and possible alternate accounts within a piece-based syntactic morphology follow. Finally, the implementation of English stress in the framework presented here is fleshed out and further discussion is given to overwriting.

## **2.3.1 Data and Background**

### **2.3.1.1 Illustrative Data**

Siegel (1974), following observations from Chomsky and Halle (1968), notes that English derivational affixes have two phonological and morphological behaviors and divides the affixes into two classes, examples shown in (31):

- (31) Examples of English affixes in two classes (Siegel 1974; Fabb 1988; Plag 2003)
- Class 1 suffixes: -al, -ate, -ic, -ion, -ity, -ive, -ous, -y<sub>N</sub>
  - Class 1 prefixes: be-, con-, de-, en-, in-, pre-, re-, sub-, para-, dis-,
  - Class 2 suffixes: -able, -er, -ful, -hood, -ist, -ize, -less, -ly, -ness, -wise, -y<sub>A</sub>
  - Class 2 prefixes: anti-, de-, non-, re-, sub-, un-, semi-, pro-

Siegel makes several observations about the morphological and phonological behavior of these classes:

- (32) Three generalizations about English Class 1 and Class 2 affixes: (Siegel 1974)

- a. Class 1 affixes attach to both words and stems while Class 2 to only words
- b. Class 1 affixes do not attach after Class 2 affixes
- c. Class 2 affixes are stress neutral while Class 1 affixes are not

A great deal of theoretical work has been given to explaining the seemingly unrelated generalizations in (32). Two theories in particular, Lexical Phonology and Stratal Optimality Theory (Stratal OT), take these generalizations to be of primary importance in the formulation of the structure of grammar.

### 2.3.1.2 Explanations given by Lexical Phonology and Stratal OT

To explain the generalizations in (32), some theories of phonology, such as Lexical Phonology (Kiparsky 1982a; Mohanan 1986; *et. seq.*) and Stratal OT (Kiparsky 2000; Bermúdez-Otero in prep), propose distinct submodules of grammar which work on different sized units in order.

Figure 2.1: Schematic of Lexical Phonology (adapted from Kiparsky 1982a and Kenstowicz 1994)

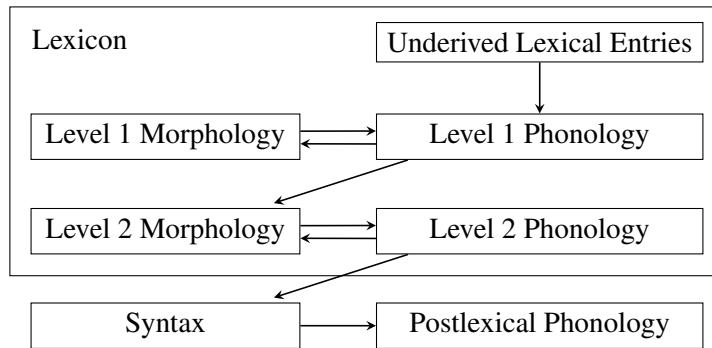
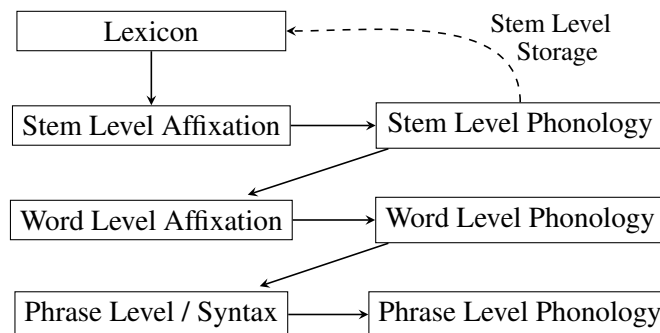


Figure 2.2: Schematic of Stratal Optimality Theory (see Bermúdez-Otero 2003, 2013)



In Lexical Phonology, it is proposed that there are different levels in the grammar which house morphological affixes and phonological processes. The strict structuring of Level 1 affixation before stress-shifting (stem-level) phonology and Level 2 affixation after stress-shifting phonology, accounts for both the generalization that Class 2 affixes are stress neutral and the fact that Class 2 affixes attach outside Class 1 affixes. In addition, defining every output of Level 1 affixation as a “word” results in Class 2 affixes only attaching to “words” (Siegel 1974).

As shown in the schematic in Figure 2.1, Lexical Phonology accounts for the generalizations by segregating the morphology and phonology into levels in the Lexicon. Underived lexical entries move only to Level 1 and the output of Level 1 becomes the input for Level 2. For English, Level 1 contains Siegel’s Class 1 affixes as well as the stress shifting rule, while Level 2 contains the Class 2 affixes. This allows only Class 1 affixes to attach to stems (here, underived lexical entries), deriving generalization (32a). Any output of Level 1 Phonology, whether returning to Level 1 Morphology or moving on to Level 2 Morphology, is to be considered a “word”. Ordering Level 1 strictly before Level 2 ensures that Class 1 affixes cannot attach outside of Class 2 affixes, deriving generalization (32b). Generalization (32c) is derived by having separate phonologies for Level 1 and Level 2, resulting in Class 2 affixes being stress neutral because the stress shifting rule is in Level 1 but not Level 2.

Stratal OT has a very similar basic flow of derivation, as schematized in Figure 2.2. Like Lexical Phonology, the layered architecture accounts for generalizations in (32), although the Levels are no longer housed in the lexicon and are now called “stem” and “word” levels. Although these levels are stated to not be in the lexicon, Stratal OT is not explicit about what exactly these levels are, how they are derived, or what relationship they have to other parts of grammatical structure.

### **2.3.1.3 False Generalizations**

One major problem with the Lexical Phonology and Stratal OT models is that two of the three generalizations in (32) are not true.

Although (32a) claims that Class 2 affixes only attach to words, there are cases of Class 2 affixes attaching to stems (examples of “bound roots”), as shown in (33). And, despite generalization (32b)



that Class 1 affixes do not attach outside of Class 2 affixes, there are cases of exactly this, as shown in (34), known as “level ordering paradoxes” or “level ordering violations” (see, e.g., Kiparsky 1982a).

(33) Examples of Class 2 affixes attaching to stems: (Siegel 1974)  
ruth-less, grue-some, hap-less, feck-less, win-some, ful-some

(34) Examples of Class 1 affixes attaching outside of Class 2 affixes: (see Selkirk 1982; Fabb 1988)

deni-abil<sub>2</sub>-ity<sub>1</sub>, capital-ist<sub>2</sub>-ic<sub>1</sub>, judg-ment<sub>2</sub>-al<sub>1</sub>, un<sub>2</sub>-grammatical-ity<sub>1</sub><sup>18</sup>, standard-iz<sub>2</sub>-ation<sub>1</sub>

In the frameworks of Lexical Phonology and Stratal OT, the exceptions in (33) and (34) are impossible under the most basic analysis. It could be claimed that the examples in (33) are examples of unaffixed roots which coincidentally (or historically but not synchronically) appear to have an affix. However, given the phonological transparency of the suffixes and the fact that they still seem to carry some semantic meaning, it seems more likely that these are examples of bound roots selecting for particular affixes which happen to be Class 2. More evidence of the decomposition of these forms comes from novel formations of these bound roots with other affixes such as *feckful* and *ruthful*.<sup>19</sup>

For the level-ordering paradoxes in (34), there have been several suggestions. Kiparsky (1982b, 2012) suggests that all of these instances of this sort are actually fused portmanteau morphemes, and thus should not be considered violations of the ordering generalization. Selkirk (1982) argues for reanalysis of the Class 2 suffix as part of the root in these cases.<sup>20</sup> However, one critical observation about these ordering paradoxes is that they are not isolated incidents restricted to a few lexical items. Rather, in these cases every instance of certain Class 2 suffixes (e.g., *-able*) seems to license the attachment of certain Class 1 suffixes (e.g., *-ity*). This is true even with nonce roots, as seen in (35):

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<sup>18</sup>With *ungrammaticality* in order to have the correct selectional restrictions for the affixes, they must be attached in the “wrong” order. That is, Class 2 *un-* attaches to an adjective and creates an adjective and Class 1 *-ity* attached to an adjective and forms a noun. Thus, Class 2 *un-* must attach before Class 1 *-ity*.

<sup>19</sup>The OED cites examples of *feckful* from the New York Times, 9 Nov. 1990, and the Sunday Times, 31 Mar. 2002, and an example of *ruthful* from the New York Post, 16 June 2006.

<sup>20</sup>Selkirk (1982, p. 104) specifically notes that there must be two *-ment* suffixes, one of which takes *-al* and another which does not (in, for example, *employment*). Selkirk argues for a reanalysis into a root for all cases of *-ment-al*.

(35) Nonce roots with level ordering paradox suffixes:

dax-abil<sub>2</sub>-ity<sub>1</sub>, wug-ist<sub>2</sub>-ic<sub>1</sub>, blicket-ment<sub>2</sub>-al<sub>1</sub>

An ideal analysis would give an explanation for the generalizations about different types of affixes from (32) without ruling out the apparent exceptions from (33) and (34).

## **2.3.2 Possible approaches in a piece-based framework**

### **2.3.2.1 A Morphosyntactic Hypothesis: Inner- vs. Outer-Attachment**

In Distributed Morphology, we assume that the syntax produces category-defining heads and that (at least some) of these heads cause phonological spell-out (Marantz 2001, 2007, Embick 2014, see also Marvin 2002; Embick and Marantz 2008; Embick 2010a). Following Embick's (2010a) proposal, we maintain that merging category-defining heads causes spell-out of their complements.

This proposal creates a distinction between affixes in the inner domain, e.g., root-attached affixes, and affixes in the outer domain, e.g., non-root-attached affixes. This distinction is necessary because, given the theoretical framework of spell-out, only a root-attached category-defining affix would be accessible during spell-out of the root. This distinction between inner and outer domains has been shown to play an important role in allomorphy and allosemy.

#### **2.3.2.1.1 Inner- and outer-attachment matter for Allomorphy and Allosemy**

In the inner domain, the selection of allomorphs of heads is potentially idiosyncratic to the root, but in the outer domain, it is not (Embick 2010a). For example, root-attached nominal heads show a wide variety of forms, while outer attached nominal heads do not, as shown in (36).

The data in (36a) shows a variety of allomorphs for the nominal in the root-derived and simple cases, but only one allomorph in the gerund cases. This is predicted by Embick (2010a) because the root-derived and simple cases are analyzed as being root attached *n* while the gerund cases have an intervening *v* head, as shown in (36b). The vocabulary items (36c) of the inner *n* heads are conditioned on a variety of lists to which the various roots belong, while the outer *n* head has no conditioning (or perhaps is conditioned by being next to a *v*).

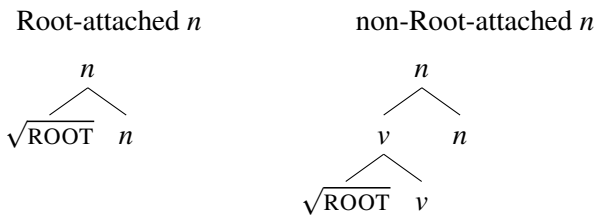
(36) Allomorphy of nominals in inner and outer domain

(Embick 2010a, pp.44–46)

a. Nominals and allomorphy

<i>Derived/Simple</i>	<i>Gerund</i>
refus-al	refus-ing
marri-age	marry-ing
destruct-ion	destroy-ing
break-∅	break-ing

b. Structure for Root-attached *n* vs. non-Root-attached *n*



c. Vocabulary Items for Inner vs. Outer Domain

Inner Domain	Outer Domain
$n \leftrightarrow \text{-al} / \text{LIST1 } \_$	$n \leftrightarrow \text{-ing}$
$n \leftrightarrow \text{-age} / \text{LIST2 } \_$	
$n \leftrightarrow \text{-tion} / \text{LIST3 } \_$	
⋮	

The same inner- and outer-domain distinction is used in some subpart of the meaning system, namely those that relate to polysemy resolution (see, for example, Marantz 2013). That is, if a root-attached head restricts the meaning of a root to a certain subset of possible meanings, meanings not included in that subset cannot be used by outer heads.

(37) Inner- and outer-domain restrictions on meaning choice of  $\sqrt{\text{FIRE}}$ :

form	structure	possible meanings of $\sqrt{\text{FIRE}}$
	$\sqrt{\text{FIRE}}$	{ "a chemical reaction of burning fuel", "excited, passionate", ... }
<i>fiery</i>	$\sqrt{\text{FIRE}+a}$	{ "a chemical reaction of burning fuel", "excited, passionate" }
<i>fire</i>	$\sqrt{\text{FIRE}+n}$	{ "a chemical reaction of burning fuel" }
<i>fire-like</i>	$\sqrt{\text{FIRE}+n+a}$	{ "a chemical reaction of burning fuel" } (crucially not {"excited"})

For example, in (37), let us assume that the root  $\sqrt{\text{FIRE}}$  has several possible meanings including "a chemical reaction of burning fuel" and "excited, passionate". The head attached in the inner domain of the root may select for a subset of these meanings. The adjective head (-y), for example, selects for the subset which contains both those meanings while the null nominal head selects for the subset which only contains the meaning "a chemical reaction of burning fuel". Outer-domain heads cannot access meanings of the root that were excluded from the subset chosen by the inner head, so if an adjective head (-like) is attached to the  $\sqrt{\text{FIRE}+n}$  structure, it only has access to the meaning "a chemical reaction of burning fuel" (as determined by the null nominal head) and not to the other possible meanings of  $\sqrt{\text{FIRE}}$ . That is, *fire-like* cannot access the root meaning "excited, passionate", and thus cannot have a meaning based upon that.

### 2.3.2.1.2 Inner- and outer-attachment do not matter for phonology

Given that the inner- and outer-attachment of heads is important in allomorphy and allosemy, a first hypothesis about the different phonological nature of affixes could be that inner domain affixes show stem-level phonology, while outer domain affixes would be word-level. If this correspondence were true, it would explain stem level affixes attaching to "stems" (here called "roots") while word-level affixes attach to words, since word-level affixes would attach outside a [root + functional head] structure. This hypothesis, however, is not true. There are four pieces of evidence for the falseness of this hypothesis: Class 2 affixes attaching to roots, level-ordering paradoxes, multiple Class 1 affixes, and morphosyntactically identical affixes showing different behavior depending on what exponent is inserted.

Examples of Class 2 suffixes attaching to roots were shown in (33) and examples of Class 2 suffixes attaching outside Class 1 suffixes were shown in (34). In the framework under discussion, we expect exactly one Class 1 affix to attach to a root so having none (in the case of Class 2 on the root)<sup>21</sup> or a Class 1 affix attached elsewhere (as in the level-ordering paradoxes) is a problem.

A further piece of evidence is that words may have multiple Class 1 suffixes, as shown in (38):

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<sup>21</sup>The examples of Class 2 attaching to roots could be construed as having a null head in between the root and the overt affix, for example, *ruthless* as  $\sqrt{\text{RUTH}-n_{\phi}-a_{\text{less}}}$ . As such, this particular argument on its own is not terribly strong. The level ordering paradoxes and the instances of multiple Class 1 affixes are a stronger argument against inner/outer attachment for phonology.

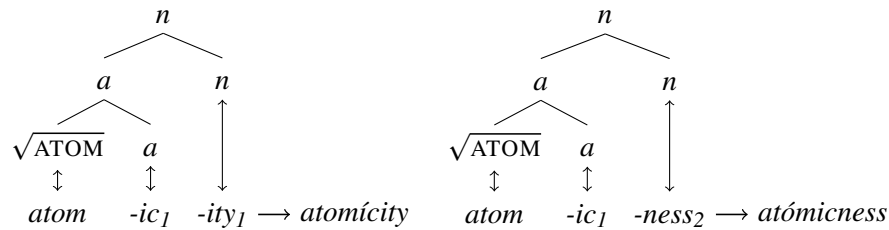
(38) Multiple Class 1 suffixes:

atom-ic<sub>1</sub>-ity<sub>1</sub>, educat-ion<sub>1</sub>-al<sub>1</sub>, monstr-os<sub>1</sub>-ity<sub>1</sub>, rotat-ion<sub>1</sub>-al<sub>1</sub>-ity<sub>1</sub>

If only the root-attached head were able to have Class 1 phonology, there should not be the possibility of having multiple Class 1 affixes because only one syntactic head can be immediately adjacent to a root.

Finally, there are cases where the same morphosyntactic structure resulting in a difference in phonological behavior dependent on the affix inserted. For example, the data in (39) show that the same head (*n*) in the same environment (attaching to [ root + *a* ] ) with approximately the same semantics (forming an abstract noun), results in a different phonological output depending on the exponent chosen.

(39) Same morphosyntactic structure shows stress shift in *atomicity* but not in *atomicness*



There is no morphosyntactic reason to believe that the structure of *atomicity* and *atomicness* is different<sup>22</sup>; Both words seem to be a noun derived from the same adjective head and root. However, the stress shift in *atomicity* shows that *-ity* is a Class 1 suffix while *-ness* is Class 2 (presuming the stress shift is a stem-level process, following Chomsky and Halle 1968; Halle and Vergnaud 1987; Halle 1998, etc.).

It is clear that every instance of a category-defining head does not cause a run of the phonological block, suggesting that the morphosyntactic spell-out process is not equivalent to a pass of the phonology (that is to say, syntactically phase-cyclic is not the same as phonologically cyclic, see Embick 2014). However, it is also not the case that the morphosyntactic structure (inner- vs. outer-attachment) can determine whether a pass of stem-level phonology is run.

<sup>22</sup>If these two *n* heads (*-ity* and *-ness*) are exactly identical, this raises questions for how blocking works in this theory. We might expect only one exponent to be always inserted resulting in the other being ungrammatical. One solution would be to assume that these *n*-heads are slightly different in some way (perhaps some morpho-semantic features, see, e.g. Plag 2003, pp. 66-67), but that they are the same morphosyntactically.

If the information about whether to run the stem-level phonological block is not an automatic result of morphosyntactic spell-out or structure, then it must instead be encoded somewhere else. I will end up positing a diacritic solution in Section 2.3.2.3 below, however, we do not want to give up on the idea of a difference in morphosyntactic structure lightly.

### 2.3.2.2 On the attachment and structure of Class 1 and Class 2

Ideally, all phonological structures would reflect syntactic structures and different phonological behaviors would be the result of underlying syntactic differences. As we saw above, for Class 1 and Class 2 affixes, this does not initially appear to be the case. The difference in phonological behavior does not immediately seem to reflect any syntactic difference. However, syntactic differences have been posited for these classes.

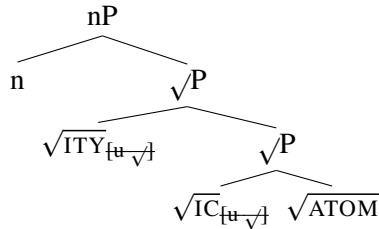
Lowenstamm (2010), for example, posits that the derivational affixes seen in English are not exponents of category defining heads but are roots of their own. Conceptually, his argument is that (at least some) derivational exponents appear to surface as more than one part of speech. For example, words suffixed with *-ic* are usually adjectives, but not always (e.g., *tunic*). Treating derivational affixes as roots presents an interesting solution to this. Lowenstamm posits that these derivational affix-roots have uninterpretable features which force them to syntactically select for either other roots or for full phrases. In the situation where an affix-root select for other roots, the result is that all of the derivational morphology is underneath the category defining head, meaning it is in the same syntactic spell-out cycle. This behavior, then, derives Class 1 affixation, allowing phonological interaction between the exponents because they are in the same cycle. Affix-roots which select for full phrases are in a separate spell-out cycle than the phrase they select and therefore do not interact phonologically. That is, they are Class 2 affixes.

For example, in (40a), both the affix-roots *ic* and *ity* have the uninterpretable feature  $[u \ \checkmark]$  which indicates that they select for root phrases only. The only category defining head (here, *n*) is merged above the three roots. This triggers spells out of the root and the Class 1 affixes in the same cycle. By contrast, in (40b), *ness* has the uninterpretable feature  $[u \ xP]$  which indicates that it selects for a phrase. Because of this, it cannot attach directly to the root complex. Instead, it can attach to the

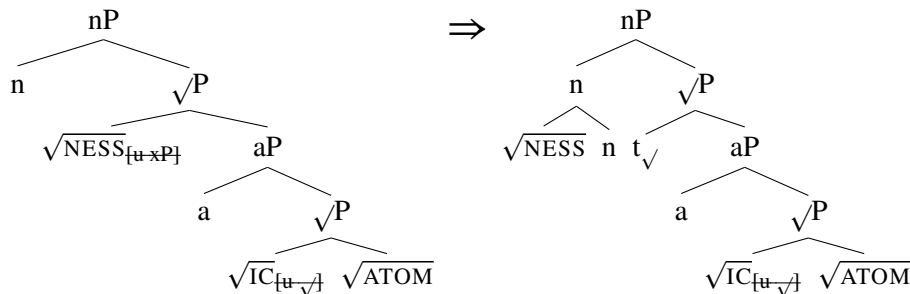
phrase that is a category defining head plus the root complex. The result is that the lower roots (*atom* and *ic*) are in one spell-out phase, but *ness* is in a different phase.

(40) Structures as proposed by Lowenstamm (2010)

a. Class 1 Affixation



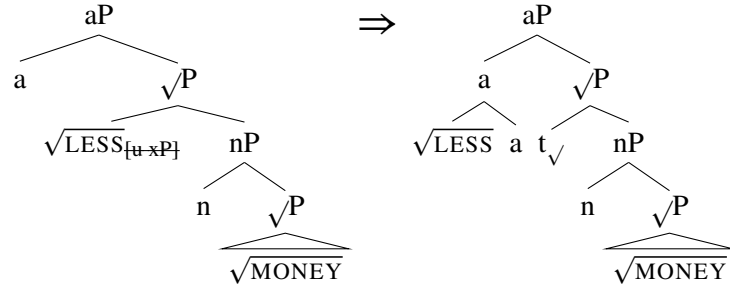
b. Class 2 Affixation



While this idea does provide an account of the interactions in the phonology with respect to the syntactic phases, it seems strange for other reasons. First, affixes do not behave like roots elsewhere in the system. We think of roots as open class items which carry some real-world semantic reference, whereas affixes only modify the existing structure and meaning. Furthermore, in Lowenstamm's system there are never overt exponents of category defining heads, which seems strange. Rather, all overt exponents (at least within the derivational morphology domain) are considered roots and all category defining heads are phonologically null. There is no *a priori* reason why the system should work this way, although it could. However, without derivation affixes carrying the semantics of category defining heads, we lose the fact that there is some compositionality of meaning with multiple affixes. For example, *atomicity* has some relation to the adjective meaning of *atomic* (although there are exceptions to this compositionality). Similarly, it would be difficult to explain the semantics of doublets such as *cómparable* “approximately equal” and *compárable* “able to be compared” without reference to the component parts; in this case, the fact that *compárable* contains the verb form of *compare* (this case is discussed more below).

Most problematic for Lowenstamm’s account, however, is that fact that this system incorrectly predicts the phonological behavior of Class 2 affixes. For example, Lowenstamm proposes the structure in (41) for *moneyless*, because *-less* is a Class 2 suffix:

(41) Lowenstamm’s (2010) structure for *moneyless*



This structure predicts two separate domains for phonological behavior, the *money* domain and the *-less* domain. While this is correct in that the addition of *-less* does not change the stress pattern of *money*, it is problematic in that empirically there is no stress assigned to *-less*. The structure proposed by Lowenstamm looks very much like compounding rather than affixation (cf. Harley 2009, although the head movement is different in Harley’s analysis). With Lowenstamm’s structure, we expect secondary stress on *-less*, like we would in a compound. This, however, is impossible.

(42) No secondary stress on *-less*

a. *móneyless* [ˈmʌ.ni.lis], \*['mʌ.ni.ˌlɛs]

b. *pénnyless* vs. *pénny lèss*

i. “he is pénnyless”

[ˈpɛ.ni.lis], \*['pɛ.ni.ˌlɛs]

ii. “just a pénny lèss than him”

[ˈpɛ.ni.ˌlɛs], \*['pɛ.ni.lis]

As shown in (42), it is impossible to put stress on the *-less* of *moneyless* as diagnosed by vowel reduction. This is made apparent in minimal pairs, such as in (42b), in which *less* as a separate word is given secondary stress and surfaces as [ɛ] instead of reduced [i].<sup>23</sup> Note that this fact is still true with two Class 2 suffixes, e.g., *móneyl[i]ssn[i]ss* which cannot take secondary stress on *-less* (\**móneyl[ɛ]ssness*).

<sup>23</sup>Here I use [i] to represent a high lax unstressed vowel for speakers with a distinction between high and mid lax vowels (i.e. *Rosa*’s [ˌɹɔzəz] vs. *roses* [ˌɹɔzɪz]).



Thus, while Lowenstamm’s proposal is a valiant attempt to make the syntax match the phonology, it drastically modifies the morphosyntax in a way which damages previous theoretical findings about the structures and relationships therein, and additionally fails to capture all of the facts about the phonological output.<sup>24</sup>

There have been other proposals to account for the Class 1/Class 2 behavior as well, mostly relying on some sort of prespecification of Class 2 as a certain domain in the phonology. Some accounts propose that Class 2 suffixes contain their own cycle or stem-level domain, resulting in their separation from the phonology of their stems (Halle and Mohanan 1985; Mohanan 1986; Baker 2005; Buckler and Bermúdez-Otero 2012; Bermúdez-Otero to appear). These proposals have the same problem as Lowenstamm’s account: They predict cyclic or stem-level stress on the Class 2 suffixes, which does not occur.

Another possibility is that Class 1 and Class 2 do not differ in their syntactic features but instead have some sort of difference in attachment to the syntactic structure. For example, building upon idea of autosegmental planes from Autosegmental Phonology (Goldsmith 1976, 1990; McCarthy 1986), Halle and Vergnaud (1987) suggest that Class 1 and Class 2 morphemes have their own planes. Halle and Vergnaud do not intend this to be differences in syntactic attachment, but we could posit a reification of these “different planes” into some meaningful difference in the way morphemes are merged into the syntactic structure. For example, in (43), Class 1 attachment is shown with straight lines and Class 2 attachment is shown with a coiled line. These line types are meant to distinguish two ways of attaching to the morphosyntactic structure.

(43) Different attachment types between *-ity* and *-ness*



This is certainly a possibility, but it must be considered that this attachment difference seems to

<sup>24</sup>Lowenstamm’s proposal also predicts domains for allomorphy that are too large because he posits that several affixes (which mainstream DM would call category defining affixes) may within the same cyclic spell-out domain and thus able to be allomorphically sensitive to each other.

only affect the phonological outcome. There does not seem to be any syntactic difference between these two types of attachment. This solution is essentially the same as the vocabulary item diacritics suggested below, but it seems strange to posit that the diacritic status is encoded in the syntax because it has no effect on the syntax. Rather, the effect is seen in the phonology, thus I posit the vocabulary item diacritics below, because that is where the phonological forms are introduced.

### 2.3.2.3 A Morphophonological Hypothesis: Vocabulary Item Diacritics

As already proposed for Slavic yers in Section 2.2, the analysis which will be pursued here follows Halle and Vergnaud (1987) by proposing that there are diacritics on vocabulary items which determine whether a pass of the stem-level phonology is to be run (see also Marvin 2002 for a similar approach).

For Halle and Vergnaud, the composition of all morphemes takes place before all phonology (as it does in the syntax all-the-way-down model of DM). Affixes are marked diacritically for whether or not they trigger cyclic phonology (equivalent here to what I have been calling stem-level). This rejects the architectural levels or strata of Lexical Phonology (and also Stratal OT).

The difference between Class 1 and Class 2 affixes is proposed to be a difference in the instructions to the phonology, notated as <sup>+</sup> in (44) below. Vocabulary Items with the <sup>+</sup> diacritic trigger a pass of cyclic or stem-level phonology, while those without the diacritic do not.<sup>25</sup>

(44) English Sample "Class 1"/"cyclic"/"stem-level" vs. "Class 2"/"noncyclic"/"word-level" Vocabulary Items

a.  $n \leftrightarrow /-ity/^{+}$

b.  $n \leftrightarrow /-ness/$

#### 2.3.2.3.1 Addressing Selkirk's (1982) objections to diacritic-based analysis

Selkirk (1982, p.112–119) presents a conceptually similar diacritic-based analysis as an alternative to her context-free grammar analysis, but rejects it for several reasons. The basic scheme of her

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<sup>25</sup>It could very well be the case that the diacritic is on the non-cyclic affixes rather than the cyclic ones. See discussion in Section 2.5.2.

diacritic analysis given in (45):

(45) Selkirk's (1982) diacritic-based analysis (Selkirk 1982, p. 113)

Category	Subcategorization Frame
Class 1 [Af; $\alpha$ , +L]	$[-\beta_{[+L]}]$ or $[\beta_{[+L]} -]$
Class 2 [Af; $\alpha$ , -L]	$[-\beta_{[\pm L]}]$ or $[\beta_{[\pm L]} -]$

where  $\alpha$  and  $\beta$  are syntactic category features (noun, verb, etc.)

The idea is that affixes have a diacritic ( $[\pm L]$  for lexical) which is used in the subcategorization of other affixes to control what affixes can be attached. Class 1 affixes are [+L] and they can attach only to other [+L] affixes, while Class 2 affixes are [-L] but are subcategorized to attach after either [+L] or [-L] affixes, allowing them to attach after Class 1 or Class 2 affixes. Selkirk also allows for affixes that are members of both Class 1 and Class 2 (such as, in her analysis, *-able*) by having a undefined [ $\mu L$ ] feature

One important difference between Selkirk's analysis and the analysis proposed here is that Selkirk's subcategorization corresponds to two distinct operations in Distributed Morphology, the combinatoric system (syntactic selection) and allomorphy (46). The combinatoric system is a function of the syntax and determines whether or not a head  $y$  can be merged with a head  $x$ . Allomorphy, on the other hand, is a function of competing vocabulary items during Vocabulary Insertion and determines what phonological exponent will be inserted for a given morpheme in a given context.

(46) Schematic of Combinatorics and Allomorphy in DM (Embick 2010a)

Combinatorics	Allomorphy
$\begin{array}{c} \checkmark \\ \wedge \\ x \quad y \end{array}$	$x \leftrightarrow / \phi_1 / \text{ Context1 } -$
$\begin{array}{c} * \\ \wedge \\ z \quad y \end{array}$	$x \leftrightarrow / \phi_2 / \text{ Context2 } -$
	$x \leftrightarrow / \phi_3 /$

Selkirk makes several important objections to her proposed diacritic-based analysis. Each will be addressed in the paragraphs that follow. Importantly The first two objections can be eliminated by the Combinatorics/Allomorphy split.

Selkirk's first objections to a diacritic-based analysis is that roots must be automatically categorized as [+L] by default so that Class 1 affixes can attach to them. In Selkirk's system, there is no

reason why roots shouldn't be able to be either [+L] or [-L]. In the combinatorics of DM, however, affixes must be root-sensitive because any given root only takes certain suffixes. For example, a root that only appears as an adjective must select for only an adjective head. In addition, heads may show allomorphy depending on their root (as discussed above). We propose that roots must be included separately in the context for allomorphy anyway. Because of this, any non-default morphemes attaching to roots must have that root (or some class or feature associated with that root) specified in their context for insertion (effectively making the [+L] in Selkirk's system). In addition, the context for insertion may include the specific affixes which license subsequent affixes. This provides a solution to the level ordering paradoxes discussed above. For example *-ity* could include *-able* in its context for insertion (allowing for *-ability*) in addition to a variety of roots.

The next objection is that, by eliminating categories (i.e. stem-attaching and word-attaching affixes) the diacritic analysis treats compounds the same as monomorphemic or affixed words, resulting in bad predictions. For example, forms such as *\*inlightsensitive* are predicted to be grammatical because *in-* has a subcategorization for [+L] which the compound *lightsensitive* is, assuming roots are [+L]. However, as noted in response to Selkirk's first objection above, it is not necessary for roots to have a particular feature, so it is not necessarily the case that *in-* would be in the right combinatoric relationship or be the right allomorph choice for a compound. Because there is (proposed to be) a difference in structure between compounding and derivational suffixes, the solution to this problem may be solved on the combinatorics side by disallowing the head spelled-out as *in-* to join to the compound structure. That is, a situation such as *\*inlightsensitive* will not arise because it would be syntactically ungrammatical (rather than morphologically or phonologically ungrammatical).<sup>26</sup>

Finally, Selkirk worries that, with a binary diacritic feature [ $\pm$ L], we would expect there to be subcategorization frames for either [+L] or [-L] affixes dependent on a context of [+L], [-L], or [ $\pm$ L], resulting in six possibilities. We only see two of these possibilities in English, and thus the diacritic system in (45) is descriptively inadequate. We might ask why, for example, are there no suffixes of type [+L] that subcategorize for only [-L]. I propose here that the diacritic is not a

<sup>26</sup>It should be additionally noted that the Class 2 prefix *un-* also cannot attach to *lightsensitive* (*\*unlightsensitive*). This means that, in Selkirk's system, *lightsensitive* seems to be neither [+L] nor [-L], which is strange.

binary feature [ $\pm L$ ], but is instead a privative diacritic mark which an affix may or may not have. As with privative features in phonology, I propose that subcategorization may reference the presence of this diacritic, but not the absence. We could further posit a restriction that only affixes with the diacritic can be subcategorized for the diacritic, resulting in exactly the situation we see in (45). If the situation is as Selkirk presents, then this subcategorization by diacritic would work. However, the proposal here is that there is, in fact, no subcategorization by diacritic. Instead vocabulary items are sensitive to specific affixes or part-of-speech categories and not subcategorization frames, following Fabb (1988). For English, Fabb argues that the attachment is actually idiosyncratic enough that each affix must simply has a list of other affixes it can attach to, modulo affixes which select only for part of speech, such as *-less*, which seems to be able to be attached to any noun. The strong form of the hypothesis about the diacritic here is that it is purely an instruction to the phonology, and is not used for vocabulary insertion.

### 2.3.2.3.2 How to explain the ordering generalization

Although the ordering generalization (Class 1 inside Class 2) is not always true, we would still like to be able to explain the tendency for Class 2 affixes to attach outside Class 1 affixes. The context for insertion (equivalent to subcategorization frames) for these exponents include various specific roots and affixes that they can attach to. Class 1 exponents seem to only be marked for specific affixes or roots, whereas Class 2 exponents have, in addition to specific affixes or roots, seem to may select for particular category defining heads regardless of their exponent, as shown in (47).

(47) English marked Class 1 vs. unmarked Class 2 Vocabulary Items with context for insertion

a.  $n \leftrightarrow /-ity/^{+} / \text{LIST1} \_$

LIST1 = [ $\{a,-ic\}$ ,  $\{a,-able\}$ ,  $\sqrt{\text{PAUC}}$ ,  $\sqrt{\text{FRATERN}}$ , etc.]

b.  $a \leftrightarrow /-less/ / \text{LIST2} \_$

LIST2 = [ $n$ ,  $\sqrt{\text{HAP}}$ ,  $\sqrt{\text{FECK}}$ ,  $\sqrt{\text{RUTH}}$ , etc.]

The vocabulary item in (47a) is the nominal head *-ity*, which is marked as cyclic. It can be inserted in the context of any of the particular exponents on its list, such as the adjective heads *-ic*

and *-able*, as well as some other contexts (such as roots  $\sqrt{\text{PAUC}}$  and  $\sqrt{\text{FRATERN}}$ ). The vocabulary item in (47b) is the adjective head *-less* which is not marked (or, conversely it is marked “noncyclic” and *-ity* is unmarked). The context of insertion for *-less* is following any nominal head as well as a list of specific roots, such as  $\sqrt{\text{HAP}}$ ,  $\sqrt{\text{FECK}}$ , and  $\sqrt{\text{RUTH}}$ .

### 2.3.3 Implementation

Taking the cyclic diacritic solution discussed above, English derivational affixes provide critical evidence about the interaction of morphology and the phonocyclic buffer introduced for Slavic yers in Section 2.2. Specifically, it appears that at least some phonological changes can be rewritten or overwritten within the same phonocyclic buffer, but that non-cyclic nodes block any rewriting across them.

To start, let us assume a cyclic stress assignment rule based on the Main Stress Rule of Halle (1998):

$$(48) \text{ Cyclic Stress Rule: } \emptyset \rightarrow ( / \_ * * _ 1 \langle ] * \rangle \# \# \\ \emptyset \rightarrow ( / \_ * _ h \langle ] * \rangle \# \#$$

“Skipping the rightmost syllable if it has a (morphological) bracket to its left, build a trochee: put a left bracket "(" before a heavy final syllable<sup>27</sup> or before the final two syllables on the right edge of the phonocyclic buffer.”

Note that the morphological bracket ] is an implementation of cyclic extrametricality of sorts. The bracket will cause the cyclic stress rule to ignore the final syllable in its own cycle, not in subsequent cycles. However, unlike classic bracket erasure, the bracket is still important in the non-cyclic phonology to block binary footing across it, so it cannot be deleted cyclically (cf. Kiparsky 1982a, although he refers to a different sort of morphological bracket). Interactions with the morphological bracket will be shown in the examples to follow. Note this means ]\* designates that the syllable will be the head of a foot, but never the tail.

In addition to the cyclic stress rule, there are non-cyclic (word-level) stress rules, shown in (49) following a grid system of meter (Lieberman 1975; Prince 1983; Halle and Vergnaud 1987; Idsardi

<sup>27</sup>A heavy syllable in English is one with a long vowel or two coda consonants (final consonant extrasyllabicity).

1992; Halle and Idsardi 1995; Hayes 1995, *inter alia*):

(49) Non-cyclic stress rules:

- Build binary feet left to right. (Do not build degenerate/monosyllabic feet.)
- Build Trochees: Project a \* onto level 1 for every \* with a left bracket to its left.
- End Rule Right (ERR): Project the rightmost \* on level 1

These rules will apply after all morphemes have been added and they ignore cyclic/non-cyclic status, simply treating all phonological material as concatenated together. These rules are, however, sensitive to morphologically specified bracketing, as discussed below.

Finally, we need to propose that several relevant affixes have stored representations with pre-specified morphological brackets, shown in (50):<sup>28</sup>

(50) Affixes with stored morphological brackets:

- |                           |               |                            |                |
|---------------------------|---------------|----------------------------|----------------|
| • <i>-al</i> <sup>+</sup> | • <i>-ist</i> | • <i>-ity</i> <sup>+</sup> | • <i>-able</i> |
| ]*                        | ]*            | * ]*                       | * ]*           |
| /al/ <sup>+</sup>         | /ist/         | /i ty/ <sup>+</sup>        | /a bil/        |

This is not meant to be an exhaustive list, but merely the list of sample affixes which will be used in the example derivations below. Note that some other affixes, such as *-ic*<sup>+</sup>, do not have any special stored brackets in their representation. It should also be noted that these affixes with stored brackets do not fall into any category; they are one or two syllable and both cyclic and non-cyclic.

Motivation for these brackets comes from the stress patterns of words containing these suffixes. For example, *cùlturalist* shows that we cannot make another foot out of the suffixes *-al* and *-ist*, resulting in the final three syllables being unstressed. If *-ist* did not have a morphological bracket, we would expect stress on *-al* (*\*cùlturálist*). Similarly, *mánageable* shows that *-able* needs to have a morphological bracket between its syllables so that no second foot can be formed from it (*\*mànageáble*). Note however, that *-ist* and the second syllable of *-able* are able to take stress if some following material is added, such as in *cùlturalístic* and *mànageábílity*. This indicates that the

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<sup>28</sup>Note that Halle (1998) has “edge marking” rules which assign these sorts of brackets in various circumstances. I don’t think this can be the case because Halle’s edge marking rules are cyclic, whereas some of the exponents which carry morphological brackets are noncyclic.

syllable in these morphemes are not entirely ignored, but are marked with something that determines how feet may be built around them, as indicated by the diacritic bracket "]".

Using the cyclic stress assignment rule in (48), the non-cyclic stress rules of (49), and the stored representations in (50), we can make an observation about the nature of the interaction between cyclic and non-cyclic affixes in the process of derivation. Adjacent cyclic nodes will be processed in the same phonocyclic buffer, allowing them to overwrite or change phonological material within the same bracket, discussed in Section 2.3.3.1. Noncyclic nodes, however, do not participate in the phonocyclic buffer and additionally block subsequent cyclic nodes from participating in the previous phonocyclic buffer. This effectively prevents changes to any phonocyclic buffer from changes once a non-cyclic node is merged, discussed in Section 2.3.3.2.

### 2.3.3.1 Overwriting in the phonocyclic buffer

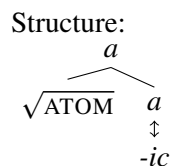
When working within a phonocyclic buffer, there seems to be some ability to modify or change phonological forms that were previously outputted. For example, Lowenstamm (2010) notes that stress with cyclic suffixes in English moves progressively rightward as further cyclic suffixes are added:

(51) Rightward moving stress: *átom*, *atómic*, *àtomícity* (Lowenstamm 2010)

What is interesting here is that the stress assignment from *atómic* is not kept in any way in *àtomícity* (*\*atòmícity*) despite the fact that *atómic* should be a constituent inside *àtomícity*. If (any) stress is assigned cyclically and is not somehow overwritten, this is a problem.

Using the stress rules proposed above, the derivation of *atómic* is as follows, assuming *atómic* is a root-derived adjective:

(52) Derivation of *atómic*





1. Linearize Morphosyntactic Structure:  $\sqrt{\text{ATOM}} - a_{ic}$   
UR vocabulary items:  $\begin{matrix} * & * & * \\ /a & tom/ & - /ic/^{+} \end{matrix}$
  
  2. Integration of root  $\sqrt{\text{ATOM}}$ 
    - 2a. Vocabulary Insertion  $\begin{matrix} * & * \\ /a & tom/ \end{matrix}$
    - 2b. No adjacent buffer, create new buffer 

*   *
a   tom
    - 2c. — No cyclic phonology, nothing to integrate
  
  3. Integration of Next Node  $\sqrt{\text{ATOM}} - a_{ic}$ 
    - 3a. Vocabulary Insertion 

*   *
a   tom

 +  $\begin{matrix} * \\ /ic/^{+} \end{matrix}$
    - 3b. Add node to buffer 

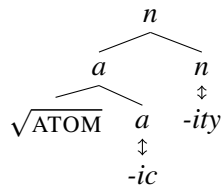
*   *   *
a   to   mic
    - 3c. Cyclic Stress Assignment: 

*   (*   *)
a   to   mic
- Input to non-cyclic phonology:  $\begin{matrix} * & (* & *) \\ a & to & mic \end{matrix}$
- Binary Footing L→R  $\begin{matrix} * & (* & *) \\ a & to & mic \\ & * & \\ & * & \\ * & (* & *) \\ a & to & mic \end{matrix}$
- Project Trochee and ERR  $\begin{matrix} * & (* & *) \\ a & to & mic \end{matrix}$
- Output after non-cyclic phonology: atómic

If we try to derive *àtomícity* straight-forwardly from the same system, we start the derivation the same as Steps 1–3 in (52), however, we run into a potential problem at Step 4 when *-ity* is integrated into the buffer and Cyclic Stress assignment is run:

(53) Incorrect Derivation of *àtomícity* (yielding *\*atòmícity*)

Structure:



1.-3. same as (52) above

4. Integration of Next Node

$\sqrt{ATOM} - a_{ic} - n_{ity}$

4a. Vocabulary Insertion

* (* *	* ]*
a to mic	+ /i ty/+

4b. Add node to buffer

* (* * *	* ]*
a to mi ci	ty

4c. Cyclic Stress Assignment:

* (* (* *	* ]*
a to mi ci	ty

← Problematic!

Input to non-cyclic phonology:

\* (\* (\* \* ]\*  
a to mi ci ty

Binary Footing L→R

\* (\* (\* \*) ]\*  
a to mi ci ty

Project Trochee and ERR

\* (\* (\* \*) ]\*  
a to mi ci ty

Output after non-cyclic phonology:

\*atòmícity

Because we had already assigned the footing in the phonocyclic buffer in Step 3, we have a left bracket before the syllable *to*, which should result in secondary stress there. This however, is not the case. Instead the initial syllable gets secondary stress and no stress is assigned to *to*: *àtomícity*.

One possible solution to this problem would be a clash avoidance technique which would take the two neighboring \*s on level one and shift one back (exactly the same process as the English Rhythm Rule, see, e.g., Halle 1998). This, however, does not seem to be the case as there are words in English that contain neighboring stresses.

(54) Rhythm Rule solution to secondary stress problem

Input to non-cyclic phonology:      \* (\* (\* \* ]\*  
a to mi ci ty

Binary Footing L→R                    \* (\* (\* \*) ]\*  
a to mi ci ty

Project Trochee                        \* (\* (\* \*) ]\*  
a to mi ci ty

Rhythm Rule                            \* ← \* ]\*  
a to mi ci ty

ERR

\*  
\* ← \*  
\* (\* (\* \*) ]\*  
a to mi ci ty

Output after non-cyclic phonology: àtomícity

While this sort of solution has been proposed (Halle 1998), I argue against it for two reasons. First, to the extent that there are counterexamples of words with stress clash of exactly this shape ( $\sigma\delta\acute{\sigma}\dots$ ), some given in (55), we don't want this rule to always apply.

(55) Example words with stress clash:<sup>29</sup> attèstátion, objèctívity, elàstícity, manifèstátion, orièn-tátion

(Chomsky and Halle 1968; Halle and Vergnaud 1987; Hammond 1989)

Additionally, this sort of metrical grid realignment misses some of the intuition about stress and footing, that it is about creating binary constituents. If we think that footing is grouping syllables into feet, it is strange to have stress retraction move across a foot boundary, rather than, for example, switch between one foot and a neighboring foot.

What I propose instead is that the cyclic stress rule is not just assigning a bracket, but forcing a foot upon the syllables it affects. So, for example, in (52) Step 3, the cyclic stress groups the second two syllables of *atomic* into a foot, as shown in (56) Step 3. When the next pass of cyclic stress applies, as in (53) Step 4, the rule *must* build a foot, so needs the second syllable of the foot to its left to make *a.to.(mi.ci).ty*, as shown in (56) Step 4c. This breaks the foot of *(to.mi)* leaving the syllable *to* unfooted in favor of footing *(mi.ci)* together. The non-cyclic phonology will later come along and foot *(a.to)* together.

Here, I change to a notation showing a foot as a binary constituent rather than the bracket notation to highlight the need for the foot to include two syllables. This is important because the removal of a foot from an earlier cycle means that the foot is simply gone and does not leave a bracket behind.

(56) Derivation of *àtomícity* with footing

---

<sup>29</sup>Although, see English stress retraction (e.g., Hayes 1982).

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{ATOM}} - a_{ic} - n_{ity}$   
 UR vocabulary items: a tom + /ic/⁺ + /i ty/⁺
2. Integration of root  $\sqrt{\text{ATOM}}$   
 2a. Vocabulary Insertion /a tom/  
 2b. No adjacent buffer, create new buffer 

* *
a tom

  
 2c. — No cyclic phonology, nothing to integrate
3. Integration of Next Node  $\sqrt{\text{ATOM}} - a_{ic}$   
 3a. Vocabulary Insertion 

* *
a tom

 + /ic/⁺  
 3b. Add node to buffer 

* * *
a to mic

  
 3c. Cyclic Stress Assignment: 

		Ft		
* *		/		*
a	to		mic	
4. Integration of Next Node  $\sqrt{\text{ATOM}} - a_{ic} - n_{ity}$   
 4a. Vocabulary Insertion 

		Ft		
* *		/		*
a	to		mic	

 + /i ty/⁺  
 4b. Add node to buffer 

		Ft				
* *		/		*		*
a	to		mi	ci		ty

  
 4c. Cyclic Stress Assignment: 

		Ft				
* *		/		*		*
a	to		mi	ci		ty
- Input to non-cyclic phonology:  
 Binary Footing L→R 

* *	( * *)	]*	
a	to	mi ci	ty

  
 Project Trochee and ERR 

		*	
* *	( * *)	]*	
a	to	mi ci	ty
- Output after non-cyclic phonology: àtomícity

If we allow this sort of overwriting of the metrical structure in the cyclic phonology, then the derivation works out as expected. The non-cyclic phonology creates additional feet and determines

primary and secondary stress. It remains to be seen whether feet are only broken when a new foot needs to be created out of one of their syllables or if all structure from a previous cycle is wiped clean every time a new pass of cyclic phonology is run on a buffer.

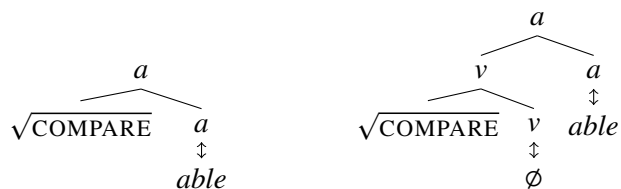
Overwriting is discussed further in Section 2.3.4.

### 2.3.3.2 No overwriting through non-cyclic nodes

Although we had to admit the ability to change or overwrite phonology within a phonocyclic buffer above, it appears to be impossible to perform such an overwriting operation across a non-cyclic morpheme.

To demonstrate, let us use a minimal pair from one of the sets of English words which has the same (overt) components but different structure as evidenced by differences in phonology and semantics. For example, *cómparable* and *compárable* are both formed from the pieces *compare* and *-able*, but the former has initial stress and means “approximately equal” while the latter has stress on the second syllable and means “able to be compared”. The transparency of meaning of *compárable* suggests that it has more structure, most likely being a nominalization of the verb *compare*. The lack of transparent meaning of *cómparable* suggests that it is a root formation, and thus subject to specialized meanings. The proposed structures are given in (57):

(57) Structures of *cómparable* and *compárable*



The stress placement of these forms can be derived following the rules in (48) and (49). The key difference between *cómparable* and *compárable* in this system is that *cómparable* never undergoes the cyclic phonology because it does not have a cyclic suffix while *compárable* does undergo the cyclic phonology (with the null *v* head).

I will assume that there is some process which reduces *bil* to *bɿ* when unstressed.

(58) Derivation of *cómparable* “approximately equal”

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{COMPARE}} - a_{\text{able}}$   
 UR vocabulary items:  $\begin{matrix} * & * & * & ]^* \\ /com\ par/ & - & /a & bil/ \end{matrix}$
2. Integration of root  $\sqrt{\text{COMPARE}}$   
 2a. Vocabulary Insertion  $\begin{matrix} * & * \\ /com\ par/ \end{matrix}$   
 2b. No adjacent buffer, create new buffer  $\begin{matrix} * & * \\ com\ par \end{matrix}$   
 2c. — No cyclic phonology, nothing to integrate
3. Integration of Next Node  $\sqrt{\text{COMPARE}} - a_{\text{able}}$   
 3a. Vocabulary Insertion  $\begin{matrix} * & * \\ com\ par \end{matrix} + \begin{matrix} * & ]^* \\ /a & bil/ \end{matrix}$   
 3b. Non-cyclic node, no addition to buffer
- Input to non-cyclic phonology:  $\begin{matrix} * & * & * & ]^* \\ com & pa & ra & bil \end{matrix}$   
 Binary Footing L→R  $\begin{matrix} (* & *) & * & ]^* \\ com & pa & ra & bil \end{matrix}$   
 Project Trochee and ERR  $\begin{matrix} * & & & \\ * & & & \\ (* & *) & * & ]^* \\ com & pa & ra & bil \end{matrix}$   
 Output after non-cyclic phonology: *cómparable*

(59) Derivation of *compárrable* "able to be compared"

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{COMPARE}} - v - a_{\text{able}}$   
 UR vocabulary items:  $\begin{matrix} * & * & * & ]^* \\ /com\ par/ & - \emptyset^+ & - & /a & bil/ \end{matrix}$
2. Integration of root  $\sqrt{\text{COMPARE}}$   
 2a. Vocabulary Insertion  $\begin{matrix} * & * \\ /com\ par/ \end{matrix}$   
 2b. No adjacent buffer, create new buffer  $\begin{matrix} * & * \\ com\ par \end{matrix}$   
 2c. — No cyclic phonology, nothing to integrate
3. Integration of Next Node  $\sqrt{\text{COMPARE}} - v$   
 3a. Vocabulary Insertion  $\begin{matrix} * & * \\ com\ par \end{matrix} + \emptyset^+$

3b. No phonology to add to buffer	
3c. Cyclic Stress Assignment: <sup>30</sup>	$\boxed{\begin{array}{c} * \quad (* \\ \text{com par} \end{array}}$
4. Integration of Next Node	$\sqrt{\text{COMPARE}} - \nu - a_{\text{able}}$
4a. Vocabulary Insertion	$\boxed{\begin{array}{c} * \quad (* \\ \text{com par} \end{array}} + \begin{array}{c} * \quad ]* \\ /a \quad \text{bil}/ \end{array}$
4b. Non-cyclic node, no addition to buffer	
Input to non-cyclic phonology:	$\begin{array}{c} * \quad (* \quad * \quad ]* \\ \text{com pa ra bil} \end{array}$
Binary Footing L→R	$\begin{array}{c} * \quad (* \quad *) \quad ]* \\ \text{com pa ra bil} \end{array}$
	$\begin{array}{c} * \\ * \end{array}$
Project Trochee and ERR	$\begin{array}{c} * \quad (* \quad *) \quad ]* \\ \text{com pa ra bil} \end{array}$
Output after non-cyclic phonology:	compáritable

While this difference is interesting in its own right, the key point for the behavior of the phonocyclic buffer is that these bracket assignments are not rewritten by later cyclic suffix attachment, as can be seen in the secondary stresses of *còmparabilité* and *compàrabilité*. If cyclic suffixes caused all brackets to be erased then we would expect these two forms to be identical. In both these cases *-ity* causes its own pass of cyclic stress rules to apply, but the brackets that are already in place from previous cycles are still there.

(60) Derivation of *còmparabilité* “the property of being approximately equal”

1.–3. As in (58) above.

4. Integration of Next Node

$\sqrt{\text{COMPARE}} - a_{\text{able}} - n_{\text{ity}}$

4a. Vocabulary Insertion

$\boxed{\begin{array}{c} * \quad * \\ \text{com par} \end{array}} + \begin{array}{c} * \quad ]* \\ /a \quad \text{bil}/ \end{array} + \begin{array}{c} * \quad ]* \\ /i \quad \text{ty}/^+$

4b. No adjacent buffer, create new buffer

$\boxed{\begin{array}{c} * \quad * \\ \text{com par} \end{array}} + \begin{array}{c} * \quad ]* \\ /a \quad \text{bil}/ \end{array} + \boxed{\begin{array}{c} * \quad ]* \\ i \quad \text{ty} \end{array}}$

<sup>30</sup>We must assume here that /par/ is a heavy syllable. Alternatively, this  $\nu$  head has a special feature on it which triggers stress assignment to the final syllable. In either case, the difference between this  $\nu$  head and the default phonologically null  $n$  head causes the stress shift seen in certain pairs of nouns and verbs in English such as: *permit* ~ *pérmít*, *record* ~ *pércórd* ~ *récórd*, *digest* ~ *dígést*, *upsét* ~ *úpset*, *fermént* ~ *fermént*, and *interchánge* ~ *ínterchange*.

4c. Cyclic Stress Assignment

* ]*
i ty

(No possible cyclic stress assignment)

Input to non-cyclic phonology:

\* \* \* ]\* \* ]\*  
com pa ra bi li ty

Binary Footing L→R

(\* \*) \* ](\* \*) ]\*  
com pa ra bi li ty

Project Trochee and ERR

\* \*  
\* \*  
(\* \*) \* ](\* \*) ]\*  
com pa ra bi li ty

Output after non-cyclic phonology:

còmparabilité

(61) Derivation of *compàrabilité* "the property of being able to be compared"

1.-4. As in (59) above.

5. Integration of Next Node

$\sqrt{\text{COMPARE}} - \nu - a_{\text{able}} - n_{\text{ity}}$

5a. Vocabulary Insertion

* (*	+ /a bil/	+ /i ty/
com par		ty

5b. No adjacent buffer, create new buffer

* (*	+ /a bil/	+	* ]*
com par			i ty

5c. Cyclic Stress Assignment

* ]*
i ty

(No possible cyclic stress assignment)

Input to non-cyclic phonology:

\* (\* \* ]\* \* ]\*  
com pa ra bi li ty

Binary Footing L→R

\* (\* \*) ](\* \*) ]\*  
com pa ra bi li ty

Project Trochee and ERR

\* \*  
\* \*  
(\* \*) ](\* \*) ]\*  
com pa ra bi li ty

Output after non-cyclic phonology:

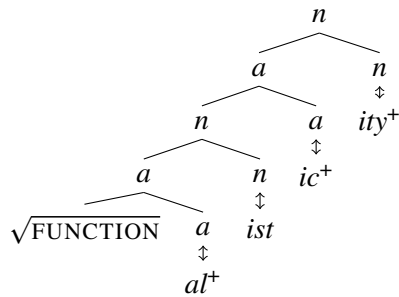
compàrabilité

The footing assigned within the left phonocyclic buffer (or lack thereof) is persistent to the end of the derivation. However, while examples (60) and (61) show that the left phonocyclic buffer has some action (with the  $\nu$  head) and then is ignored by the rightmost cyclic node, it does not show any



action in the second phonocyclic buffer. In order to demonstrate that, we need longer words with several cyclic affixes to the right of a noncyclic affix, such as *jòurnalistícity* "the abstract quality of being journalistic (having the character of a journalist)" or *fùncionalistícity* "the abstract quality of being functionalist (working within the, esp. architectural, framework which advocates function over aesthetics)". While these words may be a little awkward due to their length (and difficulty in processing the semantics), the stress pattern should be clear. To make the action explicit, (62) shows the derivation of *fùncionalistícity*:

(62) Structure of *fùncionalistícity*<sup>31</sup>



(63) Derivation of *fùncionalistícity*

1. Linearize Morphosyntactic Structure:  $\sqrt{\text{FUNCTION}} - a_{al} - n_{ist} - a_{ic} - n_{ity}$   
 UR vocabulary items:  $/*function/ - /al/^{+} - /ist/ - /ic/^{+} - /i\ ty/^{+}$
2. Integration of root
  - 2a. Vocabulary Insertion  
 $\sqrt{\text{FUNCTION}}$   
 $/*\ */$   
 $/function/$
  - 2b. No adjacent buffer, create new buffer  

* * func tion
------------------
  - 2c. — No cyclic, nothing to integrate
3. Integration of Next Node
  - 3a. Vocabulary Insertion  
 $\sqrt{\text{FUNCTION}} - a_{al}$   

* * func tion
------------------

 +  $/al/^{+}$
  - 3b. Add node to buffer  

* * ]* func tio nal
------------------------

<sup>31</sup>I am assuming a root node  $\sqrt{\text{FUNCTION}}$ , although perhaps it could be broken down further into  $\sqrt{\text{FUNC}} + \text{tion}$ . This would not affect the interaction of the outer phonocyclic buffer.

3c. Cyclic Stress Assignment:	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal
4. Integration of Next Node	$\sqrt{\text{FUNCTION}} - a_{al} - n_{ist}$
4a. Vocabulary Insertion	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal + /ist/
4b. Non-cyclic node, do not add to buffer	
4c. Non-cyclic node, No cyclic phonology processed	
5. Integration of Next Node	$\sqrt{\text{FUNCTION}} - a_{al} - n_{ist} - a_{ic}$
5a. Vocabulary Insertion	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal + /ist/ + /ic/⁺
5b. No adjacent buffer, create new buffer	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal + /ist/ + $\sqrt{(*)}$ ic
5c. — No cycle, nothing to integrate	
6. Integration of Next Node	$\sqrt{\text{FUNCTION}} - a_{al} - n_{ist} - a_{ic} - n_{ity}$
6a. Vocabulary Insertion	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal + /ist/ + $\sqrt{(*)}$ ic + $\sqrt{(*) \quad * \quad ]^*}$ /i ty/⁺
6b. Add node to buffer	$\sqrt{(*) \quad * \quad ]^*}$ func tio nal + /ist/ + $\sqrt{(*) \quad * \quad ]^*}$ i ci ty
6c. Cyclic Stress Assignment	$\sqrt{(*) \quad * \quad ]^*}$ i ci ty
Input to non-cyclic phonology:	$(*) \quad * \quad ]^* \quad ]^* \quad (*) \quad * \quad ]^*$ func tio na li sti ci ty
Binary Footing L→R	$(*) \quad (*) \quad ]^* \quad ]^* \quad (*) \quad (*) \quad ]^*$ func tio na li sti ci ty
Project Trochee and ERR	$(*) \quad (*) \quad ]^* \quad ]^* \quad (*) \quad (*) \quad ]^*$ func tio na li sti ci ty
Output after non-cyclic phonology:	fũnctionalistícity

Note that if we stop the cyclic derivation at Step 5, we derive *functionalistic*. In this case, the two syllables from *-ist* and *-ic* will be footed together in the non-cyclic phonology, ultimately leading to the assignment of stress as *fũnctionalístic*. However, the addition of the cyclic *-ity* morpheme at Step 6 causes cyclic stress assignment to be applied, which foots *-ic* with the first syllable of *-ity*. Because of this, and because of the stored representation of brackets with *-al* and *-ist*, there is no

binary foot that is able to be created around the syllables of *-al* and *-ist*. This leads to the three syllable lapse in the middle of the output form *f̀unctionalísticity*.

The application of cyclic stress assignment to the second phonocyclic buffer is critical for the correct output. If cyclic stress assignment was not applied at Step 6, in the non-cyclic phonology we would end up footing *li-sti* together resulting in *\*f̀unctionalísticity*.

What we are left with is a system where linearly adjacent cyclic morphemes are able to interact with each other phonologically, but non-cyclic morphemes do not interact with neighboring morphemes. The non-interaction is so strong that these non-cyclic morphemes prohibit the interaction of phonocyclic buffers across them, forcing new phonocyclic buffers to be created. Once a new buffer is created, however, the functionality of that buffer fully intact; Any cyclic morpheme will be incorporated and processed by the cyclic phonology.

#### **2.3.4 Discussion: Overwriting and Syntactic Spell-Out**

In dealing with the interaction of rules within a cyclic domain for this case study on English Stress, I proposed that there was something called “overwriting” which needed to happen in order allow the footing of one cycle to break up a foot built in a previous cycle.

Note that here I refer to overwriting as the phenomenon in which some phonological aspect within a phonological buffer gets assigned to something and then reassigned to something else. This is in contrast with a late phonological rule, in which the initial assignment occurs late. For example, one explanation of Vowel Harmony phenomena (see, e.g., Turkish in Section 4.4) is that vowels within the word are underspecified and specification does not happen until late. If, on the other hand, there was some evidence that the vowels were fully specified in one cycle and then got changed by a later cycle, that would be overwriting. That is to say, if it is something that is underspecified and gets assigned late, that is not overwriting *per se*, just late assignment.<sup>32</sup>

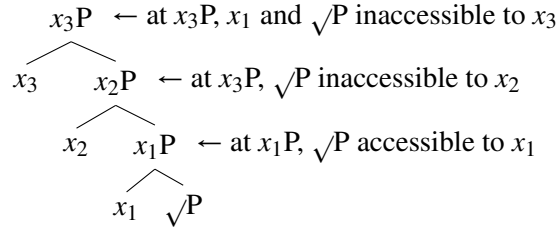
Beyond the desire to not undo any changes made by the system, overwriting is a potential problem for frameworks which have a strict adherence systems to syntactic spell-out with respect to accessibility of the morphemes in a structure.

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<sup>32</sup>Note that in the syntactic phase spell-out account described below, any sort of late assignment of the phonology is a version of overwriting because the inner nodes are supposed to be inaccessible by the time the entire structure is being phonologized.

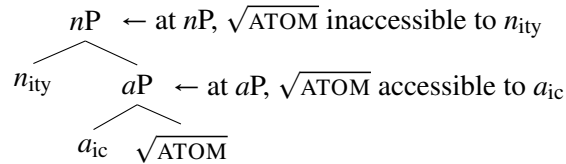
For example, Marvin (2002, 2013) proposes that category defining heads are spell-out domains (following Marantz 2001) and that, following Chomsky (2001), the phases defined by these domains are subject to the Phase Impenetrability Condition (PIC). This approach predicts the accessibility of morphemes and exponents shown in (64):

(64) Accessibility of morphemes in Marvin's system (Marvin 2013, p. 81)



In this framework, PIC means that morphemes inside a lower spell-out domain are inaccessible to the morphemes of the higher spell-out domain. Critically for the discussion here, this inaccessibility coincides exactly with the cases of overwriting. That is, in (65), by Marvin's system, the root  $\sqrt{ATOM}$  should be inaccessible to the  $n_{ity}$  in the higher spell-out domain.

(65) *atomicity* in Marvin's system



However, for the stress to work out,  $n_{ity}$  must interact with the phonology of  $\sqrt{ATOM}$ , as shown in (66):

(66) Phonological interactions of *atomicity* in Marvin's system

1. At  $aP$ :  $\sqrt{ATOM}$  is spelled out:<sup>33</sup>

\* \*  
a tom

2. At  $nP$ : the  $aP$  is spelled out as *atómic*:

<sup>33</sup>Note that in Marvin's (2013) system, at this stage  $\sqrt{ATOM}$  would actually be spelled out and subject to stress rules, resulting in *átom*. This means that Marvin also needs some kind of overwriting in order to change *átom* to *atómic* at the next spell-out domain. That is, even though  $\sqrt{ATOM}$  is active in the domain of  $a_{ic}$ , there is still an overwriting operation needed.

\*  
 \* (\* \*  
 a to mic

3. At the next higher phase, *atomicity*:

*	*	*
* (*	(* *	]*
a to	(m)i	ci ty

As shown in (66), precisely when *-ity* is spelled-out, the root *atom* is claimed to be inaccessible, indicated by the grayed out section in Step 3. However, this is precisely when the brackets need to be overwritten in order to not produce secondary stress on the wrong syllable (*\*atòmicity*).<sup>34</sup>

Thus, it cannot be the case that the inner nodes are completely inaccessible to change. However, it is interesting to note that overwriting, at least here, seems to only affect prosodic units (that is, footing and stress assignment). We might wonder if there is some inherent difference between segmental phonology and supersegmental phonology such that the PIC holds for segmental features but not supersegmental features. Note that, in principle, the supersegmental overwriting relates to segmental changes because of the relation between stress and vowel reduction and aspiration in English (i.e., *atómic* [ə.'tʰɑ.mɪk] versus *àtomícity* [æ.rə.'mɪ.sɪ.rɪ]).

It is interesting to note that stress seems to be somewhat unique for these cases of violations of PIC and overwriting. Other supersegmental phenomena may also show overwriting, such as tone (see, e.g., Hausa tonal overwriting in Trommer 2011; Newman 2000), and possibly vowel melody, at least in languages with templatic vowel overwriting (see, e.g., Hebrew vowel overwriting in Bat-El 1994). It is unclear, however, why these phonological properties have a different interactions with the PIC than others.

Embick (2014) proposes a slightly modified take on the PIC for phonology which allows non-cyclic and phrase level phonology to have “access” to embedded phonological material (based on, e.g., English Rhythm Rule), but he still maintains that cyclic phonological processes should not be able to violate the PIC. It must be noted, then, that the footing process proposed above for English in the *atomicity* case is proposed to be a cyclic rule.

In the framework presented in this dissertation, the relationship between syntactic spell-out and

---

<sup>34</sup>Marvin (2013, f.n. 15) admits that there is a small group of words that cannot be explained with the phase theory explanation. This, then is critical evidence in favor of the theory presented here.

the phonology is a little less direct than in theories like Marvin's. The syntax sends nodes to the phonology through syntactic spell-out, but the phonology then deals with the nodes in its own way (as phonologically cyclic or not). That is, it will receive the information in the same grouping as the syntactic spell-out, but it is not as restricted in its interaction (at least not at the subword level). However, this framework does not rule out any overwriting of segmental material within the same phonocyclic buffer, so it is interesting to note that mostly (or only) supersegmentals seem to be overwritten.

### **2.3.5 Case Study Conclusion**

The case study of English stress presented several important points for the subword domain. First, in contrast with Slavic, the division between cyclic and noncyclic morphemes appears to be arbitrary in English. This makes any attempt to analyze cyclic and noncyclic behavior based on structural properties difficult, although not impossible. Several possible structural solutions were discussed, but they all distort the morphosyntactic system in such a way that previous generalizations are lost. Additionally, these distortions do not provide better coverage for or explanation of the phonological phenomenon than a diacritic solution. Because the cyclic/noncyclic behavior seems to only affect the phonology, I followed the assumption made for Yers in Section 2.2, and posited that there is simply a phonological diacritic. This is discussed more in Section 2.5.2.

Another interesting point that was made is the interaction of noncyclic morphemes with surrounding cyclic morphemes. Here we showed that noncyclic morphemes are not integrated into the phonocyclic buffer but that there is interaction between subsequent cyclic morpheme. This means that a new phonocyclic buffer must be created for cyclic morphemes following a non-cyclic morpheme.

Finally, within the phonocyclic buffer, it appears that changes made from one pass of the cyclic phonology can be overwritten by a later pass. This is necessary to account for the stress pattern found in sequences of multiple cyclic nodes. It is interesting to note, as discussed in Section 2.3.4, that the overwriting seems to be limited to prosodic or supersegmental changes.

## 2.4 Cyclicity and Spanish Depalatalization

The final case study in this chapter is on Spanish which presents an interesting comparison to Slovak, Polish, and English above. All of the morphemes in Slovak were cyclic and all of the suffixes in Polish were cyclic. The fact that only the (relatively small set of) prefixes were noncyclic in Polish suggested that cyclic nodes were the norm and that noncyclic nodes should bear the diacritic. In English, cyclic and noncyclic nodes seems relatively evenly distributed across all types of affixes, making it difficult to tell which should be the base case and which should be exceptionally marked. In contrast, Spanish seems to have almost entirely non-cyclic nodes, with the exception of theme vowels, which all seem to be cyclic, even when they have null phonology. These issues will be discussed more fully in Sections 2.5.2 and 2.5.1 after the case study.

### 2.4.1 Background and Data

#### 2.4.1.1 Depalatalization

The phenomenon of interest in this section is depalatalization in Spanish, a process by which underlying palatal consonants  $\tilde{n}/\eta/$  and  $ll/\lambda/$ <sup>35</sup> become non-palatal  $n/\eta/$  and  $l/\lambda/$  when in a syllable coda (Harris 1983, 1987, 1991, 1999; Pensado 1997; Baković 1998; Colina 2003; Bermúdez-Otero 2007; Lloret and Mascaró 2007; Eddington 2012, *inter alia*). The examples in (67) show alternations of the same lexical root with a palatal in the onset of one form and a non-palatal in the coda of another form.<sup>36</sup>

(67) Spanish depalatalization in coda position

(Harris 1983, pp. 50-55)

<sup>35</sup>Most modern Spanish speakers do not have  $[\lambda]$  as the phonetic reflex of  $ll$ , but rather  $[j]$ ,  $[j]$ ,  $[j]$ , or  $[ʝ]$  varying by region and dialect (Lipski 1994). Note that, regardless of the phonetic implementation, the important point here is the interaction of the phonological change with the morphological structure.

<sup>36</sup>There is some doubt on the productivity of this rule in modern Spanish because of a variety of (semantically and/or historically) related lexical items which show palatal consonants in some forms and non-palatal consonants in other forms unpredictably, for example: *útil* "tool (n), useful (a)", *útiles* "supplies", *utilería* "props", *utilidad* "useful", and *utilizar* "to use", but *utillaje* "tools, equipment" and *utillero* "equipment manager (sports)" (Bermúdez-Otero 2007; Lloret and Mascaró 2007). However, Lloret and Mascaró (2007) show that the depalatalization process is still at least somewhat productive because it applies to loanwords, such as Catalan *Co/λ/* and *se/ɲ/* (Spanish *kol* and *sen*), see Eddington (2012) for a summary. I will put aside this debate for the purposes of the discussion here and focus on the implications for the morphology-phonology interface, assuming a version of Spanish which has an active depalatalization process.

- |    |                  |                       |                                |
|----|------------------|-----------------------|--------------------------------|
| a. | reñ <u>ir</u>    | reñ <u>cilla</u>      | "to quarrel", "quarrel (noun)" |
|    | desdeñ <u>ar</u> | desdeñ <u>ar</u>      | "to disdain", "disdain (noun)" |
|    | doñ <u>a</u>     | doñ <u>a</u>          | "Mrs., Lady", "Mr., Sir"       |
| b. | val <u>le</u>    | Val <u>derroble</u> s | "valley", "Valley of Oaks"     |
|    | bell <u>o</u>    | bell <u>dad</u>       | "beautiful", "beauty"          |
|    | doncell <u>a</u> | doncell <u>o</u>      | "lass", "lad"                  |
|    | ell <u>a</u>     | ell <u>o</u>          | "she", "he"                    |

However, the generalization that these phonemes appear as palatals in the onset and non-palatals in the coda is not surface true. Specifically, it is not true of nominal and adjectival plurals which take *-es*, as exemplified in (68):

- (68) Depalatalization in onset of plural forms (Harris 1983, pp. 50-55)
- |    |         |                     |                                     |
|----|---------|---------------------|-------------------------------------|
| a. | desdeñ  | desdenes            | "disdain (noun)", "disdains (noun)" |
|    | cf.     | desdeñes            | "you disdain"                       |
| b. | doncell | donceles            | "lad", "lads"                       |
|    | cf.     | doncella, doncellas | "lass", "lasses"                    |

Harris (1983) proposes a Cyclic Phonology solution by positing that the noun stem is one phonological domain but the verb is not, as shown in (69):

- (69) Cyclic domains according to Harris (1983)
- |  |     |   |
|--|-----|---|
| [ [ desdeñ <sub>N</sub> ] es <sub>N</sub> ]  | but | [ desdeñ es <sub>V</sub> ]                    |
| <i>desdeñ<u>es</u></i>                       |     | <i>desdeñ<u>es</u></i>                        |
| "disdains" (noun plural)                     |     | "you disdain" (verb, 2sg present indicative)  |
| [ [ doncell <sub>N</sub> ] es <sub>N</sub> ] | but | [ [ doncell a <sub>N</sub> ] s <sub>N</sub> ] |
| <i>doncell<u>es</u></i>                      |     | <i>doncell<u>as</u></i>                       |
| "lads"                                       |     | "lasses"                                      |

However, as Harris (1999) points out, in this framework, it is unclear why the noun consists of two cyclic domains while the verb has only one. Harris (1999) moves on to pursue a solution in a piece-based framework. However, this brings up the question about the nature of the *-es* plural and if it is different from verbal morphology or other plural forms.



### 2.4.1.2 Word Marker /e/ or Plural /es/

The word marker, or theme vowel (as I will call it), *e* has been discussed extensively in the literature (see, e.g., Harris 1987, 1991, 1999; Colina 2003; Bermúdez-Otero 2007).

The problem here is the fact that, in addition to the more common *a* and *o* theme vowel classes, there seem to be two different classes of words which take an *e* theme: those which always have an *e* and those (nouns and adjectives) which have no (overt) theme in the singular but *es* in the plural. To make matters more complex, there also are words seem to never have an (overt) theme, taking only *s* in the plural. Data shown in (70):

(70) Spanish words with *e*,  $\emptyset\sim e$ , and  $\emptyset$  theme words

(Harris 1987, 1991, 1999; Colina 2003; Bermúdez-Otero 2007)

a. *e*-theme words, singular and plural forms

- |                                 |                             |                     |
|---------------------------------|-----------------------------|---------------------|
| • libre, libres "free"          | • parte, partes "part"      | • embalse, embalses |
| • cruce, cruces "cross-<br>ing" | • nube, nubes "cloud"       | "dam"               |
|                                 | • jefe, jefes "boss, chief" |                     |

b.  $\emptyset\sim e$ -theme words, singular and plural forms

- |                           |                              |                          |
|---------------------------|------------------------------|--------------------------|
| • lápiz, lápices "pencil" | • hindú, hindú-es<br>"Hindu" | • vals, vales "waltz"    |
| • cruz, cruces "cross"    | • rey, reyes "king"          | • reloj, relojes "clock" |

c.  $\emptyset$ -theme words, singular and plural forms<sup>37</sup>

- |                                 |                            |                   |
|---------------------------------|----------------------------|-------------------|
| • menú, menús "menu"            | • clip, clips "paper clip" | "spray"           |
| • jersey, jerseys<br>"pullover" | • yac, yacs "yak"          | • zigzag, zigzags |
|                                 | • espray, esprays          | "zigzag"          |

Note that there are minimal pairs between these classes. For example, judging just from the plural *cruces*, it is impossible to tell whether the singular should be a  $\emptyset$ -theme *cruz* or an *e*-theme

<sup>37</sup>I will be ignoring the class of words with no change in the plural, such as *virus* "virus(es)", *brindis* "toast(s)", and *crisis* "crisis/crises", which may be  $\emptyset$  theme with either a  $\emptyset$  plural allomorph or /s-s/ degemination.

*cruce* (in fact, both exist). Similarly, judging from the phonological form of the singular *menú* or *hindú*, it is impossible to predict that the plural of *menú* has no /e/ (*menús*) while the plural of *hindú* does (*hindúes*).

The existence of these classes removes the possibility of any purely phonological account of pluralization (*contra* Moyna and Wiltshire 2000). That is, there cannot be a general rule of *e*-epenthesis for the plural consonant final words, because the  $\emptyset$ -theme class does not follow it. There also cannot be a general rule of final *e*-deletion in the singular because the *e*-theme class does not follow it. Therefore there must be something morphological going on.

One solution, that of Harris (1999), divides these words into several morphological classes in order to make a phonological generalization: The *-o* theme is Class I, the *-a* theme as Class II, and the remainder are the *-e* theme class. Harris then removes “exceptional” words (many but not all, and not exclusively, loanwords) and makes them into their own class (Class IV). The remaining words fall into Class III and follow a phonological pattern: roots ending in a vowel, glide, and the consonants /r, l, n, d, s, ç/<sup>38</sup> have  $\emptyset$  in the singular and *-es* in the plural; roots ending in other consonants or consonant clusters take *-e* in the singular and *-es* in the plural. Harris implements his solution with morphological rule which inserts an /e/ in the theme vowel node in Class III plurals of the proper phonological shape. An alternate solution with approximately the same ramifications would be to have allomorphy between /e/ and  $\emptyset$  for the Class III theme vowel conditioned on the the plural node and the phonology of the root.

However, Colina (2003) argues against Harris (1999) instead claiming that the division between Harris’s Class III and Class IV is opaque to a learner. She argues that dividing the /e/-epenthesis and *e* theme vowel categories weakens the argument that the alternation is predictable. Instead, Colina argues that the allomorphy takes place in the plural morpheme, between /-s/ and /-es/. I follow this intuition in the analysis below.

### 2.4.1.3 Summary of Issues

The main issue to be explained here is what the domain for depalatalization is. That is, depalatalization seems to occur when an underlying palatal consonant  $\tilde{n}$  or *ll* is in coda position, but this is not

---

<sup>38</sup>Harris uses /ç/ for the phoneme that is /θ/ in Castilian and /s/ in other dialects.

surface true. Precisely coextensive with the failure to depalatalize are cases of nouns with singulars in  $-\emptyset$  but plurals in *-es*.

Although other arguments have been made, following Colina (2003), I'll assume that in these particular nouns of interest the theme vowel is always  $-\emptyset$  and the plural shows allomorphy between *-s* and *-es*. When this assumption is made, the domain of palatalization seems to include everything up to the theme vowel but not the plural morpheme. This needs to be explained.

## 2.4.2 Analysis

The goal here is to find the domain of application of depalatalization. As I will show below, whether or not the underlying palatal consonant is depalatalized hinges on whether it is syllabified in a coda in the domain up to (and including) the theme vowel, but not the plural morpheme.

First, if the root takes an overt theme vowel (in either a noun, adjective, or verb) the stem-final palatal consonant stays palatal, shown for thematic nouns/adjectives (71) as well as thematic verbs (72).

(71) Thematic nouns/adjectives do not show depalatalization:

- a. bello / bella "beautiful (masc./fem.)"
- b. caballo "horse" / caballa "mackerel"<sup>39</sup>
- c. castaño "chestnut tree" / castaña "chestnut (nut)"

(72) Thematic verbs do not show depalatalization:<sup>40</sup>

- a. tañer "play (string), ring (bell)": tañes, tañido, etc.
- b. mellar "chip, nick": mellas, mellado, etc.

The same root might select for an overt theme vowel in one part of speech but a null theme vowel in another. The depalatalization follows suit, so, using an example from the discussion above, in (73a-b) the root shows a palatal consonant, but in (73c-d) it is depalatalized:

---

<sup>39</sup>It is probable that the roots of *caballo* "horse" and *caballa* "mackerel" are not related in speakers' heads, but this shows that the same underlying phonology behaves the same with a theme vowel regardless of the theme vowel's quality.

<sup>40</sup>It is interesting to note that the first person singular present indicative forms still show palatalization, despite the theme vowel being "gone" or otherwise modified: *taño*, *mello*. This will fall out directly from the analysis presented here if the output of these forms involves a theme vowel that is deleted later (*tañe+o* → *taño*).

- (73) Root  $\sqrt{\text{DESDEÑ}}$  with different theme vowels
- a. desdeña "he/she disdains (present indicative)"
  - b. desdeñado "disdained (participle)"
  - c. desdén "disdain (noun)"
  - d. desdenes "disdains (noun)"

As discussed above, if we want to maintain that the theme vowel is the boundary for the domain of depalatalization, in (73d), the plural morpheme must be assumed to be /es/ so that the /e/ is not included in the depalatalization calculation.

Note that it is not simply a noun/verb asymmetry in these forms. In forms which include overt derivational morphemes which begin with a vowel, the root-final palatal consonant is not depalatalized even in nouns (74)

- (74) Final palatal consonants in nouns with overt derivational morphemes
- a. desdeñoso "disdainful" (cf. desdén "disdain")
  - b. doncellez "virginity" (cf. doncel "lad")
  - c. clavellina "dianthus sp." (cf. clavel "carnation")

Thus the application of depalatalization cannot be reduced to a difference in the phonology of different parts of speech.

Beyond the argument from Colina (2003), evidence for the plural /es/ in the depalatalized nominal forms is from forms which can take both masculine and feminine forms in different classes. That is, nouns which have no overt theme in the masculine but do show an overt theme in the feminine show depalatalization in the masculine plural but not the feminine plural.

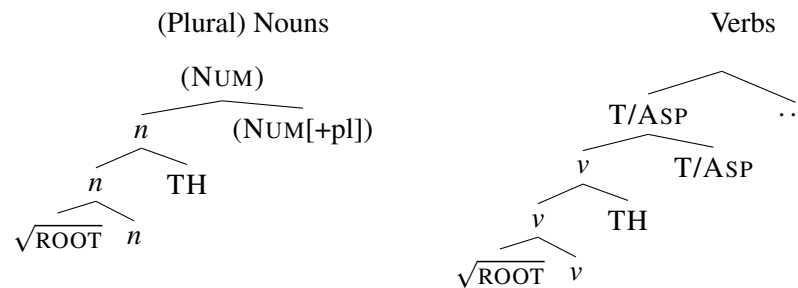
- (75) Nouns with depalatalization in masculine but not feminine
- a.  $\sqrt{\text{DONCELL}}$ 
    - doncel "lad", donceles "lads"
    - doncella "lass", doncellas "lasses"
  - b.  $\sqrt{\text{DONÑ}}$

- don "Mr., Sir", dones "Sirs"
- doña "Mrs., Lady", doñas "Ladies"

The generalization from this data is that derivational morphemes and theme vowels are included in the domain of calculation for depalatalization, but the plural is not.

Let us assume the following structures for nouns and verbs:

(76) Structure for nouns and verbs



We need a distinct domain which has two effects: (1) it separates nouns from their plurals, and (2) it separates nouns from verbs. The theme vowel domain is directly between nouns and plurals. And, because all verbs have overt theme vowels in Spanish (excepting, perhaps, a very few irregular verbs, unfortunately none of which have final palatal consonants) but some nouns do not, it is in a prime spot for this distinction as well.

If depalatalization is triggered by the addition of the theme node, we expect it never to be able to apply to verbal forms because a root final palatal consonant will always be syllabified as the onset of theme vowel syllable (assuming a null *v* head). However, in nouns without an overt theme vowel, depalatalization will apply. Thus, we run into the same problem as before, the question of the  $\emptyset \sim e$  class.

If we follow Harris (1999) and propose allomorphy or epenthetic addition of an *e* in the TH node, then we no longer have a domain for choosing a point in the derivation where depalatalization applies. That is, because the underlying structure  $\sqrt{\text{ROOT}}-n\text{-TH-NUM[+pl]}$  is the same for both *donceles* and *doncellas*, if the domain of depalatalization is the root and *n*, we should see depalatalization in both forms. If depalatalization applies to the entire structure, we expect to see

it only in the form with no overt endings, i.e., we would see the alternation *doncel~doncelles*, which is ungrammatical. If depalatalization includes the domain up to the TH vowel and there is an alternation between  $\emptyset$  and *e* in the TH vowel, then we also expect the ungrammatical alternation *doncel~doncelles*.

In order to have a unified domain of application, we need to apply depalatalization to the domain of the TH vowel, but not allow for alternations between null and overt theme vowels. For this reason, I proposed that the allomorphy is in the plural head.

To make this more explicit, I will walk through a derivations for a few forms. First, let us assume that there are four nominal classes corresponding to the four theme vowels in Spanish:

(77) Theme vowel vocabulary items for four nominal classes:

- TH  $\leftrightarrow$   $\emptyset$  / Class- $\emptyset$  –
- TH  $\leftrightarrow$  /e/ / Class-E –
- TH  $\leftrightarrow$  /a/ / Class-A –
- TH  $\leftrightarrow$  /o/ (Class-O/elsewhere)

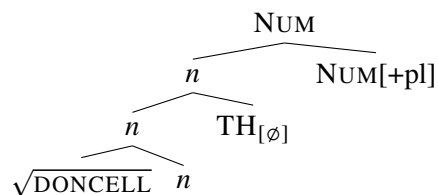
This gives us a nominal class for each overt theme vowel as well as a phonologically null theme vowel. From here, we can posit two allomorphs of the plural morpheme, a special /es/ allomorph conditioned by the Class- $\emptyset$  features on the theme vowel and the default allomorph /s/.

(78) Allomorphy of the plural morpheme:

- NUM[+pl]  $\leftrightarrow$  /es/ / TH $_{[\emptyset]}$  –
- NUM[+pl]  $\leftrightarrow$  /s/ (elsewhere)

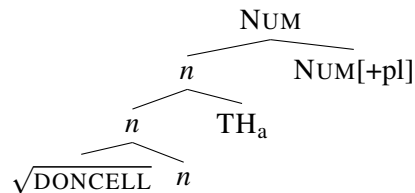
Assuming that the all theme nodes are cyclic, we can derive the correct forms of *donceles* and *doncellas*, shown in (79) and (80):

(79) Structure and derivation of *donceles* "lads"



- $\sqrt{\text{DONCELL}} \leftrightarrow /doncell/$
  - $n \leftrightarrow \emptyset$
  - $\text{TH}_{[\emptyset]} \leftrightarrow \emptyset^+$
  - $\text{NUM}[+pl] \leftrightarrow /es/ / \text{TH}_{[\emptyset]} -$
1. Linearize Morphosyntactic Structure:  $\sqrt{\text{DONCELL}} - n - \text{TH}_{[\emptyset]} - \text{NUM}[+pl]$   
UR vocabulary items:  $/doncell/ - \emptyset - \emptyset^+ - /es/$
  2. Add leftmost node to buffer  $\sqrt{\text{DONCELL}}$ 
    - 2a. Vocabulary Insertion  $/doncell/$
    - 2b. Integrate into buffer doncell
  3. Add next node to buffer  $\sqrt{\text{DONCELL}} - n$ 
    - 3a. Vocabulary Insertion doncell +  $\emptyset$
    - 3b. Integrate into buffer: No phonological material to integrate
  4. Add next node to buffer  $\sqrt{\text{DONCELL}} - n - \text{TH}_{[\emptyset]}$ 
    - 4a. Vocabulary Insertion doncell +  $\emptyset^+$
    - 4b. Integrate into buffer doncell
    - 4c. Cyclic Phonology: Depalatalization doncel<sub>l</sub>
  5. Add next node to buffer  $\sqrt{\text{DONCELL}} - n - \text{TH}_{[\emptyset]} - \text{NUM}[+pl]$ 
    - 5a. Vocabulary Insertion doncel +  $/es/$
    - 5b. Noncyclic node, no integration
- Output donceles

(80) Structure and derivation of *doncellas* "lasses"



- $\sqrt{\text{DONCELL}} \leftrightarrow /doncell/$
- $n \leftrightarrow \emptyset$

- $TH_a \leftrightarrow /a/^{+}$
  - $NUM[+pl] \leftrightarrow /s/$
1. Linearize Morphosyntactic Structure:  $\sqrt{DONCELL} - n - TH_a - NUM[+pl]$   
UR vocabulary items:  $/doncell/ - \emptyset - /a/^{+} - /s/$
  2. Add leftmost node to buffer  $\sqrt{DONCELL}$ 
    - 2a. Vocabulary Insertion  $/doncell/$
    - 2b. Integrate into buffer doncell
  3. Add next node to buffer  $\sqrt{DONCELL} - n$ 
    - 3a. Vocabulary Insertion doncell +  $\emptyset$
    - 3b. Integrate into buffer: No phonological material to integrate
  4. Add next node to buffer  $\sqrt{DONCELL} - n - TH_a$ 
    - 4a. Vocabulary Insertion doncell +  $/a/^{+}$
    - 4b. Integrate into buffer doncella
    - 4c. Cyclic Phonology: Depalatalization —
  5. Add next node to buffer  $\sqrt{DONCELL} - n - TH_a - NUM[+pl]$ 
    - 5a. Vocabulary Insertion doncella +  $/s/$
    - 5b. Noncyclic node, no integration
- Output doncellas

Note that in *donceles* (79), because the theme vowel is phonologically null, when the cyclic depalatalization is applied at Step 4, the palatal *ll* is in the coda of the syllable. This phoneme (now *ll*) is later syllabified in the onset after the addition of the plural morpheme */es/*. However, the depalatalization has already occurred. In *doncellas* (80), however, the theme vowel is an overt */a/*, which causes the palatal *ll* to be syllabified in the onset at Step 4, meaning that depalatalization does not apply to it.

Recall from (70) that there are three types of *-∅-* and *-e-* nouns in Spanish: those that take *e* in the singular and *es* (e.g., *parte, partes* "part"), those that vary between  $\emptyset$  in the singular and *es* in the plural (e.g., *rey, reyes* "king"), and those that take  $\emptyset$  in the singular and *s* in the plural (e.g.,



*menú, menús* "menu"). Using the plural allomorph /es/, I demonstrated how to derive the middle type ( $\emptyset \sim es$ ) in (79). Under this analysis, the first type ( $e \sim es$ ) are just normal Class-E nouns which always take a theme vowel /e/ regardless of singular or plural. Note that the plural morpheme in these cases will be spelled out as its elsewhere allomorph /s/ because it is not next to a  $\emptyset$ -featured theme. Essentially this posits that the two plural *es* cases are not from the same morphological source. In one case the *es* is the exponent of the plural morpheme while in the other it is the *e* theme plus the *s* plural.

The last type of noun mentioned above is most interesting. These nouns never show a theme vowel and do not condition the plural allomorph /es/. What I propose here is that these nouns are truly athematic in the sense that they lack a TH node entirely (or that, for whatever reason, they condition very early pruning of their TH node). In these cases, the lack of a TH node means both that there is no pass of the cyclic phonology at the TH node (since it is not there) and that the special /es/ allomorph of the plural is not conditioned. Note that this sets up an interesting dichotomy between morphosyntactic cases in which nodes are not inserted (or are inserted but are pruned away from the structure) and cases in which a node is morphosyntactically present (i.e., it conditions or blocks allomorphy and may trigger a pass of cyclic phonology) but happens to have no phonological content. This dichotomy between interacting and non-interacting null nodes will be discussed further in Section 2.5.1.

Returning, for a moment, to the plural allomorph /es/, we should note that this allomorph applies in more than just cases of root nouns. It also applies following a variety of derivational morphemes, such as *-dad*, *-ción*, and *-dor*, examples shown in (81):

(81) Other cases of /es/ plural

- a. *-(i)dad*: ver-dad-es "truths", verbos-idad-es "wordinesses", bon-dad-es "goodnesses", dei-dad-es "deities"
- b. *-ción*: degusta-ción-es "samples", ablu-ción-es "ablutions", loca-ción-es "locations", inyec-ción-es "injections"
- c. *-dor*: pic-a-dor-es "picadors", colg-a-dor-es "hangers", maquin-a-dor-es "schemers"

I propose that these suffixes select for the null theme class as their TH node. The plural allo-

morph /es/ then falls out naturally from the analysis given above.

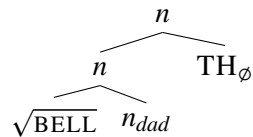
### 2.4.2.1 Cyclic Nodes in Spanish and the Cyclic Phonology Buffer

Clever readers may have spotted a interesting problem with the implementation of the phonocyclic buffer for the Spanish data presented here. Following the discussion of English in Section 2.3, I posited that cyclic nodes only interact with adjacent phonocyclic buffers and do not cross over non-cyclic nodes. A minor caveat was made for non-cyclic nodes with null phonological content because perhaps they are not counted by the phonology as intervening. However, in Spanish, overt derivational morphemes may intervene between the theme vowel and the root.

For example, let us consider the word *beldad* "beauty". Ideally we would like to be able to derive it from the same root as *bello/bella* "beautiful". However, following a strict implementation of the cyclic algorithm and phonocyclic buffer proposed above, we should not depalatalize the *ll*, as shown in (82):

(82) Incorrect derivation of *beldad*

Structure:<sup>41</sup>



- $\sqrt{\text{BELL}} \leftrightarrow /bell/$
- $n_{dad} \leftrightarrow /dad/$
- $\text{TH}_\emptyset \leftrightarrow \emptyset^+$

- |   |  |
|---|--|
| 1. Linearize Morphosyntactic Structure: | $\sqrt{\text{BELL}} - n_{dad} - \text{TH}_\emptyset$ |
| UR vocabulary items:                    | $/bell/ - /dad/ - \emptyset$                         |
| 2. Add leftmost node to buffer          | $\sqrt{\text{BELL}}$                                 |
| 2a. Vocabulary Insertion                | $/bell/$   |
| 2b. Integrate into buffer               | bell   |

<sup>41</sup>It is also possible that *-dad* is attached above a null nominal head, i.e.,  $\sqrt{\text{BELL}}-n_\emptyset-n_{dad}-\text{TH}$ . This should not affect the morphophonology under discussion here.

- |     |  |   |                |
|-----|--|---|----------------|
| 3.  | Add next node to buffer                      | $\sqrt{\text{BELL}} - n_{dad}$                      |                |
| 3a. | Vocabulary Insertion                         | $\boxed{\text{bell}} + /dad/$                       |                |
| 3b. | Non-cyclic node. No integration into buffer. |   | ← Problematic! |
| 4.  | Add next node to buffer                      | $\sqrt{\text{BELL}} - n_{dad} - \text{TH}\emptyset$ |                |
| 4a. | Vocabulary Insertion                         | $\boxed{\text{bell}} + /dad/ + \emptyset^+$         |                |
| 4b. | No adjacent buffer: start new buffer         | $\boxed{\text{bell}} + /dad/ + \boxed{\emptyset}$   |                |
| 4c. | Cyclic Phonology: Depalatalization           | —   |                |
|     | Output                                       | *belldad  |                |

There are two possible solutions to this problem. First, we could posit a non-cyclic depalatalization process in Spanish along with the cyclic process. This would take any instances of *ll* or *ñ* in codas and turn them into *l* or *n* at the non-cyclic or word level. It is, in fact, surface true that there are never palatal consonants in codas, so this is not a terrible solution.

Another possibility is that all overt derivational morphemes in Spanish are cyclic, along with the cyclic theme vowel morphemes. Under this solution, the *-dad* exponent in (82) Step 3 would get integrated into the buffer, and the cyclic depalatalization would apply to the *ll* of *bell-* (now in the coda). This solution also works for the depalatalization puzzle because the palatal consonant will either be syllabified in the onset (for a derivational morpheme that begins with a vowel) and stay palatal or will be syllabified in the coda (for a derivational morpheme that begins with a consonant) and be depalatalized. This generalization that the depalatalization of root-final palatal consonants is determined by the phonology of the first overt morpheme following them (up to the theme vowel) is also surface true. This solution creates a stark difference between overt and null category defining heads; Not only is there a difference in the presence or absence of phonological material but there is also a difference in the cyclic/noncyclic status which falls neatly along the same lines.

### 2.4.3 Case Study Conclusion

Adding to the discussion of the division between cyclic and noncyclic morphemes, Spanish shows yet another way of dividing up the morphemes. This lends more evidence to the diacritic solution for this division, discussed further in Sections 2.5.2. Additionally, the interesting difference between



## 2.5 Additional Discussions

### 2.5.1 Blocking and Non-blocking Zeros

Previous work on morphology in a piece-based framework has made a distinction between two different types of phonologically null morphemes: blocking and non-blocking zeros. Blocking zeros are morphemes which have no phonological content (that is, their exponent is  $\emptyset$ ), but which interact with the morphological and phonological system in a way that makes them look present. For example, blocking zeros prevent allomorphy and allosemy between morphemes on either side. Non-blocking zeros, on the other hand, seem to be completely gone for the purposes of both allomorphic and allosemic interactions. We posit that the syntax must generate a node in that particular syntactic position in order to make the combinatorics and feature checking apparatus of the syntax work. However, by the time any morphological or semantic operations are active, it seems that the node in question is gone (or “pruned” from the tree) (Embick 2003, 2010a).

In the case studies presented here, we have seen the same two behaviors of phonologically null morphemes with respect to their interaction with the phonological apparatus. Some of these morphemes, such as many of the *n* and *v* heads in Slavic, seem to simply be completely invisible to the phonological calculation. That is, they neither trigger a pass of the cyclic phonology nor do they block a subsequent morpheme from interacting with the existing phonocyclic buffer.

For example, recall from Section 2.2.2, that in the derivation of Slovak *stebiel* “stalk (gen. pl.)” the *n* head (whose exponent is phonologically null) can neither trigger the cyclic phonology to run nor block the K/NUM head from interacting cyclically with the root.

(83) Structure of *stebiel* “stalk (gen. pl.)”

Linearize Morphosyntactic Structure:  $\sqrt{\text{STALK}}$  - *n* - K/NUM<sub>[gen. pl.]</sub>

UR vocabulary items: /stebE/ -  $\emptyset$  - /O/

If *n* head triggered the cyclic phonology, the yer of the root would lengthen the previous vowel, ultimately resulting in *\*stiebel*. So the *n* head cannot be cyclic. If the *n* head is non-cyclic, however, it should block the cyclic interaction between the yer of the K/NUM head and the yer in the root, resulting in *\*stebI*. The derivation works out perfectly if we simply ignore the *n* head entirely. That

is, it seems like a non-blocking zero.

Similarly, we saw in Section 2.4.2 that Spanish *n* heads which were phonologically null must also behave in such a way that they neither trigger the cyclic phonology nor intervene between the TH node and the root. In contrast the Spanish TH vowels of the  $\emptyset$ -Theme class are also phonologically null but critically need to trigger the cyclic phonology. So the null *n* heads seem to be non-blocking zeros while the null TH vowel is a blocking zero.

I propose that non-blocking zeros are nodes which are pruned early enough in the derivation to be essentially non-existent for purposes of the PF side of the derivation, probably before spell-out given that they are non-interactive on both the PF and LF sides (see Embick 2010a; Wood 2012; Marantz 2013). Blocking zeros, on the other hand, are morphemes which exist in the PF derivation, they just happen to have exponents with no phonological content.

One hypothesis made about the difference between these zeros is that only morphemes whose default exponent is zero can get pruned (Embick 2003, f.n. 36). That is, the *n* and *v* heads from Slovak and Spanish discussed above have, by hypothesis, a default exponent which is phonologically null. Somehow, the computational system knows this and allows for these nodes to be pruned (perhaps to reduce calculation load).

I can offer no further explanation of this phenomenon here, but I note that, in the case studies presented, the phonological evidence aligns with the intuitions from the allomorphy and allosemy arguments made about these zeros previously: Default zeros seem transparent to the phonological system while non-default zeros interact with the system as normal exponents (except for the fact that they have no phonological content).

### **2.5.2 Diacritics and assignment of randomness**

The case studies in this chapter present a variety of ways in which the division between cyclic and non-cyclic morphemes is divided in the grammar. In Polish, as in many other Slavic languages, it seems that the division is made between prefixes and suffixes, with prefixes being non-cyclic and suffixes being cyclic. In English, there seems to be a more random distribution with both prefixes and suffixes being either cyclic or non-cyclic with no bias towards one or the other. In Spanish, most

heads seem to be non-cyclic, but critically, at least the theme vowels need to be cyclic.

Assuming, as I do here, that the distinction is diacritic, this difference between languages brings up two questions about the nature of the cyclic and non-cyclic distinction: (1) Which is the base case and which is the marked case? and (2) How is it possible for a specific language to have a generalization about the distribution of a diacritic feature?

To address the first, I suggest that, by default, the cyclic morpheme is the marked form because it triggers action in the phonological domain, whereas the non-cyclic morpheme does not. It seems more natural to me that the diacritic mark is the instruction to the phonological system. However, it is possible that this diacritic goes the other way (as I notate for the case study on Yers in Section 2.2). In that case, it seems more natural for non-cyclic nodes to be marked because the majority of morphemes are cyclic (because they are suffixes). There may be some sort psycholinguistic processing experiments which could differentiate between the base case and the diacritic case based on the reaction time, but short of that, it seems difficult to tell which morpheme type carries the diacritic.

To answer the second question, given the pattern in English, it seems that learners are able to posit arbitrary diacritics, although perhaps there is a preference against for this sort of solution. That is, it seems that learners abhor randomness. I suggest that the ability for a specific language to generalize the distribution of cyclic and non-cyclic morphemes along the lines of some other grammatical distinction is a result of the learning bias against a random system. Note that this does not mean that cyclicity is inherently linked with those grammatical features in the grammar, simply that the generalization linking some feature with cyclicity is a learning strategy.

For example, in English past tense allomorphy, it is clear that learners are able to learn random lists for strong verb membership. However, learners seem to want to make phonological generalizations about the list membership, resulting in overirregularization over time and also in wug-tests (see, e.g., Prasada and Pinker 1993; Albright and Hayes 2003).

Thus, while it is possible for a speaker to have certain phonological or morphological generalizations about what sorts of morphemes in their language are cyclic or non-cyclic, I propose that this is a relic of their particular learning apparatus and not an inherent part of the grammatical structure.

That is, there is no grammatical principle dividing, for example, prefixes from suffixes in a way that results in one set behaving as cyclic morphemes and the other as non-cyclic. The fact that we see this in Polish is a relic of historical developments and learning processes. Underlyingly, I propose that the cyclic/non-cyclic distinction must be a diacritic system.

## **2.6 Chapter Conclusion**

In this chapter, following work in Cyclic Phonology and Stratal Theories, I motivated the fact that some phonological rules (“cyclic”) apply iteratively with the addition of a morpheme while others wait until all morphemes are combined in order to apply (“non-cyclic”). Additionally, some morphemes seem to trigger the application of the cyclic phonology while others do not. Because there is no morphosyntactic reason to motivate a structural difference between these types of morphemes, I posited that the status of cyclic or non-cyclic is determined by diacritic marking. This diacritic status is also supported by the fact that different languages divide up the space of cyclic and non-cyclic morphemes differently, which I attribute to different strategies that learners take to make sense of an underlyingly random (= diacritic) system.

I introduced an explicit model for the calculation of the cyclic phonology (the phonocyclic buffer) and posited that non-cyclic morphemes are not integrated into a buffer, but I did not discuss how the calculation of the “non-cyclic” phonology is executed. This topic will be covered in Chapter 3.



## Chapter 3

# The Word Domain

### 3.1 Overview

In Chapter 2, I motivated a difference between cyclic phonology, phonological processes that applied with the addition of each (cyclic) morpheme, and noncyclic phonology, phonological processes that wait until the entire word is built to apply. The question addressed in this chapter is: what is the domain of this noncyclic phonology?

I propose that the noncyclic phonology applies exactly within the domain of the phonological word. While I referred to the relevant block of phonological processes as “noncyclic” in the previous chapter to emphasize the contrast with cyclic phonology, in this chapter (and henceforth) I will refer to this phonological block as the word level, or  $\omega$ -Level phonology, to emphasize the comparison with other notions of “word”.

In Section 3.2, I discuss some of the various notions of word that have been presented in the literature. I propose that the phonological word of this framework (the  $\omega$ -Word) is, at least for the most part, equivalent to noncyclic and postcyclic phonologies in cyclic theories, the “word level” of stratal lexical theories, and the Prosodic Word (PWd) of Prosodic Hierarchy Theories (although the comparison with prosodic theories will continue in Chapter 4 with the discussion of affixation and cliticization).

I then turn to the problem of the structural domain of the  $\omega$ -Word. In the piece-based syntactic theory of morphology followed here, there is no inherent underlying notion of word as a syntactic

or semantic unit. That is, the word is not a meaningful or necessary unit for the syntactic side of derivation in this framework (see, e.g., Marantz 1997; Embick 2010a, 2014). However, it has been posited that there is a derived structure, the complex head or morphosyntactic word (M-Word), whose domain corresponds to that of the  $\omega$ -Word.

To motivate this correspondence, I present case studies in German and English voicing phenomena in Section 3.4 which show that the  $\omega$ -Level phonology must be calculated including all of the units in the M-Word. Furthermore, the  $\omega$ -Level phonology applies exactly within the bounds of the M-Word and not between M-Words.

It must be noted that the notion that there is some correspondence between some syntactic, grammatical, or lexical structure and phonological structure is not new. There have been a variety of correspondences posited, not the least of which are theories which include a word-generating module called the lexicon. For these theories, the word is of utmost importance because it is the unit which is passed between the lexicon and the syntax (and semantics). It is a surprise for these theories, then, that mismatches have been identified between “grammatical words”, defined as cohesive morphosemantic units, and “phonological words”, defined as cohesive phonological units (see, e.g., Dixon and Aikhenvald 2002, pp. 27–30). That is, there appear to be cases where a single grammatical word may correspond to multiple phonological words and vice versa. For Lexical theories, this motivates a disjunction and non-interaction between the grammatical system which generates the words on the structure/semantics side and the phonological system which organizes the sounds to be pronounced.

In Sections 3.5–3.9, I present a few case studies where such mismatches have been proposed and show that we can explain these phenomena without disrupting the correspondence between M-Words and  $\omega$ -Words. In one direction, the phenomena of “Aoyagi” prefixes in Japanese and interleaving word order in Vietnamese have been proposed to be cases of single grammatical words surfacing as multiple phonological words. In the other direction, compounds, such as those seen in Spanish, and long polysynthetic words, such as those seen in Plains Cree, have been proposed to be multiple grammatical words corresponding to a single phonological word. I show that, given a closer look, these do not appear to be mismatches and we can use the framework presented here to

explain the data we see. Given this resolution of mismatches, there seems to be no reason to starkly divide the grammatical (here: syntactic) system from the phonological system.

Finally, although I propose a correspondence between M-Words and  $\omega$ -Words, this correspondence seems to be one way; complex M-Words always surface as  $\omega$ -Words, but not all  $\omega$ -Words are underlyingly M-Words. There seems to be at least one other way in which  $\omega$ -Words can be created. In Section 3.10, I introduce the process of Stray Terminal Grouping through which linearly adjacent morphemes which otherwise do not belong to a  $\omega$ -Word may be grouped together into their own  $\omega$ -Word. Although these phenomena represent a “mismatch” between M-Words and  $\omega$ -Words, the grouping of stray morphemes into  $\omega$ -Word perhaps has more to do with the need for every phonological item to belong to a group for the purposes of pronunciation than any deep or systematic split between the sound and structure systems.

Case studies in this chapter will more-or-less ignore the phenomenon of clitics, although it will come up, especially in the discussion of Stray Terminal Grouping. The discussion of the  $\omega$ -Word and the interaction with clitics will be taken up in Chapter 4.

## **3.2 Discussion: What is a word?**

Linguists have generally found it difficult to formulate an explicit definition for the notion of “word” because there seem to be several ways of defining words which do not necessarily refer to the same object or the same properties.

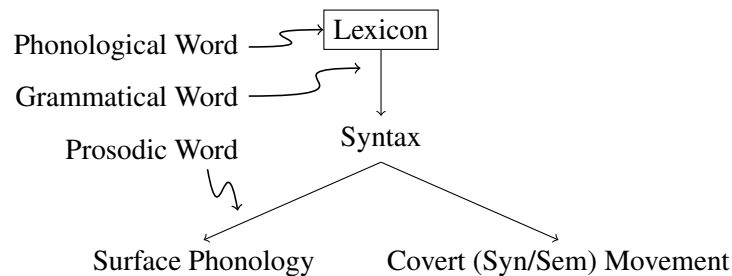
For example, when examining structure and meaning, a unit called the grammatical or lexical word has been proposed. This word is considered the atomic unit of the syntax, or an item listed in memory, or the output of the lexicon (see, e.g., Kiparsky 1982a; Sciullo and Williams 1987). Furthermore, the grammatical word has been proposed to be a unit whose grammatical elements which always occur together in a fixed order and have conventionalized meaning (Dixon and Aikhenvald 2002, p. 19).

When dealing with the phonological system, the word is a unit traditionally diagnosed by either properties that occur once within the domain (stress, accent, harmony), properties that are bounded by the domain (internal structure, word boundary phenomena), or restrictions which are enforced

only within the domain (phonotactics, minimal/maximal words) (see, e.g., Dixon and Aikhenvald 2002; Hyman 2006). Interestingly, depending on the framework, these phonological properties of the word are generated in two different places. One, which I'll call simply the phonological word is the output of the phonological processes of the lexicon. Another, usually called the prosodic word (PWd), can include syntactic objects such as clitics, and so must be calculated in the PF branch of the derivation, assuming clitics are syntactic objects (see discussion later in this chapter and in Chapter 4).

These three types of words, phonological, grammatical and prosodic, do not refer to units in the same subpart of the architecture of grammar. For example, theories with a lexicon, such as Lexical Phonology (Kiparsky 1982a; Mohanan 1986) and Stratal Optimality Theory (Kiparsky 2000; Bermúdez-Otero in prep) have an architecture where the lexicon generates the grammatical word, the phonologization of which is a phonological word, which is then inserted into the syntax. A schematic of this system is shown in (84):

(84) Architecture of Grammar in Theories with a Lexicon<sup>1</sup>



For these theories, a grammatical word is (i) the output of the lexicon, (ii) the unit of interface between the lexicon and the syntax, and (iii) the primitive or atomic unit of the syntax.

The prosodic word is calculated later and deals with the phonological properties discussed above. The prosodic word may or may not be coextensive with the grammatical word. For example, in Prosodic Hierarchy Theory (Selkirk 1981, 1984; Nespor and Vogel 1986, *et seq.*), there is a proposed correspondence between grammatical words and prosodic words.<sup>2</sup> Like the level-ordering theories, the grammatical word in Prosodic Hierarchy Theories is explicitly stated to be

<sup>1</sup>Ignoring, here, complexity internal to the lexicon.

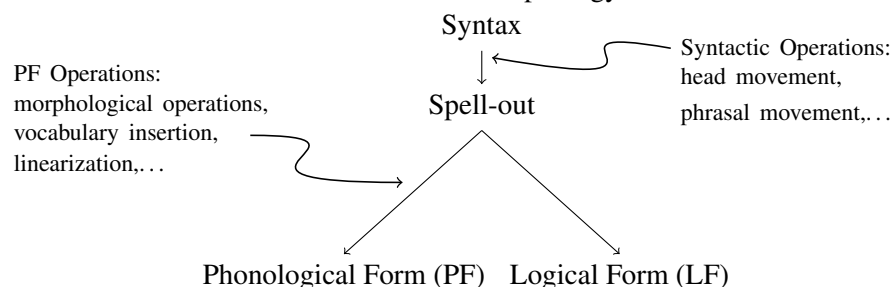
<sup>2</sup>Prosodic Words in Prosodic Hierarchy Theories are approximately the same as a phonological word elsewhere, modulo some tinkering with clitics, which will be discussed further in Chapter 4.

an atomic unit of the syntax, the equivalent to a syntactic  $X^0$  in Jackendoff-style X-Bar Theory (see, e.g., Nespor and Vogel 1986; Selkirk and Shen 1990; Prince and Smolensky 1993; Selkirk 1995; Truckenbrodt 1999). Although this relationship predicts a 1-to-1 correspondence between grammatical words and prosodic words, there have been cases brought forth that seem to not follow this. Relationships between grammatical words and phonological words have been posited, but many cases seem to show the possibility of one-to-many, many-to-one, and more complex mapping relationships (see Dixon and Aikhenvald 2002, pp. 27–30, for an overview of some of these cases).

Because of this mismatch, both level-ordering and Prosodic Hierarchy theories use only phonology-internal ways for determining whether a phonological unit counts as a phonological or prosodic word is not. This determination is either completely free of any outside structure or definition or controlled in the phonological module with some indirect alignment mechanism with the morphological structure. This is problematic, however, because these theories use circular logic in determining what a word is; A word is defined as the unit that undergoes the phonological processes associated with wordhood, but the phonological processes associated with wordhood are determined by examining words. Only by assuming that words are primitive units and that it is intuitive (at least, to the linguist) to determine what is and is not a word can this kind of circularity be circumvented.

In contrast with these lexical theories, in piece-based syntactic theories of morphology, such as Distributed Morphology, the assumption that “grammatical words” are atomic units of the syntax is rejected. Whereas the theories discussed above posit an architecture containing a special word factory module, the lexicon, to generate words as input for the syntax, DM argues that the atomic units of the syntax are morphemes rather than words.

(85) Architecture of Grammar in Distributed Morphology



As shown in (85), the syntax combines morphemes and, at a certain point, these combinations of

morphemes are subject to spell-out, which sends them off to be phonologized (at PF) and to be further manipulated by the semantics (at LF). However, in this architecture there is no interface at which “word” is a defining unit, leaving the question of what a word is and where it is used in the architecture.

In fact, much research in DM has been devoted to showing that the unit of the word is both too big and too small for various properties of the morphosyntax such as allomorphy, semantic resolution, and idiom meanings. For example, Embick (2010a, 2014) argues that, for processes such as allomorphy, the relevant domains are those of phase-cycles defined by category defining heads which are sometimes smaller than word size. Similarly, the domains for meaning storage and interpretation are sometimes smaller and sometimes larger than word size (see Marantz 1997). The general consensus in the DM literature is that morphological generalizations are better analyzed as relationships between morphemes rather than words. The word, then, is no longer a meaningful unit in the syntactic part of the derivation.

Dispensing with the word for syntacticosemantic and morphological purposes is compatible with a number of different phonological theories. As such, one of the questions that needs to be addressed is whether we need something like the word on the phonological side. There are clear cases of phonological processes applying to word sized units (and not smaller or larger units) explored in the literature based in other theories of the morphology-phonology interface (e.g., Lexical Phonology, Stratal Optimality Theory). Likewise, in Prosodic Hierarchy Theories the prosodic word is clearly needed to define the basic pieces that are joined together in prosodic phrases.

It must be noted, however, that the calculation of phonological wordhood is not made on the basis of phonological factors alone. That is, it is not the case that words are freely built from the string of sounds in a phrase, optimizing for length or metrical shape (or some other phonological desiderata). Rather, there is some reference to morphosyntactic structure determining which pieces of the morphology and phonology are grouped together into words.

So, if the word is not a necessary unit in the morphosyntax but is necessary in the phonology, and there is a relationship between some morphosyntactic structure and phonological words, then there must be something at the interface between the morphosyntax and the phonology which derives the

effects associated with the phonological word.<sup>3</sup> That is, we have removed the unit of “grammatical word” as a primitive of the morphosyntax, but there must still be some structure which is referred to in calculating the domain of the phonological word.

In the simplest scenario, having a structural account would mean that properties associated with phonological wordhood derive from one particular syntactic structure relationship. That is, we can posit that there is a direct correspondence between a “grammatical” structure and a phonological word, however, this grammatical structure is not a syntactic atom. Instead, the complex head (or M-Word) provides this structure to a large extent (following Embick and Noyer 2001, *i.a.*). The precise theory of the interface proposed here is presented in the next section.

To summarize, in the piece-based syntactic morphology presented here, there is a correspondence between a morphosyntactic structure, the complex head or M-Word, and the phonological word ( $\omega$ -Word). The fact that the M-Word is not a syntactic primitive but a derived unit means that the  $\omega$ -Level phonological processes associated with its correspondent, the  $\omega$ -Word, can account for much of the same empirical data as a variety of phonological blocks from other theories, including noncyclic phonology, postcyclic phonology, lexical words, and prosodic words. This will be exemplified by the case studies that follow.

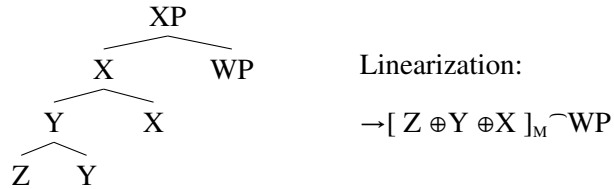
### 3.3 The M-Word $\Rightarrow$ $\omega$ -Word Correspondence

As discussed above, in the framework presented here, the “word” is not primitive unit in the syntax. However, Embick and Noyer (2001), *inter alia*, have proposed that there is a (morphosyntactically) derived unit of similar size, called the *morphosyntactic word* (M-Word). The M-Word is defined as a maximal complex head (cf.  $H^{0\max}$  of Chomsky 1995). Terminal nodes that are not maximal are considered *subwords*.

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<sup>3</sup>There is the interesting question of why the word is a necessary unit in the phonology if it has no use in the morphosyntax. One possibility is that the language faculty has the need to be able to pronounce discrete units. The word, thus, is an attempt to group phonological material into “speakable” units. This could explain in part why the word seems to be, in some respects, the minimal unit of phonological material that can be pronounced alone. See the discussion in Section 3.10.6.

- *Morphosyntactic Word (M-Word)*:  
A (potentially complex) head not dominated by a further head-projection.
- *Subword*: A terminal node of the syntax that is not an M-Word



Embick (2007b) proposes that M-Words and subwords are of different types in the calculation of linearized morphosyntactic structure such that M-Words are only linearized with respect to other M-Words while subwords are only linearized with respect to other subwords within their M-Word. In the example tree in (86), the subwords Z, Y, and X are linearized with each other (notated as  $\oplus$ ) while the M-Word that they form is linearized with respect to the next M-Word (notated as  $\supset$ ) which would be the leftmost M-Word within WP.

This difference between the interaction of subwords and the interaction of M-Words plays an important role in analyses of phenomena such as word-phrase blocking (Embick and Marantz 2008) and the synthetic/analytic alternation of comparative and superlative adjectives in English (Embick 2007a). In these cases, when complex heads are formed (by syntactic or morphological movement) the phonological output appears as one phonological word (e.g., in the case of comparative adjectives, *smarter*) whereas when the syntactic terminals are not combined into complex heads the phonological output appears as separate words (e.g., *more intelligent*).

Given this observation, we can posit an interface function between the morphosyntactic structure and the phonological structure. The syntactic derived unit of the M-Word corresponds to the phonological domain of the  $\omega$ -Word.

(87) **Morphosyntax-Phonology Correspondence Function:** M-Word  $\Rightarrow$   $\omega$ -Word

- M-Words correspond to  $\omega$ -Words.

This correspondence is implemented as a PF operation, which is ordered after a variety of morphological operations (discussed further in Section 4.2.1.2) and Vocabulary Insertion but before the



$\omega$ -Level phonology applies. This means that when the M-Word structure is built by morphosyntactic operations and spelled out, the M-Word structure is maintained and marked in the linear structure (represented here with [ ... ]<sub>M</sub>). The “M-Word  $\Rightarrow$   $\omega$ -Word” operation essentially operates by changing the ontology of the bracketing from a morphological marker to a phonological one ( $\omega$ -Brackets notated here with ( ... ) <sub>$\omega$</sub> ). These brackets are used here to delineate the domain of the  $\omega$ -Level phonology. It may not actually be necessary to change the label and simply use the M-Word structure in the phonology, but in keeping with the desideratum for a separation between morphosyntactic and phonological modules of grammar, I will maintain the change.<sup>4</sup> Additionally, there are other ways in which  $\omega$ -Words are able to be created (for example, Stray Terminal Grouping in Section 3.10), so the notation of  $\omega$ -Brackets is used both for these cases and the M-Word corresponding cases.

### 3.3.1 Restriction: Non-minimal M-Words

It must be noted that not all heads in the syntax correspond to phonological words. Specifically, single heads, or minimal M-Words, do not form phonological words on their own. In fact, these single heads are usually the functional heads that behave phonologically as clitics. This particular point will be elaborated in Chapter 4 in the discussion of clitics, see also the discussion of Stray Terminal Grouping in Section 3.10.

The fact that single heads do not correspond to phonological words requires a simply amendment to the correspondence to ensure that it applies only to non-minimal M-Words. The minimality of a head is easy to compute by checking if it is dominated by or dominates another head. The revised correspondence following this route is shown in (88):

(88) **Revised Morphosyntax-Phonology Correspondence:** Non-minimal M-Word  $\Rightarrow$   $\omega$ -Word

- Non-minimal M-Words correspond to  $\omega$ -Words.

Note that an alternate condition which could be made on the M-Word  $\Rightarrow$   $\omega$ -Word correspondence with much the same result would be a “lexical” condition. That is, there has been a great deal of work demonstrating that only lexical categories and their projections are available for reference

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<sup>4</sup>Note that this correspondence has a strong resemblance to Match Theory, a recent proposal in Prosodic Hierarchy Theory in which syntactic objects are matched on both left and right edges to phonological objects, including words (see, e.g., Selkirk 2009; *contra* earlier proposals that only allow alignment of one edge, such as Selkirk 1986)

when building base prosodic units (the Lexical Category Condition, for which see Nespov and Vogel 1986; Selkirk and Shen 1990; Prince and Smolensky 1993; Selkirk 1995; Truckenbrodt 1999). Following this intuition, we could alternately restrict the correspondence only to “lexical” M-Words, which could be defined here as M-Words which contain a category defining head (e.g., *n*, *a*, *v*).<sup>5</sup> Interestingly, since the combinatorics on the syntactic side of Distributed Morphology never allow a root to appear without a category defining head, this particular “lexical” condition is a proper subset of the non-minimal condition above. Here, I will follow the more general non-minimal condition.

### 3.4 M-Word $\Rightarrow$ $\omega$ -Word Basic Case Studies

In this section I present two brief case studies showing the regular correspondence between M-Words and  $\omega$ -Words. The first case study, syllable-final devoicing in German, shows a  $\omega$ -Level phonological process that is minimally calculated at the M-Word, meaning that all morphemes inside the M-Word must be included in the calculation. The second case study, voice assimilation in English, shows additionally that the  $\omega$ -Level process is calculated maximally at the M-Word level, meaning it does not apply between adjacent M-Words.

#### 3.4.1 German syllable-final devoicing

In Standard German, voiced obstruents in syllable coda position become voiceless,<sup>6</sup> but this process is calculated only with the inclusion of all morphemes and not sooner. Consider the data in (89). Following the traditional analysis, the examples in (89) show that underlying voiced obstruents, such as /d/ in *kind* /kɪnd/, are devoiced in when they appear in syllable coda position (*Kind* [kɪnt]) but maintain their underlying voice when they appear in the onset (*kindisch* [kɪm.dɪʃ]).

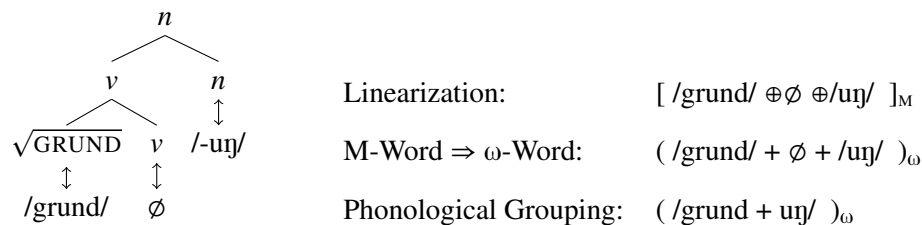
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<sup>5</sup>Note that defining “lexical” as an M-Word containing a root node would also be possible. These alternate definitions could be distinguished with investigation into places where roots and category defining heads do not always appear together, such as light verbs or light versus heavy prepositions. This point will not be pursued here because both versions of the “lexical” condition are subsets of the non-minimal condition.

<sup>6</sup>There has been some argument in the phonetics and experimental phonology literature about whether devoicing in German is truly neutralization or not (see Roettger et al. 2014, and sources cited therein). For the purposes here, it does not really matter whether the outcome of the devoicing process is the same as an underlyingly voiceless consonant. Rather, I am concerned with diagnosing where the devoicing process occurs with respect to phonological and morphosyntactic structure.

- *Kind* [-t] "child" ~ *kindisch* [-d-] "childish"
- *Ausland* [-t] "foreign countries" ~ *Ausländer* [-d-] "foreigner"
- *trüb* [-p] "cloudy, opaque" ~ *Trübung* [-b-] "cloudiness, opacity"
- *kräftig* /-g/ → /-ʏ/ → [-ç]<sup>7</sup> "strong, powerful" ~ *Kräftigend* [-g-] "bracing, invigorating"
- *Grund* [-t] "ground, bottom" ~ *grundlos* [-t-] "groundless, unfounded"  
~ *Gründung* [-d-] "foundation, establishment"

This devoicing process is sensitive to all the phonological content corresponding to the morphemes within the M-Word domain. That is, if this devoicing were a process applying cyclically with each affix (or if phonology was only active within syntactic phases, see Section 3.11) we might expect the /d/ of *Gründung*, for example, to be devoiced at the inner verb head, before the addition of the outer noun head *-ung*, see (90).

(90) Structure of *Gründung*<sup>8</sup>

In *gründung*, if the ω-Level phonology occurred at the time where only the inner *v* head and the root were in consideration, ( /gru\text{nd}/ + \textcircled{\emptyset} )<sub>ω</sub>, we would expect the the /d/ to be devoiced because it would be syllabified in the coda. However, the ω-Level process of devoicing must wait until the entire M-Word is calculated, resulting in the /d/ being syllabified in the onset of the following syllable (*Gründung* [gryn.duŋ]) and thus not subject to devoicing.

The story is not quite so simple, given that there are minimal pairs which show the same sequence of phonemes with devoicing in one case but not in another, as shown in (91):

## (91) Minimal pairs for devoicing

(Rubach 1990)

<sup>7</sup>The spirantization (and fronting) of /g/ does not happen in all dialects of German. In these dialects, forms like this end in a final [-k], as expected.

<sup>8</sup>For simplicity, I will ignore the Umlaut process in this derivation. See Section 5.3 for more on Umlaut.

- Handlung [-d-] "action" vs. handlich [-t-] "handy"  
 Exponents: Hand -l -ung hand -∅ -lich  
 Morphemes:  $\sqrt{\text{HAND}}$   $\nu$   $n$   $\sqrt{\text{HAND}}$   $n$   $a$
- neblig [-b-] "foggy" vs. glaublich [-p-] "believable"  
 Exponents: nebl -∅ -ig glaub -∅ -lich  
 Morphemes:  $\sqrt{\text{NEBL}}$   $\nu$   $a$   $\sqrt{\text{GLAUB}}$   $\nu$   $a$
- eignen [-g-] "own" vs. Zeugnis [-k-] "testimony"  
 Exponents: eign -∅ -en Zeug -∅ -nis  
 Morphemes:  $\sqrt{\text{EIGN}}$   $\nu$  ASP  $\sqrt{\text{ZEUG}}$   $\nu$   $n$

Without reference to morphological constituency, each of the pairs in (91) show the relevant consonant in approximately the same environment, but in one case there is devoicing and not in another case. Thus, it is clear that the syllabification and devoicing processes must be sensitive to morphological structure. Rubach (1990) proposes that (i) German readily uses liquids and nasals as syllable nuclei and (ii) syllabification in German is cyclic.<sup>9</sup> Adopting Rubach's proposals, we can demonstrate that devoicing is a  $\omega$ -Level process and that the  $\omega$ -Level is not calculated until the M-Word.

To derive, for example, the *Han[d]lung* ~ *han[t]lich* case, we need to assume that the inner  $\nu$  and  $n$  heads are marked as cyclic morphemes while the overt *-ung* and *-lich* are not.<sup>10</sup> The derivations are shown in (92):

(92) Derivation of *Han[d]lung* vs. *han[t]lich*<sup>11</sup>

a. Vocabulary Items:

- $\sqrt{\text{HAND}} \leftrightarrow /hand/$
- $\nu_1 \leftrightarrow /l/^{+}$
- $n_{ung} \leftrightarrow /uŋ/ / \nu -$
- $n \leftrightarrow \emptyset^{+}$
- $a_{lich} \leftrightarrow /liç/ / n -$

<sup>9</sup>Note that English has a similar set of minimal pairs with respect to the syllabification of liquids, for example *twinkling* [twɪŋk.lɪŋ] "a short instant" versus *twinkling* [twɪŋ.kl.ɪŋ] "the act of varying repeatedly between bright and faint" (Marvin 2002).

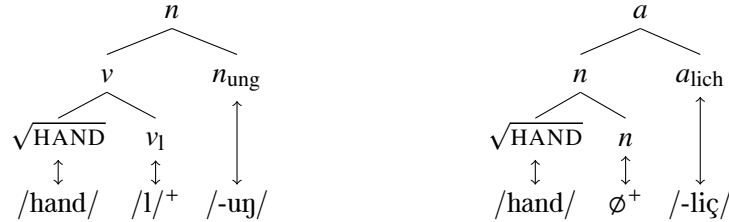
<sup>10</sup>For this example, at least, the inner- vs. outer-attachment distinction seems to hold up for German phonology.

<sup>11</sup>It is possible, given the non-transparent semantic relationship between the noun *Hand* "hand" and the verb *handeln* "act", that speakers may have two distinct roots ( $\sqrt{\text{HAND}}$  and  $\sqrt{\text{HANDL}}$ ). If this is the case, then the  $\nu$  exponent would be phonologically null but the rest of the derivation would be the same. The derivation in which both words are derived from the same root is shown here as an example of a minimal pair.

b. Phonological Processes:

- (Cyclic) Syllabification
- ( $\omega$ -Level) Devoicing of voiced obstruents in syllable coda

c. Structure, Linearization and Phonological Grouping of *Han[d]lung* and *han[t]lich*



Lin.: [  $\sqrt{\text{HAND}} \oplus v_1 \oplus n_{\text{ung}}$  ]<sub>M</sub>

Lin.: [  $\sqrt{\text{HAND}} \oplus n \oplus a_{\text{lich}}$  ]<sub>M</sub>

M $\Rightarrow\omega$ : ( /hand/ + /l/ + /-uŋ/ ) <sub>$\omega$</sub>

M $\Rightarrow\omega$ : ( /hand/ +  $\emptyset^+$  + /-liç/ ) <sub>$\omega$</sub>

d. Phonology: Cyclic and  $\omega$ -Level

1. Integration of root	$\sqrt{\text{HAND}}$	$\sqrt{\text{HAND}}$
1a. Vocabulary Insertion:	/hand/	/hand/
1b. No adjacent buffer, create new buffer	<span style="border: 1px solid black; padding: 2px;">hand</span>	<span style="border: 1px solid black; padding: 2px;">hand</span>
1c. No cyclic phonology, nothing to integrate		
2. Integration of next node	$\sqrt{\text{HAND}} \oplus v_1$	$\sqrt{\text{HAND}} \oplus n$
2a. Vocabulary Insertion:	<span style="border: 1px solid black; padding: 2px;">hand</span> + /l/ +	<span style="border: 1px solid black; padding: 2px;">hand</span> + $\emptyset^+$
2b. Add node to buffer	<span style="border: 1px solid black; padding: 2px;">handl</span>	<span style="border: 1px solid black; padding: 2px;">hand</span>
2c. Cyclic Phonology: Syllabification	<span style="border: 1px solid black; padding: 2px;">.han.dl.</span>	<span style="border: 1px solid black; padding: 2px;">.hand.</span>
3. Integration of next node	$\sqrt{\text{HAND}} \oplus v_1 \oplus n_{\text{ung}}$	$\sqrt{\text{HAND}} \oplus n \oplus a_{\text{lich}}$
3a. Vocabulary Insertion:	<span style="border: 1px solid black; padding: 2px;">.han.dl.</span> + /-uŋ/	<span style="border: 1px solid black; padding: 2px;">.hand.</span> + /-liç/
3b. Non-cyclic node, no addition to buffer		
4. All morphemes within M-Word integrated, send to $\omega$ -Level phonology		
$\omega$ -Level Phonology, Input:	.han.dl.uŋ.	.hand.liç.
( $\omega$ -Level) Devoicing:	—	han <sub>̣</sub> t.liç
Output:	handluŋ <sup>12</sup>	hantliç

<sup>12</sup>According to Rubach (1990), there is variation in whether *handlung* is pronounced with two or three syllables. This

In the derivations in (92), the addition of the cyclic nodes in Step 2 triggers the cyclic process of syllabification. This results in a difference in syllabification of the /d/ between the two derivations, ultimately leading to the difference in the application of voicing. Note that in Step 3, /-liç/ cannot be a cyclic morpheme because otherwise it would trigger resyllabification, resulting in /.han.dliç./ (mirroring *Handlung*). Additionally, an alternative solution, in which devoicing is a cyclic rule, rather than a  $\omega$ -Level rule, cannot work because devoicing cannot to apply at Step 2c to /.hand./.

This is proven by the existence of forms such as *Hände* [hɛndə], which is the plural of the basic noun *Hand*. If devoicing applied cyclically at Step 2, the resulting form of *Hände* would be \*[hɛntə] because the /d/ would be devoiced in Step 2, and there is no “revoicing” process. Thus, in order to correctly derive the output, we need to follow Rubach’s proposals that syllabification is cyclic and devoicing is  $\omega$ -Level.

More critically to the discussion at hand, this example shows that, although cyclic processes may alter the structure and change the eligibility of a segment to undergo a  $\omega$ -Level process, the  $\omega$ -Level phonology does not apply until the entire M-Word is under consideration.

### 3.4.2 English $\omega$ -Level voicing assimilation

English has progressive voice assimilation at within the  $\omega$ -Word, but not between  $\omega$ -Words, as shown in (93).<sup>13</sup>

(93) English  $\omega$ -Level voice assimilation

a. Word-level progressive voice assimilation:

i. 3 sg. Agr.: *tap* /tæp/ + *s* /z/ → *taps* [tæps̩]

*tag* /tæg/ + *s* /z/ → *tags* [tægz̩]

ii. Plural: *cat* /kæt/ + *s* /z/ → *cats* [kæts̩]

*dog* /dɔg/ + *s* /z/ → *dogs* [dɔgz̩]

---

derivation (and Rubach’s) create three. Rubach posits an optional post-cyclic rule of sonorant desyllabification which would desyllabify the *dl* sequence, resulting in two syllables. In this analysis this process would be either a  $\omega$ -Level or higher prosodic resyllabification. If  $\omega$ -Level, it would need to be ordered after devoicing.

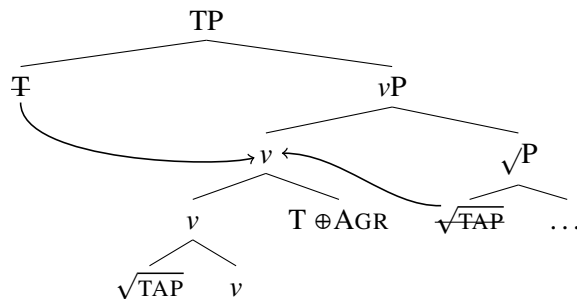
<sup>13</sup>English also has a cyclic rule (or perhaps a morphophonological rule) of voice assimilation which is regressive, for example *twelve* /twelv̩/ + *th* /θ/ → *twelfth* [twɛlfθ̩].

- b. No voice assimilation across words: *the ca[t z]ooms* (\*[d z], \*[t s])  
*the do[g s]its* (\*[g z], \*[k s])

Following the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, the phonological material which is included in the calculation of voice assimilation are the exponents of morphemes within the same the M-Word. We must assume that the relevant head movement occurs in the syntax and that T-to- $v$  lowering occurs early enough in the PF derivation to have occurred before the M-Word  $\Rightarrow$   $\omega$ -Word operation. Additionally, the “ornamental” AGR node must be attached early enough and in such a way that it is a part of the relevant M-Word (see, e.g., Embick and Noyer 2007 on ornamental or dissociated morphemes). Here, AGR is shown attached to the T head, although the morphophonological analysis is compatible with other analyses of the AGR node, provided it is attached early enough or in such a place that it is considered structurally part of the M-Word.

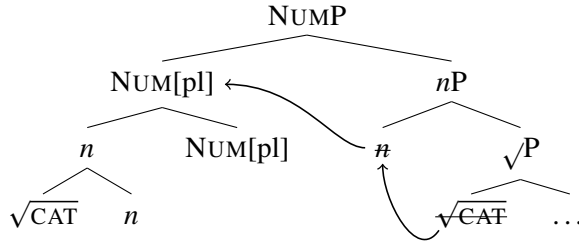
The figures in (94) show the structure, linearization, and phonological groupings for the verb *taps* and the noun *cats* from (93a). In (94a), three different operations affect the structure of the M-Word. Syntactic head movement causes the root to move up to  $v$ , T-to- $v$  lowering lowers T onto the complex  $v$ , and the ornamental AGR node is added within the M-Word. This complex head is thus subject to the M-Word  $\Rightarrow$   $\omega$ -Word correspondence. Here, critically, this means that the spell out of the AGR node /-z/ is in the same  $\omega$ -Word as the root (which ends in a voiceless segment) and thus will undergo the  $\omega$ -Level voice assimilation and become [s].

(94) a. Structure, Linearization and Phonological Grouping of *taps*



Linearization: [  $\sqrt{\text{TAP}} \oplus v \oplus T \oplus \text{AGR} ]_M$   
M-Word  $\Rightarrow$   $\omega$ -Word: ( /tæp/ +  $\emptyset$  +  $\emptyset$  + /-z/ ) $_{\omega}$   
 $\omega$ -Level Voice Assimilation: ( tæp $\underline{s}$  ) $_{\omega}$

b. Structure, Linearization and Phonological Grouping of *cats*



Linearization: [  $\sqrt{\text{CAT}}$   $\oplus$   $n$   $\oplus$  NUM[pl] ]<sub>M</sub>

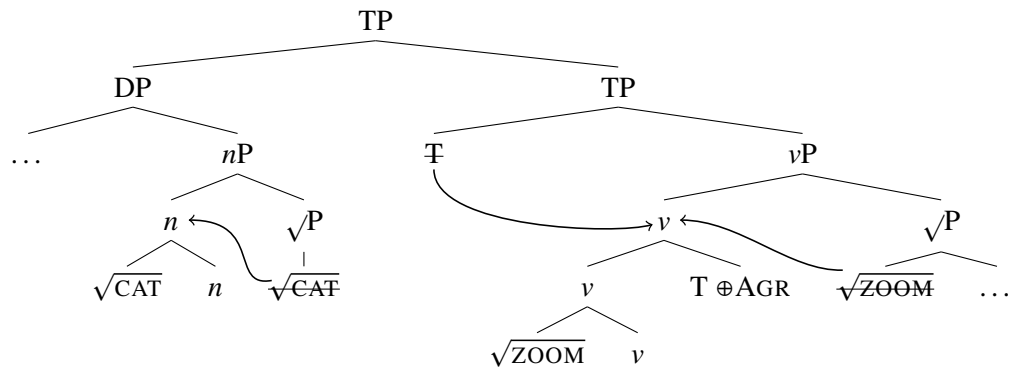
M-Word  $\Rightarrow$   $\omega$ -Word: : ( /kæt/ +  $\emptyset$  + /-z/ ) <sub>$\omega$</sub>

$\omega$ -Level Voice Assimilation: ( kæt̩ ) <sub>$\omega$</sub>

Similarly in (94b), syntactic movement raises the root to  $n$  and then to NUM[pl] creating a complex head. This M-Word contains the NUM[pl] node, spelled out as /-z/, which, because it is inside the same  $\omega$ -Word as the root (and, critically, the final /t/ of the root), results in  $\omega$ -Level voice assimilation between the /t/ and the /-z/.

In contrast, when phonological segments come in contact across  $\omega$ -Word boundaries, there is no voice assimilation, as shown above in (93b). These  $\omega$ -Word boundaries are coextensive with the boundaries between the M-Words of the linearized morphosyntactic structure. In *cat zooms*, for example, the relevant [t z] segments are not grouped in the same M-Word and thus do not get grouped in the same  $\omega$ -Word, as shown in (95):

(95) Structure, Linearization, and Phonological Grouping of *cat zooms*





Linearization:	...	$[\sqrt{\text{CAT}} \oplus n]_{\text{M}}$	$\sim$	$[\sqrt{\text{ZOOM}} \oplus v \oplus T \oplus \text{AGR}]_{\text{M}}$	...
M-Word $\Rightarrow$ $\omega$ -Word: :	...	$(/kæt/ + \emptyset)_{\omega}$		$(/zum/ + \emptyset + \emptyset + /-z/)_{\omega}$	...
$\omega$ -Level Voice Assimilation:		—		—	
Output:				$(kæt)_{\omega} (zumz)_{\omega}$	

In (95), the syntactic movement and the other operations discussed above create two maximally complex heads: the M-Word of the noun *cat* and the M-Word of the verb *zooms*. These two M-Words are linearized next to each other but are distinct complex heads in the morphosyntactic structure. By the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, each of these M-Words corresponds to its own  $\omega$ -Word. As such, the final /t/ of *cat* is not in the same  $\omega$ -Word as the initial /z/ of *zooms* so they cannot undergo  $\omega$ -Level phonology together. Thus, no  $\omega$ -Level voice assimilation applies between them.

The examples shown in (94) and (95) demonstrate that  $\omega$ -Level phonology applies within the bounds of an M-Word, but not between neighboring M-Word structures. This is evidence that, not only does the  $\omega$ -Level phonology wait until an entire M-Word is built to run its processes, it is restricted to applying exactly within the domains of the M-Word.

### 3.4.3 Case Study Conclusions

These brief case studies on English and German voicing phenomena demonstrate the basic case of the proposed morphosyntax-phonology correspondence at the word level: M-Words correspond exactly to  $\omega$ -Words. I suggest that these basic cases represent a large majority of the words built and phonologized cross-linguistically. That is, I propose that most words in most languages most of the time show exact matches between their morphosyntactic structure and the phonological structure at the word level.

As usual, however, the full picture is not quite that simple. There seem to be cases where this correspondence is not exact. Because these mismatches are of interest to linguists, they are discussed heavily in the literature, but it would be a mistake to base the entirety of a theory on the exceptions rather than on the basic cases. Nevertheless, we need to be able to explain deviations from the exact correspondence. These issues will be discussed in the following sections and in Chapter 4.

### 3.5 Discussion: $M \Rightarrow \omega$ Mismatches

I proposed that there was a correspondence between the morphosyntactic word and the phonological word in Section 3.3 and gave some examples in Section 3.4. While this particular formulation is relatively novel, the correspondence between units of structure/meaning and those of sound is not entirely a new discovery.

In particular, as mentioned earlier, Prosodic Hierarchy Theories proposes that there is some correspondence between the grammatical structure and phonological structure (Selkirk 1981, 1984; Nespor and Vogel 1986, *et seq.*). Specifically, these theories propose that the grammatical word (equivalent to a syntactic  $X^0$  node) and other syntactic units are able to be aligned in various ways with the edges of prosodic constituents, including the prosodic word (see, e.g., Nespor and Vogel 1986; Selkirk 1986, 2009). However, these theories are known as “indirect reference theories” because they propose that, while phonological constituents can be aligned with edges of grammatical or morphosyntactic constituents, there is no direct reference to the features non-phonological constituents. Part of the motivation for the indirectness are cases of mismatches between the phonological and grammatical structure. Some examples of these mismatches are presented in the case studies below (see Dixon and Aikhenvald 2002 for an overview of some other mismatches, along with other work in that volume).

There are generally two types of mismatches proposed at the word level. In the first, there appear to be multiple phonological words corresponding to a single grammatical word. In the second, multiple grammatical words appear to be grouped together into a single phonological word. I will argue that neither of these cases actually occurs, at least, not in the sense of a true mismatch between the morphosyntax and the phonology. Instead, by holding firm to one-to-one correspondence of M-Words and  $\omega$ -Words, these apparent mismatches can tell us something interesting about the morphosyntactic structure and/or the phonological structure of such cases.

(96) Possible types of mismatches between the morphosyntax and phonology<sup>14</sup>

a.  $M \Rightarrow 2\omega$ : A M-Word corresponding to multiple  $\omega$ -Words.

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<sup>14</sup>For ease of notation here, I use “2M” and “2 $\omega$ ” here to mean multiple (i.e., not specifically 2) M-words and  $\omega$ -Words respectively.

- b.  $2M \Rightarrow \omega$ : Multiple M-Words corresponding to a single  $\omega$ -Word.

Each of these mismatch types is discussed further below, and case studies are presented in Sections 3.6–3.9.

Note that in this section I am not dealing with phenomenon of cliticization and the potential mismatches between syntax and phonology that follow from that. Clitics and their behavior will be discussed in Chapter 4.

### 3.5.1 $M \Rightarrow 2\omega$ Mismatches

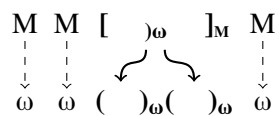
Mismatches of the  $M \Rightarrow 2\omega$  type have been given two explanations. In one, prosodic boundaries are able to be prespecified on various morphemes or exponents, which, in turn, changes the configuration of the phonological boundaries from what is expected by the syntax (or other grammatical structure). In the other, a language may choose to skip a level of the prosodic hierarchy, leaving any proposed correspondences with this level behind.

The first explanation is possible in Prosodic Hierarchy Theory, because it is an indirect reference theory, meaning that there is no reference to morphosyntactic structure after some initial boundary marking. This potentially makes it possible for a language to have phonological or prosodic boundaries which do not correspond to boundaries of morphosyntactic objects.

This would mean that, while the majority of M-Words will correspond to  $\omega$ -Words, occasionally, there might be an M-Word that can correspond to multiple  $\omega$ -Words because of these prespecified boundaries. This is schematized in (97):

- (97) Multiple  $\omega$ -Words corresponding to a single M-Word with prespecified phonological brackets:

ets:



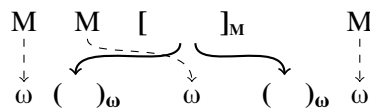
In (97) we see that most M-Words correspond to  $\omega$ -Words, but inside one of the M-Words is a prespecified  $\omega$ -Word bracket which causes that M-Word to surface as two  $\omega$ -Words. An example of this, discussed in Section 3.6 below, is Japanese, which appears to have a set of prefixes that are

prespecified with a prosodic boundary.

Although I will argue that these mismatches do not exist, they would not necessarily be terribly troubling if they did. That is, assuming that the morphosyntax generates one M-Word and manipulates it syntactically, then at spell-out that one M-Word happens to be spelled out as two  $\omega$ -Words, as in (97), it would still be the case that the syntax put the units in order; whatever the phonology did to manipulate the units is purely within the phonological domain.

However, the second flavor  $M \Rightarrow 2\omega$  mismatches shows wider distortion of the morphosyntactic boundaries. This case, exemplified by Vietnamese in Section 3.7, the integrity of the morphosyntactic objects is broken and phonological objects corresponding with the morphosyntactic objects seem to be moved around the clause and freely interspersed, as schematized in (98):

(98) Multiple  $\omega$ -Words corresponding to a single M-Word interspersed in the phrase:



Words, or at least “grammatical words” following Dixon and Aikhenvald (2002), are supposed to have the properties that their elements: (a) always occur together, (b) occur in a fixed order, (c) have conventionalized coherence and meaning. Cases like (98) seem to defy at least the first of these properties.

Previous analyses of this type of mismatch in Prosodic Hierarchy Theory propose solutions such as the “skipping” of prosodic constituents. Specifically for Vietnamese, it has been proposed that there are no prosodic words and that the correspondence with the morphology is only at the level of the syllable, allowing for syllables to be interleaved with each other. This sort of solution does not make any sense in the piece-based framework presented here because there is no possible way to extract syllables out of morphemes nor to move syllables in between separate morphological objects. For this reason, as well as evidence presented below about the sensitivity to morphological pieces, I propose that these mismatch phenomena are actually the result of morphosyntactic operations and not phonological operations.

In the sections below, I will argue against the analyses that these  $M \Rightarrow 2\omega$  phenomena are vio-

lations of the correspondence between M-Words and  $\omega$ -Words. Instead, I argue that each must be analyzed as instances of other phonological or morphosyntactic operations.

Furthermore, I observe that if (1) prosodic boundaries are able to be prespecified (on any part of an exponent) and (2) we are able to ignore certain levels of the prosodic hierarchy, we might expect to find cases where the  $\omega$ -Words are divided on strictly phonological grounds (for example, what makes an optimal word for the language). However, we don't seem to find this. Independent of the theory of if or how multiple phonological words per grammatical word arise, the phonological word divisions always fall along the lines of the morphological pieces. To repeat, phonological word boundaries are always coextensive with some morphological boundaries.

- (99) Schematic of possible M-Word to  $\omega$ -Word mismatches
- |   |   |
|---|---|
| Not found:  | Found (maybe):  |
| [            ] <sub>M</sub>   | [ W X    Y Z ] <sub>M</sub>   |
| (    ) <sub><math>\omega</math></sub> (    ) <sub><math>\omega</math></sub> | ( W X ) <sub><math>\omega</math></sub> ( Y Z ) <sub><math>\omega</math></sub> |
| with no reference to morphology   |   |

As schematized in (99), we never find multiple  $\omega$ -Words being created out of a single M-Word with no reference to morphological structure. In the cases where we do find apparent cases of multiple  $\omega$ -Words for a single M-Word, the  $\omega$ -Words are always dividing up morphological subparts of the M-Word. Although I argue against this being the correct analysis below, it is an important observation to make about the nature of the correspondence between the grammatical structure and the phonological structure.

### 3.5.2 2M $\Rightarrow$ $\omega$ mismatches

Two flavors of 2M $\Rightarrow$  $\omega$  mismatches are examined here, polysynthesis and compounding.

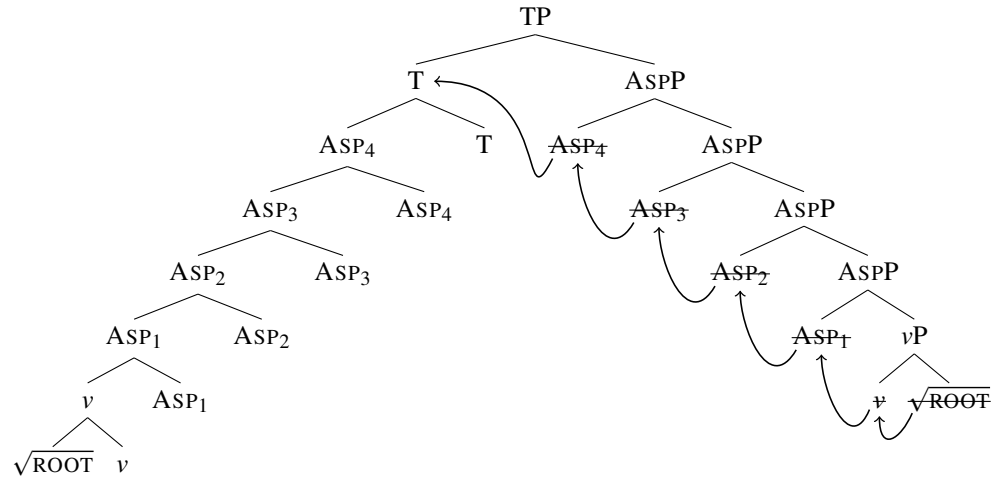
In many polysynthetic languages, words of at least one part of speech (often verbs) are extremely long both in terms of phonological segments and morphological subconstituents. This phenomenon is exemplified by Plains Cree in Section 3.8. In theories which have a division between the lexicon and the syntax, these long words may seem to reflect a mismatch between the grammatical or lexical structure and the phonological words because these verbs often carry the meaning of entire clauses. In more familiar (and less synthetic) languages these meanings are carried by multiple grammatical

words which correspond to multiple phonological words.

Two important points regarding polysynthetic languages need to be made here. First, as Russell (1999a,b) argues, the classification of these long phonological units as words is often not based on any phonological evidence. It is therefore often the case, as will be the case for Plains Cree, that there is evidence that the subconstituents of the polysynthetic units are words and that the polysynthetic unit is a phrase or some other higher prosodic constituent.

The second point is that, in the piece-based framework here, there is no *a priori* reason to suppose that these long polysynthetic units are multiple independent morphosyntactic units. That is, some polysynthetic languages have, for example, many overt Aspect heads attached to the verbal phrase. It is perfectly reasonable for syntactic head movement to combine all of these heads into a very large M-Word, as schematized in (100). There is no universal correspondence between grammatical meanings and morphosyntactic structure proposed within the framework.

(100) A potential large M-Word corresponding to a large  $\omega$ -Word



Linearized Morphological Structure:  $[ \sqrt{\text{ROOT}} \oplus v \oplus \text{ASP}_1 \oplus \text{ASP}_2 \oplus \text{ASP}_3 \oplus \text{ASP}_4 \oplus T ]_M$

M-Word  $\Rightarrow$   $\omega$ -Word:  $( /root/ + /v/ + /ASP_1/ + /ASP_2/ + /ASP_3/ + /ASP_4/ + /T/ )_\omega$

In fact, some languages may look like the structure in (100) to a large extent (see, e.g., Turkish in Section 4.4). Thus, far from representing mismatches between M-Words and  $\omega$ -Words, polysynthetic languages can tell us about the diversity in the sizes of complex heads which language can create, reflected in the sizes of the corresponding  $\omega$ -Words.

The second flavor of  $2M \Rightarrow \omega$  mismatches which will be discussed here is compounding. Com-

pounding is a difficult phenomenon to deal with in any framework because it shows complexity in the structural, the semantic, and the phonological aspects. The particular phenomenon explored will be apparent overapplication of  $\omega$ -Level phonology to the constituents of the compound.

Most lexical theories of grammar propose that compounding takes place in the lexicon due to idiosyncratic meaning and phonological processes (see, e.g., Kiparsky 1982b; Mohanan 1986). In these theories, then, the compound as a whole should be a grammatical word because it is the output of the lexicon. The constituent members of the compound should not be words. However,  $\omega$ -Level phonological processes regularly seem to apply to the compound constituents independently. In this sense, it seems like the grammatical word of the compound is being reflected by multiple  $\omega$ -Words (one for each of its constituent parts).

Using compounding in Spanish as the example in Section 3.9, I will show that the structure of (at least some types of) compounds looks not like a  $2M \Rightarrow \omega$  mismatch *per se*, but rather like nested  $\omega$ -Words, schematized in (101).

(101)  $\omega$ -Word structure of compound AB:  $((A)_\omega(B)_\omega)_\omega$

I propose that this structure does actually reflect the morphosyntax exactly, with one layer of derivation where the elements are built as separate M-Words and phonologized as  $\omega$ -Words separately, and another layer where they are used as a pseudo-root in a compound.

In fact, nesting is not unique to compounds. A similar case of  $\omega$ -Word nesting will be discussed in the cases involving Local Dislocation in Chapter 4.

### 3.5.3 Summary of apparent mismatches

In the following case studies, I will examine two types of mismatches between morphosyntactic and phonological structure, each of which has two flavors, shown in an expanded (96'):

(96') Possible types of mismatches between the morphosyntax and phonology

- a.  $M \Rightarrow 2\omega$ : A M-Word corresponding to multiple  $\omega$ -Words.
  - i. Prespecified phonological brackets
  - ii. Skipping prosodic hierarchy level

- b.  $2M \Rightarrow \omega$ : Multiple M-Words corresponding to a single  $\omega$ -Word.
  - i. Polysynthetic long words
  - ii. Nested  $\omega$ -Words in compounds

The apparent  $M \Rightarrow 2\omega$  mismatches are exemplified with Japanese (Section 3.6) and Vietnamese (Section 3.7). I show that the data from these case studies is better explained with other phonological or morphological operations, and I dismiss the possibility of mismatches of this type.

Mismatches of the  $2M \Rightarrow \omega$  type are exemplified with Plains Cree (Section 3.8) and Spanish (Section 3.9). In these cases, I argue that the structure does, in fact match the phonology, either because there is not one long word (Plains Cree) or a because there is a complex morphological structure reflective of the phonological structure (Spanish compounds).

## **3.6 Japanese Aoyagi Prefixes**

Japanese has a class of prefixes, called Aoyagi prefixes (after the first description in the literature, Aoyagi 1969), which appear to form a separate phonological word from their hosts on the basis of their tonal accent pattern. In this sense, they represent a potential mismatch between the morphosyntactic and phonological structure.

Before turning to the interesting situation of Aoyagi prefixes, however, a basic description of the facts of Japanese tonal accent is needed (Standard Tokyo Dialect, as described by Poser 1984, 1990).

### **3.6.1 Background and Data**

#### **3.6.1.1 Japanese Tonal Accent**

The basic pitch pattern of Japanese words assigns a high tone to all syllables. Words with initial light syllables have an edge-lowering effect of low tone on the first syllable. The accent system of Japanese is implemented as a change in tone; An accented on a syllable causes the pitch to drop to low tone after the that syllable. The accent can, in principle, fall on any syllable of a word, marked with ' after the syllable, examples in (102):



(102) Examples of accent on different syllables, minimal pairs (Poser 1984)

- ha'si HL 'chopsticks'
- sa'kura HLL 'cherry'
- hasi' LH(L) 'bridge'
- ota'ma LHL 'ball'
- hasi LH 'edge'
- atama' LHH(L) 'head'
- hibati LHH 'hibachi'

Accentless words show all H or LH\* tone contours while accented words show a HL contour at some point in the word. Note that words accented on the final syllable project their HL contour onto a following particle, while accentless words do not:

(103) Final Accent vs. Accentless (Poser 1984)

- hasi' wa LHL 'bridge-topic'
- hasi wa LHH 'edge-topic'

Morphemes may be accented or unaccented. Multiple accents within a word are resolved leftward under normal circumstances, examples shown in (104).

(104) Leftward resolution of accent in Japanese (Poser 1984)

- *koko'ro + ma'de* → *koko'romade* "until the heart"
- *yo'm + ta'ra* → *yo'Ndara* "if he reads"

There are some other complex situations with accent resolution, such as dominant and dependent morphemes which exceptionally take accent or steal existing accent from elsewhere in the word, examples in (105). Compounds also have complex accent resolution patterns, but always resolve to a single accent (see, e.g., Poser 1984; Labrune 2012; Kawahara In Press).

(105) Some exceptional accent resolution (dominant, dependent)<sup>15</sup>: (Poser 1984)

- Dominant suffixes such as *ma's* always takes accent:  
*yo'mu + ma's + ta* → *yomima'sita* "read (past, polite)" (\**yo'mimasita*)

<sup>15</sup>My (nonstandard) notation here is <sup>!</sup> for the accent position of dominant suffixes and <sup>°</sup> for the accent position of dependent suffixes.

- Dependent suffixes such as *te*<sup>o</sup> take accent, but only if another accent exists in the word :

*yo'mu + te*<sup>o</sup> → *yomite*' "reader" (\**yo'mite*, \**yomite*)

cf. *kiku + te*<sup>o</sup> → *kikite* "hearer" (\**kikute*' )

While I will not explore the complexity of accent resolution in these and various other cases (pre- and post-accenting, recessive accent) here, the generalization is that it is only possible to have one HL contour per word. Furthermore, the Japanese prosodic unit called the *minor phrase*, consisting of one or a few words with particles, also is limited to a single HL contour. As with words, the accent is resolved leftward in the minor phrase.<sup>16</sup>

- (106) Leftward accent resolution in minor phrases: (Labrune 2012, p. 249)
- utsukushi'i + hana'-ga → utsukushi'i hana-ga  
 L H H H L + L H -L → L H H H L L L -L  
 beautiful + flower-subj → "beautiful flower-subject"

Note that the existing accent on *hana'* is deleted in favor of the leftmost accent on *utsukushi'i* leaving a single HL contour accent for the minor phrase.

### 3.6.1.2 Behavior of Aoyagi Prefixes

Given that there is such a strong generalization that there is a single accent per word and per minor phrase, it is, then, surprising to find a set of prefixes which break this generalization. Aoyagi prefixes have their own HL pitch contour which does not seem to interact with the stem to which they are attached, examples given in (107).<sup>17</sup> Here the overbar represents high pitch and the underbar represents low pitch.

- (107) Some Sample Aoyagi Prefixes (Poser 1990)

<sup>16</sup>According to Haraguchi (1975), this phrasal accent resolution is somewhat optional, in that words may be pronounced with pauses between them and retain their word-level accent. However, in normal speech without pauses, leftward accent resolution applies to minor phrases.

<sup>17</sup>Note that not all Japanese prefixes behave this way. Many prefixes integrate cyclically into their host and participate in accent resolution. Some examples of normal prefixes are: *hi-* "slight", *o-/go-* "honorific", *ko-* "slight", *mu-* "lack of", *hu-* "non-/un-", *kei-* "light", *dai-* "big/large", *nama-* "live/fresh", *sai-* "re-".

Prefix	Gloss	Example	Gloss
mo'to	'former'	$\overline{mo'to}da'iziN$	'former minister'
ze'N	'former'	$\overline{ze'N}syu'syoo$	'former Prime Minister'
hi'	'un-'	$\overline{hi'}gooriteki$	'illogical'
ki'	'your (honor./form.)'	$\overline{ki'}syokaN$	'your letter'
ho'N	'this, at present'	$\overline{ho'N}ka'igi$	'this conference here'

Each Aoyagi prefix has an accent, but this does not interact with the accent of its host, even when its host is unaccented. That is, in (108a) both *mo'to* and *da'iziN* have accents which appear to surface as HL contours without any accent resolution. Even more surprising, though, is the fact that in (108b) the prefix *hi'* has an accent and the stem *gooriteki* is unaccented, but the Aoyagi prefix remains separate and the unaccented LH contour of the stem is maintained. Under normal circumstances, we would expect the surface pattern to appear as HL\*, because there is a single accent on the first syllable of the word.

(108) Examples of non-resolution in Aoyagi accents

- a. mo'to + da'iziN → mo'toda'iziN (\*mo'todaiziN)  
H L + H LLL → H L H LLL H L LLL L
- b. hi' + gooriteki → hi'gooriteki (\*hi'gooriteki)  
H + L HHHH → H L HHHH H L LLL L

Given that these morphemes behave phonologically like they are separate phrases than their hosts, a natural question to ask is: Are Aoyagi prefixes truly prefixes? Poser (1990) shows that, although they fail to participate in the phonology that normally is associated with affixes (accent resolution, voice assimilation, *rendaku*), morphosyntactically they appear to be true prefixes. Like other prefixes in the language, Aoyagi prefixes cannot be separated from their stem by another word, shown in (109a).

(109) Aoyagi prefixes as prefixes

(Poser 1990)

a. No breaking prefix from host: kidaigaku "your university"

\*ki yuumei na daigaku  
your famous COP university  
intended: "your famous university"

b. No wide scope: motodaiziN "former minister"

moto daiziN no komoN  
former minister GEN adviser  
"adviser to the former minister", \*"former adviser to the minister"

In addition, Poser (1990) shows that Aoyagi prefixes can only take narrow semantic scope over the stem meaning,<sup>18</sup> shown in (109b), and additionally cannot be coordinated under. Taken all together, this suggests that Aoyagi prefixes are morphosyntactic prefixes, but have something special about their phonology.

Poser (1984, 1990) suggests that Aoyagi prefixes come along with a prespecified prosodic boundary, which, when the prosodic constituents are formed, puts the prefix in a separate phonological phrase from its stem. It is unclear if Poser means that the prefix is contained in its own phrase or merely has a boundary mark for one side of a phrase, schematized in (110).

(110) Possible implementations of a phrasal boundary prespecified for Aoyagi prefixes:

$(\phi \text{ prefix } )_{\phi}$        $\text{prefix } )_{\phi}$        $\text{prefix } (\phi$

Regardless of the specific implementation, if true, this possibility represents a serious mismatch between the grammatical word and the phonological grouping because it would show that a phonological phrase boundary (not even just a phonological word boundary) is able to exist in the middle of a grammatical word.

However, this analysis is based purely on the behavior of accent, the HL contour, of the words in isolation. No phrasal data given. If the prefix is indeed represented with a prespecified phrasal boundary, this predicts that there should be some interesting interaction between a word containing an Aoyagi prefix and its neighboring words.

<sup>18</sup>Satoshi Tomioka (p.c.) suggests that the limited narrow semantic scope may not be the case for present day speakers. Here we will assume that Poser's assertion is correct, although this is an interesting case for future study.

### 3.6.2 New Data on Minor Phrases

To test the phrase boundaries, I recorded audio of words with Aoyagi prefixes in phrasal contexts.<sup>19</sup> Using Praat, I examined the pitch tracks to see what effect the phrase has on the Aoyagi prefix.

As an example, let us take *motodaijin* “former minister”, pitch track of the word in isolation shown in Figure 3.1.

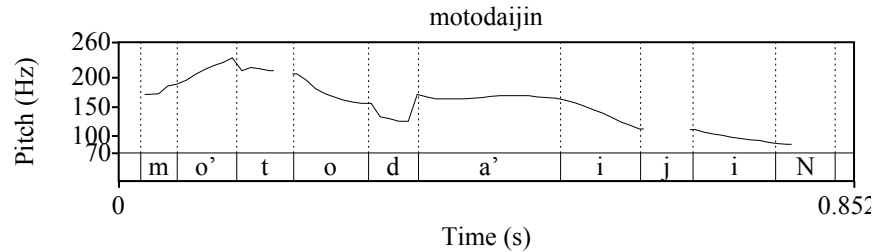


Figure 3.1: Pitch track of *motodaijin* “former minister”.

The tonal pattern HLHL is relatively clear here, with HL contour on the prefix *moto* and then a rise to a new H tone on the first syllable of *daijin* followed by a gradual decline for the remainder of the word.

When we put this word in the context of a minor phrase, we might expect some interesting interaction between the Aoyagi prefix and neighboring words, especially if the prefix is specified with only one side of a phrasal boundary. Figure 3.2 shows *motodaijin* in initially position of a minor phrase, *motodaijin no komon* “former minister’s advisor”. Figure 3.3 shows *motodaijin* in final position of a minor phrase, *kokka no motodaijin* “nation’s former minister”.

In initial position, as shown in Figure 3.2, *motodaijin* retains its HLHL tone contour. This is compatible with the possibility that there is a phrase boundary after *moto* because that would mean that *moto* forms a separate accent domain from the rest of the phrase *daijin no komon*. However, in final position, exemplified in Figure 3.3, this analysis is not possible.

When *motodaijin* is in final position in the minor phrase, both accents are deaccented, resulting in a low tones across the entire word. The phrasal accent resolution chooses the accent of the initial

<sup>19</sup>Thanks to Satoshi Tomioka for data and discussion on this part of the project. Thanks also to Sunghye Cho for helping prepare examples.

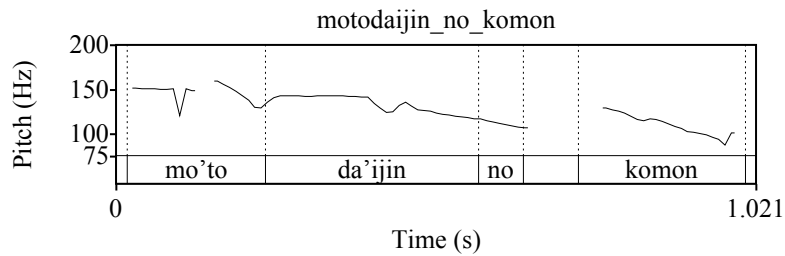


Figure 3.2: Pitch track of *motodaijin no komon* “former minister’s advisor”.

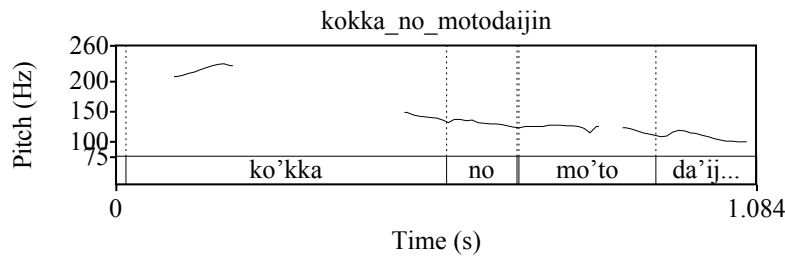


Figure 3.3: Pitch track of *kokka no motodaijin* “nation’s former minister”.

word *kokka* and removes any accent(s) to the right. If there were a phrasal boundary after *moto*, we would expect the accent on *moto* to be deaccented, but the accent on *daijin* should remain unaffected because it is within a different phrase.

This phrasal data is incompatible with any account of phrase boundaries within prefix

### 3.6.3 Analysis

Rather than a phrase boundary prespecified on Aoyagi prefixes, I propose that Aoyagi prefixes are simply non-cyclic affixes. Accent resolution, as described by Poser (1984, 1990), occurs as a cyclic rule. Furthermore, there is a phrasal process of deaccenting which deaccents non-initial words in a phrase (targeting words, not syllables/morae). The rules are as follows:

(111) Accent Resolution (Cyclic):  $\sigma' \rightarrow \sigma / \sigma' \_$

“Delete any accent following another accent within a cyclic buffer”

(112) Deaccenting (Phrasal): “Deaccent non-initial words in a minor phrase.”

Using these processes, we can explain the behavior of normal cyclic affixes, such as the conditional *-ta'ra*, shown in (113), as well as Aoyagi prefixes, example given in (114):

(113) Derivation of *yo'Ndara* “if he reads”

- |   |  |
|---|--|
| 1. Linearize Morphosyntactic Structure: <sup>20</sup> | $\sqrt{\text{READ}}$ - CONDITIONAL   |
| UR vocabulary items:                                  | /yo'N/ - /ta'ra/   |
| 2. Integrate root node                                | $\sqrt{\text{READ}}$   |
| 2a. Vocabulary Insertion                              | /yo'N/   |
| 2b. Integrate into buffer                             | <span style="border: 1px solid black; padding: 2px;">yo'N</span>           |
| 3. Integrate Next Node                                | $\sqrt{\text{READ}}$ - CONDITIONAL   |
| 3a. Vocabulary Insertion                              | <span style="border: 1px solid black; padding: 2px;">yo'N</span> + /ta'ra/ |
| 3b. Integrate into buffer                             | <span style="border: 1px solid black; padding: 2px;">yo'Nta'ra</span>      |
| 3c. Cyclic Phonology: Accent Resolution               | <span style="border: 1px solid black; padding: 2px;">yo'Ntara</span>       |
| Output:   | yo'Ntara   |

In (113), the conditional morpheme *-ta'ra* is cyclic. When it is integrated into the cyclic buffer which contains the root, Accent Resolution applies, leaving only the leftmost accent. However, in (114), *mo'to-* is non-cyclic so it is not integrated into the cyclic buffer. The result is that the output form *mo'toda'ijin* has two accents, which are reflected by the tone contour.

(114) Derivation of *mo'toda'ijin* “former minister”

- |   |                                 |
|---|---------------------------------|
| 1. Linearize Morphosyntactic Structure: <sup>21</sup> | MOTO - $\sqrt{\text{MINISTER}}$ |
| UR vocabulary items:                                  | /mo'to/{nc} - /da'ijin/         |
| 2. See leftmost node                                  | MOTO                            |
| 2a. Vocabulary Insertion                              | /mo'to/{nc}                     |
| 2b. Non-cyclic node, no buffer created                |                                 |
| 3. Integrate Next Node                                | MOTO - $\sqrt{\text{MINISTER}}$ |

<sup>20</sup>For simplicity, I will ignore the other morphosyntactic structure which is present to focus on the interaction of the two overt exponents.

<sup>21</sup>In addition to ignoring a little bit of morphosyntactic structure here, I am also ignoring any complexity in the root *daijin*.

3a. Vocabulary Insertion /mo'to/^{nc} + /da'ijin/

3b. No adjacent buffer, create new buffer /mo'to/^{nc} + da'ijin

3c. No Cyclic Phonology, nothing to integrate

Output: mo'toda'ijin

Note that if a cyclic suffix is added onto *mo'toda'ijin*, it interacts with the material in the cyclic buffer, but not the prefix. This is identical to the behavior seen with non-cyclic prefixes in Polish in Chapter 2. In (115), the dominant suffix *-ppo'i* “-ish” is added to *mo'toda'ijin*, resulting in the accent of the root being lost to the accent on the dominant affix (the mechanism for which is left unspecified here). This accent shift does not affect the accent on the prefix.

(115) Derivation of *mo'todaijinppo'i* “former-minister-ish”

1.–3. As in (114) above.

4. Integrate Next Node MOTO - √MINISTER - PPOI

4a. Vocabulary Insertion /mo'to/^{nc} + da'ijin + /ppo'i/

4b. Add to buffer /mo'to/^{nc} + da'ijinppo'i

4c. Cyclic Accent Resolution: daijinppo'i

Output: *mo'todaijinppo'i*

Finally, at the minor phrase level, the process of deaccenting removes accents of words that are not the heads (here, meaning leftmost word) of the phrase. Note that this process will retain all accents on the headword and remove any accents on non-headwords. Unlike Cyclic Accent Resolution, this process does not target accented syllables, but entire word units. This can be seen by the fact that Aoyagi prefixed words either retain both accents (when the headword) or have both accents removed, as shown in (116)

(116) Phrasal deaccenting and Aoyagi prefixed words:

“former minister’s advisor”      “nation’s former minister”

*mo'toda'ijin-no + ko'mon*      *ko'kka-no + mo'toda'ijin*

Phrasal Deaccenting: *mo'toda'ijin-no + komon*      *ko'kka-no + motodaijin*



### 3.6.4 Case Study Conclusion

The accent pattern of Aoyagi prefixes has been claimed to be evidence of mismatches between grammatical words and phonological words. Specifically, this evidence has been used to support a framework in which phrasal boundaries can be prespecified or diacritic on morphemes. However, this analysis does not hold up under the new data on the behavior of the accents of Aoyagi prefixed words in minor phrases. Instead, I propose that what we see here is a simple case of the interaction of cyclic and non-cyclic exponents. There is no mismatch between the grammatical word and the phonological word in this data.

## 3.7 Vietnamese Interleaved Words

### 3.7.1 Background and Data

Vietnamese has a phenomenon in which two grammatical words may be interleaved with each other phonologically. In certain grammatical constructions, a single-syllable word may be copied and interleaved with the syllables of a two-syllable word. A pair of two-syllable words may also undergo this interleaving, resulting in the splitting of both words. This interleaving pattern is shown schematically in (117), with real data given in (118):

(117) Schematic of Vietnamese Interleaving Construction (Nhàn 1984)

- $A + XY \rightarrow AX AY$
- $AB + X \rightarrow AX BX$
- $AB + XY \rightarrow AX BY$

(118) Examples of Interleaving Construction (Thompson 1965)

- a. *làm* "do, make" + *giàu-có* "be wealthy"  
→ *làm giàu làm có* "make wealthy"
- b. *buôn-bán* "do business" + *đâu* "anywhere, wherever"  
→ *buôn đâu bán đâu* "wherever (one) does business"

- c. *bàn-tìm* "discuss in quest of" + *muru-kế* "schemes and ruses, strategy"  
 → *bàn muru tìm kế* "discuss strategy"

At first glance, this appears to be a grave mismatch between morphosyntactic (“grammatical”) words and phonological words because a single morphosyntactic object is being phonologized as two separate phonological objects, which furthermore are able to be interspersed between other phonological element. This seems to break the criteria of cohesiveness, that the elements of a grammatical words “always occur together, rather than scattered through the clause” (Dixon and Aikhenvald 2002, p. 19).

This phenomenon (in combination with a few others, such as variable compound ordering, which will not be discussed here) has led to a view that Vietnamese does not have phonological words, but instead relies on the syllable as its base phonological unit, skipping directly from syllables to phrases (Emeneau 1951; Schiering et al. 2010).

However, upon further investigation, two details of this interleaving phenomenon shed light on the nature of the operations: (1) Not all two-syllable elements are able to participate and the participation is not limited to single syllable objects; and (2) The interleaving operations is not mandatory but seems to indicate some additional semantic or pragmatic force. Each of these points is addressed in the subsections below.

### 3.7.1.1 Participation in Interleaving

The interleaving construction is not able to apply to all two-syllable words. In fact, only a particular set of compound words, those with additive or *dvandva* semantics participate (Thompson 1965; Noyer 1998). Examples of polysyllabic words which are not compounds and do not participate in the interleaving are given in (119):

(119) Indivisible polysyllabic words (Noyer 1998)

- a. *xà-phòng* “soap” (< French *savon*)

\**Tôi uống xà uống phòng.*

I drink sa- drink -von

Intended: "I drink soap"

b. ba-ba “tortoise”

\*Tôi có ba có ba  
I have *ba* have *ba*

Intended: "I have the tortoise"

In (119), neither *xà-phòng* “soap” nor *ba-ba* “tortoise” are able to be split by the interleaving construction. Others polysyllabic monomorphemic words, such as *ô-tô* “car” (< French *auto*) and *cào-cào* “grasshopper”, as well as polysyllabic place names, such as *Hà-Nội* “Hanoi” and *Sai-Gòn* “Saigon”, are also unable to participate in interleaving (Noyer 1998).

Compound words must have an additive or *dvandva* structure in order to be split by the interleaving process. Other types of compounds, such as *ngà-ấm* “bathroom” (house+bathe), *ống-khói* “chimney” (tube+smoke), and *nước-mắt* “tear” (water+eye) are unsplittable (Noyer 1998), exemplified in (120).

(120) Indivisible compound words (Noyer 1998)

*ngã-lòng* “despair” (fall+heart)

Tôi đã ngã (\*đã) lòng  
I PAST fall (\*PAST) heart

“I despaired”

From this data, it is clear that it is not simply the polysyllabic status of words which allows them to participate in interleaving. Rather, it seems to be something about their morphological or morphosyntactic structure. Adding to this, there are instances where reduplicated polysyllabic bases do participate in the interleaving, but maintain their polysyllabic units. For example, in (121), the (doubly) reduplicated form *khóc-lóc khóc-liếc* “be a cry-baby” can be interleaved with certain grammatical elements (the negation *không* and conjunction *hay* shown here). However, it maintains each part of the reduplicated form as a unit, despite being two syllables each.

(121) Interleaving with polysyllabic reduplicated forms (Thompson 1965)

a. *khóc-lóc* “weep, cry” → *khóc-lóc khóc-liếc* “be a cry-baby”

b. đừng **khóc-lóc khóc-liếc** hoài như thế! “don’t be such a crybaby”

- c. Người đó không **khóc-lóc** không **khóc-liếc** gì đâu. "That person won't weep at all (don't be ridiculous)"
- d. Em đó hay **khóc-lóc** hay **khóc-liếc**, không bao giờ nín. "That child cries continuously, never stops"

Given that not all two-syllable words can participate in interleaving and that not exclusively two syllable words participate in interleaving, we do not want to posit that interleaving is an operation that deals primarily with syllables. Instead, it seems to be working with particular morphosyntactic units which happen to largely, but not exclusively, correspond to syllables in Vietnamese. Further evidence of that we need an analysis that does not rely on syllables comes from the same interleaving operation in a related language, Pacoh.

### 3.7.1.2 Additional Evidence: Interleaving in Pacoh

Pacoh (Katuic, Mon-Khmer) is spoken in the central highlands of Vietnam and also shows the same interleaving operation as Vietnamese. However, unlike Vietnamese, Pacoh shows a wider range of polysyllabic morphemes. The two-syllable data presented here shows that the interleaving process is sensitive to morphological objects rather than syllables. Additionally, Pacoh has three-part compounds which can take part in interleaving and show three copies of the interleaved word, again pointing to the importance of the morphological objects over the phonological syllable.

Pacoh, like Vietnamese, productively makes compounds out of morphological objects to make semantically generalized nouns. This occurs with both two elements and more, as shown in (122):

- (122) Some Pacoh compounds (Alves 2006, p. 32)
- duŋ + vɛ:l → duŋ-vɛ:l  
"house" "village" "society"
  - ʔa.ʔi: + ʔa.ʔam → ʔa.ʔi:-ʔa.ʔam  
"mother" "father" "parents"

- ʔn.truəj + ʔa.cə: + ʔa.lik → ʔn.truəj-ʔa.cə:-ʔa.lik  
"chicken" "dog" "pig" "domestic animals"
- praʔ + ti.riəʔ + ʔa.kaj → praʔ-ti.riəʔ-ʔa.kaj  
"money" "buffalo" "child" "wealth"

Like Vietnamese, when a compound is in (some sort of morphosyntactic) relationship with another word it can interleave its parts. Unlike Vietnamese, however, Pacoh compound members more regularly have more than one syllable. This makes the entire process look much more morphological and less reliant on the primacy of the syllable (as is argued for in Vietnamese). The interleaved word occurs twice for two-part compounds and three times for three-part compounds. Some of the compound members are more than one syllable, and the interleaving occurs once per morphological unit, not once per syllable. Examples given in (123):

(123) Interleaving in Pacoh (Alves 2006, pp. 36–37, p. 57)

- a. i. ʔa.kəp "don't" + rew-ʔi.ri: "sad"  
→ ʔa.kəp rew ʔa.kəp ʔi.ri: "Don't be sad"
- ii. taʔ "work, make, do" + prʉəʔ-təm.paʔ "work (non-specific) [n]"  
→ (ŋa:j) taʔ prʉəʔ taʔ təm.paʔ "(They) are working"
- b. i. cə:m "to know" + ʔu.raʔ-ʔu.ʔar "writing"  
→ (dɔ:) cə:m ʔu.raʔ cə:m ʔu.ʔar "(He) is literate"
- ii. taʔ "work, make, do" + kə.r.iəŋ-kə.r.ɔ:ŋ "fences"  
→ taʔ kə.r.iəŋ taʔ kə.r.ɔ:ŋ "make fences"
- c. jo:l "still have" + praʔ-ti.riəʔ-ʔa.kaj "wealth"  
→ jo:l praʔ jo:l ti.riəʔ jo:l ʔa.kaj "still have wealth"

In (123a), the interleaved words are divided by their morphological constituents, regardless of the number of syllables in those constituents. This also applies to reduplicated forms, such as *ʔu.raʔ-ʔu.ʔar* “writing” and *kə.r.iəŋ-kə.r.ɔ:ŋ* “fences”, in which the base and reduplicant are split, as shown in (123b). Finally, (123c) shows a three-part compound interleaved with another word in which that other word *jo:l* is copied before each of the three parts of the compound. This shows

that the interleaving process is sensitive to morphological pieces of compounds, regardless of the number of pieces or the phonological shape of those pieces.

Note that the interleaved order is not required. The examples in (124) show cases which potentially could be interleaved but are not. Note that (124a) is the non-interleaved form of (123c).

(124) Examples without interleaving in Pacoh

- a. jo:l praʔ-ti.riəʔ-ʔa.kaj "still have wealth" (Alves 2000)
- b. ʔa.bon tiən-praʔ "get money-silver" (Watson 1980)<sup>22</sup>
- c. taʔ haŋ-hə:ʔ "work fields-fields" (Watson 1980)<sup>22</sup>

Rather, the interleaved forms carry some sort of special semantic feature on them. Alves (2000) uses a variety of features, such as "semantically specified", "general", and "incorporative" which trigger this interleaving. Regardless of the actual feature, the point here is that there is some outside force (some syntactic/semantic head or feature) which causes the interleaving; it is not the default process. This is also true of Vietnamese, as discussed in the next section.

### 3.7.1.3 Semantic/Pragmatic Force of Interleaving

As just mentioned for Pacoh, in Vietnamese the interleaved word order is not the default construction, but carries some special semantic or pragmatic force.<sup>23</sup> For example, the compounds in (125) are shown in non-interleaving constructions with a basic compositional meaning, but in interleaved order with the same element to have additional meaning, such as repetitive or extreme action.

- (125) Extra semantic/pragmatic force in interleaved order (Nhàn 1984)
- a. i. bàn-ghế 'furniture'
  - ii. đập bàn-ghế 'beat the furniture'
  - (đập 'to beat, hit')
  - iii. đập bàn đập ghế 'bang all over the furniture'
  - b. i. lăn-lóc 'lying around'

<sup>22</sup>In order to match the examples from Alves, I changed Watson's examples from his Vietnamese-based orthography to IPA according to his orthography-phonetic correspondences.

<sup>23</sup>Thanks to Tuan Tran and Huy Tran for judgments.

- ii. ốm lãn-lóc ‘lying around sick  
(ốm ‘to be sick, ill’)
- iii. ốm lãn ốm lóc ‘extremely sick, almost die of sickness’

This indicates that there is some additional syntactic/semantic head in the syntactic structure which can trigger the interleaving process. A particular proposal, following Noyer (1998), is given below, but the important point here is that the apparent mismatch between the grammatical and phonological structure is not random or arbitrary, but is governed by a morphological or morphosyntactic operation and is sensitive to morphosyntactic units rather than phonological units.

### 3.7.2 Analysis

I propose that Vietnamese (and Pacoh) have a morphosyntactic operation which, triggered by a certain abstract feature, causes a head to copy itself (or split if it is a compound) and interleave. This closely follows Noyer’s (1998) proposed operation.

Part of the intuition behind this operation comes from the two types of reduplication operations in Vietnamese. The first type, “normal” reduplication, shows reduplication of its sister element in order, while the second type, “interleaved” reduplication, shows the reduplicated element next to its immediate base, schematized in (126).

(126) Vietnamese Reduplication Types<sup>24</sup> (cf. Nhàn 1984, p. 32)

- a. Normal Reduplication: [ RED [X Y] ] → [ [RED(X) RED(Y)] [X Y] ]
- b. Interleaved Reduplication: [ RED [X Y] ] → [ [RED(X) X] [RED(Y) Y] ]

The reduplication process on a single element may be a full copy or may be specified to overwrite a subpart of the syllable, depending on the exact type of reduplication for the given head in context. Examples of Normal Reduplication are given in (127) and examples of Interleaved Reduplication are given in (128):<sup>25</sup>

<sup>24</sup>Note that the order of the base and reduplicant may be reversed to [ [X Y] [RED(X) RED(Y)] ] or [ [X RED(X)] [Y RED(Y)] ] respectively.

<sup>25</sup>Here I introduce a shorthand notation, e.g., RED<sub>time=x</sub>, for reduplication which also overwrites tone or has some sort of templatic change to the reduplicant.

(127) “Normal” Reduplication Examples (Nhàn 1984; Noyer 1998)

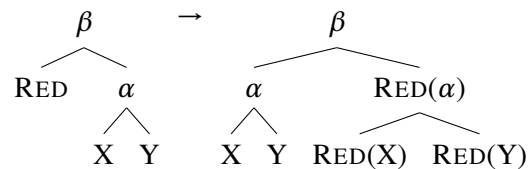
- a. liú lo + RED<sub>rime=ường</sub> → liú lo liú lường “chirp incessantly”
- b. bông lông + RED<sub>rime=ang</sub> → bông lông bang lang “wander aimlessly”
- c. học trò + RED<sub>rime=oẹt</sub> → học trò học troẹt “students and such naughty gang”

(128) “Interleaved” Reduplication Examples (Nhàn 1984; Noyer 1998)

- a. nhút nhát + RED → nhút nhút nhát nhát “rather timid”
- b. ra vào + RED → ra ra vào vào “walking to and fro nervously”
- c. lỏng lẻo + RED<sub>tone=even</sub> → long lỏng leo lẻo “loose”
- d. khệnh khạng + RED<sub>onset=l</sub> → lệnh khệnh lạng khạng “walking in an air of exceeding importance”

Following Noyer (1998), it appears that we have two different morphosyntactic operations at play. In the first, the sister node of the RED head is copied, then features of the particular reduplication percolate down into the daughters, allowing for potential instructions to the phonology to change features (depending on the particular exponent of the RED head). This operation results in Normal Reduplication, as shown in (129):

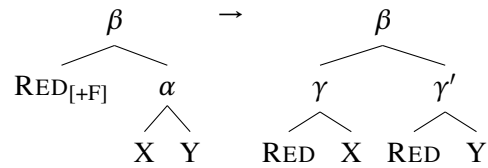
(129) Morphosyntactic Operation for Normal Reduplication (cf. Noyer 1998)



In the second, the RED head, shown here with an abstract feature [+F] to distinguish it from the other type of reduplication, is lowered to adjoin to its sister’s daughters and then perform the normal reduplication (copying its sister) on each of those.<sup>26</sup> The operation results in Interleaved Reduplication, as shown in (130)

<sup>26</sup>Note that this analysis has an interesting implication for the three-part interleaving seen in Pacoh above; It would seem to indicate that the three member compounds have a flat ternary branching structure rather than a nested binary branching structure. With a ternary structure, the fact that this operation adjoins a copy of the interleaving head onto each member of the compound falls out directly. If the compounds have two binary branches instead, this operation needs some amending in order to account for the fact that it can adjoin to each compound member, but not deeper down in the morphological structure.

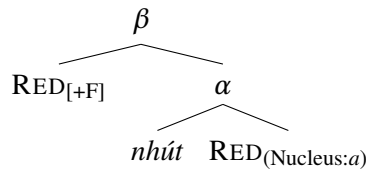
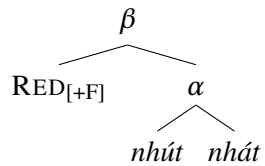
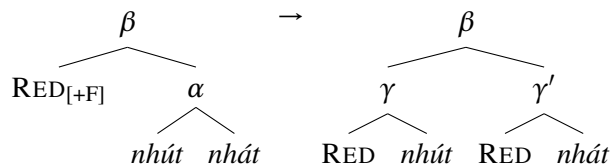
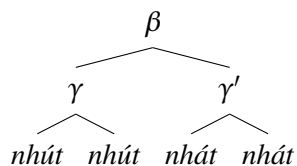




As an example of the Interleaved Reduplication operations in action, the derivation of the double reduplication of *nhút* “timid” into *nhút nhút nhát nhát* “rather timid” is shown in (131):

(131) Derivation of *nhút nhút nhát nhát* “rather timid”

## 1. Structure

2.  $\alpha$  node reduplication3.  $\beta$  node F-feature resolution3.  $\gamma/\gamma'$  node reduplication

In (131) Step 2, the Interleaved Reduplication operations triggered by [+F] causes the RED node to be copied and distributed to the children of the  $\alpha$  node. This results in the surface pattern in which the reduplicated elements are interleaved with each other.

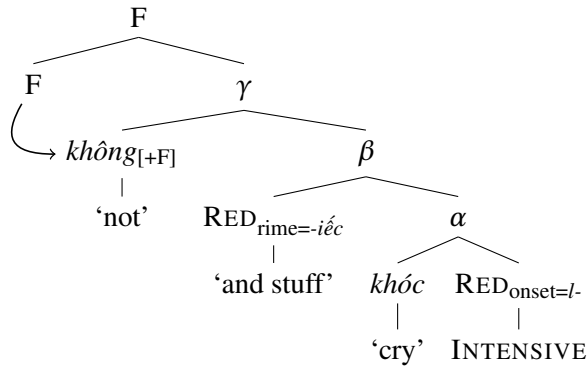
If we already need to posit this Interleaving operation, triggered by the the [+F] feature, for reduplicated forms, it falls out directly that if a [+F] feature is assigned to a head in some other way,

the same Interleaving operation will apply. I propose here that the extra syntactic/semantic force head posited above (shown here as F) assigns the [+F] feature to the head below it. Following the operation proposed for reduplication above, the interleaved order is derived, as exemplified in (132):

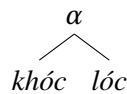
(132) Derivation of interleaved order with F head (modified from Noyer 1998, p. 86)

Example phrase: *không khóc-lóc không khóc-liếc* “not cry and stuff”

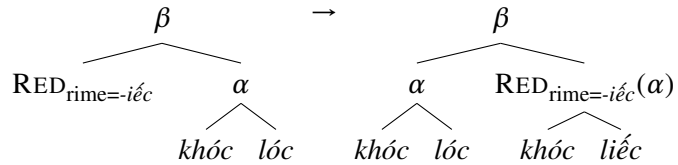
Structure:



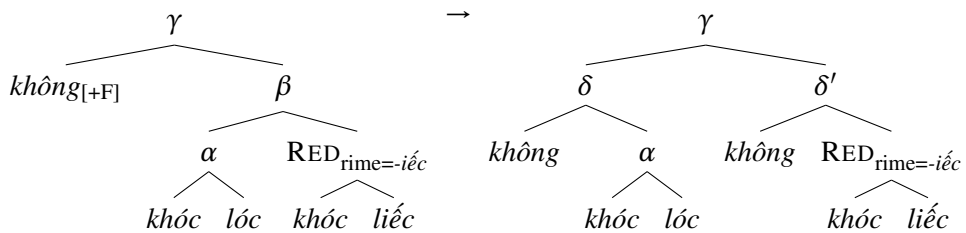
1. α node reduplication:



2. β node reduplication:



3. γ node [+F] resolution:



Output: *không khóc-lóc không khóc-liếc*

Note that the morphosyntactic nature of this operation makes it fall out naturally that the interleaved word can only appear in between the two morphological components (the sister's daughter nodes) and not be inserted deeper in the structure or between every syllable, as shown in (133):

(133) *không khóc (\*không) lóc (không) khóc (\*không) liếc*  
 “not cry and stuff”

(Noyer 1998, p.86)

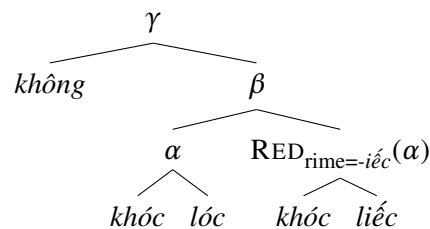
The default word order, that without any copying and interleaving, is simply derived by the lack of F head, resulting in no [+F] feature assigned to the *không* head, as shown in (134):

(134) Derivation of default order without any copying and interleaving

Example Phrase: *không khóc-lóc khóc-liếc* “not cry and stuff”

1.-2. As in (132) above.

3.  $\gamma$  node (no [+F] feature):



Output: *không khóc-lóc khóc-liếc*

The special interleaved order is the result of a morphosyntactic operation performed on morphological pieces. It is not sensitive to syllables except in that Vietnamese happens to have predominantly single syllable morphemes.

### 3.7.3 Case Study Conclusion

The interleaved word order construction in Vietnamese (and Pacoh), at first glance, appears to be a mismatch between grammatical words and phonological words because the compounds involved are thought to be independent grammatical units whose phonological elements surface out of order with each other, violating the criteria of cohesiveness for grammatical words.

However, the construction is best analyzed as a morphosyntactic operation which manipulates morphological units (and syntactic structure) rather than an operation which interleaves syllables phonologically. Given that this is a morphosyntactic operation, there is no mismatch between the structure and the phonology, rather, the phonology is directly reflecting the morphosyntactic struc-

ture resulting from the application of the interleaving operation.

### 3.8 Plains Cree Polysynthetic Verbs

In this case study, Plains Cree is used as an example of a polysynthetic language with a potential mismatch of the  $2M \Rightarrow \omega$  type. Specifically, the verbal complex is traditionally considered to be a single phonological word which covers several grammatical words.

#### 3.8.1 Background

Many of the languages of the Americas are traditionally considered to have very long, complex word structure. For example, verbs in Plains Cree consist of a prefix, zero or more preverbal elements, a stem, and ten possible suffix slots, schematized in (135) and an example given in (136).<sup>27</sup>

(135) Schematic of Cree verbal complex

prefix	(preverb)*	stem	suffixes 1–10
--------	------------	------	---------------

(136) *nikîmacipamihikonânak* “they looked after us badly” (Russell 1999b, p. 205)

Morphemes:	<i>ni-</i>	<i>kî-</i>	<i>maci-</i>	<i>pamih</i>	<i>-ko</i>	<i>-nân</i>	<i>-a</i>	<i>-k</i>
Position:	prefix	preverb	preverb	stem	2	5	8	9
Gloss:	1	PAST	badly	care.for	INVERSE	1.PL.EX	3	3.PL

As shown in (136), these verbs can look extremely long in terms of number of phonological segments, and they also often carry the meaning of an entire clause themselves. At first glance, it might appear that these verbs are mismatches between the morphosyntax and the phonology in that they seem to be a single phonological unit reflecting what we would normally consider to be multiple grammatical units. However, the question to ask is: is this all one phonological word?

Russell (1999a) points out that languages such as Cree have traditionally been viewed as “exotic” and therefore were expected to be phonologically strange. However, the traditional analysis of the phonological structure has been based on this feeling that the language must be strange and not actual linguistic evidence.

<sup>27</sup>I will follow a traditional transcription system where a circumflex accent over a vowel indicates a long vowel. Consonants are approximately their IPA values except *c* = [ts]~[tʃ], *s* = [s]~[ʃ], and *h* represents either partial devoicing of the preceding vowel of a fricative homorganic to the following consonant (Russell 1999b).

Investigating these verbal complexes, Russell (1999b) shows that there are actually several markers for word units which show that they are not a single phonological word. The evidence for this is summarized in the next section. Building off this, however, we would like to be able to show that, if this verbal complex is more than one  $\omega$ -Word, it should also be more than one M-Word, and that the phonological structure should align with the morphosyntactic structure following the M-word  $\Rightarrow$   $\omega$ -Word correspondence.

### 3.8.2 Phonological Structure of Plains Cree Verbs

This section summarizes Russell's (1999b) argument for the phonological structure of Cree verbs, starting with a description of the parts of the verbal complex and then discussing the phonological markers for wordhood.

The leftmost morpheme of the verbal complex is the prefix. These prefixes are person agreement prefixes (usually subject agreement, modulo inverse marking) or overt complementizers (such as subordinators *ê* and *kâ*). The complementizers and the person agreement markers are mutually exclusive; When an overt complementizer is present, the person agreement features appears in the verbal suffixes.

Between the prefix and the verb stem, there may be any number of preverbs. These preverbs carry tense, aspect, and modality meanings as well as adverbial functions, some shown in (137):

(137) Some Cree Preverbs (Russell 1999b, p. 204)

- |                               |                                    |                                 |
|-------------------------------|------------------------------------|---------------------------------|
| • <i>kî</i> - PAST            | • <i>âta</i> - 'although, in vain' | • <i>nôhtê</i> - 'want to'      |
| • <i>wî</i> - 'will, want to' | • <i>kâmwâci</i> - 'quietly'       | • <i>pê</i> - 'coming (hither)' |
| • <i>kakwê</i> - 'try to'     | • <i>kita</i> - 'in order to'      | • <i>matwê</i> - 'audibly'      |

Some preverbs may only occur inside verbal complex (e.g., *pê*-, tense/aspect markers, and control predicates), others can occur as independent words. An example of the variation between an independent word and a preverb is given in (138):

(138) Independent word status of preverbs in Plains Cree (Russell 1999b, p. 204)

- a. *pôsis*      *kî-*    ***takohci-*** *kwâskotow*  
 cat            PAST- on.top- he.jumped  
 "The cat jumped on top"
- b. *pôsis*      *kî-*    *kwâskotow*      ***takohc***  
 cat            PAST- he.jumped      on.top  
 "The cat jumped on top"

In (138), the adverbial element *takohc(i)* ‘on top’ may appear as its own word or as a preverb between the stem and the Tense preverb *kî*.

Following the preverbs is the verbal stem, which itself may be complex in cases such as compounds. The stem takes a number of inflectional suffixes marking a variety of categories including agreement. These suffixes and relative positions are listed in (139):

- (139) Cree verb suffix positions (Wolfart 1973; Russell 1999b)
- 1    obviative object marker *-m*
  - 2    theme (direct/inverse)
  - 3    obviative subject marker *-yi* (Plains)
  - 4    h-preterit, ht-preterit, delayed imperative
  - 5    1,2 person agreement
  - 6-7 p-preterit, dubitative (minor)
  - 8    3 person suffixes
  - 9    3 plural and obviative suffixes
  - 10  subjunctive, iterative

These suffixes have some complex relationships among themselves, which will not be explored here. Note, however, that these suffixes mark agreement (person, number, obviation), low aspect (preterit, dubitative, iterative), voice (inversion), and mood (subjunctive, imperative).

These four elements, the prefix, preverbs, the stem and suffixes form the verbal complex, schematic (135) repeated here:

- (135) Schematic of Cree verbal complex

prefix	(preverb)*	stem	suffixes 1–10
--------	------------	------	---------------

Now we turn to the phonological structure of the verbal complex. Russell (1999b) gives a variety of different indicators for the phonological structure of the verbal complex, discussed here are stress domains, word-final partial devoicing, and external sandhi.

Stress in Plains Cree is regularly antepenultimate. However, within the verbal complex, preverbs and verbs stem are separate domains for stress. Stress assignment for the verb does include suffixes. The stress assignment on preverbs surfaces as secondary stress.

(140) Stress in Cree (Russell 1999b, p. 208)

- |  |  |
|--|--|
| <p>a. <i>pimisin</i> [ˈpimism] "s/he lies down"<br/> <i>pimisini</i> [piˈmismi] "lie down!"<br/> <i>kanâtan</i> [ˈka.naːtan] "it is clean"</p> | <p>b. <i>kî- nîpin</i> [kiːˈniːpɪn]<br/>         PAST- be.summer *[kiːniːpɪn]<br/>         "it was summer"</p> |
|--|--|

As shown in (140a), stress is assigned to the penultimate syllable counting the stem and suffixes. This assignment is not affected by vowel length. However, as shown in (140b), the preverb is not a part of the stress domain of the stem and suffixes. It receives its own stress. Assuming that stress assignment is an indication of phonological wordhood, this evidence shows that the stem and suffixes are part of one phonological word, but prefixes are separate.

The other two word indicators here are boundary indicators which deal with word final vowels. The first process is word final partial devoicing. Final vowels are optionally devoiced at the end of words (indicated orthographically with *h*). This devoicing is not possible between the stem and suffixes, but does occur between preverbs and between the preverb and the stem.

(141) Word Final Partial Devoicing in Cree (Russell 1999b, p. 209)

- |   |  |
|---|--|
| <p>a. <i>anima</i> ~ <i>animah</i><br/>         [anɪma] ~ [anɪmaḥ]<br/>         "that one"</p>                            | <p>c. <i>kî</i> ~ <i>kîh</i><br/>         [kiː] ~ [kiːḥ]<br/>         PAST</p>                 |
| <p>b. <i>pîhtikwê</i> ~ <i>pîhtikwêh</i><br/>         [piːḥtiɡweː] ~ [piːḥtiɡweːḥ]<br/>         "enter!" (imperative)</p> | <p>d. <i>kakwê</i> ~ <i>kakwêh</i><br/>         [kagweː] ~ [kagweːḥ]<br/>         "try to"</p> |

In (141a), *anima* is a demonstrative pronoun which always appears as an independent word. The final vowel may be optionally partially devoiced, resulting in *animah*. In (141b), the same process is available at the end of a verb (that is, the final vowel of the verbal complex). This partial devoicing is also possible with preverbs, such as those in (141c) and (141d). Note that both of the preverbs in (141c) and (141d) are preverbs that can only show up inside the verbal complex, never as independent units. Nevertheless, the partial devoicing process is applicable to them, as shown in (142):

(142) Partial devoicing of a preverb inside verbal complex (Wolfart 1973, p. 36)

<i>nêo</i>	<i>kêkway</i>	<i>kîh-miyêw</i>
four	things	PAST-give.3s4o

“four things he had given them”

However, the partial devoicing process cannot apply between the verbal stem and the suffixes.

(143) No partial devoicing between stem and suffixes (Russell 1999b, p. 209)

<i>ê-</i>	<i>nipâ -c -ik</i>	[e: nɪpa:tʃɪk]
<i>*ê-</i>	<i>nipâh -c -ik</i>	*[e: nɪpa:ɬtʃɪk]
COMP-	sleep -3 -3PL	

“that they sleep”

In (143), the final vowel of the stem *nipâ* cannot be devoiced (*\*nipâh*) when there are suffixes following it. If we take partial devoicing to be an indicator of the edge of a phonological word, it also indicates that the stem and suffixes form a single word (no devoicing possible between them), but that preverbs are separate words from each other and from the stem.

Another vowel phenomenon may occur if devoicing does not.<sup>28</sup> This phenomenon, called “external sandhi” (or “vowel coalescence”) occurs when two vowels are adjacent across a word boundary. The result is the deletion of the first vowel, and the lengthening of the second vowel (if not already long), schematized in (144):<sup>29</sup>

<sup>28</sup>The application of both partial devoicing and external sandhi is reported to be a function of careful versus casual speech. Devoicing is reportedly more common in careful or hypercorrective speech and external sandhi is more common in fast casual speech (Wolfart 1989, based on Bloomfield 1930).

<sup>29</sup>The version of external sandhi presented here is somewhat simplified. In reality the outcome depends on relative vowel length (and some other factors). Additionally, Russell (1999b, 2008) presents slightly different facts about this



(144) External sandhi:  $V_1\#V_2 \rightarrow \bar{V}_2$  (Russell 1999b, 2008, see also Wolfart 1973, 1989, 1996)

This process occurs between independent words, as shown in (145a), and also between preverbs and stems, as shown in (145b).

(145) Cree External Vowel Sandhi:

a. Independent Words:

*nâpêw mîna atim* → *nâpêw mîn âtim* “a man and a dog” (Wolfart and Carroll 1981)

*nâpêw mîna iskwêw* → *nâpêw mîn îskwêw* “a man and a woman” (Wolfart and Carroll 1981)

*nama awiyak* → *nam âwiyak* “no one” (Russell 2008)

*ôma ita* → *ôm îta* “this here” (Russell 2008)

*êkosi êtokwê* → *êkos êtokwê* “thus I think” (Russell 2008)

*anihi oskinikiwa* → *anîh ôskinikiwa* “these youths” (Russell 2008)

*mâmâkwahta ôma* → *mâmâkwaht ôma* “chew this!” (Wolfart 1996, p. 432)

b. Preverbs and Stem:

*ati-atoskêw* → *at-âtoskêw* “he is working” (Russell 1999b, p. 209)

*(ê)-âta-itwet* → *(ê)-ât-îtwet* “although he says so” (Wolfart 1989)

*nika-âpin* → *nik-âpin* “I’ll sit down” (Wolfart 1996, p. 433)

*kî-îsi-nipahaci* → *k-îsi-nipahaci* “once you have killed him” (Wolfart 1996, p. 433)

Note in the final example of (145b) that external sandhi is applying between two preverbs *kî* PAST and *isi* “thus”. This once again indicates that preverbs are behaving identically to independent words.

In contrast with external sandhi between words, vowel hiatus within the stem and suffix domain is resolved with -y- epenthesis rather than vowel coalescence, as shown in (146)

(146) Hiatus resolution with glide insertion within the stem+suffix domain (Russell 1999b, p. 211)

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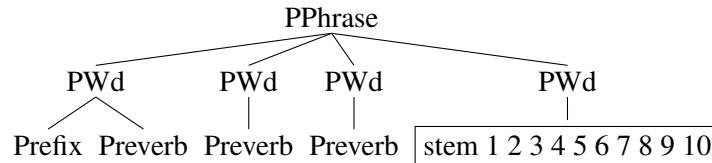
process than does Wolfart (1973, 1989, 1996), perhaps due to dialect differences or change over time. I will ignore these complications and differences here and focus on Russell’s (1999b) point that we can use external sandhi to diagnose word boundaries.

(ê-) pamih -â -ahko -k → (ê) pa.mi.hâ.yah.kok  
 (COMP) care.for DIRECT 1PL 3PL \*(ê) pa.mi.hâh.kok

“(that) we took care of them”

Taking the evidence of stress, partial devoicing, and external sandhi together, Russell concludes that the prosodic structure of the Cree verbal complex has the stem and suffixes as one word and each preverb as its own independent word, as shown in (147)

(147) Prosodic Structure of Cree Verbal Complex (simplified from Russell 1999b, p. 213)



The one element of the structure in (147) not yet discussed is the fact that the prefix is affixal to the element on its right. This evidence comes from two places: (i) Some prefixes do not meet the minimality constraints of prosodic words (2 moras), thus they seem to not be their own words (Russell 1999b); and (ii) there is special vowel hiatus resolution (or perhaps allomorphy) between the prefix and the verb stem when the prefix immediately precedes the stem. Usually a *-t-* is inserted, although some roots take *-h-* or *-w-* instead, as shown in (148):

(148) Special hiatus resolution between prefix and stem (Wolfart 1973, p. 82)<sup>30</sup>

*ni-* + *apin* → *ni-t-apin* “I sit”

*ni-* + *ayân* → *ni-h-ayân* “I have it”

*ki-* + *âtotên* → *ki-w-âtotên* “you tell it”

Note that this epenthesis is different both from the normal stem and suffix *-y-* epenthesis and from the partial devoicing or external sandhi seen above.

### 3.8.3 Morphosyntax of the Plains Cree Verb

Given all of the evidence from the previous section and the phonological structure in (147), there are three things to account for in the interface between the morphosyntax and the phonology:

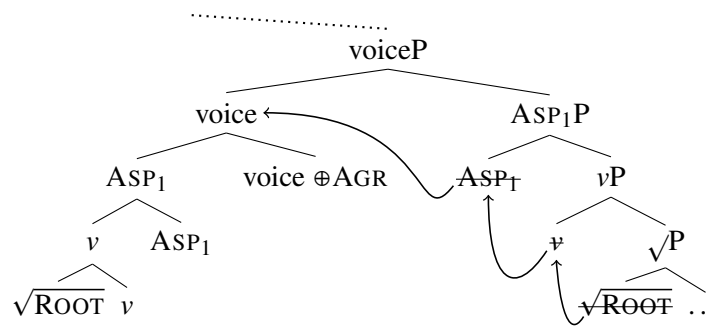
<sup>30</sup>See also Piggott and Newell (2006); Newell and Piggott (2014) for a similar process as it occurs in Ojibwe, another Algonquian language.

- (149) Behaviors to be explained:
- a. The verbal stem and suffixes comprise a  $\omega$ -Word
  - b. Preverbs are  $\omega$ -Words (to the exclusion of each other and the stem)
  - c.
    - i. The prefix is not a  $\omega$ -Word, but leans to the right.
    - ii. The prefix is either agreement or a complementizer

These behaviors follow straightforwardly from a syntactic analysis with the following properties: (a) the verbal root undergoes head movement to collect its suffixes, (b) preverbs are either functional heads which are generated above the verbal complex head or adverbs which are adjoined to the syntactic structure above the verbal root, and (c) the prefix is an element in CP which behaves as a clitic (cf. Halle and Marantz 1993 on Potawatomi). Here, I will be following the syntactic structure proposed for Ojibwe by Piggott and Newell (2006); Newell and Piggott (2014).

First, the fact that the verbal stem and suffixes comprise a  $\omega$ -Word (149a) can be explained with normal syntactic head movement. Recall that the suffixes mark grammatical units such as agreement (person, number, obviation), low aspect (preterit, dubitative, iterative), voice (inversion), and mood (subjunctive, imperative). I propose that the verbal root raises through the  $v$  head, some aspect heads, a voice head and agreement (shown here ornamental on the voice head), creating an M-Word, as shown in (150)

(150) M-Word of the verb and suffixes



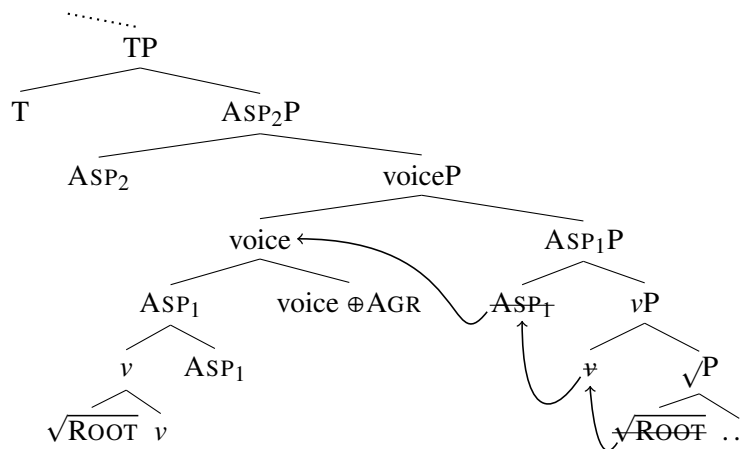
Linearized Morphological Structure: [  $\sqrt{\text{ROOT}} \oplus v \oplus \text{ASP}_1 \oplus \text{voice} \oplus \text{AGR} ]_M$

The exact heads involved here will depend on the particular construction, but the important part is that these heads are combined via syntactic head movement. Head movement forms these heads into

an M-Word and the standard correspondence between M-Word and  $\omega$ -Word applies, resulting in the verb stem and suffixes being a  $\omega$ -Word.

In contrast with the heads which appear as verbal suffixes, preverbs do not form part of the same  $\omega$ -Word as the root. I take this to indicate that the verbal root does not undergo head movement up to these heads. There are two types of preverbs, those that only appear in the verbal complex and those that may be independent words. Preverbs that only appear in verbal complexes carry the semantics of tense, aspect and modal heads. I propose that these are heads which attach above the voice head in the syntactic structure, but which do not participate in the verbal head movement. In (151), I show a tense head and a high aspect head, though, of course, multiple aspects and other modal heads may also be attached in this domain.

(151) Preverbs which only appear in the verbal complex



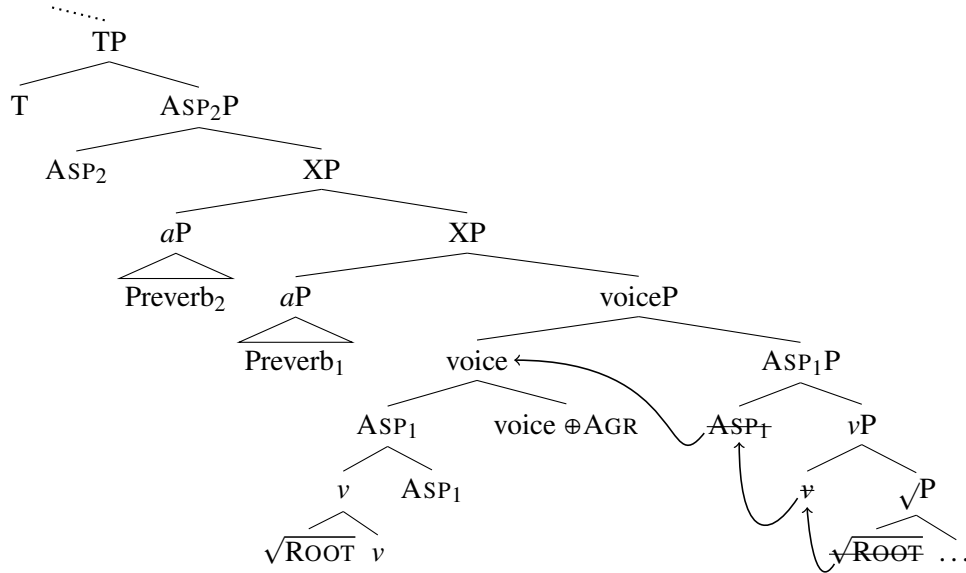
Linearized Morphological Structure: T<sup>-</sup>ASP<sub>2</sub><sup>-</sup>[ √ROOT ⊕ v ⊕ ASP<sub>1</sub> ⊕ voice ⊕ AGR ]<sub>M</sub>

Because these heads do not participate in the head movement of the root, they are not part of the M-Word of the root and are linearized as separate morphosyntactic objects. It is interesting to note here that, unlike other cases which will be discussed in Chapter 4, independent single heads in Cree appear to be treated as their own M-Word and  $\omega$ -Word rather than as clitics without a  $\omega$ -Word status (although, see the discussion about special sandhi in Section 3.8.4 below).

Preverbs of the second type are adverbial elements that may appear as independent words. I propose that these are adjoined to the structure as a phrasal element (somewhere above the voice

head, shown here simply as XP). In other sentences, these phrases are able to be attached elsewhere in the structure, resulting in the behavior that they may be appear outside the verbal complex. Being their own phrases, they have their own internal M-Word structure (and, perhaps, have already undergone spell-out elsewhere). They do not participate in any of the syntactic movement and thus do not participate in the M-Word of the verbal stem.

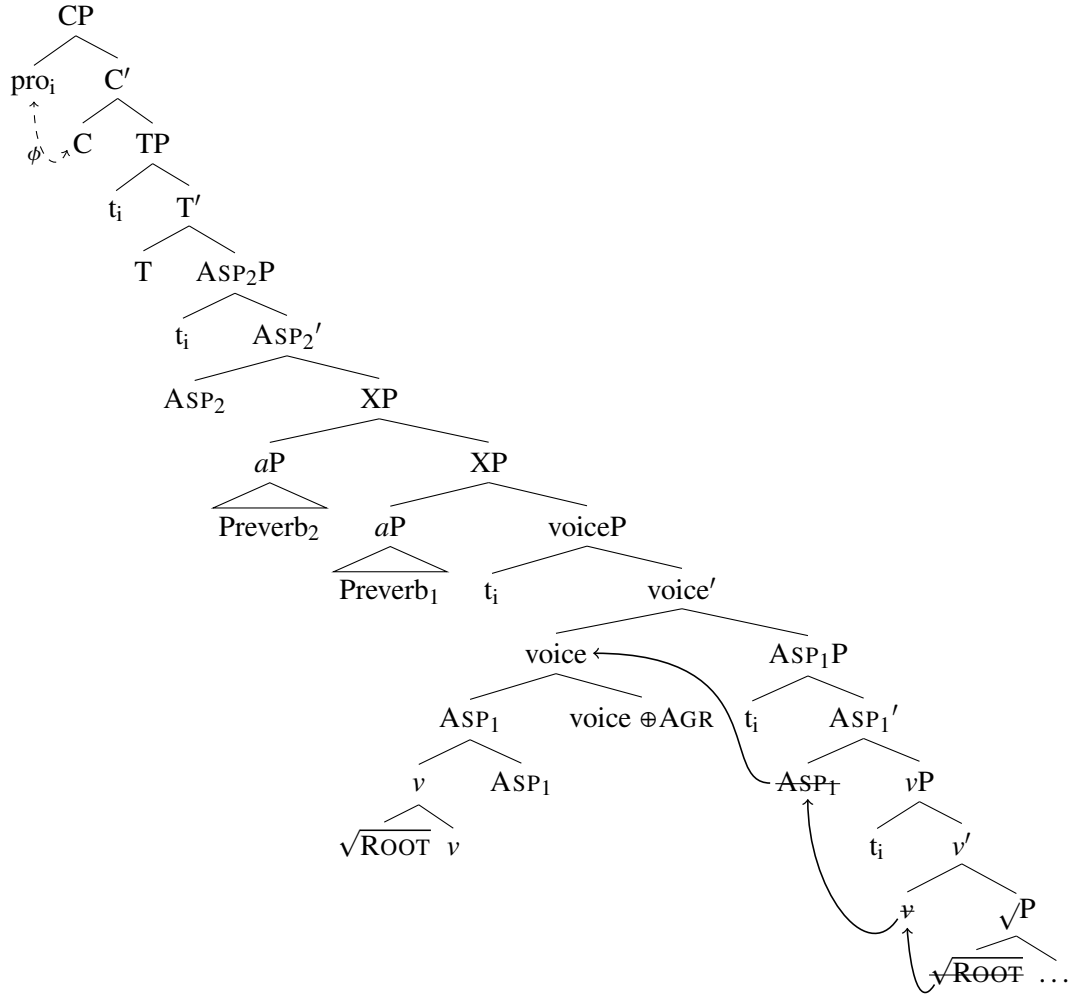
(152) Preverbs which may appear as independent words



Lin. Morph. Str.: T<sup>-</sup>ASP<sub>2</sub><sup>-</sup>[ Preverb<sub>2</sub> ]<sub>M</sub><sup>-</sup>[ Preverb<sub>1</sub> ]<sub>M</sub><sup>-</sup>[ √ROOT ⊕ v ⊕ ASP<sub>1</sub> ⊕ voice ⊕ AGR ]<sub>M</sub>

Finally, for the behavior of the prefix (149c), Newell and Piggott (2014) propose that there is a subject *pro* which is generated as an argument of the verb and is raised through the other heads to spec(CP). They further follow Lochbihler and Mathieu (2008) by proposing that with a null C head (independent order), phi-features of C trigger the insertion of an overt agreement exponent for *pro* in spec(CP). When an overt C is present (conjunct order), these phi-features are situated below TP in the verbal domain, resulting in the agreement being suffixal. The result is the mutual exclusivity of overt complementizers and agreement prefixes. Full structure shown in (153):

(153) Full Structure of Cree Verbal Complex



Furthermore, the prefixes are specified to obligatorily cliticize onto the element to their right. This adjunction could occur through Lowering, like in English T-to-*v* lowering, or through other incorporation into the  $\omega$ -Word, such as Local Dislocation (see discussion of Local Dislocation Chapter 4). Because the prefix is incorporated into the  $\omega$ -Word, this allows for some special allomorphy or phonology for hiatus resolution when the prefix is directly next to the verbal stem, as shown in (148) above.

The phonological evidence points towards the verbal stem and suffixes being one  $\omega$ -Word, the preverbs being their own  $\omega$ -Words, and the prefix being a proclitic. A reasonable syntactic analysis can be provided which aligns the morphosyntactic structure with this phonological structure. As such, there does not appear to be any mismatch between the morphosyntax and the phonology here.

### 3.8.4 Special Sandhi

A further indication of the status of preverbs is found in the Special Sandhi which occurs between special preverbs. Special Sandhi occurs when the certain preverbs<sup>31</sup> end with an *a* or *â* and the following element begins with a short *i*. In this case, the vowels can coalesce to produce *ê*, shown in (154) (Wolfart 1989, 1996; Russell 2008). Recall that normal external sandhi produces a long *î* in similar cases, as shown in (155):

(154) Special sandhi:  $a\hat{a} + i \rightarrow \hat{e}$

•  $k\hat{a}\text{-}\underline{i}tw\hat{e}t \rightarrow k\text{-}\hat{e}tw\hat{e}t$  “he is saying so” (Wolfart 1996; Russell 2008)

•  $ni\text{-}ka\text{-}\underline{i}tw\hat{a}n \rightarrow ni\text{-}k\text{-}\hat{e}tw\hat{a}n$  “I’ll say so” (Wolfart 1989, 1996)

(155) Normal external sandhi:  $a\hat{a} + i \rightarrow \hat{i}$

•  $awa\text{-}\underline{i}skw\hat{e}w \rightarrow aw\text{-}\hat{i}skw\hat{e}w$  “this woman” (Wolfart 1989, 1996)

•  $\hat{o}ma\text{-}\underline{i}statinan \rightarrow \hat{o}m\text{-}\hat{i}statinan$  ( $k\text{-}\hat{e}siy\hat{i}hk\hat{a}t\hat{e}k$ ) “This place (is called) Stettler”<sup>32</sup> (Wolfart 1989)

•  $\hat{e}\text{-}\hat{a}ta\text{-}\underline{i}tw\hat{e}t \rightarrow \hat{e}\text{-}\hat{a}t\text{-}\hat{i}tw\hat{e}t$  “although he says so” (Wolfart 1989)

Note especially the last example of (155), showing a preverb *âta* “although” which is not one of the preverbs that is subject to special sandhi.

I propose that the preverbs subject to special sandhi are simply exponents which fill the C and T heads. Preverbs not subject to special sandhi are those which already have complex M-Word structure (e.g., adverbial preverbs). Because the C and T exponents are simplex heads they are not immediately given their own  $\omega$ -Word and instead may have interesting phonological interactions (via leaning, cliticization or incorporation) into neighboring elements. This is in contrast with the adverbial preverbs (such as *âta* “although”) which are already complex by virtue of being in their own adverb phrase.

<sup>31</sup>Russell (2008) refers to the “first” preverb, although it is unclear what this means. Russell explicitly states that the subordinator *kâ-* and the future *ka-* participate in special sandhi. Note, however, that the future preverb can appear with a prefix on it while the subordinator cannot. Wolfart (1989, 1996) presents a slightly different account than Russell, mentioning only the future markers *ka-*, *kita-*, and *ta-*. In any case only the future markers are noted to be affected by the blocking of special sandhi in irrealis situations, so the main point here is that, regardless of the exact conditions on special sandhi, there is a potential syntactic explanation for the lack of special sandhi in the irrealis situations.

<sup>32</sup>Note that *istatinan* “Stettler” is a borrowed word with an epenthetic *i-* attached to the initial *st-* cluster. This *i* still participates in external sandhi (Wolfart 1989).

One piece of evidence for this sort of analysis is the fact that in sentences with irrealis mood, it is impossible to get special sandhi, even with heads that normally participate in special sandhi. Examples are given in (156):

(156) No special sandhi in irrealis condition<sup>33</sup>

• *tânis ôma nika-itwân* "how should I say this" (Wolfart 1996)

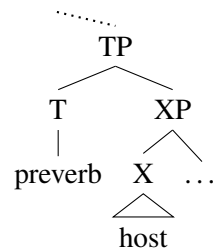
(\**nikêtwân*)

• *nikah-itohtân ôm ânohc kaskihtâyân* "I would go today, but I can't" (Wolfart 1989)

(\**nikêtohtân*)

This prohibition on special sandhi for a seemingly unrelated reason (irrealis mood) is mysterious. However, if we have a morphosyntactic condition that the preverb must be immediately adjacent to its host in order to be in a position for special sandhi to apply, there is a solution. I propose that in these irrealis situations there is an intervening head between, for example, the Tense head and the heads below it. I will demonstrate this with the irrealis feature in ASP<sub>2</sub> head in (158), which is conveniently placed, but it could be a different head with the same locality conditions. This head happens to be phonologically null, but it intervenes between the preverb and its host, effectively preventing them from being grouped together for the purposes of special sandhi. The situation for application of special sandhi is shown in (157), and the situation with a blocking irrealis head is shown in (158).

(157) Structure for special sandhi



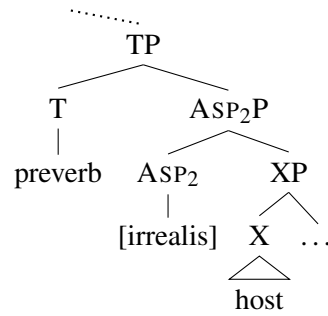
Linearized Morphological Structure: preverb<sup>^</sup>[ host ]<sub>M</sub>

Adjacency Condition: Special Sandhi Can Apply

<sup>33</sup>Note that partial devoicing may or may not occur here, but special sandhi is impossible.



(158) Structure for blocking of special sandhi by irrealis head



Linearized Morphological Structure: preverb<sup>^</sup>irrealis<sup>^</sup>[ host ]<sub>M</sub>

Adjacency Condition: Special Sandhi Cannot Apply

Given the proposed morphosyntactic structure for the Cree verbal complex, we can use the fact that it is syntactic structure to motivate the blocking of special sandhi through the placement of an additional syntactic head. Without this structure, the correlation between special sandhi blocking and irrealis mood is completely strange.

### 3.8.5 Conclusion

Under the traditional analysis, polysynthetic languages such as Plains Cree appear to be mismatches between grammatical and phonological structure because elements, such as the verbal complex, appear to be a variety of grammatical words being grouped into a single phonological word. However, upon more careful investigation of the phonology, it appears that these complexes are better analyzed as phrases containing more than one phonological word.

The morphosyntactic analysis proposed here follows the newer phonological analysis that these complexes are multiple words and provides a syntactic underpinning for why the breakdown into phonological words falls exactly the way it does. Additionally, this morphosyntactic structure can account for certain phenomena (such as the relationship special sandhi and irrealis mood) which otherwise are difficult to explain.

While Plains Cree was the example given here, I suggest that this sort of analysis can be transferred to a wide range of polysynthetic languages, especially those which have already been proposed to have a prosodic structure similar to that of Cree (see, e.g., McDonough 1990 on Navajo, Russell 1999b on Dakota, and Miller 2014 on Kiowa).

### 3.9 Word-Level Recursion in Spanish Compounds<sup>34</sup>

This case study looks at one particular type of exocentric compound in Spanish for a potential mismatch between M-Words and  $\omega$ -Words. Spanish exhibits some basic word-level phonological processes which help to diagnose the boundaries of the phonological word. I posit that the phonological structure of these compounds is nested  $\omega$ -Words and that this reflects a particular construction on the morphosyntactic side. The result is that the  $\omega$ -Word structure and the M-Word structure correspond.

#### 3.9.1 Background and Data

##### 3.9.1.1 Spanish Word-Level Processes

Two phonological processes apply at the word-level in Spanish: diphthongization and epenthesis.<sup>35</sup> Diphthongization applies (certain) mid vowels under stress, as shown in (159). Note that these same vowels are not diphthongized if stress does not fall on them, as shown by the derivationally or inflectionally related words in the “not diphthongized” column.

(159) Diphthongization of (certain) mid vowels under stress (Harris 1989)

$$\text{Process: } \begin{cases} /e/ \rightarrow [ie] \\ /o/ \rightarrow [ue] \end{cases}$$

Diphthongized	Not diphthongized (unstressed)
<i>c[ué]lga</i> “he/she hangs”	<i>c[o]lgámos</i> “we hang”
<i>p[ié]nso</i> “I think”	<i>p[e]nsámos</i> “we think”
<i>c[ié]n</i> “100”	<i>c[e]nténa</i> “group of 100”

<sup>34</sup>A version of this case study was presented at PLC38 and is forthcoming in PWPL21.1

<sup>35</sup>Note that the assertion that these processes take place at the word-level (and not at the stem-level) is not uncontroversial (see, e.g., Bermúdez-Otero 2007). Assuming, however, that subword phonology is bounded by word boundaries, the main thrust of the argument here still stands even if we were to implement a particular process as a subword rule.

*b[ué]no* “good”                      *b[o]ndád* “goodness”

The process of epenthesis adds an *e-* onto underlying *sC* clusters when these clusters are word initial, as shown in (160). Note that epenthesis does not apply to these same clusters when certain prefixes are added, shown in the “*sC* with prefix” column. Epenthesis is also applied to loan words beginning with *sC* clusters.

(160) Epenthesis of *e-* to initial *sC* clusters                      (Lema 1978; Harris 1987; Eddington 2001)

Epenthesis	<i>sC</i> with prefix
<i>escribir</i> “write”	<i>inscribir</i> “inscribe”
<i>esfera</i> “sphere”	<i>hemisferio</i> “hemisphere”
<i>estreñir</i> “constipate”	<i>constreñir</i> “constrict, compel”
<i>estrofa</i> “stanza”	<i>antistrofa</i> “antistrophe”
	<i>sC</i> in Loan Source
<i>esmóquin</i> “smoking jacket”	< Eng. <i>smoking</i>
<i>eskot</i> “Scott”	< Eng. <i>Scott</i>

### 3.9.1.2 Overapplication of Word-Level Processes in Compounds

In compounds, these two processes “overapply”, meaning that the processes apply despite the conditions for application not being surface true. In (161a), word-level stress falls on the second member of the compound, but the mid vowel in the first member of the compound still undergoes diphthongization. Similarly, in (161b), the epenthetic *e-* is still added to the *sC* cluster of the second member of the compound despite the fact that this *sC* cluster is not initial in the compound. Both overapplications may even occur in the same compound (161c).

(161) Overapplication in compounds                      (Harris 1989)

a. Overapplication of diphthongization

*c[ue]lgacápas* “coatrack”    (\**c[o]lgacápas*)

*c[ie]mpiés* “centipede”    (\**c[e]mpiés*)

b. Overapplication of epenthesis

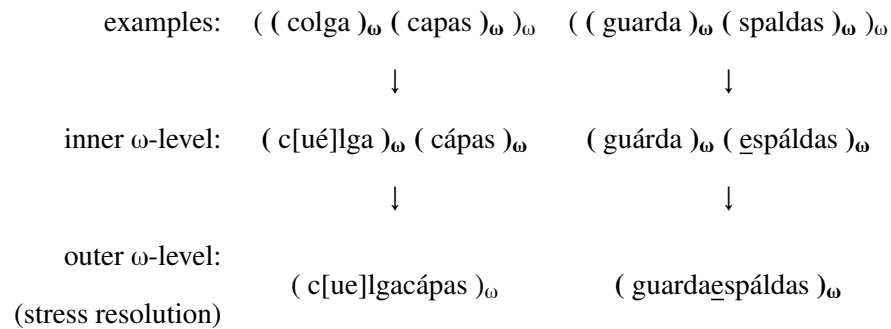
*guardaespáldas* “bodyguard” (\**guardaspáldas*)  
*quitaesmálte* “nail-polish remover” (\**quitasmálte*)

c. Overapplication of both diphthongization and epenthesis

*p[ue]rcoespín* “porcupine” (\**p[o]rcospín*)  
*h[ie]rbaestrélla* “buckhorn plantain” (\**h[e]rbastrélla*)

If we take the application of these word level processes as diagnostic of the word level, it appears that each member of a compound is its own word prior to compounding. However, if primary stress is also an indication of wordhood, then each compound is also a single word. That is, these compounds appear to have a nested word structure, as schematized in (162):

(162) Schematic of Word Levels in Compounds: ((X)<sub>ω</sub> (Y)<sub>ω</sub>)<sub>ω</sub>



The behavior of compounds is a complex issue for all the frameworks of the morphology-phonology interface under discussion here.

In theories with a stratified lexicon, the process of compounding is usually presented as its own level of the lexicon for both morphological and phonological purposes (see, e.g., Kiparsky 1982b; Mohanan 1986). There are several important observations to be made about compounds in this architecture. First, there is no claim to a relationship between the structure or order of the elements of the compound and the syntactic structure of the language. That is, the lexicon decides how the elements are combined, not the syntax. Furthermore, there is no claim to a relationship between the phonology of the compound and the phonology of other parts of the language. That is, if compounding is its own special part of a lexicon, the mechanism for combining elements into compounds need not be the same as the normal mechanism for combining elements in the language (i.e., the syntax), nor do the phonological processes applicable to compounds need to be the same

as the normal phonological processes in the language (i.e., the word-level phonology).

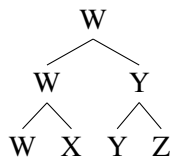
Prosodic Hierarchy Theories, on the other hand, propose that compounding is not in the domain of the lexicon but is formed by the combination of two PWds into either a recursive PWd or a higher prosodic group (such as a Clitic/Constituent Group, see Section 3.9.3.3). This analysis allows for the arrangement of the compound elements by the syntax, but does not allow for any idiosyncratic interpretation of compounds (because the semantic pieces should be combined syntactically, not lexically). Additionally the Clitic/Constituent Group approach does not make any claim that the phonology of the domain of each compound member and the domain of the entire compound will be the same.

It needs to be noted that these two theory types, level-ordering theories and Prosodic Hierarchy Theories are supposed to be coexistent. That is, one deals with the pre-syntactic phonology and one deals with the post-syntactic phonology. However, both sides are making claims that compounding occurs in their domain. This is strange.

Within the framework presented in this dissertation, I argue that compounds are, in fact, combined by the general syntactic mechanisms and phonologized according to the word-level phonology applicable to other words in the language. These claims follow from a theory which builds words through the regular syntactic mechanism, which is required in an architecture of a theory without a lexicon.

However, if we wish to adhere to the correspondence between M-Words and  $\omega$ -Words, the nested word structure of compounds still seems very strange. Syntactically, morphemes are either part of a complex head or they are not, there is no syntactic structure through which a nested M-Word configuration can be the come about. That is, even if a structure such as the one in (163) cannot generate nested M-Words.

(163) Syntactic structure which does not result in nested M-Words



Recall that the definition of M-Word is a maximal complex head. In (163), the top level W node is the maximal projection, so everything under it is within the M-Word. The middle level W and Y nodes are not maximal because they are dominated by another head. This structure simply results in the linearized morphological structure [ W X Y Z ]<sub>M</sub>. If the top level node were a phrase (say, WP), then the linearized morphological structure would be [ W X ]<sub>M</sub>[ Y Z ]<sub>M</sub>. There is no syntactic configuration which results in a nested structure [ [ W X ]<sub>M</sub>[ Y Z ]<sub>M</sub> ]<sub>M</sub>. Thus, if we are to maintain the M-Word ⇒ ω-Word correspondence, we need some way other than syntactic head movement to generate a nested ω-Word structure.

### 3.9.2 Analysis of Compounds

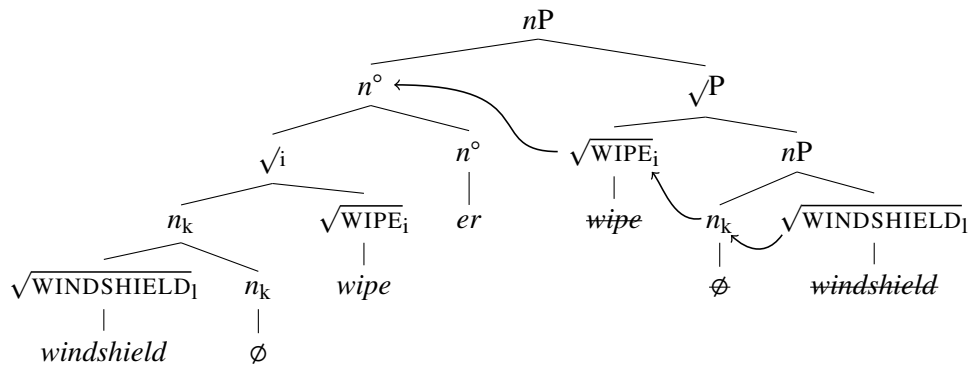
We would like to explain both the order of the elements of the compound and the nested ω-Word structure, that is, how the ω-Level phonology is applied both to the individual elements alone and to the compound as a whole. We can account for these facts with through a combination of multiple syntactic workspaces and the M-Word ⇒ ω-Word correspondence.

#### 3.9.2.1 Background: Previous DM Analysis of Endocentric Compounds

Before introducing my proposed analysis, there has been an analysis within a DM framework suggested for a different type of compound, Endocentric compounds.

Harley (2009) suggests that endocentric compounds build actively in syntax. For example, Harley's structure for the compound *windshield wiper* is shown in (164):

(164) Structure for *windshield wiper* following Harley (2009)



In (164), *Windshield wiper* is initially created by the *nP windshield* merging with the root  $\sqrt{\text{WIPE}}$  to form a root phrase (as if it were the phrase *wipe windshield*). When this root phrase merges with its *n* head, syntactic movement raises the elements into one compound head.

If we strictly follow the M-Word  $\Rightarrow$   $\omega$ -Word correspondence proposed here, this sort of syntactic structure should result in the phonological structure shown in (165a), or, if some flavor of cyclic spell-out had spelled out the *nP windshield* first, the structure shown in (165b).

(165) a. Linearized morphological and phonological structure resulting from (164):

$$[ \sqrt{\text{WINDSHIELD}} \ n_k \ \sqrt{\text{WIPE}} \ n^\circ ]_M \Rightarrow ( \textit{windshield} + \emptyset + \textit{wipe} + \textit{er} )_\omega$$

b. Same structure assuming cyclic spell-out of *windshield*:

$$[ [ \sqrt{\text{WINDSHIELD}} \ n_k ]_M \ \sqrt{\text{WIPE}} \ n^\circ ]_M \Rightarrow ( ( \textit{windshield} + \emptyset )_\omega + \textit{wipe} + \textit{er} )_\omega$$

Note that neither phonological structure in (165) is same structure as the one posited for Spanish compounds in (162) above. However, it must also be noted that there are significant differences between the endocentric compounds discussed by Harley (2009) and the exocentric compounds presented here. For example, the order of the elements in the compound is reversed between endocentric and exocentric compounds (compare exocentric *pick-pocket* to endocentric *pocket-picker*). Additionally, in endocentric compounds, the head of the compound is active for both semantics (a *windshield wiper* is a type of *wiper*) and for allomorphy of the category defining head (compare *windshield wip-er* to *windshield technic-ian* or *windshield art-ist*). In contrast, the members of exocentric compounds are not active for either semantics or allomorphy. That is, a *pick-pocket* is neither a type of *pick* nor a type of *pocket*, and there is no allomorphy of a category defining head sensitive to either member of the compound.

### 3.9.2.2 Analysis of Exocentric Compounds

Harley (2009) does suggest an alternative method for forming compounds of the XP-n type. These are compounds whose left member (in English) is an entire phrase, see examples in (166).

(166) Examples of XP-n type compounds

- These aren't your standard *stuff-blowing-up effects*. (Harley 2009)

- She gave me the *don't-ever-say-that-again* look.
- Clients will be seen on a *first-come-first-served* basis.

For XP-n compounds, Harley suggests that the XP phrase is derived syntactically as a phrase and then sent off to LF for interpretation (and, I posit, PF for phonologization). This phonologized and interpreted phrase is then “renumerated” for use in another workspace. Renumeration (based on Johnson 2004) is the process by which the derived semantic and phonological form of the phrase is reinserted into the syntactic numeration (the set of objects from which the syntax chooses). Essentially, renumeration turns the spelled-out phrase into a pseudo-root.<sup>36</sup> I use the term pseudo-root to indicate that the combinatorics of this unit are the same as those of roots, e.g., it must select for a category defining head, but that the unit is derived from a separate workspace rather than from memory.

I propose that Harley’s analysis of XP-n compounds also applies to exocentric compounds. That is, the components of the exocentric compound are built up in a separate syntactic tree or workspace before being repackaged as a pseudo-root and used in the syntactic space where they behave as a compound. In fact, Exocentric compounds look very much like phrases; They have the same word order as phrases and appear to have the same meaning as the phrase. For example, to return to the Spanish compounds discussed above, *cuelgacapas* “coatrack” looks very much like the phrase *cuelga capas* “(it) hangs coats”. I propose that this is because *cuelga capas* is initially built as a phrase by the syntax. When this phrase is turned into a compound, it is phonologized and then renumerated into a pseudo-root for use in another syntactic workspace.

I notate renumeration with a modified root symbol ( $\sqrt{\prime}$ ) to mark that it may be different in some ways from a normal root. For the purposes here, however, it behaves identically to a normal root except that it has already undergone some phonologization. Note however that this renumeration process may be responsible for some of the idiosyncratic interpretations of compounds because during renumeration any internal morphosyntactic structure of the object is lost and only the resulting phonological structure (and some combination of semantics) remains. Because the morphosyntactic structure is gone, there is the possibility of reinterpretation of the meaning in a way that does not

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<sup>36</sup>There is an interesting side question to be investigated about whether renumeration involves storage into memory of the phrase in any real sense. That is, is renumeration a type of lexification of a phrase, or is it an active syntactic process?

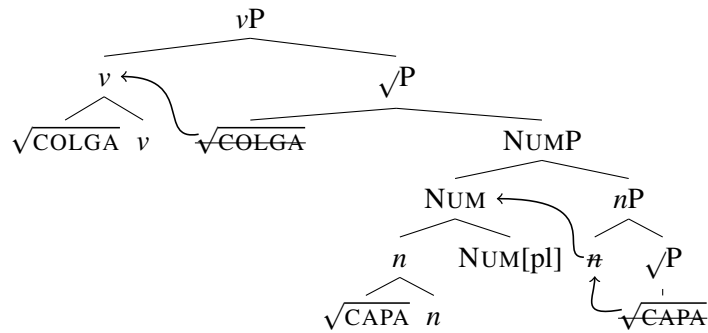


follow the normal interpretation provided by the morphosyntax.

Returning to the main analysis, the derivation of *cuelgacápas*, for example, is given in (167). Initially, the phrase *cuelga capas* is built in the syntax, as shown in (167a). This phrase is linearized and phonologized. Note that there are two M-Words in the phrase resulting in two  $\omega$ -Words. When  $\omega$ -Level phonology is applied, the first member of the compound, which is underlyingly *colga*, becomes *cuelga* by the normal diphthongization process of Spanish words.

(167) Analysis of *cuelgacápas*

a. Initial Phrasal Derivation:



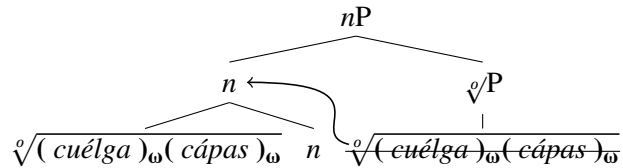
Linearization:  $[ \sqrt{\text{COLGA}} \oplus v ]_M [ \sqrt{\text{CAPA}} \oplus n \oplus \text{NUM}[\text{pl}] ]_M$

M-Word  $\Rightarrow$   $\omega$ -Word:  $( \text{colga} + \emptyset )_\omega ( \text{capa} + \emptyset + s )_\omega$

$\omega$ -Level Phonology:  $( \text{cué}lga )_\omega ( \text{cápas} )_\omega$

Renumeration:  $\overset{\circ}{\sqrt{ ( \text{cué}lga )_\omega ( \text{cápas} )_\omega }}$

b. Use as a “pseudo-root” in another tree:



Linearization:  $[ \overset{\circ}{\sqrt{ ( \text{cué}lga )_\omega ( \text{cápas} )_\omega }} \oplus n ]_M$

M-Word  $\Rightarrow$   $\omega$ -Word:  $( ( \text{cué}lga )_\omega ( \text{cápas} )_\omega + \emptyset )_\omega$

$\omega$ -Level Phonology:  $( \text{cuelga cápas} )_\omega$

Output: *cuelgacápas*

The entire phonologized phrase *cuélgacápas* is then renumerated for use as a pseudo-root in a separate syntactic workspace, as shown in (167b). In this workspace, the renumerated unit is combined with an *n* head to form the noun compound. This forms a single M-Word which corresponds to a single  $\omega$ -Word. When the  $\omega$ -Level phonology is applied to this grouping, stress is resolved, and the normal stress resolution rules of Spanish words resolve the two stresses to one stress, resulting in a single primary stress for *cuelgacápas*.

This analysis results in a recursion of the  $\omega$ -Level phonology, consistent with the  $\omega$ -Level groupings posited in (162) above. The first  $\omega$ -Level applies to the components of a compound during initial phrasal derivation. At this point they are treated as separate words because they are separate words for the purposes of the initial phrasal derivation. The second  $\omega$ -Level applies to the compound as a whole in second workspace because the renumerated root (plus the category defining head) is a single complex head and therefore a single  $\omega$ -Word.

### **3.9.3 Discussion**

There are a few further considerations to be made about the phrasal derivation analysis of the compounds presented above. First, some discussion must be given to the presence or absence of certain syntactic heads in the phrasal derivation. Second, this analysis provides an explanation for another phenomenon found in Spanish compounds, the coordinate *-i-*. Finally, a discussion of an alternate analysis in Prosodic Hierarchy Theory is discussed.

#### **3.9.3.1 Default Heads**

In the analysis of the compounds above, the phrase used to derive the compound is not a complete sentence in the sense that all syntactic heads which would normally be present are not. Rather, there is some sort of limit on what heads are attached to the structure before it was sent off for renumeration. For example, it must be noted that there are no (overt) TENSE or ASPECT heads and no verbal agreement marking on the verb of the phrase. To take the example of *cuelgacápas* used above, note that the verb appears as the stem *cuelga*. The same is true for English; English compounds which do not show tense or agreement information, e.g., *\*picks-pocket* or *\*picked-pocket*. I posit that the process of renumeration (at least for Spanish and English) is somehow

restricted to bare *v*Ps, thus excluding higher heads from being included.

There are some functional heads that do seem to appear in the nouns of compounds, at least when the compounds are of the Verb-Noun type, like those discussed above. That is, the *capas* of *cuelgacapas* seems to include a NUMBER head, as it appears to be plural on account of the final *-s*. However, in English compounds there is no plural marking allowed, e.g., *\*rats-catcher* or *\*pick-pockets*. I propose that each language has a default configuration of noun phrases which either does or does not include a NUMBER head. For Spanish, the NUMBER head is inserted by default, but for English there is no NUMBER head inserted. It must be noted, however, that the semantic information of number is not really carried by the compound. That is, *cuelgacapas* "coat-rack" does not inherently contain a plurality of coats. In fact, a single-hooked coat-rack, which is arguably only for one coat, is still a *cuelgacapas*. Note also that any other elements which must agree with these compounds (adjectives, determiners, and verbs) agree as singular.

Because there is not semantic information included in the default NUMBER head, I further posit that the exponent inserted for this head (if it is inserted) must be the default exponent. This may help to explain the cross-linguistic tendency for compounds to contain "linking morphemes" that look suspiciously like default NUMBER or CASE heads. For example, in German, many compounds take *-en-* (arguably a default plural marker) between members. One such example is *Schwanengesang* "swan song, final performance". Note that the plural of *Schwan* "swan" is normally *Schwäne* not *\*Schwanen*. Further investigation along this line of study is needed, but will not be pursued here.

### 3.9.3.2 Spanish Coordinate Compounds

The phrasal derivation analysis above provides an analysis for another type of compound in Spanish, the coordinate compound. These compounds generally take two adjectives (or occasionally nouns) and mean *X-and-Y*, or something with qualities of both adjectives. The mystery is that most<sup>37</sup> of these compounds appear with an *-i-* connecting the two parts, as shown in (168) (Clements 1992; Núñez-Cedeño 1992; Moyna 2011; Renner and Fernández-Domínguez 2011).

#### (168) Example of Spanish coordinate compounds

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<sup>37</sup>Further work needs to be done to determine if there is some semantic or morphosyntactic difference between the coordinate compounds that take a connecting *-i-* and those that do not.

- *arqui**banco*** “chest-bench” = “bench with drawers”
- *azul**i**verde* “blue-and-green” or “bluish-green”
- *roj**i**azul* “red-and-blue”
- *agripic**ante*** “sour-and-spicy”
- *anchic**orto*** “wide-and-short”
- *tont**i**loco* “dumb-and-crazy”

This mysterious *-i-* can be explained if these compounds are also built through the phrasal derivation posited above. To take *azuliverde* “bluish-green” as an example, it is initially built as the phrase *azul y verde* “blue and green”.<sup>38</sup> This phrase is phonologized and renumerated, as shown in (169).

(169) Derivation of *azuliverde*

Derivation as phrase X and Y    *azul y verde*

Phrasal Phonologization:    *azuliverde*

Renumeration:     $\sqrt[0]{\text{azuliverde}}$

This analysis equates the connecting *-i-* with the conjunction that connects the two elements of the compound during the phrasal part of the derivation.

It must be noted that there are some other types of compounds in Spanish that have a linking *-i-* which are not coordinate compounds. Although there is not space to deal with them in this paper, the prediction made by this analysis is that the *-i-* is a result of another default head or phrasal element that is generated in the initial phrasal derivation of the compound.

### 3.9.3.3 Clitic Group and Prosodic Hierarchy Theory

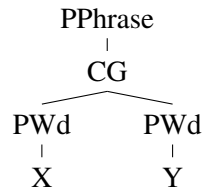
It must be pointed out that, while there are two applications of phonology which I have been treating as nested or recursive word levels, the phonological evidence on its own does not necessarily show that these are both applications of the same phonological level.<sup>39</sup> That is, the inner constituents of the compound are diagnosed with diphthongization and epenthesis while the outer constituent

<sup>38</sup>Orthographic *i* and *y* in Spanish are both pronounced /i/.

<sup>39</sup>Thanks to Taylor Lampton Miller for discussion on the Prosodic Hierarchy Theory analysis of the data.

is diagnosed by stress. An alternate analysis of this data can be given using versions of Prosodic Hierarchy Theory that include the Clitic Group or Constituent Group (CG) level above the level of Prosodic Word (PWd) (see, e.g., Nespor and Vogel 1986; Hayes 1989; Vogel 2009). This analysis would posit that the members of a compound are Prosodic Words which are combined into a compound at the Constituent Group level, as schematized in (170).

(170) Prosodic structure for compounds using a Constituent Group



Under this analysis diphthongization and epenthesis are applicable at the PWd Level while primary stress is determined at the CG level.

I have two points of contention with this analysis. First, under the standard phonological analysis of Spanish, primary stress is necessary to trigger diphthongization. Although a different analysis may be possible, it would need to carefully distinguish between stress assigned at the PWd level and that at the CG level. That is, stress cannot be reassigned at the CG level, because of (classic) cases such as *piénsatelo* “think about it!” which do not get a new stress assignment beyond that of the base PWd *piénsa* (*\*piénsátelo*, *\*piensatélo*). Under the recursive word analysis I propose above, both the inner and outer constituents apply the same stress rules (which should trigger diphthongization in both levels, although this is vacuous in the case of the outer constituent). It would be very coincidental in the CG analysis that both the PWd level and the CG level have the same stressing rule.

Second, this Prosodic Hierarchy analysis tells us nothing about the relationship between the syntax and the phonology. That is, it merely stipulates that compounds are CGs (*contra* lexical theories which state that compounds are built in the lexicon). While this may be a possible analysis in a theory of indirect reference between the phonology and the syntax (as Prosodic Hierarchy Theories are), it gives us no information about why compounds might be CGs. In contrast, the analysis proposed here follows a direct reference theory of syntax to phonology, claiming that the two must relate to each other in a particular way. Here, if compounds have recursive phonological

word structure and we posit a single syntactic structure which corresponds to the phonological word (M-Word  $\Rightarrow$   $\omega$ -Word), we learn that there must be some recursive structure in the syntax which generates compounds (here, renumeration). We can then use this framework to explore other issues surrounding compounds from both the syntactic and phonological sides (such as default heads and the connecting *-i-*, as mentioned above).

### 3.9.4 Case Study Conclusion

In this case study, certain exocentric Spanish compounds showed overapplication of word-level phonological processes. The phonological structure appeared to be that of nested  $\omega$ -Words. If compounds are built in the lexicon, this appears to be a mismatch between the grammatical structure and the phonological structure.

I presented an analysis using a two-part derivation for these exocentric compounds, which results in them being generated as two separate M-Words in one workspace, phonologized into separate  $\omega$ -Words, and then renumerated as a pseudo-root in a second workspace. The normal syntactic head movement of this second workspace results in an M-Word containing the pseudo-root, which, in turn, results in a nested  $\omega$ -Word structure.

Although compounds are complex, both structurally and phonologically, we can use the M-Word  $\Rightarrow$   $\omega$ -Word correspondence to relate the structure and the phonology in such a way that it helps us understand both parts more.

## 3.10 Stray Terminal Grouping

### 3.10.1 Introduction

In Section 3.5 and the case studies in Sections 3.6–3.9, I argued that there were not any mismatches between M-Words and  $\omega$ -Words, at least not of the type where multiple words of one type correspond to a single word of the other type. However, a different sort of mismatch between the two structures does appear to occur. This phenomenon is the creation of  $\omega$ -Words where no M-Word exists.

Recall that the M-Word, as I have defined it here, is a *complex* head. Syntactic heads which

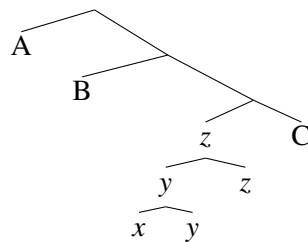
are not complex seem to have slightly different properties than complex heads. While I argue that complex heads always convert into  $\omega$ -Words at the morphosyntax-phonology interface, single heads seem to have variable behavior. In some cases they do appear as  $\omega$ -Words (see, for example, the preverbs of Plains Cree in 3.8 above). In other cases, they seem to act as clitic elements leaning on neighboring  $\omega$ -Words and perhaps being incorporated into those word (see, for example, the discussion of clitics and affixation in Chapter 4). However, sometimes single syntactic heads show another behavior in which they are grouped with neighboring simple heads into  $\omega$ -Words. I will call the operation which groups these heads together *Stray Terminal Grouping* because it collects adjacent terminal nodes from the syntax which initially belong to no  $\omega$ -Word (“stray”) and groups them together.

(171) Stray Terminal Grouping:

When converting from morphological groupings to phonological groupings, terminal nodes not in a M-Word may get grouped with neighboring terminals nodes into a  $\omega$ -Word.<sup>40</sup>

This operation takes place complementary to the M-Word  $\Rightarrow$   $\omega$ -Word correspondence. For convenience I will show it ordered after the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, although the two operations should never affect the same units. For example, in the sample structure in (172), the complex head  $[x y z]_M$  corresponds to a  $\omega$ -Word by virtue of it’s M-Word status. The remaining single heads A, B, and C, however, have no  $\omega$ -Word status. Barring the application of other operations, these may be grouped with neighboring stray heads into a  $\omega$ -Word, resulting in the  $\omega$ -Words  $(A B)_\omega$  and  $(C)_\omega$ .

(172) Stray Terminal Grouping:



Morphological Grouping

Linearization: A B  $[x y z]_M$  C

M-word  $\Rightarrow$   $\omega$ -word: A B  $(x y z)_\omega$  C

Stray Terminal Grouping:  $(A B)_\omega (x y z)_\omega (C)_\omega$

Phonological Grouping

<sup>40</sup>In their definition of a prosodic word, Nespor and Vogel (1986) propose a similar idea that unattached elements of the syntactic tree attach to a nearby prosodic word or form a prosodic word on their own.

The notion that not all syntactic nodes are able to carry phonological word status is not new. Rather, there has been a great deal of work demonstrating that only lexical categories and their projections are available for reference when building prosodic units, usually called the Lexical Category Condition (for which, see Nespors and Vogel 1986; Selkirk and Shen 1990; Prince and Smolensky 1993; Selkirk 1995; Truckenbrodt 1999). With the Lexical Category Condition, however, there is no real explanation for this effect, it is just assumed to be a principle of the grammar. Under the framework here, there is a reason for this effect. “Lexical” heads, or roots in the theory here, always form  $\omega$ -Words by virtue of the fact that, in the syntactic part of the theory, roots always select for a category defining head (e.g., *n*, *a*, *v*) and form a complex head with that category defining head (the “categorization assumption”, see Embick and Noyer 2007; Embick and Marantz 2008). Because of this, roots, along with any heads they happen to pick up through head movement, always form their own  $\omega$ -Word. By contrast, functional heads are usually considered to be single heads and, as such, do not obligatorily form complex heads. In work involving the Lexical Category Condition, functional heads are usually considered to be clitics. Some discussion has been given to cases where several functional heads are grouped together into their own phonological constituent, usually a Clitic/Constituent group (see, e.g., Nespors and Vogel 1986; Hayes 1989; Vogel 2009). In the case studies in this section, it seems relatively clear that simplex heads which are linearly adjacent (but not predicted to be combined by the syntax) are grouped together into a  $\omega$ -Word.

Three examples of Stray Terminal Grouping are presented below: The stress pattern of clitics with functional items in Bilua, the phonology of contraction in Standard English, and /t/-assibilation with subjects *it*, *that*, and *what* in African American Vernacular English.

### 3.10.2 Bilua

Bilua (Central Solomon; East Papuan) shows an interesting interaction between grammatical elements and the assignment of stress. Stress is normally word-initial, but proclitics are not included in the calculation of stress. However, when a proclitic (or more than one proclitic) attaches to a simplex functional head the proclitic is counted as part of the domain of stress. I propose that this is because the series of functional heads without complex M-Word structure are grouped together by



Stray Terminal Grouping.

Stress in Bilua is applied to the first syllable of a phonological word, as shown in (173):

- (173) Initial stress (Obata 2003, pp. 12,18)
- |                       |                                |                              |
|-----------------------|--------------------------------|------------------------------|
| <i>'toup</i> a “lake” | <i>'sitolu</i> “eight”         | <i>'βairutu</i> “today, now” |
| <i>'uri</i> “good”    | <i>'ru<sup>h</sup>ge</i> “bad” | <i>'toruru</i> “egg”         |

However, Bilua has a variety of pro- and enclitic particles which mark subject and object agreement, nominal possession, tense/mood, and other grammatical features. If a word has a proclitic, that proclitic is not included in the calculation of stress, so stress falls on the surface second syllable, as shown in (174):<sup>41</sup>

- (174) Stress on the surface second syllable with proclitics (Obata 2003, pp. 14–17)
- |  |   |
|--|---|
| a. <i>a= 'naja</i><br>1SG= mother<br>"my mother"                             | b. <i>o= 'sisu</i><br>3SG.M= sweet.potato<br>"his sweet potato"                           |
| c. <i>o= βouβaε =k =a</i><br>3SG.M= kill =3SG.F.O =PRES<br>"...he killed it" | d. <i>a= <sup>n</sup>dare =k =oσ</i><br>1SG= wait =3SG.F.O =FUT<br>"I will wait for her." |

The intuition here is that the proclitics are not participating the ω-Level phonology, which assigns stress. This is schematized in (175):

- (175) Proclitic non-participation with host’s ω-Word:
- |                      |   |
|----------------------|---|
| Lin. Morph. Struct.: | clitic <sup>~</sup> [ host ] <sub>M</sub> |
| M ⇒ ω:               | clitic + ( host ) <sub>ω</sub>            |
| Leaning:             | clitic=( host ) <sub>ω</sub>              |

<sup>41</sup>Note that the interaction of the proclitics with their host is dependent on the phonology of the host; Proclitics ending in a vowel will not lean on hosts beginning with a vowel. Instead, they behave as independent phonological words and take their own stress:

- (i) Non-cliticization of proclitic under hiatus (Obata 2003, p.15)
- |                         |                  |
|-------------------------|------------------|
| <i>'o</i>               | <i>'odie=k=a</i> |
| 3SG.M call=3SG.F.O=PRES |                  |
| "...he called her"      |                  |

I suggest this is phonologically conditioned Local Dislocation, discussed further in Section 4.5. In this case, the structure would actually be that of a nested ω-Word and the stress assignment process would have to respect the stress marked by the inner ω-Word. I will not give a full analysis of this here, but instead focus on the Stray Terminal Grouping aspect.

While these clitics are not grouped together into the same  $\omega$ -Word, they still “lean” on their host (see the discussion in Chapter 4).

In verbs, various elements may intervene between the stem and the proclitic. These elements form a separate  $\omega$ -Word from the verbal stem, as diagnosed by stress. If these intervening elements are adverbial, they behave exactly like other words with respect to a proclitic and stress; Stress assignment ignores the proclitic.<sup>42</sup>

(176) Agreement clitic on an adverb (Obata 2003, p. 14)

*o= 'sasa 'mamaz =a*  
 3SG.M= a.bit rest =PRES  
 "...he rested a bit,"

However, if the intervening element is any functional head, rather than an adverb, the proclitic is included in the calculation of stress. Thus, “a Bilua phonological word may consist of morphemes that bear no inherent stress” (Obata 2003, p. 14). I take this to mean that a group of functional morphemes are grouped together into their own  $\omega$ -Word resulting in the initial stress. Examples are shown in (177):

(177) Initial stress with proclitics and functional heads (Obata 2003, pp. 15–16)

- a. *'ko=<sup>m</sup>beta 'kort=a*  
 3SG.F=CONT climb=PRES  
 "... she is climbing,"
- b. *'o=k=a 'zari=a 'rae= $\eta$ =o*  
 3SG.M=3SG.F.O=VAL<sup>43</sup> want=PRES marry=2SG.O=NOM  
 "...he wants to marry you..."
- c. *'ke=k=ar 'besi $\epsilon$ -kij=ov*  
 3PL=3SG.F.O=VAL exchange-RECIP=FUT  
 "...they will exchange [food]..."

Examples of minimal pairs of sentences in which the subject proclitic leans directly on the verbal stem (and does not take stress) in one case and leans on functional heads (and does take stress) in

<sup>42</sup>It is interesting to note that the structure of the Bilua verbal complex, both morphologically and phonologically, looks very similar to that seen in Plains Cree in Section 3.8.

<sup>43</sup>The VAL(ency) morpheme marks an increase of the verb’s valency and causes raising of the additional argument’s clitic to the pre-verbal domain.

the other case are given in (178):

(178) Minimal pairs for subject proclitic stress (Obata 2003, p. 164)

- a. i. *a='rabut=ala*      *'dʒoni 'kage*  
 1SG=weed=PAST<sup>44</sup> John BEN  
 "I weeded for John"
- ii. *'a=v=a*      *'rabut=ala*  
 1SG=3SG.M.O=VAL weed=PAST  
 "I weeded for him"
- b. i. *ko='vatuti=k=ala*      *'se 'kasi 'azo*  
 3SG.F=move=3SG.F.O=PAST 3PL at ABL  
 "She moved it (away) from them"
- ii. *'ko=m=a*      *'vatuti=k=ala*  
 3SG.F=3PL.O=VAL move=3SG.F.O=PAST  
 "She moved it (away) from them"

In (178a-i) and (178b-i) the pronominal proclitics *a* 1SG and *ko* 3SG.F are not included in the calculation of stress because their host is a verbal stem, and thus an M-Word. Their phonological structure is the same as that schematized above in (175). In contrast, in (178a-ii) and (178b-ii), the same pronominal proclitics are grouped together with other functional elements (here an object proclitic and the functional head marking increased valency). This is schematized in (179):

(179) Proclitic with Functional Heads:

Lin. Morph. Struct.:      clitic<sup>^</sup>clitic<sup>^</sup>functional-head

M ⇒ ω:      —

Stray Terminal Grouping: ( clitic + clitic + functional-head )<sub>ω</sub>

The point here is that the same morphosyntactic object (here, the proclitics) can have variable phonological behavior depending on their morphosyntactic context. When they are adjacent to M-Words, they do not participate in the ω-Level phonology. However, when they are adjacent to other simplex heads, the group of simplex heads behaves like a ω-Word together.

<sup>44</sup>Note that I am simply using PAST for what Obata (2003) glosses as RCP “recent past”.

### 3.10.3 Standard English Contraction

Another example of Stray Terminal Grouping is found in the phonology of contraction in Standard English.<sup>45</sup>

Zwicky (1970) notes that a pronoun with a contracted auxiliary has a “close” phonological relationship (see also MacKenzie 2012; Embick 2012b). In this case the “close” phonology results in the pronoun and auxiliary being syllabified in the same syllable and the possibility of some vowel reduction, as shown in (180a). Pronouns that are embedded in phrases and full nouns (such as names) do not show this relationship, as shown in (180b).

#### (180) Phonology of Standard English Contraction

(Zwicky 1970; MacKenzie 2012; Embick 2012b)

##### a. “Close” phonological relationship:

- You’ll have to do that. (/jʊl/)<sup>46</sup>

##### b. Not “close” phonological relationship:

- The people with you’ll have to do that. (\*/jʊl/, ✓/ju.əl/)
- Sue’ll have to do that. (\*/su:l/, ✓/su.əl/)

Assuming that this “close” phonological relationship is related to  $\omega$ -Word boundaries, it seems that *you* and *’ll* in (180a) are a single  $\omega$ -Word but the *’ll* and the host are not a single  $\omega$ -Word in the examples in (180b).

We must make two reasonable assumptions for the analysis here: (i) pronouns and expletives are not full noun phrases, meaning they are non-complex heads and not immediately dominated by a cyclic head (see, e.g., Déchaine and Wiltschko 2002); and (ii) syllabification and vowel reduction both happen at the  $\omega$ -Level.

Given these assumptions, the difference between the “close” phonology of pronoun subjects with an auxiliary and the not-“close” phonology of full nouns is reduced to the  $\omega$ -Word groupings

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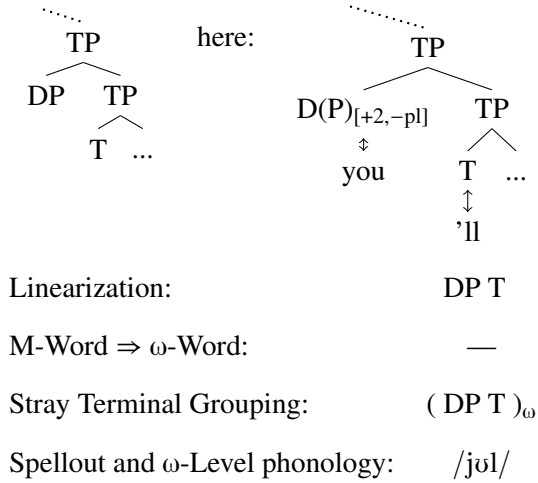
<sup>45</sup>I use “Standard English” to cover a wide variety of mainstream dialects, and in particular to create a distinction with the dialect-specific phenomena of /t/-assibilation for African American Vernacular English discussed below.

<sup>46</sup>It must be noted that this *you’ll* may be pronounced as /ju.əl/. I suggest that this happens when there is some sort of focus or contrast on *you* which must affect the phonological grouping discussed below.

because full nouns are complex heads while pronouns do not.

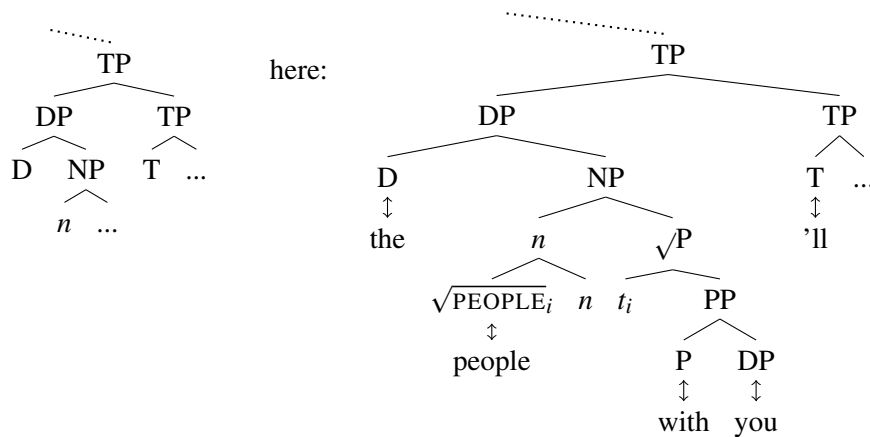
With the pronoun subject *you*, the subject DP and T node are not in a M-Word, but end up getting grouped together by Stray Terminal Grouping. This puts them in the same  $\omega$ -Word where they become syllabified together:

(181) Derivation of Pronoun + Auxiliary: *you'll*  $\rightarrow$  /jʊl/



In comparison, in a full NP subject where the pronoun *you* is embedded, the pronoun and the auxiliary are never grouped together, as shown in (182):

(182) Derivation of Full NP + Auxiliary: *the people with you'll* /ju.əl/



Insertion of *n* causes linearization of complement of *n*

Linearization: [  $\sqrt{\text{PEOPLE } n}$  ]<sub>M</sub> P DP

Phonological Grouping: (  $\sqrt{\text{PEOPLE } n}$  )<sub>ω</sub> ( P DP )<sub>ω</sub> ← NB: Stray Terminal Grouping!

Spellout and ω-Level phonol.: *people with* /ju/

Later spell out of T node:

Linearization: ... (NP) T

Phonological Grouping: ... (*people with* /ju/) T

Spellout and ω-Level phonol.: ... *people with* /ju/ =/l/

... →/ju/ =/əl/

Assuming some form of cyclic spell-out here (triggered at either the *n* or D heads, for example), the pronoun *you* will be spelled-out and grouped together with the P to its left. Because the *you* is already grouped, when the T node is spelled out later, it cannot be grouped together with *you*. In this case, *you* and *'ll* are not in the same ω-Word and so do not undergo the ω-Level phonology together. It should be noted that the contracted *'ll* still “leans” on its host, although it does not participate in the ω-Level phonology (see Section 4.3).

Note that the grouping together of the preposition *with* with the pronoun *you* is another case of Stray Terminal Grouping (and has the potential to explain various special interactions that are seen between prepositions and pronouns but not full noun phrases). Then, in the later cycle in which T is spelled out, its exponent *'ll* ends up leaning on *you* but, because they are not grouped in the same ω-Word, there is no resyllabification or vowel reduction possible. Instead, *'ll* must be syllabified on its own, resulting in the schwa insertion /əl/ (or it becoming a syllabic *l* /l̩/).

This shows that the syntactic structure, specifically the difference complex heads and simplex heads, plays a role in determining where phonological groupings are made. Here, pronouns, which are simplex heads are grouped together with neighboring simplex heads (via Stray Terminal Grouping), resulting in them being grouped together into the same ω-Word.

### 3.10.4 AAVE copula contraction<sup>47</sup>

A similar case to auxiliary contraction in Standard English (abbreviated SE in this section) is the contraction of the copula and the interaction with subject type in African American Vernacular English (AAVE). In this case study, morphologically conditioned allomorphy of the copula interacts with Stray Terminal Grouping in an interesting way.

The copula in AAVE shows variable contraction and deletion. With full NP subjects, the copula variably shows full, contracted or null forms, as shown in (183a). With animate pronouns subject (here, *he/she*), the copula varies between contracted and null forms, as shown in (183b). With inanimate pronouns (*it, that, and what*), however, the pronoun and copula are categorically pronounced as *i[s], tha[s], and wha[s]*, as shown in (183c):

(183) Forms of the copula with different subject types

a. NP/Name — variable Full, Contracted, or Null (Labov et al. 1968)

- His wife is suppos' a be gettin' money for this child
- Boot's here
- Boot  $\emptyset$  always comin' over my house to eat

b. He/She — variable Contracted or Null<sup>48</sup> (Frank Porter Graham Corpus)

- No, she's not mad at you.
- She  $\emptyset$  not mad though.

c. It/That/What — categorical 's (Labov et al. 1968)

- I's a real light yellow color.
- Tha's my daily routine: women.
- Wha's your name again?

Because of this categoricity, *it, that, and what* are traditionally considered “don’t count” forms and excluded from variationist analysis (Labov et al. 1968; Rickford et al. 1991; Blake 1997).

<sup>47</sup>The work in this section represents joint work with Brittany McLaughlin, presented at NELS44 and PLC38 and published in the proceedings of NELS44 (Shwayder and McLaughlin 2014). We would like to thank Walt Wolfram and the Frank Porter Graham Institute for access to the Frank Porter Graham Corpus.

<sup>48</sup>The two sentences in (183b) were spoken by the same speaker in the same interview.

However, using conditioned allomorphy and Stray Terminal Grouping, we can explain both the categoricity of *i*[s], *tha*[s], and *wha*[s] and the phonological form.

### 3.10.4.1 Conditioning factors on the variation of AAVE copula

Variation in the choice of full, contracted, or null copula form has been shown to be conditioned by morphological factors such as subject animacy and whether the subject is a pronoun. Because of these factors are morphological features, the variation in the copula form is seems to be allomorphy (as opposed to syntactic variation or phonological variation). That is, following MacKenzie’s (2013) model for SE, shown in (184), we posit that AAVE has three allomorphs of the copula, as shown in (185).

(184) Two allomorphs of copula in SE: (MacKenzie 2013)

- a) IS<sup>49</sup> ↔ [ɪz] “full”
- b) IS ↔ [z] ”contracted”

(185) Three allomorphs of copula in AAVE:

- a) IS ↔ [ɪz] “full”
- b) IS ↔ [z] ”contracted”
- c) IS ↔ ∅ “null”<sup>50</sup>

The categoricity of the subjects *it*, *that*, and *what* can be explained by a combination of morphological factors: subject animacy and pronoun subject (Labov 1969; MacKenzie 2013; McLaughlin 2013). These morphosyntactic features are known to affect other alternations in both SE and AAVE, listed in (186):

(186) Animacy and Pronominal Subject as conditioning factors in SE and AAVE.

- a. SE: Genitive and Dative alternations shown to be sensitive to animacy

- Genitive Alternation (Rosenbach 2005; Tagliamonte and Jarmasz 2008)

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<sup>49</sup>IS is a shorthand for the feature bundle that is the third person singular copula.

<sup>50</sup>The phonologically null form is sometimes called the “deleted” copula. However this terminology suggests something was present and then removed. Under this analysis, instances in which there is no overt copula are the result of a phonologically null exponent being inserted rather than the phonological deletion of an overt exponent. For this reason, this allomorph is will be referred to as the null allomorph here.



- The woman’s shadow vs. The shadow **of** the tree
- Dative Alternation
  - (Bock and Irwin 1980; Bresnan et al. 2007; Bresnan and Ford 2010)
  - We gave **my sister** the book vs. We gave the book **to the library**
- b. SE: Animate (human) subjects showing more contraction than inanimates even accounting for weight and frequency of subject (McLaughlin and MacKenzie 2013)
- c. AAVE: Animacy affects choice of 3sg. verbal /-s/ and copula deletion (McLaughlin 2013)
- d. SE: Pronominal subjects condition the choice of contracted allomorph at near ceiling levels (98%) (MacKenzie 2013)

Thus it is not strange to propose that subject animacy and pronoun subject affect the allomorph selection for the copula in AAVE. These two conditioning factors interact to select allomorphs in the following way: (1) pronoun subjects highly disprefer full forms, selecting instead for either contracted or null forms; and (2) inanimate subjects disprefer null forms, selecting instead either full or contracted forms. A schematic of the interacting conditioning factors is shown in (187):

(187) Schematic of conditioning factors for AAVE copula allomorphy

	inanimate pro	animate pro	inanimate NP	animate NP
	<i>it, that, what</i>	<i>he, she</i>	<i>the table</i>	<i>the man, Boot</i>
IS ↔[ɪz]	0	0	✓	✓
IS ↔[z]	✓	✓	✓	✓
IS ↔∅	0	✓	0	✓

In (187), the check marks are used to indicate possible selection by the subject while “0” is used to indicate failure of selection (for a corpus study showing the allomorphy here, see McLaughlin and Shwayder 2014). Animate full NPs meet neither of the conditioning factors and, as such, are predicted to show equal variation between the three possible allomorphs. Inanimate full NPs do not select for null forms but should vary equally between full and contracted forms. Animate pronouns do not select full forms but should choose between contracted and null forms. Inanimate pronouns,

as a combination of the two features, do not select for full forms (as pronouns) nor for null forms (as inanimates), resulting in selecting for the contracted form only. The main point here is that the categorical behavior of *it*, *that*, and *what* as subjects is not exceptional but is simply the result of the combination of conditioning factors.

This allomorphy conditioned on morphological features can account for the distribution of allomorphs and the categoricity of the inanimate pronouns. However, it does not explain the phonology of the *i's*, *tha's* and *wha's* forms.

### 3.10.4.2 Stray Terminal Grouping with *i's*, *tha's* and *wha's*

Given that the subjects *it*, *that*, and *what* undergo /t/-assibilation and other subjects ending in /t/ do not, it seems that *it*, *that*, and *what* have a different phonological relationship with the copula than other subjects. We propose that these pronouns are part of the same  $\omega$ -Word as the copula whereas full NPs are not.

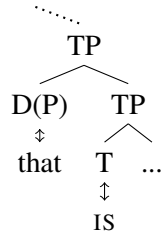
To show this explicitly, let's assume a process of /t/-assibilation (188) which applies at the  $\omega$ -Level.

(188) /t/-Assibilation: /t/ → [s] / \_ s

We propose that this process is general across AAVE, as part of the general tendency of cluster reduction (see, e.g., Thomas 2007). This assibilation should apply to monomorphemic /ts/ sequences (if any exist in English) but should not apply across  $\omega$ -Word boundaries. We will additionally need a /z/ voicing assimilation process (as in Standard English; ordered before /t/-assibilation). Given these phonological processes, Stray Terminal Grouping, and the conditioned insertion of the 3 exponents of the copula, we can derive the surface forms of *i[s]*, *tha[s]*, and *wha[s]*.

Taking *tha's* as our example, the DP and T are grouped together in the same  $\omega$ -Word by Stray Terminal Grouping, as shown in (189). The inanimate pronoun subject conditions insertion of the contracted allomorph. Then the  $\omega$ -Level phonology causes voice assimilation and t-assibilation resulting in *tha's*.

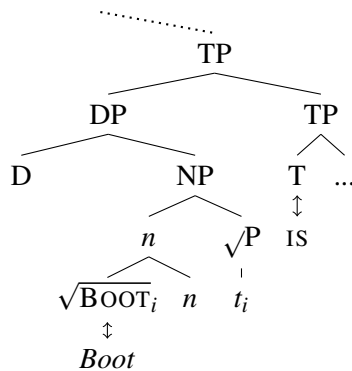
(189) Derivation of *tha's*



Linearization:	DP T
Phonological Grouping:	( DP T ) <sub>ω</sub>
Allomorph Selection	IS ↔ [z]
Spellout and ω-Level Phonology:	
Input	<i>tha</i> [t z]
voice assim.	<i>tha</i> [t s]
t-assib.	<i>tha</i> [s s] <sup>51</sup>
Output:	<i>tha's</i>

In comparison, a full NP subject (here a name, *Boot*) behaves exactly as full NPs in the case of SE contraction (see 182 above). As shown in (190), *Boot* is spelled out by its *n* head, and thus does not become part of the same ω-Word as the copula in T. The copula has a choice of allomorphs, but even if the contracted allomorph is inserted, the fact that the copula and subject are not grouped together results in them not undergoing ω-Level phonology together. Thus, /t/-assibilisation does not apply.

(190) Derivation of *Boot's*



Insert. <i>n</i> causes linear. of complement	
Linearization:	[ $\sqrt{BOOT} n$ ] <sub>M</sub>
Phonol. Grouping:	( $\sqrt{BOOT} n$ ) <sub>ω</sub>
Spellout/ω-Phonol.:	<i>Boo</i> /t/
Spell out of remaining structure	
Linearization:	D (NP) T
Phonol. Grouping:	D ( <i>Boo</i> /t/ ) <sub>ω</sub> T

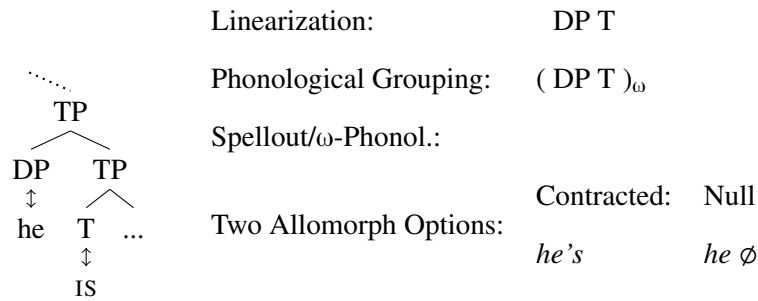
Three Allomorph Options:	Full:	Contracted:	Null
	<i>Boot is</i>	<i>Boot's</i>	<i>Boot</i> ∅

Finally, with an animate pronoun subject, here *he*, this analysis posits that the subject and copula do end up in the same ω-Word. However, the ω-Level phonology happens to have no effect on the

<sup>51</sup>There may or may not be degemination of the [ss] sequence. Many recordings we have heard sound geminate to us, but no studies have been done.

input, resulting in *he's*, as shown in (191).

(191) Derivation of *he's*



To summarize the derivations, the inanimate pronoun subject (*that*) always conditions insertion of the contracted allomorph ('s) and is in the morphosyntactic configuration which results in *that* and 's being in same ω-Word. This results in ω-level phonology applying ( $\rightarrow$ *tha's*). For full NP subjects (name *Boot*), there is variable insertion of all three allomorphs of the copula. However, the morphosyntactic configuration and phonological grouping result in the copula being in a different ω-Word than *Boot*. For animate pronoun subjects (*he*), there is variable insertion of contracted or null allomorphs of the copula and the syntactic configuration is such that it results in *he* and the copula being in the same ω-Word. However, because these forms do not end in /t/, the ω-level phonology does not cause any changes.

Stray Terminal Grouping, in combination with conditioned allomorphy, provides an explanation for the categoricity and the phonological form of *i[s]*, *tha[s]*, and *wha[s]*. Without an operation such as Stray Terminal Grouping, there is no apparent reason for the application of assibilation with these pronominal subjects as compared to full NP subjects. In the analysis here, the fact that pronouns are simplex and full NPs are complex results in a different phonological grouping with the copula functional head, presenting a possibility to explain the difference in behavior.

### 3.10.5 Conclusion

In this section I proposed a method of forming ω-Words that did not directly relate to the M-Word structure. In fact, the Stray Terminal Grouping operation appears to operate precisely where no (complex) M-Word structure is produced by the morphosyntax. This operation is necessary because, although these stray morphemes do not participate in any complex M-Words, on the phonological

side they seem to be grouped together and show the effects of the same  $\omega$ -Level phonological processes as morphemes that are in an M-Word. The case studies here presented several different instances where separate morphosyntactic items get grouped together into a single phonological word.

There is some unspecified interaction between this Stray Terminal Grouping operation and clitic leaning (see Section 4.3). It is unclear why one language would choose to group functional heads together into a separate  $\omega$ -Word while another will have those heads lean on a nearby  $\omega$ -Word instead. Both these options seem viable and are chosen by different languages for different structures.

### **3.10.6 Aside: Why do we need phonological words anyway?**

There is an interesting question to be asked about why we need phonological words in the first place. As shown in recent work in morphosyntax and semantics, the word is not a meaningful or even particularly useful unit for these domains of grammar. On the phonological side, however, we see all morphosyntactic pieces being assigned to a phonological word in some way, either inherently (M-Word  $\Rightarrow$   $\omega$ -Word), by leaning (see Section 4.3), or being made into their own group (Stray Terminal Grouping). So why does there seem to be such a desire to make sure every morphosyntactic unit belongs to a phonological word in one way or another?

One possibility is that it has something to do with the psychological process of chunking information to send to the pronunciation system. That is, all pieces that need to get pronounced must get “wordified” in order to be properly processed by the pronunciation unit (either in the brain, the mind, or perhaps the physical sound production system itself). In this sense, the notion of phonological word is not necessary until extremely late in the linguistic derivation, just before the information is being pronounced.

A related notion is that these words groups may be helpful for language learners. That is, many of the phonological features which are associated with the word level (such as a stress, harmony, and edge effect) are helpful in distinguishing between different words. The division of all morphosyntactic pieces into words could be a result of the learning mechanism looking for cues

as to how to interpret a long string of sounds as individual meaningful pieces.

Another possible reason for the existence of phonological words might have to do with processing costs in a different way. That is, there seems to be a “pop-up” cost when processing embedded syntactic structure, such as relative clauses, because it appears to be difficult to process the switch from the embedded clause back up to the main clause (see, e.g., Gibson 1998, and sources cited therein). This difficulty causes a time delay in processing which gets interpreted as a prosodic boundary. Perhaps the complex structure of M-Words creates a similar cost, and the resulting prosodic boundary gets grammaticalized as a unit. This does not explain why, for example, Stray Terminal Grouping occurs, but it does relate the notion of phonological word to other known processing phenomena.

I do not have any real light to shed on this question of why phonological words exist, other than to point out that all morphosyntactic units seem to need a phonological word to be associated with in one way or another.

### **3.11 Discussion: Syntactic Phases**

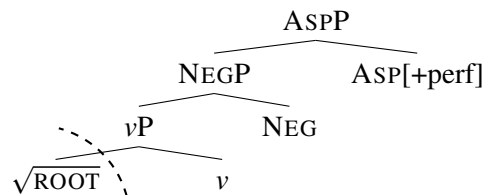
While discussing the processing of subword constituents in Section 2.3.4, I argued against the syntactic spell-out only account for the interaction of smaller objects (*contra* Marvin 2002, 2013). The argument there was that the phenomenon of overwriting violated the Phase Impenetrability Condition (PIC) when multiple category defining heads were present in an word. I noted, however, that the violation seemed limited to supersegmental features, such as stress, and in general the PIC holds. I need to make a similar point about the syntactic spell-out only theories for the larger objects (words) under discussion here.

The hypothesis of the syntactic spell-out only theories is that the syntactic phases exactly define the domains of phonology. For example, we can contrast the analysis of Plains Cree given in Section 3.8 with the analysis of Ojibwe given by Piggott and Newell (2006); Newell and Piggott (2014), and the analysis of Turkish in Chapter 4 with that of Newell (2005). In these theories, the boundaries of words are determined by big spellout phases such as *v*P and CP. Heads which are inside a spell-out domain together get phonologized together and are therefore able to be counted in the domain for

various phonological processes, such as stress and vowel coalescence. Heads which are outside this spell-out domain cannot be counted for such processes.

These phases do pick out many of the same domains as I do here by other mechanisms. However, as I note in Section 4.4.3, they are some phonological mechanisms which do respect these phase boundaries (and are also not purely across-the-board or completely insensitive to morphological boundaries). In particular, the syntactic spell-out only theories make no claims about why certain heads will lean phonologically onto nearby  $\omega$ -Words versus form their own  $\omega$ -Words (see Stray Terminal Grouping phenomena in Section 3.10 and cliticization phenomena in Chapter 4). For example, Turkish heads which, under the syntactic spell-out only theory of Newell (2005), are outside the phase boundary and therefore outside the calculation of stress still lean on the  $\omega$ -Word spelled-out by that phase boundary and undergo vowel harmony with the root of that  $\omega$ -Word. For example, in (192) the NEG and ASP heads are separated from the root by the phase boundary determined by the  $v$  head. The phase boundary correctly predicts stress (which falls on the root, discussed further in Section 4.4), but not vowel harmony. Vowel harmony applies across the phase boundary, spreading from the root to NEG and ASP.

(192) Phase boundary of  $v$  predicts stress but not vowel harmony



a. *çıkma*<sup>miş</sup> “did not go out”

çık            - $\emptyset$  -ma    -miş  
 $\sqrt{\text{GO.OUT}}$      $v$     NEG    ASP[+perf]

b. *gitme*<sup>miş</sup> “did not go”

git            - $\emptyset$  -me    -miş  
 $\sqrt{\text{GO}}$      $v$     NEG    ASP[+perf]

According to the syntactic phase theory and the phase impenetrability condition, these NEG and ASP heads should be in a completely separate calculation space from the root (a different syntactic phase). However, these heads “lean” onto the root’s  $\omega$ -Word and harmonize with the root, so it cannot be the case that they are completely separate. We might ask why these heads do not form a  $\omega$ -Word of their own or lean onto a  $\omega$ -Word above them in the same spell-out phase.

I suggest that syntactic spell-out phases are important to the phonological system in that the

phases determine what chunks of material get sent to the phonology at a time. That is, the syntax certainly seems to use phases for processing and sends information to the phonology phase by phase. However, the phonology does not strictly adhere to the boundaries given to it by the syntax. Rather, it can wait and incorporate elements across phase boundaries into some sort of phonological constituent, although, perhaps not until some phonological processing is done on each phase unit itself.<sup>52</sup>

In general, the syntactic phase approach is highly compatible with the framework proposed here, but I propose that there needs to be more to the phonological mechanism for determining phonological domains than pure sensitivity to syntactic phases.

### 3.12 Chapter Conclusion

In this chapter, I proposed that the  $\omega$ -Level phonology (equivalent to “non-cyclic” or “word level”) is calculated in a domain directly related to morphosyntactic structure. Specifically, the proposed relationship is that complex morphosyntactic heads (M-Words) are turned into  $\omega$ -Words (the domain of  $\omega$ -Level phonology) at the morphology-phonology interface. This statement is similar to statements in other theoretical frameworks that grammatical words align with phonological words. However, because grammatical words are proposed to be generated by the lexicon and are atomic units of the syntactic, this has caused some problems with supposed some mismatches between grammatical words and phonological words. However, in the framework here, I dismissed these mismatches in terms of the M-Word  $\Rightarrow$   $\omega$ -Word correspondence by showed that they can be handled either through other phonological processes or through the fact that the M-Word is a derived morphosyntactic unit and not an atomic one. The conclusion from this discussion, then, is the fact that the M-Word  $\Rightarrow$   $\omega$ -Word correspondence holds up. This means that there is a direct relationship between the domain of calculation of  $\omega$ -Level phonology and a particular morphosyntactic structure.

An additional type of mismatch between morphosyntactic and phonological structure which

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<sup>52</sup>One possibility is that all of the determination of M-Word status and  $\omega$ -Word status for the phonology is done extremely late in the derivation, perhaps only after the entire syntactic tree is computed. One small piece of evidence in this direction is the interaction of vowel deletion with the imperative clitic in Kashaya, in which the CP level clitic appears to be incorporated into the  $\omega$ -Word to its left even if that  $\omega$ -Word is deeply embedded in another phrase (see Buckley 2015). That is, the calculation of the  $\omega$ -Word needs to wait until the entire sentence is built in order to know whether the  $\omega$ -Word final vowel is going to get deleted or not.



was not discussed in this chapter is the interaction of clitics with phonological words. This will be covered in Chapter 4.

## Chapter 4

# The Clitic/Affix Distinction

### 4.1 Overview

In Chapter 3, I motivated the correspondence between M-Words and  $\omega$ -Words. Recall, however, that the revised correspondence claims that only non-minimal M-Words correspond to  $\omega$ -Words.

(193) **Revised Morphosyntax-Phonology Correspondence:** Non-minimal M-Word  $\Rightarrow$   $\omega$ -Word

- Non-minimal M-Words correspond to  $\omega$ -Words.

This revision claims that non-minimal M-Words correspond to  $\omega$ -Words, but leaves out what happens to minimal M-Words (= individual syntactic heads). I suggested that these elements are clitics, but did not elaborate on what that with respect their syntactic or phonological interactions. In this chapter, I take up this issue of the morphosyntactic and phonological status of clitics.

As a standard assumption, I will treat clitics as syntactic heads (see, e.g., Klavans 1985; Marantz 1988). However, even though individual heads are M-Words, they are defective in some way. Note that it is not unusual to have objects which are phonologically defective in one way or other. For example, extrametrical feet and extrasyllabic consonants are regularly found in analyses of a wide variety of phenomena. Here I will posit that clitics, *qua* individual syntactic heads, are exceptional in the sense that they do not correspond to  $\omega$ -Words. This is formulated by the Defective M-Word hypothesis, a corollary of the Non-minimal M-Word  $\Rightarrow$   $\omega$ -Word correspondence:

(194) **Defective M-Word Hypothesis:** A minimal M-Word (an individual syntactic head) does not correspond to a  $\omega$ -Word.

The Defective M-Word hypothesis simply states that  $\omega$ -Words are not built from individual (i.e., non-complex) syntactic heads.

The problem to be solved, then, is what do these defective M-Words do phonologically? As we saw with Stray Terminal Grouping in Section 3.10, one possibility is that these defective M-Words get grouped together with adjacent defective M-Words to form their own  $\omega$ -Word via Stray Terminal Grouping. This is not the only possibility.

Two other phonological behaviors of defective M-Words involve these units becoming somehow phonologically dependent on a neighboring  $\omega$ -Word. In what I will propose is the base case, these morphemes “lean” onto a  $\omega$ -Word and behave in a manner that we typically associate with clitics; they do not participate in the  $\omega$ -Level phonology, but are otherwise pronounced next to the  $\omega$ -Word and seem to function as a single unit with the  $\omega$ -Word for higher level prosodic computation.

The other behavior that these morphemes show is to become incorporated into their neighboring  $\omega$ -Word and behave precisely as if they were an affix (i.e. a head inside of the M-Word). That is, sometimes morphemes which we believe are generated outside of the M-Word for syntactic reasons behave phonologically like they are inside the  $\omega$ -Word. To maintain the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, there must be a post-syntactic operation which modifies the morphosyntactic structure in such a way that these morphemes are incorporated into the M-Word.

Note that the difference I am describing here between participation in the  $\omega$ -Level phonology and “leaning” is the classic problem of clitic versus affix, at least on the phonological side. That is, phonologically, affixes are supposed to participate in the  $\omega$ -Level phonology of their host while (free) clitics are supposed to not participate (of course, the behavior of so-called affixal clitics participating in the  $\omega$ -Level phonology has been noted and has caused trouble in some theories, see Zwicky 1977, 1985; Nespors and Vogel 1986; Selkirk 1995).

In this chapter, I’m going to explore the traditional differentiation between clitics and affixes and show that in the theory proposed here, these terms are not inherent types of objects, but rather they are descriptions of behaviors that morphemes take in different contexts.

In Section 4.4 on Turkish, I will show cases of morphemes that variable do or do not participate in the  $\omega$ -Word based upon their syntactic structure. That is, depending on the syntax, morphemes are sometimes affixes and sometimes free clitics.

In Section 4.5, I will show the effect of a post-syntactic morphological operation, Local Dislocation, which modifies the linearized morphosyntactic structure of the M-Word. In doing so, it can take morphemes which were syntactically generated outside the M-Word (that is, they should be free clitics) and move them into the M-Word (so that they end up behaving like affixes phonologically). Two case studies showing this variation are presented in Section 4.6.

The goal of this chapter is to show that an interface function based on derived morphosyntactic units can explain the variable phonological behavior of morphemes and solve some of the problems which clitics pose for other frameworks.

## 4.2 Discussion: Theories of Cliticization and Affixation

Morphemes show several different phonological behaviors with respect to neighboring pieces. Some pieces, affixes, seem to interact closely with neighboring pieces while others, clitics, are less close. Affixation and cliticization are, to a large extent, descriptions of phonological behaviors not explanations of the behaviors. An important question to ask about the phonology of affixes and clitics is: What do these behaviors derive from?

There are two types of theories which make different claims about the source of the differences in phonological behavior between clitics and affixes. The main difference between these theory types is whether they adhere to the Storage Assumption (195) or not:

(195) **Storage Assumption:** The phonological behavior of morphemes is stored in memory.

Theories which follow the Storage Assumption (“Listing Theories”) claim that morphemes are listed in memory as either a clitic or an affix. That is, the phonological behavior of a piece is predetermined as a memorized property of that object. Theories that implement the Storage Assumption include theories we have already made comparisons to elsewhere in this dissertation: Level Ordering theories such as Lexical Phonology and Strata Optimality Theory (Kiparsky 1982a;

Mohanan 1986; Kiparsky 2000; Bermúdez-Otero in prep), and Prosodic Hierarchy Theories (Selkirk 1981, 1984; Nespór and Vogel 1986, *et seq.*).

The second type of theory denies the Storage Assumption, claiming that the phonological behavior of a morphosyntactic piece is not predetermined in memory. Instead, these “Contextually Determined Theories” posit that the phonological behavior of a morpheme is the result of the interaction between that morpheme and the derivation or structure in which it ends up. The framework proposed here is a Contextually Determined Theory, as are other works in Distributed Morphology, especially those works which concern themselves with the phonological outcome of morphosyntactic structure (see, e.g., Pak 2008; Embick 2010a, 2014; Calabrese 2012).

For many phenomena, Listing Theories and Contextually Determined Theories are both able to make correct predictions. This is because in the majority of cases the phonological behavior of a particular morphological piece is uniform. The uniform behavior can be explained either by storage of that behavior or by the fact that the piece always undergoes the same derivation or is part of the same structure.

However, there are a range of phenomena in which the phonological behavior of a morphosyntactic piece is not uniform. These phenomena have been mentioned in a number of places (Zwicky 1970; Selkirk 1995; Embick 1995; Basri et al. 2000, *i.a.*) but the implications for the theory of the syntax-phonology interface have not been appreciated. A key difference between the two theories introduced above is that Listing Theories predict that a piece should always behave the same way phonologically (because that behavior is stored) while Contextually Determined Theories claim that phonological behavior is derivative of several other factors. Because the empirical evidence indicates that these factors do affect the phonological behavior, these non-uniform phenomena are more easily accounted for in Contextually Determined Theories.

Some examples of these non-uniform phenomena have already been touched on in this dissertation, including examples of Stray Terminal Grouping, such as Standard English contraction and African American Vernacular English (AAVE) copula with inanimate pronoun subjects. I give an additional example of Polish mobile inflections in (196) (see Embick 1995 for more on this data). In each of these cases a morphological piece varies between having an affixal relationship and a

non-affixal relationship with its host.

(196) Examples of non-uniform phonological behavior of a morphosyntactic piece

- a. Standard English contraction: (Zwicky 1970; MacKenzie 2012; Embick 2012b)

Affixal: You'll have to do that. (/jʊl/)<sup>1</sup>

Non-Affixal: The man with you'll have to do that. (\*/jʊl/, ✓/ju.əl/)

- b. AAVE copula with inanimate pronoun subjects:

(Labov et al. 1968; Shwayder and McLaughlin 2014)

Affixal: That's a good idea. (tha[s], /t/-assibilation)<sup>2</sup>

Non-Affixal: Scott's a good writer. (Sco[ts], no /t/-assibilation)

- c. Polish mobile inflections (Booij and Rubach 1987; Embick 1995)

Affixal: Samochód pomogł-em. (pom[o]gł-em, no word-final /o/-raising)

car helped-1SG "I helped the car"

Non-Affixal: Samochód-em pomógł. (samoch[u]d-em, word-final /o/-raising)

car-1SG helped "I helped the car"

In Standard English (196a), the contracted auxiliary 'll is sometimes affixes to its host and sometimes not. This affixation is diagnosed by whether the auxiliary becomes part of the same syllable as its host and triggers vowel reduction. The auxiliary affixes to a bare pronoun host, but does not affix when the host is syntactically embedded. Similarly, in AAVE (196b), the contracted copula 's sometimes triggers assibilation of a neighboring /t/ and sometimes does not. This assibilation occurs with hosts *it*, *that*, and *what*, but not with other hosts. The mobile person-number inflection in Polish (196c) also shows variable behavior with respect to affixation, as diagnosed by whether it blocks word-final /o/-raising or not. The person-number inflection behaves affixally when it attaches to a verb, but non-affixally when it attaches to a noun or other non-verbal element.

All these examples are cases of what I will call *amphitopy* ("both places"), the phenomenon of a morphosyntactic object which is variably inside or outside a  $\omega$ -Word, as shown by the contextual

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<sup>1</sup>In certain conditions it is possible to get /ju.əl/ for this case, perhaps when an extra Focus head, or some other manipulation to the structure is involved. This will not be explored further in this paper. The important point is that /jʊl/ is possible here but impossible in the embedded case ("The man with you'll...").

<sup>2</sup>Following Labov et al. (1968), I call this /ts/ →[s] process assibilation although, without a definite intermediate geminate [ss] stage, it might be better characterized as deletion.

behavior as either an affix or a clitic.

Cases of amphitopy pose a challenge to the Storage Assumption. In order to account for amphitopy following the Storage assumption, one would have to posit two homophonous items in memory that serve the same morphosyntactic and semantic function but give different instructions to the phonology. That is, with the Polish Mobile Inflections in (196c), for example, one would have to posit two separate *-em* pieces which express the same semantics and have identical segmental phonology but have different phonological behaviors with respect to their phonological grouping. This sort of account is clearly missing a generalization.

On the other hand, cases of amphitopy are relatively easy to account for in Contextually Determined Theories. These are not cases of free variation, but rather show differences in either the syntactic, morphological or phonological context of the morphosyntactic piece in question. If we take into consideration the derivational history, the resulting syntactic structure and the morphological and phonological context of a piece, we can account for the difference in phonological behavior. In this way, amphitopy is evidence that morphosyntactic pieces are not predestined to have one phonological behavior or another but that the phonological behavior is determined by the derivation in which that morpheme is employed.

#### **4.2.1 Analysis and predictions of each theory type**

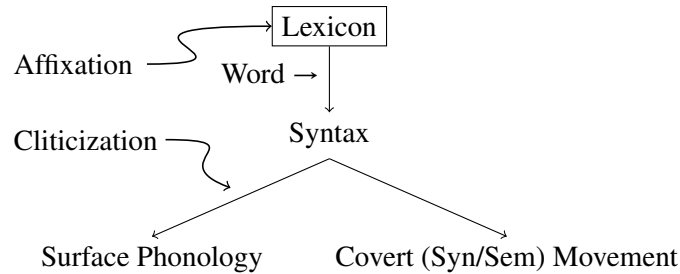
In order to frame the comparison between the theories, let us flesh out the analyses and predictions that each theory makes with respect to affixes, clitics, and amphitopy.

##### **4.2.1.1 Listing Theory**

All of the Listing Theories mentioned above (Lexical Phonology, Stratal Optimality Theory, and Prosodic Hierarchy Theories) employ a lexicon in their architecture. Putting aside the internal complexity of the lexicon (with respect to divisions between levels or strata), in these theories affixation is an operation which takes place inside the lexicon. This contrasts with cliticization, which is a later phonological operation or grouping (see, e.g., Halpern 1992). This division is necessary because, while the placement of affixes is argued to be arranged within the domain of the lexicon, the placement of clitics is manipulated by the syntax according to the standard derivational

view. A schematic of the architecture of these theories is given in (197):

(197) Architecture of Grammar in Theories with a Lexicon



In these theories, the final product of the lexicon is the grammatical word, which serves as the unit of interface between the lexicon and the syntax, functioning as the atomic unit of the syntax. Given this architecture, the most natural way to make distinctions in phonological behavior is to posit that affixes, which are attached in the lexicon, are inside the same word as their host, while clitics, which are attached by the syntax, are outside their host's word.

If the extent of possible phonological behaviors of a morpheme were limited to being inside the word or outside the word, the Storage Assumption could account for this. That is, the architecture of these Listing Theories explains the two behaviors by positing, essentially, two different types of objects in memory: objects that are available for use in the lexicon and objects that are available for use in the syntax.

However, it has long been noted that there are different ways in which clitics behave phonologically with respect to their host (see, e.g., Zwicky 1977). Some clitics appear linearly adjacent to their host without being part of the same word (as predicted by the architecture in (197) above), but others are incorporated into the word or, at least, participate in the word-level phonology of their host.

This, of course, is an apparent problem for a theory where clitics are attached to their host after the word is built. This problem is recognized by Listing Theories, but the solution is generally to posit an additional diacritic on clitics which directs the phonological interaction. For example, theories of Lexical Clitics in the Lexical Phonology literature rely on a diacritic to determine whether a clitic interacts at the lexical level or the phrasal/syntactic level with its host (Nevis 1985; Halpern 1992). Similarly, Prosodic Hierarchy Theories present a solution to this problem by positing that the word unit of the lexicon (the lexical word or "grammatical word") is not the same as the



word unit of the prosody (the prosodic word, or PWd). That is, while lexical words are often the same as prosodic words, it is possible to include other syntactic or phonological material in the level of the prosodic word (Nespor and Vogel 1986; Selkirk 1995). With this assumption, clitics can be (diacritically) specified to form part of a PWd with their host or not.

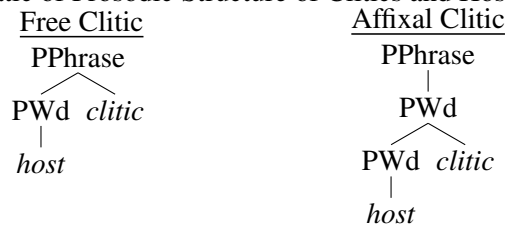
Conceptually, the behavior of clitics makes it clear that we need another assumption about the nature of the morphology-phonology interface, the Affixation Assumption:

(198) **Affixation Assumption:** There is some mechanism through which independent syntactic units can be affixed to neighboring units (i.e., clitics can behave like affixes).

In the Prosodic Hierarchy approach, the Affixation Assumption is combined with the Storage Assumption (195), by proposing that clitics are stored with different “levels of attachment” or phonological behaviors as part of their memorized information.

Specifically, Selkirk (1995) proposes that there are several classes of clitics distinguishable by their interaction with the PWd domain. For example, as schematized in (199), Free Clitics are proposed to join their hosts to form a prosodic phrase (PPhrase) while Affixal Clitics create an additional recursive PWd group with their hosts.<sup>3</sup> Under this model, Affixal Clitics have a closer phonological relationship with their host than Free Clitics because Affixal Clitics and their hosts are both a part of a PWd group.

(199) Schematic of Prosodic Structure of Clitics and Hosts (Selkirk 1995)



There are two questions to be asked of this approach: How does a syntactic unit know whether it is a word or a clitic? Furthermore, how does a clitic know what type of clitic it is?

The first of these questions is answered by the Lexical Category Condition, which states that only lexical categories and their projections are available for reference in building prosodic units

<sup>3</sup>Clitic/Constituent Group approaches propose that affixal clitics do not form a recursive PWd, but another constituent (see, e.g., Nespor and Vogel 1986, Hayes 1989, Vogel 2009). This does not change the fact that these clitics must be prespecified for whether they will be free or affixal.

and not functional categories or their projections (see, e.g., Nespor and Vogel 1986; Selkirk and Shen 1990; Prince and Smolensky 1993; Selkirk 1995; Truckenbrodt 1999). Essentially, this means that when a unit exits the lexicon as a “grammatical word”, it is endowed with the ability to be a PWd. Syntactic projections of functional heads are proposed to be provided purely by the syntax and not the lexicon, and, as such, they cannot be PWds without further operations. Thus, functional heads and projections are, by default, clitics while lexical heads are not.

But how does a clitic know what sort of clitic it will be? Selkirk (1995) states that the determination of what type of prosodic structure a clitic has depends on the interaction of constraints on the prosodic structure. In particular, there is a mechanism which aligns grammatical constituent edges with prosodic constituent edges. However, if these constraints are set for a language as a whole, this does not explain why, within the same language, some pieces behave like one type and others like another type (even when there is no pertinent phonological difference between them).

Importantly, even when such differences are stipulated on a case-by-case basis, this framework does not explain the cases of amphitopy, that is, why the very same morpheme sometimes behaves one way and sometimes another.

#### **4.2.1.2 Contextually Determined Theory**

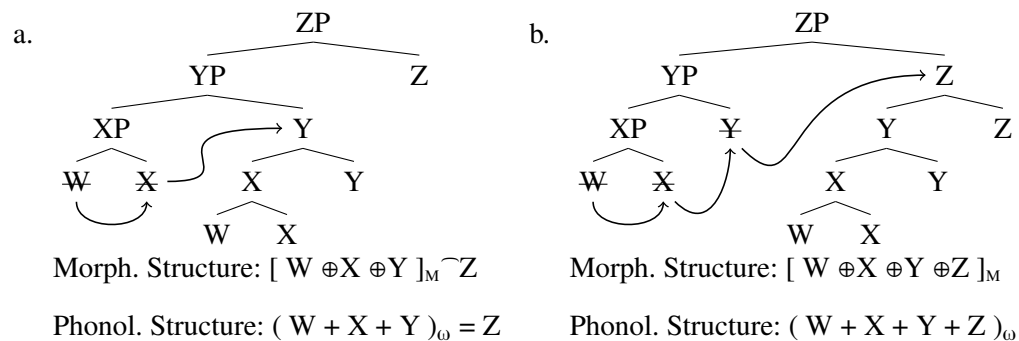
Like Listing Theories, it is necessary for Contextually Determined Theories to uphold the Affixation Assumption (198) in order to account for amphitopy. However, I argue that in these theories we can do away with the Storage Assumption (195) and maintain the same phonological generalizations through reference to the morphosyntax.

That is, the assumptions made in the framework presented here allow us to argue that affixation and cliticization are descriptions of phonological behaviors and not stored instructions or representations. These phonological behaviors can be directly related to the status of a morpheme with respect to M-Word boundaries. Because of the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, if a morpheme is inside an M-Word it will behave phonologically as an affix (because it will be inside a  $\omega$ -Word and subject to  $\omega$ -Level phonology) whereas if a morpheme is outside an M-Word it will behave phonologically as a clitic (i.e., not subject to  $\omega$ -Level phonology).

It is important to note again that the M-Word is a *derived* object, not a primitive one. As such, an item can “enter” an M-Word despite being generated outside of it. In fact, there are a variety of syntactic and morphological operations that can create or modify M-Words. At the most basic syntactic level, head movement combines heads to create M-Words. We have also already seen other syntactic and morphological operations can manipulate syntactic heads to create and modify M-Words, for example T-to-*v* lowering in English (Section 3.4.2). The Local Dislocation operation, discussed in depth in Section 4.5, also manipulate the M-Word structure.

For example, in (200a), if syntactic head movement raises the heads W and X to Y, it will create an M-Word that Z is left out of. Because Z is outside the M-Word, it is outside the  $\omega$ -Word, not subject to  $\omega$ -Level phonology. As such, the phonological behavior of Z will be that a clitic. By contrast, in (200b), if syntactic head movement raises all the heads into a single M-Word, then Z will be an affix inside the  $\omega$ -Word which corresponds to that M-Word. If, for example, Y carried a feature which sometimes allowed head movement through it and sometimes did not, we could see Z varying its phonological behavior because of Y’s features.

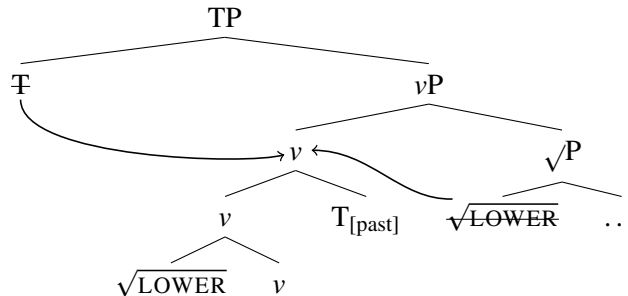
(200) Varying clitic or affix status of Z head based on head movement



Similarly, Lowering can be blocked by an intervening head. For example, with English T-to-*v* lowering, if T and *v* are in the proper syntactic relationship, T can be lowered onto *v* and will behave as an affix, as shown in (201a). However, if a NEG head intervenes, T cannot lower and cannot be an

affix on the verb, as shown in (201b) (although here it is rescued through the *do*-support operation rather than cliticization).

(201) a. Derivation of *lowered*

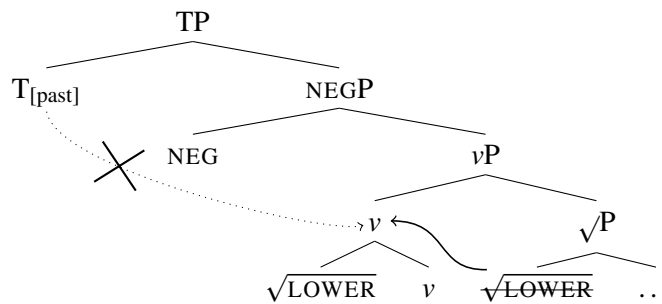


Morphological Structure:  $[ \sqrt{\text{LOWER}} \oplus v \oplus T_{[\text{past}]} ]_M$

Phonological Structure:  $( /\text{low}\partial/ + \emptyset + /-\text{d}/ )_\omega$

Output:  $( \text{low}\partial\text{d} )_\omega$

b. Derivation of *did not lower*



Morphological Structure:  $T_{[\text{past}]} \frown \text{NEG} \frown [ \sqrt{\text{LOWER}} \oplus v ]_M$

Phonological Structure: *did* *not*  $( /\text{low}\partial/ + \emptyset )_\omega$

Output: *did not*  $( \text{low}\partial )_\omega$

Although the T node never appears as a clitic in this particular example, the main point is that there is a morphosyntactic mechanism through which it is sometimes affixed to the verb and sometimes not.

Thus, in Contextually Determined Theories such as the one proposed here, there is no underlying architecture or storage distinction between clitics and affixes. Rather, morphemes function phonologically as clitics or affixes depending on their morphosyntactic environment. Typically

this behavior is uniform, which can be explained by both theories easily. However, a Contextually Determined Theory can explain cases of amphitopy as morphemes which sometimes are sometimes combined into an M-Word (whether by syntactic or morphological operations) and sometimes not.

#### 4.2.2 Key Predictions/Summary of Theory Comparison

There are two assumptions about the nature of morphemes and their phonological behavior, the Storage Assumption and the Affixation Assumption, repeated below:

- (195) **Storage Assumption:** The phonological behavior of morphemes is stored in memory.
- (198) **Affixation Assumption:** There is some mechanism through which independent syntactic units can be affixed to neighboring units (i.e., clitics can behave like affixes).

The two types theories under discussion, Listing Theories and Contextually Determined Theories, both follow the Affixation Assumption, but differ with respect to the Storage Assumption. Because both theories follow the Affixation Assumption, they are both able to handle phenomena which show morphological pieces which should be clitics but behave phonologically as affixes. However, these theories make different claims about whether the phonological behavior of morphemes is stored. To help distinguish between these theory types, we need cases where storage of a morpheme's phonological behavior is problematic. Schematically, these are cases of amphitopy, where the same morpheme sometimes behaves as a clitic and sometimes as an affix.

(202) Schematic of Amphitopic Morpheme:

	Linearized Morphosyntax	→	Phonological Grouping
Affixal:	Host <sub>1</sub> + X	→	( Host <sub>1</sub> + X ) <sub>ω</sub>
Non-Affixal:	Host <sub>2</sub> + X	→	( Host <sub>2</sub> ) <sub>ω</sub> + X

It must be noted that some cases which look like (202) do have solutions in Listing Theories. Specifically, in Prosodic Hierarchy Theory, Selkirk (1995) argues that prosodically weak words do not form their own PWd. This means that, if an amphitopic morpheme is sensitive to the prosodic strength of a host, there is an analysis which can be applied.

Take for example, the case of Standard English contraction from (196a) above, reprinted here:

(196a) Standard English contraction: (Zwicky 1970; MacKenzie 2012; Embick 2012b)

Affixal: You'll have to do that. (/jʊl/)

Non-Affixal: The man with you'll have to do that. (\*/jʊl/, ✓/ju.əl/)

A Selkirk-style solution would argue that the prosodic strength of *you* is different in the two cases. In the case of affixal phonology (*you'll* → /jʊl/) the *you* is prosodically weak and must combine with the clitic 'll to form a PWd. In the other case (*you'll* → /ju.əl/), the *you* is prosodically strong, and is able to form its own PWd, forcing the clitic 'll to lean onto it but not be affixed.

This type of solution may hold for cases where amphitopy is correlated with a prosodic property of the host. However, there are cases of amphitopy which cannot be caused by prosodic properties of the host. For example, in the Polish case in (196c), reprinted below, the affixal phonology occurs with verbs but not nouns:

(196c) Polish mobile inflections (Booij and Rubach 1987; Embick 1995)

Affixal: Samochód pomogł-em. (*pom*[o]gł-em, no word-final /o/-raising)

car helped-1S "I helped the car"

Non-Affixal: Samochód-em pomógł. (*samoch*[u]d-em, word-final /o/-raising)

car-1S helped "I helped the car"

Phonological descriptions of Polish (e.g., Gussmann 2007) do not distinguish the prosodic status of nouns and verbs, so it is problematic to propose that nouns are prosodically strong while verbs are prosodically weak. So, even granting the ability to arrange constituents based on the prosodic properties of the host, we are still left with the core problems that theories which implement the Storage Assumption cannot account for all cases of amphitopy.

I present three case studies of amphitopic clitics below. The first, on Turkish Stress (Section 4.4), shows amphitopy based solely on syntactic structure. The second two, on Makassarese and Maltese (Section 4.6), show interaction with the phonology in an interesting way. Their amphitopy in these cases is caused by the Local Dislocation operation, to be discussed in Section 4.5.

### 4.3 Discussion: Leaning

Before looking at the case studies, some discussion about "leaning" is warranted.

I posited in Chapter 3 that morphemes which are incorporated into an M-Word via syntactic or morphological movement operations are grouped phonologically into a  $\omega$ -Word. I also posited that there was (at least) one other operation, Stray Terminal Grouping, which could create  $\omega$ -Words out of morphemes which were not morphosyntactically combined.

In this chapter, we see some instances of morphemes which are not incorporated into an M-Word, but instead “lean” onto a neighboring  $\omega$ -Word (taking the term from Zwicky 1982, 1985). Some questions which need to be asked about this operation are: What exactly does it mean to lean onto a  $\omega$ -Word? Is this the same operation as Stray Terminal Grouping? I propose that “leaners” are not incorporated into their host’s  $\omega$ -Word, but are a constituent with their host for higher prosodic purposes. In contrast, Stray Terminal Grouping does combine elements into a  $\omega$ -Word, and thus it is not the same operation.

To elaborate, we know that leaners, being syntactic heads, are placed by the syntax. However, they do not appear to have any special syntactic relationship with their hosts, other than being linearly adjacent. Phonologically, we have seen above that leaners do not participate in their hosts’  $\omega$ -Level phonology. They do, however, show phonological affiliation with a host in two ways. First, the leaner is grouped together with its host for the purposes of higher prosodic constituents. That means that if there is a phrasal phenomenon being applied to a domain including the host, the clitic will also be in that domain. Second, there are processes which are sensitive to the grouping of host and clitic but do not apply between one (host+clitic) group and another. Vowel Harmony, such as that seen in Turkish in Section 4.4 is one such process. Some languages also have stress assignment processes which apply to this domain, see the optional stressing in Turkish in Section 4.4.4 and the obligatory stressing in Maltese in Section 4.6.2.

Thus, there needs to be some constituent grouping above the  $\omega$ -Level to which the  $\omega$ -Word and the clitic both belong in contrast with the next (host+clitic) group. This is potentially the same as the Clitic/Constituent Group (CG) structure, proposed in various Prosodic Hierarchy Theories (Nespor and Vogel 1986; Hayes 1989; Peperkamp 1997; Vogel 2009). Note that, *contra* the CG hypothesis, Selkirk (1995) posits that clitics are either recursive PWds (affixal clitics) or group with a PWd into a CG.

In a syntactic direct-reference theory, this higher group could be a couple of different things. Following Pak (2008) we could propose a chain of M-Words that includes exactly the host M-Word and the clitic M-Words. Note that this chain would then have to be a constituent in a higher order of chaining to form larger phrasal chains to account for phrasal phonology phenomena.

Another possibility is that, just like there are some mismatch cases at all interfaces, leaners are an example of a mismatch between calculation of word-sized units “from below” and calculation “from above”. That is, in the calculation “from below”, morphemes are built up into complex heads and these are  $\omega$ -Words and undergo  $\omega$ -Level phonology. However, in the calculation “from above” everything needs to be a part of a word-unit, so in order to satisfy this, items that have no  $\omega$ -Word status will get lumped in with a nearby unit. This “lumping” must not have access to the  $\omega$ -Level phonology because it does not get run again.

We might ask why all morphemes need to be lumped into a unit. Perhaps, as discussed in Section 3.10.6, there is some minimal processing needed for pronunciation. The idea is that everything must get “wordified” (meaning it belongs to a word unit of some sort) in order to be pronounced as a linguistic unit.

Given that we need to have syntactic heads which lean onto something to form a higher prosodic group, we might want to propose that Stray Terminal Grouping (Section 3.10) is the same operation as leaning, and should result in a constituent that is a CG rather than a  $\omega$ -Word (argued for by Nespor and Vogel 1986, see also Peperkamp 1997; Vogel 2009). However, at least in the Bilua case in Section 3.10.2, this is not possible. Recall that, in this case, if the structure was proclitic+host, the proclitic was not a part of the stress domain, but when several clitics were grouped together the proclitic was part of the stress domain. That is, the constituent which incorporates the proclitic and the host cannot be the same as the constituent that incorporates the proclitic with other clitics, as shown in (203)

- (203) Stray Terminal Grouping cannot form a CG
- a. If Stray Terminal Grouping forms a CG



	Clitic and Host	Group of Clitics
Lin. Morph. Struct.:	$\text{clitic} \widehat{[ \text{host} ]}_M$	$\text{clitic}_1 \widehat{\text{clitic}}_2$
$M \Rightarrow \omega$ :	$\text{clitic} + ( \text{host} )_\omega$	—
Stray Term. Group.:	—	$\{ \text{clitic}_1 + \text{clitic}_2 \}_{CG}$ ←Problematic!
Leaning:	$\{ \text{clitic} = ( \text{host} )_\omega \}_{CG}$	—

b. If Stray Terminal Grouping forms a  $\omega$ -Word

	Clitic and Host	Group of Clitics
Lin. Morph. Struct.:	$\text{clitic} \widehat{[ \text{host} ]}_M$	$\text{clitic}_1 \widehat{\text{clitic}}_2$
$M \Rightarrow \omega$ :	$\text{clitic} + ( \text{host} )_\omega$	—
Stray Term. Group.:	—	$( \text{clitic}_1 + \text{clitic}_2 )_\omega$
Leaning:	$\{ \text{clitic} = ( \text{host} )_\omega \}_{CG}$	—

If Stray Terminal Grouping forms a CG, as schematized in (203a), there is no constituent which groups the host to the exclusion of its clitic but which groups the clitics with each other when there is no host. By contrast in (203b), the  $\omega$ -Word provides exactly this division if we posit that Stray Terminal Grouping forms a  $\omega$ -Word.

Note that I am not arguing against the existence of a prosodic constituent such as a CG for the case of leaners with  $\omega$ -Word hosts. However, I do argue against the use of CG as the prosodic unit for stray terminals, such as groups of clitics. I also argue against the CG as a strategy to deny the existence of recursive PWds (or here,  $\omega$ -Words). That is, there still need to be recursive word structures, such as those in compounds (see Section 3.9) and those posited in the case studies involving Local Dislocation in Section 4.6.

To summarize, leaners are clearly not part of their hosts'  $\omega$ -Word but do need to get “lumped” together somewhere above the word level. The exact nature of the morphosyntactic and/or prosodic constituent of this “lumped” unit will not be dealt with here. However, it is an interesting topic for future research.

## 4.4 Turkish Stress

This case study in Turkish stress shows the interaction of phonological structure (as diagnosed by stress) and syntactic structure. Here, the formation (or non-formation) of complex heads by syntactic mechanisms is reflected directly in the phonological structure. However, of particular interest here is the fact that the same morphemes and the same exponents of those morphemes sometimes are included in the relevant M-Word, and thus participate in the  $\omega$ -Word phonology, and sometimes left on their own, resulting in their leaning onto the  $\omega$ -Word structure but not participating in the  $\omega$ -Level phonology.

Critically, this is the traditionally accepted phonological difference between the behavior of affixes and the behavior of clitics; affixes participate in the  $\omega$ -Word while clitics do not. This case study is an excellent example of the fluid nature of affixal and clitic behavior. In the framework presented here, of course, there are not inherent differences between clitics and affixes, but these terms are simply descriptions of morphophonological behaviors. Morphemes are morphosyntactic pieces and their phonological behavior is as dependent on the morphosyntactic environment in which they are placed as much as (if not more than) any inherent specifications on the morpheme or its exponent.

### 4.4.1 Data

In the data presented here, we will be concerned with the assignment of primary stress and the interaction of this assignment with morphosyntactic structure and particular morphemes in those structures. Note that there are other interesting phenomena which will be mostly ignored in order to keep the exposition simple (although, see the brief discussion of Vowel Harmony in Section 4.4.4).

In Turkish, stress regularly falls on the final syllable of a word. This general pattern holds for all parts of speech, shown here on nouns and verbs:

(204) Regular final stress in nouns

(Göksel and Kerslake 2004, p. 29)

- a. **kitáp** ‘book’
- b. kitap-**lár** ‘books’
- c. kitap-lar-**ím** ‘my books’
- d. kitap-lar-ım-**dá** ‘in my books’

(205) Regular final stress in verbs (Göksel and Kerslake 2004, pp. 29–30)

- a. **kír-** ‘break’
- b. kır-**íl** ‘be broken’
- c. kır-ıl-**acák** ‘it will be broken’
- d. kır-ıl-acak-**lár** ‘they will be broken’

There are, however, some exceptional stress patterns. Some roots are exceptional<sup>4</sup> in that they keep stress on them regardless of suffixation:

(206) Exceptionally stressed root, example *iskemle* ‘chair’ (Göksel and Kerslake 2004, p. 30)

- a. **iskémle** ‘chair’
- b. **iskémle**-ler ‘chairs’
- c. **iskémle**-ler-imiz ‘our chairs’
- d. **iskémle**-ler-imiz-de ‘on our chairs’

Similarly, some suffixes are exceptionally stressed and usually appear with stress (although they interact with other exceptional stress patterns):

(207) Exceptional stressed suffix, example *-(I)yor* PROGRESSIVE (Göksel and Kerslake 2004, p. 30)

- a. gel-**íyor** ‘s/he is coming’
- b. gel-**íyor**-lar ‘they are coming’
- c. gel-**íyor**-du-lar ‘they were coming’ (Özçelik 2014, p. 232)

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<sup>4</sup>There has been some discussion in the literature on stems which are exceptional in that they do not show the normal final stress but instead predictably show stress on the penult or the antepenult if the penult is light (often called “Sezer stems”, cf. Sezer 1983). Some researchers consider this class to be a separate generalization about the stress pattern and suggest co-phonologies to handle the different stress patterns. (e.g., Inkelas and Orgun 1998; Inkelas 1999). Others argue that, while some exceptionally stressed words follow the Sezer pattern, enough others do not that there is no fruitful use to creating a separate system to handle this particular subset and instead rely on lexical marking (e.g., Kabak and Vogel 2001; Özçelik 2014). I will follow this latter group and treat all exceptionally marked stress the same.

If there are multiple exceptionally stressed morphemes, the leftmost wins, regardless of whether that specified stress is associated with a root or an affix:

(208) Leftmost specified stress surfaces (Inkelas and Orgun 2003)

a. Meksíka-lı-laş-ıy<sup>o</sup>r → Meksíkalılaşıy<sup>o</sup>r

Mexico-ASSOC-VBL-PROG

“by becoming Mexican”

b. bırak-ıver-érek → bırakıvererek

leave-suddenly-ADV

“by suddenly leaving”

We can think of the stress process here as a scan from left-to-right, stopping at any exceptionally marked syllables, and otherwise ending up on the rightmost syllable.

In addition to the exceptionally marked stress, there are a group of exceptional morphemes called “unstressable” (by, e.g., Kabak and Vogel 2001; Göksel and Kerslake 2004) or “prestressing” (by, e.g., Inkelas and Orgun 2003; Kahnemuyipour and Kornfilt 2006; Özçelik 2014), shown here underlined, which seem to mark that the syllable preceding them must bear stress. I will refer to these as “prestressing”.

(209) Prestressing morpheme, example *-mA* NEGATION

a. gel-di-níz ‘You came.’ (Kabak and Vogel 2001, ex. 3)  
come-PAST-2PL

gél-me-di-niz ‘You didn’t come.’  
come-NEG-PAST-2PL

b. sev-il-di-níz ‘You were loved.’ (Kabak and Vogel 2001, ex. 20)  
love-PASS-PAST-2PL

sev-ıl-me-di-niz ‘You were not loved.’  
love-PASS-NEG-PAST-2PL

In (209), the stress normally falls on the final syllable, on the agreement suffix *niz*. However, if the negation morpheme is in the word, stress is unable to move through it (in the left-to-right scan), resulting in the syllable before negation being stressed.

If there are multiple prestressing morphemes, the syllable before the leftmost one is stressed.<sup>5</sup>

(210) Multiple prestressing morphemes (Göksel and Kerslake 2004)

- otur-**acák**-sa-da-mı "even if s/he's going to sit?"
- iste-**mış**-mi-ydi-n-ki "had you asked for [it], then?"

When prestressing morphemes interact with exceptionally stressed morphemes, the outcome is that the leftmost exceptionally marked syllable wins if it is to the left of the prestressing morpheme, shown in (211a). Otherwise, the syllable before the prestressing morpheme surfaces as stressed, shown in (211b).

(211) Interaction of exceptional stress and prestressing (Inkelas and Orgun 2003)

a. Exceptionally stressed syllable to the left of a prestressing morpheme

- pencére-yle → pencéreyle (\*penceréyle)

window-COM

“by/with window”

- yap-ıyor-mu → yapıyormu (\*yapıyórmu)

do-PROG-INT

“is he/she/it doing?”

b. Exceptionally stressed syllable to the right of a prestressing morpheme

- bırak-ma-ıyor → bırakmıyor (\*bırakmıyor)

leave-NEG-PROG

“he/she/it isn't leaving”

- yap-ma-(y)árak → yapmayarak (\*yapmayáarak)

do-NEG-ADV

“by not doing”

It appears that the leftmost “special instruction” wins here. Prestressing morphemes do not obligatorily assign stress to the syllable before them, rather, they seem to limit the assignment of

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<sup>5</sup>This is ignoring the optional phrasal stress, discussed in Section 4.4.4 below.

stress to any element to their left. Within this domain, stress is assigned normally: to the leftmost exceptionally stressed syllable, otherwise to the rightmost syllable. Another way of putting this is that exceptionally stressed syllables can only attract stress if they are within the stress assignment domain, which appears to be limited to the domain before any prestressing morphemes.

This leads to an interesting situation where even syllables which are marked as exceptionally stressed sometimes do not surface as stressed. This is seen with *ıyör* PROG in (211b), which does not surface as stressed when it appears after the prestressing negation morpheme.

Similarly, some types of morphemes appear to act as prestressing sometimes and not others. This situation also occurs with subject agreement suffixes. Note, however, that the exponents are different in each case, the two paradigms are shown in (212):

(212) Two paradigms of agreement (Good and Yu 2005)

	Normal		Prestressing	
	SINGULAR	PLURAL	SINGULAR	PLURAL
1ST	<i>-m</i>	<i>-k</i>	<i>-(y)Im</i>	<i>-(y)Iz</i>
2ND	<i>-n</i>	<i>-nIz</i>	<i>-sIn</i>	<i>-sInIz</i>
3RD	<i>-∅</i>	<i>-∅</i>	<i>-∅</i>	<i>-∅</i>

a. Normal: *unut-tu-nIz* → *unuttunúZ*

forget-PAST-2PL

“you forgot”

b. Prestressing: *unut-acak-sInIz* → *unutacáksınız*

forget-FUT-2PL

“you will forget”

Good and Yu (2005) convincingly argue that these two paradigms are not arbitrary, but are, in fact, the difference between copular agreement (the prestressing set) and normal verbal agreement (the normal set). Because the copula is a clitic in Turkish, Good and Yu use this to explain the phonology, as well as several morphosyntactic distributional facts, such as the fact that the “normal” verbal agreement only appears on verbal predicates (of some tense/mood/aspect categories), while

the prestressing set appears on both verbal and non-verbal predicates.

In fact, many of the prestressing morphemes seem to be clitics, in that they show low degree of selectivity for their host, carry phrasal meanings, or appear to be functional heads in high domains (such as CP). However, other prestressing morphemes look less like clitics, in that they are derivational or generally more selective about their morphosyntactic context.

(213) Prestressing morphemes which look like clitics (Göksel and Kerslake 2004, p.31–33)

- Copular markers *-(y)DI* (past cop), *-(y)mIş* (evidential cop), *-(y)sA* (conditional copula)
- *bile* "even" particle
- *mI* Question particle
- Clitic *-(y)sA/ise* "as for"
- Clitic *dA* "but"
- Clitic *ki* complementizer
- Clitic *ya* emphatic

(214) Prestressing morphemes which look less like clitics (Göksel and Kerslake 2004, p.31–33)

- Case marker *-(y)lA/ile* "with, by, and"
- Derivational suffixes *-(A/I)cIK*, *-CA*, *-CAsInA*, *-en*, *-(y)In*, *-lA*, *-leyin*, *-rA*
- Converbial marker *-(y)ken*
- Generalizing modality marker *-DIr*
- Negative *-mA* and composite *-mAdAn* "without"

So, while it may be possible to propose that all clitics behave as prestressing morphemes, it does not seem to be the case that all prestressing morphemes are clitics (at least, in the classic sense of clitic).

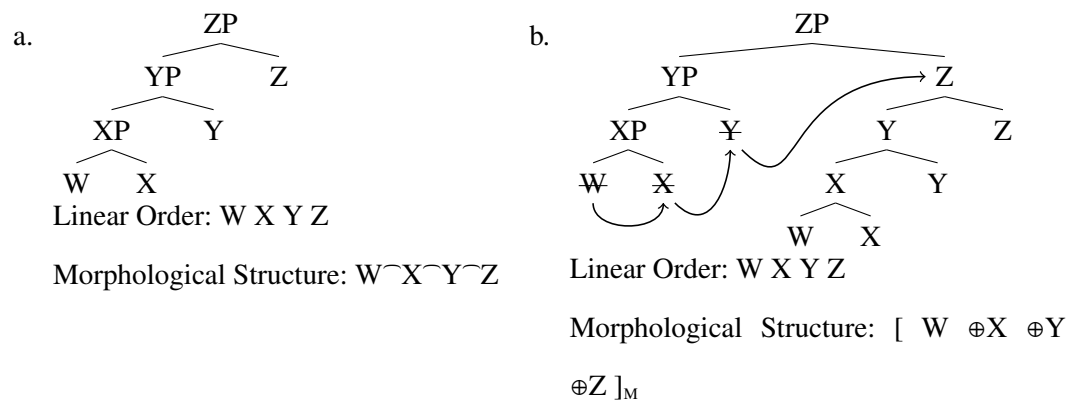
The problems which need to be explained in this data, then, are: (1) how does the interaction of prestressing morphemes and exceptionally stressed syllables work? (2) if (some) prestressing morphemes are clitics, how do we explain the prestressing behavior in other morphemes?

#### 4.4.2 Analysis

The general idea behind this analysis is that, in languages with a pile up of syntactic heads on one side, it is difficult to tell from the ordering of morphemes what morphemes have been syntactically combined into complex heads and which are simply linearly adjacent.

That is, both (215a) and (215b) have the same linear order of morphemes, although different syntactic structures.

(215) Syntactic Trees with the same linear order of morphemes



If we believe that phonological word boundaries are determined (largely) by complex M-Word boundaries, however, then the difference between (215a) and (215b) should be evident in the phonological structure. In (215a) each head is its own morphological unit, while in (215b) the heads should form a single M-word all together. There are, of course, other movement and structure possibilities in between (215a) and (215b), which should each have their own phonological outcome.

Following this idea, the analysis proposed here adheres to the following intuition:

(216) Analysis bullet points:

- Primary stress is placed on the final syllable of a ω-Word, modulo lexically specified stress.
- Clitics are not part of the ω-Word and therefore outside the domain for primary stress



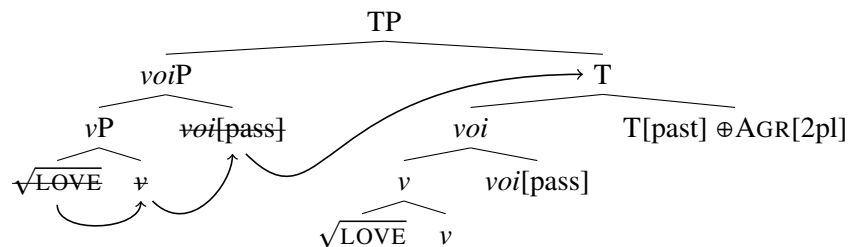
- Morphological pieces which block stress assignment (prestress morphemes) are clitics or otherwise not included in the relevant M-Word.
- Morphological pieces which vary with respect to stress properties also vary with respect to their inclusion in the  $\omega$ -Word, and thus the M-Word.

To start, I posit a main stress rule of Turkish:

(217) Main Stress Rule for Turkish: “Stress the leftmost exceptionally marked syllable, otherwise stress the rightmost syllable”

The main stress rule applies at the  $\omega$ -Word level. Following the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, this means that all morphemes within the complex head are subject to the main stress rule. For example, in *sevildiniz* “you were loved” (218), syntactic head movement combines the relevant heads into an M-Word.<sup>6</sup> This corresponds to a  $\omega$ -Word, resulting in stress on the final syllable (since there are no exceptionally marked syllables).

(218) Structure and derivation of *sevildiniz* “you were loved”



Linear Order: [  $\sqrt{\text{LOVE}} \oplus v \oplus voi[\text{pass}] \oplus T[\text{past}] \oplus \text{AGR}[\text{2pl}] ]_M$

Vocab. Insertion: [ /sev/ +  $\emptyset$  + /il/ + /di/ + /niz/ ]<sub>M</sub>

M-Word  $\Rightarrow$   $\omega$ -Word: ( /sev/ +  $\emptyset$  + /il/ + /di/ + /niz/ ) <sub>$\omega$</sub>

$\omega$ -Level stress assignment: ( sevildiniz ) <sub>$\omega$</sub>

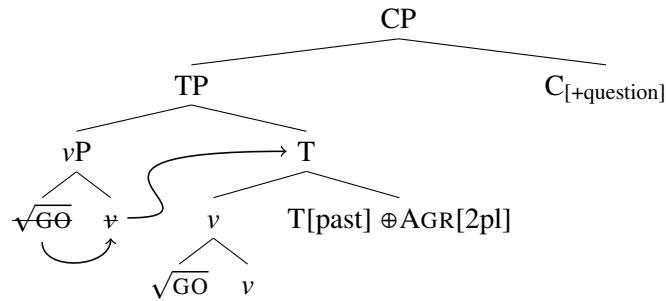
If a morpheme is not included in the M-Word because it is generated elsewhere (e.g., as a phrasal head) or because head movement does not apply through that head, it is excluded from the  $\omega$ -Word and does not participate in stress. This can account for the phonological behavior of prestressing morphemes. Some of these are structurally separate from the M-Word and therefore out of the  $\omega$ -

<sup>6</sup>I am assuming that Turkish is right-headed here.

Word stress domain. Some of these are morphemes which, for whatever reason, do not allow head movement.

As an example of the first, several of the prestressing morphemes are most likely elements in CP. For example, I will assume that the question marker clitic is generated in C (although it could be some other head above the verb, see Kahnemuyipour and Kornfilt 2006 for another possibility which is compatible with the morphophonology here). The verbal complex underneath C undergoes head movement and combines into an M-Word, but there is no head movement which raises it to C. Instead, the question clitic is separate from the M-Word, and thus outside the  $\omega$ -Word, as shown in (219):

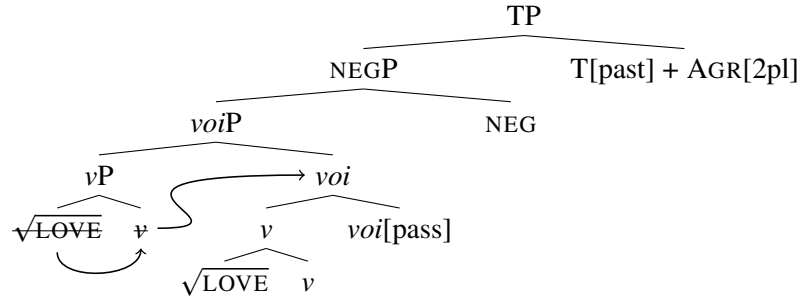
(219) Behavior of question marker clitic. Example: *gittinízmi* “Did you go?”



- Linear Order:  $[ \sqrt{GO} \oplus v \oplus T[past] \oplus AGR[3sg] ]_M \bar{C}_{[+question]}$
- Vocab. Insertion:  $[ /git/ + \emptyset + /ti/ + /niz/ ]_M \bar{/mi/}$
- M-Word  $\Rightarrow$   $\omega$ -Word:  $( /git/ + \emptyset + /ti/ + /niz/ )_{\omega} + /mi/$
- $\omega$ -Level stress assignment:  $( gittiníz )_{\omega} = mi$

Other prestressing morphemes are functional heads which do not participate in syntactic head movement. For example, the negation head blocks the normal head raising of the verbal complex. Compare the movement without the negation head in (218) with the movement when the negation head is in the structure in (220):

(220) No head movement through the negation head. Example *sevílmediniz* “you were not loved”



- Linear Order:  $[\sqrt{\text{LOVE}} \oplus v \oplus \text{voi}[\text{pass}]]_M \sim \text{NEG} \sim \text{T}[\text{past}] \sim \text{AGR}[\text{2pl}]$
- Vocab. Insertion:  $[\text{/sev/} + \emptyset + \text{/il/}]_M + \text{/me/} + \text{/di/} + \text{/niz/}$
- M-Word  $\Rightarrow$   $\omega$ -Word:  $(\text{/sev/} + \emptyset + \text{/il/})_\omega + \text{/me/} + \text{/di/} + \text{/niz/}$
- $\omega$ -Level stress assignment:  $(\text{sev}^\acute{\text{i}}\text{l})_\omega = \text{me} = \text{di} = \text{niz}$

Note that morphemes such as *di* T[past] and *niz* AGR[2pl] show variable behavior vary with respect to their affix or clitic status between (218) and (220). When head movement moves through these nodes, they are included in the M-Word of the verb root and therefore the  $\omega$ -Word. When head movement is blocked (by, e.g., the NEG morpheme), these nodes are not part of the M-Word. Instead, they lean onto the verbal  $\omega$ -Word but do not participate in the  $\omega$ -Level phonology (here, stress assignment).<sup>7</sup>

Another category of morphemes which show this variable behavior are the person agreement markers, as discussed in (212) above. Following Good and Yu (2005), these can be divided into cases of true verbal agreement and cases of participle with copula and agreement. When the person markers are true verbal agreement, they are inside the verbal  $\omega$ -Word and participate in stress. Normal verbal agreement has a structure such as that in (218) above; syntactic head movement raises the verbal root up through the the tense and agreement nodes, so all morphemes are inside the same  $\omega$ -Word.

However, with some aspect features, Turkish employs a participle and copula strategy (Kornfilt 1996; Newell 2005; Good and Yu 2005).<sup>8</sup> In these cases the agreement suffixes are dependent on the copula rather than the verb itself. Allomorphy of the agreement conditioned on the copula explains

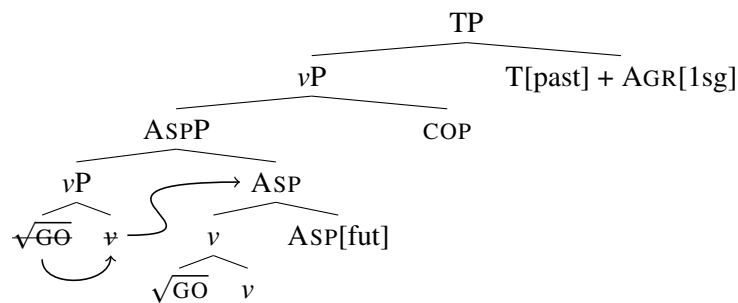
<sup>7</sup>Although they must be in some phonological domain together, because vowel harmony applies to clitics. See the discussion in Section 4.4.4.

<sup>8</sup>Further evidence of this copula strategy comes from suspended affixation, which can occur under the copular agreement but not the normal verbal agreement, see Good and Yu (2005) and sources cited therein.

the difference in form of these exponents between the two types of agreement. Additionally, if we posit that there is no head movement through the copula, we derive the fact that these markers are outside the  $\omega$ -Word of the verb and will not participate in the  $\omega$ -Word stress. Note that although the copula is sometimes phonologically null, it can appear as *y* or *i* depending on the phonological environment (Kornfilt 1996; Newell 2005). An example of the copula construction is shown in (221):

(221) Structure and derivation of copula construction (cf. Newell 2005, p. 53)

Example: *gidecékitim* ‘‘I will have gone’’



Linear Order:  $[\sqrt{GO} \oplus v \oplus ASP[future]]_M \sim COP \sim T[past] \sim AGR[1sg]$   
 Vocab. Insertion:  $[/gid/ + \emptyset + /ecek/]_M \sim /i/ \sim /ti/ \sim /m/$   
 M-Word  $\Rightarrow$   $\omega$ -Word:  $(/gid/ + \emptyset + /ecek/)_\omega \sim /i/ \sim /ti/ \sim /m/$   
 $\omega$ -Level stress assignment:  $(gidec\acute{e}k)_\omega = i = ti = m$

The analysis here proposes that prestressing morphemes are, in fact, morphemes which inherently do not participate in the normal syntactic head movement of the verbal phrase. In some cases this is because they are base generated outside the normal raising height of that phrase (i.e. particles in CP), in other cases it is because they are designated to block head movement through them. This explains both the behavior of clitics as prestressing morphemes and the fact that other morphemes which do not initially appear to be clitics can behave as prestressing. Additionally, the facts about the interaction between exceptionally stressed syllables and prestressing morphemes fall out directly from this analysis; exceptionally stressed syllables which are inside the  $\omega$ -Word are able to take  $\omega$ -Level stress while those that are outside the  $\omega$ -Word (i.e., to the right of a prestressing morpheme) are unable to take  $\omega$ -Level stress.

### 4.4.3 Notes on previous analyses

A brief comparison with some previous analyses of Turkish stress is given here.

There have been several accounts of the data using a purely phonological system. Inkelas and Orgun (1998, 2003; Inkelas 1999) propose an account in which all irregular stress (both exceptional marking and prestressing) are built with trochaic feet. This means that prestressing morphemes have a floating syllable built into their foot, e.g. the negative *-mE* is prespecified as ( $\acute{\sigma}$ -*mE*). Final stress is assigned by a principle of “Innermost Wins” or “Leftmost Wins”. There are two problems with this account. One is that it does not account for multisyllabic prestressing morphemes such as *bile* “even”, *ile* comitative, *ise* “as for”, *mAdAn* “without”, *leyin* “-time”, etc. More importantly, though, the solution is entirely diacritic. There is no phonological generalization to be made about what suffixes are default, exceptionally stressed, or prestressing, so no generalization is made. Özçelik (2014) argues for a purely phonological account along the lines of Inkelas and Orgun (although argues against their co-phonology approach).

Kabak and Vogel (2001) also present a purely phonological solution using diacritics, although they argue against the Inkelas and Orgun accounts on other grounds. For Kabak and Vogel, prestressing morphemes are marked as being “Prosodic Word Adjoiners” meaning that they close off a PWd and lean onto it like a clitic. Any following affixes also must lean onto the PWd. Note that this is very similar to the account I propose here, but the diacritic nature of the Prosodic Word Adjoiners means that there is no generalization to be made as to why certain morphemes are marked and others are not. While it is true that there does not seem to be a phonological generalization, there is a clear morphosyntactic generalization to be made. The diacritic Prosodic Word Adjoiners account fails to make that generalization.

In contrast, the analysis proposed here follows more syntactic oriented approaches. Good and Yu (2005), for example, make a strong argument for the clitic/affix distinction in different agreement paradigms based on both the phonology of stress and the phenomenon of suspended affixation. Similarly, Kornfilt (1996), Newell (2005), and Kahnemuyipour and Kornfilt (2006) present purely syntactic accounts of the distribution of prestressing morphemes consistent with the approach proposed here. In particular, Kahnemuyipour and Kornfilt (2006) present an account with more syntac-

tic movement than proposed here, but the difference between the prestressing morphemes and other morphemes with respect to their morphosyntactic structures are exactly the same division between M-Word external and M-Word internal. The morphophonological side of my proposal is consistent with their syntactic analysis.

Making a slightly different generalization, Newell (2005) proposes that the prestressing morphemes are unable to join the phonological word of the material below them because they sit atop a  $vP$  or  $CP$  syntactic spell-out domain, and therefore are not spelled out in the same syntactic cycle.

As discussed in Sections 2.3.4 and 3.11, while the purely syntactic spell-out theory does make important generalizations, it cannot be the only mechanism determining the phonological groups. For example, Newell's system does make the same generalization about movement as the analysis here. That is, if verb moves all the way up to  $T$ , it is now outside the  $vP$  spell-out domain, and all the morphemes can be spelled out together. If the verb is blocked from moving up (by  $NEG$  for example), it will be inside a spell-out different domain ( $voiP$  in my analysis,  $vP$  in Newell's) than higher heads, resulting in different stress. Newell states that once an element is spelled out it is "no longer susceptible to phonological rules (except post-syntactic, across the board rules)" (Newell 2005, p. 23–24). However, this system does not explain why the heads above the verb's spell-out domain lean onto the verb's  $\omega$ -Word (instead of getting spelled out as their own  $\omega$ -Words). Additionally, as will be discussed in Section 4.4.4 below, there are phonological phenomena such as Vowel Harmony which are not across-the-board processes, but are restricted to the group of the M-Word plus leaners. This phonological grouping seems to be able to cross syntactic phase boundaries but is still sensitive to morphophonological objects (i.e., not across-the-board phonology).

#### **4.4.4 Aside: Clitic Group Phenomena**

The analysis of stress here relies on there being a phonological domain (argued to be the  $\omega$ -Word) which includes morphemes in an M-Word and excludes morphemes outside that M-Word. This follows from the proposed M-Word  $\Rightarrow$   $\omega$ -Word correspondence.

However, there are at least two phenomena in Turkish which appear to apply not only to the morphemes in an M-Word, but also to morphemes which "lean" onto the M-Word.

The first phenomenon is vowel harmony. While I ignored vowel harmony above, it must be noted that harmony-undergoing morphemes which end up outside the relevant M-Word (that is, they behave as clitics), still harmonize with the root inside the M-Word.

For example, the question particle *-mI*, argued to behave as a clitic in (219), harmonizes in backness and roundness with its host:

- (222) Vowel harmony of question clitic *-mI* (Göksel and Kerslake 2004, pp. 112–116)
- Gitsek-mi?* “Should we go?”
- Gördün-mü?* “Did you see?”
- Kalayım-mi?* “Should I stay?”
- Okumuş-mu?* “Has he/she read [it]?”

This problem could be solved by a search-based theory of vowel harmony in which the harmonizing vowel is “needy” and searches left for the features it needs (see, e.g., Nevins 2010). This search could be made to not be sensitive to  $\omega$ -Word boundaries.

However, this sort of solution is not possible with the phrasal stress phenomenon described below, so another solution is to posit that there is another phonological group that includes the  $\omega$ -Word and any leaners. This is essentially the proposal for the Clitic Group of Prosodic Hierarchy Theories (see, e.g., Nespor and Vogel 1986; Hayes 1989; Vogel 2009).

The second phenomenon for which a phonological constituent including leaners appears to be necessary is optional phrasal stress shifting. With some clitics and particles, stress may optionally be shifted off the syllable determined by the  $\omega$ -Level phonology and onto the syllable preceding that clitic or particle (Göksel and Kerslake 2004, p. 33–34; Özçelik 2014, pp.242–243). Examples are given in (223):

- (223) Optional phrasal stress shifting with Turkish clitics
- a. İstánbul bile ~ İstanbúl bile (Göksel and Kerslake 2004, p. 33)  
Istanbul while "even Istanbul"
- b. gél-me-ki ~ gel-mé-ki (Özçelik 2014, pp.242–243)  
come-NEG-COMP “Don’t come so that . . .”

- c. *gél-me-de* ~ *gel-mé-de* (Özçelik 2014, pp.242–243)  
come-NEG-CONN “If you don’t come, then . . .”

Note that this stress shifting cases (the second of each pair) ignore both exceptionally stressed morphemes, such as *İstánbul* in (223a), and prestressing morphemes, such as *-me* NEG in (223b,c). As such, this assignment of stress cannot be the same interaction of stress and structure proposed for the  $\omega$ -Level above, because it does not follow the same principles as (210) and (211) above.

I do not have more to say about these phenomena, but to simply note that they are examples of processes which need a larger phonological group, as discussed in Section 4.3.

#### 4.4.5 Case Study Conclusions

The stress pattern of Turkish can be explained through the interaction of morphosyntactic structure and phonological structure. That is, heads combined together into an M-Word by the syntax are within the  $\omega$ -Word domain for stress, whereas heads that are not combined into that M-Word are outside the  $\omega$ -Word domain.

Critically for the broader discussion, the analysis of Turkish presented here shows the principle that affixation and cliticization are behaviors rather than inherent specifications. That is, the same morpheme will behave as an affix if it is included in an M-Word but as a clitic if it is not. I posited that this variable behavior in Turkish is determined entirely the syntactic mechanisms.

### 4.5 Local Dislocation

One particularly interesting morphological operation which modifies M-Words is Local Dislocation (Embick and Noyer 2001, Embick 2007a,b; cf. Morphological Merger of Marantz 1984, 1988 and m-merge of Matushansky 2006). This is an operation which, under the relevant conditions, moves linearly adjacent elements from the syntactic output in a way that reflects morphophonological (rather than syntactic) boundaries. Local Dislocation takes elements that are adjacent at the M-Word level and concatenates them at the subword level (in either linear order), as schematized in (224):



(224) Schematic of Local Dislocation

(Embick and Noyer 2001)

$$[X]_M \wedge [Y]_M \rightarrow [X \oplus Y]_M \text{ or } [Y \oplus X]_M$$

Local Dislocation has been posited to account for the analytic/synthetic alternation in English comparative and superlative adjectives (Embick and Noyer 2001; Embick 2007a). For example, comparing *more intelligent* vs. *smarter*, the comparative morpheme not only changes its  $\omega$ -Word membership (going from a separate word to an affix), but it switches sides with its stem. Similarly, the placement the Latin conjunction *-que* exactly one word into the second part of the conjunct is able to be explained by Local Dislocation (Embick and Noyer 2001; Embick 2007b).

For the discussion here, there are two important points to be made about Local Dislocation. The first is that this is an operationalization of the Affixation Assumption (198) discussed above. Local Dislocation takes the linearized syntactic output of two adjacent M-Words and combines them into a single M-Word, effectively affixing the two together. As such, this operation has the potential to create serious “bracketing paradoxes” or other mismatches in the syntax-phonology correspondence because the syntactic structure generated two separate constituents (M-Words), but the phonological structure outputs one constituent (a  $\omega$ -Word).

The second point is that Local Dislocation creates an opportunity for recursive phonological structure depending on the timing of the operation with respect to spell-out of the elements. If one of the elements in the morphosyntactic structure is phonologically spelled out before Local Dislocation applies (because, for example, if how cyclic spell-out works; see, e.g., Embick 2010a), that element will be phonologized on its own before being grouped together with the other element (225):

(225) Schematic of Local Dislocation with Interleaved Phonology

1. Phase 1: just X

Morphosyntactic Structure:  $[X]_M$

Phonological Grouping:  $(/X/)_\omega$  where  $/X/$  is the phonological exponent of X’s vocabulary item

2. Phase 2: Y is added

Morphosyntactic Structure:  $[ (/X/)_{\omega} ]_M \widehat{[ Y ]}_M$

Local Dislocation:  $[ (/X/)_{\omega} \oplus Y ]_M$

Phonological Grouping:  $((/X/)_{\omega} + /Y/)_{\omega}$

The interleaving of phonology and morphosyntactic structure shown in (225) is critical. The phonological form of the element from the first phase,  $/X/$ , is available for reference during the second phase. This is important for Embick's (2007a) analysis of Local Dislocation for the analytic/synthetic alternation in English comparative and superlative adjectives because the alternation, caused by Local Dislocation under Embick's analysis, is sensitive to the phonology of the adjective stem. This phonological conditioning of Local Dislocation is also important for the case studies presented below.

It must also be noted that the phonological output of Local Dislocation is exactly the phonological grouping proposed by Selkirk (1995) for Affixal Clitics. That is, in both theories the Affixation Assumption (198) is implemented to account for the phonological structure. However, in this Contextually Determined Theory, which rejects the Storage Assumption (195), we have the flexibility to account for a variety of phenomena involving affixation through different operations in the morphosyntax and phonology. Specifically, the context-determined affixation of amphitopic clitics can be accounted for through the conditioned application of Local Dislocation. Case studies of amphitopy caused by Local Dislocation are presented in Section 4.6. First, however, a simpler example of obligatory Local Dislocation from English is given here.

#### 4.5.1 Voice assimilation of the English possessive clitic

As an example, obligatory application of Local Dislocation can explain the well known paradox of the English possessive clitic 's. Recall from Section 3.4.2 that English has progressive voice assimilation at the  $\omega$ -Level. Examples were given of assimilation of the 3SG verbal agreement (*taps* /tæps/, *tags* /tægz/) and the plural (*cats* /kæts/, *dogs* /dɔgz/). Note now that the English possessive clitic also undergoes the same voice assimilation.

(226) English possessive clitic undergoes  $\omega$ -Level progressive voice assimilation:

*cat* /kæt/ + 's /z/ → *cat's* [kæts]

*dog* /dɔg/ + 's /z/ → *dog's* [dɔgz]

The possessive clitic has interesting behavior syntactically it attaches to a phrase, but phonologically it depends only on the final word of that phrase regardless of the morphosyntactic category of that word (Zwicky 1987).

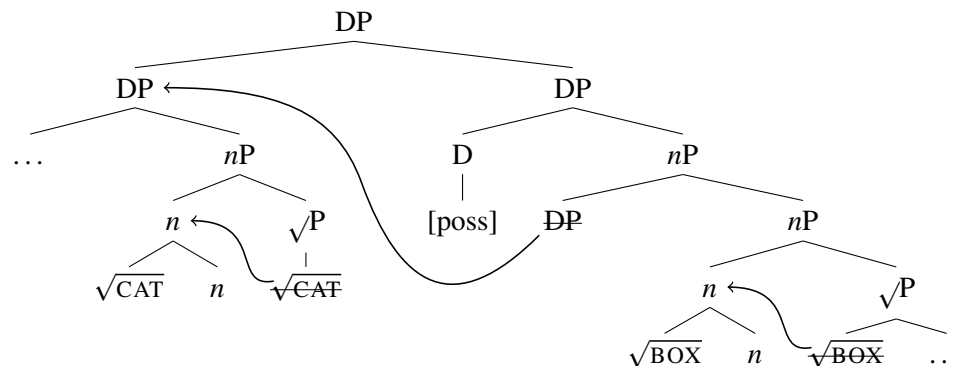
(227) Examples of English possessive clitic 's with hosts of different categories (Zwicky 1987,

- the oxen's yoke (noun)
- p.136) • the person I talked to's theories (preposition)
- the person who's talking's theories (verb)

Following other work on this clitic, I propose that the possessive clitic is generated as a separate syntactic head,<sup>9</sup> as shown by the fact that attaches to a phrase (see, e.g., Klavans 1985; Zwicky 1987; Anderson 2008). However, phonologically it depends only on the final word of that phrase, becoming part of that words ω-Word, as shown by the fact that it undergoes word-level voice assimilation dependent on that word.

Specifically, I propose that the possessive clitic is generated outside as the D to the possessee and that the possessor occupies another DP above it, as shown in (228). The M-Word ⇒ ω-Word equivalence should treat the possessive clitic as outside the ω-Word and thus not subject to the ω-Level voice assimilation. However, since the possessive clitic does participate in the ω-Level voice assimilation, it must get incorporated into the ω-Word.

(228) Structure for *cat's box*



<sup>9</sup>An alternative analysis proposes that the possessive clitic is a “phrasal inflection” (see, e.g. Bermúdez-Otero and Payne 2008)

Linearization:	...	$[\sqrt{\text{CAT}} \oplus n]_{\text{M}}$	$\hat{\quad}$	D[poss]	$\hat{\quad}$	$[\sqrt{\text{BOX}} \oplus n]_{\text{M}}$
M-Word $\Rightarrow$ $\omega$ -Word:	...	$(/kæt/ + \emptyset)_{\omega}$		/z/		$(/baks/ + \emptyset)_{\omega}$
Actual Phonological Grouping:	...	$(/kæt/ + \emptyset + /z/)_{\omega}$				$(/baks/ + \emptyset)_{\omega}$

In *cat's box*, the possessive clitic is generated outside the phrase it attaches to (here shown as the D of the possessee DP), but gets included into the  $\omega$ -Word linearly on its left. The phrasal-level hierarchical behavior of this clitic is thus explained by the syntactic movement allowing any DP to move out above the possession D, but the linear phonological behavior of the clitic is explained by its inclusion in the M-Word to its left after Linearization has applied. The linear part of the derivation is given in

(229) Derivation of *cat's box* with Local Dislocation

Linearization:	...	$[\sqrt{\text{CAT}} \oplus n]_{\text{M}}$	$\hat{\quad}$	D[poss]	$\hat{\quad}$	$[\sqrt{\text{BOX}} \oplus n]_{\text{M}}$
Local Dislocation:	...	$[\sqrt{\text{CAT}} \oplus n \oplus \text{D[poss]}]_{\text{M}}$		$\hat{\quad}$		$[\sqrt{\text{BOX}} \oplus n]_{\text{M}}$
M-Word $\Rightarrow$ $\omega$ -Word:	...	$(/kæt/ + \emptyset + /z/)_{\omega}$				$(/baks/ + \emptyset)_{\omega}$
$\omega$ -Level voice assimilation:	...	$(/kæts/)_{\omega}$				$(/baks/ + \emptyset)_{\omega}$

This brief example of the English possessive shows that Local Dislocation can be an obligatory process for a particular morpheme. The analysis here shows that Local Dislocation can cause the mismatch between the syntactic structure and the phonological structure by moving an independent syntactic element into a neighboring M-Word, resulting in it behaving like an affix.

## 4.6 Case Studies in Amphitopy<sup>10</sup>

The two case studies below present cases of amphitopic clitics: clitics which show variable phonological groupings with their host. In these cases, the same morphosyntactic unit in the same syntactic structure results in different phonological groupings based on the phonology of the host.

In both case studies, we see the expected difference in the phonological grouping of affixes and free clitics. While suffixes are a part of the M-Word of their host and thus part of their  $\omega$ -Word, clitics are not a part of either grouping.

<sup>10</sup>Earlier versions of these case studies were presented at LSA2013 and PLC37, and published in PWPL20.1.

(230) Differences in phonological grouping between suffixes and free clitics

- Suffix: [ host suffix ]<sub>M</sub> ⇒ ( host suffix )<sub>ω</sub>
- Clitic: [ host ]<sub>M</sub> clitic ⇒ ( host )<sub>ω</sub> clitic

However, we also see amphitopy in clitics which sometimes behave like Free Clitics and sometimes like Affixal Clitics:

(231) Same clitic in two phonological arrangements

- Situation 1 “Free Clitic”: [ host ]<sub>M</sub> clitic ⇒ ( host )<sub>ω</sub> clitic
- Situation 2 “Affixal Clitic”: [ host ]<sub>M</sub> clitic ⇒ ( ( host )<sub>ω</sub> clitic )<sub>ω</sub>

In both case studies, this situation is analyzed as an application of Local Dislocation conditioned on the phonology of the host. The amphitopic clitic is generated as a Free Clitic, but if Local Dislocation applies, it becomes an Affixal Clitic by virtue of the change in morphosyntactic structure.

#### 4.6.1 Makassarese Suffixes, Clitics, and the Definite Determiner

##### 4.6.1.1 Data

Basri et al. (2000) present an interesting three-way phonological distinction in morphemes that attach to adjectives in Makassarese (South Sulawesi, Austronesian). Two of the distinctions, suffix and clitic, are shown in (232):

(232) Makassarese adjectives with comparative and 1sg. absolutive (Basri et al. 2000)

	V-stem	C-stem	{r,l,s}-stem
a. Adjective stem	<i>lómo</i> “big”	<i>gássij</i> “strong”	<i>rántasa?</i> “dirty”
b. Suffix: Comparative /-aŋ/	<i>lompó-aŋ</i> “bigger”	<i>gassíŋ-aŋ</i> “stronger”	<i>rantás-aŋ</i> “dirtier”
c. Clitic: 1sg. Absolutive /-aʔ/	<i>lómo-aʔ</i> “I am big”	<i>gássij-aʔ</i> “I am strong”	<i>rántasak-aʔ</i> “I am dirty”

Bare adjectives come in three different shapes, as shown in (232a); vowel-final, consonant-final, and stems ending in /r/, /l/, or /s/. The segments /r/, /l/, and /s/ are illicit word-finally in Makassarese, so in these cases an epenthetic /aʔ/ (alternating with /ak/)<sup>11</sup> is added. This epenthesis, in addition to stress placement, serves as one of the indicators of  $\omega$ -Word boundaries. Stress in Makassarese is generally penultimate at the  $\omega$ -Word level, although epenthetic material is extrametrical.<sup>12</sup>

There is a difference in phonological behavior between the suffixes and clitics, as shown in the example forms in (232b-c). Suffixes, such as the comparative /-aŋ/ (as well as the benefactive /-aŋ/, the transitivizer /-i/, the iterative /-i/, and possessive suffixes), appears to be part of the same stress domain as the stem, as we see from the stress shift between the forms in (232a) and (232b). That is, the calculation of penultimate stress is made including the phonological material of the suffix. In addition, the comparative suffix bleeds epenthesis in the {r,l,s}-stems as we see in the form *rantas-aŋ* (and not *\*rantasak-aŋ*). This gives us an indication that these suffixes are part of the same word as the stem.

In comparison, clitics, such as the 1sg. absolute marker /-aʔ/<sup>13</sup> (as well as the absolute markers for other person/number combinations and the emphatic markers /-mi/ and /-ma/), have a different behavior with respect to stress placement and word-final epenthesis, as shown (232c). These clitics appear to be outside the domain of stress because there is no stress shift from the bare stem form. That is, the calculation of penultimate stress occurs excluding the phonological material of the clitic. In addition, these clitics do not bleed epenthesis, as we see the epenthetic *-ak* is still added to the {r,l,s}-stem before the absolute /-aʔ/, resulting in *rantasak-aʔ*.<sup>14</sup> Given this behavior, it appears that the clitics are not part of the host's phonological word.

If these were the only phonological behaviors, the analysis would be as easy as the distinction

<sup>11</sup>The alternation between /ʔ/ and /k/ is completely predictable; The segment appears as /k/ if it is in an onset and /ʔ/ if it is in a coda. The exact mechanics of this allophony are not important for the issue under discussion, so no deeper explanation will be given here. It is interesting to note, however, that in some closely related languages, such as Selayarese, this /k/~ʔ/ alternation seems to be sensitive to word-level boundaries although this is not the case in Makassarese (see, e.g., Basri 1999 on Selayarese).

<sup>12</sup>Alternatively, in a theory with ordering of phonological processes, calculation of stress could be ordered before the addition of epenthetic material.

<sup>13</sup>The absolute marker is a personal pronoun expressing the absolute case. The syntactic origin of the absolute clitic is discussed in Section 4.6.1.2.2 below.

<sup>14</sup>It should be noted that the outcome *rantasak-aʔ* includes the epenthetic *-ak* despite the fact that the outcome without it (*rantas-aʔ*) is a perfectly licit phonological form — in fact, it is the surface form of the bare adjective stem.

between affix and clitic. However, there is the interesting case of the definite determiner /-a/ in Makassarese, which shows a behavior split between that of suffixes and clitics, as shown in (233):

(233) Makassarese adjectives with definite determiner (Basri et al. 2000)

V-stem	C-stem	{r,l,s}-stem
a. Adjective stem		
<i>lómpo</i> “big”	<i>gássij</i> “strong”	<i>rántasaʔ</i> “dirty”
b. Suffix: Comparative /-aŋ/		
<span style="border: 1px solid black; padding: 2px;"><i>lómpó-aŋ</i></span> “bigger”	<i>gássij-aŋ</i> “stronger”	<i>rántás-aŋ</i> “dirtier”
c. Clitic: Absolutive 1sg. /-aʔ/		
<i>lómpo-aʔ</i> “I am big”	<span style="border: 1px solid black; padding: 2px;"><i>gássij-aʔ</i></span> “I am strong”	<span style="border: 1px solid black; padding: 2px;"><i>rántasak-aʔ</i></span> “I am dirty”
d. Definite Determiner /-a/		
<span style="border: 1px solid black; padding: 2px;"><i>lómpó-a</i></span> “the big ...”	<span style="border: 1px solid black; padding: 2px;"><i>gássij-a</i></span> “the strong ...”	<span style="border: 1px solid black; padding: 2px;"><i>rántasak-a</i></span> “the dirty ...”

As highlighted in (233), when the stem is part of the C-stem or {r,l,s}-stem class, the definite determiner behaves exactly like the 1sg. absolutive clitic; It is not part of the stress domain and does not bleed epenthesis. However, when the host is a V-stem, the definite determiner behaves exactly like the comparative suffix; It is part of the stress domain. The behavior of the determiner alternates (predictably) between behaving like a suffix and behaving like a clitic.

#### 4.6.1.2 Piece-Based Analysis

The point of interest here is that the same morphosyntactic structure with the same morphophonological pieces has different phonological outcomes. These phonological outcomes are not just a result of the “normal” phonology, but are affected by the morphological structure.

Critically, it should be highlighted that this is the same morphosyntactic piece (the definite determiner) with the same phonological unit (/a/) in the same syntactic configuration (attaching to an adjective stem) with the same meaning (“the *adjective* ...”), but with different phonological results.

This raises the question: why is the phonological outcome different? One possibility is that there

is something funny going on in the phonology. That is, a possible phonological solution involves special phonology that applies only for the determiner morpheme. While this remains a possibility, such a solution gives us no insight into why the phonological outcome might be different with different stems given that the special phonology is only seen in this one place in the language. Additionally, this solution would become implausible if there happen to be another morpheme that follows the same pattern (which, although is not the case here, is predicted to be possible in the solution presented below).

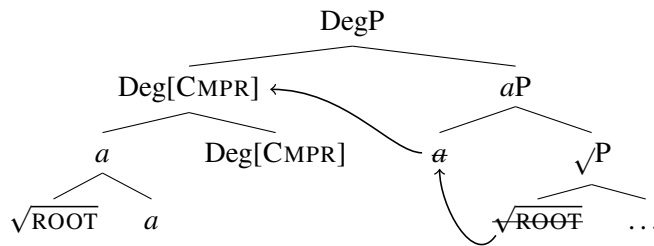
The second possibility is that there is something different about the structure of the determiner or the operations that apply to it. This is the solution argued for here. Specifically, I propose that the definite determiner is subject to Local Dislocation which, under the appropriate conditions, causes it to move inside the word of its host and behave like an affix.

The following sections show the derivation of suffixes, clitics, and the definite determiner in Makassarese.

#### 4.6.1.2.1 Structure and Phonology of Makassarese Suffixes

For Makassarese suffixes, syntactic movement (or early PF operations such as agreement) must create complex heads. For example, with the comparative suffix /-aŋ/ syntactic movement raises the root to the adjective head and then to the comparative head, as shown in (234):

(234) Proposed Structure of Comparative



The linearization of this structure will result in the  $\sqrt{\text{ROOT}}$ , *a* and Deg[CMPR] heads being inside the same M-Word, as shown in (235a). By the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, these heads will be grouped together into the same  $\omega$ -Word in the phonology, as shown in (235b) with the example root  $\sqrt{\text{DIRTY}}$  ( $\leftrightarrow$ /rantas/).



(235) Linearization and Phonological Grouping of Adjective and Comparative Suffix

- a. Linearization:  $[ \sqrt{\text{DIRTY}} \oplus a \oplus \text{Deg}[\text{CMPR}] ]_M$
- b. Phonological Grouping:  $( /rantas/ + \emptyset + /aŋ/ )_\omega$

If we assume that the relevant phonological operations of /aʔ/-epenthesis and penultimate stress apply only to  $\omega$ -Level groupings, this structure and phonological grouping correctly generates the outcomes seen in the data:

(236) Application of  $\omega$ -Level Phonology to Suffix Example:

- Phonological Grouping:  $( /rantas/ + \emptyset + /aŋ/ )_\omega$
- Stress:  $/rantásaŋ/$
- Epenthesis: —

**4.6.1.2.2 Structure and Phonology of Makassarese Clitics**

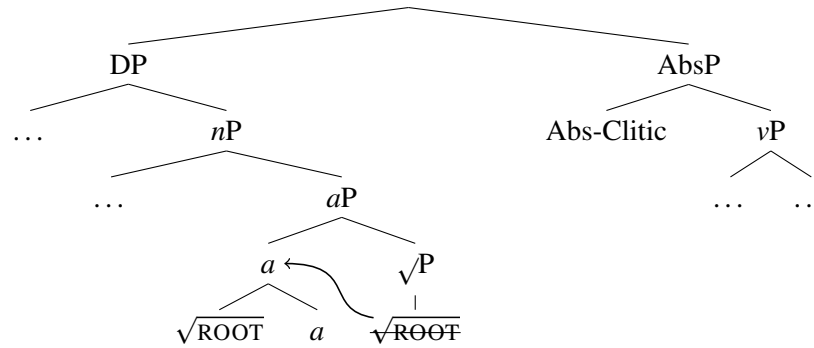
In contrast with the suffixes, the structure of clitics will result in the clitic morpheme not being a part of the complex head of the adjective.

For the syntax of the absolutive clitics, Finer (1999) and Basri (1999) propose that these clitics are generated in their own functional head projection above the  $\nu P$  in South Sulawesi languages (see also Kaufman 2008 for more detail on clitics in the South Sulawesi family). If the DP containing the relevant adjective raises above the AbsP (to a spec,T or Focus position, for example), the resulting structure will be one in which the adjective and the absolutive clitic will not be in a complex head together but will be linearized next to each other (because adjectives are final in their  $nP$ ), as shown in (237):<sup>15</sup>

(237) Proposed Structure of Adjective with Absolutive Clitic

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<sup>15</sup>The morphophonological analysis is compatible with any syntactic analysis which places the adjective and the absolutive clitic in different complex heads but linearly adjacent.



In this case the  $\sqrt{\text{ROOT}}$  and  $a$  head form a complex head to the exclusion of the absolutive clitic. Following the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, the root and adjective head will be grouped together as a  $\omega$ -Word while the absolutive clitic is outside that  $\omega$ -Word.

(238) Linearization and Phonological Grouping of the Adjective with the 1sg. Abs. Clitic

- a. Linearization:  $[ \sqrt{\text{DIRTY}} \oplus a ]_M \frown [ \text{Clitic} ]_M$   
 b. Phonological Grouping:  $( \sqrt{\text{DIRTY}} + a )_\omega + /a?/$

When the  $\omega$ -Level phonology applies, it will apply to the root and adjective head as a group:

(239) Application of  $\omega$ -Level Phonology to Clitic Example:

- Phonological Grouping:  $( /rantas/ + \emptyset )_\omega$   
 Stress:  $/r\acute{a}ntas/$   
 Epenthesis:  $/r\acute{a}ntasak/$   
 (Later) Clitic Leaning:  $/r\acute{a}ntasak/ = /a?/$

As shown in (239), the 1sg. absolutive clitic does not participate in the word level phonology of the adjective stem (as diagnosed by lack of stress shift and presence of epenthetic material).<sup>16</sup>

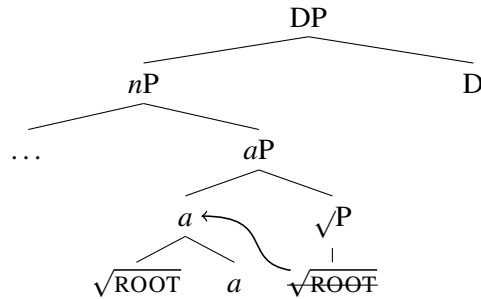
#### 4.6.1.2.3 Structure and Phonology of the Definite Determiner in Makassarese

Now that we have explained the normal behavior of affixes and clitics, let us turn to the definite determiner. As a reminder, the definite determiner behaves like other clitics with C-stem and {r,l,s}-stem hosts but like an affix with V-stem hosts.

<sup>16</sup>As discussed above in Section 4.3, there is some level at which the adjective stem and the clitic are considered one unit. That is, the clitic “leans” onto the adjective  $\omega$ -Word.

Like other clitics, the definite determiner in Makassarese starts out in a syntactic relationship with the adjective stem that puts it outside the adjective's M-Word, but linearly adjacent. The determiner in Makassarese is always on the right edge of the phrase, so, following Basri (1999), the proposed structure of a right-headed Makassarese DP<sup>17</sup> is given in (240):

(240) Proposed structure for DP with NP(+AP) complement in Makassarese



When this structure is linearized, the root and adjective head are a separate complex head from the determiner. The resulting M-Word and ω-Word grouping is parallel to the case of other clitics:

(241) Linearization of the Adjective Stem with the Definite Determiner

- a. Linearization:  $[ \sqrt{\text{DIRTY}} \oplus a ]_M \frown [ D[\text{def}] ]_M$
- b. Phonological Grouping:  $( \sqrt{\text{DIRTY}} + a )_\omega + /a/$

In the cases of C-stem and {r,l,s}-stem adjectives, the derivation from here is identical to that of the clitics. That is, the ω-Level phonology only applies to the root and adjective head as a group:

(242) Application of ω-Level Phonology to Determiner with C-stems and {r,l,s}-stems:

	{r,l,s}-stems	C-stems
Phonological Grouping:	$( /r\acute{a}ntas/ + \emptyset )_\omega$	$( /g\acute{a}ssiŋ/ + \emptyset )_\omega$
Stress:	$/r\acute{a}ntas/$	$/g\acute{a}ssiŋ/$
Epenthesis:	$/r\acute{a}ntasak/$	—
(Later) Clitic Leaning:	$/r\acute{a}ntasak/ = /a/$	$/g\acute{a}ssiŋ/ = /a/$

However, the definite determiner with V-stem adjectives shows a different phonological outcome. The definite determiner is included in the domain of stress, which we take as evidence that

<sup>17</sup>Finer (1997), discussing the Sulawesi family which includes Makassarese, argues for left-headed DPs with raising out of the complement of D, although he presents the right-headed DP as a possible alternative. A left-headed structure is compatible with the morphophonological analysis given here provided that the raising is A'-movement resulting in a separate complex head for the adjective and the determiner.

it has become part of the M-Word (and thus  $\omega$ -Word) despite the fact that it did not originate as part of the M-Word. This is one of the effects of the Local Dislocation operation. That is, in exactly the cases where the stem ends in a vowel Local Dislocation applies, causing a change in the morphophonological grouping. The Makassarese definite determiner Local Dislocation operation is schematized in (243):

(243) Makassarese definite determiner Local Dislocation Rule

$$[ /X/ ]_M \cap [ D[\text{def}] ]_M \rightarrow [ /X/ \oplus D[\text{def}] ]_M$$

where the phonological form /X/ ends in a vowel<sup>18</sup>

The conditioning factor of this operation relies on the phonological form of  $[ \sqrt{\text{ROOT}} \oplus a ]_M$  being active. In order for this to be the case we must make two (reasonable) assumptions: (1) There is some form of cyclic spell-out, and (2) The D head must be (syntactically) cyclic in Makassarese. That is, let us assume that the *nP* and *aP* within the DP structure undergo Spell-Out and Vocabulary Insertion when the cyclic D head is merged, but the D does not (until the next cyclic head is merged). This means that the phonology of the adjective stem is available for reference during the linearization phase of the morphology and can be used as a condition for application of Local Dislocation. Simply put, D can see *a*'s phonological form.

The complete derivation of a V-stem adjective with the definite determiner is given in (244). The steps in (244-1) derive the adjective stem and the steps in (244-2) show the derivation after the addition of the definite determiner. Note that the linearization of the stem and the determiner (244-2a) is the same linearization regardless of the phonology of the adjective stem. However, Local Dislocation applies (244-2b) only if the stem ends in a vowel. Once Local Dislocation applies, the resulting morphophonological groupings are the same as those of the suffixes in Makassarese. That is, the definite determiner is part of the same M-Word (and  $\omega$ -Word) as the adjective stem. Note that the phonological operations applied both at step (244-1c) and step (244-2d) is the  $\omega$ -Level phonology.

(244) Derivation of Makassarese *lompóa* “the big . . .”

<sup>18</sup>See discussion on the conditioning of Local Dislocation in Section 4.6.3

1. Merger of D triggers Spell-Out of NP
  - (a) Linearization: ... [  $\sqrt{\text{BIG}}$   $\oplus a$  ]<sub>M</sub>,
  - (b) Vocabulary Insertion: ... [ {  $\sqrt{\text{BIG}}$ , /lompɔ/ }  $\oplus \{a, \emptyset\}$  ]<sub>M</sub>
  - (c) Input to  $\omega$ -Level Phonology: lompɔ  
 Stress: lómpɔ  
 Epenthesis: —
2. Merger of higher cyclic head causes Spell-Out of D[def]
  - (a) Linearization: [ /(lómɔpɔ)/ ]<sub>M</sub><sup>^</sup> [D[def]]<sub>M</sub>
  - (b) Local Dislocation: [ /(lómɔpɔ)/  $\oplus$  D[def] ]<sub>M</sub>
  - (c) Vocabulary Insertion: [ /(lómɔpɔ)/  $\oplus$  {D[def], /-a/} ]<sub>M</sub>
  - (d) Input to  $\omega$ -Level Phonology: lompɔ-a  
 Stress: lompóa  
 Epenthesis: —
  - (e) Output: *lompóa*

To summarize, the linearization of the syntax of the determiner phrase results in a structure identical to that of other clitics, and, in cases with consonant final stems, the derivation is identical. When attaching to V-final stems, however, the Makassarese definite determiner Local Dislocation process applies, causing the determiner to move into the M-Word structure and showing recursion of the  $\omega$ -Level phonology.

(245) Morphological structures of Makassarese suffixes, clitics, and the definite determiner

- a. Suffix: [  $\sqrt{\text{ROOT}}$   $\oplus a$   $\oplus$  Suffix ]<sub>M</sub>
- b. Clitic: [  $\sqrt{\text{ROOT}}$   $\oplus a$  ]<sub>M</sub><sup>^</sup> [ Clitic ]<sub>M</sub>
- c. Definite Determiner: [  $\sqrt{\text{ROOT}}$   $\oplus a$  ]<sub>M</sub><sup>^</sup> [ D[def] ]<sub>M</sub>

-Subject to Makassarese definite determiner Local Dislocation Rule, resulting in:

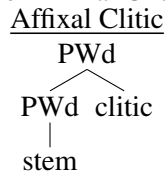
$$[ ( / \sqrt{\text{ROOT}} / + /a/ )_{\omega} \oplus D[\text{def}] ]_{\text{M}}$$

A summary of the proposed morphological structures for Makassarese suffixes, clitics, and the definite determiner are given in (245).

### 4.6.1.3 Alternative Theories

Basri et al. (2000) present an analysis of the Makassarese data in a Prosodic Hierarchy Theory framework. Following the types of clitics proposed by Selkirk (1995), Basri et al. propose that the definite determiner is an Affixal Clitic while other clitics are Free Clitics.

(246) Schematic of Affixal Clitic (Selkirk 1995)



Basri et al. argue for this attachment scheme for two reasons: (1) the evidence from stress shift in the V-final stems indicates that the definite determiner is part of the same PWd as V-final stems and (2) the evidence from epenthesis in {r,l,s}-stems indicates that the {r,l,s}-stems are a PWd to the exclusion of the definite determiner. If we follow the Storage Assumption, a clitic must have a single stored phonological behavior. The definite determiner, then, must be both included in a PWd with its host and simultaneously excluded from a PWd containing its host.. That is, the definite determiner must be an Affixal Clitic.

However, if we deny the assumption that the phonological behavior is stored and propose that the behavior could change during PF, we must examine the rest of the evidence for the proposed attachment scheme. There is no evidence that the definite determiner and the C-final stems form a PWd, nor is there (surface) evidence that a V-final stem is a PWd before the definite determiner attaches. Put another way, with {r,l,s}-stems there is evidence of the definite determiner attaching to a PWd and with V-final stems there is evidence of the stem and definite determiner forming a PWd but there is not evidence of both at the same time.

Furthermore, the phonological behavior of the definite determiner does not actually fall out directly from its assignment to the Affixal Clitic class. Rather, Basri et al. must posit an additional constraint, CRISPEGE, in order to derive the phonological output. This additional constraint seems to matter only in the particular case of the definite determiner, which is suspicious. Thus, the three-way distinction in attachment types (affix, free clitic, affixal clitic) not only does not derive the output on its own, it misses the generalization that the definite determiner behaves exactly like the

other clitics in most cases but exactly like an affix under specific phonological conditioning.

#### 4.6.1.4 Conclusion to Makassarese Case Study

I proposed that affixes in Makassarese are syntactically a part of the M-Word of their hosts while clitics are not. In the critical case of the definite determiner, the conditioned application of Local Dislocation causes the determiner, which begins in the syntactic configuration as a clitic, to move into the M-Word of its host and behave as an affix. This operation produces the correct output without further modification to the phonology of Makassarese.

An additional observation should be made on the derivation of *lompóa* in (244) above; The  $\omega$ -Level phonology is triggered twice. The first occurrence of the  $\omega$ -Level phonology happens when the M-Word  $[\sqrt{\text{ROOT}} \oplus a]_M$  is spelled out by the merger of D. The second occurrence happens after the Local Dislocation applies and the M-Word containing the definite determiner is created. While the Makassarese data does not provide any evidence of this recurrence of the phonology (because the only evidence, stress, is rewritten in the second pass of the phonology), the case study in Maltese below, which is parallel to the Makassarese case, does.

### 4.6.2 Maltese Subject Agreement and Object Clitics

Subject agreement suffixes and object clitics in Maltese present a case similar to the Makassarese suffixes and clitics above.

#### 4.6.2.1 Data

In Maltese perfective verb forms, there is a difference in the application of syncope (247) between subject agreement suffixes and object clitics.

(247) Maltese Syncope: Delete unstressed vowels not in the final syllable

At first approximation, the domain of syncope includes subject agreement suffixes but not object clitics. However, there is an asymmetry in the application of syncope to forms with clitics. While the domain of syncope excludes the clitics in stems with strong final consonants (a consonant other

than a glide or guttural), in stems with weak final consonant (a glide or a guttural) syncope does seem to include the clitic in its domain. Example data is shown in (248):

(248) Maltese perfect verb with 1pl. subject suffix and object clitic (Brame 1974; Odden 1993)

	strong final stem /hataf/	weak final stem /ʔaraj/
a. 3Msg. Subj. Agr. -∅	<u>h</u> átaf “he snatched”	ʔ <u>á</u> ra “he read”
b. 1pl. Subj. Agr. /-na/	<u>h</u> táf-na “we snatched”	ʔ <u>r</u> áj-na “we read”
c. 3Msg. Subj. Agr. -∅	<u>h</u> atáf-na “he snatched us”	ʔ <u>r</u> á:-na “he read us”
+ 1.pl Obj. Clitic /-na/		

For stems with strong final consonants (example /hataf/ above), there is a difference in the effect of syncope between the attachment of subject agreement and object clitics. With subject agreement (of the shape CV, e.g., 1pl. /na/ and 2pl. /tu/), the initial vowel of the stem undergoes syncope. For example (248b), /hataf/ with 1pl. subject agreement (/na/) becomes /htáfna/. However, syncope does not apply when an object clitic of the same shape<sup>19</sup> is attached. In (248c), the subject agreement is -∅ (3Msg.) resulting in the same phonology as a bare stem (/hataf/). When the 1pl. object clitic (/na/) is attached, the initial vowel does not undergo syncope. That is, in (248c), /hataf/ with the 1pl. object clitic /-na/ becomes /hatáfna/ and not \*/htáfna/.

Note that the exponent for 1pl. in both subject agreement and the object clitic is /na/.<sup>20</sup> Thus, the difference in syncope between 1pl. subject (/htáfna/) and 1pl. object clitic (/hatáfna/) is not simply due to the segmental phonology of the exponent. Instead, the difference in phonological outcome must be related to a difference in the structures of the two forms. A standard approach to this sort of phenomenon is that subject agreement is a part of the phonological word of the host while the object clitics are not.<sup>21</sup> If syncope is proposed to be a word level phonological process,

<sup>19</sup>Object clitics of shape CV(C) are: 1sg. /ni/, 3.F.sg. /ha/, 1pl. /na/, 2pl. /kom/ and 3pl. /hom/.

<sup>20</sup>It could be argued that both the 1pl. subject agreement and the 1pl. object clitic are the same exponent being inserted in two different morphosyntactic places. Whether this is the case or whether they are simply homophonous does not matter for the analysis given here. What matters is that the difference in phonological outcome between the two is not because of the segmental phonology of the exponent.

<sup>21</sup>An alternative is an abstract phonology solution in which these two exponents would differ in some diacritic, floating feature, or pre-attached metric structure which would affect the application of syncope. Note, however, that the same diacritic mechanism would have to apply to all the other suffixes or clitics of that class (that is, those that do or do not affect syncope, depending on the exact formulation of the solution). This abstract phonology solution misses the generalization that these suffixes and clitics fall into such classes. It should also be noted that these diacritics would need to change between strong final and weak final stems or, minimally, be rigged to affect strong and weak stems differently. Again, this would seem to miss a generalization.



then the object clitic should be outside its domain.

However, the observation that subject agreement participates in syncope and object clitics do not does not seem to hold true with weak final stems (example /ʔaraj/ above). In these stems, syncope of the initial vowel applies both in the case of the 1pl. subject agreement (/ʔrájna/) and in the case of the 1pl. object clitic (/ʔrá:na/). This data poses a problem to the analysis that clitics are outside of the word domain of the stem.

To summarize, there are two contrasts to be made in the data: (1) there is the difference between the phonological outcomes of subject agreement and object clitics when attached to the perfect verb stem, even when the phonological pieces are the same (248b vs. 248c for /hataf/); (2) there is a different phonological outcome when the object clitic attaches to the perfect verb stem which depends on the phonological shape of the stem (248c for /hataf/ vs. /ʔaraj/). These contrasts are summarized in (249):

(249) Contrasts in Phonological Outcomes

	Subject vs. Object		Object in Strong vs. Weak Stems	
Pieces:	hataf + na <sub>sub</sub>	hataf + na <sub>obj</sub>	hataf + na <sub>obj</sub>	ʔaraj + na <sub>obj</sub>
Outcome:	hátafna	hatáfna	hatáfna	ʔrá:na
	syncope	no syncope	no syncope	syncope

An ideal analysis will be able to account for both of these contrasts.

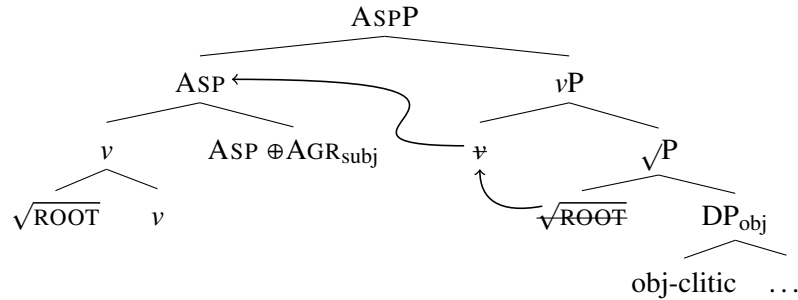
#### 4.6.2.2 Analysis Overview

In the framework proposed here, the contrast between subject agreement and object clitic will begin as a standard difference between suffixes and clitics: suffixes are part of the M-Word of the verbal stem while clitics are not. This analysis is supported by the syntactic distribution of these morphemes: The subject agreement morphemes only appear on verbs and are obligatory while the object clitics are optional and can appear attached to other hosts, such as prepositions.<sup>22</sup>

(250) Syntactic Structure of Maltese verb and object clitic<sup>23</sup>

<sup>22</sup>Examples of prepositions with object clitics include: /taht-na/ “under us”, /fi-ja/ “in me”, /lil-hom/ “to them” (Borg and Azzopardi-Alexander 1997).

<sup>23</sup>Maltese is described as having an aspect rather than a tense system by Borg and Azzopardi-Alexander (1997) so an ASP node is used in this tree. Whether this node is aspect or tense or both does not affect the relevant morphophonology.



The proposed structure of the Maltese verb and object clitic is shown in (250). Syntactic head movement must occur raising the  $\sqrt{\text{ROOT}}$  to  $v$  and to ASP, and the ornamental AGR node must be added to this complex head (shown here on the ASP head; see Embick and Noyer 2007 on ornamental or dissociated morphemes). The structure posited here assumes that the object clitic originates as a specifier of an object DP, but any syntactic structure which has the clitic generated outside the  $\sqrt{\text{ROOT}}-v$ -ASP-AGR complex is consistent with the morphophonological analysis.

The resulting structure is one in which the object clitic and the  $\sqrt{\text{ROOT}}-v$ -ASP-AGR complex are linearized adjacent to one another, but not in the same M-Word. The linearized morphosyntactic structure before combining the clitic is shown in (251):

- (251) Linearized morphological structure of Maltese verbal complex and object clitic  
 $[ \sqrt{\text{ROOT}} \oplus v \oplus \text{ASP} \oplus \text{AGR} ]_M \text{ } [ \text{obj-clitic} ]_M$

Following the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, the structure in (251) results in the exponents of the  $\sqrt{\text{ROOT}}-v$ -ASP-AGR complex being a  $\omega$ -Word to the exclusion of the object clitic, as shown in (252).

- (252) Initial phonological structure of Maltese verbal complex and object clitic  
 $( \sqrt{\text{ROOT}} + v + \text{ASP} + \text{AGR} )_\omega + \text{obj-clitic}$

Assuming that syncope applies only within  $\omega$ -Words, the pattern of syncope seen in the strong final stem cases falls out from structure in (252).

To account for the inclusion of the object clitic in the domain of syncope in weak final stems, I propose the an application of Local Dislocation, schematized in (253):

(253) Maltese object clitic Local Dislocation Rule

$[/X/ ]_M \neg [ \text{obj-clitic} ]_M \rightarrow [ /X/ \oplus \text{obj-clitic} ]_M$

where the phonological form of /X/ ends in a vowel<sup>24</sup>

Note that, like the case of Makassarese above, the application of Local Dislocation to the object clitic is conditioned by the segmental phonology of the final segment of the host.

When Local Dislocation moves the clitic into the M-Word of the verbal complex. This results in the inclusion of the clitic in the  $\omega$ -Level processes of the verb, and thus it is included in the domain of syncope.

#### 4.6.2.3 Analysis Details

In this section, I illustrate the analysis of Maltese in more detail. Let us assume the following phonological processes in Maltese:

(254) Some relevant  $\omega$ -Level Phonological Processes of Maltese:

- Stress:
  - Extramoraic final consonant<sup>25</sup>
  - Quantitative trochees built left to right (or aligned left)<sup>26</sup>  
Possible Feet: (H L), (L L), (H)  
No degenerate feet: \*(L)
  - End Rule Right: Rightmost foot get main stress
- Syncope: Delete unstressed vowels not in the final syllable

<sup>24</sup>Note that this Local Dislocation occurs with stems which underlyingly have a glide (or other weak consonant). However, at the time of application, the final segment of the clitic's neighbor (and host) is a vowel because deletion has previously applied to the final glide.

<sup>25</sup>Kiparsky (2011) suggests that postvocalic /j/ (and /w/) should be considered part of a diphthong and thus be moraic (even in final position). This suggestion is not adopted here, although the morphophonological analysis could potentially be adapted to include this assumption without damaging the theoretical point. One possibility which would be consistent with both the analysis presented here and Kiparsky's analysis is that glides derived from vowels are moraic while underlying glides are not. Under this assumption the final glide of the verbal root /ʔaraʃ/ would be non-moraic (as is needed for the analysis here), while the surface glides of nouns such as *kawkáw* "cocoa" and *mexxéj* "leader" as well as the plural marker in the imperfect (underlying /u/, surfacing as /w/ in weak final stems) would be moraic (resulting in heavy final syllables in these forms).

<sup>26</sup>For the main thrust of the argument, the domains are small enough that the direction or alignment of footing is unclear. For the derivation of the imperfect form of the strong final stem (/ja/+hataf+/u/ → /jahtfu/ "they were snatching") the footing critically needs to be left-to-right so this directionality is used here.

The derivation of the strong final stems using the processes in (254) and the phonological structure given in (252) above is shown in (255):

(255) Derivation of strong final consonant forms, example root /hataf/

	1pl. Subj. Agr. /na/	3Msg. Subj. Agr. -∅
Lin. Morph. Struct.:	$[ \sqrt{\text{ROOT}} \oplus_V \oplus_{\text{ASP}} \oplus_{\text{AGR}} ]_M$	$[ \sqrt{\text{ROOT}} \oplus_V \oplus_{\text{ASP}} \oplus_{\text{AGR}} ]_M$
VI and Phon. Structure:	$( \text{hataf} + \emptyset + \emptyset + \text{na} )_\omega$	$( \text{hataf} + \emptyset + \emptyset + \emptyset )_\omega$
$\omega$ -Level Stress:	$( \text{hátafna} )_\omega$	$( \text{hátaf} )_\omega$
$\omega$ -Level Syncope:	$( \text{htáfna} )_\omega$	—
Output:	$( \text{htáfna} )_\omega$	$( \text{hátaf} )_\omega$
Addition of Clitic:		+ 1.pl Obj. Clitic /-na/
Lin. Morph. Struct.:		$[ ( \text{hátaf} )_\omega ]_M \frown [ \text{obj-clitic} ]_M$
VI and Phon. Structure:		$( \text{hátaf} )_\omega + \text{na}$
Phrasal Restressing:	htáfna	hátafna

With the 1pl. subject agreement /-na/, the agreement suffix is part of the M-Word of the verbal stem, and thus is included in the domains of stress and syncope. This results in the syncope of the first vowel of the stem. In the case of the 1pl. object clitic, we must first build the 3Msg. subject agreement form ( $\rightarrow$ /hátaf/). The object clitic is added, but is not part of the  $\omega$ -Word, so it does not interact in the  $\omega$ -Level syncope process.

While the structure and phonological processes proposed above predict the correct syncope pattern, they do not output the correct surface stress for the form with the clitic. In (255), I have added a reapplication of the stress rules at a later stage (Phrasal or perhaps Clitic Group, depending on the architecture).<sup>27</sup> This results the correct surface stress and, since only the stress (and not syncope) is reapplied, there is surface opacity in the unstressed non-final vowels of the output.

For the weak final root /ʔaraj/ with the 1pl. object clitic, we expect that the phonological outcome should parallel that of the strong final root, but it does not ( $*/\text{ʔarájna}/$ ,  $*/\text{ʔará:na}/$ ). It must be noted that there is no reason to suppose a difference in initial syntactic structure between the

<sup>27</sup>This phrasal or postlexical restressing seems to be necessary. For example, Kiparsky (2011), while positing an analysis different from the one here, must also posit a postlexical reapplication of stress in cases where final long vowels are shortened (e.g.,  $/\text{ʔará:}/ \rightarrow / \text{ʔará} / \rightarrow / \text{ʔára} /$ ).

strong final and weak final cases; Both configurations have the same meaning (modulo the difference in root meaning) and the 1pl. object has the same morphological features and phonological exponent (/na/). Rather, I propose it is the application of Local Dislocation which modifies the structure, resulting in a difference in phonological output.

Maltese has several phonological processes affecting glides and vowels at word boundaries which must be included to give a full derivation:

(256) Additional  $\omega$ -Level Phonological Processes of Maltese:

- /j/-deletion: Delete /j/ at the right edge of a  $\omega$ -Word
- Final vowel lengthening: Lengthen a vowel at the right edge of a  $\omega$ -Word<sup>28</sup>

(257) Additional Phrasal Phonological Process:

- Shorten a long vowel at the right edge of a  $\omega$ -Word

The derivation of weak final stems using Local Dislocation is shown in (258). In the case of 1pl. subject agreement in (258), the derivation proceeds as in the case of the strong final stems. The subject agreement suffix /na/ is included in the verbal complex and thus in the  $\omega$ -Word. As such, it is in the domains of stress and syncope, resulting in the syncope of the first vowel of the stem. In the case of the 1pl. object clitic, we must first build the 3MSg. subject agreement form. Note that the output of the phonology at this stage is (minus phrasal V shortening) the same as the output of the 3MSg. form without a clitic (i.e., /ʔára/ “he read”). When the clitic is added, it begins outside the M-Word of the verbal complex. However, because the verbal complex (which was just spelled out) ends in a vowel, Local Dislocation applies. This moves the clitic into the verb’s M-Word resulting in its inclusion in the  $\omega$ -Level domain. Now it is included in the domain of stress and syncope, which results in the syncope of the initial vowel of the form.

(258) Derivation of weak final consonant forms, example root /ʔaraj/

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<sup>28</sup>The /j/-deletion process feeds the vowel lengthening process. While it might look like this vowel lengthening is a compensatory process related to the /j/-deletion in this example, other data (not presented here) shows that all final vowels lengthen regardless of whether or not a /j/ was deleted (see Borg and Azzopardi-Alexander 1997; this also plays an important role in Kiparsky’s (2011) analysis).

	1pl. Subject Agreement /na/	3Msg. Subj. Agr. -∅
Lin. Morph. Struct.:	[ $\sqrt{\text{ROOT}} \oplus \nu \oplus \text{ASP} \oplus \text{AGR}$ ] <sub>M</sub>	[ $\sqrt{\text{ROOT}} \oplus \nu \oplus \text{ASP} \oplus \text{AGR}$ ] <sub>M</sub>
VI and Phon. Structure:	( $\text{ʔara}j + \emptyset + \emptyset + na$ ) <sub>ω</sub>	( $\text{ʔara}j + \emptyset + \emptyset + \emptyset$ ) <sub>ω</sub>
ω-Level Stress:	( $\text{ʔa}r\acute{a}jna$ ) <sub>ω</sub>	( $\text{ʔa}r\acute{a}j$ ) <sub>ω</sub>
ω-Level Syncope:	( $\text{ʔr}\acute{a}jna$ ) <sub>ω</sub>	—
ω-Level /j/-deletion:	—	( $\text{ʔa}ra$ ) <sub>ω</sub>
ω-Level final vowel length.:	( $\text{ʔr}\acute{a}jna:$ ) <sub>ω</sub>	( $\text{ʔa}ra:$ ) <sub>ω</sub>
Output:	( $\text{ʔr}\acute{a}jna:$ ) <sub>ω</sub>	( $\text{ʔa}ra:$ ) <sub>ω</sub>
Addition of Clitic:		+ 1.pl Obj. Clitic /-na/
Lin. Morph. Struct.:		[ ( $\text{ʔa}ra:$ ) <sub>ω</sub> ] <sub>M</sub> [ obj-clitic ] <sub>M</sub>
<b>Maltese Local Dislocation:</b>		[ ( $\text{ʔa}ra:$ ) <sub>ω</sub> $\oplus$ obj-clitic ] <sub>M</sub>
VI and Phon. Structure:		( $\text{ʔa}ra: + na$ ) <sub>ω</sub>
ω-Level Stress:		( $\text{ʔa}r\acute{a}:na$ ) <sub>ω</sub>
ω-Level Syncope:		( $\text{ʔr}\acute{a}:na$ ) <sub>ω</sub>
ω-Level /j/-deletion:		—
ω-Level final vowel length.:		( $\text{ʔr}\acute{a}:na:$ ) <sub>ω</sub>
Output:		( $\text{ʔr}\acute{a}:na:$ ) <sub>ω</sub>
Phrasal Final V Shortening:	$\text{ʔr}\acute{a}jna$	$\text{ʔr}\acute{a}:na$
Phrasal Restressing:	$\text{ʔr}\acute{a}jna$	$\text{ʔr}\acute{a}:na$

One point of interest with the derivation in (258) is it gives evidence for the recursion of the ω-Level phonology. The processes of /j/-deletion and final vowel lengthening only apply at the right edge of a ω-Word. However, we see /ʔr $\acute{a}$ :na/ (with /j/-deletion and final vowel lengthening) for the form with the 1pl. object clitic despite the fact that the /j/ and vowel are not word final in the surface form. The fact that we see the application of these processes indicates that the /j/ and the vowel must be word final at some point in the derivation. We can see from the 1pl. subject agreement form /ʔr $\acute{a}$ jna/ that these processes do not apply if the /j/ is not word final. This indicates that there must be a ω-Word boundary before the 1pl. object clitic. However, the entire form including the clitic

must be inside a  $\omega$ -Word in order for syncope to apply correctly. That is, the /-na/ of the object clitic must be excluded from one  $\omega$ -Word group (so that the /j/ and vowel are word final) but must also be included in one  $\omega$ -Word group for the application of syncope. The phonological grouping, then, must include two  $\omega$ -Word levels, as schematized in (259):

(259) Schematic of  $\omega$ -Word levels in case with clitic:

$$((\text{?araj} + \emptyset + \emptyset + \emptyset)_{\omega} + \text{na})_{\omega}$$

By contrast, this nested  $\omega$ -Word structure cannot be the case with the strong final consonant forms (/ħatáfna/) because application of  $\omega$ -Level phonology to the entire unit would result in syncope of the first vowel, which does not happen. That is, the object clitic must be excluded from any  $\omega$ -Word group, schematized in the structure of ( $\text{ħataf}$ ) $\omega$ -na.

#### 4.6.2.4 Alternative Analyses

##### 4.6.2.4.1 Prosodic Phonology

Although to my knowledge, no analysis of the Maltese data presented here has been published in a Prosodic Hierarchy Theory framework, it is worth addressing a potential analysis.

Like the analysis of Makassarese given by Basri et al. (2000), one could posit that the object clitics in Maltese are Affixal Clitics. This would mean that the host would be a PWd to the exclusion of the clitic, but that the host+clitic would also form a PWd. This is, in fact, precisely the same structure we see with the weak-final stems, as shown in (259) above. However, as mentioned above, this cannot be the structure for the strong final stems because we would expect application of syncope. That is, the object clitics behave like Affixal Clitics when interacting with weak-final stems but not when interacting with strong-final stems. If the behavior of these clitics is stored as Affixal or Free, as assumed in Prosodic Hierarchy Theories following the Storage Assumption, this is a difficult situation to resolve.

Without further rigging of the phonology, it cannot be the case that the stem+clitic unit has the same phonological structure in the strong final cases as in the weak final cases. Since this framework does not allow for an affix to change its type mid-derivation, it is difficult to derive the amphitopic

behavior of the object clitics in such a framework.

#### 4.6.2.4.2 Other Analyses

There has been discussion of the Maltese data previously in other frameworks.

Brame (1974), looking only at the strong final stem data, offers a solution using a cyclic phonology framework by placing (what becomes secondary) stress on the initial vowel when the subject agreement (3Msg. / $\emptyset$ /) is attached protecting it from later deletion, as shown in (260):

(260) Schematic of Brame's (1974) solution to *ħtáfna* vs. *ħatáfna*

	Stem + Subj. Agr.	Result	+ Obj. Clitic	Result
"we snatched"	ħataf + na →	ħtáfna		
"he snatched us"	ħataf + $\emptyset$ →	ħátaf ⇒	ħátaf + na →	ħàtáfna

While this works sufficiently for the strong final stems, it does not explain why the weak final stems behave differently.

Odden (1993) solves the strong final stem problem in a Lexical Phonology framework by having subject agreement attached at Level 1 but the object clitic attached at Level 2. By having syncope only apply at Level 1, the result is that syncope cannot apply after the object clitic is attached.

However, Odden also notices the difference in the pattern of syncope in the weak final stems (/ʔrá:na/ as compared to /ħatáfna/). In order to solve this problem (and the problem of the long vowel /a:/ in /ʔrá:na/), Odden adds a precompiling phase to his version of Lexical Phonology, wherein the morphemes are concatenated before any phonology occurs. This allows the Level 1 phonology to see if there is anything in Level 2 before applying the phonology, resulting in the ability to lengthen the final vowel and delete the initial vowel before proceeding to Level 2. This addition of precompiled phonology simply stores the idiosyncrasies of the stem forms, missing the generalization that the clitics are, in the relevant cases, behaving exactly like affixes.

Taking an entirely different approach, Wolf (2011) uses a Optimal Interleaving, an Optimality Theoretic framework that includes the spell-out of exponents as part of the OT system. Wolf proposes the use of PREC(ENDENCE) constraints which allow him to manipulate the order of exponent insertion with respect to phonological changes. This manipulation allows syncope to apply



at different points in the derivation with respect to the visibility of different morphemes (subject or object) and different shape stems (strong or weak) allowing Wolf to derive the surface pattern.

Kiparsky (2011) argues (convincingly) against both Odden and Wolf. He argues that Odden's approach amounts to allomorphy (storage of different stems) while Wolf's approach lacks empirical coverage and loses generalizations about the structure of grammar. Rather than the data falling neatly out of a particular framework and set of constraints, Kiparsky argues that Wolf needs to add additional PREC constraints for every new piece of data.

Kiparsky presents a solution in Stratal Optimality Theory following closely the cyclic phonology argument of Brame (1974). That is, secondary stress from the stem level protects the initial vowel of /hatafna/ from deleting, although secondary stress is later lost. However, this framework does not cover the data without further rigging of the phonology. Specifically, Kiparsky posits that final /j/ (and /w/) of weak final stems is the offglide of a nucleus diphthong and thus moraic (as compared to other final consonants which are extramoraic). This extra mora allows Kiparsky to foot /hata<f>/ and /ʔaraj<sub>μ</sub>/ differently, resulting in different secondary stress and, consequently, different syncope patterns.

While I agree with the principle of Kiparsky's framework that the asymmetries seen in the data should be solved by structural differences between affixes and clitics, Kiparsky's solution misses the generalization that the object clitics have variable behavior with respect to their ω-Word membership.

Additionally, Kiparsky's solution does not cover other data points from Maltese. Specifically, he posits that syncope only applies at a postlexical level. While there is not space for full treatment of the analysis here, any system which has only postlexical syncope of unstressed vowels along with binary feet predicts that there should never be deletion of two adjacent vowels (since one of the vowels should receive secondary stress and be protected). However, this seems to be exactly the case in some of the imperfective forms of strong-final stems in Maltese, where both of the stem vowels are deleted. For example, in /jãhtfu/ "they were snatching" (< /ja/ + /hataf/ + /u/) both stem vowels undergo syncope (Kiparsky's constraint set predicts \*/jãhtáfu/).

#### **4.6.2.5 Conclusion of Maltese Case Study**

Two contrasts in phonological behavior from Maltese subject agreement and object clitics were presented above. The first contrast is that, in strong final stems, the subject agreement suffixes fall within the domain of stress and syncope while the object clitics fall outside that domain. As in previous analyses, this contrast can be solved by a difference in the phonological grouping of the two types of morphemes. Subject agreement attaches inside the word level while object agreement attaches outside the word level. This correlates with the syntactic structure as the subject agreement is part of the same complex as the verbal stem while the object clitic is not.

The second contrast is between the object clitic in the case of strong final stems, where it appears outside the word level, and the same clitic in the case of weak final stems, where it appears inside the word level. I proposed that, in cases with weak final stems, the object clitic undergoes Local Dislocation which moves it inside the M-Word of the stem, and will result in it being a part of the same  $\omega$ -Word.

One point of interest in this case study is that there is evidence of recursion of the  $\omega$ -Level phonology in the cases where Local Dislocation has applied. We see application of /j/-deletion and final vowel lengthening on the verbal stem of the weak final verb even when the object clitic is attached. It thus appears that there are two nested  $\omega$ -Words, one which excludes the clitic and another which includes the clitic. However, this structure cannot be the case in strong final stems where Local Dislocation does not apply. We must therefore conclude that the resulting morphophonological structure of clitics is different between strong and weak final stems, as is predicted with Local Dislocation.

The relationship between the morphosyntax and the phonology proposed here, along with the changes to the morphological structure incurred by Local Dislocation, provide an explanation for why we see the pattern of  $\omega$ -Words in these cases.

#### **4.6.3 Discussion: Conditioning on Local Dislocation**

A brief mention of the limitations on the conditioning of Local Dislocation is warranted. In both the Maltese and Makassarese case studies above, the application of Local Dislocation was conditioned

on the phonemic features or CV status of final segment of the host. Other analyses involving Local Dislocation have used unconditioned application, in the case of Latin *-que* and the Bulgarian definite (Embick and Noyer 2001; Embick 2007b), and conditioning on the prosody (syllable count and stress) of the host, in the case of English comparative/superlative adjectives (Embick and Noyer 2001; Embick 2007a). Note that, at least in these cases, the conditioning factor is something very basic about the phonology of the host: its basic prosody or final segment CV status. While there is nothing inherent about the formulation of Local Dislocation that prevents a more complex phonological fact from conditioning the application, it is a nice fact that this complex interaction between the morphosyntax and the phonology only refers to very basic units and properties of each module.

By hypothesis, Local Dislocation should only be able to be conditioned on features that are visible to the constituents at the time of operation. That is, if these units have not yet been spelled out, only their morphosyntactic features should be available for reference. However, once they have been spelled out, their phonological information is available for reference (see Embick 2014 for a discussion of the interaction of syntactic cyclicity and phonological activity). This claim is upheld in the two case studies presented here because in both cases Local Dislocation is conditioned on the phonological information of morphemes that have already been spelled out.

#### **4.6.4 Case Study Summary and Conclusion**

In Makassarese, suffixes appeared to be inside the stress and epenthesis domain of the root while clitics appeared to be outside that domain. However, one clitic, the definite determiner, sometimes appeared to be inside the domain and sometimes appeared to be outside the domain. This inclusion or exclusion of the definite determiner was predictable based on the phonological shape of the stem to which it was attaching. I posited a rule of Local Dislocation sensitive to the phonology of the stem which moved the definite determiner from outside the M-Word of the stem (where it was derived syntactically) to inside to the M-Word of the stem. By the M-Word  $\Rightarrow$   $\omega$ -Word correspondence, this created a  $\omega$ -Word which included the definite determiner and resulted in it being included in the domain of stress and epenthesis.

Similarly, in Maltese, object clitics appeared to be outside the domain of stress and syncope for some verbal stems but inside the domain for other stems. Once again, the inclusion or exclusion of the clitic was predictable by the phonological shape of the stem. I posited a Local Dislocation rule which caused the object clitic to move inside the M-Word of the verbal stem in weak final cases, while remaining outside that domain (where it was initially derived from the syntax) in the strong final cases. This correctly derived the domains of application for stress and syncope.

The main thrust of the argument for both case studies is that the phonological behavior of certain clitics is variable with respect to  $\omega$ -Word boundaries. This variable behavior cannot be characterized by a single structure with recursive word groups (as in an Affixal Clitic) because in the situations where Local Dislocation does not apply, there is evidence against two  $\omega$ -Word groups. That is, the behavior of these clitics cannot be stored as a single attachment scheme, but must be sensitive to modifications made during the derivation.

In many frameworks (including Prosodic Hierarchy Theory, Lexical Phonology, Stratal Optimality Theory, and Distributed Morphology), the phonological behavior of an object is critically related to the procedures that assemble that complex form. However, these theories differ in whether the grammatical procedures for assembling complex forms are visible in the phonological behavior or whether that behavior is inherently stored with the pieces or with the whole forms.

In many cases, it is difficult to distinguish between these two types of theories because uniform phonological behavior of a form (or a morpheme) can be explained either by listing of that behavior in memory or by uniform derivation of that form. However, it is important to examine cases which can distinguish between these theories.

The case studies in amphitopic clitics presented here are one type of data that can distinguish between Listing and Contextually Determined Theories. Because these clitics appear as part of their host's  $\omega$ -Word in some cases but outside the  $\omega$ -Word in other cases, they are difficult to account for in theories which list the phonological behavior of the clitics as an inherent property. Instead, they support the view that changes to the morphological structure during derivation play a role in the determination of the phonological structure. That is, both syntactic and morphological operations may change the M-Word structure which, in turn, directly affects the  $\omega$ -Word structure, allowing

morphemes which underlying may be separate heads (and expected to behave like clitics) to join a  $\omega$ -Word and behave like affixes.

## 4.7 Chapter Conclusion

In this chapter I investigated a potential challenge to the correspondence between M-Words and  $\omega$ -Words, clitics. As independent syntactic units that sometimes appear to interact with the  $\omega$ -Level phonology, this is a potential problem. This problem has been noticed in the literature previously, and, in fact, is one of the motivations for the creation of Prosodic Hierarchy Theories.

I showed, however, that in the framework presented here we can maintain the M-Words  $\Rightarrow$  correspondence even in the face of clitics because the M-Word, unlike the grammatical word of previous frameworks, is a derived unit. This means that a variety of syntactic and morphological operations can create and change the M-Word structure. As I showed here, this allows us to easily analyze cases of amphitopy, in which morphemes shift between behaving phonologically as affixes and clitics.

Sometimes this is because of syntactic operations, such as head movement, as shown for Turkish in Section 4.4, sometimes this is because of morphological operations, such as Local Dislocation, as shown for Maltese and Makassarese in Section 4.6.

I made mention in several places of clitic “leaning” and the phonology of a higher phonological constituent which includes the  $\omega$ -Word and leaners (perhaps the Clitic/Constituent Group). However, a full treatment of this group, and of larger prosodic constituents, is not within the domain of this dissertation and is left for future research.

## Chapter 5

# Morpheme-Specific Phonological Rules

### 5.1 Overview and Proposal

In previous chapters, we have seen two types of interactions between morphology and phonology at the subword level: cyclic phonology and non-cyclic phonology. There are both cases of “pure phonology” in that the phonological blocks themselves are dealing only with phonological constituents. They are affected by the morphology in that the diacritics on morphemes and the morphological structure affect when these block are run and what exponents are in their domain. However, once this was determined, the changes made were only dealing with phonological constituents.

There other kinds of interactions at between morphemes and the phonology that are slightly more idiosyncratic to particular morphological pieces. It is well known that some phonological changes can be restricted to be triggered by certain morphemes or restricted to affect only certain morphemes. Following Embick (2012a, 2013), we can posit four different types of morphological and phonological rules as shown in (261): purely phonological rules, morphologically triggered rules, morphologically targeting rules, and morpheme/morpheme readjustments.

The first case, “normal” phonological rules, we have already seen with the majority of the processes discussed so far. The environment and sensitivity for these rules are defined only in terms of phonological features and obey phonological locality. The other types of rules are sensitive to morphological diacritic or features in various ways.

(261) Rule Typology

(Embick 2012a, 2013)

	Phonological Trigger	Morphological Trigger
Phonological Target	a. “Normal” Phonological Rules	b. Morphophonological Rules Type 1
Morphological Target	b. Morphophonological Rules Type 2	c. Morpheme/Morpheme Readjustments

- a. “Normal” Phonological Rules: Phonological rules which have phonological triggers and targets. Expected to obey *phonological locality*.
- b. Morphophonological Rules: Phonological rules in which either the trigger (Type 1) or target (Type 2) is morphological. Expected to obey *phonological locality*.
- c. Morpheme/Morpheme Readjustments: Rules that change the form of one morpheme when adjacent to another morpheme. Expected to obey *morphological locality*.

Morphophonological rules are rules that are activated by a morphological trigger or target, but otherwise look very phonological in nature. In the framework here, I propose that phonological rules may be turned on (or off) by diacritics on the morpheme or exponent (following Halle and Nevins 2009; Embick 2010a). This keeps the phonological block purely phonological (as indicated by the process itself), but allows for rules to be activated or deactivated by morphological diacritics.

One ramification of this approach is that, when dealing with morphologically triggered phonological rules, morphemes should only be able to trigger or block rules for phonological blocks that they interact with. That is, cyclic morphemes should be able to have a diacritic to turn on or off rules of the cyclic block. Non-cyclic morpheme, on the other hand should not be able to do this because they are not integrated into a cyclic buffer and do not interact with the cyclic phonology. Both cyclic and non-cyclic morphemes should be able to carry diacritics which affect the non-cyclic block of the phonology. However, the expectation is that, by the time the non-cyclic phonology is run, the morphological features on the exponents may not be available anymore.

(262) **Morphological Trigger Strong Hypothesis:** Morphemes may only trigger or block application of phonological rules for phonological blocks which they interact with.

On the strong hypothesis here, this restricts the interaction in such a way so that morphological

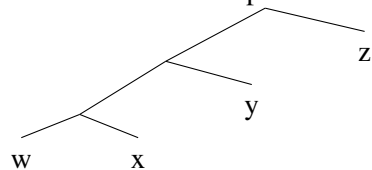
features on morphemes can trigger exceptional cyclic phonology, but only diacritics on exponents can trigger exceptional non-cyclic phonology.

Three examples of morphophonological rules are presented in the case studies below: Derived Imperfective Raising in Slavic in Section 5.2, German Umlaut (of the “elsewhere” type) in Section 5.3, and Plural Agent Palatalization in Kashaya in Section 5.4.

The other type of rule, morpheme/morpheme readjustments, are changes which are triggered by the placement of one morpheme in a morphologically local relationship to another morpheme. These rules do not follow phonological locality, but instead are sensitive to the morphological structure. These rules are some subset of readjustment rules in other version of DM, and have some similarity to what are called lexical rules in Lexical Phonology (see, e.g., Kaisse and Shaw 1985).

To account for the domain of morpheme/morpheme readjustments, I propose that linearization of the syntactic structure proceeds in two stages (following Pak 2008, cf. also Marantz 1984, 1988; Embick 2007b). In the first stage, called “concatenation”, morphemes are put in binary relationships with their linearly adjacent morphemes. In the second stage, “chaining”, these binary relationships are strung together into a single polyadic linear sequence. This is shown schematically for the subword level in (263):

(263) Schematic of two-step linearization at subword level



(Subword) Concatenation:  $w \oplus x, x \oplus y, y \oplus z$

(Subword) Chaining  $(w+x+y+z)$

At the level of syntactic complex heads, this division is motivated by different morphological and phonological operations which include either exactly two units or a string of units (see especially Pak 2008). The typological predictions of concatenation and chaining at both the subword and word levels is discussed further in Section 6.1.

I propose that morpheme/morpheme readjustments are operations implemented (or at least triggered) at the concatenation level. This limits their effect to linearly adjacent morphemes and



accounts for the fact that they are sensitive to the morphological features of both the trigger and target morphemes.<sup>1</sup> In contrast, I propose morphophonological rules (and “normal” phonological rules) are implemented at the chaining level. This accounts for their ability to potentially see across several morphemes (but still obey phonological locality).

Two examples of morpheme/morpheme readjustments are given in the case studies below: German Umlaut (type 1) in Section 5.3 and Decrement in Kashaya in Section 5.4.

Through the case studies below, I demonstrate the difference in the morphological and phonological properties between morphophonological rules and morpheme/morpheme readjustments.

## 5.2 Slavic Derived Imperfect Raising

In addition to the cyclic and non-cyclic rule types described above, there also seem to be rules which are triggered by specific morphemes. An example of this sort of rule, Derived Imperfective Raising, was briefly brought up in Section 2.2.3.

Recall that, in the normal interactions between the morphological structure and the phonology, underlying yers in Slovak and Polish have two surface forms, vocalized or deleted. There is another possibility, however, which is “raised”. One example was given in (24), reprinted here in (264):

(264)	Yer surface outcomes				(Rubach 1993, pp. 159–160)
	root	"to undo"	"I undo"	"They undo" (Derived Imperfect)	
	Slovak:	/pÄn/	odo+pä+t'	odo+pn+em	odo+pín+aj+ú
	Polish:	/p <sup>l</sup> En/	od+pią+ć	ode+pn+ę	od+pin+aj+a

In the second column of (264), “to undo”, we see the root yers surface as full vowels (albeit in Polish with some other changes). In the third column, “I undo”, we see the root yers are deleted. In

<sup>1</sup>It is sometimes difficult to distinguish between allomorphy and morpheme/morpheme readjustment. Both process can be sensitive to neighboring morphological features and both show phonological changed not associated with “normal” phonology. I propose two diagnostics: (1) Unlike allomorphy, morpheme/morpheme readjustments cause an activation of a phonological rule. As such, the relationship between forms in a morpheme/morpheme readjustment is not arbitrary, but is a recognizable phonological change from one form to the next. Allomorphy, on the other hand, shows no particular phonological relationship from one allomorph to the next. (2) The environment for morpheme/morpheme readjustment is often heterogeneous (i.e., a list of triggers for the target). Under the usual assumption that we do not want disjoint environments for allomorphic vocabulary items, an allomorphic analysis of such a heterogeneous environment would result in several exponents for different environments that coincidentally have the exact same phonological form. In this case, a morpheme/morpheme readjustment analysis seems preferable.

the fourth, however, they surface as full vowels, but as /i/ rather than their normal vocalized quality.

This change from the underlying yer to /i/ is found in many Slavic languages and is traditionally called Derived Imperfective (D.I.) Raising because it is triggered *only* by the addition of the Derived Imperfective morpheme /aj/.<sup>2</sup> This morpheme is one of the normal ways to form an imperfective aspect, as shown for verbs without a yer in (265):

(265) Derived Imperfective /aj/ with yer-less roots<sup>3</sup>

a. Slovak (Rubach 1993, pp. 62–64)

Perfective		D.I. (3PL)	Gloss
dvih-nú-t'	→	dvíh-aj-ú	“raise”
o-vlád-nu-t'	→	o-vlad-aj-u	“command”
u-my-t'	→	u-my-j-ú	“wash”

b. Polish<sup>4</sup> (Rubach 1984, p. 37)

Perfective		D.I. (3PL)	Gloss
gryż-ć	→	(wy-)gryz-aj-ą	“bite (out)”
od-młodz-i-ć	→	od-mładz-aj-ą	“make younger”
za-pros-i-ć	→	za-prasz-aj-ą	“invite”

However, when it attaches to a root with a yer, that yer surfaces as /i/ (written <i> or <y> in Slovak).

(266) Derived Imperfective /aj/ with a yer-full root

a. Slovak (Rubach 1993, pp. 150)

UR	Examples	D.I. (3PL)
/na+zOv/	ná-zov, na-zv-u	na-zýv-aj-ú
	“name (NOM,GEN)”	“they name”
/pri+jEm/	prí-jem, prí-jm-u	pri-jím-aj-ú
	“receipt (NOM,GEN)”	“they receive”

<sup>2</sup>Slovak also shows vowel lengthening before the Derived Imperfective /aj/ (Rubach 1993, p. 63).

<sup>3</sup>The D.I. forms are shown with 3PL subject agreement because that particular agreement exponent does not cause any further changes to the D.I. exponent (such as *j*-deletion).

<sup>4</sup>Note that the D.I. morpheme also causes some other changes, such as *o*-lowering and *s*→*sz*.

b. Polish

Root	Examples	D.I. (3PL)	
/zamEk/	zamek, zamk-a "lock (NOM,GEN)"	zamyk-aj-a "they will lock"	(Rubach 1984)
/sEch/	sech-ł, sch-ł-a "he dried", "she dried"	wy-sych-aj-a "they dry"	(Booij and Rubach 1987)
/posEl/	poseł, posła "envoy (NOM,GEN)"	posył-aj-a "they send"	(Booij and Rubach 1984)

As shown in (266), yers which normally either delete or vocalize to /e/ or /o/ surface as /i/ when followed by the D.I. /aj/. The classic formulation of this rule is simply to put the /aj/ in the context for the raising change and tag it with a morphological bracket for D.I., as shown in (267):

(267) Classic formulation of D.I. raising for Polish<sup>5</sup> (Gussmann 1980; Rubach 1984, 1986)

$$\left[ \begin{array}{c} \text{V} \\ +\text{high} \\ -\text{tense} \end{array} \right] \rightarrow [+tense] / \_ \text{C}_0 \text{aj}_{\text{D.I.}}$$

This sort of formulation is strange in a framework that attempts to separate morphological and phonological information. It is even stranger that the rule needs to reference both the phonological and the morphological information of the D.I. morpheme, because other exponents of the D.I. morpheme (such as /ova/ or /eva/) do not trigger raising. Note, however, that the actual process applied is a relatively natural phonological process, it just happens to be triggered exceptionally by a morphological object rather than being a normal part of the phonological block.

This points to D.I. raising being a morphophonological rule, a rule which is triggered by some diacritic on the Derived Imperfect morpheme, but which triggers an otherwise phonological rule.

This strong hypothesis about phonological cyclicity for morphophonological rules, that only cyclic morphemes should be able to trigger processes in the cyclic phonology, holds for the D.I. raising case here. D.I. raising is posited to be a cyclic morphologically triggered rule by Rubach (1993, 1984). As expected, it is triggered by the D.I. exponent /aj/ and not other exponents of the

<sup>5</sup>This formulation assumes a representation of yers as high lax vowels which normally get "lowered" (what I am calling "vocalization") but get tensed instead by D.I. raising.

D.I. morpheme. Additionally, the raising rule interacts with the rest of the cyclic phonology. For example, in Polish, D.I. Raising occurs before vowel lowering before /r/, and the newly raised yer is lowered to /ie/, as shown in (268):

(268)	D.I. raising before /r/-lowering	(Rubach 1984, pp. 55–56)
	Root	Example
	/umEr/	umrɛ “I will die”
	/wE-spEr/	wesprɛ “I will support”
		D.I. Raising and /r/-lowering
		umEr-aj → umir-aj → umier-aj (IMPER)
		wE-spEr-aj → wE-spir-aj → w-spier-aj (IMPER)

Slovak also has a similar vowel lowering process which occurs before all before liquids (Rubach 1993, pp. 150–151).

Another interaction between the D.I. morpheme and the cyclic phonology is yer vocalization. Note, first, that where D.I. raising applies it is not a situation in which the root yer would normally vocalize. That is, the root yer is not followed by another yer. The D.I. raising process changes the yer into a full vowel, which then will change the interaction between that vowel and any preceding yers. For example, in the second example of (268), note that in the example *wesprɛ* the root yer is deleted but the prefix yer is vocalized. In contrast when D.I. raising applies to the stem, the prefix yer is not vocalized (because it is not followed by an unvocalized yer).<sup>6</sup>

To summarize, I propose that diacritics on the derived imperfect morpheme trigger the process of yer raising. This is a classic case of a morphophonological rule with a morphological trigger, but a phonological target.

### 5.3 German Umlaut

German Umlaut is interesting for the study of morpheme-specific rules because it appears to be two processes; one is a morphophonological rule with a morphological trigger and the other is a morpheme/morpheme readjustment rule.

<sup>6</sup>Note that in Slovak, the generalization that the prefix interacts first with the root is true here also:

(1)	odopínaj “they undo”	(Rubach 1993, pp. 159–160)
	Cycle 1: odO + pÄn → odopÄn	
	Cycle 2: odopÄn+aj → odopín+aj (/aj/ is added and raising applies)	

Both German umlaut processes are processes by which a back vowel gets fronted. The correspondences are shown in (269):

(269) Umlaut vowel correspondences (Wiese 1996a,b)

/u:/	→	/y:/	<i>Huhn</i> ~ <i>Hühn-er</i> “hen (sg.,pl.)”
/ʊ/	→	/ʏ/	<i>dumm</i> ~ <i>dümm-lich</i> “silly”, “foolish”
/o:/	→	/ø:/	<i>Vogel</i> ~ <i>Vögel</i> “bird (sg.,pl.)”
/ɔ/	→	/œ/	<i>Holz</i> ~ <i>hölz-ern</i> “wood”, “wooden”
/a:/	→	/ɛ:/	<i>Europa</i> ~ <i>europä-isch</i> “Europe”, “European”
/a/	→	/ɛ/	<i>Stand</i> ~ <i>ständ-ig</i> “stand (n.)”, “continuous”
/aʊ/	→	/ɔʏ/	<i>sauf-en</i> ~ <i>Säuf-er</i> “drink (v.)”, “drinker”

The actual phonetics/phonological features of the process are a little complicated, but this will be ignored here. The point is that the vowel correspondences of Umlaut are able to be described as a phonological change.

However, the application of Umlaut is not purely phonological. While historically the process derives from a phonetic and then phonological fronting of back vowels before front vowels or glides in the following syllable, in modern German it is no longer phonological. It is instead sensitive to morphological features and diacritics.

There are two senses in which Umlaut is not phonological. First, there is no relevant phonological generalization to be made about the triggers.<sup>7</sup> They are syllables, vowels, consonants and even have no phonological segments (e.g., *-lich*, *-isch*, *-ig*, *-en*, *-er*, *-e*, *-t*, *-st*, *-ø*). Second, the targets are not phonologically generalizable. That is, only back vowels undergo umlaut, but not every word containing a back vowel undergoes umlaut with every trigger, for example, *dumm*~*dümm-er* “dumb, dumber” but *dumpf*~*dumpf-er* “dull, duller”. So the Umlaut process is a phonological change but is sensitive to several morphological factors.

I propose that there are actually two different Umlaut processes, or, at least, that the Umlaut process is able to be turned on in two different ways. This is because there are two different types of suffixes that cause umlaut with different sensitivities.

<sup>7</sup>Kiparsky (1996) points out that none of the triggering suffixes has a back vowel. I take this to be a fact about the diachronic circumstances of the process rather than anything meaningful about the synchronic process.

### 5.3.1 Morphophonological Umlaut with *-chen* and *-lein*

The first Umlaut process occurs with the diminutive suffixes *-chen* and *-lein*. With these suffixes, all possible umlaut targets undergo umlaut. That is, any back vowel immediately adjacent to *-chen* or *-lein* is fronted:<sup>8</sup>

(270)	Regularity of Umlaut for <i>-chen</i> and <i>-lein</i>	(Wiese 1996a)
	<i>Glöck-chen</i> “bell (dim.)”	<i>Fräu-lein</i> “miss”
	<i>Hünd-chen</i> “dog (dim.)”	<i>Häus-lein</i> “house (dim.)”
	<i>Melön-chen</i> “melon (dim.)”	<i>Lämp-lein</i> “lamp (dim.)”
	<i>Büs-chen</i> “bus (dim.)”	<i>Männ-lein</i> “man (dim.)”
	<i>Natiön-chen</i> “nation (dim.)”	<i>Gärt-lein</i> “garden (dim.)”
	<i>Progrämm-chen</i> “program (dim.)”	<i>Löch-lein</i> “hole (dim.)”

This, then, looks very much like a morphophonological rule with a morphological trigger but a phonological target. I propose that these suffixes carry a diacritic which turns the Umlaut process on for the phonological material to its left. This parallels the case of Derived Imperfect Raising seen in Section 5.2.

Note that this umlauting process follows phonological locality in that it can only trigger fronting on the vowel immediately to the left of the suffix, for example, *\*Bübi-lein* “little Bubi”, *\*Dörit-chen* “little Dorit” (Kiparsky 1996).<sup>9</sup> The diacritic on the suffix turns on the Umlaut process, but the application of Umlaut proceeds as if it were a normal rule of the phonological block (following Halle and Nevins 2009; Embick 2010b).

### 5.3.2 Umlaut as Morpheme/Morpheme Readjustment

Unlike *-chen* and *-lein*, other suffixes which trigger Umlaut have a more idiosyncratic distribution. In these cases the triggering suffixes are heterogeneous, meaning there is no phonological or morphological generalization to be made about them, as shown in (271):

<sup>8</sup>Note that there is also a different suffix *-chen*, forming a hypocoristic rather than a diminutive, which does not appear to cause always trigger umlaut (Wiese 1996a).

<sup>9</sup>Note that a few apparent counterexamples of this, such as *Väter-chen* “father (dim.)” and *Vöge-lein* “bird (dim.)” (< *Vogel*) can be explained with schwa-epenthesis before the liquids after Umlaut applies (Kiparsky 1996).

(271) Some Morphosyntactic Environments for Umlaut (Wiese 1996a; Embick and Halle 2005)

- a. Verbal Agreement: *fahr-en* “drive” ~ *fähr-t* (3sg pres.)
- b. Subjunctive Mood: *brach-t-e* “brought” ~ *bräch-t-e* “would bring”
- c. Noun Plurals: *Huhn* ~ *Hühn-er* “hen(s)”, *Vogel* ~ *Vögel* “bird(s)”, *Hand* ~ *Händ-e* “hand(s)”
- d. Adjective Formation: *Europa* “Europe” ~ *europä-isch* “European”, *glaub-en* “believe” ~ *gläub-ig* “devout”
- e. Comparatives: *lang* ~ *läng-er* “long(er)”
- f. Noun formation: *gut* “good” ~ *Güt-e* “goodness”, *bau-en* “build” ~ *Ge-bäu-de* “building”, *dumm* “silly” ~ *Dümm-ling* “fool”
- g. Feminine Gender: *Hund* ~ *Hünd-in* “dog (masc., fem.)”

As mentioned above, the targets are also heterogeneous in that not every morpheme containing a back vowel undergoes Umlaut with every (or any) trigger. In fact, even a root which does undergo Umlaut with one trigger may not with the other. There is no cline or scale of Umlaut-trigger strength either, but the choice is specific to each trigger and target. For example, verbal roots idiosyncratically Umlaut with the 3SG agreement and the agentive noun, as shown in (272):

(272) Trigger-Target pair specificity for Umlaut

Infinitive	3SG pres. indic.	Agentive Noun	Gloss
<i>mal-en</i>	<i>mal-t</i>	<i>Mal-er</i>	"paint-paints-painter"
<i>back-en</i>	<i>back-t</i>	<b><i>Bäck-er</i></b>	"bake-bakes-baker"
<i>fahr-en</i>	<b><i>fähr-t</i></b>	<i>Fahr-er</i>	"drive-drives-driver"
<i>trag-en</i>	<b><i>träg-t</i></b>	<b><i>Träg-er</i></b>	"carry-carries-carrier"

In (272) we see that all four possibilities with the Umlaut triggers 3SG and agentive noun exist. Any given root may Umlaut with either one of the suffixes independently of its choice for the other.

This indicates that in order for this version of Umlaut to apply both the trigger and target must be morphologically determined. This is confirmed by the necessity for morphological locality between

the trigger and the target. For example, as shown in (273), the root *Mann* which undergoes Umlaut with the suffix *-lich* does not undergo it if there is an intervening morpheme.

(273) Effect of intervening morpheme (Lowenstamm 2012)

- a. *Mann* “man”, *männ-lich* “manly”
- b. *Mann-schaft* “team”, *mann-schaft-lich* “teamlke” (\**männ-schaft-lich*)

Note that the morpheme specificity of Umlaut is not limited to roots. Compare the non-undergoing of Umlaut of *-schaft* next to *-lich* with the undergoing of *-tum* with the plural *-er* regardless of the stem:

(274) Stem independent Umlaut: *-tum*, *-tüm-er*

*Reich-tum*, *Reich-tüm-er* “wealth (sg.,pl.)”

*Eigen-tum*, *Eigen-tüm-er* “property (sg.,pl.)”

*Irr-tum*, *Irr-tüm-er* “error (sg.,pl.)”

*Kaiser-tum*, *Kaiser-tüm-er* “empire (sg.,pl.)”

That is, this Umlaut process needs to be analyzed as a morpheme/morpheme readjustment rather than the morphophonological rule proposed for *-chen* and *-lein*.

I propose to implement this rule as the activation of a phonological rule at the Subword concatenation level. That is, for each statement  $x \oplus y$ , if  $x$  has  $y$  on a list of Umlaut triggers (for itself), turn on the Umlaut rule for  $x$ .<sup>10</sup> Note that this differs from the morphophonological rules which do not

<sup>10</sup>Wiese (1996a,b) notes that umlaut with compounds actually works in the opposite direction than expected. That is, if being a target for Umlaut is a diacritic feature, then we might expect compounds to either maintain the feature from their constituent parts or lose the feature. What we don't expect is for compounds to act as targets for Umlaut even when their constituent part is not! For example:

- (1) Exceptional Umlauting in compounds: (Wiese 1996a,b)
  - a. *blut-ig* “bloody” (\**blüt-ig*), *blut* is not a target for *-ig*  
*Voll-blut* “full-blood, thoroughbred” → *voll-blüt-ig* “full-blooded”
  - b. *mut-ig* “brave” (\**müt-ig*), *mut* is not a target for *-ig*  
*Groß-mut* “generosity” → *groß-müt-ig* “generous”

Because of this, I propose that the trigger/target situation for Umlaut might be somewhat inverted. That is, Umlaut-triggering suffixes want to trigger Umlaut on everything they attach to. Targets, rather than having a list of suffixes which *do* cause umlaut, have a list of suffixes which *do not* cause umlaut. If this is the case, then it seems more natural that derived items, such as compounds (also past tense forms of strong verbs), would undergo umlaut by default. Because this particular aspect of Umlaut is not necessary for the broader point of the discussion on morphologically triggered and targeted rules, I leave the details of this analysis for future work.



look for a list but simply turn on the the rule.

### 5.3.3 Morphological or Phonological Locality

Kiparsky (1996) argues that the Umlaut process is actually phonologically local and not morphologically local. For the analysis of the second type of Umlaut as a morpheme/morpheme readjustment, it is crucial that the locality is morphological and not phonological. Unfortunately these domains are largely overlapping, so it can be difficult to tell.

Kiparsky makes several observations about the phonological nature of Umlaut. He notes that the application of Umlaut depends on specific allomorph for triggering context. That is plural *-s* does not trigger Umlaut, but plural *-er* does. Therefore, he argues that Umlaut must follow selection of allomorph. In the framework presented here, this argument does not hold because the selection of the allomorph is done by the internal morpheme. That is, in the situation  $x\oplus y$ , it is the features of  $x$  that select for which allomorph of  $y$  will be chosen. For example,  $\sqrt{\text{HAND}}$  knows that its plural is going to be *-e* (because the features of  $\sqrt{\text{HAND}}$  are what cause *-e* to be inserted, and doesn't need *-e* to have already been selected in order to activate its Umlaut rule. The fact that the plural morpheme is next to  $\sqrt{\text{HAND}}$  is sufficient information to know what is going to happen.

However, the critical case for Kiparsky is the past subjunctive in which, according to him, the trigger for Umlaut is separated from the target by a morpheme (but not another vowel). Kiparsky gives the example *bräuch-t-e* "s/he would need". Under the assumption that the trigger for the Umlaut is the *-e* of the agreement suffix, this indeed looks like a violation of morphological locality. However, I question the assumption that *-e* AGR[3sg] is the trigger. First, *all* agreement suffixes in the past subjunctive would have to diacritically trigger Umlaut. This is very coincidental if, by his own admission, Umlaut is triggered by allomorphs and not features. However, the very same agreement exponents appear on the past indicative and the subjunctive present forms without causing any Umlaut (and without an intervening morpheme in the subjunctive present). The paradigms are given in (275):

(275) Present Subjunctive, Past Indicative, and Past Subjunctive Paradigms of *brauchen* "need"

	1SG	2SG	3SG	1PL	2PL	3PL
Present Subjunctive	<i>brauch-e</i>	<i>brauch-est</i>	<i>brauch-e</i>	<i>brauch-en</i>	<i>brauch-et</i>	<i>brauch-en</i>
Past Indicative	<i>brauch-t-e</i>	<i>brauch-t-est</i>	<i>brauch-t-e</i>	<i>brauch-t-en</i>	<i>brauch-t-et</i>	<i>brauch-t-en</i>
Past Subjunctive	<i>bräuch-t-e</i>	<i>bräuch-t-est</i>	<i>bräuch-t-e</i>	<i>bräuch-t-en</i>	<i>bräuch-t-et</i>	<i>bräuch-t-en</i>

If we would like to claim that the agreement and tense exponents are the same between one tense/mood combination to the next, it is difficult to claim that the agreement exponents are the trigger of Umlaut in the Past Subjunctive when they do not trigger it in the other tense/mood combinations.

Instead, I posit that it is the [+subjunctive] feature on the T head which triggers umlaut in the past subjunctive (on verbal root targets which have that on their list of Umlauters). Specifically, I propose that [+subjunctive] in the context of T[+past] is a trigger for Umlaut. Note that the rest of the T[+past] node is spelled out as expected (-t).

This returns us to the situation in which Umlaut meets both phonological and morphological locality. Kiparsky (1996), however, notes several additional facts about the Umlaut change itself, some of which I already mentioned above: the target is a target is a single phonologically defined segment, the change is the assignment of a phonological property [-back], it is always the rightmost vowel that undergoes the change, and the change is fed by other phonological processes (such as schwa truncation, e.g., *Jude+isch* → *Jüd-isch*).

The question arising from this is: If this morpheme/morpheme readjustment is obeying morphological locality and not phonological locality, why does it look so much like it is phonologically local?

One possible solution is to propose that there is no phonologically locality constraining the synchronic application of the morpheme/morpheme readjustment. In principle, a readjustment does not have to obey these properties. The reason it appears that way is a result of the historical process that changed into the modern process. Because Umlaut used to be a phonological rule, it still seems to show phonological adjacency (but we might expect further changes to make this apparent adjacency disappear)

However, I propose a second solution. This solution takes the phonological locality of Umlaut as meaningful for the structural description of how morpheme/morpheme readjustments work. I posit that the morphophonological Umlaut rule and the morpheme/morpheme readjustment Umlaut are

actually the same rule. That is, the Umlaut process is stored in one place (in memory) and both the morphophonological rule and the morpheme/morpheme readjustment access that same process. By hypothesis, rules that change the phonological form have to have certain descriptions; they are able to pick out certain things (phonological edges, vowels, stress, etc.) and change them in certain ways. Because of this, the process is phonologically local.

This hypothesis tells us something more interesting about the nature of morphologically triggered rules in general: Phonological rules are phonological rules. They deal in phonological currency and can affect phonological units. However, these phonological rules can be accessed and activated (or deactivated) in a variety of ways. Rules may be on by default, in which case, they are part of the “normal” phonology. However, rules can also be activated by morphological diacritics (= morphophonological rules) or by a morphological readjustment relationship between two morphemes. Under this hypothesis, the reason morpheme/morpheme readjustments look phonologically local is because they are not changes themselves but activations of phonological rules for the phonological processing system.

#### **5.3.4 Case Study Conclusions**

I proposed that there were two types of German Umlaut processes, one which was a morphophonological rule and one which is a morpheme/morpheme readjustment. Both of these processes, however, seem to be an application of the same phonological change. I argued that this is because the changes caused by morphologically specific rules are underlyingly phonological in nature and that morpheme/morpheme readjustments and morphophonological rules are simply different methods for activating or deactivating that phonological rule.

### **5.4 Kashaya Decrement and Palatalization**

Kashaya (Southwestern Pomo) has a very complex phonology and interaction between the phonology and morphosyntactic domains. There is not space for a full treatment here (indeed, an entire dissertation could be written about it, such as Buckley 1994). However, I pick out two processes in particular which show sensitivity to specific morphemes: Decrement and Plural Agent Palatal-

ization. Here, I argue that Decrement has the properties of a morpheme/morpheme adjustment while Plural Agent Palatalization is a morphophonological rule with a morphological trigger but a phonological target.

In this section I will use the transcription system of Buckley (1994). Most segments have their IPA values except <y> which is the glide /j/, <t> which is a more dental stop /t̪/ and <ʈ> which is a more alveolar or retroflex stop /t̻~/t̻/. Vowel length is represented with the single dot /·/. There are three sequences of stops, plain (e.g., <p>), aspirated (e.g., <p<sup>h</sup>>), and glottalized (e.g., <p̥>), which is usually pronounced as an ejective. Note that except where important, I do some simplification of the representations so that the points under discussion are clear. For example, there are several complex processes involving vowel length which I ignore here (see Buckley 1994 for details).

### 5.4.1 The Decrement

The Decrement, called such by Oswalt (1961), is a process in Kashaya which deletes a laryngeal increment (a special /ʔ/ or /<sup>h</sup>/ linked with the following consonant) in certain morphological environments (Buckley 1994, p. 269ff.). For example, the alternation between the base noun and the locative form is shown in (276). Note that the locative, whose exponent is an increase in vowel length /-·/ as shown on roots without an increment in (276a), triggers the Decrement in roots with an increment in (276b).

(276) The Decrement with the locative suffix (Buckley 1994, p. 289)

a.	dono	“mountain”	dono·	“in, to the mountains”
	kulu	“wilderness”	kulu·	“in, to the wilderness”
	ʔimo	“hole”	ʔimo·	“in a hole”
b.	ʔa <sup>h</sup> q <sup>h</sup> a	“water” <sup>11</sup>	ʔaq <sup>h</sup> a·	“at, to the water”
	bi <sup>ʔ</sup> da	“stream”	bida·	“below, downward”
	ʔa <sup>h</sup> ca	“house”	ʔaca·	“home(ward)”

<sup>11</sup>Note that the laryngeal increment only occurs before consonants. The smaller /<sup>h</sup>/ written after a consonant (e.g., /q<sup>h</sup>/) represents aspiration on that consonant not an increment (see Buckley 1994).

The Decrement is morpheme specific in two ways. First, the triggers are heterogeneous both phonologically and morphologically, as shown in (277).

(277) Some Triggers for the Decrement

(Buckley 1994, p. 288ff.)

- Directional suffixes (some not all): /-ibic/ "up, away", /-aq/ "out hence", /-ala/ "down", etc.
- Plural Act allomorphs (most not all): /-t/, infixing /-t-/, /-w/, /ʔta/, -∅, /-aq/, /-ataq/, etc.
- Derivational suffix /-t/ forming verbs from nouns and adjectives
- The nominal locative suffix /-ʔ/
- 3sg. possessor prefix of kinship nouns: /miyaʔ-/

Note that there is no phonological generalization to be made about these triggers,<sup>12</sup> nor is there any morphological generalization to be made. That is, the trigger status seems to be diacritic in nature.

The targets of the Decrement are similarly idiosyncratic. While most laryngeal increments are subject to the Decrement under the right conditions, not all combinations of target and trigger result in the Decrement. For example, in (278), the plural act suffixes *-aq* and *-ataq* trigger the Decrement with the first host but not the second.

(278) Idiosyncratic blocking of the Decrement

(Buckley 1994, p. 291)

- a. ba-<sup>h</sup>c<sup>h</sup>ital-aq-ʔ → bac<sup>h</sup>itá'laʔ "string together (pl)"  
     di-<sup>ʔ</sup>kol-aq-ʔ → di<sup>ʔ</sup>kolaʔ "prune (pl)"
- b. qa-<sup>h</sup>p<sup>h</sup>ul-ataq-ʔ → qap<sup>h</sup>ulá'taʔ "winnow (pl)"  
     mu-<sup>h</sup>kul-ataq-ʔ → mu<sup>h</sup>kulataq-ʔ "stir while cooking (pl)"

Furthermore, the application of the Decrement obeys morphological locality. If a morpheme intervenes between the trigger and the target, there is no application of the Decrement. In (279a),

<sup>12</sup>Buckley (1994, p. 289, f.n. 23) notes that among the directional suffixes, only and all of those beginning with a vowel trigger the Decrement. However, given the fact that in other triggers this is not true, it must be a coincidence or a relic of diachronic change.

the intervening movement morpheme *-w* between the directional morpheme trigger and the increment in the root. Even more telling is that a phonologically null exponent, such as the verbal head which forms verbs from adjectives intervenes and blocks the Decrement, as shown in (279b).<sup>13</sup>

(279) Intervening morphemes block the Decrement

a. */-w/* (movement) (Buckley 1994, p. 296)

qo<sup>h</sup>q<sup>h</sup>o-w-ay-ač-ʔ → qo<sup>h</sup>q<sup>h</sup>owa'yaʔ “keep standing against (pl)”

mi<sup>h</sup>ca-w-ay-ʔ → mi<sup>h</sup>caway “toss to someone (pl)”<sup>14</sup>

b. *-∅* (*a* → *v*) (Buckley 1994, p. 295)

bu<sup>h</sup>ku “hunched over (adj.)”

bu<sup>h</sup>ku-∅-ad-i → bu<sup>h</sup>ku'du “walk along hunched over”

pi<sup>h</sup>ki “having a slender neck (adj.)”

pi<sup>h</sup>ki-∅-ala-w → pi<sup>h</sup>ki'law “stretch slender neck downward”

The intervening morphemes do not change the phonological locality of the rule (especially for the  $\emptyset$  exponent). That is, like in the case of Umlaut in Section 5.3, the actual change being made by the Decrement process is a well-defined phonological change. The process searches for the leftmost metrical consonant (i.e., it is sensitive to extrametricality) of the morpheme and, if it has an increment, deletes it. Neither of the morpheme interveners set up a situation in which the underlined increment would be phonologically discounted by the increment process.

Note that, because the Decrement is sensitive to extrametricality, the actual process itself must be run after the calculation of extrametricality, which is a phonological calculation. That is, the Decrement does not apply until some point (at least not initially) in the phonological block. As suggested above, this is evidence that, although the trigger and target for the Decrement are morphological, the implementation of a morpheme/morpheme readjustment is such that the readjustment activates a rule in the phonological block but the change is not actually processed until that phonological block is run.

<sup>13</sup>This analysis follows Oswald (1961) in positing that there is a phonologically null morpheme in these cases *contra* Buckley (1994), who posits a solution using bracket sensitivity. In the framework here, positing the phonologically null morpheme makes the most sense.

<sup>14</sup>Buckley (1994, p. 296) notes that there is a rarer form of this verb which does not take the *-w* movement suffix. In this case, as expected, the Decrement applies: mi<sup>h</sup>ca-ay-ʔ → mica' “toss to someone (pl)”.

Another piece of evidence for the fact that the Decrement is a morpheme/morpheme readjustment is the fact that it can be triggered by both prefixes and suffixes. Suffix examples were presented above, examples of the Decrement with a prefix is given in (280):

(280) Third person kinship prefix <i>miya-</i> triggers decrement	(Buckley 1994, p. 379)																		
	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%; border-bottom: 1px solid black;">No Decrement</th> <th style="width: 33%; border-bottom: 1px solid black;">Decrement</th> </tr> <tr> <td style="text-align: center;">2nd “your”</td> <td style="text-align: center;">3rd refl. “his/her own”</td> </tr> <tr> <td style="text-align: center;"><i>/h<sup>h</sup>ɛ/</i> “mother”</td> <td style="text-align: center;"><i>mi-h<sup>h</sup>ɛ</i>      <i>ma-h<sup>h</sup>ɛ</i></td> </tr> <tr> <td style="text-align: center;"><i>/h<sup>h</sup>cɛye/</i> “son-in-law”</td> <td style="text-align: center;"><i>mi-h<sup>h</sup>cɛye</i>      <i>ma-h<sup>h</sup>cɛye</i></td> </tr> <tr> <td style="text-align: center;"><i>/<sup>ʔ</sup>daq<sup>h</sup>aɪ/</i> “spouse”</td> <td style="text-align: center;"><i>mi-<sup>ʔ</sup>daq<sup>h</sup>aɪ</i>      <i>ma-<sup>ʔ</sup>daq<sup>h</sup>aɪ</i></td> </tr> <tr> <td></td> <td style="text-align: center;">3rd “his/her”</td> </tr> <tr> <td></td> <td style="text-align: center;"><i>miya-<sup>h</sup>ɛ</i></td> </tr> <tr> <td></td> <td style="text-align: center;"><i>miya-cɛye</i></td> </tr> <tr> <td></td> <td style="text-align: center;"><i>miya-daq<sup>h</sup>aɪ</i></td> </tr> </table>	No Decrement	Decrement	2nd “your”	3rd refl. “his/her own”	<i>/h<sup>h</sup>ɛ/</i> “mother”	<i>mi-h<sup>h</sup>ɛ</i> <i>ma-h<sup>h</sup>ɛ</i>	<i>/h<sup>h</sup>cɛye/</i> “son-in-law”	<i>mi-h<sup>h</sup>cɛye</i> <i>ma-h<sup>h</sup>cɛye</i>	<i>/<sup>ʔ</sup>daq<sup>h</sup>aɪ/</i> “spouse”	<i>mi-<sup>ʔ</sup>daq<sup>h</sup>aɪ</i> <i>ma-<sup>ʔ</sup>daq<sup>h</sup>aɪ</i>		3rd “his/her”		<i>miya-<sup>h</sup>ɛ</i>		<i>miya-cɛye</i>		<i>miya-daq<sup>h</sup>aɪ</i>
No Decrement	Decrement																		
2nd “your”	3rd refl. “his/her own”																		
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<i>/h<sup>h</sup>cɛye/</i> “son-in-law”	<i>mi-h<sup>h</sup>cɛye</i> <i>ma-h<sup>h</sup>cɛye</i>																		
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	3rd “his/her”																		
	<i>miya-<sup>h</sup>ɛ</i>																		
	<i>miya-cɛye</i>																		
	<i>miya-daq<sup>h</sup>aɪ</i>																		

If we expect the Decrement to have some sort of directionality, it would seem strange that either a prefix or a suffix could trigger the its application. However, under the proposal that morpheme/morpheme readjustments are triggered at the Subword Concatenation phase, then we should not be surprised to find readjustments triggered by either directionality of the binary relationship (a⊗b or b⊗a) between morphemes at that stage.

To summarize, given that the Decrement has heterogeneous triggers and targets and follows morphological locality, I propose that it is a morpheme/morpheme readjustment.

### 5.4.2 Plural Agent Palatalization

In contrast with the Decrement, Plural Agent Palatalization is a morphophonological rule with a morphological trigger but a phonological target. The Plural Agent is marked by changing all instances of /*n̩*/ to /*ɕ*/ (called Palatalization by Buckley 1994).<sup>15</sup> Note that the Plural Agent morpheme otherwise has a phonologically null exponent. Examples are given in (281), with the proposed location of the plural agent morpheme notated as  $\emptyset_{PA}$ :

(281) Plural Agent Palatalization <sup>16</sup>	(Buckley 1994, p. 140–141)
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<sup>15</sup>Note that the actual implementation of Plural Agent Palatalization is slightly more complicated because it only targets /*n̩*/s that have not already been syllabified into an onset (which results in their Desonorization to /d/). For simplicity here, I have shown those underlying /*n̩*/s which have already been Desonorized as /d/ and those that are targets for Palatalization as /*n̩*/. See Buckley (1994) for more details on the interaction.

<sup>16</sup>The placement of the  $\emptyset_{PA}$  in these examples is mine. Oswald (1961) and Buckley (1994) propose that the Plural Agent immediately follows the verbal stem. See discussion below.

mo-ht-aq-qa-meri- $\emptyset_{PA}$ - → mohtahqameč- “(pl.ag.) drive (cars) (pl.mvmt.)”  
 mo-ht-mani-iwani- $\emptyset_{PA}$ - → mohtimačiwac- “(pl.ag.) run here and there at a place (pl.mvmt.)”  
 du<sup>h</sup>luni-ani-ani- $\emptyset_{PA}$ - → du<sup>h</sup>lučacac- “(pl.ag.) keep picking while moving”  
 ca-ht-ani-ani-ani- $\emptyset_{PA}$ - → cahtačacacacac- “(pl.ag.) flit along (pl.mvmt.)”  
 mo-ht-manic- $\emptyset_{PA}$ - → mohtimačic- “(pl.ag.) run home (pl.mvmt.)”  
 wa<sup>h</sup>ni-wani-hqa- $\emptyset_{PA}$ -?k<sup>h</sup>e=t<sup>h</sup>in → wačwačqa?k<sup>h</sup>et<sup>h</sup>in “(pl.ag.) not let roam around”<sup>17</sup>

This process is a classic case of a morphophonological rule. The trigger is only the Plural Agent; no other morphological or phonological situation in the language triggers such a change. However, once the process is triggered, it proceeds as a well defined phonological rule, obeying phonological locality. Although it is slightly strange in that it is an iterative rule or some sort of harmony process, the change is simply to palatalize all /*n̄*/s to /*č*/. It follows phonological locality, rather than morphological locality. That is, it applies freely across morpheme boundaries, applies to roots and affixes alike, and can skip both morphemes that do not contain /*n̄*/ and phonemes that are not /*n̄*/.

Oswalt (1961) posits that the Plural Agent marker is the first suffix after the verbal stem (Buckley 1994 follows this as well). If this is the case, then the exact process of the change is a little strange; it would need to look both directions, left to the root and right to other suffixes, but be bounded by the some outer domain (Buckley’s Level 4 participates but Level 5 does not).<sup>18</sup> However, there is no morphosyntactic evidence given for the ordering of this particular suffix, and, because the exponent is /- $\emptyset$ /, it is impossible to say where it is based on segments.

As an alternative, I suggest that Plural Agent is placed somewhere relatively high in *vP* (perhaps *spec,vP*) for two reasons: (1) Plural Agent could easily be some sort of subject agreement (which otherwise does not exist in Kashaya),<sup>19</sup> which should reside in this position, and (2) the mor-

<sup>17</sup>This example is from Oswalt’s (1964) texts (10,20.1) as analyzed by Eugene Buckley.

<sup>18</sup>Buckley (2012) suggests that, because the only Level 5 suffix which is relevant is evidential /*n̄*o/, we can do away with the level restriction and instead have a phonological restriction which blocks Palatalization before [+round] vowels.

<sup>19</sup>Oswalt (1961) does present some evidence that the Plural Agent may not be exactly the subject:

- (1) Examples from Oswalt (1961, p. 154)
- a. mohtač “they are running along (under their own will and power)”
 

mo	-ht	-ani	- $\emptyset_{PA}$	
$\sqrt{\text{RUN}}$	Pl.Mvmt.	along	Pl.Agent	



phophonological evidence from Palatalization points to this position. That is, the morphemes inside the domain of Palatalization express object properties (plural act, plural movement), low aspect (inceptive, durative, distributive) and valency (reflexive, reciprocal, causative).<sup>20</sup> The morphemes outside the domain of Palatalization include mood (imperative, conditional), evidentials (visual, aural, circumstantial, hearsay), switch reference (same/different subject and temporal sequences) and the absolutive (used as perfective, infinitive or to form deverbal nouns/adjectives) (Buckley 2012, to appear). That is, the morphemes outside the domain seem to be related to T, higher aspect heads and CP domain semantics. Thus, I propose that the Plural Agent head is in spec,vP, which is where I show it in (281) above.

If the Plural Agent head is in spec,vP, the phonological process of Plural Agent is simplified somewhat. Under this assumption, when the Plural Agent head is considered by the phonology, it triggers the activation of Palatalization on all of the material already phonologized (that is, everything to its left).

To summarize, Palatalization is a morphophonological rule with a morphological trigger (the Plural Agent morpheme) and a phonological target and a phonologically defined change. It follows phonological locality.

### 5.4.3 Case Study Conclusion

Although the phonology-morphology interactions of Kashaya are complex, I have presented two interesting morpheme-specific processes here, the Decrement and Palatalization, which I argue have different trigger/target and locality conditions. I argue that the Decrement is a morpheme/morpheme readjustment while Palatalization is a morphophonological rule.

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b. kató'te mohtan? "the marbles are running along"  
 kató'te mo -ht -añ  
 marbles √RUN Pl.Mvmt. along

In (a.) there is a Plural Agent morpheme, as seen by the palatalization of the final consonant (*mohtač*). In (b.), however, there is no Plural Agent morpheme (*mohtañ*). Oswald argues that the logical subject (kató'te "marbles") is plural, but that there is no Plural Agent morphemes because the original agent or force causing the action is singular (e.g., spilling marbles from one bag). If Oswald's analysis is correct, then it seems that the Plural Agent morpheme is probably not exactly subject agreement. Nevertheless, I argue that, whatever the morpheme is, the morphophonological evidence points to it being structurally located somewhere in the vicinity of spec,vP.

<sup>20</sup>The directional affixes are also in the domain under Palatalization. I do not have anything interesting to say about their morphosyntactic position at the moment except to suggest that, based on the evidence from Palatalization, they must be inside the vP.

## 5.5 Chapter Conclusion

In this chapter I introduced the interaction of morphological and phonological triggers and targets. I posited four types of phonological rules: “normal” phonological rules, morphophonological rules with morphological triggers, morphophonological rules with morphological targets, and morpheme/morpheme readjustments.

I argued that morphophonological rules and morpheme/morpheme readjustments differ in several ways. Morphophonological rules follow phonological locality conditions and only show morpheme-specific idiosyncrasies for either a trigger or a target, not both. Morpheme/morpheme readjustments follow morphological locality conditions and show morpheme-specific idiosyncrasies for both the trigger and the target.

I proposed that this difference derives from the different stages of linearization at which these rules apply. Morpheme/morpheme readjustments apply at the stage of Subword Concatenation, in which there are only binary relationships between morphemes. Morphophonological rules apply at the stage of Subword Chaining in which the linear chain of morphemes is visible.

I noted, however, that all of these rules seem to have phonological rule descriptions, meaning the specific target of change and the actual featural change could be defined in purely phonological terms. I proposed that this fact indicated that the rules themselves were separate from the way they are activated or deactivated. That is, although rules may be (de)activated by morpheme/morpheme readjustments or morphophonological rules, the rule itself is housed in one of the blocks of the phonology and interacts with the other (“normal”) phonological rules of that block.

# Chapter 6

## Conclusions

### 6.1 Discussion: Typology of Domains for Phonological Processes

The framework proposed here uses a more intricate morphosyntax than many previous frameworks dealing with the morphology-phonology interface. In this section, I sketch out a variety of morphosyntactic relationships posited by this theory and attempt to link these structural relationships to different domains of phonological processes.

If we assume that the morphosyntax and the morphophonology are sensitive to the difference between M-Words and subwords (following the Typed Linearization Hypothesis of Embick (2007b), also assumed in Embick and Noyer 2001 and elsewhere), we can derive a typology of linearization domains to which phonological processes may apply. That is, I propose a derivational system that interleaves linearization of various types and application of phonological processes to the linearized material, each step in the linearization process is a potential domain for phonological processes.

At the level of the M-Word interaction, Pak (2008) argues that there are two steps of linearization and correspondingly two types of phrasal phenomena in the phonology. The first phase of M-Word linearization is Concatenation, which is the binary operation linking two adjacent M-Words. Phonology that applies to concatenated M-Words is restricted to applying across only the two constituents of the Concatenation operation. That is, at this level the domain for phonological processes is between two M-Words but not across multiple M-Words. After Concatenation, the Chaining operation applies to take the binary Concatenation statements and link them together in

order to linearize multiple M-Words across the entire domain. Phonological processes that apply at this stage have the ability to apply across many adjacent M-Words.

(282) Concatenation and Chaining operations from Pak (2008):

A, B, etc. are M-Words

- a. M-Word Concatenation:  $A\hat{B}$ ;  $B\hat{C}$ ;  $C\hat{D}$ ;  $D\hat{E}$  Pak's Example: Luganda Low Tone Deletion
- b. M-Word Chaining:  $(A-B-C-D-E)^1$  Pak's Example: Luganda High Tone Anticipation

Given that phrasal phonology phenomena are broken down into a stages of binary Concatenation and polyadic Chaining, I proposed in Section 5.1, that the same two stages of linearization also apply to the domain of Subwords:

(283) Proposed Subword Concatenation and Subword Chaining operations:

a, b, etc. are subwords

- a. Subword Concatenation:  $a \oplus b$ ;  $b \oplus c$ ;  $c \oplus d$ ;  $d \oplus e$
- b. Subword Chaining:  $(a+b+c+d+e)$

As discussed in Section 5.1, this division of Subword linearization aligns with the notions of morpheme/morpheme readjustments in comparison with morphophonological rules and “normal” phonological rules. Specifically, I propose that morpheme/morpheme readjustments apply at the stage of Subword Concatenation because they are restricted to applying to the constituents of a binary Subword Concatenation statement. Processes that apply at the stage of Subword Chaining, on the other hand, are able to see the entire chain of morphemes. That is, the domain of Subword chaining is coextensive with the domain for morphophonological rules and the cyclic phonology block. Because these processes see across several morphemes, they appear to be sensitive to phonological locality and not morphological locality.

Furthermore, I have shown that some phonological processes are sensitive to the domain of an M-Word but not to a chain of subwords. That is, a further type of phonological process applies after

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<sup>1</sup>Note that Pak (2008) allows for alternate groupings of M-Words during chaining depending on speech rate and other factors with Chain-splitting and Chain-merging operations.

the domain of Subword Chaining, but is sensitive to only a single M-Word and not to a binary pair of M-Words as is the case in M-Word Concatenation. These processes are the non-cyclic, or  $\omega$ -Level, phonology. This phonology applies after all subword or morpheme concatenation and phonology has applied but before an M-Word is grouped with neighboring M-Words for phrasal phenomena.

Finally, the behavior of clitics (simplex functional heads) with respect to neighboring M-Words presents a need for another level of phonological application. Some clitics are incorporated into the M-Word (via Local Dislocation, for example) and can be handled by a reapplication of the  $\omega$ -Word phonology. However, clitics which are not incorporated simply “lean” onto the  $\omega$ -Word. As discussed in Sections 4.4.4 and 4.3, there are phenomena which apply to exactly this group of  $\omega$ -Word and leaners and not across those groups. Here I propose the Clitic Leaning stage of linearization in which stray subwords lean onto neighboring  $\omega$ -Words to form a new constituent, the Clitic Group. It is interesting to note that the phonology of the Clitic Group is not the same as that of the M-Word/ $\omega$ -Word (see, e.g., Vowel Harmony in Section 4.4.4), but that both groups seem to be treated the same by subsequent steps of linearization.

Following Pak (2008) on the intuition that subwords are linearized with respect to each other before M-Words are, we may order the linearization of morphosyntactic structures and domains for phonology from smallest and first to largest and last. The full spectrum of these domains is shown in (284):

(284) Structures of Linearized Morphosyntax and Domains for Phonological Processes:

- a. Subword Concatenation:  $a\oplus b; b\oplus c; c\oplus d; d\oplus e$       cf. Morpheme/Morpheme Readjustments
- b. Subword Chaining:  $(a+b+c+d+e)$       cf. Morphophonological rules, Cyclic phonology
- c. M-Word creation:  $(a+b+c+d+e) \Rightarrow A$       cf.  $\omega$ -Word, Non-cyclic phonology, PWD
- d. Clitic Leaning:  $(A)_{\omega}=b \Rightarrow \{(A)_{\omega}=b\}_{CG}$       cf. Clitic Group
- e. M-Word Concatenation:  $A\bar{B}; B\bar{C}; C\bar{D}; D\bar{E}$       cf. Small domain phrasal, PPhrase
- f. M-Word Chaining:  $(A-B-C-D-E)$       cf. Large domain phrasal, Intonational Phrase

As shown on the right of each statement in (284), the steps of linearization of the morphosyntactic structure correspond to the domains of phonology discussed in a variety of phonological

theories. While in many theories of phonology these domains are theory internal, meaning the only reason to posit these domains is phonological, here I have given an explicit account of the relationship between each of these phonological domains and some aspect of the linearization of the morphosyntactic structure.

## 6.2 Conclusion

I set out to account for phonological generalizations previously made about units of word and subword size in a morphology that was piece-based and syntactic.

Previous theories made some generalizations about the relationship between syntactic structure and phonological structure:

- (At least) some phonological constituents must be built after the syntax. (Prosodic Hierarchy Theories)
- There is some relationship between the syntactic spell-out domains and the phonological domains. (Syntactic Spell-Out Only Theories)
- There are adjustments made to the structure in between the syntactic structure and the phonological structure. (*SPE*)

In the framework presented here, I cover these generalizations by proposing that the syntax precedes all phonological operations (“late insertion”), that the syntax feeds information to the phonology in chunks (“cyclic spell-out”), but that the morphology and phonology have a variety of ways of manipulating the information which can change the syntactic output in non-syntactic ways (“morphological operations”). Additionally, I proposed that the phonology may hold onto information give to it from the syntax and needs not act on it immediately (“phonocyclic buffer”, cf. Pak’s “holding bins”).

At the level of the subword, the phonological generalizations about subword units are:

- There are two blocks of phonological rules (cyclic/non-cyclic). (Cyclic phonology, Stratal theories)

- There are two types of affixes (cyclic/non-cyclic). (Cyclic phonology, Stratal theories)
- There appear to be some ordered ways in which morphemes are attached to a word. (Stratal theories)

In this domain, I proposed an implementation which follows Cyclic Phonology relatively closely. Morphemes are diacritically marked as cyclic or non-cyclic. Cyclic morphemes are integrated into the phonocyclic buffer which triggers a pass of the cyclic phonology. Non-cyclic morphemes are not integrated and block cyclic interactions across them. I argue against an intrinsic ordering of morphemes in some ways, but there are two ways in which the ordering generalization is held up in this framework. First, because morphemes are arranged by the syntax in particular ways, if the syntax always arranges the morphemes in a particular order, the result will be a particular order on the phonological side. Second, the context for insertion of particular morphemes/allomorphs allows for the phenomenon of “licensing”, which is the cause of many classic “level ordering paradoxes”. For example, in English, *-ity* is always licensed (able to be added) after *-abil-*, despite being in the wrong order with respect to the ordering generalization that Class 1 affixes are added before Class 2 affixes.

At the word domain, the phonological generalizations are:

- There is some unit called “word” which includes all affixes. (Cyclic phonology, Stratal theories)
- There appear be mismatches between grammatical words and phonological words. (Prosodic Hierarchy Theories)
- Content (lexical) words are somehow different from functional words with respect to their status as phonological units. (Prosodic Hierarchy Theories)
- Clitics have a variety of behaviors with respect to their interaction with the word level. (Stratal theories, Prosodic Hierarchy Theories)

In the framework presented here, I argued that the notion of “word”, while unnecessary in the syntax and semantics, was important to the phonology. I proposed a correspondence between the

morphosyntactic structure of the complex head (M-Word) and the phonological word ( $\omega$ -Word). This structure includes all affixes combined into the head through syntactic and morphological movement. I argued against apparent mismatches between the morphosyntactic and phonological structures, arguing that the phenomena in question could either be handled by other phonological mechanisms or that the morphosyntactic structure was complex and the phonological structure reflected that. The lexical/functional word distinction is implemented in this framework through the hypothesis that only non-minimal complex heads are eligible for the correspondence with  $\omega$ -Words (“Defective M-Word Hypothesis”). Because the combinatorics of the syntax necessitate that roots always select for category defining heads, roots never surface as minimal heads. Non-root morphemes may, however, be minimal heads which behave as clitics and interact with nearby  $\omega$ -Words. The variety in behavior of these clitics was explained through the morphological operation Local Dislocation, which changed clitics from leaners into affixes.

The main thrust of the theoretical argument put forth here is that phonological phenomena can only be fully understood with reference to their syntactic underpinnings and their derivational history. It is not the case that phonological structure is completely independent from other modules of grammar, rather, there is a direct connection between the morphosyntactic structure and the phonological output. However, morphosyntactic structure and spell-out is not the only way of determining phonological domains. Morphological and phonological operations also manipulate the information in ways that modify the syntactic output after spell-out. The surface phonological form is a result of the interaction of syntactic, morphological, and phonological operations.

As always, there is further work to be done in this framework. In particular, there are other mismatches between M-Words and  $\omega$ -Words which need to be examined and accounted for. Compounds, in particular, seem like a fruitful place to look because there most likely are several ways to build a compound, each of which may have a unique morphosyntax and corresponding phonological structure. Additionally, the “leaning” behavior of clitics needs to be examined further, particularly with respect to the Clitic Group prosodic structure and how it matches with the Subword/M-Word division and two-step linearization process adopted here, and whether any reconciliation can be made between Clitic Groups and Stray Terminal Grouping.



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